SMITHSONIAN

CONTRIBUTIONS TO KNOWLEDGE.

VOL. XXI.

EVERY MAN IS A VALUABLE MEMBER OF SOCIETY, WHO, BY HIS OBSERVATIONS, RESEARCHES, AND EXPERIMENTS, PROCURES KNOWLEDGE FOR MEN.—SMITHSON.

CITY OF WASHINGTON:
PUBLISHED BY THE SMITHSONIAN INSTITUTION.
MDCCCLXXVI.
1876

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ADVERTISEMENT.

This volume forms the twenty-first of a series, composed of original memoirs on different branches of knowledge, published at the expense, and under the direction, of the Smithsonian Institution. The publication of this series forms part of a general plan adopted for carrying into effect the benevolent intentions of JAMES SMITHSON, Esq., of England. This gentleman left his property in trust to the United States of America, to found, at Washington, an institution which should bear his own name, and have for its objects the "*increase* and *diffusion* of knowledge among men." This trust was accepted by the Government of the United States, and an Act of Congress was passed August 10, 1846, constituting the President and the other principal executive officers of the general government, the Chief Justice of the Supreme Court, the Mayor of Washington,[1] and such other persons as they might elect honorary members, an establishment under the name of the "SMITHSONIAN INSTITUTION FOR THE INCREASE AND DIFFUSION OF KNOWLEDGE AMONG MEN." The members and honorary members of this establishment are to hold stated and special meetings for the supervision of the affairs of the Institution, and for the advice and instruction of a Board of Regents, to whom the financial and other affairs are intrusted.

The Board of Regents consists of two members *ex officio* of the establishment, namely, the Vice-President of the United States and the Chief Justice of the Supreme Court, together with twelve other members, three of whom are appointed by the Senate from its own body, three by the House of Representatives from its members, and six persons appointed by a joint resolution of both houses. To this Board is given the power of electing a Secretary and other officers, for conducting the active operations of the Institution.

To carry into effect the purposes of the testator, the plan of organization should evidently embrace two objects: one, the increase of knowledge by the addition of new truths to the existing stock; the other, the diffusion of knowledge, thus increased, among men. No restriction is made in favor of any kind of knowledge; and, hence, each branch is entitled to, and should receive, a share of attention.

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[1] This office has been abolished.

The Act of Congress, establishing the Institution, directs, as a part of the plan of organization, the formation of a Library, a Museum, and a Gallery of Art, together with provisions for physical research and popular lectures, while it leaves to the Regents the power of adopting such other parts of an organization as they may deem best suited to promote the objects of the bequest.

After much deliberation, the Regents resolved to divide the annual income into two parts—one part to be devoted to the increase and diffusion of knowledge by means of original research and publications—the other part of the income to be applied in accordance with the requirements of the Act of Congress, to the gradual formation of a Library, a Museum, and a Gallery of Art.

The following are the details of the parts of the general plan of organization provisionally adopted at the meeting of the Regents, Dec. 8, 1847.

DETAILS OF THE FIRST PART OF THE PLAN.

I. To increase Knowledge.—*It is proposed to stimulate research, by offering rewards for original memoirs on all subjects of investigation.*

1. The memoirs thus obtained, to be published in a series of volumes, in a quarto form, and entitled "Smithsonian Contributions to Knowledge."

2. No memoir, on subjects of physical science, to be accepted for publication, which does not furnish a positive addition to human knowledge, resting on original research; and all unverified speculations to be rejected.

3. Each memoir presented to the Institution, to be submitted for examination to a commission of persons of reputation for learning in the branch to which the memoir pertains; and to be accepted for publication only in case the report of this commission is favorable.

4. The commission to be chosen by the officers of the Institution, and the name of the author, as far as practicable, concealed, unless a favorable decision be made.

5. The volumes of the memoirs to be exchanged for the Transactions of literary and scientific societies, and copies to be given to all the colleges, and principal libraries, in this country. One part of the remaining copies may be offered for sale; and the other carefully preserved, to form complete sets of the work, to supply the demand from new institutions.

6. An abstract, or popular account, of the contents of these memoirs to be given to the public, through the annual report of the Regents to Congress.

II. To INCREASE KNOWLEDGE.—*It is also proposed to appropriate a portion of the income, annually, to special objects of research, under the direction of suitable persons.*

1. The objects, and the amount appropriated, to be recommended by counsellors of the Institution.

2. Appropriations in different years to different objects; so that, in course of time, each branch of knowledge may receive a share.

3. The results obtained from these appropriations to be published, with the memoirs before mentioned, in the volumes of the Smithsonian Contributions to Knowledge.

4. Examples of objects for which appropriations may be made:—

(1.) System of extended meteorological observations for solving the problem of American storms.

(2.) Explorations in descriptive natural history, and geological, mathematical, and topographical surveys, to collect material for the formation of a Physical Atlas of the United States.

(3.) Solution of experimental problems, such as a new determination of the weight of the earth, of the velocity of electricity, and of light; chemical analyses of soils and plants; collection and publication of articles of science, accumulated in the offices of Government.

(4.) Institution of statistical inquiries with reference to physical, moral, and political subjects.

(5.) Historical researches, and accurate surveys of places celebrated in American history.

(6.) Ethnological researches, particularly with reference to the different races of men in North America; also explorations, and accurate surveys, of the mounds and other remains of the ancient people of our country.

I. To DIFFUSE KNOWLEDGE.—*It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge not strictly professional.*

1. Some of these reports may be published annually, others at longer intervals, as the income of the Institution or the changes in the branches of knowledge may indicate.

2. The reports are to be prepared by collaborators, eminent in the different branches of knowledge.

3. Each collaborator to be furnished with the journals and publications, domestic and foreign, necessary to the compilation of his report; to be paid a certain sum for his labors, and to be named on the title-page of the report.

4. The reports to be published in separate parts, so that persons interested in a particular branch, can procure the parts relating to it, without purchasing the whole.

5. These reports may be presented to Congress, for partial distribution, the remaining copies to be given to literary and scientific institutions, and sold to individuals for a moderate price.

The following are some of the subjects which may be embraced in the reports:—

I. PHYSICAL CLASS.

1. Physics, including astronomy, natural philosophy, chemistry, and meteorology.
2. Natural history, including botany, zoology, geology, &c
3. Agriculture.
4. Application of science to arts.

II. MORAL AND POLITICAL CLASS.

5. Ethnology, including particular history, comparative philology, antiquities, &c.
6. Statistics and political economy.
7. Mental and moral philosophy.
8. A survey of the political events of the world; penal reform, &c.

III. LITERATURE AND THE FINE ARTS.

9. Modern literature.
10. The fine arts, and their application to the useful arts.
11. Bibliography.
12. Obituary notices of distinguished individuals.

II. To diffuse Knowledge.—*It is proposed to publish occasionally separate treatises on subjects of general interest.*

1. These treatises may occasionally consist of valuable memoirs translated from foreign languages, or of articles prepared under the direction of the Institution, or procured by offering premiums for the best exposition of a given subject.

2. The treatises to be submitted to a commission of competent judges, previous to their publication.

DETAILS OF THE SECOND PART OF THE PLAN OF ORGANIZATION.

This part contemplates the formation of a Library, a Museum, and a Gallery of Art.

1. To carry out the plan before described, a library will be required, consisting, 1st, of a complete collection of the transactions and proceedings of all the learned societies of the world; 2d, of the more important current periodical publications, and other works necessary in preparing the periodical reports.

2. The Institution should make special collections, particularly of objects to verify its own publications. Also a collection of instruments of research in all branches of experimental science.

3. With reference to the collection of books, other than those mentioned above, catalogues of all the different libraries in the United States should be procured, in order that the valuable books first purchased may be such as are not to be found elsewhere in the United States.

4. Also catalogues of memoirs, and of books in foreign libraries, and other materials, should be collected, for rendering the Institution a centre of bibliographical knowledge, whence the student may be directed to any work which he may require.

5. It is believed that the collections in natural history will increase by donation, as rapidly as the income of the Institution can make provision for their reception; and, therefore, it will seldom be necessary to purchase any article of this kind.

6. Attempts should be made to procure for the gallery of art, casts of the most celebrated articles of ancient and modern sculpture.

7. The arts may be encouraged by providing a room, free of expense, for the exhibition of the objects of the Art-Union, and other similar societies.

8. A small appropriation should annually be made for models of antiquity, such as those of the remains of ancient temples, &c.

9. The Secretary and his assistants, during the session of Congress, will be required to illustrate new discoveries in science, and to exhibit new objects of art; distinguished individuals should also be invited to give lectures on subjects of general interest.

In accordance with the rules adopted in the programme of organization, each memoir in this volume has been favorably reported on by a Commission appointed for its examination. It is however impossible, in most cases, to verify the statements of an author; and, therefore, neither the Commission nor the Institution can be responsible for more than the general character of a memoir.

The following rules have been adopted for the distribution of the quarto volumes of the Smithsonian Contributions:—

1. They are to be presented to all learned societies which publish Transactions, and give copies of these, in exchange, to the Institution.

2. Also, to all foreign libraries of the first class, provided they give in exchange their catalogues or other publications, or an equivalent from their duplicate volumes.

3. To all the colleges in actual operation in this country, provided they furnish, in return, meteorological observations, catalogues of their libraries and of their students, and all other publications issued by them relative to their organization and history.

4. To all States and Territories, provided there be given, in return, copies of all documents published under their authority.

5. To all incorporated public libraries in this country, not included in any of the foregoing classes, now containing more than 10,000 volumes; and to smaller libraries, where a whole State or large district would be otherwise unsupplied.

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TABLE OF CONTENTS.[1]

[1] Each memoir is separately paged and indexed.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.
280

STATEMENT AND EXPOSITION

OF

CERTAIN HARMONIES

OF

THE SOLAR SYSTEM.

BY

STEPHEN ALEXANDER, LL.D.,
PROFESSOR OF ASTRONOMY IN THE COLLEGE OF NEW JERSEY.

[ACCEPTED FOR PUBLICATION, JULY, 1874.]

WASHINGTON,
MARCH, 1875.

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ADVERTISEMENT.

The principal part of the following Memoir on Certain Harmonies of the Solar System was read before the American National Academy of Sciences, at its meeting in April, 1873, and some additional portions of the same, at the meeting in April, 1874.

In accordance with usage in such cases the whole is now presented to the public through the Smithsonian Contributions to Knowledge.

JOSEPH HENRY,
Secretary S. I.

Note by the Author.—After reading the whole memoir, a synopsis of the principal relations may be obtained by a reperusal and comparison of the Tables (B) to (F) inclusive, with their explanations; and, especially, the Summation of Consistencies at the end.

CONTENTS.

N.B. The references are to the articles, not to the pages.

SECTION I.

SECTION II.

SECTION III.

CERTAIN HARMONIES OF THE SOLAR SYSTEM.

SECTION I.

INTRODUCTORY.

(1) KEPLER'S 3d Law is ordinarily expressed by saying that the squares of the periodic times of the several planets of the solar system are to one another, respectively, as the cubes of their distances from the sun. The same law includes also the periodic comets, and it is, in like manner, applicable to the satellite systems.

But from this we do not learn that any laws are to be found determining the ratios of the distances themselves.

It will be one main object of the present discussion to show that such laws exist, and precisely what they are—generality and precision being characteristics of every law of nature.[1]

(2) Approximations to the laws in question have, from time to time, been exhibited, by the author of this paper, to the American Association for the Advancement of Science, at several of their meetings, beginning with that at New Haven, in 1850, and more especially, also, that at Montreal, in 1857; Baltimore, in 1858; and Springfield, Massachusetts, in 1859; but it is only within the past few months, or even almost up to this present time (July, 1874), that the entire form and consistency of the results hereinafter exhibited have been quite fully made out.

(3) All that is to be stated will, it is conceived, be the more readily intelligible by proceeding, as occasion may seem to require, *inductively*, and consequently following, to some extent, the order of discovery.

Antecedently even to this, however, it seemed to be desirable to discuss anew the expressed values of the distances in question, and this, in view of the fact, that Kepler's 3d Law is itself slightly modified by the consideration due to the *masses* of the revolving bodies.

Thus if M represent the mass of the sun, and m, m' the respective masses of any two planets, while a, a' represent their mean distances from the sun, and T, T' represent their periodic times, we have

$$\left.\begin{aligned}\left(\frac{T'}{T}\right)^2 = \left(\frac{a'}{a}\right)^3 \times \frac{M+m}{M+m'}, \text{ or} \\ \left(\frac{T'}{T}\right)^2 \times \frac{M+m'}{M+m} = \left(\frac{a'}{a}\right)^3\end{aligned}\right\} \ldots (1);$$

[1] The so-called Law of Bode or of Titius, it need scarcely be said, fails in both these respects.

When m and m' are mere particles of matter *Eqs.* (1) are both reduced to

$$\left(\frac{T'}{T}\right)^2 = \left(\frac{a'}{a}\right)^3 \ . \ . \ . \ (1)'.$$

It may be convenient to regard, once for all, a, m, and T, in so far as they appear, as being special for the earth, while a', m', and T' respectively represent like quantities in the instance of any other planet.

Now T' and T having both been well ascertained, and being themselves constant, the same is true of their ratio, which involves also the *constant value* of $\left(\frac{T'}{T}\right)^2$; and hence it follows that, to preserve *Eq.* (1)', we must have the value of $\left(\frac{a'}{a}\right)^3$ also *constant*, and this, although the accepted value of a, the earth's mean distance from the sun, which is the unit of measurement, may itself require correction in comparison with other standards. If *it* then be diminished, every other mean distance a', as it is represented in *Eq.* (1)', will be found to be diminished in the same ratio; and thus, while the numbers representing them remain *unchanged*, "all the distances have to be reckoned on a new scale."[1]

Next, as respects the modifying factor $\frac{M + m'}{M + m}$, in the second of *Eqs.* (1). As it is moreover true, that M itself varies directly as a^3; if a^3 be *diminished*, M will be *diminished* in the same ratio, and *the like* will be true of m' represented, as usual, in terms of M as the measuring unit; so that all such masses will be represented by the same numbers as before, but all, as in the case of the distances, "reckoned on a new scale," while *the mass of the earth* will, in this comparison, be *increased*, as that will vary *inversely* as a^3.

Now the more recent determination of the solar parallax requiring that the actual value of a should be diminished, it became requisite for the accurate determination of the values of the mean distances of such other planets as have ascertained and appreciable masses, that those values, as already intimated, should be rediscussed.

This has been done with the aid of logarithms computed to ten decimal places of figures; and the results, to the seventh decimal place inclusive, are exhibited in Table (A), in which withal, in their appropriate column, are also the values of the masses made use of, with indications of the authorities to which they are referable.

The densities which besides are exhibited in Table (A), will be found to vary more or less from those hitherto ordinarily accepted. This is due to the increase in the relative mass of the earth, and also to the more accurate determination of the masses of the planets.

The arrangement of the series of planets begins with the most distant, as that will be found to be the more convenient for the application of these data to the special purposes of the whole investigation.

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[1] Sir J. Herschel's *Outlines of Astronomy*, 11th edition (357 c.)

The results given are those which are respectively consistent with two values of the solar parallax; viz., Prof. Newcomb's value $\pi = 8''.848$,[1] and that which some prefer, $\pi = 8''.78$.

TABLE (A).

A Synoptic Table of some of the Elements of the Planetary System.

	Names.	Periodic Times.	Masses ($\pi = 8''.848.$)	Masses ($\pi = 8''.78$).	Mean Distances. ($\pi = 8''.848.$)	Mean Distances ($\pi = 8''.78$).	Densities ($\pi = 8''.848$).	Densities $\pi = 8''.78$).
♆	Neptune,	$60186^d.6385$	$\frac{1}{19700}$	$\frac{1}{19700}$	30.0567298 —	30.0567339 —	0.142 —	0.145 +
♅	Uranus,	30688 50	$\frac{1}{22000}$	$\frac{1}{22000}$	19.1833617 +	19.1833622 —	0.182 —	0.186
♄	Saturn,	10759.2198174	$\frac{1}{3501.600}$	$\frac{1}{3501.600}$	9.5388544 —	9.5388546 —	0.119 —	0.122 —
♃	Jupiter,	4332.5848212	$\frac{1}{1047.879}$	$\frac{1}{1047.879}$	5.2028004 —	5.2028005 —	0.240 —	0.245
♂	Mars,	686.9796458	$\frac{1}{3200900}$	$\frac{1}{3200900}$	1.5236913	1.5236913 +	0.585 +	0.599 +
⊕	Earth,	365.2563582	$\frac{1}{322800}$	$\frac{1}{330358}$	1.0000000	1.0000000	1.000	1.000
♀	Venus,	224.7007869	$\frac{1}{408134}$	$\frac{1}{408134}$	0.7233322 —	0.7233322 —	0.809 +	0.828 +
☿	Mercury,	87.9692580	$\frac{1}{4865751}$	$\frac{1}{4865751}$	0.3870987 —	0.3870987 —	1.122 —	1.148 +
☉	Sun,	....	1	1	....	....	0.250 +	0.256 +

REMARKS.—The authorities for the *Periodic Times* are :—

Uranus. From Prof. NEWCOMB's Tables of Uranus.

Earth. The sidereal year of HANSEN and OLUFSEN, as quoted by Prof. WATSON. *Theor. Astronomy,* Table XXI.

The other periodic times are those usually accepted.

For the *Masses* we have—

Neptune. The Pulkova deduction, furnished by Prof. NEWCOMB.

Uranus. From Prof. NEWCOMB's Tables of Uranus.

Saturn. BESSEL, *Comptes Rendus,* 1841.

Jupiter. BESSEL, Die Masse des Jupiter, p. 64. [Its great accuracy is confirmed by Prof MÖLLER's deduction from the perturbations of *Faye's Comet,* and by the recent investigations by Dr. KRUEGER, of the perturbations of *Themis, Ast. Nachrichten,* No. 1941.]

Mars. HANSEN and OLUFSEN's mass, as quoted by Prof. HILL. *Tables of Venus,* p. 2.

Earth. Prof. NEWCOMB's *Investigation of the Distance of the Sun,* etc., § 11 (with $\pi = 8''.848$). With $\pi = 8''.78$, the mass was deduced, with a change of value proportioned to π^3.

Venus. Prof. HILL, *Tables of Venus,* p. 2.

Mercury. ENCKE, *Astronomische Nachrichten,* No. 443.

The columns of densities have been computed by the aid of the other data. If we admit for *Venus* the mass $\frac{1}{427240}$, to which some indications point (*Hill's Tables,* p. 2), then the density of that planet with the value of the solar parallax $= 8''.848$, will be represented by 0.773, or for the value of $\pi = 8''.78$, the representative density will be 0.791 +. The only change in the value of the mean distance of Venus will then be that the last decimal figure (with $\pi = 8''.848$) will read 1 + instead of 2 —.

[1] Smithsonian Contributions to Knowledge—Investigation of the Distance of the Sun, etc., § 10.

SECTION II.

ON THE LAWS OF ARRANGEMENT OF THE DISTANCES, BOTH OF PLANETS AND THEIR SATELLITES, FROM THEIR RESPECTIVE CENTRES OF ATTRACTION.

(4) The object of this section is to indicate distinctly the ratios which prevail among the planetary and satellite distances from their respective centres, and also the *laws* which include the same; *without the introduction in this same connexion of any physical hypothesis on which those laws seem to be founded, or of which they are the exponents.*

The hypothesis which seems to reconcile and explain those laws, *as well as a number of other phenomena*, will be considered in a subsequent section.

(5) The first correspondence and arrangement of ratios that will be noticed, may be thus stated: Beginning with the mean distance of Neptune as found in Table (A) in (3), if of this we take $\frac{5}{9}$, and of that fractional product, again, $\frac{5}{9}$, etc., etc.; then, among *the terms in the geometrical progression thus developed*, in addition to that pertaining to Neptune, we shall find those which respectively, in their order, exhibit close approximations to the mean distances of the two great planets Saturn and Jupiter; another having an appropriate position among the asteroids;[1] with, again, others which respectively exhibit close approximations to the mean distance of Mars, and that of Mercury *in aphelion;* all which can be distinctly traced in the following tabular arrangement, in which the approximations are carried to the third place of decimals inclusive; though the computations were extended to the fifth place. In the third column, it will be remembered, every *term* after the first, is $\frac{5}{9}$ *of that immediately preceding;* so that the ratio of every one to *its next succeeding term* will be that of 9 to 5 = to $\frac{9}{5} = \frac{18}{10} = \frac{1.8}{1} = 1.8$; a statement which, in certain comparisons, will be found to be more convenient than the other.

In this arrangement the column under the title of *Law* exhibits the results in accordance with the (approximate) law of succession of the terms as now explained; in comparison, respectively, with the recorded distances found in the column of *Fact ; the terms in the column of Law forming a series in geometrical progression, the ratio being* 1.8.

1st Approximate Arrangement.

Names and Symbols.		Law.	Fact.	Difference L.—F.
♆	Neptune,	30.05733	30.05733	0.000
♅	{ Uranus,	....	{ 19.183+	....
(U)	{ *Limit* (U),	16.698+	{	....
(♅*i*)	{	....	{ (missing)	
♄	Saturn,	9.277—	9.539—	—0.262
♃	Jupiter,	5.154—	5.203—	—0.049
(A)	*Limit* (A),	2.863+	(to be supplied)	....
♂	Mars,	1.591—	1.524	+0.067
⊕	{ Earth,	....	{ 1.000	....
(⊕♀)	{ *Limit* (⊕♀),	0.884—	{	....
♀	{ Venus,	....	{ 0.723+	....
Aph. ☿	Mercury, in Aphelion,	0.491—	0.467—	+0.024

[1] Of which more hereafter.

(6) An inspection of what is here exhibited will at once reveal the fact that the Earth and Venus seem to have characteristics of *half-planets;* the *one* term, 0.884 (in the series), pertaining to them, being indicative of a distance between those of the two planets at which their masses should be united; and which is designated as *limit* (⊕ ♀).

[To avoid circumlocution, such an arrangement as this, will be termed *a half-planetary arrangement*, and the planets subject to it, be, at times, designated as *half-planets;* those situated, as Uranus and the Earth are, *without* the intervening *limit*, being styled *exterior* half-planets; while those, like Venus, *within the limit*, are specially designated as being *interior* half-planets; Uranus being regarded as an *exterior* half-planet as well as the Earth. For the ratio of the mean distance of Neptune to that of Uranus is very *nearly the same as that of Mars to the Earth's;* viz., a very little greater than the ratio of $1\frac{1}{2}$ to 1. And so[1] the *limit* (♅) in the *progression* is very nearly *the same fraction* of the term for *Uranus* in the column of Fact, that the *limit* (⊕ ♀) is of the *Earth's distance;* viz. very nearly $\frac{9}{10}$, in both cases.]

(7) Uranus, then, like the earth, has the characteristics of an *exterior half-planet;*[2] though there is no other half-planet (analogous to Venus) apparent between *limit* (♅) and Saturn. But *the region* of the system where the appropriate term for *such* a half-planet should be found has been marked in the tabular arrangement, and its symbol (♅*i*) shows that *it* would belong to *a half-planet interior* to Uranus; such as Venus is in the region interior to the Earth's place.

(8) Now the ratios for the mean distances from the Sun of the *exterior* half-planet terms, are as follows:—

$$\left.\begin{aligned}\frac{\textit{Neptune}}{\textit{Uranus}} &= 1.56681\\ \frac{\textit{Mars}}{\textit{Earth}} &= 1.52369\\ \frac{\textit{Mercury in aphelion}}{\textit{Mercury in perihelion}} &= 1.51768\end{aligned}\right\}\ \text{Mean} = 1.53606;$$

while it is also true, with respect to the ratio for other than half-planet distances [which $= \frac{9}{5}$ or $\frac{1\cdot 8}{1}$ very nearly], that

$$(1.8)^{\frac{3}{4}} = 1.55401,$$

agreeing very nearly with the preceding; so that, r being the ratio for other than half-planets, the ratio for the *exterior* half-planets is $r^{\frac{3}{4}}$.

Also, as again respects mean distances from the Sun,

$$\frac{\textit{Earth}}{\textit{Venus}} = 1.38249.$$

---

[1] *Having all the while in view* the table of the first Approximate Arrangement under discussion.

[2] This was not discerned until just before the Meeting of the American Association for the Advancement of Science, in Baltimore, in 1858. It is just the non-perception of a *half-planet* relationship, that has seriously troubled most of the investigations into the arrangements, etc., of the planetary system, whether purely speculative or otherwise.

But r being still = 1.8, *the square root of* r, or

$$r^{\frac{1}{2}} = 1.34161,$$

so that, r being still the leading ratio, the ratio for the *interior* half-planet Venus, is $r^{\frac{1}{2}}$; and this planet furnishes the only *existing* example of its kind in the planetary system. Another will appear in the system of Saturn.

The relations thus ascertained may be symbolized as follows; the dependence of a following term on that from which it is *derived* being indicated by a brace connecting the two, and the power of r involved marked outside of the brace: as, for example, we have

Mars Planet } $r^{\frac{3}{4}}$ *Mars* } r

Earth { $\frac{1}{2}$ *planet* }

. . . . $r^{\frac{1}{2}}$ { . . . . Pl. limit } . . { *Earth* / *Venus* } Limit (⊕ ♀) }

Venus { $\frac{1}{2}$ *planet* } r

Planetary limit. . . . . Aphelion of Mercury.

(9) This being kept in view, it will be apparent from what precedes, that the rules now established for the derivation of all the distances in the planetary arrangement subsequent to the first, are as follows:—

[Leading ratio r being = 1.8 very nearly]

Rule 1*st.*—When the *term in question* in the series of planetary distances is *other* than that pertaining to a *half-planet*, the value of that term may be obtained by dividing the value of the term immediately preceding by the leading ratio.

Examples.—Thus, as indicated by the symbols,

$$\frac{\textit{Saturn term}}{r} = \textit{Mean distance of Jupiter}$$

$$\frac{\textit{Mars term}}{r} = \textit{Limit } (\oplus\, ♀); \text{ and}$$

$$\frac{(\oplus\, ♀)}{r} = \textit{Aphelion distance of Mercury.}$$

[This (incidentally it may be) includes the term for *Mercury*,[1] with the variety, that the term which immediately precedes (and which is to be employed in *that* computation) is the term pertaining to the *half-planet Venus;* though Mercury itself is not a half-planet, but even has characteristics approaching to those of a *double-planet.*]

Rule 2*d.*—The value of *any term* in the series of *exterior* half-planets may be obtained by dividing the value of the term immediately preceding *that* in the planetary arrangements, by $r^{\frac{3}{4}}$.

[The *Examples* are: The respective mean distances of Uranus and the Earth, and the *perihelion* distance of Mercury. Thus,

$$\frac{\textit{Mars term}}{r^{\frac{3}{4}}} = \textit{Earth term.}]$$

---

[1] Incidentally, it *may* be; for Mercury's mean distance has other relations; as will appear in Section III.

Rule 3d.—The value of *any term* in the series of *interior* half-planets may be obtained by dividing the value of the term of the planetary arrangement immediately preceding *that*, by $r^{\frac{1}{2}}$.

[*Examples* are: The mean distance of Venus, and that due to the *missing interior half-planet*, next in the arrangement to the *exterior* half-planet Uranus. Thus

$$\frac{\textit{Earth term}}{r^{\frac{1}{2}}} = \textit{Venus term.}]$$

With D', or D'', or D''', as the case may be, for the value of the distance in question, and D that to which that value is referred, we have

For *Case* under *Rule First*,

$$D' = \frac{D}{r}; \text{ whence, withal, } r = \frac{D}{D'} \quad . \; . \; . \; . \; . \quad (a)$$

$$\left[\text{For Mercury, } D' = \frac{(d)}{r}\right]^{1}$$

For *Case* under *Rule Second*,

$$D'' = \frac{D}{r^{\frac{3}{4}}}$$

For *Case* under *Rule Third*,

$$D''' = \frac{D}{r^{\frac{1}{2}}}$$

From these equations we also learn, that

$$\left.\begin{array}{l} \frac{D'}{D}, \text{ or } \frac{D'}{(d)}, \text{ each } = \frac{1}{r}, \\ \frac{D''}{D} = \frac{1}{r^{\frac{3}{4}}}, \text{ and} \\ \frac{D'''}{D} = \frac{1}{r^{\frac{1}{2}}} \end{array}\right\} \quad . \; . \; . \; . \quad (P)$$

(10) These equations express the laws of apportionment of the planetary distances; which are these:—

Laws of Apportionment of the Planetary Distances.

[Value of $r = 1.8$, very nearly.]

LAW FIRST. For any term subsequent to the first, in the series of terms of planetary distances; and *other than* a half-planetary term:—

succeeding term : *prec. term* : : 1 : *leading ratio r.*

LAW SECOND. For an *exterior* half-planetary term:—

ext. half-planet. term : *prec. term* : : 1 : $\frac{3}{4}$ *power of leading ratio r*, i. e. $r^{\frac{3}{4}}$.

LAW THIRD. For an *interior* half-planetary term.

int. half-planet. term : *prec. term* : : 1 : *square root of leading ratio r, or* $r^{\frac{1}{2}}$.

---

[1] (*d*) being the term pertaining to the *interior half-planet Venus.*

In the second approximate arrangement which follows, the dependence of the value of one term on that of another is indicated by *the brace* connecting them, and the power of r in question is also shown; the half-planetary terms have their names printed in italics; while Mercury's name (in view of the peculiarity of that planet) appears in capitals: other symbols, etc., as heretofore.

The leading ratio here accepted, after many trials of *it* and of other ratios, is 1.805.

Second Approximate Arrangement of the Planetary System. [*Value of Leading Ratio* 1.805].

Names and Symbols.				Law.	Fact.	Diff. L.—F.
♆		Neptune } $r^{\frac{3}{4}}$,		30.05673	30.05733	—0.001
♅		*Uranus* }	r	19.30118	19.18336	+0.118
(U)	$r^{\frac{1}{2}}$	Limit (U),		16.65193	....	....
♅ *i*		....	r	....	(Missing).	....
♄		Saturn,		9.22545	9.53885	—0.313
			r			
♃		Jupiter,		5.11105	5.20280	—0.092
			r			
(A)		Limit (A),		2.83161	....	....
			r			
♂		Mars } $r^{\frac{3}{4}}$		1.56876	1.52369	+0.045
⊕		*Earth* }	r	1.00739	1.00000	+0.007
(⊕♀)	$r^{\frac{1}{2}}$	Limit (⊕ ♀),		0.86912	....	....
♀		*Venus*,	r	0.74982	0.72333	+0.026
Aph. ☿	r	Mercury in Aph.		0.48151	0.46670	+0.015
☿		MERCURY	$r^{\frac{3}{4}}$	0.41543	0.38710	+0.028
Per. ☿		*Mercury in Per.*		0.30920	0.30750	+0.002

(11) The approximation of law to fact here shown, though in the main very close, yet exhibits some terms in which the discrepancy is a greater fraction of the whole than seems to be quite tolerable, in view of the accuracy of the other terms.

Then, too, the last column of the arrangement here shows a tendency in the difference of law from fact to be *negative* for the *first* part of the series of terms, *but positive afterwards;* as though the value of the leading ratio were in excess for the one portion, and thus had given the results in general too small; but the same value of the ratio having been too small in the case of the remaining terms, had consequently given results too large. All this makes it not improbable that the leading factor r, from first to last, should regularly increase, beginning *below* the mean value of 1.805, and ending *above* the same; the increase, however, in any event, being *very small.*

To ascertain whether this is so, it will be found advisable to institute a separate induction within the narrower limits of the region from Saturn to Mars inclusive, in which we possess three out of the four requisite terms;[1] the fourth (the asteroid term or limit (A)) to be accurately determined by the process here proposed, and its value *thus* obtained to be made *the criterion* for the comparison of its value as ascertained in the more extended series. In the several instances of the three planets here in question, there are withal no *half-planet* relations, and the fourth term being a *limit* in the regular series in which r enters, the half-planet relation does not pertain to *it;* so that the character of the leading factor r, as to variability or otherwise, is here to be sought for.

(12) Now the *existing* mean distances from the sun in this region, together with *the asteroid limit* (A), may be arranged as follows, viz.:—

	Dist. from Sun.[2]	Log. of Ratios.	Difference.
Saturn	9.53885 +		
		0.2632591 —	
Jupiter	5.20280		+ 0.002274
		0.2655331 —	
Limit (A)	(2.82296 —)		0.002274
		0.2678071 —	
Mars	1.52369 +		

The log. differences being equal, the ratios themselves increase *in geometrical progression.*

But if the arrangement be made with the ratios increasing *in arithmetical progression*, we shall have—

	Dist. from Sun.[2]	Ratios.	Difference.
Saturn	9.53885 +		
		1.83341	
Jupiter	5.20280		+ 0.00964
		1.84305	
Limit (A)	(2.82293 —)		0.00964
		1.85269	
Mars	1.52369 +		

Now we do not know enough of the nature of the case to decide which of these conditions ought to prevail, though the analogy of logarithms etc. would lead us to suppose that the ratios themselves should increase in arithmetical progression. But, happily, such a decision is of no moment practically; since the differences in question are so small, that the value of the limit (A) in the one case differs from that in the other only in the fifth decimal place.

So the value of the limit (A) = 2.82293–, which is that due to the increase of the ratio in *arithmetical progression*, will be accepted, and the same will be adopted; and then, as heretofore intimated, this value will be made the *criterion* for the comparison of the value as ascertained in the more extended series. This standard value, being withal a direct derivation from fact, in its own special region, will hereafter be inserted as *a limit* in the column of *Fact*, the figures being inclosed in a parenthesis.[3]

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[1] In the order of discovery, it was in *this region* that the approximation of the series of distances to a geometrical progression, with the ratio = 1.8 nearly, was first discerned.

[2] See Table (A), in (3).

[3] This value, 2.82293, is greater than the mean of the distances from the sun of 122 known asteroids, which is only 2.70282. But then about $\frac{7}{12}$ of that number are distances below the mean; leaving but $\frac{5}{12}$ above the same. So that it seems not unreasonable to suppose that were many more included, which mostly are now unknown—partly, it may be, because of their greater distance—the mean

(13) The *increment* of the leading ratio, or factor r, having been ascertained to be *real* for the region thus examined, an application of the rule which that implies was tried throughout the planetary system; and after an enormous number of such tentative processes, the following local values of r were found to give the most consistent results, the values of r, it will be seen, increasing withal in arithmetical progression.

Values of r in the Planetary System.

Region.	*Factor r.*	
Neptune to *limit* (U)	1.7770	
Limit (U) to Saturn	1.7908	0.0138
Saturn to Jupiter	1.8046	0.0138
Jupiter to *limit* (A)	1.8184	0.0138
Limit (A) to Mars	1.8322	0.0138
Mars to *limit* (⊕♀)	1.8460	0.0138
Limit (⊕♀) to the Aphelion of Mercury	1.8598	0.0138
Aphelion of Mercury to *limit* within	1.8736	0.0138

The mean of these is 1.8253; differing a little less than $\frac{1}{38}$th of itself from either extreme.

From these we have for the *exterior* half-planet intervals:—

Region.	*Factor* $r^{\frac{3}{4}}$.
Neptune to Uranus	1.5369 —
Mars to Earth	1.5710 —
Aphelion to Perihelion of Mercury	1.6014 +

For the *interior* half-planet intervals, we have:—

Region.	*Factor* $r^{\frac{1}{2}}$.
Uranus to ⛢*i*	1.3356 +
Earth to Venus	1.3612 +

From the *interior* half-planet Venus to Mercury

$$r = 1.8632 +$$

Under these conditions the value of the *half-planet limit* ⛢*i*, *i.e.* interior to Uranus, may now be determined; and it will be found to be 14.64275.[1]

(14) The arrangement of the planetary system in accordance with all that has now been determined, is similar to that of the *Second Approximate Arrangement* heretofore exhibited, (10); the value of the *interior* half-planet limit ⛢*i* and the standard value[2] of the asteroid limit (A) being both inserted; and besides the column of differences of Law from Fact in terms of the Earth's mean distance as 1, we have

---

would then approach more nearly to the standard value of limit (A). In this aspect of the matter, the difference of limit (A) from the mean in question would seem to be *on the right side.*

If, however, we take the mean between the two extremes of the known distances, that of Flora 2.20336, and that of Sylvia 3.49411 (as Prof. Kirkwood has done—*Proceed. of Royal Ast. Soc.*, vol. xxix. p. 99), we shall have the value 2.84873; which is almost exactly the same with the value of (A) here brought out.

[1] What ought to be the *mass* of the missing half-planet cannot be ascertained without the introduction of *theoretical* considerations; of which more hereafter.

[2] As exhibited in *Article* (12).

an additional column expressing in every case the same difference in terms of the quantity to be compared, which is a', the planet's own mean distance from the Sun, or else d', the distance from the Sun of the *limit* in question.

Thus, for example, in the instance of Saturn, Law—Fact = 0.094 of the Earth's mean distance; and *that*, in the next column, is seen to be only 0.010 of Saturn's own mean distance from the Sun.

Completed Arrangement of the Planetary System, exhibiting the Correspondence of Law with Fact.

Table (B).

Names and Symbols.		Ratios	Law.	Fact.	Law—Fact. Earth's dist. = 1.	Law—Fact. a′ or d′ = 1.
♆	Neptune,	$r^{\frac{3}{4}}$	30.057264	30.057332	— 0.000 +	— 0.000 +
♅	*Uranus,*	r	19.55718	19.18336	+ 0.374 +	+ 0.019 +
(U)	Limit (U),	$r^{\frac{1}{2}}$	16.91431	....	....	
♅i	*Int. to* ♅,	r	(14.64275)	(missing)	....	
♄	Saturn,		9.44511	9.53885	— 0.094 —	— 0.010 —
		r				
♃	Jupiter,		5.23391	5.20280	+ 0.031 +	+ 0.006
		r				
(A)	Limit (A),		2.87831	(2.82293)	+ 0.055 +	+ 0.020 —
		r				
♂	Mars,	$r^{\frac{3}{4}}$	1.57096	1.52369	+ 0.047 +	+ 0.031
⊕	*Earth,*	r	0.99335	1.00000	— 0.007 —	— 0.007 —
(⊕♀)	Limit (⊕♀),	$r^{\frac{1}{2}}$	0.85101	....	....	....
♀	*Venus,*	r	0.72975	0.72333	+ 0.006 +	+ 0.009 +
Aph. ☿	Aph. of Mercury,	r	0.45758	0.46670	— 0.009 +	— 0.020 —
☿	Mercury,	$r^{\frac{3}{4}}$	0.39166	0.38710	+ 0.005 —	+ 0.012 —
Per. ☿	*Per. of Mercury,*		0.28573	0.30750	— 0.022 —	— 0.071 —

The coincidences between Law and Fact, as compared with previous approximations, are now far more complete. The greatest actual difference is that in the instance of Uranus, which, after all, on the large scale of that planet's orbit is less than $\frac{1}{50}$th of the quantity to be measured.[1]

The distances of Mercury in aphelion and in perihelion as stated in the column of Fact are themselves computed from Mercury's mean distance and the eccentricity of his orbit, *at the present date.* With other values of the eccentricity, we would have had as follows:—

Eccentricity.	Aph. Dist.	L.—F	Per. Dist.	L.—F.
Maximum[2] = 0.2317185	0.47680	— 0.019 +	0.29740	— 0.012 —
Mean = 0.1766064	0.45546	+ 0.002 +	0.31873	— 0.033
Minimum[2] = 0.1214943	0.43413	+ 0.023 +	0.34007	— 0.054 +

[1] Why, after all, Uranus seems to have, as it were, *fallen in* from his appropriate position, may be considered in another connexion; not here, where only the relations themselves are permitted to have place, without the introduction of any physical hypothesis to explain them, as was indeed intimated in the first part of this Section. The same may be said of Mars.

[2] The maximum and minimum values of the eccentricity here inserted, are those given by John N. Stockwell, M.A., in his Memoir on the Secular Variations of the Elements of the Orbits of Eight Principal Planets, Introduction, p. xi.—*Smithsonian Contributions to Knowledge*, vol. xviii.

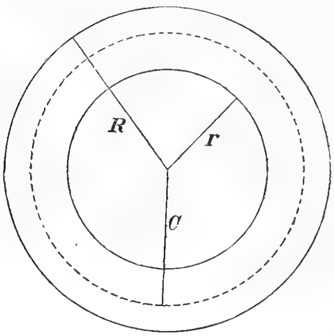
SATELLITE SYSTEMS.

SYSTEM OF SATURN.

(15) In the System of Saturn we find again three ratios; all of them fractional powers of one another, and one of these, like the special one in the Planetary System, *the square root* of another.

The rings, both bright and dusky, have also *their* places in the satellite series, with the condition always understood, that the distance of any ring from Saturn's centre is to be measured from that ring's *own centre of gyration.*

Fig. 1



(16) Now the *centre of gyration* of an *indefinitely thin* ring, and one which has, in effect, a uniform density and thinness, this centre, has *itself* special relations which it will be well to notice.

For let R be the radius of the outer edge of the ring, C the distance of the centre of gyration from Saturn's centre (or from the common centre of all the circles in question), and r the radius of the inner edge of the ring.

Then, we have

$$C = \sqrt{\frac{R^4 - r^4}{2R^2 - 2r^2}}.[1]$$

or,

$$C = \sqrt{\tfrac{1}{2} \cdot \frac{R^4 - r^4}{R^2 - r^2}}.$$

That is

$$C = \sqrt{\tfrac{1}{2} \cdot \frac{(R^2 + r^2)\,(R^2 - r^2)}{R^2 - r^2}};$$

or

$$C = \sqrt{\tfrac{1}{2}(R^2 + r^2)} \;\; . \; . \; . \; . \;\; (A).$$

But now, if the ring be supposed to be *so* divided by the circumference of a circle concentric with the edges of the ring, that the two portions thus obtained shall be *equal in area*, and the radius of this bisecting circumference be x; then the expressions for the two portions of the ring will be equivalent to one another, and so we shall have

$$\pi(R^2 - x^2) = \pi(x^2 - r^2); \text{ whence}$$
$$R^2 - x^2 = x^2 - r^2; \text{ and}$$
$$R^2 + r^2 = 2x^2; \quad \text{whence}$$
$$x^2 = \tfrac{1}{2}(R^2 + r^2); \text{ and}$$
$$x = \sqrt{\tfrac{1}{2}(R^2 + r^2)} \;\; . \; . \; . \; . \; . \;\; (B).$$

[1] Dr. Olinthus Gregory's Mechanics, 4th edition, Art. 312, Ex. III.

The value of x in equation (B) is the same with that of C in equation (A). Hence

$$C = x;$$

or *the centre of gyration is in the circumference of a circle concentric with the edges of the ring, and bisecting its area.*

And a cylindrical surface having this bisecting circle for one of its edges, and cutting perpendicularly through a ring formed like that of Saturn, would (density uniform) also bisect the volume of the ring, and also would bisect the material of the ring; and the value of C, the centre of gyration of this ring of sensible thickness, would not be affected by these new circumstances; the indefinitely thin ring being the plane of rotation on which the other might be projected.[1]

(17) The equation for the centre of gyration of any two equal masses will take the same form as that of *Eq.* (B), with the condition, however, that R and r shall respectively denote the radii of gyration of those masses. Indicating these radii then by R' and r', and the masses (equivalent or not) by M and m; and then (since velocities are as radii of *simultaneous* rotation) the general formula will be thus expressed:—

$$C = \sqrt{\frac{MR'^2 + mr'^2}{M + m}} \quad \ldots\ldots \text{(C)};$$

which, when $M = m$, is reduced to

$$C = \sqrt{\tfrac{1}{2}(R'^2 + r'^2)} \quad \ldots\ldots \text{(C)}',$$

so that when the equivalent masses are both rings, the one wholly clasping the other, like the two halves of the ring in question, the position of the centre of gyration may be obtained by a similar process, whether the $\frac{1}{2}$ sum of the squares under the radicle be that of those quantities representing the radii of outer and inner perimiters of the whole ring, as in *Eq.* (A); or the radii of gyration of the respective halves, as in *Eq.* (C)′.

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[1] This property of the centre of gyration of a ring like those of Saturn, as well as of the indefinitely thin ring, has about it a species of mathematical elegance. I know not whether the enunciation of it is new; but the correspondence of the position assigned by it with that of the division between the bright ring systems of Saturn, is a curious, if not an interesting one. [See *Article* (19).]

System of Saturn.

Table (C).

(18) *Definite Arrangement of the System.*

Names, etc.			Law.	Fact.	Diff. L.—F
Japetus,	r'		64.3590	64.3590	0.00
....	r'	r'^4			
....	r'				
....	r'				
Hyperion,	r'	r'	27.4069	26.7834	+ 0.62 +
Titan,			22.1397	22.1450	— 0.01 —
....	r	r^2			
....	r				
....	r'	r'			
Rhea,	r''	$r^{\frac{1}{2}}$	9.5972	9.5528	+ 0.04 +
....	r''	$r^{\frac{1}{2}}$			
Dione,	r'	r'	6.8453	6.8398	+ 0.01 —
Tethys,	r	r	5.3365	5.3396	— 0.00 +
Enceladus,	r'	r'	4.3109	4.3135	— 0.00 +
Mimas,	r	r	3.3607	3.3607	0.00
	r	r			
....	r'	r'			
Outer B. Ring,	r'	r'	2.1165	2.1246	— 0.01 —
Inner B. Ring,			1.7097	1.7323	— 0.02 +
Dusky Ring,	r'	r'	1.3811	1.3402 1.3588	+ 0.04 + + 0.02 +

In the instance of the Dusky Ring two values appear in the column of Fact; the first of these indicating the position of the centre of gyration, if the Dusky Ring have *an interval* between it and the inner Bright Ring (proportional, perhaps, on a smaller scale, to that which exists between the two systems of Bright Rings). The second value is that which obtains, if we suppose the Dusky Ring to extend quite up to the Bright Ring. The difference between the results is but a small fraction of the quantity to be compared.

[In view of the very considerable number of limits in the upper region of the system at which no satellite is found, and the ratios themselves being so small, it might almost seem that the approximate coincidence between Law and Fact was a forced one, brought about by a special arrangement and combination of terms. But not merely the number of terms (or ratios, or their equivalent) is indispensable, but the right order of their grouping must also be measurably maintained, to bring about the coincidences in their appropriate places. Then, afterward, from Dione downward, every limit has its corresponding satellite or ring, with the bare exception of that between the satellites and the rings. Then the discrepancy between Law and Fact is, in most cases, all but insensible. The most conspicuous deviation is that in the instance of the more recently discovered satellite Hyperion, the distance of which is not yet well determined. Another fact seems also not without its significance; viz., that the two ratios in the region of the rings have the same value, r'.][1]

The somewhat abnormal deviation from Law in the instance of *Hyperion*, presents a case like those of *Uranus* (especially) and, also, *Mars*, in the planetary system;[2] the resemblance being all the more accurate because the difference from Law is, in all these instances, *negative*. These, and other peculiarities, will be reviewed in the aspect of theory, in Section III.

Other Relations.

(19) The centre of gyration of the whole system of Bright Rings is at the distance from Saturn's centre = 1.9090; being just within the outer edge of the inner Bright Ring (or Rings) which is at the distance 1.9276.

In the subordinate system of the two outer Bright Rings the ratio of their distances (2.1825 — and 2.0522 —) = 1.06438; while $r^{\frac{1}{4}}$ = 1.06423.

Manifestly, then, the arrangement of the *Outer System* of Bright Rings is

$$\left.\begin{array}{l}\text{Exterior Ring}\\ \text{Interior Ring}\end{array}\right\} r^{\frac{1}{4}}, \text{ agreeing well with } \overset{\textit{Fact.}}{\left\{\begin{array}{l}2.1825 -\\ 2.0522 -\end{array}\right\}}$$ [3]

SYSTEM OF JUPITER.

TABLE (D).

(20). *Definite Arrangement of the System.*

SATELLITES.	LAW.	RATIO.	FACT.	L.—F.
IV.	26.99835	$r = (1.6007)^{\frac{6}{5}}$	26.99835	0.000
III.	15.35202		15.35024	+ 0.002 —
II.	9.62147	$r' = 1.5956$	9.62347	— 0.002
I.	6.04934	$r' = 1.5905$	6.04853	+ 0.001 —

Here $r = r'^{\frac{6}{5}}$, or $r' = r^{\frac{5}{6}}$; and the value of r' regularly *diminishes* by 0.0051.

[1] The accepted values in the column of Fact agree very closely with the very careful deductions of Capt. Jacob, from his own observations (*Memoirs of the Royal Astronomical Society*, vol. xxviii. p. 108). These are referred to Titan's distance as the standard; and when measured by Saturn's eq. radius give for

Rhea	9.5562	instead of	9.5528.
Dione	6.8445	" "	6.8398.
Tethys	5.3470	" "	5.3396.
Enceladus	4.3207	" "	4.3125.

[2] See *Note* 1 to (14).

[3] Of these relations, and what else is connected with them, more hereafter in Section III.

System of Uranus.

Table (E).

(21) *Approximate Arrangement.*

Satellites.	Mean Distance from Planet.	Ratios.
Oberon	22.56	1.3333
Titania	16.92	$(1.3913)^{\frac{3}{2}} = 1.6411$
Umbriel	10.32	1.3932
Ariel	7.40	

Here $r = r'^{\frac{3}{2}}$, or $r' = r^{\frac{2}{3}}$; and the value of r' *increases*; as r did (but regularly) in the planetary system.

Summing up of Relations of Mean Distances from their Respective Centres.

(22) In the *Planetary System* the value of the leading ratio r is at first 1.7770, and the regularly progressive *increase* of its value afterwards, from term to term $= 0.0138$. Also $r' = r^{\frac{3}{4}}$; and $r'' = r^{\frac{1}{2}}$.

In the *System of Saturn* $r = 1.28273$, $r' = r^{\frac{6}{7}}$, and $r'' = r^{\frac{1}{2}}$; and all the ratios are *constant*. Moreover, for the two outermost rings, $r''' = r^{\frac{1}{4}} = (r^{\frac{1}{2}})^{\frac{1}{2}}$.

In the *System of Jupiter* we have $r' = r^{\frac{5}{6}}$; r', at first, $= 1.6007$; and the regularly progressive *decrease* of its value $= 0.0051$.

In the *System of Uranus* $r' = r^{\frac{2}{3}}$; and the value of r' shows an *increase* from term to term.

Additional Feature of Resemblance of Two Half-Planets.

(23) The inclination of the equator of *Venus* to the plane of that planet's orbit, does not seem to have been accurately determined, but it is usually stated to be nearly 72°; the rotation of the planet (as is usually the case) being direct.

In the *Monthly Notices of the Royal Astronomical Society*, vol. xxiii. p. 166 (Jan. 1873), *W. Buffham, Esq.*, as a merely approximate result as yet, makes the inclination of the equator of Uranus 80°.[1] "Movement direct."

The orbits of the satellites are inclined to the ecliptic at an angle of about 79°; and *their* motion is *retrograde.*

These two half-planets, then, though near to the two extremes of the system, are again alike; viz., in the great inclinations of their equators, as well as in the direction of their rotations.

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[1] Inclination, viz., to the plane of the ecliptic. The inclination to the plane of the planet's own orbit is about $79\frac{1}{3}$°.

SECTION III.

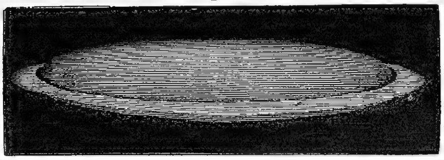
APPLICATION OF THEORETICAL CONSIDERATIONS AND THE DEVELOPMENT OF OTHER RELATIONS.

(24) The further discussion of the relations exhibited in Section II. will be aided, and circumlocution, at the same time, avoided, by the introduction of considerations having reference to the *Nebular Hypothesis of Laplace;* and this especially in the exposition of other relations, the investigation of which was prompted by suggestions furnished by the application of this very hypothesis somewhat extended and modified, in a manner now to be specified.

In the exposition of his hypothesis, its illustrious author supposes the atmosphere of the *rotating* Sun to have extended, in ancient times, to the limit (or, when at the furthest, very near to the limit) at which the centrifugal force of rotation must have balanced the force of attraction.

That afterwards—the atmosphere shrinking from loss of heat—the rotation (for reasons which he specifies) would be accelerated as the atmospheric molecules drew nearer to the centre of the Sun,[1] and, that the limit in the plane of the Sun's equator, at which the two forces—centripetal and centrifugal—would balance one another, would, therefore, be found further and further in.[2]

Fig. 2.



That thus successively, at new limits *in the plane of the Sun's equator*, further and further inward, the centrifugal and centripetal forces would indeed balance one another; insomuch that the *thin and narrow zones* thus *in equilibrio* in the plane of the equator (they having no tendency either to fall in or to be thrown off), would themselves be "abandoned" by the atmosphere in its farther shrinkage.[3]

(25) The description then goes on to state that the same equilibrium of forces *not* existing with respect to the atmospheric molecules situated on the *parallels* to

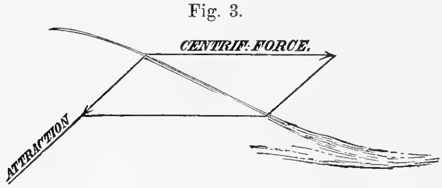
[1] The loss of heat will not affect the moment of rotation—the *turning power*—and every molecule (because of the shrinkage) having a shorter circuit, will accomplish it in *less time*. Then also, as shown hereafter, there will be some acceleration of the *actual velocity*. The original phraseology, as it were, anticipates this also, and provides for both. "La rotation doit être plus prompte, quand ces molecules se rapprochent du centre du soleil."—*Exposition du Système du Monde*. Note VII

[2] The centrifugal force, in accordance with its law, increasing at a more rapid rate than the attractive force; the centrifugal force (with conservation of areas) varying inversely as the cube of the distance, instead of inversely as the square of the distance, so that, at a distance *a little within* the atmospheric limit, and at which the attractive force was still somewhat *in excess*, it would soon happen that a small increase of both forces (from the shrinkage of the material) would result in increasing the centrifugal force so much more rapidly as to exhaust the difference of the two forces, and leave the nebulous material ready to be "abandoned."

[3] Very different this, from the supposition of many misinformed persons, that the rings here spoken of were *thrown off* by an excess of centrifugal force.

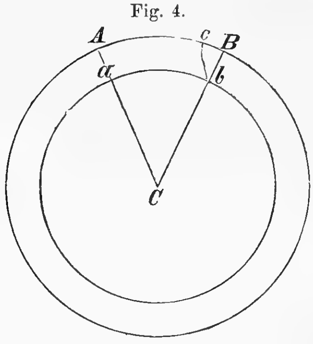
the solar equator, these molecules would, by their attraction, be brought closer to the atmosphere, in the progress of its condensation, and would not cease to belong to it until, in consequence of this motion, they were brought nearer to the plane of the equator.[1]

Fig. 3.



(26) The description proceeds, saying of these "zones of vapor" (or rather nebulous zones) successively abandoned, that these zones, must, in all probability, form by their condensation and the mutual attraction of their molecules, diverse concentric nebulous rings circulating around the Sun. The mutual friction of the molecules of every ring must accelerate some and retard others, until all had acquired the same angular motion. And (when all this went round together) the actual velocity of molecules further from the centre would be greater than that of those nearer; the parts near the outside of the ring going *uniformly* round in a large circuit, in *the same time* in which those nearer, also moving *uniformly*, described a smaller circuit. Thus, with time the same, the angle ACB being the same for both, the part, such as AB, is greater than the similar part ab of the smaller circuit;[2] and the *part* of AB described in a unit (say a second) of time, greater than the similar part of ab; *i.e.* the *actual velocity* in AB is *greater*.

Fig. 4.



(27) Besides all this, in the progress *inward* of the particles forming the nebulous rings, the *actual velocity of rotation* of those particles would be *increased* conformably to the principle of the conservation of areas; which requires that an area such as ACB, in the figure, should *continue* to be passed over, by the rotation of CB, in the *same* time; so that if AC and BC be shortened, the figure must be *broader* to preserve its size, or the distance BA, traversed in *the same time* must be *greater* than before; *i. e*, the particle must move *faster* along BA; while the particles attracted toward the others *outward*, and then forming the inner part of the ring, would, in obedience to the same principle, have *their* actual velocity of rotation *diminished*.

(28) Then if all the molecules of the nebulous ring continued to condense without being disunited, they would at length form a liquid or a solid ring.[3] But the regularity requisite in such a case, in every part of the ring and also in its cooling, must make this a very rare phenomenon. Accordingly the solar system affords but a single example of this kind—that of the rings of Saturn.

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[1] The diagrams are our own. M. Laplace employs none in his Exposition du Système du Monde.

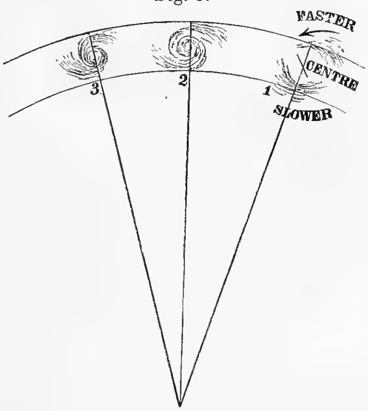
[2] The difference being $= Bc$.

[3] Or a ring of small solids closely arranged, as seems to be actually true of the rings of Saturn.

(29) But almost always, the nebulous ring must have broken into several masses, which, moving with velocities but slightly different, would continue to circulate at the same distance from the sun.

These masses would take a spheroidal form with a motion of rotation in the direction of their motion of revolution (from west to east), because of the inferior molecules (26), having less actual velocity than the superior; and thus would soon be formed so many nebulous planets. But if one of these were sufficiently powerful to bring together successively, by its attraction, all the others about its own centre, the nebulous ring would then be transformed into a single nebulous spheroidal mass revolving around the sun, and having a rotation in the direction of its revolution. This last has been the most common case; though the solar system, nevertheless, furnishes an example of the first case, in the small planets which revolve between Mars and Jupiter, at least if we do not suppose with Olbers that they primitively formed a single planet, which a powerful explosion divided into several parts animated with different velocities.

Fig. 5.



(30) Now if we follow the changes which an ulterior cooling would produce in the nebulous planets of which we have come to conceive the formation, we shall see form, at the centre of each, a nucleus incessantly increasing by the condensation of its surrounding atmosphere.

(31) In this state the planet would perfectly resemble the sun in the nebulous state in which we considered it. The process of cooling must then produce, at different limits in its atmosphere, phenomena similar to those which we have described; that is to say, rings and satellites circulating around its centre in the direction of the planet's own rotation, and turning at the same time (the satellites that is) upon themselves. The regular distribution of the mass of the rings of Saturn about its centre, and in the plane of its equator, results naturally from this hypothesis, and without it becomes inexplicable. "The rings" (exclaims the framer of the hypothesis) "appear to me to be an ever-present proof of the primitive extension of the atmosphere of Saturn, and of its successive retreats."[1]

(32) He then proceeds to say that the singular phenomena of the small eccentricity of the orbits of the planets and the satellites, of the small inclination of those orbits to the solar equator, of the identity of direction of rotation and revolution of all[2]

[1] "Me paraissent être des preuves toujours subsistantes de l'extension primitive de l'atmosphère de Saturn, et de ses retraites successives."

[2] Difference of density, etc. might cause the rotation of a satellite in a rare case to be in a contrary direction, as is true of the orbital motion of the satellites of Uranus.

these bodies with that of the rotation of the sun, flow from the hypothesis which he proposes, and give to it great probability.[1]

(33) If the solar system had been formed with perfect regularity, the orbits of the bodies which compose it would have been circles, the planes of which, as well as those of their several equators and rings, would have coincided with the plane of the solar equator. But we may conceive that the innumerable varieties which must exist in the temperature and density of the different parts of those great masses, have produced the eccentricities of their orbits, and the deviation of their motions from the plane of that equator.

(34) The author then goes on to show that, on this hypothesis, the comets are strangers to the system, formed by the condensation of nebulous matter elsewhere, but drawn in when they come into the region in which the attraction of the sun is predominant; and he then proceeds further to show that this will account for all the peculiarities of their motion, as well as the variety in the inclinations of their orbits.

(35) M. Laplace then adds that, if in the zones abandoned by the atmosphere of the sun there were found molecules too volatile to unite to one another, or to the planets, they ought, while continuing to circulate around the sun, to present all the appearances of the Zodiacal Light, without opposing sensible resistance to the several bodies of the planetary system, either because of their extreme rarity, or because their motion is the same with that of the planets themselves.

(36) In all that has now been stated, which, for the most part, is a translation, or else a paraphrase of M. Laplace's *Note VII.* to his *Exposition du Système du Monde*, in all this, there has been no allusion to the operation of another cause, which may well have produced changes in the nebulous material, antecedent to those which have been already contemplated. The solar atmosphere, when at its largest extent, must also have had a very oblate form, and the portions near to the pole of the rotating sun, because of the superior density, and close proximity of the sun's body, have been subjected to an attractive force greatly superior to that prevalent (or barely in equilibrio) in the equatorial regions.

(37) Now a greater attractive force acting on nebulous matter increases the local density where the force is thus urgent; as is manifest from what we observe in the nuclei of comets. But a greater density of the same sort of material is accompanied by *a more profuse radiation of heat.* All this could not fail to produce changes in the actual, as well as angular, velocity of the portions thus affected, which would not conform to the changes of both, then going on, in the regions nearer to, or at the equator.[2] A *rending* of the material of the atmosphere must thus result, perpetuating itself all round the sun, so long as the portions most affected were not detached to the extent of "abandonment."

There might still be a tendency in the portions thus separated by the rent from those parts still closely attached, to preserve, at least rudely, an approximation, even in their exterior surface, to the spheroidal form; the situation, at any given distance from the axis—when once that situation has been attained—presenting the same ratio there of centripetal and centrifugal forces; since, in so far as density

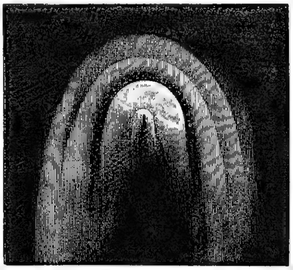
[1] Verisimilitude rather—"vraisemblance."

[2] To say nothing of the *molecular* changes which might be superinduced by the condensation itself.

is concerned, the centrifugal force at the extremity of the radius of rotation, would be as the density, and the attractive force, still acting at the same angle with the plane of the parallel, be also as the density, so that the element of density being, in effect, all but excluded from the comparison, there would remain very nearly the same ratio of the forces as before; so that the not yet "abandoned" portion of the atmosphere would scarcely have its exterior spheroidal form affected.[1]

And, although the case is not *just the same*, divisions into something like *spheroidal shells* resembling those here supposed may be[2] traced in the representations of the heads of comets, among others that of 1680, as represented in Plate VI. of the third volume of *Delambre's Astronomie Théorique et Pratique;* the same being copied from the *Histoire Céleste* of *Lemonnier.* The appearance in question is yet more conspicuous in the representations of the head of the great comet of 1858, given by Prof. G. P. Bond. in Vol. III. of the *Annals of the Observatory of Harvard College.* A very faithful copy of one of these is here given.

Fig. 6.



(38) Now, the partially condensed *shell* thus formed (if indeed admissible) must itself have exerted a *conservative power* in preventing the too frequent occurrence of cases like that of the asteroids; viz., by an earlier holding together of the greater number of the "abandoned" equatorial portions of the atmosphere in the process tending to form rings or planets.[3]

Nay, it might even be questioned whether the more dense portions of the atmosphere, earlier separated, may not in their progress toward the equatorial plane, described in (25), have arrived at the state of equilibrium of the forces, before the equatorial portions were ready for the same; and so, *the formation of a planet have gone on thus far, from a shell instead of a ring.*

Just one change more, to be followed by its consequences, might then have taken place. The more dense portions, being the *first* about to be "abandoned," might be found to be further *outward* than the rarer equatorial portions; and attaching the latter to themselves by the attraction due to a greater density.

(39) Now, the special arrangements of the two half-planets, Earth and Venus, are *as though* what has here been discussed and explained, were entirely applicable to them.

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[1] Though the ellipticity of the same might be appreciably changed.

[2] Which may indeed, in part, be consequent on the changes adverted to in *Note* 2, on p. 20.

[3] The oblate form of the spheroid here alluded to; the more profuse radiation of heat due to a greater condensation of the nebulous material in the polar region; and the division of the envelope into shells were all insisted upon by the author of this paper in a communication made by him to the American Association for the Advancement of Science, at their meeting in Montreal, in 1857. The idea of a more profuse radiation of heat from the polar regions seems, since that date, to have independently occurred to others; and a profound and thorough investigation of the form of the oblate solar spheroid and its variations, as also of the density of the solar atmosphere, at the various planetary distances, the relative breadth of the rings, etc., though without reference in that connexion to a more profuse polar radiation, is given by David Trowbridge, A.M., in vol. xxxviii. (Second Series) of the *American Journal of Science and the Arts,* Nov. 1864.

Specialities of the Half-Planets Earth and Venus.

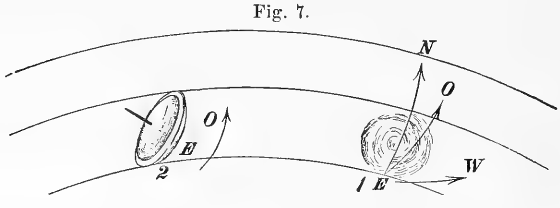
1. In accordance with the immediately preceding conclusion, the *exterior* half-planet, the Earth, not merely shows a density greater than that of its interior half-planet Venus, but also, as seen in Table (A), in (3), a density altogether remarkable in view of the Earth's place in the planetary system.

2. The inclination of the equator of Venus to the plane of that planet's orbit (from 73° to 75°, most probably) presents a marked contrast to what we find in the cases of Mercury, the Earth, and Mars, in all which the inclination of the equator approaches to a mean value that is nearly the same with the obliquity of our equator to the ecliptic; and this, while a like contrast does not exist in the respect of the time of rotation (the sidereal day) of Venus; for that is nearly the same with each of the respective sidereal days of these same other three planets, in this region of the system. But the inclination of the equator of Venus is, up to the present time, without a parallel in all the system, except in the instance of another *half-planet*, viz. Uranus.[1]

And here the state of things is, withal, *as though* the enormous deviation of the plane of the equator from the plane of the planet's own orbit (and which implies also a very large deviation from the plane of the sun's equator) were itself *due to the attraction* towards the more dense outer portion, already commented on, which went to the formation of the Earth; an attraction acting in a direction nearly *perpendicular* to the half-planet's first-forming equator and its parallels.

Thus the material, at its first rolling up from the form of a ring or shell, would be inclined to rotate in the plane of *EW*, but being drawn outward by the attraction of the more dense material in the direction *EN*, the resultant rotation would be in a direction such as *EO*, as represented in the figure at 1, and transferred to the position marked 2.

Fig. 7.



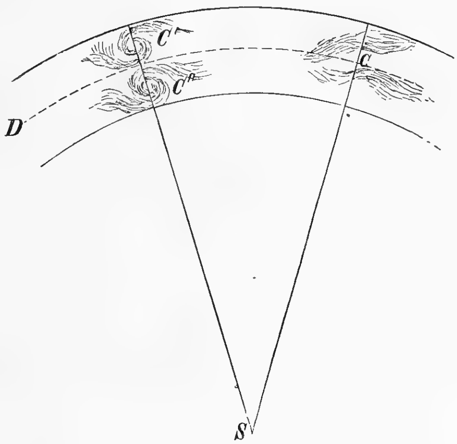
All this might begin antecedently to the process of rending which introduced the formation of half-planets, or perhaps go on during that very process; in which

[1] During the *revolution* of a whole ring or shell around the sun, every part of the outside would be presented *once* in its turn to the entire circuit of the heavens; and so in effect would *rotate once* around a point within that ring or shell. This would determine the angular velocity of rotation at the first gathering up to form a planet. The existence of more dense material outside would seem *not* to have superinduced a *retrograde* rotation in this case; but to have interfered to the preventing of an *accelerated* rotation, and thus the *more dense* material be kept *outside*, until, in the contest of forces, the rending into two half-planet masses took place. The existing state of things, in its various aspects, seems to look toward this; but the problem is too complicated a one to justify an assertion that such was the succession of events.

same process of rending, the attraction of material outward, *i.e.*, toward the more dense Earth-forming mass, may itself have been efficient.[1]

3. The division of material into two half-planet portions, would very probably take place, at what, with reference to the revolution around the sun, was the *centre* (or rather the central line) *of gyration* of the whole mass (at the distance SC in the figure); leaving the material on the one side and the other of that limit, to be gathered into the half-planet masses, each around its own special centre of gyration (at C' and C''); which special centre would be that due to the *half-planet itself*, when formed.

Fig. 8.



Making use, then, of the half-planets themselves (gathered at C' and C''),[2] and finding *their* centre of gyration, we shall approximate to the former position of (C) the centre of gyration of the whole mass. But *that* would be the position of the *whole* planet, if the material had all gone to form it, *i.e.*, the *limit* (⊕♀) in Table (B), so that the centre of gyration of the two half-planets should be found very near to the limit (⊕♀) in Table (B), in (14).

Now—with the masses of the Earth and of Venus as given in Table (A), in (3), and their distances as given in the column of Law in Table (B) in (14)—from *Eq.* C in (17), we have for the distance from the sun of the centre of gyration of the Earth and Venus,

with sun's horizontal parallax = 8″.848, C = 0.88665
" " " " = 8.78, C = 0.88579.

And the position due to the *whole* planetary limit (⊕♀) in Table (B), in accordance with *Law* 1*st* (10), is

(⊕♀) = 0.85101.

4. But the separation of the material into two half-planet portions would, withal, take place at the limit where the attractive forces of the forming half-planets were in equilibrio; on one side of which limit the material would be gathered (by the excess of attractive force on *that* side) in the formation of a half-planet toward *that* side; and on the other side of (the neutral) limit, in the formation of another

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[1] A writer in the *Westminster Review*, vol. lxx. (July, 1858), has introduced the idea of a greatly inclined rotation in a *thick* ring, or even a retrograde rotation; but he has applied it in a region of the system in which the conditions which he introduces are misplaced. A different explanation is applicable in the instance of Uranus, as will be shown hereafter.

[2] Which will scarcely differ, in either case, from the very centre of the planet itself.

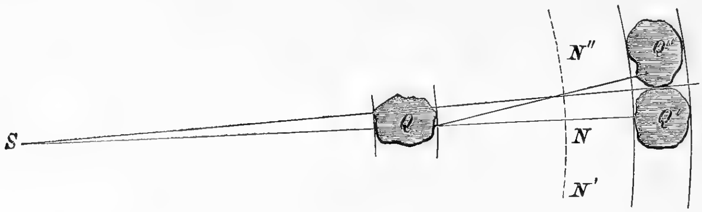
half-planet on that *other* side [as they are represented in Fig. 8], gathering around C', C'', the one on the one side, and the other on the other side of CD, the dividing limit of neutrality, where the forces being equivalent and opposed would be in equilibrio. It would seem then to be desirable to ascertain whether the limit *thus* defined will agree with either, or nearly with both, of the other two determinations already made.

Fig. 9.

Now when two planets (P and P') are in conjunction, as seen from the sun (at S), the position of the point (N), at which their attractions would be equivalent and opposite, and so neutralize one another, may be found, as is well known, by so dividing the distance (PP') between those planets, that

$$\frac{NP}{NP'} = \frac{\sqrt{\text{of mass of } P'}}{\sqrt{\text{of mass of } P}}.^{1}$$

Fig. 10.



But, in the act of the rending described in the *Note* on p. 22, portions such as Q and Q' would act on one another directly (in the line QQ') very much as would two small planets; and so the neutral point (N) be determined as before, viz.:—

$$\frac{QN}{Q'N} = \frac{\sqrt{\text{of mass of } Q'}}{\sqrt{\text{of mass of } Q}};$$

And the local oblique action of neighboring portions would conform to very nearly the same ratio; so that the whole action within distances at which it would be appreciable would have its neutral limit ($N'NN''$) dividing the distance between the points of reference of rupturing annular masses in a manner approximating to that which obtains in the case of two planets. And what is here stated of them, might also be asserted of the sections of shells, parallel to the equatorial rings, with approximately the same result as to the dividing limit.

Making use then, as heretofore, of the half-planets themselves, as accumulated around what were their respective points of reference, while yet their masses were

[1] The point N is one of the limits of Prof. Kirkwood's spheres of attraction, made use of in his Analogy.

in the former state; we shall, by the application of the equation here adopted, in effect obtain QN or $Q'N$, and hence also SN, the distance of the neutral point N from the sun's centre. With the same data from Tables (A) and (B) in (3) and in (14), as before, we shall then have

with the sun's horizontal parallax 8''.8448, $SN =$ 0.85383,
and with " " " 8.78, SN 0.85459.

While, (14), limit (⊕♀) due to a whole planet distance in Table (B), is 0.85101,
exhibiting all but a perfect coincidence; while, as before, the distance of the centre of gyration from the sun's centre . . $SC = \begin{cases} 0.88665, \text{ or} \\ 0.88579, \end{cases}$

(40) Summing up then the specialities of the two half-planets, Earth and Venus, which are consistent with the theoretical considerations now exhibited, we have

1. In accordance with the conclusion in (39), the greater density of the *exterior* half-planet, the Earth.

2. The *tilting up* (if the expression be allowable) of the equator of Venus and its parallels—as if by the attraction outward, due to that same greater density—in the antecedent arrangement of the half-planet masses.

3 and 4. The decided approximation to agreement in position of—

(*a*) The whole planet limit (⊕♀) in Table (B).

(*b*) The neutral point, or point of equal attraction between the two half-planet masses, and

(*c*) The distance from the sun's centre of the centre of gyration of the same two half-planet masses, thus—

(⊕♀) = 0.851 +
Neutral position is at 0.854 ±
Centre of gyration is at 0.886 ±.

Determination of the Mass due to a Half-Planet ♅i (now missing), interior to Uranus.

(41) The distance due to such a half-planet has already been determined in accordance with *Law 3d*, (10), and the same is recorded in Table (B), in (14).

The *mass* of this half-planet may be determined by means of the equation for the centre of gyration of it and Uranus; the case being similar to that of the Earth and Venus,[1] and the whole planet limit here being *limit* (♅), in Table (B).

Now let a' represent the mean distance of Uranus from the sun, and m' the mass of that planet; while a and m, respectively, represent like quantities in the instance of $♅_i$. Then, as limit (♅) represents the position due to the centre of gyration, *Eq.* (c) of (17), will read

[1] But here the agreement of the position of the centre of gyration with the whole planet limit, will have this favoring condition; that under the less stringent circumstances, in this region of the planetary system, it is not probable that any considerable portion of the more dense material was carried to the *outside*, in the half-planet formation (or the tendency to it), as, (39), seemed to have been true in the instance of the Earth.

$$(U) = \sqrt{\frac{m'.a'^2 + m.a^2}{m + m'}}; \text{ or}$$

$$(U)^2 = \frac{m'.a'^2 + m.a^2}{m + m'}; \text{ whence}$$

$$m(U)^2 + m'(U)^2 = m'.a'^2 + m.a^2; \text{ and}$$

$$m \left\{ (U)^2 - a^2 \right\} = m' \left\{ a'^2 - (U)^2 \right\}; \text{ and}$$

$$m = \frac{a'^2 - (U)^2}{(U)^2 - a^2} \times m'; \text{ or}$$

$$m = \frac{\overline{a' + (U)} \times \overline{(a' - (U)}}{\overline{(U) + a} \times \overline{(U) - a}} \times m';$$

which, as a', (U), and a are all determined, will give us m in terms of m'.

Substituting, then, the values of a', (U), and a, as found in the column of *Law* in Table (B), in (14), we have

$$m = (1.38865)\, m',$$

i. e., the mass of ♅i = (1.38865) of the *mass of Uranus;* or, substituting the value of the latter, as found in Table (A), in (3), we shall have

$$\textit{Mass of } ♅_i = \tfrac{1}{15843} = 0.00006312- \text{ of the mass of the sun.}$$

The most probable Answer to the Question—What has become of the Missing Mass?

(42) The most ready reply to this question would seem to be—that the missing mass had, (29), been formed into a group of *asteroids.* But then, as this region of the planetary system is one in which large masses abound, it would also seem that the mass of a group of asteroids here, might reasonably be supposed to be very considerable, even if the computation already made, (41), had not indicated this very mass to be almost $1\frac{4}{10}$ that of *Uranus.*

And if these considerations are conceded to have weight, the existence of the seemingly missing mass, in the form of a group of asteroids, becomes at once inadmissible; since, if such a group were there, its existence would speedily be evidenced by the perturbations of both Uranus and Saturn, which such a group would produce.

(43) Rejecting, then, the hypothesis of the existence of a group of asteroids in this region, the next hypothesis which it may be found to be appropriate to consider will be, whether, in the accumulation of the great mass which was to constitute *Saturn*, the material which would have formed the *interior* half-planet ♅i was not *itself drawn over and inward by the o'ermastering attraction of the Saturn-forming mass*, which thus *attached to itself* the interior half-planet mass rent away from Uranus.

In favor of this hypothesis we shall find *ten special consistencies*, which in their turn will *introduce others*, having *more extended relations.*

1.

The *mass* of the forming Saturn would be *adequate* to the exercise in its own place of the o'ermastering attraction here supposed.

For if from the mass of Saturn, as found in Table (A) in (3); viz.:—

$$\frac{1}{3501.6} = 0.00028558 +,$$

we subtract the mass of ⛢*i* $= 0.00006312 +,$

as computed in (41), there will remain $0.00022246 +,$

for the mass of the forming Saturn; *before* the mass due to the interior half-planet ⛢*i*, had been drawn over and inward to unite with the other portion of the entire mass which has gone to constitute the complete Saturn system as we now have it.

Now as the symbol for Saturn is ♄, we may represent this first *formative portion* of that planet's mass [which we just now found to be $= 0.00022246 +$] by the symbol ♄̂. And then computing the position of the point of equal attraction, or neutral point [as, heretofore, (39), in the case of Earth and Venus], we shall find ♄̂'s attraction to extend in the direction of Uranus, to the distance from the sun's centre = to 16.40924, which is far beyond the distance due to the (missing) interior half-planet ⛢*i* (viz., 14.64275) as found in Table (B), in (14). The attractive force of the pre-existing Saturn-mass was, then, adequate *in measure* to the effect here supposed.

2.

But this same limit, 16.40924, to which the attractive force of ♄̂ extended, in the direction of Uranus, this, also, is not so *very far short of* the limit (U),[1] *i.e.*, 16.91431, at which the whole planet mass would be likely to be rent to form the two half-planets, Uranus and ⛢*i*; it being, *in that respect*, a limit analogous to that found to be a dividing limit in the case of Earth and Venus in which *both* the half-planets *still exist*

3.

The very great inclination of the satellite system of Uranus to the plane of the planet's orbit was, long ago, determined by Sir William Herschel; the inclination of the orbits of the satellites to the plane of the ecliptic being nearly 79°; and the inclination to the plane of the orbit of Uranus must therefore be nearly 79°1',[2] while their ascending nodes on the ecliptic are nearly in longitude 166½°; *motion retrograde.*

And, again, the recent observations, (23), of W. Buffham, Esq., detailed in the *Monthly Notices of the Royal Astronomical Society*, vol. xxxiii., No. 3 (Jan. 1873), lead to results at present stated by him to be "the merest approximations;" but which yet give

[1] In Table (B), in (14).

[2] Or 100°59'; the motion being *retrograde.*

Long. of the asc. node of the equator	110°
Inclination of the equator	80°
Time of rotation	$12^h \pm$;

motion direct.

From these several data, it would seem probable that the equator is inclined about $79\frac{1}{3}°$ to the plane of the planet's orbit, and some 60° to the orbits of the satellites.

So that the drawing over of material (*inward* now, and not outward) due to the proximity of *the great mass of* ♄, would seem to have produced *in the direction of the plane of the equator of Uranus, an alteration like that which*, as heretofore shown, (39), *seems to have taken place in the instance of another half-planet, Venus;* the *tilting-up* (if the expression may again be tolerated) being quite as great in this instance as in the other; and here the orbits of the satellites are also enormously displaced.

4.

In the instance of Venus, it would seem that the great inclination of the equatorial plane was, (39), brought about by the attractive force of the Earth-mass of *greater density;* but, in the present instance, the like effect, as already shown, seems to have been due to proximity of *the great mass* of ♄; though, (3), the *density* of the existing planet Saturn, as exhibited in Table (A), is the *least* in the whole planetary system.

But even *that* is here found to be *a fact in place.* For the drawing over, (41), of a mass nearly equal to $1\frac{4}{10}$ of that of Uranus, from a region in which the *mean density* of the nebulous material was far inferior to that of the ♄-mass,[1] could hardly fail to have resulted in a mean density of the existing Saturn, such as we find.

5.

The scrupulously exact coincidence of the numbers in the column of *Law* with those in the column of *Fact* in Table (B), in (14), approaches the nearest to an exception, in the very instance of Uranus; the existing Uranus being 0.374 of the Earth's distance *within* the distance due to Uranus in accordance with *Law 2d*, in (10); though even that difference is less than $\frac{1}{50}$th of the whole distance of Uranus itself. But this, if we give it any weight at all, is, again, *a fact in place.* Uranus in the drawing over of the material towards ♄, may, perhaps, have somewhat *fallen in.*

6.

The acquisition of so much additional material, drawn in from a great distance, must, it would seem, have the effect of giving to the condensing Saturn-mass a much more oblate form than that which would otherwise have pertained to it; which seems to be confirmed by the fact that the outermost satellite is at the dis-

[1] For the probable ratio of the densities here in question, see the paper of Mr. Trowbridge already referred to in the *Note* to (38).

tance of more than 64 radii of Saturn from his centre; while the distance of the outermost satellite of Jupiter, measured in the same way, is scarcely 27 radii of its primary.

And the *comparatively feeble light* of this same outermost satellite of Saturn is withal consistent with a *low density* of that satellite;[1] a fact also *in place*, in view of the acquisition of a less dense material from the planetary region *exterior* to the ancient Saturn ♄̂: the outermost satellite, in the view of the hypothesis as to its formation, being most probably constituted of the portion the least dense of all.

7.

Such being the special form and constitution of the Saturn-forming mass—the formation of the extensive system of satellites might have been nearly completed, *in advance of the "abandonment" of the material* which now constitutes *Saturn's rings*;[2] or that satellite formation, at least have gone so far, as to *keep the rings* in their *form* and *general arrangement*, while Saturn, condensing, shrank away from the rings, yet with his central position with regard to them (or rather their corresponding arrangement around him) preserved; *the conservative power* of the satellites, in these respects, being exerted in those very ancient times, even as now.[3]

It was then, it would seem, the drawing over and inward of the material which else had constituted the half-planet between Saturn and Uranus, that, as has been said, gave to Saturn and to his system the special form and arrangements that rendered the retaining of the rings *as* rings a possibility; which has made them an actuality; made Saturn what the author of the Novum Organum would term an "*instantia solitaris*," in the solar system.

8.

The same processes of the transference and combination of material here insisted upon, seem also to have affected the *inclination of Saturn's own equator*, and *that of almost the whole Saturnian System, to the plane of the planet's orbit.*

For this great planet's equator, and his rings, and the orbits of his satellites[4] are inclined at an angle of more than 28° with the plane of his orbit; while the inclination of Jupiter's equator, and that of the orbits of three of his satellites, does not much differ from 3°.

9.

Another relation may possibly have some significance in this connexion; viz., the ratio of the *periodic time* of the interior half-planet ♁*i* to the periodic time of the ancient Saturn ♄̂.

---

[1] Not that the phenomenon of a comparatively feeble light would absolutely *require* the supposition of a low density; but, as stated, the one thing would be consistent with the other.

[2] There being material for that so *far outward* in the direction of the plane of the equator of the *very* oblate spheroid, or near to that; the spheroid being made so very oblate *by the acquisition from without of the material of* ♁*i*.

[3] For "no planet can have a ring, unless it is surrounded by a sufficient number of properly-arranged satellites. *Saturn* seems to be the only planet which is in this category; and it is the only one, therefore, which could sustain a ring."—Prof. Peirce, On the Constitution of Saturn's Ring, in the *Astronomical Journal* No 27, p. 18.

[4] All but that of the outer one.

For the mean distance from the sun of the (now missing) interior half-planet ⛢*i*, and that of Saturn [as recorded in the column of Law in Table (B), in (14)] being, respectively, 14.64275 and 9.44511, the application of Kepler's 3d Law will give us the corresponding periodic times; and then the measurement of the greater of these by the less, will show the periodic time due to the half-planet ⛢*i* to be to the periodic time of the ancient Saturn ♄̂ at its theoretical distance, in the ratio of 1.9303 to 1; and a still more scrupulous determination of the data in question than that exhibited in Table (B), might, perhaps, show the ratio to be very accurately that of 2 to 1.[1]

But with this ratio existing, the perturbations of one of the masses by the other at their nearest approach (intensified, it may be, by eccentricity of form or of orbit; or otherwise) would *recur* after *every two* subsequent revolutions of the ancient Saturn ♄̂; and very possibly the effect of those perturbations become, in this way, *cumulative;* and thus the passing over of the material of the half-planet have been furthered and aided, until its mass was absorbed by the ancient Saturn ♄̂.[2]

10.

It is not inconsistent with all that has just now been stated, that the term for the distance of Saturn reported in the column of *Law* in Table (B) is *less* than the corresponding term in the column of *Fact;* the ancient Saturn ♄̂ having, as it were, been *drawn outward* in the completion of the catastrophe of the absorption of ⛢*i;* while Uranus, as indicated in Consistency 5 of this series, may, perhaps, have somewhat *fallen in*.

11.

The (additional) 11th of these consistencies has much more extensive relations; some of which will here be exhibited and explained; they being especially such as are comprehended under the following title:—

The more Ancient Arrangement of the Material of the Planetary System.

For if—*always adhering to the hypothesis that the material of the existing Saturn was increased in the way so often already specified*—we endeavor to show what was *the more ancient combination and arrangement of the material of the solar system* (viz., ere the rending and the rupture, of which we now seem to find traces, were, in all their extent, accomplished), we shall find that, by regarding the masses in question (*half-planets, Asteroid mass or masses,* etc.), as recombined about their respective centres of gyration, and then ascertaining the *positions* of those centres, to serve as our points of reference, we shall thus obtain *a new and fully justified series of terms*, in which, very much as in the other instances of leading ratios in the planetary, and also in the satellite systems, every term will have a ratio to the next

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[1] The distance of ⛢*i* being, as stated, 14.64275; then, to perfectly justify a ratio of the periodic times of 2 to 1, would require the distance of the ancient Saturn ♄̂ to be 9.24562 instead of 9.44511.

[2] [For a further discussion and application of what is here intimated; as well as that of what more the relation in question may be significant, see *Articles* (64) to (67) inclusive.]

succeeding term, which will, here, *decrease* very slowly, but regularly, in the progress inward.

(44) With respect, then, to this recombination—

The value of the 1st, or *Neptune-term* of the series, closely corresponds to that in Table (B) of the completed arrangement of the Planetary System in (14).

For the *2d term* of the series—

Double Planet Arrangement.

Whole planet mass (U).	(*a*). The mass of Saturn being reduced to that of ♄̂—to furnish the material for the half-planet ⛢*i*—that half-planet must then be regarded as being restored to its appropriate place [as the same is exhibited in Table (B)]. (*b*). The two half-planets, Uranus and ⛢*i*, must then be regarded as combined around their centre of gyration to form the *whole-planet mass* (U).
Whole planet mass ♄̂.	The mass of ♄̂ will then be left at a *whole-planet distance.*

Then, (*c*).—The *whole planet mass* (U), accumulated anew (as already indicated), must be combined with the mass ♄̂ to form from *both*, around *their* centre of gyration, a quasi *double-planet* mass [(U) ♄̂]; to furnish the *2d term* required.

Jupiter will itself, in its mean distance from the sun, furnish the *3d term.*

Mars and the *Asteroid mass* (A) will, in the quasi *double-planet* arrangement, at their centre of gyration, furnish the *4th term;* designated as that of [♂ (A)].[1]

The *Earth* and *Venus*, now existing as separate *half-planets*, will, in a *whole-planet* arrangement, furnish (at their *centre of gyration*) the *5th term* very near, (39), to the already recognized limit (⊕♀). This *5th term* is then designated as that of [⊕♀].

Mercury, in its mean distance from the sun, furnishes the *6th term.*[2]

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[1] In the computation of this 4th term, such a value has, of necessity, been attributed to the asteroid-mass as would make that 4th term in the column of Fact, absolutely the same with the corresponding term in the column of Law. But the value of the asteroid-mass thus determined, is confirmed in a way which cannot but be regarded as extraordinary. [See *Article* (46).]

[2] Neither the *aphelion* nor the *perihelion* distance appearing; though the one is found at a *whole-planet distance,* and the other at an *exterior half-planet distance,* in Table (B), in (14). Mercury, then, at a distance the mean of these two (but in another arrangement) has thus characteristics approaching to those of *a double-planet* [as was intimated, though not explained in (9)]; and this with an appropriate place in the series in which the *double-planet* arrangement appears; the difference between this and the otherwise analogous terms of the arrangement being, that whereas, in the other cases, the material of the two planetary bodies (with reference to its more ancient state) is regarded as accumulated anew, and, as it were, in some measure, reconstructed about the centre of gyration of those bodies; the actual combination, in an analogous position, seems to be found in the *existing planet,* Mercury itself.

The conditions prevalent in this series (with a quasi double-planet arrangement for every *alternate* term), require that the mean ratio R_1 should nearly$=r^{\frac{3}{2}}$, r being the mean leading ratio for the *whole-planet* arrangement in Table (B), in (14).[1] Accordingly we find that, with the mean value of r, in Table (B), [which, (13), $=1.8253$], that $r^{\frac{3}{2}}=2.4660+$, while the mean value of R_1 prevalent in this new series, is 2.4021.

(45) The whole arrangement, in accordance with what has now been stated, is exhibited in the following table; the symbols of mode of connexion, and dependence, etc., being similar to those in Table (B), in (14).

TABLE (F).

More Ancient State and Arrangements of the Planetary System.

NAMES, etc.		SYMBOLS.	LAW.	FACT AND DERIVATIONS.	Diff. L.—F.	Diff. in terms of quantity measured.
	NEPTUNE	♆	30.06039	30.05733	+0.003+	+0.000+
½ *planet Uranus* } ½ *planet* ⛢*i* }	Whole-planet (U) } Whole-planet ♄̂ } ..	[U♄̂]	12.44376	12.40099	+0.043	+0.003
	JUPITER	♃	5.16574	5.20280	—0.037	—0.007
	Asteroid mass (A) } Mars .... } ..	[♂(A)]	(2.15051)	(2.15051)	......	......
Earth....... } *Venus*....... }	....	[⊕♀]	0.89780½	0.88665	+0.011	÷0.013
	MERCURY............	☿	0.37589	0.38710	—0.011	—0.030

The values of the ratio R_1, which determine the numbers in the column of *Law*, are—

		Diff.	
♆ to [(U)♄̂]	2.4157		
[(U)♄̂] to ♃	2.4089	0.0068	
♃ to [♂(A)]	2.4021	0.0068	Mean 2.4021.
[♂(A)] to [⊕♀]	2.3953	0.0068	
[⊕♀] to ☿	2.3885	0.0068	

The mean value of R_1 is, then, very nearly 2.4, which $=\frac{24}{10}=\frac{12}{5}$, so that every

[1] It being among those conditions that the *centre of gyration* of the component masses should very closely correspond in its position with that due to the intermediate term in the quasi *double-planet series;* a fact which itself seems to indicate, that the law of apportionment of the masses is not independent of that of the distances, but that the one (in the mathematical sense of the term) is a *function* of the other.

term, after the first, is $\frac{5}{12}\pm$ of that which immediately precedes it; instead of $\frac{5}{9}\mp$, which is the whole planet ratio in the existing planetary system.[1]

Now, it is especially to be again observed, that the *2d term* of the series in this Table, in the way in which it is here obtained, *supposes*, and it *depends* upon the supposition, that the material of the missing half-planet ♄*i passed over and was combined with* the other portion of the Saturn-forming mass, to, thus, construct the existing planet Saturn; and it is, (44), by supposing that process *reversed—restoring* ♄*i to its place*—and then *combining* in the way already indicated, (44), that the *2d term* of the Table is obtained for the column of Fact, and can, consistently and accurately, occupy its place in the series;[2] so that *this 11th consistency*, supporting the hypothesis of the disappearance of the missing planet, in consequence of its mass having been drawn inward and combined with the Saturn-forming mass, has even more extended relations than the others.

Having, then, as far as may be, answered the question, (41), *What has become of the missing mass*, it may next be well to consider what more we may be taught by certain other relations exhibited in Table (F).

Mass of the Asteroids.

(46) With the term [♂(A)], [at the centre of gyration of Mars and the Asteroid mass (A), as found in Table (F), in (45)], and also with the mass of Mars taken as unity, and the mean distances, from the sun, of Mars and (A), respectively, in Table (B), in (14), we may determine m', the Asteroid-mass which will be required to justify the term [♂(A)] in Table (F); the case being similar to that of the *interior* half-planet ♄*i* in (41); except that the value of m', the *exterior* mass, is here required instead of m.

Substituting in the equation, in (41), the values here indicated, we shall find m', *the Asteroid-mass*, = 0.58929 of *the mass* of Mars.

This, with the mass of Mars, as in Table (A), in (3), [$=\frac{1}{3200900}$], will make *the mass of the asteroids* $=\frac{1}{5431814}$ of the mass of the sun.

(47) Now M. Le Verrier, in the *Comptes Rendus*, tome lxv, p. 880 (Nov. 25,

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[1] As R_1 here approximates to $r^{\frac{3}{2}}$ [r being the ratio for the whole-planet terms in Table (B)], R_1 will also, incidentally, express very nearly the ratio of the *periodic times* due to the whole-planet distances. Accordingly we find that the ratio of the periodic time of Saturn to that of Jupiter = 2.4697; while the nearly corresponding value of R_1, as stated in (45), is, as near as may be, 2.4089.

[2] Not only so, but if *leaving out the hypothesis here in question*, we attempt to form the 2d term of the series with the Saturn-mass as it exists, we shall, of course, *fail;* since the placing of so large a portion of the same masses so much *farther inward*, will, at once, displace the centre of gyration in the same direction, and so make the term too small. And the same effect would even be manifest, if we might suppose a group of asteroids to exist in this region; but that, (42), is inadmissible.

On the first of these two suppositions, the centre of gyration would be displaced quite the whole of the Earth's distance from the Sun [being at 11.35 instead of 12.40]; and if the second supposition were admissible, the displacement would be nearly $\frac{1}{2}$ that distance [being at 11.96 instead of 12.40].

1867) has given us the following equation, dependent on the necessity of an admitted increase in the motion of the perihelion of Mars.

He states that, in so far as we now know—

Ten times the correction of the mass of the Earth, *plus* three times the mass of the small planets, in a mean distance reference of the group, would make a sum equal to 1.38; the mass of the Earth deduced from the parallax of Encke, 8″.58, being taken for unity.[1] This mass is $\frac{1}{354936}$.

The mass of Mars which M. Le Verrier employed in his investigations, would seem to be the same with that which he has, provisionally, attributed to that planet in the *Comptes Rendus* for July 22, 1872; viz, 0.000000333 of the sun.

With these values of the data, the equation of M. Le Verrier will give us, FOR THE ASTEROID MASS, THE SAME FRACTION OF THE MASS OF MARS WITH THAT WHICH JUSTIFIES THE TERM [♄ (A)] IN OUR TABLE (F); *if we make* THE SOLAR PARALLAX 8″.896;[2] which is a value included within the present limits of uncertainty, *and near to the mean of all the more recent determinations.*

(48) If, then, fortified by these several coincidences, we allow any weight to the determination of the value of the *Asteroid mass* derived from the justification of the term [♄ (A)] of the series here in question; it may be noted that this value, (41), depends on the ratio of the difference of the squares of the terms [♄ (A)] and Mars to the difference of the squares of (A) and [♄ (A)]; and the tabular values of the quantities represented in the terms thus involved, may all be considered as being approximately well-determined.

[It will, moreover, be observed that the several independent elements which have entered into the computation of this result are:—

1. The leading ratio r, in Table (B), in (14).
2. The leading ratio R_1, in Table (F), in (45).
3. The application of the formula *for the centre of gyration;* and

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[1] . . . . "on doit dire que dix fois la correction de la masse de la Terre, plus trois fois la masse de l'ensemble des petites planètes distribuées en moyenne, d'après ce qu'on en sait aujourd'hui, doit faire une somme égale à 1.38; l'unité étant la masse admise pour la Terre quand on la déduit de la paral laxe d'Encke, 8″.58."

[2] For, $\left(\frac{8''.896}{8''.58}\right)^3 = \frac{\textit{increased mass of Earth, M}}{1}$; the mass due to parallax 8″.58, being $=1$

M being thus determined—

Then $M - 1 =$ *increment* of Earth's mass $= i$.

Then m' being *asteroid mass,* M. Le Verrier's equation gives—

$$10i + 3m' = 1.38; \text{ whence}$$

$$3m' = 1.38 - 10i, \text{ and}$$

asteroid mass, $m' = \frac{1.38 - 10i}{3}$; the mass of the Earth due to parallax 8″.58 being 1.

Then $\frac{1}{354936} m' =$ *asteroid mass* m'' in terms of the *Sun's mass* 1.

And *this* last value is *our* fraction (0.58929) of *M. Le Verrier's mass of Mars, i.e.* the *same* fraction of the mass of Mars (taken $= 1$), which *justifies the value of our* [♄ (A)] *term* in our Table (F).

4. The mass of Mars itself, deduced from the mutual action of it and those of the other planets.]

But the value of the same *Asteroid-mass*, as derived from M. Le Verrier's equation, depends on $\frac{1}{3}$ of *ten times* the excess above 1 of $\left(\frac{8''.896}{8''.58}\right)^3$. This value, then, albeit that it wholly depends on ascertained facts for its data, is, nevertheless, very *sensitive* to any, the smallest, change in the value of the solar parallax.

[In a subsequent Memoir on the Masses of the Planets and the Parallax of the Sun, in the *Comptes Rendus*, for July 22, 1872, M. Le Verrier, as the result of a discussion of the *secular variations* of the elements of the orbits of *Mercury*, *Venus*, the *Earth*, *Mars*, and *Jupiter*, states that it is probable that the attraction of the minor planets amounts, up to the present time to a quantity which may be neglected.[1]]

(49) The value of the Asteroid-mass, which we have thus obtained, is, as far as may be, confirmed by yet another consistency.

For with this value of the mass, at distance (A) in the column of *Law in* Table (B), and other masses and distances in Tables (A) and (B), [(3) and (14)], we shall find that the neutral point, or point of equal attraction of this same mass, is, on the side of Jupiter, at the distance 3.16559 from the sun. And the similar limit, on the side of Mars, is at the distance from the sun = 2.13869.

These numbers at once suggest the limits (thus far recognized) of the mean distances of the asteroids.

The supposition of a *half-planet* arrangement of the material in the progress of its early "abandonment" will, however, better provide for all this; as well as exhibit yet other consistencies, as will be shown hereafter.[2]

Peculiar Relations of the Planet Mercury.

(50) From Table (B) in (14) and Table (F) in (45), we find that the position and relations of Mercury may be represented as follows:—

	Table (B).	*Table* (F).	
Limit or term	(⊕♀)	..................[⊕♀]	$R_1 = r^{\frac{3}{2}}$
Whole planet ratio, r	Aphelion of Mercury		
$\frac{1}{2}$ planet ratic, $r^{\frac{3}{4}}$	*Perihelion of Mercury*	...(at mean dist.) MERCURY	

so that Mercury, when *in aphelion*, is in the position due to a *whole-planet*; and when *in perihelion* his distance is that due to a *half planet*.

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[1] As quoted in the translation of W. T Lynn, B. A , in the *Monthly Notices of the Proceedings of the Royal Astronomical Society*, vol xxxii., No. 9, p. 323.

[2] See *Articles* (60) and (108).

Then, at his *mean distance* (half-way between the two) his place is that of an *almost double-planet*, in the special arrangement in Table (F).

Of these it may be said:—

1.

That these several peculiarities seem, at once, *to be reconciled and explained* by the supposition that the condensing material (ring, or shell, etc.) which was in position to have formed a whole planet at the *aphelion distance*, and another portion of the condensing material (ring, or shell, etc.) which was in position to have formed what we have termed an *exterior* half-planet, at the *perihelion distance*, have been *combined* to form the existing planet; which, thus, is made up of a *whole-planet mass* and a *half-planet mass.*

2.

But all this *accounts for* and *explains in mode and in measure*, the VERY GREAT ECCENTRICITY OF THE ORBIT OF MERCURY; his perihelion distance not *extending beyond* the centre (or a point near the centre) of gyration of the half-planet mass (ring, or shell, etc.) due there; and his aphelion distance, *reaching out* to the centre of gyration, or near it, of the whole planet mass due *there.*

Mass and Distance of a possible Planet interior to Mercury.

(51) The position of the perihelion of Mercury has, (14), been shown to be that due to an *exterior* half-planet. Hence the distance from the sun of the next planet interior to Mercury may, most probably, be ascertained by dividing the term value of Mercury's perihelion distance, in the colum of *Law* in Table (B), in (14), by the value of $r^{\frac{1}{2}}$, in accordance with *Law* 3*d*, in (10).

The value of $r^{\frac{1}{2}}$, for this region of the system, is 1.3733.

Performing then the division thus indicated, we shall have the distance from the sun of the planet interior to Mercury—

$$☿_i = 0.20836.$$ [1]

We may also ascertain the *whole-planet* position next to that due to the *aphelion* of Mercury, by dividing the aphelion term in the column of Law in Table (B), in (14), by the value of r, in accordance with *Law* 1*st* in (10).

The value of r, for this region of the system, is 1.8736. Dividing the value of the *aphelion limit* by that number, will give for the *whole-planet limit* interior to Mercury's aphelion distance, the value 0.24422 + .

Thus, then, we shall have the following arrangement:—

$r^{\frac{3}{4}}$	. . . . . (Whole planet limit) aph. distance		0.45758	r
	(*Exterior* ½ *planet-limit*) *per. distance* . .	0.28573		
$r^{\frac{1}{2}}$	. . . . . whole planet limit		0.24422	
	Interior half-planet ☿$_i$	0.20836		

[1] This is very accurately the distance required (by *Kepler's* 3*d Law*) to justify the periodic time of the so-called "planet Vulcan," as the same has recently been ascertained by Prof. Kirkwood, on the hypothesis, that the appearances of certain solar spots were due to the transits of such a body.

Then for the *mass* of the *interior* half-planet ☿*i*, we need first to redistribute the material of Mercury, so as to place its *whole-planet portion* at the aphelion, and its *half-planet portion* at the perihelion; to come back to the forming state, etc., described and exhibited in symbol in (50).

Putting then the whole mass of Mercury = to 1; if *that* be so distributed to the aphelion and perihelion positions, that *the centre* of *gyration* of the distributed portions shall be found at Mercury's *mean distance*,[1] we shall have—

0.5617245 of *Mercury's mass*, for *the aphelion*, and
0.4382755 " " " " " *perihelion*.

The values *thus* far requisite having been ascertained, the case is but a repetition of that of the *mass* of ♁*i* in (41); and by substituting the values now before us, and reducing, we shall find the value of the *mass* of the *interior* half-planet—

m of ☿*i*, interior to Mercury, =0.594059 of *the mass* of *Mercury*.

(52) Now M. Le Verrier, in the *Comptes Rendus*, tome XLIX. p. 382, (Sept. 1859), speaking of a cause adequate to produce an ascertained secular motion of 38″ in the perihelion of Mercury, admits the supposition of a hypothetical planet, situated between Mercury and the Sun, and says that, as the hypothetical planet ought to impress on the perihelion of Mercury a secular motion of 38 seconds, the resulting relation between its (the planet's) mass and its distance from the sun will be such that, in measure, as we suppose the distance less, the mass will be increased, and the converse: and he adds, that, "For a distance a little less than the half of the mean distance of Mercury from the Sun, the mass sought would be equal to that of Mercury."

The mass which, *on our own plan, in the following out of our own hypothesis*, (51), we have found for the hypothetical planet is 0.594059 *of the mass of Mercury*; and when, in conjunction with Mercury, as seen from the sun, the distance between the two planets [see (51) and Table (A), in (3)], would be

$$0.38710 - 0.20836 = 0.17874;$$

and "a mass equal to that of Mercury," *similarly situated*, would have the same attractive force with that due to our hypothetical planet, at a distance, for that mass, inside of Mercury = to 0.23190, *i. e.*, a distance from the sun = 0.15520; which is indeed, assuredly, somewhat "less than the half of the mean distance of Mercury from the Sun," which ½ distance, accurately, =0.19355.

---

[1] For this purpose, $m+m'$, the sum of the two masses, being put = to 1; $m'=1-m$.

Also—since the ratios of the distances are known, or may be readily ascertained—if (C) be the distance of the centre of gyration, and the distance of the outer body = q (C), and that of the inner = p (C); then, substituting in *Eq.* (C) in (17), and reducing, we shall have, for the fraction of the whole mass pertaining to the inner body,

$$m = \frac{q^2 - 1}{q^2 - p^2};$$

which will, also by substitution and subtraction, give us m', since it = $1 - m$.

All this, *so* far, approximates to an accordance with M. Le Verrier's required action of the mass in question. It is then sufficiently manifest that our hypothetical planet, as to *mass and distance both*, would be such as measurably to satisfy the conditions of the ascertained perturbation; and so we need not pursue the investigation of a troublesome problem any farther.

Peculiar Relations of the Living Force of (simultaneous) Rotation of some of the Planetary and Satellite Masses.

(53) If Jupiter and Saturn should (or if they did) turn around the sun, *in the same time;* the moment of rotation must, in the instance of either, be represented by the formula, *mass* × (*velocity*)^2; or, as velocity in this case would be, as a, the radius vector of rotation, the *ratio* of the moments will be obtained by comparing *mass* × (*radius vector*)^2 of the one with *mass* × (*radius vector*)^2 of the other. So with m and m', respectively, for the masses, and a and a' for the radii vectores; *i. e.* the mean distances from the sun, as in the column of *Law in Table* (*B*), in (14), and the masses, as in *Table* (*A*), in (3); we have—

For *Jupiter*, $m a^2 = 0.026142.$
For *Saturn*, $m'a'^2 = 0.025477.$

or with the distances as in column of *Fact* in Table (B); we have—

For *Jupiter*, $m a^2 = 0.025832.$
For *Saturn*, $m'a'^2 = 0.025985.$

The approach to a ratio of equality is here very close.[1]

There is also an approximation to the same state of things in the following cases.[2]

The respective moments of (simultaneous) rotation of ♄̂ (*i. e.* Saturn *reduced* to its *ancient state*), of *Uranus*, and also of ♅*i* [the half-planet (supplied) *interior* to Uranus], are all nearly equal to one another; the ratios being—

$$\frac{m\, r^2 \hat{♄}}{m'\, r'^2 ♅} = 1.1431 \;.\;.\;.\;.\;.\; (1).$$

$$\frac{m'\, r'^2 ♅}{m''r''^2 ♅ i} = 1.0060 \;.\;.\;.\;.\;.\; (2).$$

Then, when the *combined* masses of Saturn and Uranus [in the *More Ancient State*, as exhibited in the *term* [(U)♄̂], in *Table* (F), in (45)], are compared with *Neptune* in respect to the moment of (simultaneous) rotation; we have for the ratio—

---

[1] This curious relation was first made known by the author of this paper to the *American Association for the Advancement of Science*, at their Meeting in Montreal, in 1857; also the division into shells, etc.

[2] Which might be somewhat varied, were all the masses more accurately determined.

$$\frac{m_1{}^2 r_1{}^2 \text{ of } [(\text{U})♄]}{m'''^2 r'''^2 \text{ of } ♆} = 1.1101 \;.\;.\;.\;.\;.\; (3)$$[1]

Lastly, in the *System of Saturn*, m being the mass of the outer, and m' that of the inner bright system of rings; we shall have for the ratio of the moments of (simultaneous) rotation—

$$\frac{m \times a^2 \text{ of } \textit{outer rings}}{m' \times a'^2 \text{ of } \textit{inner rings}} = 1.1400 \;.\;.\;.\;.\;.\; (4);$$

the rings being respectively referred, each to its centre of gyration [obtained as in (16)].

[Then, since the rings in Table (C) in (18), have their places as *satellites;* if the *periodic times* of the rings referred to their centres of gyration agree with *Kepler's 3d Law*, and so actual velocities are as $a^{\frac{1}{2}}$ to $a'^{\frac{1}{2}}$, and hence their 2d powers as a to a'; we shall have for the ratio of the moments of rotation of the existing and turning rings

$$\frac{m' \times a' \text{ of } \textit{inner rings}}{m \times a \text{ of } \textit{outer rings}} = 1.0752.]$$

There is a very close resemblance between ratios (1) and (4).[2] Were, then, those *ancient masses* compared in (1), *ring-like in form;* and *did* the masses, with nearly equal moments of (*simultaneous*) rotation, go round the central body together?

If, in an ancient state, they were *parts of the atmospheres of their primary and central body*, in every case; then they *did* go round *together*. But, whether we admit any part of that hypothesis, or else reject any portion, or all of it; THE RATIOS REMAIN, and seemingly without that hypothesis, they remain unaccounted for.

There is yet another aspect of the matter, and that is—that the rings or shells, etc., separated about the time *when the moments in question became nearly equal.*

Application of other Conditions appertaining to the ring-like Form. What succeeded these.—Position of great Planets, and of largest Satellites.

(54) It has, (16), been shown that the centre of gyration of a *homogeneous* ring is in the circumference in which the mass of the ring is bisected; and that thus, we have

$$(C)^2 = \tfrac{1}{2}(R^2 + r^2)$$

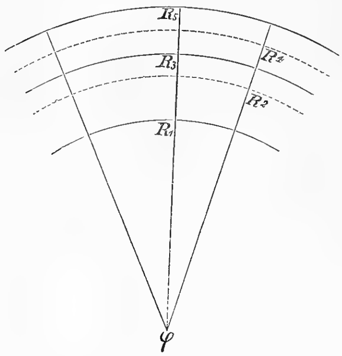
---

[1] Ratios (2) and (3) are consistent with the supposition in (43), that the material of Saturn was gathered in part from *the interior half-planet*, now missing (the values ♄ and ♅i being dependent on that); but they did not seem to be of such importance as to require their admission as *Coincidence 12th* of the series exhibited in (43) and (45).

[2] Though it should not be overlooked that ratio (4) is that existing in a satellite system, which is here compared with those found in the system of the primary planets.

(C) representing ϕR_3 in the figure, *i.e.* the distance of the centre of gyration from the centre of force, and R and r, respectively, the radii of the edges of the ring, so that we have

Fig. 11.



$$\overline{\phi R_3}^2 = \tfrac{1}{2}(\overline{\phi R_1}^2 + \overline{\phi R_5}^2).$$

Now the like being also true of the half-rings, with *their* centres of gyration at R_2 and R_4, respectively; we shall also have

$$\overline{\phi R_2}^2 = \tfrac{1}{2}(\overline{\phi R_1}^2 + \overline{\phi R_3}^2); \text{ and}$$

$$\overline{\phi R_4}^2 = \tfrac{1}{2}(\overline{\phi R_3}^2 + \overline{\phi R_5}^2);$$

from which, by substitution and reduction, we shall obtain

$$\overline{\phi R_3}^2 = \tfrac{1}{2}(\overline{\phi R_2}^2 + \overline{\phi R_4}^2);$$

in which the *centres of gyration of the half-rings* respectively, take the places of the *edges* of the whole ring.

(55) The supposition here throughout has been that all the material was homogeneous. But as the "abandoned" rings, or ring-like masses, would increase in density inward, the centre of gyration for each half-ring, as well as that of the whole ring, would also, therefore, be *within* that assigned by the formula.

Nevertheless it would seem that this would affect, or rather has affected, the several quantities, proportionally.

Accordingly, we find that *the mass* of the system of the inner bright rings of Saturn *is* considerably *greater* than *the mass* of the system of the outer bright rings; yet the other condition here in question is fulfilled.

For the centre of gyration of the outer bright rings, [Table (C) in (18)], is at the distance . . . . 2.1165.

And the centre of gyration of *both systems* of the bright rings, as obtained independently by the general formula, is at distance . 1.9090.

And that of the system of the *inner* bright rings is at . . . 1.7097.

Now the sum of the squares of the first and last of these numbers is 7.16399197;

and $\frac{1}{2}$ of the same = 3.58199593+

And the square of the intermediate number, 1.9090, = 3.64428100;

showing a very close correspondence with the formula.

Accepting, then, this result as *an induction*, we shall find, on trial, in the same way, a semblance of a *ring-like* form of the "abandoned" masses, apparent, even in the case of the *Earth* and *Venus*.

For the sum of the squares of their mean distances [as those distances are given in the column of *Law* in Table (B) in (14)] is . . . 1.51928

and $\frac{1}{2}$ sum = 0.75964

And, (C) being distance of the centre of gyration, . . . $(C)^2 =$ 0.78616;

in which case $(C)^2$ is the greater because of the superior density of the Earth. [And the great relative distance of our own satellite (nearly 60 radii of the Earth) as, in the similar instance in Saturn's system, is also [6 of (43)] indicative of a great oblateness of the nebulous material at some stage of its progress.]

(56) Again, a like relation is found in the case of the mean distance and centre of (simultaneous) gyration of *Uranus* and *Neptune*.

In the instance of these we have an approximation to *equality in the masses*;[1] the ratio of the mass of Neptune to that of Uranus being

$$\frac{m\Psi}{m'♅} = 1.11678.$$

Moreover (C), the centre of gyration of the two planets is at the distance 25.4457–; and while

$$\tfrac{1}{2}(\textit{mean dist. } \Psi)^2 + \tfrac{1}{2}(\textit{mean dist. } ♅)^2 = 635.704$$
$$(C)^2 = (25.4457-)^2 \quad . \quad . \quad . \quad . \quad . \quad = 647.481$$

This is consistent with a *ring-like* form of the two masses in question, after the "abandonment" of the material of which they were constituted; the flowing over of material in this outer portion of the oblate solar atmosphere having given to the whole, or, at least, to both the parts of the masses in question, a form not unlike that of a thick ring.

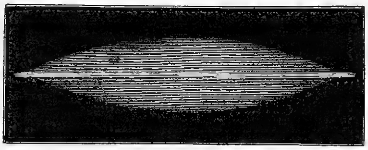


Fig. 12.

All this is consistent with that form, yet does not *require* the masses to have had such a form; since, (17), the equation here in question would, accurately, exist in the case of *any equal masses*.

(57) The state of things arrived at (perhaps later) in the case of *Jupiter* and *Saturn*, (53), seems to be inconsistent with a mere ring-like form for both masses; but to be a consequence of the accession of material from regions of the sun's atmosphere extra-equatorial. Accordingly we shall find that the equation here in question does not obtain in that instance.

But under the conditions approximated to in the case of planets exterior to them, and at length attained in the instance of those two great masses, viz.

$$ma^2 = m'a'^2,$$

we have the masses inversely as the squares of the radii of gyration; so that the resulting planets must increase in mass, in the progress inward, until we come to the instance of Jupiter, the greatest of all;[2] the ring-like masses, or the shells, though successively decreasing in volume, yet increasing more rapidly in density,

[1] The mass of Neptune is the greater; Uranus having just possibly lost somewhat in the process, (43), which carried away the mass of the now missing planet.

[2] Mr. Trowbridge, in his investigation already referred to (*Note* to 38), [in 1864], shows that this would be true of the "abandoned" rings. But the increase of the mass of the great planets, in the progress inward, would seem to be too rapid to be explained by *that alone*. The other changes and relations in question may, as it would seem, have been even more efficient; and the *most* of these were indicated by the author of this paper in 1857, as heretofore stated in the *same Note to Article* (38).

for some distance within; so that the planets of greatest mass would *not* be the *outermost*, but the masses of the successive planets will be greater and greater, so long as the density increases in a greater ratio than that in which the volume diminishes; aided, withal, by the whole-planet arrangement, which supervenes in the Saturn and Jupiter arrangement, and, in the instance of Saturn, (42), by the half-planet acquired.

And this arrangement of the masses we actually find, with some variation in the instance of Uranus.[1]

(58) Closely analogous to this arrangement of the masses in the great planetary system is that which we find in the *System of Saturn;* viz. Japetus outside, for one of the larger satellites, followed by Titan, the Jupiter of the system, with smaller satellites after it (Hyperion *before* it, in the place analogous to that of Uranus), and other satellites, larger than Hyperion, farther inward.

(59) Then too, in the *System of Jupiter*, the relative masses of the satellites are—

Satellite IV.	42659
" III.	88497
" II.	23235
" I.	17328

so that the mass of Satellite IV. approaches to being more than double that of either Satellite II. or Satellite I.; while the mass of Satellite III. is more than the double of *that* again; the *great* masses *outside* of the others; and yet, as in the other systems, the *greatest of all* not the *outermost.*

Arrangements of the Asteroid-mass.

(60) The neutral points for the Asteroid-mass, towards *Jupiter* on the one side and *Mars* on the other, have, (49), been already stated. But when we come to apply the formula for the ring-like mass; viz. that which has, (55), been especially in question, we do not succeed. We thus have a *negative* indication that the Asteroid-mass, *as a whole*, did not have a ring-like form.

But if we suppose a *half-planet* arrangement of the mass, we shall have

Distance of *exterior* half-planet	3.34083
" " *interior* "	2.47748
And then the sum of their squares	17.29905+
$\frac{1}{2}$ sum	8.64953–
Square of mean distance (A), in Table (B) in (14),	8.28067;

again approximating to the requirements of the formula.

The neutral point, or point of equal attraction, between *Jupiter* and the exterior half-planet will be	3.35790
That between the two half-planets,	2.94068
Between the interior half-planet and *Mars*,	2.14438

[1] May be in a measure accounted for and explained by the special influences to which, (43), that planet appears to have been subjected.

The first and last of these, toward one limit and the other, also indicate the *range* of the mean distances of the asteroids better than the result in (49). [The middle limit 2.94068 here given, is a little outside of the centre of gyration of the two half-planet masses, which is at whole-planet distance (A) of Table B, =2.87831 —the more dense material being inward: a state of things of which there is a distinct semblance, (19), in the previous example of *Saturn's rings*. In the case of the *Earth* and *Venus*, (39), the centre of gyration is without the neutral point, as it ought to be, because of the superior density of the earth.]

The exterior limit, 3.35790, at which the attraction of the outer mass and that of *Jupiter* would seem to have been in equilibrio, is scarcely 0.017 (of the Earth's mean distance) outside of the position due to the exterior half-planet.[1]

(61) The distances 3.34083 and 2.47748, respectively due to the exterior and interior half-planets, themselves exhibit approximations to the *aphelion* and the *perihelion distances of several of the existing asteriods;* insomuch that their case in that respect resembles that of MERCURY, already commented on in (50): with the marked difference, however, that while the orbit of MERCURY is, indeed, limited in its aphelion by a whole-planet distance, and in its perihelion by the succeeding half-planet distance, the existing planet seems to have *combined in itself* the material which would have appertained to both the whole and the half-planet.

(62) The very small mass due to the exterior half-planet (0.4274 of the interior half-planet, or 0.2518 of *Mars*) would itself suggest the probability that but few asteroids were to be looked for at a mean distance, near to the outer limit 3.35790; and the progress of discovery, thus far, has justified such a conclusion.

Special Relations of the Moments of (simultaneous) Rotation (around the same centre) of the two supposed Asteroid-masses and that of Mars.

(63) The moments of (simultaneous) rotation of the *two* Asteroid-masses (*half-planetary* in position) and that of *Mars* have, respectively, the ratio of the following representative numbers:—

Exterior Asteroid-mass	2.8108	*Mean*, 2.4410
Interior " "	2.0712	
Mars		2.4679.

Of Missing Terms, or, at least, Varieties in Planetary or Satellite Series, other than those heretofore noticed; and the Explanation of the same.—A Resisting Medium.

(64) As "the comet of Lexell" had its orbit *twice* changed, as a special consequence of its periodic time being very nearly $\frac{1}{2}$ that of *Jupiter*, so that the comet was for the second time brought very near to that disturbing planet after only two revolutions; so, also, it has been well argued that when the periodic time

[1] So that, as has often been surmised, the o'ermastering attraction of Jupiter must (it would seem) have interfered with the existence of the outer half-planet as such; and this, by an action not very unlike that of Saturn, (43), in preventing the continuance of anything like a half-planet interior to Uranus.

of the disturbing planet was very nearly a multiple of the periodic time of an "abandoned" ring; very similar effects would follow, which have, in part, at least, been indicated by Prof. Daniel Kirkwood in his paper *On the Nebular Hypothesis and the Approximate Commensurability of Planetary Periods*, in the *Monthly Notices of the Royal Astronomical Society*, vol. xxix. In that paper, at p. 99 of the volume quoted, he sums up, in part, what he had discussed, as follows:—

"A planetary particle at the distance 2.5—in the interval between *Thetis* and *Hestia*—would make precisely three revolutions while *Jupiter* completes one; coming always into conjunction with that planet in the same parts of its path.[1] Consequently its orbit would become more and more eccentric until the particle would unite with others, either interior or exterior, thus forming the nucleus of an asteroid. Even should the disturbed body not come in contact with other matter, the action of *Jupiter* would ultimately change its mean distance, and thus destroy the commensurability of the periodic times. In either case the primitive orbit of the particle would be left destitute of matter.[2] The same reasoning is, of course, applicable to other intervals;" and Prof. Kirkwood produces evidence to show that the "intervals in the asteroid zone"—however small at best—are yet appreciably greater in the instances of "nearly commensurable periods." With respect to the interval between the two *Rings* (or system of rings) of *Saturn*, Prof. Kirkwood, after a discussion of the distances and periodic times in question, concludes, "It is thus seen that the interval occupies precisely the space in which the periods of satellites would be commensurable with those of the four members of the system immediately exterior. As, therefore, the powerful attraction of *Jupiter* produces the observed *gaps* in the asteroid zone, so the *disturbing influence of Saturn's interior satellites is the physical cause of the permanent interval between the two bright rings.*"

Prof. Kirkwood concludes his paper with the declaration that the Nebular Hypothesis . . . . . "assigns an obvious cause for the establishment of nuclei in such positions that their periods will be nearly commensurable with that of the disturbing body. As these nuclei would receive accretions of matter from portions of space both interior and exterior to their respective orbits, their distances from the central body, during their planetary growth, would not be liable to great variation."

(65) Now, with our half-planetary arrangement of the Asteroid-mass, (60), the periodic times of Jupiter, the *exterior* half-planet mass, the *interior* half-planet mass, and *Mars*, will, respectively, be related as follows; the coincidences, though not absolute, being yet very close—

P. Time (T) of *Jupiter* = 2 (T) of *exterior* asteroid-mass,
= 3 (T) of *interior* asteroid mass; and
(T) of *interior* asteroid-mass = 2 (T) of *Mars*.

Thus with the action of *Jupiter* on the one side, and *Mars* on the other, there would be abundant occasion for the effects under discussion.

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[1] All but the very distance of the *interior* asteroid-mass, as exhibited in (60).

[2] *See*, again, Consistency 9, in (44); referred in *Note* 2, on p. 30, to this place.

Then also, in view, (62), of the very small *exterior* half-planetary mass, in this instance, and the close approximation of *Jupiter's* o'ermastering influence; and the much larger, (62), *interior* half-planetary mass, and its special relations to *Mars* as here specified, we discern, at last, how the formation of half-planets in this region may have been prevented; also, why the range of the asteroids should be so extensive; why the eccentricity of their orbits should be so great; why so many have been discovered at distances approaching to that of the interior half-planetary mass, and even on the side toward *Mars;* and why so few have been found at distances approaching to that of the *exterior* half-planetary mass.[1]

Besides all this, we have the fact, that the actual distance of *Mars* [as seen in Table (B), in (14)], is appreciably *less* than the distance registered in the column of *Law; Mars,* like *Uranus* [*see* 5 of (43)], having seemingly *fallen in;* though not, like *Uranus,* influenced, to a proportionate extent, by a large planet interior to itself; yet the *acquisition* of sufficient material *from the interior half-planetary mass,* with the inferior velocity of revolution appertaining to that mass, would produce just such an effect.[2]

And the Earth-Venus mass, while it endured (if at all), would have had a periodic time $\frac{2}{5}$ths of that of *Mars;* and might, with the other influences in question, contribute to the very considerable *eccentricity* of the orbit of *Mars;*—on which, however, it does not seem to be justifiable to insist.

(66) In the *System of Saturn* there are withal vacuities, (64), in the series of satellites, under the conditions already specified in the other cases. Thus, in the large interval from Japetus to Titan, if the places for interpolated terms as indicated in Table (C), in (18), be compared with those which would be due to satellites with periodic times *commensurable* with the periodic time of Japetus, or with that of Titan, we shall have the following results:—

---

[1] Then, among things *supposable,* but not as yet fortified by groups of coincidences, and which *cannot now be used in the way of induction,* are these: If either of the half-planets were after all formed, the oblateness of the nebulous material must have been so great that it might be questioned whether of the two possible forms of a rotating spheroid of equilibrium—the density and the time of rotation being given—the one usually differing but little from a sphere, the other, with the *equatorial diameter enormous* in comparison with *the axis,* the latter might not be the form of the spheroid here produced; it being such as the ring of *Saturn* might become if the body of the planet were removed, and the ring filled up so as to be imperforate. Such a form would be eminently unstable; and if it were broken up, the fragments would *all be small;* as the asteroids indeed are.

Then two such half-planets (with orbits, as has been seen, very eccentric) might all the more readily have realized the ingenious conjecture advanced by Prof. Vaughan at the meeting of the American Association for the Advancement of Science, in 1857; viz. that the asteroids were the fragments resulting from the *collision of two planetary bodies,* in that region of the solar system; thus presenting a new phase of the hypothesis of Olbers.

In the same category, as to not furnishing any induction as yet, may be included the fact that the orbit of Halley's (*retrograde*) comet very nearly (now) intersects that of Phocea.

[2] For additional proof of a half-planetary arrangement in the Asteroid region, see *Article* (108).

(Reckoning from Japetus inward), submultiples of periodic-time of Japetus, and corresponding distances.		Distances in accordance with ratios of terms in Table (C).	(Reckoning from Titan outward) multiples of the periodic-time of Titan, and corresponding distances.	
P. TIME.	DISTANCE.		P. TIME.	DISTANCE.
$\frac{2}{3}$ that of JAPETUS	49.109	51.9925	$3\frac{1}{2}$ that of TITAN	51.037
$\frac{1}{2}$ " "	40.544	41.9986	$2\frac{1}{2}$ " "	40.782
$\frac{2}{5}$ " "	34.939	33.9271	2 " "	35.145
$\frac{3}{7}$ " "	27.919	27.4069 (*Hyperion*)	$1\frac{1}{2}$ " "	29.014

In the Interval from Titan to Rhea.

In accordance with Ratios of Terms in Table (C.)	(Reckoning from Titan inward) submultiples of the periodic-time of Titan, and corresponding distances.	
DISTANCE.	PERIODIC TIME.	DISTANCE.
17.2598	$\frac{2}{3}$ that of TITAN	16.894
13.4556	$\frac{1}{2}$ "	13.947
10.8696	$\frac{1}{3}$ "	10.644
(*Rhea*) 9.5972	$\frac{2}{7}$ "	9.604

In this region the coincidences, it will be perceived, are more perfect than in the other region exterior to *Titan*.

But it is here, again, worthy of remark, that Hyperion, outside of Titan, in a place analogous to that of Uranus in the planetary system, has, like that planet, *seemingly fallen in somewhat* from its true position in series; as if influenced by the great interior body, under stringent circumstances. [*See*, again, 5 of (43).]

Exact Commensurability of Periodic Times.—Explanation of this.

(67) M. Laplace, in the course of his comments on his own hypothesis, especially notices and accounts for "the rigorous equality observed between the angular motions of rotation and revolution of every satellite;" all which will be considered in another connexion.

But, he adds, that "the first three satellites of Jupiter present a still more extraordinary phenomenon;" which consists in this, that "the mean longitude of the first *minus* three times that of the second, *plus* twice that of the third, is always equal to two right angles."

Next, with respect to the *existing* satellites of Saturn, we have the statement of Sir J. Herschel that "A remarkable relation subsists between the periodic times of the two interior satellites and those of the two next in order of distance, viz., that the period of the third (Tethys) is double that of the first (Mimas), and that of the fourth (Dione) double that of the second (Enceladus). The coincidence is exact in either case to about the 800th part of the larger period."[1]

Again, in the *American Journal of Science and Arts*, 3d *Series*, vol. iii, p. 67 (1872), is an extract from a letter of Prof. Benjamin Peirce to Prof. Newton, in which Prof. Peirce says: "I have discovered three fixed equations between the mean motions of the four outer planets. If the mean motions of Jupiter, Saturn, Uranus, and Neptune are respectively represented by n^{v}, n^{vi}, n^{vii}, and n^{viii}, these equations are—

$$4n^{vi} + 9n^{viii} = 16n^{vii}$$
$$2n^{v} + 17n^{vii} + 6n^{viii} = 12n^{vi}$$
$$3n^{vii} + 8n^{viii} = n^{v}$$

. . . . . To which he adds . . . . . "If all the three equations are admitted, the mean motions of three of these planets can be computed when the fourth is given;" and he exhibits the requisite equations. He states, moreover, that the reception of these "involves a laborious revision of the theory of these planets, ... and must seriously change the elements of their orbits."

Lastly;—to this, Prof. Daniel Kirkwood adds:[2] "The recent note of Prof. Peirce announcing his discovery of some interesting relations between the mean motions of the four outer planets, has recalled my attention to a number of similar coincidences detected by myself several years since, while engaged in a somewhat laborious examination of the planetary elements. Of these the following may be worth putting on record for future discussion:—

$$2n^{v} - 3n^{vi} - 11n^{viii} = 0 \;.\;.\;.\;.\;.\; (1).$$
$$2n^{vi} - 21n^{vii} + 30n^{viii} = 0 \;.\;.\;.\;.\;.\; (2).$$
$$3n^{v} - 8n^{vi} - 2n^{vii} + 7n^{viii} = 0 \;.\;.\;.\;.\;.\; (3).$$

"The re-examination of the last of these has recently led to the discovery of two others, viz:—

$$68n^{vi} - 325n^{vii} + 257n^{viii} = 0 \;.\;.\;.\;.\;.\; (4).$$
$$257n^{v} - 844n^{vi} + 587n^{vii} = 0 \;.\;.\;.\;.\;.\; (5)."$$

. . . . . "The fifth, however, is not an independent equation, but is derived from the third and fourth. . . . It is obvious, moreover, from the same equations, that *no three of the four outer planets can ever be in conjunction at the same time.*"

The more thorough revision indicated by Prof. Peirce would be requisite before *all* these relations could be definitely settled; but they furnish additional occasion both in the planetary system and in that of Saturn for the explanation which M. Laplace himself has given, in Note VII to the *Système du Monde*, of the special relation apparent in the first of the instances here quoted, viz., that of Jupiter's satellites.

That illustrious astronomer indicates that "in order to produce the equation with regard to those satellites, already quoted, it would be sufficient that, at first,

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[1] *Outlines of Astronomy* (11th edition), (550).

[2] At p. 208 of the same volume.

there should have been a very close approximation to the conformity in question, and then the mutual attraction of the satellites would rigorously establish such a conformity;" and hence, moreover, " make the mean longitude of the first satellite *minus* three times that of the second, *plus* twice that of the third, always equal to a semi-circumference."

At the same time, as he says, this would originate a periodical inequality dependant on the small quantity by which the mean motions " primitively deviated from the relation which we have announced. Notwithstanding all the care which Delambre took to make out this inequality by observation, he could not discover it; which proves its extreme minuteness, and consequently indicates with very great probability a cause which made it disappear."

M. Laplace then proceeds to show that, on his own hypothesis, the satellites of Jupiter, immediately after their formation, did not move in a perfect vacuum; but that the less condensable molecules of the primitive atmospheres of the sun and of the planet *furnished a resisting medium*,[1] the effect of which would be different on every one of the satellites in question, and when their motions attained the conditions requisite to the establishment of the conformity of motions, the same resistance diminished the inequality to which this relation gave rise, and finally rendered it insensible.

All this may well be extended to the case of *the conformity of periodic-times in Saturn's system*, as well as *those of the periodic-times of the outer planets* already specified.

M. Laplace illustrates the process in question by the retarded motion of a pendulum in a resisting medium; entire revolutions being reduced to oscillations diminished continually by the resistance of the medium, and in the end annihilated; the pendulum coming to rest, and ever after remaining so.

The original passage in which this illustration occurs, is the closing one of the *Système du Monde;* and is as follows:—

"On ne peut mieux comparer ces effets, qu'au mouvement d'un pendule animé d'une grande vitesse, dans un milieu très peu résistant. Il décrira d'abord un grand nombre de circonférences; mais à la longue, son mouvement de circulation toujours décroissant se changera dans un mouvement d'oscillation, qui diminuant lui-même de plus en plus, par la résistance du milieu, finera par s'anéantir; alors le pendule arrivé à l'état du repos, y restera sans cesse."

The changes indicated in the quotation in the next article, contemplate a veritable oscillation, in some measure like this.

Special Characteristics of the Moon, and other Satellites.

(68) M. Laplace, commenting on his own hypothesis, in the connexion already referred to, (67), thus expresses himself: "One of the most singular phenomena of the solar system is the rigorous equality observed between the angular motions of rotation and revolution of every satellite. We may wager infinity to one that

[1] The italics are our own.

this is not due to chance. The theory of gravitation causes the infinity of this unlikelihood to disappear, by showing us that, for the existence of the phenomenon, it would be sufficient that the motions should have been very little different at their origin.[1] Then the attraction of the planet established between them a perfect equality; but at the same time gave rise to a periodic oscillation of the axis of the satellite directed toward the planet, the extent of it dependant on the primitive difference of the two motions. The observations of Mayer on the libration of the moon and those which MM. Bouvard and Nicollet made with reference to this matter, at my request, have failed to make known this oscillation. The difference on which it depends must, therefore, have been very small; which indicates, with extreme probability, a special cause which first kept this difference within the very narrow limits within which the attraction of the planet could establish an equality between the mean motions of rotation and revolution, and which afterwards destroyed the oscillation which this equality had originated. Both these effects result from our hypothesis. For it will be understood that the moon in the state of vapors, formed, because of the powerful attraction of the earth, an elongated spheroid the major axis of which must be incessantly directed towards that planet, from the facility with which vapors yield to the smallest force which animates them. The terrestrial attraction continuing to act in the same manner when the moon was in a fluid state, at length, in approximating incessantly the two motions of this satellite, caused them to fall within limits such that their rigorous equality began to be established. Afterwards this attraction must, little by little, have annihilated the oscillation which this equality produced in the axis of the spheroid directed towards the earth."

"It is thus that the fluids which covered this planet[2] have destroyed, by their friction and their resistance, the primitive oscillations of its axis of rotation, which now is subjected but to the nutation resulting from the actions of the sun and the moon. It will be readily seen that the equality of motions of rotation and revolution would present an obstacle to the formation of rings and of secondary satellites from the atmospheres of those bodies. Accordingly, observation has thus far indicated none such."

(69) It is claimed that the other satellites of the planetary system resemble the moon in the coincidence of their times of rotation and revolution; and thus presenting always nearly the same side of any satellite toward its primary. This is inferred from special vicissitudes of the light of the satellites *recurring* when they have again arrived *at the same positions* in their orbits around their respective primaries.

Nor is that all. Among the remarkable phenomena presented by satellites is that of their seeming loss of light; all Jupiter's satellites, having, at times, been seen to transit the disk of the planet, appearing, in whole or in part, as *dark* instead of *bright* spots; and that sometimes after having *first* appeared *bright* and then *dusky*.

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[1] In this connexion, *see*, again, *Note* on p. 22.

[2] The Earth.

This—as has elsewhere been indicated by the author of this paper—would seem to be due to the absorption, and, possibly also, to the interference of light on a scale such as Astronomy alone exhibits; of the light, viz., reflected from Jupiter and meeting that of the satellite.

(*a*) Aside from all that, however, the phenomenon, or rather phenomena, in question would seem to be consistent with the conclusion of a coincidence in the times of rotation and revolution; for the appearance of the satellite, in the course of its transit, as a black spot has, within moderate intervals of succession, recurred when the satellite had returned to a like position in its orbit around its primary.[1]

(*b*) Admitting the absorption already indicated; then, instructed by the revelations of the spectroscope, we may regard it as probable that the satellite must be *colder* than its primary.[2]

(*c*) This last would happen—indeed we would have a reason for it—if the satellite, like the moon, had *little or no atmosphere.*

(*d*) All these analogies would be quite consistent with the hypothesis that all these satellites (including the moon) had been similarly condensed from the nebulous state, and then subjected to the stringent conditions which prevail in satellite systems. The loss of atmosphere is one of the supposable consequences of those stringent conditions; as indeed M. Laplace has intimated, when after stating the distance at which the attractive force of the earth is in equilibrium with that of the moon, he adds: "If at this distance, the primitive atmosphere of the moon had not been deprived of all elasticity, it would be carried to the earth, which could thus draw it to itself, (*aspirer*). This is, perhaps, the reason why the moon's atmosphere is so nearly insensible."[3]

Of the Zodiacal Light.

(70) As to the region of the zodiacal light; M. Laplace, in speaking of the atmosphere of the sun, says: "The atmosphere at the equator cannot extend beyond the point where the centrifugal force exactly balances gravitation; for it is manifest that beyond that limit the fluid must itself be dissipated. As respects the sun, this point is at the distance from his centre of the radius of the orbit of a planet which would complete its revolution in a time equal to that of the rotation of the sun. The atmosphere of the sun, therefore, does not extend even to the

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[1] But the conclusion is not a necessary one. M. Secchi makes the time of rotation shorter than that.

[2] Some recent observations of Jupiter seem to indicate that the planet itself is highly heated—possibly even to the extent of being locally self-luminous. The color of the belts and its variations together seem consistent with all this. [Witness the exquisitely beautiful chromo-lithographs accompanying the Earl of Rosse's paper in No. 5. of vol. XXXIV, of the *Proceedings of the Royal Astronomical Society;* and Mr. John Browning's very beautiful representations of similar phenomena in No. 9 of the same volume. Also M. Tacchini's very remarkable diagram of Jupiter's appearance; with his explanations (*Comptes Rendus*, tome LXXVI, p. 423).]

[3] Conclusion of Chap. X, of Book IV, of the *Système du Monde.* For a discussion and an explanation of the various phenomena here in question, see two communications, by the author of this paper, to the *Astronomische Nachrichten,* Nos. 1986 and 2012.

orbit of Mercury, and, consequently, it does not produce the zodiacal light, which seems to extend even beyond the earth's orbit. Moreover this atmosphere, whose polar axis must be at least two-thirds of that of the equator, is very far from having the lenticular form which observations give to the zodiacal light."[1]

(71) Next as to the origin and the constitution of the material which gives us the zodiacal light, we have: "If, among the zones abandoned by the atmosphere of the sun, there should be molecules too volatile either to combine themselves, or to unite with the planets, they ought, while continuing to circulate about the sun, to present all the phenomena of the zodiacal light without opposing a sensible resistance to the diverse bodies of the planetary system, either because of the extreme rarity of those volatile molecules, or because their motion is very nearly the same with that of the planets which they encounter."[2]

It will be observed that the first of the two quotations, here made, intimates it as probable that the material from which the Zodiacal Light proceeds, itself extends beyond the earth's orbit. This is, in fact, intimated by the existence of what in German accounts of observations of the Zodiacal Light has been designated as the *gegenschein;* which is seen in the part of the heavens opposite to the sun; the existence of which phenomenon is established by numerous observations, such especially as are detailed in various numbers of the *Astronomische Nachrichten.*

(72) Both eastern and western appearances occurring simultaneously are reported by the late Rev. George Jones, A.M., chaplain in the U. S. Navy; these phenomena being, among numerous others, the description of which, and other things connected with them, itself occupies the whole of vol. iii. of the *Report of the U. S. Japan Expedition;* and the extent of the light to *both sides of the heavens* is confirmed by the observations of Col. Charles G. Forshey, U. S. A., made while he was stationed in an elevated and dry region of Texas; where, as stated by Col. Forshey to the author of this paper, that phase of the phenomenon was a common occurrence; though the appearance of the Zodiacal Light in lower Louisiana, as described by him, was very different.[3]

(73) All this makes it more difficult to admit that the material in question can be maintained in position, with the sun for its centre of reference; the conservative

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[1] *Système du Monde,* Book IV, Chap. X. [2] *Système du Monde,* Note VII.

[3] In Col. Forshey's manuscript notes, which he has since confided to me, the Zodiacal Light is described as being "very distinct across the heavens," Nov. 10, 1858, at 10 o'clock P.M. As delineated on star charts, the outlines on this occasion, as on many others, approach to a hyperbolic form, the central line of the luminous band being in the position of an asymptote to the two edges; or—if the comparison may be allowed—the appearance often was that of an enormous trumpet, the lower end widening rapidly and extensively; and on the occasion here referred to, *two* such appearances are delineated, as having been observed; the broad ends spreading out to the horizon, on opposite sides, and the narrow portions united midway.

On the 9th of May, 1860, the phenomenon is described as being "faintly visible across the canopy;" though the whole display is characterized as being "rather faint;" while the "evening" is noted as being "splendidly clear."

Also Nov. 13, 1859—"Not a very bright display. Still column very distinct all the way across the sky."

And, in a "Note" under the date of March 31, 1858, Col. Forshey expressly says: "I now begin to think that well-trained eyes can see it all the way round, at all times that are clear and moonless."

influence of the great planets being not supposable within the extended limits of the solar system; though the satellites of Saturn, [*Note* 3 to 7 of (43)], are efficient in that way, maintaining the position of the rings, under the more stringent conditions of a closer arrangement.

Added to this, is the consideration of the enormous extent which would seem to be required on both sides of the ecliptic, to account for the great breadth of the *base* of the zodiacal illumination, even after the disappearance of twilight in the evening, or before daylight in the morning; all which seems to be true of *the more dense*, and, if surrounding the sun, also *the more distant portion* of the material in question, which ought, unless uncommonly extensive, to be seen *under a smaller angle* than the other portions of the same; a difficulty to which the hypothesis recently advanced by Mr. Richard A. Proctor, F.R.A.S., viz. that the Zodiacal Light is due to a closely arranged group of meteors, would seem to be especially liable; and all the more so, if "assuming" (as he himself says we are bound to do) "a considerable degree of flatness in the actual figure of the zodiacal disk, and more especially of its more distant portions."[1]

And just *that* difficulty still remains if we were even to *admit* Prof. Arthur W. Wright's conclusion from his recent experiments on the *polarization* of the Zodiacal Light, as far as this—that "the light is reflected from matter in *a solid state;*" since, he adds, in explanation of the same that this solid matter is that of "innumerable small bodies revolving about the sun in orbits of which more lie in the neighborhood of the plane of the ecliptic than near any other plane passing through the sun."[2]

Now this portion of the hypothesis of Prof. Wright, Mr. Proctor, and, it may be, others—whatever may be the special composition of the material in question—would seem to require that the apparent form of the Zodiacal Light should be somewhat like that of the head of a comet, with the *expansion* beyond it extending *upward* from the sun; whereas the actual appearance and position are both the reverse of that; the *broad* base near the horizon, and the *narrow* and curved termination at *the upper* end.

And then, moreover, it would seem, on the part of the hypothesis here considered, that, in any event, there must be a conspicuous central beam or core of the Zodiacal Light; which we do not find.

And, lastly, what shall be said of the *planetary perturbations*, which, it would seem, ought to be superinduced by such a closely arranged group of meteors; especially if the "light" be indeed "reflected from matter in a *solid* state?"

Other objections to hypotheses which would make the material to which we owe the Zodiacal Light to be an appendage of a lenticular or other form, referable to the sun as its centre, are very exhaustively considered by Chaplain Jones in the volume already referred to. The hypothesis that the Zodiacal Light is due to

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1 In a long and carefully considered *Note on the Zodiacal Light* in the *Monthly Notices of the Royal Astronomical Society*, vol. xxxi, No. 1 (Nov. 11, 1870).

2 *American Journal of Science and Arts, Third Series*, vol. vii. p. 457 (No. 41—May, 1874). Will, after all, our terrestrial experience as to the conditions of *polarization*, justify us in making *it* a *criterion* of the *state* of anything so peculiar as the matter in question?

reflection from the earth's atmosphere is also discussed and rejected by him. Upon this, however, it will not be necessary here to comment; as it, most probably, is no longer insisted upon by any one.

(74) It remains, then, to consider *with what modifications* we may admit Mr. Jones's hypothesis; that the nebulous material which gives the Zodiacal Light is a terrestrial appendage; and also what is the conservative force, which may insure its preservation of form, and its maintenance in its revolution around the earth, even in close proximity to the moon.

Antecedent to all that, however, will be found to be the questions of density and of mode of illumination, as well as, in its proper connexion, the question of parallax.

The density of the material in question seems indeed to be that intimated in the description of M. Laplace already quoted, (71); viz. that which pertains to the state of molecules "too volatile either to combine themselves, or to unite with the planets." And this is confirmed by the spectrum-analysis; the result of which has led to no other reliable conclusion than that of the extreme rarity of this same material.[1]

This same rarity of the material in question is withal indicated by its transparency.

Of this Rev. George Jones says, under date of Dec. 30, 1854 (in lat. 10°46′ N., long. 89°31′ W. of Greenwich): "I also, this morning, gave attention to the stars as seen through the Zodiacal Light, and found, even to $4^h\,30^m$, when the effulgent light below the zigzag lines (in the chart) is very strong, that with the naked eye I could readily make out stars of the 6th magnitude within the effulgent light; . . . . . also a line of four stars below 19 Libræ, and ranging with β Libræ; . . . . . the two northernmost of these last are of the 7th magnitude, yet I think the naked eye detected them, even within this effulgent light; but the last are near its upper edge. All this shows the great transparency of the substance giving the Zodiacal Light."[2]

(75) The consideration of these phenomena leads to the conclusion, That this light proceeds from particles which, as respects size, are, at most, all but *molecular*, and if discrete, and, possibly, " solid," yet *excessively* small solids. It then must also largely be *transmitted* light; and so the illuminated material *appear brighter in the special direction in which the light is transmitted.* Chaplain Jones illustrates this in part, when he says that "it seems to be quite conclusive, on an inspection of these charts, that *we never at any one time see the whole actual extent of the Zodiacal Light.* This subject can, perhaps, be elucidated by noticing a common event—a cloud silvered at one edge by the rays of the declining sun. The sun may be shining on the bordering, quite around that cloud; and, if so, it is sending off from every portion of the border, an equally brilliant silvery light. But our eye is in a position to

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[1] Such is in effect the statement of Prof. Charles A. Young (as the result of his experience and that of others), made in a personal communication with the author of this paper.

[2] Report of Japan Expedition, vol. iii, No. 271, at p. 542.

catch this reflection from only one portion of it; and the rest is dull to our vision. If we could with great rapidity change our positions, other portions of the silvered edge would show themselves according to our changes of place. So also, when a rainbow is presented to our eye; the myriads of drops of falling water in the whole rain-shower are sending off from each drop reflections of light in all directions, and the universal atmosphere about us is full of these brilliant variously-colored rays; but only that portion, which, to us, forms the rainbow arch, can reach our eye; and all the rest is lost to our sight."

"So it is also with the Zodiacal Light; and the proof that we never see the whole of its extent at once, is manifest in the following facts:—

"1. When I was in a position *north* of the ecliptic, the main body of the Zodiacal Light was on the *northern* side of that line.

"2. When I was *south* of the ecliptic, the main body of the Zodiacal Light was on its *southern* side.

"3. When my position was *near* or *on* the ecliptic, this Light was equally divided by the ecliptic, or nearly so.

"4. When, by the earth's rotation on its axis, I was, during the night, carried rapidly to or from the ecliptic, the change of the apex, and of the direction of the boundary lines, was equally great, and corresponded to my change of place.

"5. That, as the ecliptic changed its position as respects the horizon, the entire shape of the Zodiacal Light became changed, which would result from new portions of the nebulous matter coming into position for giving us visible reflection; while portions lately visible were no longer giving us such reflection."[1]

(76) The phenomena here commented upon all serve to confirm the assertion, (75), that the zodiacal illumination must largely be transmitted light; and so the illuminated material *appear brighter in the special direction in which the light is transmitted;* as the sun illuminates the partially transparent vapor in our atmosphere through rifts in the clouds, and thus produces the appearance familiarly described as "the sun drawing water."[2]

(77) The light being transmitted, other phenomena would also be in place, among which are *absorption*—possibly *interference*—and also *fluorescence;* new waves being originated in this case, as well as, perhaps, in that of the comets; the spectrum-analysis of whose light seems to show, among other phenomena, characteristics of self-luminous material.

(78) To this it may now be added, that the nebulous ring of Chaplain Jones, may well be regarded as having, indeed, not the *lenticular form* attributed to the

[1] "The first four of these results were not always uniform; but the exceptions were few, and were probably occasioned by the nebulous ring's not lying exactly in the plane of the ecliptic." From the *Introduction* to Chaplain Jones's Report, pp. XVI and XVII.

[2] Mr. Proctor also seems inclined to admit the possibility of a more intense illumination in special directions; though not decided as to its cause, when he says at the close of his Note on the Zodiacal Light, referred to in (73): "If some solar action, for example, rouses luminosity in certain definite directions—as, for instance, near the plane of the Sun's equator—in some such way as light is caused to appear along radial lines through and beyond the heads of comets, our power of theorizing from such considerations as have been dealt with in this paper would be limited."

material giving the zodiacal light by older hypotheses (which he does not claim); nor yet that of a ring like those of Saturn; nor yet a ring of greater thickness, partially luminous indeed in appearance, as Mr. Jones would have it; but we must have for it the form of what may rather be termed *a girdle*, of *no great thickness*, it may be—it is too translucent for that—but yet of very considerable width, such as will provide for the broad base of the Zodiacal Light, and the extended elliptical spot which exhibits the "*gegenschein*"[1] opposite to the sun; and which latter would seem to be almost wholly due to reflection. There may also be some reason to suppose that the curvature of the girdle, on the one side at least (that on which the "gegenschein" appears) is such as would be due to a spheroidal shell such as has been described in *Article* (37) of this paper. Such a girdle, withal, could not always—perhaps ever—have all its breadth enveloped in *the earth's shadow*.

How the Girdle is maintained.

(79) The question at once becomes a pertinent one, How can such a girdle escape destruction by the continued perturbation of the moon, acting in close proximity?

The answer to this question may be found, if the girdle be so situated that ITS TIME OF REVOLUTION AROUND THE EARTH SHALL BE EQUAL TO, AND IN THE SAME DIRECTION WITH, THAT OF THE MOON. The conditions requisite to fulfil this will first be considered, and then the phenomena that seem to be accordant with the actual maintenance of such conditions.

(80) If the *earth's* attraction *alone* were concerned, the form of the revolving girdle must, it would seem, be that of a spheroidal shell; such as that indicated in (37). The attraction of the moon will distort this, yet so that the shape shall also be consistent with the stringent condition as to the periodic time.

Fig. 13.

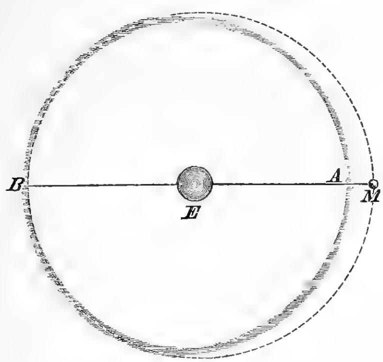
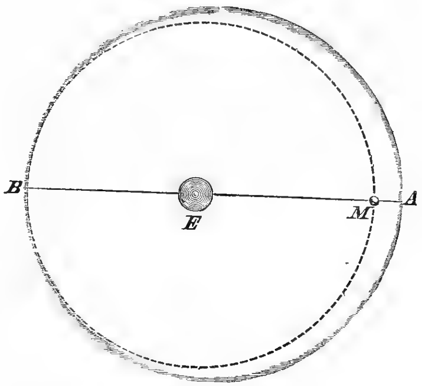


Fig. 14.



[1] *Counter-gleam*, we might perhaps term it; though that scarcely seems so apt as the German word for the same thing, here quoted.

The middle line of the girdle will, notwithstanding, form an oval, which, at any time, in its arrangement around the earth, will not anywhere be found at a distance differing much from that of the moon at that time; except in those portions comparatively near to the moon.

That part of the oval nearest the moon may pass between the moon and the earth, as in *Fig.* 13; or else outside of the moon, as in *Fig.* 14; in both of which E marks the position of the earth, and M that of the moon.

In the determination of the dimensions in either case, it will be convenient to ascertain the periodic time of a particle, or of an inappreciable mass, revolving around the earth at the mean distance of the moon; which we may obtain by the aid of the following formula, in which (T) will be put for the periodic time; M and m representing the masses in question, and r the radius-vector; and we have

$$(T) = \frac{2\pi r^{\frac{3}{2}}}{\sqrt{M+m}} \quad \ldots\ldots \quad (1).^1$$

Then, when m is insensible,

$$(T') = \frac{2\pi r^{\frac{3}{2}}}{\sqrt{M}} \quad \ldots\ldots \quad (2);$$

and, when r is the same for both, from these we also have,

$$\frac{(T')}{(T)} = \frac{\sqrt{M+m}}{\sqrt{M}} \quad \ldots\ldots \quad (3); \text{ or}$$

$$(T) = \frac{\sqrt{M+m}}{\sqrt{M}}(T) \quad \ldots\ldots \quad (4);$$

which, otherwise expressed, is

$$(T') = \sqrt{\frac{M+m}{M}} \cdot (T) \quad \ldots\ldots \quad (5).$$

Then, 1*st*—Making special application of either *Eq.* (4), or *Eq.* (5) to the example in which M and m, respectively, represent the masses of the earth and the moon, and (T) the moon's periodic time, we shall have the periodic time of a particle, or of an insensible mass, revolving around the earth at the distance of the moon.

2*d.* Ascertain the periodic time (t) of the same insensible mass, revolving about the earth, at the assumed distance EA, by the application of *Kepler's* 3*d Law.*

3*d.* The attractive forces of the moon and the earth, respectively, acting at A may be separately computed in accordance with the law of gravitation $\left(\frac{M}{d^2}\right)$, and then taking the *difference of* the two forces, when the state of things is that represented in *Fig.* 13; and expressing this difference in terms of the earth's force F, viz. as $\frac{p}{q}F$; then (with (t), the periodic time around the earth of an insensible mass revolving at distance EA, *already computed*), we shall have

[1] Encyclopædia Metropolitana—*Physical Astronomy,* Section V.

$$\frac{(t')^2, \text{ for } \frac{p}{q}F}{(t)^2, \text{ for } F} = \frac{F \text{ itself}}{\frac{p}{q}F}; \text{ whence}$$

$$(t')^2 = \frac{F}{\frac{p}{q}F} \cdot (t)^2; \text{ and}$$

$$(t') = \left\{ \frac{F}{\frac{p}{q}F} \cdot (t)^2 \right\}^{\frac{1}{2}}$$

Then if (t'), thus computed, be found to be equal to the moon's own periodic time, the point A will have been accurately ascertained; the particle, or the insensible mass (in the line EM), completing its revolution at the distance EA, in the same time with the actual revolution of the moon around the common centre of gravity of the moon and the earth.

But if (t') differ at all from *that*, the difference may be exhausted by the continued application of the method of trial and error.

When A is situated beyond the moon (in accordance with the representation in *Fig.* 14) the *sum* of the attractive forces of the two bodies must be made to enter into the equation to determine the value of (t'), instead of the difference of those same forces. So also, for the distance from E to B, on the opposite side of the earth.

(81) Now the division or the extension of EM (as the case may be) so as to give the distance EA, this depends upon the forces in question, and, ultimately, on the ratio of the masses, and not upon the absolute length of EM. Hence EA and EB will each have a constant ratio to EM; whether the moon be in apogee, or in perigee, or at the mean or any other distance. The same is true of the distance of the moon from the common centre of gravity of the moon and the earth, *i. e.* of the *radius-vector of the moon's orbit;* and for the same reason.

Now,—(*a.*) Every other of the quantities in question having, after this manner, a constant ratio to EM; it will follow that, under all their variations of value, the value of any one of the quantities will preserve a constant ratio to the coexistent value of any other; and therefore, specifically, to the coexistent value of the *moon's radius-vector;* or the square of the one, a constant ratio to the square of the other.

(*b.*) Next, as M, E, A, and B, under the conditions in question, are preserved in the same straight line; it follows from the doctrine of parallels, that *the angular change of direction* of M revolving about the common centre of gravity of M and E, or that of A and B revolving about E, will be *the same* with reference to any fixed direction in space, such as that of EM (at any instant), or with reference to its parallel; or the same will be true with respect to the first tendency to such change, *i. e.* its *differential.*

(*c.*) Hence also, especially, the angular change of direction which would take place, were such a tendency preserved during the next *unit of time, i. e. the co-*

existing angular velocity of *M*, *A*, *B*, (in their revolution of every one of them around its centre of reference) would, in every instance, have the same value.

(*d.*) But this *same* angular velocity in the moon's orbit varies inversely as the square of the *radius-vector*, and the coexisting values of the squares of *EA* and *EB*, respectively, having (as already shown) constant ratios to *that;* their ratios may be substituted for the ratios of the respective coexisting values of the squares of the radii-vectores themselves; and the inversion of the one for the inversion of the other.

(*e.*) By substitution, then, the respective squares of *EA* and *EB* are inversely as the coexisting angular velocities in the moon's orbit.

(*f.*) But the same angular velocity being (as also shown) common to all the three masses in question; every one of those masses will also have its angular velocity inversely as the square of its own radius-vector; and that will imply the principle of *the conservation of areas;* and thus maintain not only for the moon, but also for the other masses, in the consentaneous revolution of all, *a dynamical equilibrium.*

(*g.*) Then withal the constancy of the ratios already specified, will secure, under the coexisting similar change of angle, the same ratios among the radii-vectores of all the three trajectories here in question; and just all that implies that the *same polar equation* will apply to all the three.

(*h.*) Hence the trajectories of *A* and *B* are both *ellipses;* as well as (perturbations apart) is the orbit of the moon; even more than this, under those stringent conditions (common to all); viz. the trajectories are all *similar* ellipses.

(82) The positions of the points *A* and *B*, on the supposition that the girdle on the one side, is between the earth and the moon, as in *Fig.* 13, is exhibited in the following table; the distances represented being in terms of the earth's equatorial radius.

	IN PERIGEE.	AT MEAN DISTANCE.	IN APOGEE.
MOON'S DISTANCE........................	56.964	60.273	63.583½
(*EA*) Internal Distance of Girdle........	48.309	51.116	53.922½
(*EB*) External Distance of Girdle........	56.790	60.090	63.389

On the supposition that the girdle encompasses the moon, as in *Fig.* 14, we have:—

	IN PERIGEE.	AT MEAN DISTANCE.	IN APOGEE.
MOON'S DISTANCE........................	56.964	60.273	63.583½
(*EA*) External Distance of Girdle........	66.426	70.285	74.144½

(83) As *A*, *B*, and the moon thus describe similar ellipses with their radii-vectores coincident in the same straight line; it is manifest that the portions of the girdle in the immediate neighborhood of *A* and *B* will *expand* (the material

being readily adjustable) as the moon passes from perigee to apogee; and they will contract as the moon passes from apogee to perigee; the cohesive power and the gravitation of outer to inner portions being, in any event, insensible; and so each particle or molecule moving in its independent, or nearly independent, ellipse very much as Sir J. Herschel has intimated that the molecules of comets might move.[1]

Then, too, a *permanent* tide must influence and control the form of the girdle; this tide (with the arrangement as in *Fig.* 14) being in some sense *supra*-lunar, instead of *sub*-lunar, in the region of the crest of the girdle extending beyond the moon.

By such a tidal action an *accumulation of material* will be determined toward the *two extremities* of that axis of the girdle, which at any time passes through the two centres—that of the earth and that of the moon—and which is extended to the girdle on both sides [*i.e.* toward *A* and *B* in either of the cases represented, the one in *Fig.* 13, and the other in *Fig.* 14].

And the portions of the adjustable material here specified having themselves been once so adjusted (radii-vectores and all) as to be held, or very nearly held, in a dynamical equilibrium, such as is specified in (81); the compulsory power of the forces acting on such material, under such stringent circumstances, might well be supposed to bring about the form required to secure a dynamical equilibrium of the girdle; though the oscillations, in various directions, antecedent to that, would present a problem of no ordinary difficulty.

However all that may be—the dynamical equilibrium of all parts of the girdle being once established, the state of things afterward would be eminently conservative of the same; such being especially the case with respect to *the various* actions, which, under other conditions, might be eminently destructive.

(84) If the girdle (as at *A* in *Fig.* 13) were between the moon and the earth, *its* curvature would be *diminished* in the direction perpendicular to the moon's orbit, by the moon's own action; though the curvature would be *increased* by the action of the moon, on the opposite side; as was, indeed, intimated, though not at all explained, in (78). But if the girdle (as at *A* in *Fig.* 14) were outside of the moon, the curvature (perpendicular to the moon's orbit) would be greater still.

(85) The second thing proposed in this connexion, was to consider the phenomena which seem to be accordant with the state of things thus far represented as being merely supposable. With respect to these phenomena, it may be observed, that the hypothesis of the girdle having the same periodic time with the moon suggested itself as a necessity, to insure the preservation of the girdle itself; and, in the brief interval which has since elapsed, the variations of the Zodiacal Light have, to some extent, been carefully noted, and *then* referred for explanation to the hypothesis.

And here the phenomena seem to be more consistent with the arrangement of the girdle as represented in *Fig.* 14; the point *A* being situated *beyond* the moon.

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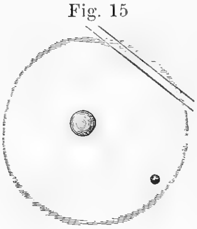
[1] Cabinet Cyclopædia—*Astronomy* (488).—With this Prof. Wright's conclusions, (73), with respect to the *constitution* of the material in question would not be inconsistent. See, again, *Article* (73).

With that in view, the special appearances of the Zodiacal Light may be arranged as follows:—

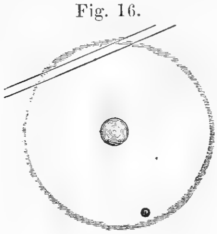
Case 1*st*. The Zodiacal Light appears narrow and towering high just about the time of the new moon; *as though the sun's light were indeed transmitted, at that time, through the least curved, and, probably, somewhat rarer sides of the oval-shaped girdle; and that through a great part of the length of the oval.* (*Fig.* 15.)

Fig. 15



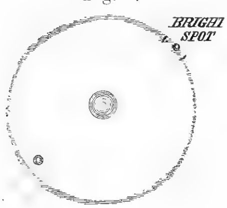
Case 2*d*. After the new moon, when the moon is approaching her first quarter; when the moon has set, and the twilight has disappeared, the Zodiacal Light does not extend so high as in the preceding case, and its termination is broader, and not so sharply curved, and the intensity of the light, withal, is not especially conspicuous (as in *Fig.* 16, for Zodiacal Light of the morning), *as though the sun's light indeed, in all its transmission, passed through the rather less dense portion of the girdle; and passed out of it in a direction more across the girdle and not so nearly at a tangent to it (in its exit under these circumstances), as in the preceding case.*

Fig. 16.



Case 3*d*. After the full moon, and when the moon is approaching her last quarter; then, before the rising of the moon, and after the end of twilight, a luminous spot of considerable size, and, in appearance, like the brighter portion of an aurora borealis, occupies the place in the Zodiacal Light which is quite accurately opposite to the moon's place; and night after night, as the moon advances, this luminous spot rises among the stars, so as still to keep opposite to the moon; *as though the somewhat more dense portion at the farther end of the oval (as respects the moon) were thus more conspicuous than the other portions then in view; and then the upper extremity of the Zodiacal Light is broader and not so sharply pointed as in Case* 1*st; as though for the reason assigned in Case* 2*d.* (*Fig.* 17.)

Fig. 17.



Case 4*th*. After the last quarter and before the new moon, the Zodiacal Light of the evening is again faint, as it was before the first quarter; *as though the illumination were wholly of that part of the girdle beyond the region near the longer axis.* (*Fig.* 18.)

Case 5*th*. When the moon is nearly in quadrature, it would seem that the Zodiacal Light must appear *short and bright*, if apparent at all after the twilight of the evening, or before the twilight of the morning. For the sun's light would be transmitted by a short course through the most curved portion, near to one end of the longer axis of the oval. (*Fig.* 19.)

(86) Increase of brightness might be looked for, with the moon in perigee; and of extent, with the moon in apogee. Traces of something like one and the other have been apparent.

(87) After an examination of Chaplain Jones' very numerous charts, a selection was made of those which seemed to exhibit instances in which the light was most

Fig. 18.

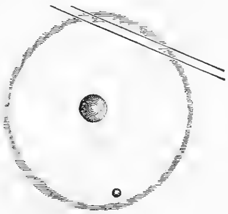


Fig 19.

extensive, or most conspicuous, and others in which, in one or both respects, the light seemed to be deficient (the character of the light, and not the position of the moon, furnishing the guide in the selection); and *then* the age of the moon, and her position in her orbit were ascertained, for a comparison of the phenomena with theory.

The following instances were then classified with reference to our hypothesis now under discussion. The *Nos.* are those of Mr. Jones' charts:—

Examples under Case 1*st.*

No. 219.—Morning of Sept. 21, 1854; 1 day before new moon.
No. 220.—Evening of Sept. 23, 1854; 1 day after new moon.
No. 232.—Morning of Oct. 20, 1854; 1 day before new moon.
No. 233.—Morning of Oct. 21, 1854; the day of new moon.
No. 243.—Morning of Nov. 21, 1854; 1 day after new moon.
No. 259.—Morning of Dec. 19, 1854; the day of new moon.

(A very marked instance; and not only was the day that of *new moon*, but the moon was also *in perigee.*)

Mr. Jones, without any reference to the moon's age, or to her distance from the earth, says of the zodiacal light, "At 2h. the eastern zodiacal light was bright, at 3h. 30m. quite so. At 5h. it was as brilliant as I have ever seen it, and was especially so within the zigzag" (waving lines toward the lower part of the diagram), "where the light had more of a cone shape than I ever saw it have before.[1] . . . . Sun rose at 6h. 57m."

Approximation to Case 1*st.*

No. 49. Morning of Sept. 2d, 1853; 1 day before new moon.

Examples under Case 2*d.*

No. 31. Evening of July 9th, 1853; 3 days after new moon.
No. 114. Morning of Feb. 1st, 1854; $3\frac{1}{2}$ days before first quarter.

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[1] The description here is such as might, in anticipation, have been dictated by the hypothesis under discussion.

Case 2d, or Case 4th.

No. 161.—Evening of May 29th, 1854; 3 days after new moon.
No. 237.—Morning of October 30th, 1854; 2 days after first quarter.

Examples under Case 3d.

No. 212.—Evening of Sept. 12th, 1854; $1\frac{1}{4}$ day before last quarter.
No. 213.—Evening of Sept. 13th, 1854; $\frac{1}{2}$ day before last quarter.

Examples under Case 4th.

No. 18.—Evening of June 29th, 1853; $1\frac{1}{2}$ day after last quarter.
No. 60.—Morning of Sept. 30th, 1853; $2\frac{1}{2}$ days before new moon.
No. 215.—Evening of Sept. 16th, 1854; 2 days after last quarter.

Examples under Case 5th.

No. 67.—Morning of Oct. 8th, 1853; 1 day before first quarter.
No. 214.—Evening of Sept. 14th, 1854; day of last quarter.
No. 239.—Evening of Nov. 11th, 1854; 1 day before last quarter.
No. 241.—Evening of Nov. 13th, 1854; 1 day after last quarter.[1]

(88) Mr. Jones also gives examples of "Moon Zodiacal Light."

(89) Baron Humboldt, commenting on Rev. Mr. George Jones's observations, quotes from his own ship-journal on his voyage from Callao to Acapulco, and speaks of the brilliancy of the Zodiacal Light as exceeding anything which he had previously witnessed. The time when this was observed was from the 17th to the 19th of March, 1803. Indeed the intensity of the light increased for five or six nights after the 14th. Height 39° 5′.[2]

As the moon was new on the 23d, this bright light must have begun before the last quarter; and will present a probable instance of *Case 3d*, passing into and beyond Case 5th.

But, strangely enough, Baron Humboldt finds occasion to add: "We did not see the Zodiacal Light the 20th and 21st of March, *although the nights were of greatest beauty.*"

Now something—perhaps not a little—of that may have been due to differences in the state of moisture of the atmosphere, such as those, (72), of which Col. Forshey has informed us. But the time being withal from two to three days before the new moon, the sun's light would, on the hypothesis here in question, be transmitted through the curved portion of the girdle a little in advance of the longer axis.

The length of the transmitted portion would not be great, and the upper end would set almost as soon as the twilight ended.

(90) In the account of Prof. C. Piazzi Smyth, Astronomer Royal at Edinburgh, of his expedition to Teneriffe, under date of Aug. 19th, 1856, speaking of the Zodi-

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[1] See *Astronomische Nachrichten*, No. 989.

[2] The dates with reference to the phases of the moon are but close approximations; yet such as are quite sufficient.

acal Light, he says: "So bright was it toward the base that it produced a weak reflected glow to the west, and we could occasionally fancy a tail of the faintest conceivable light extending nearly to the zenith." (Length of the bright light was 63°.) "Nevertheless there was no doubt of the lenticular form of the chief mass of light, and the place of its apex as measured, was always consistent enough."[1]

This was almost three days after the full moon, and seems to present an example of *Case* 3d. Under the date of Sept. 8th, Prof. Smyth says of the Zodiacal Light—"bright at base, glowing toward the lower part of the axis."[2]

This was one day after the first quarter of the moon; and we here would seem to have an example of *Case 5th.*

(90 *bis*) The observations of Col. Charles G. Forshey, already alluded to in (72), were made while Col. Forshey was superintendent of the Texas Military Institute (Lat. 30° N., Long. 96°25′ W. of Greenwich), in 1858, 1859, and 1860.

Among these observations we find the following, which seem to furnish *consistent* examples under the *Cases* described in (85); and the list might readily be extended.

Case 1st.

Evening of Oct. 5, 1858; 1 day before new moon.
Evening of Nov. 6, 1858; 1 day after new moon.
Evening of Nov. 7, 1858; 2 days after new moon.
Evening of March 3, 1859; ½ day before new moon:—
Light narrow, except near the horizon, and towering high.

Case 2d.

Evening of Oct. 12, and morning of 13, 1858; between new moon and the first quarter. A midnight band of light seems to be delineated; such as will also be noted among the observations under *Case 5th.*

Approaching to the conditions of *Case 2d:—*

Evening of March 31, 1858; 2½ days after full moon.
Evening of Nov. 10, 1858; 3 days before the first quarter of the moon.
Evening of Nov. 13, 1859; 3½ days after full moon.
[The three last-mentioned instances are specially described in *Note* 3 to (72).]
Evening of Nov. 11, 1858:—

This observation may be specially classified with the preceding three. It was made three days before the first quarter of the moon. The position, therefore, is nearly that of *Case 5th.*

Case 3d.

Evening of April 22, 1859, 2 days before the last quarter of the moon.

Figure seems to show the peculiar bright spot indicated in the description of our *Case 3d*, of this *Article.*

Case 4th.

Evening of Oct. 29, 1858; day of last quarter of the moon.
Time 11*h.* to 12*h.* P. M.

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[1] Page 217

[2] Page 298.

A midnight band with parallel edges. The figure seems to indicate that the band was about 7° or 8° wide. The appearance is such as it might be if the light were reflected at all but right angles to the girdle.

Evening of April 4, and also that of April 5, 1858; two and one days, respectively, before the last quarter of the moon.

In the evening of April 5, the light is expressly noted as being visible "entirely across the heavens, from Aries at least to Libra."

Evening of Oct. 27, 1858; nearly one day before the last quarter of the moon.

The light seems to have, consistently, been short but considerably bright.

Both characteristics are more distinctly manifest, in the evening of Oct. 28, 1858; day of the last quarter of the moon.

Evening of Dec. 28, 1858; about 2 days after the last quarter of the moon.

Light short and rounded at the top, and the base very broad.

Evening of Jan. 15, 1860; 1 day after the last quarter of the moon.

Light described as having been "intensely bright;" and, in the drawing, it tapers rapidly.

(91) Among the *Notes on the Zodiacal Light*, by Rev. Samuel J. Johnson (*Proceedings of Royal Ast. Society for March*, 1874), we find—"What Humboldt speaks of as the 'mild pyramidally-shaped zodiacal light, very visible to the unassisted eye' has been displayed here" (at *Upton Helions Rectory*, *Crediton*) "this winter with far more distinctness than I have noticed since Feb. 21, 1870, when I witnessed a vivid appearance of the phenomenon from Lytham, on the Lancashire coast. It was conspicuous, amongst other nights, on February 8, when the impression that Tycho mistook the light for the 'abnormal vernal evening twilight,' appeared at first sight almost pardonable."

This seems again to present an example of our *Case 5th.*

"Feb. 16. Sky clear for a brief interval about 8 P. M. The conical figure very fairly defined, except at the apex, where the curvature was somewhat difficult to make out. *Mars*, situated nearly on the axis; about which point the light seemed equal in brightness to that portion of the *Milky Way* that passes through *Cassiopeia*. Near the horizon the intensity was decidedly greater, ν *Ceti* appeared just outside the cone of light; the head of *Aries* faintly involved in it; it could be traced, though with difficulty, 3° or 4° above the *Pleiades*."

Again, a remarkable example of our *Case 1st.* For this was *the day* of the *New Moon*, and the moon was $1\frac{1}{4}$ day from the *Perigee*. Confirmed this is withal by the next observation.

"Feb. 18. Could be readily followed before the moon set. . . . . Clear extent at the base 30° to 35°. Not quite so brilliant as on the 16th; I fancied a slight reddish tinge in the brighter portions."

Appropriately descriptive of our *Case 2d.*

"March 6. The Zodiacal Light again conspicuous. In extent and general features unaltered; in intensity scarcely so great. The clearest defined portion lay between ν *Ceti* and γ *Arietis ;* at lower altitudes the light, although brighter, appeared very much diffused. *Mars* about 5° left of the axis."

An example of our *Case 3d.* "The clearest defined portion" was nearly *opposite* to the moon, then $3\frac{1}{2}$ days past the full, and $1\frac{1}{3}$ day beyond the apogee.

"March 7. With regard to the earliest visibility of the light, it was not noticeable till 15m. after stars of the brightness of γ *Arietis* had shone out, and not quite so soon as the *Milky Way* at equal altitudes. Its whiteness more dusky than the latter. At an altitude of about 20°, η and α *Piscium* (the latter just within the boundary) were somewhat dimmed by its intensity."

This is followed by another *Note on the Zodiacal Light*, by E. B. Knobel, Esq., who writes from *Stapenhill Burton on Trent*, and says: "I would beg to direct attention to the unusual brilliancy of the Zodiacal Light this winter. . . ." On two clear evenings in the first week in January, on January 17, at 6.45 P.M., and, lastly, on Feb. 8, at 7 P.M., it appeared as an elongated luminous cone, the apex of which, on January 17, extended nearly to the star γ *Arietis*, and on Feb. 8, the apex just enclosed η *Piscium.*

"It appeared nearly as bright as the *Milky Way*, and sufficiently bright to attract the attention of a casual observer.

"I should mention that my situation is quite away from the town, and sufficiently high to be above the mists of the valley."

The observation of Jan. 17 affords another good example of our *Case 1st;* the date being a little more than $\frac{1}{2}$ a day before *New Moon*, and about 3 days before the moon arrived at the *Perigee.*

The observation of Feb. 8 confirms that of Rev. Samuel J. Johnson of the same date, previously quoted.

These observations are, moreover, all confirmatory of those made about the same time, as well as at other dates, at the College of New Jersey, by the author of this paper; and which, indeed, furnished the data for the distinction of the various *Cases.*

[A very little observation will suffice to make it very evident, that under circumstances in other respects entirely similar, the fact of the atmosphere being *dry* will notably affect the apparent extent as well as brightness of the Zodiacal Light; in accordance with the special, and even uniform, experience of Col. Forshey, already referred to in (72) and *Note.*]

(92) Chaplain Jones also speaks of pulsations in the Zodiacal Light; as having been observed by himself and others. His synopsis of these observations at p. XIII of his Introduction is: "Some time early in 1854 I saw in a newspaper a brief notice of the pulsations of the Zodiacal Light seen at Kew Observatory; but as the newspaper did not state where they were observed, or the authority, and as I had now been observing for a year without having noticed anything of the kind, I set it down as an ocular deception, and the thing passed entirely from my mind. But in March of this year (see No. 111), I was surprised, one evening, at seeing the Zodiacal Light fade sensibly away, dimmed to almost nothing, and then gradually brighten again. This was repeated several times; but the effect, after all, was to leave me only in amazement and doubt; subsequent nights, however, gave abundant exhibitions of this kind, of which, with the times and changes, I have

made ample records with the particularity which the case required. It was a great satisfaction, after my return home, to find that Baron Humboldt had observed the same thing while in southern latitudes, though he thought it more probable that it was owing to 'processes of condensation going on in the uppermost strata of air, by which the transparency, or rather the reflection of light, may be modified in some peculiar and unknown manner.' My records, however, will show that there is a regularity of appearance at the closing off of these pulsations, which proves that they do not belong to so uncertain a cause as atmospheric changes, but to the nebulous substance itself. They seem to intimate a great internal commotion in the nebulous matter, for they were too rapid to be occasioned by irregularities in its exterior surface.

"I noticed them again the following year, but must refer the reader to my records and charts. The changes were a swelling out, laterally and upwards, of the Zodiacal Light, with an increase of brightness in the light itself; then, in a few minutes, the shrinking back of the boundaries, and a dimming of the light; the latter to such a degree as to appear, at times, as if it was quite dying away; and so back and forth for about three-quarters of an hour; and then a change still higher upward toward permanent bounds."

(93) That these pulsations should be real seems not incredible in the instance of a substance having, as it would seem, a density even less than that of the material which exhibits the rapid changes of intensity, etc., of the aurora borealis. The girdle, moreover, would have a very nearly constant position with respect to the earth and the moon—*both magnetic*; and the earth in a relatively rapid *rotation*.[1]

(94) It would seem most probable that the middle plane or equator of the girdle should nearly coincide with the plane of *the moon's* orbit; but even in that case, the more intense illumination by transmitted light would be in directions nearly parallel to the plane of the ecliptic. That, and the local illumination, (75), ascertained and described by Mr. Jones, would together make it difficult to determine where the middle plane may be situated; though some observations of the "gegenschein" might seem to make it the same with the plane of the moon's orbit.

The position of the vertex of the Zodiacal Light would need to be more carefully scrutinized, and compared with that condition.

Such being the state of things, observations for *parallax* must, withal, most probably continue to be unsuccessful.

(95) As a summation of the consistencies of the hypothesis of a nebulous girdle revolving around the earth in the same time and general direction with the moon, and exhibiting the phenomena of the Zodiacal Light, we have:—

1. That it provides a conservative force for the maintenance of such an appendage.

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[1] But it would be more difficult to understand and account for these special phenomena presented by the material in question, if it were directly a solar, instead of a terrestrial, appendage.

2. It will account for the phenomena common to all appearances of the zodiacal light, *broad base* and all.

3. It accounts for certain periodical changes in form and intensity, etc., of the same, which seem to be completed in a synodical revolution of the moon.

4. It provides for the *gegenschein* in form and position; and possibly also for "a lunar zodiacal light."

5. It renders a plausible account of the fading, at times, and total disappearance of the Zodiacal Light.

6. It accounts for the absence of a determinate parallax of the girdle.

7. It shows why, when east and west zodiacal lights are visible at the same time, the middle, even, of the zodiacal arch need not be wholly obscured by the earth's shadow.

8. It provides for the "pulsations."

Origin of the Girdle.

(96) It remains to consider how far the origin of the girdle may be accounted for by the modified nebular hypothesis, already so frequently applied.

If the moon herself were formed of a spheroidal shell [such as those described in (37)], while the form of the earth with its expanded atmosphere was yet very oblate; the equatorial diameter extending beyond the present distance of the moon—*i. e.* more than 60 times the radius of the earth's equator—the moon, derived from the atmosphere of this spheroid, might, at first, indeed have had the form of a spheroidal shell, with its equatorial circle nearly *in the plane of the ecliptic*, as the orbit of the moon now is, instead of *the plane of the earth's equator, since determined.*

This whole collection of material having, by processes heretofore described, (26), been brought to revolve together, the outer portions having thereafter failed to be collected with those that went to form the moon herself, these same outer portions would still continue to revolve and complete the same periodic time.

The part between the moon and the earth would nearly all be compelled to fall toward the earth in obedience to her superior attraction; except, possibly, some small remnant still forming an extra-mundane nebulosity (the middle of it at the position *A* in *Fig.* 13); the existence of which might help to account for some of the phenomena of *solar eclipses*, if not also of those of *transits* of the inferior planets; which it would be out of place to enlarge upon in this connexion.[1]

(97) Whether the material which exhibits the *Aurora Borealis*, or rather *Aurora Polaris*, can have had a similar origin, near to the pole of the oblate expanded atmosphere, and so, also, near to the pole of the Ecliptic in direction, as well as actually near to the earth, can be little better than matter of conjecture. The results, of the spectrum-analysis [(74) and *Note*] do not yet establish a composition

[1] The present Astronomer Royal, Sir George B. Airy, is understood to have said, soon after the total eclipse of the sun, in 1842, that some of the phenomena of that eclipse required for their explanation the supposition of the existence of a material *between* the moon and the earth.

of this material similar to that of the Zodiacal Light. It may, however, be asserted that auroral phenomena are most intense in latitude *about* that of the arctic circle; in which region, it must also be remembered, we have the magnetic poles. It is withal true, that the Zodiacal light seems sometimes to have exhibited (like the Aurora) a *ruddy* tint. An instance is mentioned in (91).

Saturn's Dusky Ring.

(98) The situation of the dusky ring of Saturn somewhat resembles that of the zodiacal girdle (if supposed to be a terrestrial appendage). But the shape of the dusky ring is different from that of the girdle; and its position, concentric with that of Saturn [7 of (43) and *Note*], is maintained by the action of many satellites instead of one; the total action of the several bright rings on particles within being in every case *zero*. But the dusky ring besides is, as it were, *walled in* by the bright rings, which themselves are kept concentric with both the planet and the dusky ring.

Of the Inclination of the Planes of the Orbits of the Planets and Satellites to the Equators of their respective Primaries; and the relative positions of their Perihelia and Nodes.

(99) In a Memoir on the Secular Variations of the Elements of the Orbits of Eight Principal Planets, its author, Mr. John N. Stockwell, M.A., has given us the maximum and minimum inclinations of the planes of those orbits to the invariable plane of the solar system.[1]

From these and the inclination, 7°15′, of the plane of the solar equator to the plane of the ecliptic of 1850, as ascertained by Mr. Carrington,[2] we obtain the following approximate inclinations of the planes of the orbits to the plane of the sun's equator; carrying the reference back to that ancient state of things in which the nodes (of the same name), of the sun's equator and those of the planets' orbits in the invariable plane, respectively *coincided*.

INCLINATION OF ORBIT TO SUN'S EQUATOR.

With . . .	Minimum Inclination to Inv. Plane.	Mean Inclination to Inv. Plane.	Maximum Inclination to Inv. Plane.
MERCURY	0°56′	1°18′	3°31′
VENUS	5 40	4 58	2 24
EARTH	5 40	4 37	2 34
MARS	5 40	2 42	0 16
JUPITER	5 36	5 28	5 11
SATURN	4 53	4 46	4 39
URANUS	4 45	5 9	4 33
NEPTUNE	5 6	4 59	4 53

[1] *Smithsonian Contributions to Knowledge*, vol. xviii, p. 169 of the Memoir in question.
[2] As quoted in Sir J. Herschel's *Outlines of Astronomy* (11th edition), (392).

It will be observed that when the planes of the orbits most nearly coincide with the invariable plane, they yet make an angle of nearly 5° with the plane of the sun's equator, except in the instance of Mercury, in which the inclination is scarcely 1°; while the Earth and Venus, under the variety of circumstances here indicated, still, as it were, assert their *character as half-planets*, by preserving among themselves always nearly the same inclination.[1]

In view of our hypothesis all along kept in view, the question would here seem to be a pertinent one—Why so great an average deviation in the planes of the planetary orbits from the plane of the sun's equator?

The answer to this may, perhaps, be found in what has heretofore been insisted on; viz. the acquisition of material in the nebulous state from *extra-equatorial* portions of the sun's atmosphere; it being added withal that such an acquisition would not take place from both the northern and southern half-spheroids *at the same time*.[2]

The extra-equatorial acquisition, (37), of more dense material being thus mainly from one side, *that* has, it would seem, tended to produce an average deviation in the plane of the resulting orbit.[3] In that aspect of the matter, and, in view also of the *Ancient State* contemplated in (44) and in Table (F), it may not be entirely without significance that the color of Neptune is a pure white, while that of Uranus is inclined to yellow, and that of Saturn, the other component [as in Table (F)] is decidedly so. But Jupiter is, again, white, while Mars is ruddy, and the Asteroids are—Juno of a pale yellow color, and the others reddish.[4]

Then, again alternately, the half-planet Venus, and also our satellite are both white; while Mercury is nearly of a rose color.[5] In the case here supposed, it is

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[1] With M. Sporer's value of the inclination of the sun's equator, the numbers in column 2*d* will be diminished 18′.

[2] An examination of Mr. Trowbridge's paper, already referred to [*Notes* to (38) and (57) respectively], shows that he has wrought with the same idea in view; though he has applied it to the change in the solar axis of rotation.

[3] Unless, with Mr. Trowbridge, we say that "the invariable plane of the solar system must" (also) "be the invariable plane" for "the primitive solar spheroid, and that it must have coincided approximately with the plane of the sun's equator;" and so he compares the inclination of "the invariable plane" to the ecliptic with that of the orbit of Neptune, with which it nearly agrees. In such a case, with the average existing inclination of the plane of the sun's equator to those of the planetary orbits; it would seem that the sun's equator has itself changed its position; the vicissitudes being similar to those, (68), which, according to M. Laplace, the earth in its forming state seems to have undergone.

But it should here be borne in mind that the invariable plane has its position ascertained by a reference to the conditions of material as *now* accumulated into planets with well-determined orbits; and so the invariable plane thus conditioned may very possibly be not coincident with "the invariable plane of the *primitive* solar spheroid."

[4] *Le Ciel*, par Amédée Guillemin, 4ième Edit. pp. 283 and 284.

[5] Are the white planets, then, in part derived from the one half-spheroid, and the planets of another color from the other? and is the half-spheroid, which furnished the white series, the *northern* one? (?)

For, as respects the existing state of comparative activity in the two hemispheres of the sun, as indicated by the appearance of the solar spots, "a very material difference in their frequency and magnitude subsists in its northern and southern hemisphere; those on the northern preponderating besides manifest that what would be the *ascending* node of the planetary orbit when, in such a case, the acquisition was from the one half-spheroid, would be the *descending* node in the instance of the other.

And with respect to the matter here brought into question, as well as in other aspects, though without deciding that they have any significant connexion; we may consider some of the relations developed by Mr. Stockwell, and exhibited in his *Memoir;* such as—

"The *mean motion of Jupiter's node* on the invariable plane *is exactly equal to that of Saturn, and the mean longitudes of those nodes differ by exactly* 180°."

The latter portion of that description may have some interest in this connexion.

Mr. Stockwell states, withal, that "The mean angular distance between the perihelia of Jupiter and Uranus is exactly 180°."

These and other relations connected with them, are shown by Mr. Stockwell to be eminently harmonious and conservative; and then, after stating that he had prepared separate solutions corresponding to several increments of the Earth's assumed mass; and that a comparison of the values which the different solutions give for the superior eccentricity of the Earth's orbit "has suggested the inquiry whether there may not be some unknown physical relation between the masses and mean distances of the different planets."[1]

After having withal arrived at the conclusion that "a system of bodies moving in very eccentric orbits is" . . . . "one of manifest instability;" he says, "and if it can also be shown that a system of bodies moving in circular orbits is one of unstable equilibrium, it would seem that between the two supposed conditions, a system might exist which should possess a greater degree of stability than either," and then indicates a superlatively grand problem, viz., that "The idea is thus suggested of the existence of a system of bodies in which the masses of the different bodies are so adjusted to their mean distances as to insure to the system a greater degree of permanence than would be possible by any other distribution of masses." He adds: "The mathematical expression of a criterion for such distribution of masses has not yet been fully developed; and the preceding illustrations have been introduced here, more for the purpose of calling the attention of mathematicians and astronomers to this interesting problem than for any certain light we have yet been able to obtain in regard to the solution."[2]

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in both respects" [Sir J. Herschel's *Outlines*, etc., (393)]. See, also, the enumeration and classification of solar spots, founded upon Mr. Carrington's observations, as reported by M. Faye (*Comptes Rendus*, tome lxxvi, p. 393).

The white planets Jupiter and Venus seem to show in their atmospheres, *now*, traces of great activity, even such as ould be consistent with a high temperature. As respects Jupiter, see again *Note* 2 to (69).

[1] See pp. xiv, xvi, and xvii of the Introduction to the *Memoir*, respectively.

As to the existence of such a relation and also as to its connexion with the times of rotation of the several planets—see, again, *last Note* to (44); also *Article* (109), and *Consistency* 61*st* of the *Summation* in (110).

[2] See pp xiv, xvi, and xviii of the Introduction to the *Memoir*.

(100) In the *satellite systems* we find the orbit of the outermost satellite of *Saturn* making an angle of about 14° with the plane of his equator and that of the rings, this angle being about one-half of that which the latter makes with Saturn's orbit, while the orbits of the other satellites are nearly in the plane of rings and the equator.

Then the orbit of *our own moon* has a mean inclination of something less than 5° 9′ to the *orbit* of the Earth; while the variable inclination to the *Earth's equator* is *more than four times as great;* as though the moon in the nebulous state had been "abandoned" in the form of a spheroidal shell *before* the axis of the earth, (68), was *established;* and so with Saturn's outer satellite, under it may be even more disturbing circumstances, (43); while the orbits of the inner satellites and the rings of Saturn, having a *later history*, nearly coincide with the plane of his equator, the same being very nearly the case with the satellites of *Jupiter;* the outer one, notwithstanding, justifying its character as shown in Table (D) in (20), by exhibiting an inclination greater than that of either of the other three.

The orbits of the satellites of *Uranus* are nearly perpendicular to the plane of his orbit; and so that their motions are even retrograde; while the equator of the planet [3 of (43)], inclined at an angle of about $79\frac{1}{3}$°, has its rotation direct; all exhibiting, as it would seem, the effect of the great transference of material to Saturn, described in (43).

And although, at present [see 3 of (43)], the equator is inclined to the orbits of the satellites at an angle of about 60°; yet, if it be indeed allowable to refer the situation of all these to that *very* ancient time when the *ascending* node of the equator on the planet's orbit nearly coincided with the *descending* nodes of the orbits of the satellites, then all would be found approximating to a coincidence in the *same plane*, the several inclinations of *all of them* to the plane of the planet's orbit being now near to 79°; but the *direction of rotation* of the planet the *reverse* of that of the *revolutions* of the satellites.

It might almost seem then, as if, in the great *transference of material* to the ancient Saturn here again spoken of, *the rotation of the outer, and mostly rarer, portions of the mass had been most affected; so that, in the satellite-formation, the resultant rotation became even retrograde, while the condensing planet conformed to the usual result of a direct rotation; though (in what was apologetically characterized as the tilting up of this whole system) all were constrained to revolve in planes nearly at right angles to the planet's orbit*, and all nearly in the *same* plane.

The satellite of *Neptune* revolves in an orbit having a large inclination to the plane of the planet's orbit, and the motion is retrograde; but whether that also marks the direction of the rotation of the planet's equator, does not yet appear; nor *which* direction, therefore (that of revolution, or that of rotation), might be regarded as having been established before the other.

The Minor System.

(101) After the separation of the great mass of Jupiter, the "abandonment of the solar atmosphere would seem to have again occurred more exclusively in the region of the solar equator; and thus the Asteroid-mass and Mars appear to have been separated; to be succeeded in order, and with variety of constitution, by the Earth, Venus, and Mercury.

And so it would appear, on a smaller scale (*within more restricted limits* for the balancing of the centripetal and centrifugal forces), was constituted *that minor system*, which, *in fact*, resembles the whole great solar system, in the features and mode of constitution already traced in changes on the larger scale. A system, viz., in which the Asteroids and Mars, as far as may be, have the places respectively of Neptune and Uranus on the greater scale, and the Earth and Venus those of Saturn and Jupiter [the Earth, (39), greater than Venus, from the accession, from regions of the sun's atmosphere other than equatorial]. After these Mercury [and possibly an interior planet], to have the place analogous to that of all the small planets (not Asteroids) in the great solar system.

Resemblances and Differences between Saturn and the Earth.

(102) It may not be without some interest to exhibit in connexion the resemblances and differences between Saturn and the Earth—the Saturn of this Minor System. These are:—

1*st.* In ancient times, an unusual oblateness of form, evinced [(43) and (96)] in the case of both planets by the great distances of their satellites; the outer satellite of Saturn, and also our own moon, being each at the distance of more than 60 radii of its own primary.

2*d.* Saturn and the Earth have each an abnormal density; that of Saturn being *too low*, it would seem, because of the absorption, (43), of the rare material, which would otherwise have constituted the half-planet interior to Uranus; but the Earth's density, (39), being made abnormally *great* by the absorption of an extra-equatorial portion of the sun's nebulous atmosphere.

3*d.* Each of these planets exceeds the other planets in the same region of the solar system with itself, in number of satellites. This is true, though the Earth has but one; but that is the only one in the Minor System.

4*th.* Saturn is surrounded by two systems of bright rings and a dusky ring; and the Earth [if we admit the existence of the Zodiacal Girdle, (78)] is surrounded by something analogous to the dusky ring of the other planet; though they differ from one another to some extent, both in form and position; and the one is preserved because the planet has *many* satellites, the other because its planet has but *one* such accompaniment. [See, again, 7 of (43), and (79) to (83) inclusive.]

5*th.* The Earth [2 of (39)] seems to have been instrumental in producing the great inclination of the equator of its interior half-planet Venus, and Saturn [3 of (43)] as efficient in producing a similar effect upon the half-planet exterior to itself, viz., Uranus.

(103) The analogies to the great planetary system, presented by the satellite systems, have been discussed, in another connexion and aspect, in (58) and (59).

Possible Succession of Changes, in the Progress of the Division, Recombination, and Final Separation of the Great Masses of the Solar System.

(104) In the *Ancient State* contemplated in (44) and in Table (F) in (45), the relation of masses and distances was, it would seem, very nearly the same with that of the existing masses and distances of Jupiter and of Saturn as exhibited in (53); viz., that in which $m(r)^2$ of the one $= m'(r')^2$ of the other.

For—retaining the symbols in (44)—[the second mass in order in Table (F) in (45), including in itself the masses of Uranus and Saturn, while the first mass is that of Neptune]; we have in the instance of the second mass

$$m'(r')^2 \text{ of } [(\text{U})\hat{♄}] = 0.05090861;$$

and for the first,

$$mr^2♆ = 0.0458582;$$

the ratio of the two being

$$\frac{m'(r')^2 \text{ of } [(\text{U})\hat{♄}]}{mr^2♆} = 1.1101;$$

which, since mr^2, thus, nearly $= m'(r')^2$, gives

$$\frac{m}{m'} = \frac{(r')^2}{r^2};$$

or the masses nearly in the inverse ratio of the squares of the distances.

Next, comparing the mass and distance of Neptune—also those of the whole-planet (U), made up of *Uranus* and its (now) missing *interior half-planet* ♅*i*—and then, the mass and distance of $\hat{♄}$, that is of Saturn in its *ancient* state before, (43), ♅*i* was absorbed [the mass of ♅*i* being deduced as in (41)]; we shall obtain for the several ratios of the distances and the *inverse ratio* of the $\frac{3}{4}$ *powers of the masses*, respectively:

$$\frac{\text{dist. of } ♆}{\text{dist. of (U)}} = 1.7770; \qquad \frac{(m')^{\frac{3}{4}} \text{ of (U)}}{m^{\frac{3}{4}} \text{ of } ♆} = 1.7687.$$

$$\frac{\text{dist. of (U)}}{\text{dist. of } \hat{♄}} = 1.7908; \qquad \frac{(m'')^{\frac{3}{4}} \text{ of } \hat{♄}}{(m')^{\frac{3}{4}} \text{ of (U)}} = 1.7125.[1]$$

And then, with respect to the existing *Saturn* and *Jupiter*, we have, as in (53),

$$\left.\begin{matrix} m'''(r''')^2 \text{ of } ♄ = 0.025985 \\ m^{\text{iv}}(r^{\text{iv}})^2 \text{ of } ♃ = 0.025832 \end{matrix}\right\};$$

a coincidence more perfect than that found in the instance of the two outer great masses, in which the data to be used are less accurately ascertained. Then here,

[1] It is at least curious that Saturn deprived of the mass of ♅*i* (*i. e.* the *ancient* Saturn) must here once more enter into the computation instead of the existing planet.

of course, again, the masses are very nearly in the inverse ratio of the squares of the distances.[1]

The history of the changes would then seem to be:—

1. That the division of the great masses, *Neptune* and that composed of *Uranus* and *Saturn*, *first* occurred; in accordance with a proportion of masses and powers of distances, such as *Jupiter* and *Saturn* now present.

2. That *afterward* occurred the division of the compound *Uranus-Saturn mass* into the masses of the whole-planet (U) and the *ancient Saturn* ♄̂.

3. That *subsequently to that*, the material of the whole-planet (U) was rent [the outer half-planet Uranus possibly falling inward somewhat, to justify the new equilibrium of forces];[2] and, (43), the material of the *inner* half-planet ♅*i* passing over and combining with the ancient *Saturn* ♄̂, to form the mass in part of the existing *Saturn* ♄.

4. That, *before the planetary character of Saturn was complete*, the mass [derived in great part, it may be, from the atmosphere of the other half-spheroid of the sun],[3] which was to form *Jupiter*, became temporarily *blended* with the *Saturn-mass;* to be in the end separated in accordance with the same law of arrangement of masses and distances which, at first, was prevalent in the instance of the great masses, *Neptune* and the combination of *Saturn-Uranus*.[4]

(105) It will be observed, that the preservation of the continued equality of ratios here in question, depends upon the introduction, in one connexion, of the *ancient* Saturn, that is Saturn deprived of the very mass acquired by the process which brought about the disappearance of the mass of the *interior* half-planet ♅*i*, as the same is described in (43) and (44), and the proof of which is manifold; while the preservation of an equality of ratios in another connexion is as truly dependent on the introduction of the *whole* mass of the *existing* Saturn.

Such are the facts; and no explanation appears, except that of the process which bore away the mass of the *interior* half-planet, the reality of which seems thus, again, to be confirmed; to which, possibly, may be added the mode of subsequent combination and separation suggested in (104).

Then we have the negative evidence, that the supposititious separation of the great masses in question in any other way, is not found to yield at all similar proportions.

Kirkwood's Analogy.

(106) This Prof. Daniel Kirkwood communicated to the *American Association* for the Advancement of Science in 1849.[5]

He first speaks of what, (39), we have described as the neutral point.

Thus, as Prof. Kirkwood states it (and the same is applied to the Earth in our

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[1] The *existing* and *not the ancient* Saturn appearing here.

[2] See 5 of (43).

[3] See (99) and *Note*.

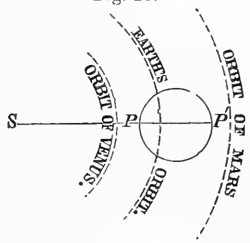
[4] In this connexion—see, again, *Articles* (56) and (57).

[5] *Proceedings*, p. 208.

figure): "Let P be the point of equal attraction between any planet and the next interior, the two being in conjunction; P' that between the same and the one next exterior.

"Let also $D =$ the sum of the distances of the points PP' from the orbit of the planet" (the whole PP' in the figure); "which I shall call the diameter of the sphere of the planet's attraction.

Fig. 20.



"$D' =$ the diameter of any other planet's sphere of attraction found in like manner.

"$n =$ the number of sidereal rotations performed by the former during one sidereal revolution round the sun.

"n', the number performed by the latter; then it will be found that

$$n^2 : n'^2 :: D^3 : D'^3; \text{ or } n = n'\left(\frac{D}{D'}\right)^{\frac{3}{2}}"$$

From this we shall have, alternately,

$$n^2 : D^3 :: n'^2 : D'^3; \; i.e.$$

$$\frac{n^2}{D^3} = \frac{n'^2}{D'^3} = a \; constant.$$

The coincidence with fact is very close in the several instances of *Venus*, the *Earth*, and *Saturn*.

The proportion thus exhibited is *analogous* to Kepler's 3d Law; that the squares of the periodic-times of the planets are as the cubes of their mean distances from the sun; and it is hence called *Kirkwood's Analogy*.

An "Examination" of this by the late Sears C. Walker is also given in the *Proceedings of the American Association* for 1849 (pp. 213 to 219 inclusive), and its consistency with *Laplace's Nebular Hypothesis* made the subject of comment.

Failure of the Analogy in the Case of Uranus.

(107) Conceding that the time of rotation of Uranus [3 of (43)], as found by W. Buffam, Esq., viz. 12 hours ±, is a first approximation to the truth; Kirkwood's Analogy will be found to fail in the case of Uranus.

For if we apply Mr. Walker's formula, in which θ represents the time of rotation (a mean solar day of the Earth being $= 1$); a, a planet's mean distance from the sun; and D, the diameter of the (Kirkwood) sphere of the planet's attraction; then,

$$\theta = \left(\frac{a}{2D}\right)^{\frac{3}{2}};$$

and we shall find, with the values of masses and distances as given in our Table (A), in (3), that, in the instance of Uranus,

$$\theta = 1^d.30380+ = 31.291 \; hours.$$

instead of nearly 12 hours; the result of the observation already quoted.

But even this negative result seems almost like *a shadowing forth of the* catastrophe, which happened when the material of the half-planet interior to *Uranus* [(43) etc.] passed over to Saturn; which has so often asserted itself in our preceding investigations.

With the half-planet restored to its place [its distance as in Table (B), in (14), and its mass, as in (41)], we shall have, by a comparison of Uranus, with that and with Neptune, and the application of the formula,

$$\theta = 31.883 \textit{ hours};$$

agreeing nearly with the former result.[1]

But if we combine Uranus and the restored interior half-planet, in a whole-planet arrangement at the whole-planet limit (U) in Table (B), in (14); we shall have (by a comparison with Neptune and the *ancient* Saturn ♄, and the application of the formula) for the time of rotation of whole-planet (U),

$$\theta = 16.451 \textit{ hours}.$$

Was there, then, in the collection of material adapted to form a whole-planet at limit (U), the origination of a moment of rotation of the remaining half-planet Uranus, which was not all destroyed when the interior half-planet mass passed over to Saturn??

All this is not for a moment to be insisted upon; but there seems to be a possibility that the failure of the *Analogy* in question, may, in this case, be due to these special conditions here also appearing as if in question; as they have been heretofore.

Approximate Result in the Case of Mars.

(108) In the application to the case of Mars, we may make use of the relative asteroid-mass as made out in (46); viz., 0.58929 of the mass of Mars.

Then, as in (60) the indications were in favor of a half-planet arrangement of the asteroid-mass, we have—distributing the mass [*Note* to (51)] in accordance with *that*—the *interior* half-asteroid mass = 0.33745 of the mass of Mars; and the distances withal [in accordance with the *Laws* found in (10)] being derived from those in the region in question (viz., *Saturn* to *Mars* inclusive), as exhibited in (12).

From these and the masses, on the one side, and the mass and distance of the Earth on the other, we may then obtain D, the diameter of Mars's sphere of attraction; and then, Mr. Walker's formula,

$$\theta = \left(\frac{a}{2D}\right)^{\frac{3}{2}},$$

will give for Mars's time of rotation 27*h*. 34*m*.8.[2] Observation gives 24*h*. 37*m*.4. The coincidence is as close as could be expected; the masses being more or less uncertain, and the formula confessedly "approximate."

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[1] For the interior half-planet ♁*i*, if it ever had the planetary form and state, the time of rotation would be 33*h*.982.

[2] Deriving the distances from the more extended series in the column of Law in Table (B), in (14), we have 27*h*.46*m*.3, for the time of rotation.

[With a *whole-planet* arrangement of the asteroid-mass, the resulting time of rotation of Mars would be 19*h*.968; the half-planet arrangement of (60), thus appearing again as preferable.]

So that, in the case of the asteroids, although the component material has been dispersed; yet, as a half-planet portion has not passed over and been absorbed by an interior planet, the determining conditions of the next interior planet's rotation have, it would seem, not been entirely disturbed.

Of "Bode's Law," and the reasons for its success in the approximate determination of the respective distances of Uranus and several other planets, and also for its failure to determine the distance either of Saturn or that of Neptune.

(109) The most simple statement of the (so-called) Law of Bode (or of Titius) is that of Sir J. Herschel; viz.: . . . . "The interval between the orbits of the Earth and Mercury is nearly twice that between those of Venus and Mercury; that between the orbits of Mars and Mercury nearly twice that between the Earth and Mercury; and so on."[1]

Now, (13), the mean value of our whole-planet ratio is (stated here approximately) 1.8. But, if we subtract Mercury's distance from each of two successive terms in the whole-planet series, to obtain the *intervals* between orbits here in question, the ratio of the remaining intervals will exceed the ratio r of 1.8+, since the smaller of the two distances compared will be *more than proportionally* diminished by such a subtraction; and the value of greater divided by the less (*i. e.* here of the ratio) will be *increased*. Thus:—

$$\frac{\textit{Asteroid limit (A)}}{\textit{Mars' distance}} = 1.8+$$

But

$$\frac{\text{(A)}\textit{—Mercury's distance}}{\textit{Mars'—Mercury's distance}} = 2+;$$

the ratio being a very little greater than that which "Bode's Law" requires.

The same ratio is, even, very well justified in the instance of the Earth compared with Venus, and Mars with the Earth; though [as exhibited in Table (B) in (14)], while the ratio of the distance of Venus to that of Mercury is (incidentally) the whole-planet ratio r, that of the Earth's distance to that of Venus is only $r^{\frac{1}{2}}$, and even the ratio of Mars' distance to that of the Earth is only $r^{\frac{3}{4}}$. But the increase of the measuring unit in the comparison, as we proceed, and the subtraction of Mercury's distance in every instance (one being more effective in the one case, and the other, in the other) together make the one interval near to the *double* of the other.

The ratio, as has been already stated, nearly accurate for the Asteroid-*interval* in the middle of the whole-planet series. But, when we pass beyond that to the Jupiter and Saturn terms, successively, the subtraction of only Mercury's distance, though just about sufficient for the justification of the Jupiter interval, gives a result *too small* in the instance of that of Saturn.

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[1] *Outlines of Astronomy* (11th Edition), (505)

Thus—making use of the veritable distances as stated in Table (B), expressed approximately, we shall find:—

$$\frac{\textit{Jupiter's distance} - \textit{Mercury's distance}}{\textit{Asteroid distance} - \textit{Mercury's distance}} = \frac{4.81}{2.43} = \frac{1.98}{1}.$$

But

$$\frac{\textit{Saturn's distance} - \textit{Mercury's distance}}{\textit{Jupiter's distance} - \textit{Mercury's distance}} = \frac{9.15}{4.81} = \frac{1.90}{1}.[1]$$

The same process would fail notoriously in the case of the next whole-planet (U), were that yet to be found. But Uranus being an *exterior* half-planet, the ratio of its distance to that of Saturn is $r^{\frac{5}{4}}$ instead of r; and so the double interval for Uranus is tolerably well preserved in comparison with that of Saturn.

But as the ratio of Neptune's distance to that of the *exterior* half-planet Uranus (though on a larger scale than that immediately preceding, in the order here pursued) is only $r^{\frac{3}{4}}$, the subtraction of only Mercury's distance from each of the others, leaves the interval for the greater in a ratio to that for the less of not more than $\frac{1.52+}{1}$; and so, the representative number when it ought to be 301 appears in the series of numbers illustrating the "law" as 388.

The latest application of "Bode's Law" would seem to be that of Maxwell Hall, Esq.; an abstract of whose communication is given in the *Monthly Notices of the Royal Astronomical Society*, vol. XXXIV, No. 7 (May, 1874), under the title of "*The Solar and Planetary Systems.*"

The author states "Bode's Law" as follows: "In the solar and planetary systems the mean distances of the planets do not greatly differ in value from the terms of the series:

$$4\lambda,\ 7\lambda,\ 10\lambda,\ 16\lambda,\ 28\lambda,\ 52\lambda,\ 100\lambda,\ 196\lambda,\ 388\lambda, \text{ etc.},$$

where λ has different values in different systems. But there may be more than one, or there may be no planet or satellite near any of the above theoretical distances."[2] And he then proceeds to determine λ in miles for the planetary system, and for the Jovian, Saturnian, and Uranian satellite-systems respectively.

"Some of the numerical coincidences are very close; thus in the Uranian system, taking the distances to be 7λ, 10λ, 16λ, and 28λ, the first three satellites give $\lambda = 17600$, and 17100, and 17600 miles respectively (but the fourth satellite gives $\lambda = 13400$ miles)."[3]

"He then states a second proposition: 'Twice the unit of length in any system

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[1] Accordingly in the statement of the "Law" as not unfrequently made, which represents the successive distances by the numbers 4, $4+1\times3$, $4+2\times3$, $4+2^2\times3$, etc., Saturn's representative number exhibits a conspicuous failure. For instead of the true number 95, the distance is represented by 100; the veritable distance—as has, in effect, been stated—being too *small* to conform to "Bode's Law."

[The representative numbers 4, 7, 10, etc., appear in Mr. Hall's series, quoted in this *Article.*]

[2] Especially in this connexion, see *Note* to (7).

[3] What has already been stated in the way of exposition of the application of this (so-called) law in the planetary system, and an inspection of our Table (E) in (21), with its *two* ratios in accordance with veritable laws, will at once show the reason for this discrepancy. See also *Note* to (7).

is approximately equal to that distance which corresponds to the period of rotation of the central body of that system,' or say"

$$\lambda = 1580 M^{\frac{1}{3}} P^{\frac{2}{3}},$$

where M = mass of central body, in terms of the mass of the earth, P the period of the axial rotation in hours, λ in miles as before.

It thus appears that dividing the value of λ for any system by the value of $M^{\frac{1}{3}}P^{\frac{2}{3}}$ for the central body of the system, the quotient should be 1580. For the Solar, Jovian, and Saturnian the quotients are 1790, 1340, 1720, mean 1620. For the Earth $\lambda = 13100$; so that regarding the Moon as a fourth satellite (the three interior ones missing) the theoretical distance is 210,000 miles.[1]

The paper concludes with some considerations as to M. Lescarbault's planet *Vulcan.*

[Sir J. Herschel, in a *Note* to Article (505) of the 11th edition of his *Outlines of Astronomy*, makes the following statement:—

"Another law has been proposed (in a letter to the writer, dated March 1, 1869), by Mr. J. Jones, of Brynhyfryd, Wrexham. If the planets' mean distances from the sun be arranged in the following orders: Mercury, Venus, Jupiter, Saturn; the Earth, Mars, Uranus, Neptune; the product of the means in each group is nearly equal to the product of the extremes.

$\frac{Venus \times Jupiter}{Mercury \times Saturn} = \frac{Earth \times Neptune}{Mars \times Uranus} = 1.$ In point of fact the first fraction $= 1.02$, and the last $= \frac{1}{1.03}$, so that the approach to verification of the law is really very near."

Now the first fraction

$$\frac{Venus \times Jupiter}{Mercury \times Saturn},$$

may be resolved into

$$\frac{Venus}{Mercury} \times \frac{Jupiter}{Saturn}.$$

An inspection of the ratios exhibited in our Table (B), in (14), will show that the first of these component fractions expresses a whole planet ratio r; and the second component the *inversion* of that, $\frac{1}{r}$. So that the value of the whole expression

$\frac{Venus \times Jupiter}{Mercury \times Saturn}$, resolved into its two components here specified $= \frac{r}{1} \times \frac{1}{r} = 1.$

Then the other fraction, $\frac{Earth \times Neptune}{Mars \times Uranus}$, may be resolved into $\frac{Earth}{Mars} \times \frac{Neptune}{Uranus}$;

[1] The error is here nearly $\frac{1}{8}$ of the quantity to be determined; whereas in our Tables (B) to (E), and even (F), inclusive, the greatest difference between veritable Law and Fact is that in the instance of Uranus, in which the discrepancy is not $\frac{1}{60}$ of the quantity to be measured, and even for that [5 of (43)] a special reason is assigned. In almost every other instance the discrepancy is far less than that; indeed, all but incomparably small. The greater differences specified in Mr. Hall's paper are such as are characteristic of "Bode's Law."

and, from Table (B) again, we learn that the first of these component fractions expresses the *inversion* of an *exterior* half-planet ratio $\frac{1}{r^{\frac{3}{4}}}$, and that the second component expresses the *exterior* half-planet ratio $r^{\frac{3}{4}}$ itself. So we have the value of $\frac{Earth \times Neptune}{Mars \times Uranus}$ resolved into $\frac{1}{r^{\frac{3}{4}}} \times \frac{r^{\frac{3}{4}}}{1} =$, again, to 1.

The small differences from 1 (in the one way and the other) in the actual values already quoted, are due to the slight increase in the value of the ratio r (and its derivatives); as exhibited in our *Article* (13).

For the arrangement, otherwise, into the two "orders" here first quoted, there is no very manifest reason; and so it would seem to be merely artificial.][1]

Summation of Coincidences.

(110) In the summation of coincidences and the comparison of the same with theoretical deductions, those will be first considered which have at various times been indicated by commentators on the nebular hypothesis of Laplace, beginning with those which M. Laplace has himself specified, and of which his hypothesis was especially designed to furnish the explanation.

1*st.* The motion of the planets in the same circular direction, and nearly in the same plane.

2*d.* The motions of the satellites, with few exceptions, in the same direction with those of the planets.

3*d.* The rotation of these different bodies and of the sun, also in that same circular direction, and in planes not much inclined to one another.

4*th.* The small eccentricity of the orbits of the planets.

5*th.* The hypothesis accounts for the existence of comets in the solar system, as well as the variety of inclination of their orbits; also for the very great eccentricity, and the change in the form of the same. *See* (34), and Note VII of the *Système du Monde.*

[M. Laplace's expansion and explanation of these five coincidences is exhibited in our *Articles* (24) to (34) inclusive.]

6*th.* The hypothesis accounts for Saturn's rings, (28), and that they also revolve in the same circular direction with the planets and their satellites.

7*th* Asteroids as well as ordinary planets are provided for; as is explained in (29).

8*th.* The great heat of the sun and, possibly also, of some of the existing planets, are facts in place.

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[1] Though it is also *curious* that we have, in both the instances in question, the product of the expressions of *white* planet distances, divided by that of those which are not of that description; the reason for the classification of the planets in that respect even, having (99), at least a quasi-relation to the *Ancient State* of the system exhibited in Table (F), in (45); which is again related (in the connexion in question) to the *more recent* arrangements exhibited in Table (B), in (14).

[See in this connexion (69) and its *Note*[2]. The seeming perturbations of the atmospheres of *Venus* and *Mercury*, and even those of the atmosphere of Jupiter, are also consistent with the supposition of a high temperature.]

9*th*. The very existence of a gaseous or nebulous envelope of the sun, as well as of the atmospheres to so many of the planets, is itself consistent with the hypothesis in question. [Confirmed by recent investigations with the spectroscope].

10*th*. Another evidence of previous high temperature, as the hypothesis would require, is found in the internal heat of the Earth, even now.

11*th*. Similar is the evidence of geological facts; many of which require the existence of a very high temperature in ancient times.

12*th*. The evidences of the effects of a former high temperature in the moon, supplement the evidence of geology.

13*th*. The hypothesis accounts for the lack of an atmosphere to the moon; in the explanation quoted in (69).

14*th*. The hypothesis, in like manner, accounts for the absence of secondary satellites (satellites of satellites); and also shows why there are no secondary rings; in the explanation quoted in (68).

15*th*. The hypothesis accounts for the arrangement by which the moon and (it may be) the other satellites, present the same faces severally to their respective primaries; the explanation being that quoted in (68).

16*th*. The hypothesis accounts for the *spheroidal form* of the planets; they having been supposed to have been, in older times, in a gaseous or in a liquid state, in which they took a form suited to the rotation of their gravitating material. The researches of Prof. H. Hennesey "have shown that the ultimate ellipticity" in consequence of the accumulation of water, etc., in the equatorial regions, and the gradual abrasion of polar continents in case the Earth were *at first* a *solid* sphere, would be $\frac{1}{404}$, instead of "that found by actual measurement;"[1] viz, a little greater than $\frac{1}{300}$. The *Earth* could not then have been solid at first. The oblateness of *Mars* seems to be too great; but it is supposed that the liquid surface of some planets was solidified before they could assume the figure appertaining to their rotation.

17*th*. The molecular constitution and whole composition of *aerolites;* so like, and yet in some respects so different from, what we find on the earth, is consistent with a common origin of all from the ancient solar atmosphere. [The spectrum-analysis has, within a recent period, afforded similar testimony, and to a greatly enlarged extent].

[The existence of the Zodiacal Light is also consistent with the hypothesis in question. This consistency is not numbered here; as it must appear in another connexion.]

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[1] As stated by Prof. Kirkwood.—*American Journal of Science and the Arts*, for Sept. 1860, p. 167.

18*th*. We have Kirkwood's Analogy; already discussed [(106) to (108) inclusive].

19*th*. It is consistent with Laplace's Nebular Hypothesis that the large planets should be furnished with satellites, while the small planets are not so attended, with the bare exception of the Earth; which, even, has but one, unless some small bodies, not wholly unlike aerolites, are to be added to the number. The "abandonment" of nebulous rings, etc., could more readily proceed and be carried to the result of condensed rings, or of satellites, in the case of the larger bodies.

20*th*. The greater density of the smaller planets in comparison with the larger; and the tendency to a law of increase from without inward, in the whole series; as manifested in Table (A) in (3). The decidedly abnormal deviations from this are specially accounted for. [See references in exposition of Consistencies 32*d* and 39*th* respectively.]

21*st*. The Nebular Hypothesis furnishes M. Laplace with an explanation of the exact commensurability of the angular motions, and thus of the periodic times, etc., of Jupiter's satellites; they having "immediately after their formation not moved in a perfect vacuum." The action, in this case, of a resisting medium, itself consistent with his hypothesis, is illustrated by M. Laplace in the way already indicated in (67).

The farther summation of consistencies will have special reference to other phenomena and relations discussed in this paper.

22*d*. In addition to Consistency 21*st*, we have an approximate commensurability of periodic times of some of the *satellites* of Saturn, and also of those of *the four outer planets* of the *Solar System;* as detailed in (67).

23*d*. The modification of the Laplace Nebular Hypothesis, (37), providing for spheroidal shells, provides, also, for a conservative force for the holding together of great masses; and so prevents the indefinite multiplication of asteroids in all regions of the system.

24*th*. As if in consistency with a common origin and mode of development, we have the three laws of distances of planets and half-planets, as stated in (10); and the arrangement in accordance with these, in Table (B), in (14).

25*th*. We have also the prevalence of similar laws in the *System of Saturn;* the arrangement in accordance with which is exhibited in Table (C) in (18. Then, moreover, we have the arrangement in so far as a more restricted system would admit (viz., in accordance with two such laws) in the *System of Jupiter;* as shown in Table (D) in (20); and in the approximate arrangement of the *System of Uranus* in Table (E) in (21).

26*th*. The gradual and systematic increase or diminution, as the case may be, of the leading ratio, and its powers in these several systems, would seem again to indicate that the arrangement had a *physical* origin, not unlike that under discussion. [See the Summing up of these relations in (22).]

27*th*. The consistency of the results obtained in so many connexions by a reference of positions to the *centres of gyration* of the revolving masses, together with other facts in the same connexion, all but *insist upon and require* that the masses in question must have turned around *together*. [See especially the application of this in (39) and (41); also (44) with Table (F) in (45); and (53), (54), (56), and (104).]

28*th*. The conditions involved in connexion with what is stated in Consistency 27*th*, also show that the law or laws of apportionment of the masses are not independent of the laws of the distances; but that they are *functions*, one sort of the other. [See, again, last *Note* to (44); also quotations in (99), and *its last Note but one*.]

29*th*. It is in perfect agreement with Consistency 26*th* and 27*th*, if not also with Consistency 28*th*, that the *rings* of Saturn referred to their respective *centres of gyration* have, in Table (C), in (18), the places of *satellites*.

30*th*. We have, besides, the commensurability of the periodic times of the two great satellites of Saturn with those due to some of the limits of Table (C) in (18), at which satellites are now missing, as that commensurability is exhibited in (66), and in consequence of which (in view of the Laplace Hypothesis, or of that hypothesis as modified) the existence of satellites may have been prevented there; and thus also possibly may have been occasioned the space between the two systems of Saturn's bright rings; all, as explained in (64).

31*st*. Again we have the commensurability of the periodic time of *Jupiter*, and some of the periodic times due to certain of the *asteroid limits*, and also that of *Mars;* which may have been the means of breaking up former planets or asteroids, as is also explained in (64). With respect to the special relations of the *half-planets*, Earth and Venus—in accordance with the Laplace Nebular Hypothesis, or else with the same modified as in (37), we have:—

32*d*. The abnormal density of the Earth accounted for (a density too great for the Earth's place in the system). [See 1 of (39).]

33*d*. In connexion with that, we have the great inclination of the equator of the other half-planet Venus to the plane of its orbit; apparently accounted for in 2 of (39).

34*th*. We have the approximate agreement of the neutral point (the Kirkwood limit of the Earth's sphere of attraction between the two half-planets on that side) with the *whole-planet* limit for the combination of the two masses; as exhibited in 4 of (39). [The approximation to an agreement also of this last with the centre of gyration of the two half-planets has already been adverted to in the exposition of Consistency 27*th*, and its reference.]

35*th*. The great *oblateness* of the nebulous Earth (with its accumulated dense material) is, (96), recorded in the great distance of the moon, = to full sixty equatorial radii of its primary planet.

36*th*. That the ascertained *density* of the moon should be but 0.55654 of that of the Earth is another fact in place in this discussion, in view of Consistency 35th.

In *consistency with the rest, and in confirmation of our subsidiary hypothesis accounting for the disappearance of the now-missing half-planet, which should be* *found interior to Uranus; viz., that its mass was absorbed by what previously constituted the mass of Saturn*, we have:—

37*th*. That the mutual attractive force of the missing mass and the *then-existing* Saturn was adequate in measure to the effect supposed; as is explained in 1 of (43).

38*th*. That the limit to which the same mutual attraction extended is itself not very far short of the limit (U) at which the *whole-planet* mass would be likely to be rent; as in the Earth-Venus case [4 of (39)]; as is farther explained in 2 of (43).

[The mass of the missing planet is found in (41) by the application of the formula for the centre of gyration; which has its reference in Consistency 27*th*.]

39*th*. The very *inferior density* of Saturn [below that due to his place in the system, and the least in all the series of densities of planets in Table (A) in (3)], is here a special fact in place; so much of the material of the existing Saturn being derived from the region *outside*. [See 4 of (43).]

40*th*. All this would contribute to give the forming nebulous Saturn a *very oblate* figure; the ellipticity being even greater than that of the forming Earth —for the outer satellite Japetus is at the distance of more than sixty-three radii of its primary; and the very faint light of that satellite in certain positions may be accepted as one condition not in itself inconsistent with a low density.

41*st*. All this would permit the formation of *satellites* to begin and advance, some time before that of the rings; and so the *conservative* influence of the satellites be exerted, in those early times, to preserve those rings and keep them concentric with the shrinking planet; and thus make it possible for Saturn to be adorned with those remarkable appendages which make him an *instantia solitaris* in the system. [See explanations and quotations in 7 of (43) and its *Note* 3.]

42*d*. The great mass of the *ancient Saturn* ♄, (notwithstanding its low density), would seem to have been efficient in bringing about the great inclination of the equator of Uranus to the plane of its orbit, as well as to that of the ecliptic, [and also that of the whole Uranian system, specially described in 3 of (43);] the whole so like the effect on the inclination of the equator of Venus, insisted on in Consistency 33*d*. Thus these two phenomena, so like, but which present themselves in regions of the system remote from one another, are found to be referable to the action of not unlike causes.

43*d*. The very considerable inclination of the Saturnian system (equator of the planet, rings, and orbits of satellites)—so unlike in that respect to the system of the other great planet Jupiter—would seem itself to be referable to the same disturbance which so *tilted up* the equator and all the system of Uranus.

44*th*. It is not inconsistent with all this, that on a comparison of the column of Fact with the column of Law in Table (B) in (14), Uranus would almost seem to have *perceptibly* fallen in; and Saturn perhaps have been drawn a little outward. [See 5 and 10 of (43)]. And it may be that Consistency 31*st* is also to be found here [see 9 of (43)].

45*th.* A like effect may be more distinctly traced in the system of *Saturn*, in the instance of the satellite Hyperion, which is just outside of Titan, the Jupiter of the system; as may be made apparent by a comparison of the columns of Fact and of Law in Table (C) in (18); which is withal explained in (66). That *Mars* also seems to have *perceptibly* fallen in by the acquisition of material from the asteroid mass is discussed in (65).

46*th.* The subsidiary hypothesis of the transference of the half-planet mass, is still farther and very remarkably confirmed by the ratios due to the Ancient State exhibited in Table (F) in (45), the Uranus-Saturn ratio of which is *not justified*, unless we also *restore* Saturn to its *ancient state*, by restoring also the missing planet to its legitimate place; and then combine that, the mass of Uranus, and also that of the *ancient* Saturn ♄̂, all at *their* common centre of gyration; and *then* the appropriate ratio in Table (F) *is very scrupulously justified.*[1]

47*th.* The conformity of the ratios of the *Ancient State* is itself a justification of the *mass* of the missing half-planet; that mass being independently determined in conformity to the condition, that the centre of gyration of that half-planet and Uranus should be the same with the whole-planet limit (U) in Table (B) in (14).

This value of the mass is still farther confirmed, in so far as may be, by the curious relations developed in (104); in which the mass of the *ancient* Saturn ♄̂ (Saturn deprived of the mass of the now-missing planet) enters in one connexion, and the mass of the existing Saturn in another.

48*th.* The justification of the ratios of the *Ancient State*, as the same are exhibited in Table (F) in (45), itself demands a special value of the asteroid-mass; and the value thus ascertained, with the data which we have, agrees closely with that signified by M. Le Verrier (in one of his investigations of the subject), as being required by the *perturbations of the planet Mars.* [See explanations and quotations in (47) and *Note.*]

49*th.* The arrangements of the *Ancient State* exhibited in Table (F) in (45), into which combinations of planetary masses alternately enter, justify the position of Mercury in *their own series.* Then withal the aphelion of Mercury's orbit has a whole-planet place in Table (B) in (14), while the perihelion of the same has a half-planet place. The arrangements of both tables thus consistently indicate that Mercury has accumulated in itself the material appropriate for a planet and a half planet, and that its position justifies that.

50*th.* The arrangements now specified, also serve to account for the *great eccentricity* of Mercury's orbit; the planet having absorbed into itself the ring-like or shell-like masses, one due to the whole-planet position at the aphelion of the orbit, and the other to the half-planet position at the perihelion.

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[1] As the annual aberration of the sun, planets, and fixed stars is without explanation, if we do not admit the doctrine of the earth's motion; but the whole explanation is adequate in mode and in measure with that motion first admitted. There is certainly an approximation to a parallelism here.

51st. The distribution of masses which Consistency *50th* would indicate, and the Laws of Distance in (10), together enable us to compute the mass and mean distance of material (possibly planetary) immediately interior to Mercury. And the mass thus indicated seems to be adequate to produce the perturbations of Mercury's orbit to the *extent required by M. Le Verrier.* [See discussion of all in (52)].

52d. With the arrangement of distances of *Jupiter* and *Saturn* either in the column of Law or in the column of Fact, in Table (B), in (14), and with the ascertained value of their masses, we find, (53), the *vis viva* or moment of (simultaneous) rotation of the one very accurately equal to that of the other; so that the masses are inversely as the squares of the radii of gyration; *i. e.* here inversely as the squares of the mean distances from the sun.

There is, at least, a rude approximation to the same, on a large scale, when the masses and distances of Neptune and the next term of the series [U♄̂] in Table (F) in (45) are, in like manner, made the subjects of a proportion in (104).

It may be then that the great divisions of the nebulous solar atmosphere (antecedent perhaps to other planet-forming developments) were made in conformity to the proportion here in question.

But in what seems like the subsequent subdivision of the [U♄̂] mass, in its special comparison with Neptune, the proportion, (104), of *distances inversely* as the $\frac{3}{4}$ *power* of the masses is very accurately justified; in which the whole-planet mass (U) (consisting of the mass of Uranus and that due to its now-missing interior ♅i) enter, as well as the ancient Saturn ♄̂; though, as already intimated in Consistency *47th*, the *existing* Saturn enters in the comparison with Jupiter.

The moments of (simultaneous) rotation of the outer and inner systems of bright rings of Saturn exhibit, (53), an approximation to equality like that of the great outer masses here spoken of.

[Also if the expressions of the respective velocities of the existing ring systems, at their centres of gyration be made to enter, instead of the *2d* powers of the same, we have, (53), with m and m' for the masses, and a and a' for the distances from the centre of the planet

$$\frac{m \times a \text{ of } \textit{inner rings}}{m' \times a' \text{ of } \textit{outer rings}} = 1.0752.$$

Incidental very possibly, but curious.]

53d. From what is stated in Consistency *52d*, it would seem to have been the case, that the large masses of the system, in the series from without inward, increased in a more rapid ratio than the respective distances diminished (in a more rapid ratio, viz., than the inverse ratio of the distances); the increased density of material more than counterbalancing the effect of its diminished quantity.

Accordingly, in (57), with scarcely an exception, we find a continual increase of the masses, from Neptune to Jupiter inclusive; the mass of Jupiter being transcendently the greatest of all.

The like, (58), is true (Hyperion being the exception there) in the system of Saturn; Titan being the Jupiter of the system; as is, (59), the *3d* satellite among the four satellites of Jupiter; while, lastly, the Earth and Venus, (101), are, respectively, the Saturn and the Jupiter of the Minor System of planets; and there are other curious relations, furnishing subjects for comparison, which are detailed in (101) and (102).

54th. It is shown in (16) that the centre of gyration of a thin homogeneous ring is in the circumference of a circle concentric with the edges of the ring, and bisecting its area. Also that R' and r' being the radii of the edges of the ring and C that of the centre of gyration, we shall have

$$C^2 = \tfrac{1}{2}(R'^2 + r'^2).$$

(*a*) The same, in (54), is extended to the case in which the equivalent masses are both thin homogeneous rings, one wholly clasping the other; R' and r' representing the respective radii of the centres of gyration of the two clasping rings, and C that of the common centre of gyration.

(*b*) The common formula for the centre of gyration will, when reduced, give us the same equation, in the case of *any* two *equal* masses, irrespective of the form of either.

Now although the two systems of bright rings of Saturn can scarcely be presumed to be homogeneous, and although they do not seem to be equal in mass, yet, (55), the equation in question is found to be very nearly applicable to them.

[Making use of this *inductively*, as some indication of the ring-like form in revolving masses, (55), we found, that the like equation in the solar system was very nearly justified in the case of the half-planets Earth and Venus; and, (56), that a similar one was nearly realized in the case of Neptune and Uranus; the distances being those in the column of Law, in Table (B) of (14).[1]

These results might seem to be consistent with the supposition that the flowing over of the material of the oblate solar atmosphere had given to the masses in question, at some period of their development, a form not unlike that of *a thick ring;* and yet the same cannot be regarded as decisive; and in the case of Uranus and Neptune, there is the other explanation found in (*b*) of this Consistency; for the masses of Neptune and Uranus are nearly *equal.*]

In another and different instance we have a closer agreement.

The centre of gyration, (19), of the whole system of Saturn's Bright Rings is at a distance from the planet's centre = 1.9090; being just within the outer edge of the Inner Bright Ring (or Rings), which is at the distance 1.9276; as though the division of one great ring had taken place there.

Some reason why the opening between the system of rings should be permanent, is given in (64); which reason has already been alluded to in Consistency *30th.*

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[1] Before Uranus (Consistency *44th*) had perceptibly *fallen in.*

55*th*. An application of the criterion of the ring-like form as stated in Consistency 54*th*, was, as far as might be, made use of [(60), (61), and (62)] in determining as to whether it would be preferable to attribute to the *asteroid-mass* (in the progress of its development) at any period, a whole-planet or a half-planet arrangement; without the assertion that either is, beyond controversy, supposable.

In favor of the supposition of a *half-planet* arrangement, we had:—

(*a*) That we do not find the equation here in question justified when a comparison is instituted between the whole-planet arrangement and Mars; but, with an appropriate distribution of the mass for a *half-planet* arrangement we find, (60), a close approximation to the fulfilment of the equation in question.

(*b*) This might seem to have the less weight, were it not also true that the limit of equal attraction between the exterior half-asteroid mass and Jupiter, (60), is 3.35790, and that between the interior half-asteroid mass and Mars, is 2.14438; which limits very well mark the *range* of the mean distances of the known asteroids; and, (61), the respective distances 3.34083 and 2.47748 of the exterior and interior half-asteroid masses approximate to the *aphelion* and *perihelion distances* of several of the existing asteroids; so that the case in that respect may possibly resemble that of Mercury, commented on in (50).

(*c*) Other circumstances discussed in (65), and referred to in Consistencies 31*st* and 45*th*, seem to indicate that (with the wide range and great eccentricity of the asteroid-orbits) Mars may have acquired material of slower motion; which caused that planet (*perceptibly*) to fall in. Such is the look, when Fact and Law in Table (B) in (14) are compared.

[This is again alluded to here because of its present connexion with the other considerations; though formally noticed in Consistency 45*th*.]

(*d*) Though we may not attribute too much weight to our results when the data are imperfect—yet, in this connexion, we find that the formula derived from Kirkwood's Analogy, which, (107), signally fails (for reasons assigned) to give us the length of the sidereal day of Uranus, yet, (108), approximates to a true result in the case of Mars, referred on the one side to the Earth and on the other to the interior *half-asteroid* mass.

56*th*. In view of the secular variations of the planetary orbits, we have exhibited in (99) the close approximation to coincidence of the planes of those orbits in very ancient times.

In (99) we make the suggestion that the mean inclination of the sun's equator (of nearly 5°) to these may have arisen from the fact that the acquisition of material of a planet from the extra-equatorial regions of the sun's nebulous atmosphere, may have been mainly from one side; the changes in the two half-spheroids not being *simultaneous*.

But this is a region for speculation in which our sources of information are very restricted. [Not quite discordant with it, however, is the fact mentioned in (99), and *its Note* (5), that the great planetary masses of Table (F) [in (45)] are alternately white and yellow or ruddy.]

57*th*. Other harmonies may be gathered from the *Memoir on the Secular Variations of the Elements of the Orbits of Eight Principal Planets*, by John N. Stockwell, M.A., from which the positions of the planes of the planetary orbits, alluded to in Consistency 56*th*, are taken; which harmonies are to some extent described in (99). These, like Consistencies 22*d* and 31*st*, seem to indicate a common origin of the bodies concerned—under restricted circumstances.

58*th*. As stated in (100), the orbits of the outermost satellites of Saturn and Jupiter have very considerable inclinations to the equators of their respective primaries; as though their development had an earlier history than that of the other satellites and appendages.

And the orbit of *our own moon* has a mean inclination of something less than 5°9′ to the *orbit* of the Earth; while the variable inclination of the Earth's *equator is more than four times as great;* as though the moon in the nebulous state had been separated *in the form of a spheroidal shell*, *before* the axis of the Earth was *established.*

The like, withal, would seem, (100), to have happened in the instance of the satellites of Uranus and their primary planet: with additional varieties, themselves, as it were, confirmatory of the supposition of the rending away and absorption by Saturn of the *mass due* to the (now missing) half-planet, which was once connected with *that* of Uranus.

59*th*. In our explanation of the appearances of certain of Jupiter's satellites as dark spots, while they were in transit across the disk of their primary; the conclusion was arrived at, (69), that the phenomena were due to absorption, and possible interference, of the light proceeding from Jupiter and encountering that of the satellite; as is explained in (69). The circumstances also seemed to indicate:

(*a*) A confirmation of the supposition that the satellites, in their revolution, continue to present, respectively, each nearly the same face to its primary.

(*b*) That the phenomena of absorption, etc., indicate, as a reasonable probability, that the satellites are *colder* than their primary.

(*c*) That, therefore, the satellites, like our moon, have very possibly little or no atmosphere.

(*d*) That, in view of the Laplace Nebular Hypothesis, the satellites may, then, possibly have lost their atmospheres, in the same way in which M. Laplace supposes the moon's atmosphere may have been carried away; which was already alluded to in Consistency 13*th*, and explained in (69).

All this bears upon the question of a similar origin and development of all the bodies (comets excepted) of the solar system.

60*th*. In Articles (70) to (95) inclusive we have a discussion of the phenomena of the *Zodiacal Light;* which, in (78), are regarded (in modification of Chaplain George Jones's hypothesis) as due to *a girdle* encompassing the Earth. It is further indicated, in (79), that the girdle is preserved from destruction by having its periodic time coincident with that of the moon; and the limits of the girdle, (82), are computed in accordance with that subsidiary hypothesis, and the variations, (83), in the size of the girdle are distinctly stated. Also *tidal* actions at the ends of the major diameter. Accumulations of material, or the contrary, must also exist, in the maintenance of the dynamical equilibrium *where* the central forces of earth and moon act at an angle with one another; somewhat, it may be, like that which appears in *Fig.* 14, at *Article* (80).

Examples of observed phenomena are afterwards given; and in (95) eight particulars are specified, in which the whole hypothesis seems, thus far, to be consistent with the observed phenomena.

The resemblances and differences of the Girdle and Saturn's *Dusky* Ring are stated in (98).

61*st.* The late Sears C. Walker in a personal communication to the author of this paper, made some years since, was understood to say, that he had computed what would be the time of rotation of the now existing Earth, if its material were given a ring-like form extending to the Kirkwood limits; and that he had found a year for the time of rotation, as the Laplace Nebular Hypothesis would require.

Prof. Benjamin Peirce, commenting on the explanation of the rotation of the planets on their axes, as deduced from the nebular hypothesis of Laplace, and reasoning especially with regard to Jupiter and Saturn, is understood to have "demonstrated, by a mathematical analysis of the movements of the particles constituting the liquid ring, that the velocities of the resulting rotations of those planets must be such as are actually observed." No authentic information of this, however, seems as yet to have been made public.

[Then Maxwell Hall, Esq., (109), would establish a connexion between the mass of a central body, sun or planet, and its period of axial rotation, and certain approximate ratios developed from the so-called Bode's Law.]

In the statement of Consistencies no allusion has been made to the coincidences in the times of revolution of the planets with the respective times of rotation of the sun with an atmosphere supposed to be expanded successively to the distances of the planets. Sufficient data for this are not attainable.

Other coincidences not sufficiently accurate have not been insisted on in the enumeration; and conjectures, like that in (97), with respect to the *Aurora*, cannot yet be verified. The giving of undue weight to the result, in any instance, has, withal, been carefully guarded against.

In view, however, of all the consistencies which have now been enumerated, the inquiry whether these *can all be incidental*, would seem at once to suggest its own negative answer.

But whether that, indeed, be so or no, a single additional statement should, if possible, once for all, be made emphatic:—

THE SPECIAL RELATIONS EXHIBITED IN SECTION II. (DESIGNEDLY STATED WITHOUT REFERENCE TO ANY THEORETICAL CONSIDERATIONS), AND THE OTHER PHENOMENA DETAILED IN SECTION III., AT LEAST IN SO FAR AS MERE NUMERICAL RELATIONS ARE CONCERNED—ALL THESE, FROM FIRST TO LAST, DEPEND UPON EXISTING FACTS OR RELATIONS IN THE SOLAR SYSTEM ITSELF; AND SO MUST ENDURE WHILE THE SYSTEM LASTS, THOUGH EVERY HYPOTHESIS WITH REGARD TO THOSE RELATIONS SHOULD BE REJECTED.

But if every hypothesis be rejected, the relations exist as more or less consistent, but yet as ultimate facts; *i.e.* without any explanation; while the hypothesis, or rather theory, which has been discussed in these pages, seems, with a more or less perfect applicability, to *include and grasp the whole.*

ADDENDUM.

Consistency 62*d*. In addition to what is already stated as a part of Consistency 55*th*, it may be noted, that the resulting rotation of Mars as determined by Kirkwood's Analogy, (108), is not merely, *in so far as may be*, confirmatory of the half-planet arrangement of the *asteroid-mass* exhibited in (60); but also of the *value* of the *mass itself*, as determined in (46): the appropriate fraction of the mass entering into the computation of the time of rotation in question.

NOTE (A).

On the Origin of Clusters and Nebulæ.

The application of similar principles to those involved in the Nebular Hypothesis of Laplace, but on a larger scale, and with reference to a greater variety of circumstances, led the author of this paper to his own hypothesis of the *Spheroidal Origin of Clusters and Nebulæ;* which represents those groups and conglomerations as being the derivations of spheroids (or of rings derived from spheroids, or of masses of an ancient ring-like form) all rotating in a state of dynamical equilibrium, at periods very remote. But, that the process of cooling brought about like phenomena to those which the Laplace-hypothesis maintains to have taken place in the instance of our sun; viz. the same more rapid rotation, sometimes with a local increase of actual velocity, sometimes with a diminution of the same; but always, on the whole, with an increase of angular velocity, continued, however, until the *centrifugal force of rotation o'ermastered cohesion and gravitation*, and, in place of an "abandoned" equatorial ring, portions of the ruptured material were *ejected;* to be left behind the others, in the direction *opposite* to that of the rotation—the material thus being broken into elongated fragments, and they again into drops; but every drop having in it material sufficient to form a condensed nebula, or in the end a star: the result presenting appearances such as are visible in the very beautiful nebula H. 1173; the spirals described and figured by the late Lord Rosse; the projections from the one end of the annular nebula in Lyra; and the teeth *leaning backward* in the globular cluster H. 1968, etc. etc.

The expositions in the communication here referred to, occupy in all twenty-nine (double-column) quarto pages of the 2d volume of (*Gould's*) *Astronomical Journal*, published in 1852; and among those expositions is one, drawn out in detail, the heading of which is "*The Milky Way—a Spiral;*" which is found in No. 37 of the Journal specified, at p. 101; followed by some reasons for supposing that the spiral had four branches, and a dense central cluster.[1]

For a variety of other details as well as a more complete exposition of the phenomena and their progress, reference must be made to the memoir itself; but one of its concluding paragraphs should, if possible, be made emphatic; and, therefore, we also introduce it here. It reads thus:—

"While it is even to be expected that errors may hereafter be found in the various details which have been so fully exhibited, it is respectfully submitted whether this same hypothesis of the spheroidal origin of so many of the clusters and nebulæ, in its most important features, is not adequate *in mode;* or whether, in the very least, the phenomena do not even *require* the admission of *a dynamical equilibrium destroyed*, as the one pervading principle—guiding, as it would also seem, to the explanation of all the other conditions."

It would seem, indeed, to be in vain to look for an exposition of the phenomena and their progress, if we do not keep in view and adhere to the hypothesis of a dynamical equilibrium *destroyed;* a *conservative* view does not *now* suit the case.

Among the conditions requiring just *that*, are the phenomena here briefly adverted to; and the fact that the centres of clusters do not exhibit the enormous condensation *anywhere*, which the "clustering power" of Sir William Herschel, it would seem, must *somewhere* have produced; but, on the contrary, the central portions uniformly appear as if, when they were released from superincumbent pressure, by the rupture of the outer portions of the spheroid, or other primitive form, their feeble central attraction could no longer preserve them in form; and so the centres are always broken up. The *sudden curvature of the spirals*, moreover, seems to be more like that due to the ejection of material under the influence of an excess of centrifugal force, than that which would result from a rushing inward, in obedience to an excess of attraction.

The supposition of original *nebulous* spheroids does not seem to be contradicted by the revelations of the *spectroscope;* but, on the contrary, to be consistent with them.

In further justification of an hypothesis, the distinguishing feature of which is the utter destruction, on the *large* scale, of a dynamical equilibrium, we also reproduce the conclusion of the communication already referred to, which is as follows:—

The more condensed clusters (other things being equal) must, upon this plan, be regarded as probably of the more recent origin; instead of being the older, as supposed by Sir William Herschel (*Phil. Trans.* for 1789, pp. 224 and 225); and if a continued dispersion is even yet in progress, the *permitted* collisions regarded

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[1] This assuredly must have been overlooked, or else—though noticed—have been forgotten; or we would not find among the *Proceedings of the Royal Astronomical Society* (Dec. 1869), "A *New* Theory of the Milky Way, by R. A Proctor, B. A.;" which describes and figures the Milky Way as being *a spiral*—though not, indeed, with four branches.

by Sir John Herschel [*Outlines of Astronomy* (872)] as quite supposable as consequences of the clustering power, will be the more frequently avoided; and stars, which, like our sun, may have planets in their keeping, will bear their attendants away beyond the reach of harm.

In view, then, of even the little that has yet been ascertained, may we not in all humility ask whether *this* was not indeed *the way* in which the SUPREME DISPOSER of both great and small events executed his vast purposes; the changes being, alternately, destructive and conservative.

For the growing leaf is fed by the exhalations which it finds in the atmosphere; and the leaf, in its decay, nourishes the vegetating tree; the roots of that tree are embedded in the *débris* of a comparatively ancient earth; the earth itself, in view of the nebular hypothesis (of Laplace), has been detached from the sun; and the sun and other stars would now seem to be but the comparatively small fragments or drops of greater masses: the one great plan pervading the *whole*, being, BY MEANS OF A PERMITTED DESTRUCTION, TO PROVIDE FOR A MORE PERFECT ADAPTATION AND DEVELOPMENT.

NOTE (B).

Of the Nebular Hypothesis of Sir William Herschel.

On this subject, Sir John Herschel says in his *Outlines of Astronomy*, (871):—"The first impression which Halley, and other early discoverers of nebulous objects received from their peculiar aspect, so different from the keen, concentrated light of mere stars, was that of a phosphorescent vapour like the matter of a comet's tail, or a gaseous and (so to speak) elementary form of luminous sidereal matter. Admitting the existence of such a medium, dispersed in some cases irregularly through vast regions in space, in others confined to narrower and more definite limits, Sir W. Herschel was led to speculate on its gradual subsidence and condensation by the effect of its own gravity, into more or less regular spherical, or spheroidal forms, denser (as they must in that case be) towards the center. Assuming that in the progress of this subsidence, local centers of condensation, subordinate to the general tendency, would not be wanting, he conceived that in this way solid nuclei might arise, whose local gravitation still further condensing, and so absorbing the nebulous matter, each in its immediate neighborhood, might ultimately become stars, and the whole nebula finally take on the state of a cluster of stars. Among the multitude of nebulæ revealed by his telescopes, every stage of this process might be considered as displayed to our eyes, and in every modification of form to which the general principle might be conceived to apply. The more or less advanced state of a nebula towards its segregation into discrete stars, and of these stars themselves towards a denser state of aggregation round a central nucleus, would thus be, in some sort, an indication of age. Neither is there any variety of aspect which nebulæ offer, which stands at all in contradiction to this view. Even though we should feel ourselves compelled to reject the idea of a gaseous or vaporous 'nebulous matter,' it loses little or none of its force." [The spectroscope indicates that *that* need not always be.] "Subsidence, and the central aggregation consequent on subsidence, may go on quite as well among a multitude of discrete bodies under the influence of mutual attraction, and feeble or partially opposing projectile motions, as among the particles of a gaseous fluid."

"(872) The '*nebular hypothesis*,' as it has been termed, and the *theory of sidereal aggregation* stand, in fact, quite independent of each other, the one as a physical conception of processes which may yet, for aught we know, have formed part of that mysterious chain of causes and effects antecedent to the existence of separate self-luminous solid bodies; the other as an application of dynamical principles to cases of a very complicated nature no doubt, but in which the possibility or impossibility, at least, of certain general results may be determined on perfectly legitimate principles."

"Among a crowd of solid bodies of whatever size, animated by independent and partially opposing influences, motions opposite to each other *must* produce collision, destruction of velocity, and subsidence or near approach towards the center of preponderant attraction; while those which conspire or remain outstanding after such conflicts, *must* ultimately give rise to circulation of a permanent character. Whatever we may think of such collisions as events, there is nothing in this conception contrary to sound mechanical principles."

"Ages which to us may well appear indefinite may easily be conceived to pass without a single instance of collision, in the nature of a catastrophe. Such may have gradually become rarer as the system has emerged from what must be considered its chaotic state, till at length, in the fulness of time, and, under the pre-arranging guidance of that DESIGN which pervades universal nature, each individual may have taken up such a course as to annul the possibility of further destructive interference."

To which we may add, that it is well understood, that, with respect to *all* this, Sir J. Herschel has but fully and clearly expressed the very thoughts and feelings of his distinguished father.

[The supposed "aggregation," in view of what is stated in *Note* (A), must be regarded as being a wider segregation, by the continuance of an even now progressive *dispersion*.]

In so far as the *nebular hypothesis* here under consideration, has, at least, the character of an ingenious conjecture in the form of a generalization, it would seem to relate to a more ancient state of things than that contemplated in our *Note* (A); being indicative of the way in which the rotating spheroids there described *might* themselves have been formed.

The existing phenomena seem to *require* the spheroids to have preceded the present state of things; but there is very little to indicate what must have been the state of the material composing the spheroids before *they* acquired their form.

The revelations by the spectroscope of a similarity of molecular constitution in so very many instances are not indeed inconsistent with the supposition of a common origin; yet *they* do not *require* that.

The statement of Sir J. Herschel, already quoted, speaks of the "chain of causes and effects" here in question as being antecedent to the existence of self-luminous solid bodies.

Being thus antecedent, the traces of the phenomena which have *required* the admission of such causes and effects have, it would seem, been so far obliterated, in the course of the changes which have since taken place, that the nebular hypothesis here in question cannot now be proved; and yet enough has even here been stated, to show that it cannot be disproved.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE.

281

ON THE

GENERAL INTEGRALS

OF

PLANETARY MOTION

BY

SIMON NEWCOMB,

PROFESSOR OF MATHEMATICS UNITED STATES NAVY.

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ADVERTISEMENT.

THE following Memoir, on the "General Integrals of Planetary Motion," was submitted to Prof. H. A. Newton, of Yale College, and Mr. G. W. Hill, of Nyack, N. Y., and has received their approval for publication in the "Smithsonian Contributions to Knowledge."

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, D. C.,
December, 1874.

PREFACE.

THE present memoir may be considered as, in part, an extension and generalization of two former papers by the author: the first being *Théorie des perturbations de la Lune qui sont dues à l'action des Planètes*, published in *Liouville's Journal*, tome xvi., 1871; and the second, *Sur un Théorème de Mécanique Céleste*, published in the *Comptes Rendus*, tome lxxv. Notwithstanding its extent, the author is conscious, in his treatment of the subject, of several gaps, which may detract from entire rigor. He believes that some of these are of such a nature that the reader can readily fill them, while the remainder would have led into long digressions, and thus caused great delay in the publication of the paper. To the former class belong (1) the analogy between the expressions for the rectangular co-ordinates x and y, which differ only in that the latter is composed of products of sines, while the former is composed of similar products of cosines; and (2) the omission of all considerations of the modifications growing out of the fact that in equation (1) one value of h vanishes. To the latter class belong the omission of all considerations respecting the convergence of the series encountered, respecting terms of long period, and respecting the occurrence of relations among the arguments, such as that known to subsist between the mean motions of three of the satellites of Jupiter. These subjects will naturally come up for consideration when the process of actually integrating the differential equations of planetary motion in the most general way is undertaken. No method for the actual execution of this integration is given at present, partly because the paper may be considered complete without it, partly because the author has not succeeded in working out any method satisfactory to himself. It is true that a large part of the paper is devoted to reviewing the general forms met with in a certain integrating process, but the actual execution of this process, even for a single approximation, may be considered impracticable on account of the enormous labor involved in it. It is shown, by a bird's eye view, that a certain object is, in the nature of things, attainable; but a practicable way of actually reaching it is yet to be pointed out. It would be extremely agreeable to the author to learn that abler hands than his were successfully working to effect the actual solution of this noble problem in its most general form.

CONTENTS.

ON THE

GENERAL INTEGRALS OF PLANETARY MOTION.

§ 1. *Introduction.*

If we examine what has been done by geometers towards developing the co-ordinates of the planets in terms of the time, we shall see that the most general expressions yet found are those for the development of the secular variations of the elements in a periodic form. It is well known that if we neglect quantities of the third order with respect to the eccentricities and inclinations, the integration of the equations which give the secular variations of those elements, and of the longitudes of the perihelia and of the nodes, leads to the conclusion that the general expressions of those elements in terms of the time are of the form

$$\begin{aligned} e \sin \pi &= \sum_{1}^{n}{}_i N_i \sin (g_i t + \beta_i) \\ e \cos \pi &= \sum_{1}^{n}{}_i N_i \cos (g_i t + \beta_i) \\ \phi \sin \theta &= \sum_{1}^{n}{}_i M_i \sin (h_i t + \gamma_i) \\ \phi \cos \theta &= \sum_{1}^{n}{}_i M_i \cos (h_i t + \gamma_i) \end{aligned} \qquad (1)$$

n being the number of planets, N_i, M_i, g_i, and h_i being functions of the eccentricities at a given epoch and of the mean distances, while β_i and γ_i are angles depending also on the positions of the perihelia and nodes at a given epoch. It is to be remarked that one of the values of h_i is zero, the corresponding quantities M and γ depending on the position of the plane of reference.

The numerical values of these constants for the solar system have been found by several geometers. The latest and most complete determinations are those of Le Verrier and of Stockwell.[1]

When we consider the terms commonly called periodic, that is, those which depend on the mean longitudes of the planets, we shall find that their determination depends on the integration of differentials of the form

$$m'h \frac{\cos}{\sin} (i'l' + il + j'\pi' + j\pi + k'\theta' + k\theta),$$

where we put
m' the mass of the disturbing planet.

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[1] Smithsonian Contributions to Knowledge, No. 232. Vol. XVIII.

h a function of the eccentricities, inclinations, and mean distances of the two planets, developable in powers of the two former quantities.
l, l' the mean longitudes of the planets.
π, π' the longitudes of their perihelia.
θ, θ' the longitudes of their nodes.
i, j, k, numerical integer coefficients,
and in which $i' + i + j' + j + k' + k = 0$.

The coefficient h is of the form

$$Ae^j e'^{j'} \phi^k \phi'^{k'} (1 + A_1 e^2 + A_2 e'^2 + \text{etc.}),$$

while the circular function of which it is a coefficient may be put in the form

$$\begin{gathered} {\cos \atop \sin} (j\pi + j'\pi' + k\theta + k'\theta') \cos (i'l' + il) \\ \pm {\sin \atop \cos} (j\pi + j'\pi' + k\theta + k'\theta') \sin (i'l' + il). \end{gathered}$$

As these equations have hitherto been integrated the different elements are developed in powers of the time, and we are thus led to expressions of the form

$$(A + A't + A''t' + \ldots\ldots) {\cos \atop \sin} (i'l' + il).$$

But it is clear, that we shall get more general expressions if, instead of using developments in powers of the time, we substitute the general values of the elements given by equations (1). The substitution will be most readily made by reducing the circular to exponential functions. Putting in (1) for brevity

$$\begin{aligned} g_i t + \beta_i &= \lambda_i \\ h_i t + \gamma_i &= \lambda'_i \end{aligned}$$

and

$$\begin{aligned} \Pi &= \varepsilon^{\pi\sqrt{-1}} \\ \Lambda &= \varepsilon^{\lambda\sqrt{-1}} \\ \Theta &= \varepsilon^{\theta\sqrt{-1}}, \end{aligned}$$

the equations (1) may be put in the form

$$\begin{aligned} e\Pi &= \Sigma_i N_i \Lambda_i \\ e\Pi^{-1} &= \Sigma_i N_i \Lambda_i^{-1} \\ \phi\Theta &= \Sigma_i M_i \Lambda'_i \\ \phi\Theta^{-1} &= \Sigma_i M_i \Lambda'^{-1}_i. \end{aligned}$$

In the preceding differential to be integrated the coefficient of ${\sin \atop \cos} (i'l' + il)$ is of the form

$$(1 + A_1 e^2 + A_2 e'^2 + \text{etc.}) \, Ae^j e'^{j'} \phi^k \phi'^{k'} {\cos \atop \sin} (j\pi + j'\pi' + k\theta + k'\theta').$$

If in the last factor we substitute the preceding exponentials for the circular functions, its product by $e^j e'^{j'} \phi^k \phi'^{k'}$ in the case of a cosine reduces to half of the sum

$$(e\Pi)^j (e'\Pi')^{j'} (\phi\Theta)^k (\phi'\Theta')^{k'} + \left(\frac{e}{\Pi}\right)^j \left(\frac{e'}{\Pi'}\right)^{j'} \left(\frac{\phi}{\Theta}\right)^k \left(\frac{\phi'}{\Theta'}\right)^{k'}.$$

Substituting the values of these expressions in terms of the exponentials just given, developing by the polynomial theorem, and then substituting for the exponentials their expressions in circular functions, we find that this sum reduces to a series of terms, each of the form

$$h \frac{\cos}{\sin} (i_1\lambda_1 + i_2\lambda_2 + \ldots + i_n\lambda_n + j_1\lambda'_1 + j_2\lambda'_2 + \ldots + j_n\lambda'_n),$$

in each of which we have

$$i_1 + i_2 + \ldots + i_n = j + j'$$
$$j_1 + j_2 + \ldots + j_n = k + k'.$$

The expressions $A_1e^2 + A_2e'^2 +$ etc., comprising products and powers of the squares of e, e', ϕ and ϕ' by constant coefficients by the substitutions of the values (1) reduce themselves to a series of terms of the form

$$h \cos (i_1\lambda_1 + i_2\lambda_2 + \ldots + i_n\lambda_n + \ldots j_1\lambda'_1 + j_2\lambda'_2 + \ldots + j_n\lambda'_n),$$

in which

$$i_1 + i_2 + \ldots + j_1 + j_2 + \ldots = 0.$$

By these operations and by corresponding ones in the case of sines the expressions to be integrated finally reduce themselves to the form

$$m'A' \frac{\sin}{\cos} (i'l' + il + i_1\lambda_1 + i'_2\lambda_2 + \ldots + j_1\lambda'_1 + \ldots + j_n\lambda'_n),$$

in each of which the sum of the integral coefficients of the variable angles vanishes, while A' is a function of the mean distances and of the $2n$ quantities N_i and M_i. By integration this expression will remain of the same form, so that we may regard it as a general form for the perturbation due to the mutual action of two planets, the elements of each being corrected for secular variations. If we consider the action of all the planets in succession, we shall introduce no new variable angles except their mean longitudes, which will make n mean longitudes in all. We shall therefore have, at the utmost, not more than $3n$ variable angles.

We may thus conclude inductively that by the ordinary methods of approximation, the co-ordinates of each of $3n$ planets, moving around the sun in nearly circular orbits, and subjected to their mutual attractions, may be expressed by an infinite series of terms each of the form

$$k \frac{\cos}{\sin} (i_1\lambda_1 + i_2\lambda_2 + \ldots + i_{3n}\lambda_{3n}) \qquad (2)$$

$i_1, i_2 \ldots i_{3n}$ being integer coefficients, different in each term; $\lambda_1, \lambda_2 \ldots \lambda_{3n}$ being each of the form

$$l_i + b_it$$

$l_1, l_2 \ldots l_{3n}$ being $3n$ arbitrary constants, and $b_1, b_2 \ldots b_{3n}k$, being functions of $3n$ other arbitrary constants.

We shall further assume that the inclination of the orbit of each planet to the plane of $x\,y$ is so small that the co-ordinates may be developed in a convergent series, arranged according to the powers of this inclination, while it may be shown that the general expressions for the rectangular co-ordinates will be of the form

$$\begin{aligned} x &= Sk \cos (i_1\lambda_1 + i_2\lambda_2 + \ldots + i_{3n}\lambda_{3n}) \\ y &= Sk \sin (i_1\lambda_1 + i_2\lambda_2 + \ldots + i_{3n}\lambda_{3n}) \\ z &= Sc \sin (j_1\lambda_1 + j_2\lambda_2 + \ldots + j_{3n}\lambda_{3n}) \end{aligned} \qquad (3)$$

The letter S being used to express the sum of an infinite series of similar terms; k, i, and j having the signification just expressed, and each system of values of the integers i and j being subjected to the condition

$$\begin{aligned} i_1 + i_2 + i_3 + \ldots\ldots + i_{3n} &= 1 \\ j_1 + j_2 + j_3 + \ldots\ldots + j_{3n} &= 0 \end{aligned} \qquad (3)'$$

It is evident that when x, y, and z are expressed in this form, any entire function of these quantities will reduce itself to the same form.

We shall now proceed to show that the form (3) is a general one: that is to say, that having an approximate solution of this form, if we make further approximations, developed in powers of the errors of this first solution, every approximation can be expressed in the form (3).

We can make no general determination of the limits within which these approximations will be convergent, we are therefore obliged to assume their convergency.

§ 2. *Canonical Transformation of the Equations of Motion.*

If we put

Ω, the potential of the $n+1$ bodies, that is, the sum of the products of every pair of masses divided by their mutual distance, the differential equations of motion will be $3(n+1)$ in number, each of the form

$$m_i \frac{d^2 x_i}{dt^2} = \frac{\partial \Omega}{\partial x_i}.$$

If we substitute for the co-ordinates themselves their products by the square roots of their masses, putting

$$\text{X}_i = m_i^{\frac{1}{2}} x_i; \ \text{Y}_i = m_i^{\frac{1}{2}} y_i, \text{ etc.},$$

the differential equations will assume the canonical form

$$\frac{d^2 \text{X}_i}{dt^2} = \frac{\partial \Omega}{\partial \text{X}_i}. \qquad (4)$$

We suppose the index i to assume for each of the three co-ordinates all values from 0 to n, the value 0 referring to the sun, and we thus have $3(n+1)$ equations of the form (4) the integration of which will give the co-ordinates in terms of the time, and $6(n+1)$ arbitrary constants.

We shall now diminish the number of variables to be determined in the following general manner: Suppose that we have m differential equations of the first order, between m variables and the time t, each being of the form

$$\frac{dx_i}{dt} = X_i.$$

Suppose also that we have found k integrals of these equations, each of the form

$$f(x_1, x_2, \ldots\ldots x_m, t) = \text{constant}.$$

Let us assume at pleasure $m-k$ other independent functions of the variables, each of the form

$$\xi_i = \phi_i(x_1, x_2, \ldots\ldots x_m, t),$$

so that the m variables x can be expressed as a function of k arbitrary constants, the time t, and the $m-k$ variables

$$\xi_1, \xi_2, \ldots \xi_{m-k}.$$

Differentiating the above expression for ξ_i, and substituting for $\frac{dx}{dt}$ its value X, we shall have

$$\frac{d\xi_i}{dt} = \frac{\partial\phi_i}{\partial t} + X_1\frac{\partial\phi_i}{\partial x_1} + X_2\frac{\partial\phi_i}{\partial x_2} + \ldots\ldots + X_m\frac{\partial\phi_i}{\partial x_m}.$$

By substituting for the x's in the right hand side of this equation their expressions in terms of $\xi_1, \ldots \xi_{m-k}$, t, and the arbitrary constants, we shall have the problem reduced to the integration of $m-k$ equations between that number of variables.

In the special problem now under consideration, the m variables are the co-ordinates x, y, z, and their first derivatives with respect to the time. The integrals by which we shall seek to reduce the number of the variables are those of the conservation of the centre of gravity. We shall take for ξ_1, ξ_2, etc., linear functions of x_1, x_2, etc., so chosen that the reduced equations shall maintain the canonical form. Let us take the $n+1$ linear functions of the co-ordinates x:—

$$\begin{aligned} \xi_0 = a + bt &= \alpha_{00}x_0 + \alpha_{01}x_1 + \ldots\ldots + \alpha_{0n}x_n \\ \xi_1 &= \alpha_{10}x_0 + \alpha_{11}x_1 + \ldots\ldots + \alpha_{1n}x_n \\ &\vdots \\ \xi_n &= \alpha_{n0}x_0 + \alpha_{n1}x_1 + \ldots\ldots + \alpha_{nn}x_n, \end{aligned} \tag{5}$$

where we have put for symmetry

$$m_i = c\alpha_{0i}, \text{ or } \alpha_{0i} = \frac{m_i}{c}, \tag{6}$$

c being an arbitrary coefficient, while the other coefficients are to be chosen, so that the resulting differential equations shall be of the canonical form. Let us represent the values of x which we obtain from these equations by

$$x_i = \beta_{0i}\xi_0 + \beta_{1i}\xi_1 + \beta_{2i}\xi_2 + \ldots\ldots + \beta_{ni}\xi_i. \tag{7}$$

Differentiating any one of the preceding expressions for ξ, and substituting for $\frac{d^2x}{dt^2}$ its value, we have

$$\frac{d^2\xi_i}{dt^2} = \frac{\alpha_{i0}}{m_0}\frac{\partial\Omega}{\partial x_0} + \frac{\alpha_{i1}}{m_1}\frac{\partial\Omega}{\partial x_1} + \ldots\ldots + \frac{\alpha_{in}}{m_n}\frac{\partial\Omega}{\partial x_n}.$$

If we suppose x_0, x_1, etc., replaced by their expressions in ξ_0, ξ_1, etc., obtained by solving the equations (5), that is, by their values in (7), we shall have

$$\frac{\partial\Omega}{\partial x_j} = \alpha_{0j}\frac{\partial\Omega}{\partial\xi_0} + \alpha_{1j}\frac{\partial\Omega}{\partial\xi_1} + \ldots\ldots + \alpha_{nj}\frac{\partial\Omega}{\partial\xi_n}.$$

Substituting these values in the preceding equation, it becomes

$$
\begin{aligned}
\frac{d^2\xi_i}{dt^2} = &\left(\frac{\alpha_{00}\alpha_{i0}}{m_0} + \frac{\alpha_{01}\alpha_{i1}}{m_1} + \frac{\alpha_{02}\alpha_{i2}}{m_2} + \cdots\cdots + \frac{\alpha_{0n}\alpha_{in}}{m_n}\right)\frac{\partial\Omega}{\partial\xi_0} \\
&+ \left(\frac{\alpha_{10}\alpha_{i0}}{m_0} + \frac{\alpha_{11}\alpha_{i1}}{m_1} + \frac{\alpha_{12}\alpha_{i2}}{m_2} + \cdots\cdots + \frac{\alpha_{1n}\alpha_{in}}{m_n}\right)\frac{\partial\Omega}{\partial\xi_1} \\
&\quad \vdots \qquad\qquad \vdots \qquad\qquad \vdots \qquad\qquad\qquad\qquad \vdots \\
&+ \left(\frac{\alpha_{n0}\alpha_{i0}}{m_0} + \frac{\alpha_{n1}\alpha_{i1}}{m_1} + \frac{\alpha_{n2}\alpha_{i2}}{m_2} + \cdots\cdots + \frac{\alpha_{nn}\alpha_{in}}{m_n}\right)\frac{\partial\Omega}{\partial\xi_n}.
\end{aligned}
$$

In order that this equation may reduce to the canonical form

$$\frac{d_2\xi_i}{dt^2} = \frac{\partial\Omega}{\partial\xi_i},$$

it is necessary and sufficient that the expressions

$$\frac{\alpha_{j0}\alpha_{i0}}{m_0} + \frac{\alpha_{j1}\alpha_{i1}}{m_1} + \frac{\alpha_{j2}\alpha_{i2}}{m_2} + \cdots\cdots + \frac{\alpha_{jn}\alpha_{in}}{m_n}$$

should vanish whenever i is different from j, and should reduce to unity whenever $i=j$. In other words, it is necessary and sufficient that the coefficients α should be so chosen that the $(n+1)^2$ quantities

$$
\begin{array}{cccc}
\dfrac{\alpha_{00}}{\sqrt{m_0}}, & \dfrac{\alpha_{01}}{\sqrt{m_1}}, & \cdots\cdots & \dfrac{\alpha_{0n}}{\sqrt{m_n}} \\
\vdots & \vdots & & \vdots \\
\dfrac{\alpha_{n0}}{\sqrt{m_0}}, & \dfrac{\alpha_{n1}}{\sqrt{m_1}} & \cdots\cdots & \dfrac{\alpha_{nn}}{\sqrt{m_n}},
\end{array}
\tag{8}
$$

should form an orthogonal system. The first line of coefficients is already determined by the equation (6), the coefficient c excepted, which is to be determined by the condition

$$\frac{\alpha_{00}^2}{m_0} + \frac{\alpha_{01}^2}{m_1} + \cdots\cdots + \frac{\alpha_{0n}^2}{m_n} = 1,$$

or, from (6)

$$m_0 + m_1 + \cdots\cdots + m_n = c^2,$$

which gives

$$c = \sqrt{m},$$

putting m for the sum of the masses of the entire system of bodies. Having thus

$$\alpha_{0i} = \frac{m_i}{\sqrt{m}},$$

the orthogonal system (8) becomes

$$
\begin{array}{cccc}
\dfrac{\sqrt{m_0}}{\sqrt{m}}, & \dfrac{\sqrt{m_1}}{\sqrt{m}}, & \cdots\cdots & \dfrac{\sqrt{m_n}}{\sqrt{m}} \\
\dfrac{\alpha_{10}}{\sqrt{m_0}}, & \dfrac{\alpha_{11}}{\sqrt{m_1}}, & \cdots\cdots & \dfrac{\alpha_{1n}}{\sqrt{m_n}} \\
\vdots & \vdots & & \vdots \\
\dfrac{\alpha_{n0}}{\sqrt{m_0}}, & \dfrac{\alpha_{n1}}{\sqrt{m_1}}, & \cdots\cdots & \dfrac{\alpha_{nn}}{\sqrt{m_n}}.
\end{array}
$$

The number of coefficients to be determined is now $n(n+1)$. The total number of conditions which the system must satisfy is $\frac{(n+1)(n+2)}{2}$, but one of these being already satisfied by the quantities in the first line, there remain only $\frac{n(n+3)}{2}$ conditions to be satisfied by $n(n+1)$ quantities, we have therefore

$$n(n+1)-\frac{n(n+3)}{2}=\frac{n(n-1)}{2}$$

quantities which may be chosen at pleasure.

The general theory of the substitution which we have been considering, and the various modes in which the orthogonal system just found may be formed, have been developed very fully by Radau in a paper in *Annales de l'Ecole Normale Supérieure*, Tome V. (1868).[1] We shall, therefore, at present confine ourselves to a brief indication of the special form of the substitution which has been found useful in Celestial Mechanics. We first remark that if we form the $(n+1)$ equations

$$y_i=\frac{\alpha_{i0}}{\sqrt{m_0}}z_0+\frac{\alpha_{i1}}{\sqrt{m_1}}z_1+\ .\ .\ .\ +\frac{\alpha_{in}}{\sqrt{m_n}}z_n$$

by giving i in succession all values from 0 to n, we shall have by the theory of orthogonal substitutions the $(n+1)$ equations

$$z_i=\frac{\alpha_{0i}}{\sqrt{m_i}}y_0+\frac{\alpha_{1i}}{\sqrt{m_i}}y_1+\ .\ .\ .\ .\ +\frac{\alpha_{ni}}{\sqrt{m_i}}y_n.$$

If we suppose in the first equations

$$z_j=\sqrt{m_j}\,x_j$$

we shall have from (5)

$$y_i=\xi_i,$$

whence, by substituting these values of z_i and y_i in the second equation, we shall have for the expression of x_i in terms of ξ_0, ξ_1, etc. to replace equation (7)

$$x_i=\frac{1}{\sqrt{m}}\xi_0+\frac{\alpha_{1i}}{m_i}\xi_1+\frac{\alpha_{2i}}{m_i}\xi_2+\text{etc.} \qquad (9)$$

The first term of this expression is common to all the values of x_i, representing, as it does, the co-ordinates of the centre of gravity of the system. It may, therefore, be omitted entirely, when we seek only the relative co-ordinates of the various bodies, and, in any case, it will disappear from the differential equations of motion.

The most simple way of forming the coefficients α_{ij} is to suppose $\frac{n(n-1)}{2}$ of them equal to zero. Let us first suppose $\alpha_{ij}=0$ whenever $j>i$, the first line, in which $i=0$, being, of course, excepted.

The orthogonal system will then be of the form

[1] Sur une Transformation des Equations Différentielles de la Dynamique.

$$\begin{array}{llllll}
\frac{\sqrt{m_0}}{\sqrt{m}}, & \frac{\sqrt{m_1}}{\sqrt{m}}, & \frac{\sqrt{m_2}}{\sqrt{m}}, & & \ldots\ldots & \frac{\sqrt{m_n}}{\sqrt{m}} \\
\frac{\alpha_{10}}{\sqrt{m_0}}, & \frac{\alpha_{11}}{\sqrt{m_1}}, & 0, & 0, & \ldots\ldots & 0 \\
\frac{\alpha_{20}}{\sqrt{m_0}}, & \frac{\alpha_{21}}{\sqrt{m_1}}, & \frac{\alpha_{22}}{\sqrt{m_2}}, & 0, & \ldots\ldots & 0 \\
\vdots & \vdots & \vdots & \vdots & & \vdots \\
\frac{\alpha_{n0}}{\sqrt{m_0}}, & \frac{\alpha_{n1}}{\sqrt{m_1}}, & \frac{\alpha_{n2}}{\sqrt{m_2}}, & & \ldots\ldots & \frac{\alpha_{nn}}{\sqrt{m_m}}.
\end{array} \qquad (10)$$

Then α_{nn} will be determined by the condition

$$\frac{\alpha_{nn}^2}{m_n} + \frac{m_n}{m} = 1,$$

while all the other coefficients in the bottom line will be determined by the condition

$$\frac{\alpha_{ni}\,\alpha_{nn}}{\sqrt{m_i\,m_n}} + \frac{\sqrt{m_i\,m_n}}{m} = 0.$$

Taking the line next the bottom the diagonal coefficient will be determined by the equation

$$\frac{\alpha_{n,\,n-1}^2 + \alpha_{n-1,\,n-1}^2}{m_{n-1}} + \frac{m_{n-1}}{m} = 1,$$

while the remaining coefficients of the form $\alpha_{n-1,\,i}$ will be given by the equations

$$\frac{\alpha_{n,\,i}\,\alpha_{n,\,n-1} + \alpha_{n-1,\,i}\,\alpha_{n-1,\,n-1}}{\sqrt{m_i\,m_{n-1}}} + \frac{\sqrt{m_i\,m_{n-1}}}{m} = 0.$$

The general values of the coefficients to which we are thus led may be expressed in the following way: put

$$\mu_i = m_0 + m_1 + \ldots\ldots m_i,$$

by which m will become μ_n. Also, suppose

$$\nu_j = \frac{\sqrt{m_j}}{\sqrt{\mu_j\,\mu_{j-1}}}.$$

We shall then have

$$\alpha_{ii}^2 = \frac{m_i\,\mu_{i-1}}{\mu_i}$$

$$\alpha_{ji} = -\nu_j\,m_i\,.\ \ldots\ (i < j).$$

It is easy to prove that the coefficients thus formed fulfil the required conditions.

If we substitute these values of the coefficients in the expressions for ξ_1 and ξ_2, they become

$$\xi_1 = \frac{\sqrt{m_0\,m_1}}{\sqrt{m_0 + m_1}}(x_1 - x_0)$$

$$\xi_2 = \frac{\sqrt{m_2}}{\sqrt{\mu_1\,\mu_2}}\Big((m_0 + m_1)\,x_2 - m_1\,x_1 - m_0\,x_0\Big).$$

We see that, supposing x_0 to represent the co-ordinates of the sun or other central body, ξ_1 is equal to the co-ordinate of the first planet, which may be any one at pleasure, relatively to the sun, multiplied by a function of the masses, while ξ_2 is equal to the co-ordinate of the second planet relatively to the centre of gravity of the sun and first planet multiplied by another function of the masses, and so on. These functions ξ_i, when divided by the functions of the masses just alluded to, will differ from the co-ordinates of the several planets relatively to the sun only by quantities of the order of magnitude of the masses of the planets divided by that of the sun.

In what precedes we have considered only the co-ordinates x_1. Of course the other co-ordinates are to be subjected to the same transformation. If we represent by η and ζ the corresponding functions of y and z, and if in the expressions for ξ, η, and ζ we substitute for x, y, and z, the expressions (3), those quantities will themselves reduce to expressions of this same form.

§ 3. *Approximation to the Required Solutions by the Variations of the Arbitrary Constants in a First Approximate Solution.*

By the transformation in question we have for the determination of the relative motion of the $n+1$ bodies, $3n$ differential equations, of the canonical form

$$\frac{d^2\xi_i}{dt^2} = \frac{\partial\Omega}{\partial\xi_i}; \qquad \frac{d_2\eta_i}{dt^2} = \frac{\partial\Omega}{\partial\eta_i}; \qquad \frac{d^2\zeta_i}{dt^2} = \frac{\partial\Omega}{\partial\zeta_i}. \qquad (11)$$

Let us now suppose that we have found approximate solutions of these equations in the form (3), the quantities x, y, z being there replaced by ξ_i, η_i, and ζ_i, that is, solutions which possess the property that, if, on the one hand, each expression is twice differentiated, and if, on the other hand, the values (3) are substituted in the second members of (11), the two expressions shall differ only by terms multiplied by small numerical coefficients. We have to show that when we make a further approximation to quantities of the first order relative to these coefficients, the solution will still admit of being expressed in the form (3). To do this we shall make the further approximation by the method of the variation of arbitrary constants, remarking, however, that the usual formulæ of this method cannot be applied, because they presuppose that the first approximation is a *rigorous* solution of an approximate dynamical problem, while, in the present case, we are not entitled to assume that our approximate solution (3) possesses this quality; in other words, we are not entitled to assume that any function Ω_0 of the quantities ξ, η, and ζ, can be formed, such that we shall find the $3n$ equations of the form

$$\frac{d^2\xi}{dt^2} = \frac{\partial\Omega_0}{\partial\xi}$$

rigorously and identically satisfied by the approximate expressions, both with respect to the time, and the $6n$ constants which the solution contains. Consequently, we cannot assume the existence of a perturbative function, and must employ other expressions in place of the derivatives of that function.

We set out, then, with the three sets of equations, having n in each set

$$\begin{aligned} \xi_i &= Sk_i \cos (i_1\lambda_1 + i_2\lambda_2 + \ldots\ldots + i_{3n}\lambda_{3n}) \\ \eta_i &= Sk_i \sin (i_1\lambda_1 + i_2\lambda_2 + \ldots\ldots + i_{3n}\lambda_{3n}) \\ \zeta_i &= Sk'_i \sin (j_1\lambda_1 + j_2\lambda_2 + \ldots\ldots + j_{3n}\lambda_{3n}), \end{aligned} \qquad (12)$$

in which all the quantities are supposed to be given in terms of $6n$ arbitrary constants and the time, each λ being of the form

$$\lambda_i = l_i + b_i t,$$

l_i being an arbitrary constant, which each b, k, and k' is given as a function of $3n$ other arbitrary constants, which we may represent in the most general way by

$$a_1, a_2, \ldots\ldots a_{3n}.$$

So long as no distinction between a and l is necessary, we may represent the entire $6n$ arbitrary constants by

$$a_1, a_2, \ldots\ldots a_{6n},$$

Let us now take the complete second derivatives of (12) with respect to the time, supposing all $6n$ constants variable. We shall suppose the variable constants to fulfil Lagrange's conditions, now $3n$ in number:—

$$\sum_{j=1}^{j=6n} \frac{\partial \xi_i}{\partial a_j} \frac{da_j}{dt} = 0; \qquad \sum_{j=1}^{j=6n} \frac{\partial \eta_i}{\partial a_j} \frac{da_j}{dt} = 0; \qquad \sum_{j=1}^{j=6n} \frac{\partial \zeta_i}{\partial a_j} \frac{da_j}{dt} = 0, \quad (13)$$

which will give

$$\frac{d\xi_i}{dt} = \frac{\partial \xi_i}{\partial t} = \xi'_i, \text{ etc.}$$

From the second derivatives, combined with the differential equations (11), we shall have $3n$ equations of the form

$$\sum_{j=1}^{j=6n} \frac{\partial \xi'_i}{\partial a_j} \frac{da_j}{dt} = \frac{\partial \Omega}{\partial \xi_i} - \frac{\partial^2 \xi_i}{\partial t^2},$$

which it is required to satisfy. The expression in the right-hand member of this equation corresponds to $\frac{\partial R}{\partial \xi_i}$ in the usual theory, when R is the perturbative function.

Let us multiply this equation by $\frac{d\xi_i}{da_k}$, and add up the $3n$ equations which we may form in this way by substituting for ξ_i all the values of ξ, η, and ζ in succession. We may thus obtain

$$\sum_{i=1}^{i=n}{}' \sum_{j=1}^{j=6n} \frac{\partial \xi_i}{\partial a_k} \frac{\partial \xi'_i}{\partial a_j} \frac{da_j}{dt} = \frac{\partial \Omega}{\partial a_k} - \sum_{i=1}^{i=n}{}' \frac{\partial^2 \xi_i}{\partial t^2} \frac{\partial \xi_i}{\partial a_k},$$

the sign Σ' indicating that all values of η and ζ as well as of ξ are to be included. The right-hand member of this equation corresponds to $\frac{\partial R}{\partial a_k}$ in the usual theory. Let us now multiply the equations (13), the first by $\frac{\partial \xi'_i}{\partial a_k}$, the second by $\frac{\partial \eta'_i}{\partial a_k}$, and the third by $\frac{\partial \zeta'_i}{\partial a_k}$, and add together the $3n$ equations which may be thus formed by giving i all its values. If we subtract their sum from the last equation, putting

$$(a_k, a_j) = \sum_{i=1}^{i=n}{}' \left(\frac{\partial \xi_i}{\partial a_k} \frac{\partial \xi'_i}{\partial a_j} - \frac{\partial \xi_i}{\partial a_j} \frac{\partial \xi'_i}{\partial a_k} \right), \tag{14}$$

we shall have

$$(a_k, a_1) \frac{da_1}{dt} + (a_k, a_2) \frac{da_2}{dt} + \dots \text{ etc.} = \frac{\partial \Omega}{da_k} - \sum_{i=1}^{i=n}{}' \frac{\partial^2 \xi_i}{\partial t^2} \frac{\partial \xi_i}{\partial a_k}, \tag{15}$$

the sign Σ' including, as before, not only all values of i from 1 to n, but the corresponding terms in η and ζ.

By giving k all values in succession from 1 to $6n$, we shall have a system of $6n$ differential equations, the integration of which will give the values of the $6n$ quantities

$$a_1, a_2, \dots a_{6n}$$

in terms of the time.

By the fundamental assumption with which we set out, the expressions for ξ, η, and ζ are such that the right hand members of these equations are small quantities of which we neglect the powers and products. We may, therefore, after solving these equations so as to get the derivatives in the form

$$\frac{da_i}{dt} = f(a_1, a_2 \dots a_{3n}, t),$$

integrate by a simple quadrature, supposing a_1, a_2, etc., in the second members to be constant. Moreover we shall require the values of the quantities (a_k, a_j) only to the first degree of approximation, and within this limit they must necessarily conform to the well-known law of Lagrange of being functions of the constants only, and not containing the time explicitly. This theorem will materially assist us in their formation.

§ 4. *Formation of the Lagrangian Coefficients (a_i, a_k), and Reduction of the Equations to a Canonical Form.*

Restoring the two classes of constants represented by a and l, we shall have three classes of the functions sought, included in the forms

$$(a_k, a_j), (l_k, l_j) \text{ and } (a_k, l_j).$$

Let us now differentiate the equations (12) with respect to the time, putting for brevity

$$\begin{aligned} i_1 b_1 + i_2 b_2 + \dots + i_{3n} b_{3n} &= b \\ i_1 \lambda_1 + i_2 \lambda_2 + \dots + i_{3n} \lambda_{3n} &= N \\ j_1 b_1 + j_2 b_2 + \dots + j_{3n} b_{3n} &= b' \\ j_1 \lambda_1 + j_2 \lambda_2 + \dots + j_{3n} \lambda_{3n} &= N'; \end{aligned}$$

we shall then have, omitting the index i of b, k, and N,

$$\begin{aligned} \xi'_i &= - Sbk \sin N \\ \eta'_i &= Sbk \cos N \\ \zeta'_i &= Sb'k' \cos N'. \end{aligned} \tag{15'}$$

To form the combination (a_k, a_j) we must differentiate the equations (12) and (15′) with respect to a_i and a_k, and substitute the results in (14). In forming these quantities, two series of terms represented by the sign S of summation are to be multiplied together, which renders it necessary to be more explicit in representing the double summation we thus encounter. Having n of each of the quantities ξ, η, and ζ distinguished by writing the various values of the index i, which takes all integer values from 1 to n, the quantities b, k, and N should all be affected with this same index. But it is not necessary to write it after N or b, because each N is common to all the ξ's and η's, or to all the ζ's, respectively. Again, we have as many values of N as there are combinations of the coefficients i_1, i_2, i_3, etc., which enter into it, while each N has its corresponding coefficients k, i in number. We must, therefore, consider k to be written

$$k_i\,(i_1, i_2, i_3\,.\,.\,.\,.\,.\,i_{3n}),$$

while b and N are affected with the same indices, the first excepted. In other words, we have

$$b\,(i_1, i_2, i_3\,.\,.\,.\,.\,.\,i_{3n}) = i_1 b_1 + i_2 b_2 + \,.\,.\,.\,.\,.\, + i_{3n} b_{3n}$$
$$N(i_1, i_2, i_3\,.\,.\,.\,.\,.\,i_{3n}) = i_1 \lambda_1 + i_2 \lambda_2 + \,.\,.\,.\,.\,.\, + i_{3n} \lambda_{3n}.$$

Then, in the sense in which we have hitherto used the sign of summation S we have symbolically

$$S = \sum_{i_1=-\infty}^{i_1=\infty} \sum_{i_2=-\infty}^{i_2=\infty} \,.\,.\,.\,.\,.\, \sum_{i_{3n}=-\infty}^{i_{3n}=\infty}$$

To avoid the complication of writing so many indices we shall represent any one combination, as $(i_1, i_2, \,.\,.\,.\,.\,.\, i_{3n})$ by the symbol ν, and any other combination by μ. We shall also put

$$S' = \sum_{i=1}^{i=n} S.$$

This summation includes all the terms in all the values of any one co-ordinate, as ξ, η, or ζ, respectively. A sign for a summation including all $3n$ co-ordinates is not here necessary, as k and N are common to ξ and η, while the corresponding quantities for ζ, being of a different form, must be written separately. We have, in fact, distinguished them by an accent.

The co-ordinates and their derivatives which enter into the expressions (a_k, a_j) will then assume the following form, the index i being understood after k and k'.

$$\left.\begin{aligned}
\xi_i &= S_\mu k_\mu \cos N_\mu \\
\eta_i &= S_\mu k_\mu \sin N_\mu \\
\zeta_i &= S_\mu k'_\mu \sin N'_\mu \\
\xi'_i &= -\,S_\nu\,(bk)_\nu \sin N_\nu \\
\eta'_i &= \,S_\nu\,(bk)_\nu \cos N_\nu \\
\zeta'_i &= \,S_\nu\,(b'k')_\nu \cos N'_\nu
\end{aligned}\right. \qquad (16)$$

$$\left.\begin{aligned}
\frac{\partial \xi_i}{\partial a_k} &= S_\mu \left\{ \frac{\partial k_\mu}{\partial a_k} \cos N_\mu - k_\mu \frac{\partial b_\mu}{\partial a_k}\, t \sin N_\mu \right\} \\
\frac{\partial \eta_i}{\partial a_k} &= S_\mu \left\{ \frac{\partial k_\mu}{\partial a_k} \sin N_\mu + k_\mu \frac{\partial b_\mu}{\partial a_k}\, t \cos N_\mu \right\} \\
\frac{\partial \zeta_i}{\partial a_k} &= S_\mu \left\{ \frac{\partial k'_\mu}{\partial a_k} \sin N'_\mu + k_\mu \frac{\partial b'_\mu}{\partial a_k}\, t \cos N'_\mu \right\}
\end{aligned}\right\} \qquad (17)$$

$$\left.\begin{aligned}
\frac{\partial \xi'_i}{\partial a_j} &= S_\nu \left\{ -\frac{\partial (bk)_\nu}{\partial a_j} \sin N_\nu - (bk)_\nu \frac{\partial b_\nu}{\partial a_j} t \cos N_\nu \right\} \\
\frac{\partial \eta'_i}{\partial a_j} &= S_\nu \left\{ \frac{\partial (bk)_\nu}{\partial a_j} \cos N_\nu - (bk)_\nu \frac{\partial b_\nu}{\partial a_j} t \sin N_\nu \right\} \\
\frac{\partial \zeta'_i}{\partial a_j} &= S_\nu \left\{ \frac{\partial (b'k')_\nu}{\partial a_j} \cos N'_\nu - (b'k')_\nu \frac{\partial b'_\nu}{\partial a_j} t \sin N'_\nu \right\}
\end{aligned}\right\} \qquad (18)$$

By changing a_k into a_j in the three equations (17), and making the reverse change in (18), we have the complete expressions necessary to form any term of the expression

$$(a_k, a_j) = \sum_{i=1}^{i=n} \left\{ \frac{\partial \xi_i}{\partial a_k}\frac{\partial \xi'_i}{\partial a_j} - \frac{\partial \xi_i}{\partial a_j}\frac{\partial \xi'_i}{\partial a_k} + \frac{\partial \eta_i}{\partial a_k}\frac{\partial \eta'_i}{\partial a_j} - \text{etc.} \right\}$$

We see at once that this expression will be of the form

$$\sum_{i=1}^{i=n} S^2_{\mu,\nu} \left\{ A_{\mu,\nu} \sin (N_\mu - N_\nu) + A't + A''t^2 \right\}$$

Since the expression is known to be independent of t, we must have, to quantities of the first degree of approximation, $A' = 0$ and $A'' = 0$ by the condition that ξ, η, and ζ satisfy the original differential equations, and the coefficient $A_{\mu,\nu}$ must vanish, unless we have

$$N_\mu - N_\nu = \text{constant}.$$

The coefficients $b_1, b_2 \ldots\ldots b_{3n}$, being supposed incommensurable, this can only happen when we have in (3)'

$$i_{1\mu} = i_{1\nu}; \quad i_{2\mu} = i_{2\nu}, \text{ etc.},$$

and hence

$$N_\mu = N_\nu,$$

when $\sin (N_\mu - N_\nu)$ will itself vanish. Hence, (a_k, a_j) containing no constant term whatever, we must have

$$(a_k, a_j) = 0. \qquad (19)$$

Again, differentiating the equations (16), the first three with respect to l_k and the last three with respect to l_j, we find

$$\begin{aligned}
\frac{\partial \xi_i}{\partial l_k} &= - S_\mu (i_k k)_\mu \sin N_\mu \\
\frac{\partial \eta_i}{\partial l_k} &= S_\mu (i_k k)_\mu \cos N_\mu \\
\frac{\partial \zeta_i}{\partial l_k} &= S_\mu (j_k k)_\mu \cos N'_\mu \\
\frac{\partial \xi'_i}{\partial l_j} &= - S_\nu (i_j bk)_\nu \cos N_\nu \\
\frac{\partial \eta'_i}{\partial l_j} &= - S_\nu (i_j bk)_\nu \sin N_\nu \\
\frac{\partial \zeta'_i}{\partial l_j} &= - S_\nu (j_j b'k')_\nu \sin N'_\nu.
\end{aligned}$$

From these expressions it may be shown that

$$(l_k, l_j) = 0 \tag{20}$$

in the same way that we found $(a_k, a_j) = 0$.

We have next to consider the combinations of the form (a_k, l_j), for which the expression is

$$(a_k, l_j) = \sum_{i=1}^{i=n} \left\{ \frac{\partial \xi_i}{\partial a_k} \frac{\partial \xi'_i}{\partial l_j} - \frac{\partial \xi_i}{\partial l_j} \frac{\partial \xi'_i}{\partial a_k} + \frac{\partial \eta_i}{\partial a_k} \frac{\partial \eta'_i}{\partial l_j} - \text{etc.} \right\}$$

The terms which do not contain t as a factor are found to be

$$- S_\mu S'_\nu \left\{ (i_j bk)_\nu \frac{\partial k_\mu}{\partial a_k} + (i_j k)_\mu \frac{\partial (bk)_\nu}{\partial a_k} \right\} \cos (N_\mu - N_\nu)$$

$$- \tfrac{1}{2} S_\mu S'_\nu \left\{ (j_j b' k')_\nu \frac{\partial k'_\mu}{\partial a_k} + (j_j k')_\mu \frac{\partial (b'k')_\nu}{\partial a_k} \right\} \cos (N'_\mu - N'_\nu).$$

S' having the meaning given on page 12.

The only non-periodic terms in this expression will be those in which $\mu = \nu$, and these terms reduce to

$$- S' \left\{ i_j bk \frac{\partial k}{\partial a_k} + i_j k \frac{\partial (bk)}{\partial a_k} + \tfrac{1}{2} j_j b' k' \frac{\partial k'}{\partial a_k} + \tfrac{1}{2} j_j k \frac{\partial (b'k')}{\partial a_k} \right\}$$

$$= - S' \left\{ \frac{\partial (i_j bk^2)}{\partial a_k} + \tfrac{1}{2} \frac{\partial (j_j b' k'^2)}{\partial a_k} \right\}$$

or, by putting

$$c_j = S' \left\{ i_j bk^2 + \tfrac{1}{2} j_j b' k'^2 \right\} \tag{21}$$

we have

$$(a_k, l_j) = - \frac{\partial c_j}{\partial a_k}. \tag{22}$$

These expressions are now to be substituted in the differential equations represented by (15), which will then divide into two classes according as the derivative of Ω is taken with respect to $l_1, l_2 \ldots\ldots$ or l_{3n}, or with respect to $a_1, a_2 \ldots\ldots$ or a_{3n}. Having regard to equation (20) we find those of the first class to be of the form

$$(l_j, a_1) \frac{da_1}{dt} + (l_j, a_2) \frac{da_2}{dt} + \ldots\ldots + (l_j, a_{3n}) \frac{da_{3n}}{dt} = \frac{\partial \Omega}{\partial l_j} - \sum_{i=1}^{i=n}{}' \frac{\partial_2 \xi_i}{\partial t^2} \frac{\partial \xi_i}{\partial l_j}.$$

If, in the first member, we substitute for the coefficients their values (22), noticing that

$$(l_j, a_k) = -(a_k, l_j),$$

and in the second member put for brevity

$$\frac{\partial \Omega}{\partial l_j} - \Sigma_i \left\{ \frac{\partial^2 \xi_i}{\partial t^2} \frac{\partial \xi_i}{\partial l_j} + \frac{\partial^2 \eta_i}{\partial t^2} \frac{\partial \eta_i}{\partial l_j} + \frac{\partial^2 \zeta_i}{\partial t^2} \frac{\partial \zeta_i}{\partial l_j} \right\} = \Omega_j,$$

the differential equation reduces to

$$\frac{\partial c_j}{\partial a_1} \frac{da_1}{dt} + \frac{\partial c_j}{\partial a_2} \frac{da_2}{dt} + \ldots\ldots + \frac{\partial c_j}{\partial a_{3n}} \frac{da_{3n}}{dt} = \Omega_j,$$

or

$$\frac{dc_j}{dt} = \Omega_j. \tag{23}$$

By giving j all values in succession from 1 to $3n$, we shall have $3n$ equations to determine the variations of $c_1, c_2, \ldots\ldots c_{3n}$, from which the variations of $a_1, a_2, \ldots\ldots a_{3n}$ are to be obtained by the $3n$ equations (21). But, for our present purposes, it will be more convenient to consider the c's as the fundamental elements, and to consider $a_1, a_2, \ldots\ldots a_{3n}$ to be replaced by $c_1, c_2, \ldots\ldots c_{3n}$ in the original equations.

The second class of differential equations (15) will, by (19), be represented by

$$(a_k, l_1)\frac{dl_1}{dt} + (a_k, l_2)\frac{dl_2}{dt} + \text{etc.} = \frac{\partial\Omega}{\partial a_k} - \sum_{i=1}^{i=n}\left\{\frac{\partial^2\xi_i}{\partial t^2}\frac{\partial\xi_i}{\partial a_k} + \frac{\partial^2\eta_i}{\partial t^2}\frac{\partial\eta_i}{\partial a_k} + \frac{\partial^2\zeta_i}{\partial t^2}\frac{\partial\zeta_i}{\partial a_k}\right\}$$

Substituting for the coefficients in the first member their values (23), we shall have $3n$ equations represented by

$$\frac{\partial c_1}{\partial a_k}\frac{dl_1}{dt} + \frac{\partial c_2}{\partial a_k}\frac{dl_2}{dt} + \ldots\ldots = -\frac{\partial\Omega}{\partial a_k} + \sum_{i=1}^{i=n}\left\{\frac{\partial^2\xi_i}{\partial t^2}\frac{\partial\xi_i}{\partial a_k} + \text{etc.}\right\}$$

Putting k successively equal to $1, 2 \ldots\ldots 3n$, we shall have $3n$ equations of this form. Let us multiply the first of these equations by $\frac{\partial a_1}{\partial c_1}$, the second by $\frac{\partial a_2}{\partial c_1}$, the *ith* by $\frac{\partial a_i}{\partial c_1}$, and so on to the *3nth*, and add all the products, noticing that the theory of functional determinants gives

$$\sum_{i=1}^{i=3n}\frac{\partial c_j}{\partial a_i}\frac{\partial a_i}{\partial c_k} = +1 \text{ or } 0$$

according as k is or is not equal to j. Then, by putting

$$\frac{\partial\Omega}{\partial c_j} - \sum_{i=1}^{i=n}\left\{\frac{\partial^2\xi_i}{\partial t^2}\frac{\partial\xi_i}{\partial c_j} + \frac{\partial^2\eta_i}{\partial t^2}\frac{\partial\eta_i}{\partial c_j} + \frac{\partial^2\zeta_i}{\partial t^2}\frac{\partial\zeta_i}{\partial c_j}\right\} = \Omega'_j,$$

we shall have

$$\begin{aligned}\frac{dl_1}{dt} &= -\Omega'_1\\ \frac{dl_2}{dt} &= -\Omega'_2\\ &\vdots\\ \frac{dl_{3n}}{dt} &= -\Omega'_{3n}.\end{aligned} \qquad (24)$$

These $3n$ equations, combined with the $3n$ equations (23), will give, by simple integration by quadratures, the perturbation of the $6n$ constants, which, being substituted in the original equations (12), will give values of the variables which satisfy the original differential equations to terms one order higher than they were satisfied by (12) originally.

It will be observed that if our functions of the time and $6n$ arbitrary constants, which we have represented by ξ_i, η_i, and ζ_i, possessed the property that a function Ω_0 of ξ, η, and ζ could be found such that for all values of i

$$\frac{\partial^2\xi_i}{\partial t^2} = \frac{\partial\Omega_0}{\partial\xi_i};\quad \frac{\partial^2\eta_i}{\partial t^2} = \frac{\partial\Omega_0}{\partial\eta_i};\quad \frac{\partial^2\zeta_i}{\partial t^2} = \frac{\partial\Omega_0}{\partial\zeta_i}$$

we should have in (23) and (24) by putting $R = \Omega - \Omega_0$,

$$\Omega_j = \frac{\partial R}{\partial l_j}$$

$$\Omega'_j = \frac{\partial R}{\partial c_j}$$

§ 5. *Fundamental Relation between the Coefficients of the time, b_1, b_2, etc., considered as Functions of c_1, c_2, etc.*

In the preceding section we have found ourselves able to express the first approximate values of the variables in terms of $3n$ pairs of arbitrary constants

$$\begin{matrix} c_1 & l_1 \\ c_2 & l_2 \\ \vdots & \vdots \\ c_{3n} & l_{3n} \end{matrix}$$

in which the two members of each pair are *conjugate* to each other; or possess the property that the expressions (14) all vanish except when a_k and a_i represent the two members of a conjugate pair, in which case we have

$$(l_i, c_i) = +1. \qquad (25)$$

The distinguishing characteristic of the integrals we have been investigating is that they do not contain the time, except as multiplied by the $3n$ factors b, which are functions of the $3n$ constants c. This characteristic will enable us to deduce a fundamental relation between the differential coefficients of b with respect to c. In the first place, we remark that each c has a b to which it stands in a peculiar relation, in that the latter, multiplied by the time, is added to the l, which is conjugate to c to form the corresponding λ. The theorem in question is this: each b being supposed to be marked with the index of its corresponding c, we shall have for all values of i and j from 1 to $3n$,

$$\frac{\partial b_i}{\partial c_j} = \frac{\partial b_j}{\partial c_i};$$

in other words, the expression

$$\Sigma\, b_i dc_i$$

will be an exact differential.

It is quite possible that this theorem may admit of being deduced immediately from the preceding theory, but I have not succeeded in doing so, and have therefore been obliged to consider the problem in the reverse form. We have, in starting, supposed ourselves to have completely expressed the $3n$ co-ordinates ξ, η, ζ, as functions of the $6n$ quantities

$$a_1, a_2 \ldots\ldots a_{3n}, \lambda_1, \lambda_2 \ldots\ldots \lambda_{3n},$$

and we have just shown how to replace the first $3n$ quantities by the quantities $c_1, c_2 \ldots\ldots c_{3n}$. If we add to these the first derivatives of the co-ordinates (16) we shall have $6n$ variables, represented by $\xi_i, \eta_i, \zeta_i\, \xi'_i\, \eta'_i, \zeta'_i$, expressed as functions of the $6n$ quantities

$$c_1, c_2, c_3 \,.\,.\,.\,.\,.\, c_{3n}, \lambda_1, \lambda_2, \lambda_3 \,.\,.\,.\,.\,.\, \lambda_{3n}.$$

Let us now suppose these equations solved with respect to these last quantities. We shall then have $6n$ equations of the form

$$c_i = \phi_i\,;\ \lambda_i = \Psi_i, \text{ whence } l_i = \Psi_i - \bar{b}_i t, \qquad (26)$$

ϕ and Ψ being functions of ξ, η, ζ, etc. The first and third of these expressions are the $6n$ first integrals of the given equations, or, what we may call the integral functions, being those functions of the co-ordinates, and the time, which remain equal to arbitrary constants during the entire movement.

Let us now, for generality, once more represent the $6n$ arbitrary constants by

$$a_1, a_2, \,.\,.\,.\,.\,.\, a_{6n},$$

and let us consider the $(6n)^2$ quantities of Poisson formed from the general expression[1]

$$[a_\mu, a_\nu] = \Sigma'_k \left[\frac{\partial a_\mu}{\partial \xi_k}\frac{\partial a_\nu}{\partial \xi'_k} - \frac{\partial a_\mu}{\partial \xi'_k}\frac{\partial a_\nu}{\partial \xi_k}\right], \qquad (27)$$

the symbol Σ'_k including, as in (14), the $3n$ values of ξ, η, and ζ in succession. Putting the general expression (14) in the form

$$(a_i, a_j) = \Sigma'_s \left[\frac{\partial \xi_s}{\partial a_i}\frac{\partial \xi'_s}{\partial a_j} - \frac{\partial \xi'_s}{\partial a_i}\frac{\partial \xi_s}{\partial a_j}\right],$$

forming by multiplication the product of this expression by (27), then putting $\nu = j$, and forming the summation

$$\sum_{j=1}^{j=6n} (a_\mu, a_j)\ (a_i, a_j),$$

noticing also that the expression

$$\sum_{j=1}^{j=6n} \frac{\partial x}{\partial a_j}\frac{\partial a_j}{\partial y}$$

is equal to unity whenever x and y represent the same symbol, and to zero in the opposite case, we find

$$\sum_1^{6n}{}_j (a_i, a_j)\ [a_\mu, a_j] = \Sigma_s \left[\frac{\partial \xi_s}{\partial a_i}\frac{\partial a_\mu}{\partial \xi_s} + \frac{\partial \xi'_s}{\partial a_i}\frac{\partial a_\mu}{\partial \xi'_s}\right],$$

an expression which is itself equal to unity when $\mu = i$, and which vanishes in all other cases.

Now a_i, a_j, and a_μ may here be any of the $6n$ arbitrary constants. Let us then suppose a_i, a_μ to represent l_i and l_μ respectively, and a_j to represent c_j. This equation will then become

$$(l_i, c_1)\ [l_\mu, c_1] + (l_i, c_2)\ [l_\mu, c_2] + (l_i, c_3)\ [l_\mu, c_3] + \text{etc.} = 1 \text{ or } 0$$

---

[1] It will be observed that the notations introduced by Lagrange and Poisson respectively, are here reversed, a proceeding which was not intentional on the part of the writer

according as i and μ represent the same or different indices. But we have already found that the expression $(l_i\, c_j)$ vanishes whenever i is different from j, and reduces to unity when those indices are equal. The equations we are considering thus become

$$[l_i, c_i] = 1, \qquad (28)$$

while all other combinations $[l_i, c_j]$, $[l_i, l_j]$ and $[c_i, c_j]$ vanish.

Let us now return to the integral equations (26), and first form the combination

$$[l_i, c_j] = \Sigma_k \left[\left(\frac{\partial \Psi_i}{\partial \xi_k} - t\,\frac{\partial b_i}{\partial \xi_k}\right)\frac{\partial \phi_j}{\partial \xi'_k} - \left(\frac{\partial \Psi_i}{\partial \xi'_k} - t\,\frac{\partial b_i}{\partial \xi'_k}\right)\frac{\partial \phi_j}{\partial \xi_k}\right]$$

$$= [\Psi_i, \phi_j] - t\,[b_i, \phi_j].$$

The conditions (28) therefore give

$$[\Psi_i, \phi_j] = 0$$

and $\qquad (29)$

$$[\Psi_i, \phi_i] = 1,$$

the first equation applying whenever j is different from i, the second when they are the same.

Let us next consider the combination $[l_i, l_j]$ which we know must vanish for all values of i and j. Forming the general expression (27) from the integrals (26), we find:—

$$[l_i, l_j] = [\Psi_i, \Psi_j] - t\,\Big\{[b_i, \Psi_j] - [b_j, \Psi_i]\Big\} + t^2\,[b_i, b_j] = 0.$$

This equation being identically zero, the coefficient of each power of t must vanish identically. This gives, in the case of the middle term,

$$[b_i, \Psi_j] = [b_j, \Psi_i]. \qquad (30)$$

Forming these expressions by the general formula (27), and putting

$$\frac{\partial b_i}{\partial \xi} = \Sigma_k \frac{\partial b_i}{\partial c_k}\,\frac{\partial c_k}{\partial \xi},$$

we find

$$[b_i, \Psi_j] = \sum_1^{3n}{}_k \Big[\phi_k, \Psi_j\Big]\frac{\partial b_i}{\partial c_k}$$

$$[b_j, \Psi_i] = \sum_1^{3n}{}_k \Big[\phi_k, \Psi_i\Big]\frac{\partial b_j}{\partial c_k}.$$

By (29) all the terms of these expressions vanish except that one in the first equation in which $k = j$, and that one in the second in which $k = i$, in both of which the first coefficient reduces to -1. Hence

$$[b_i, \Psi_j] = -\frac{\partial b_i}{\partial c_j}$$

$$[b_j, \Psi_i] = -\frac{\partial b_j}{\partial c_i},$$

and (30) now gives

$$\frac{\partial b_i}{\partial c_j} = \frac{\partial b_j}{\partial c_i}. \qquad (31)$$

§ 6. *Development of* Ω, Ω_j, *and* Ω'_j.

We have next to find the forms of the expressions Ω_j and Ω'_j which enter into the equations (23) and (24). In the first place we have

$$\Omega = \sum_1^n {}^2_{i,j} \frac{m_i m_j}{\sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^2}}.$$

We now substitute for x, y, and z their expressions (9) as linear functions of ξ, η, and ζ respectively. By this substitution we shall introduce no terms of the form $\xi\eta$, $\eta\zeta$, or $\zeta\xi$. Hence, when we substitute for ξ, η, and ζ, their expressions in infinite periodic series, the reduced expressions will contain cosines only. In fact, using the forms

$$\xi_i = Sk_i \cos N$$
$$\eta_i = Sk_i \sin N$$
$$\zeta_i = Sk'_i \sin N',$$

we shall have from (12) when we put for brevity

$$\left(\frac{\alpha_{1i}}{m_i} - \frac{\alpha_{1j}}{m_j}\right)k_1 + \left(\frac{\alpha_{2i}}{m_i} - \frac{\alpha_{2j}}{m_j}\right)k_2 + \text{etc.} \ldots = k_{ij},$$

$$\begin{aligned} x_i - x_j &= Sk_{ij} \cos N; \\ y_i - y_j &= Sk_{ij} \sin N; \\ z_i - z_j &= Sk'_{ij} \sin N'. \end{aligned} \qquad (32)$$

Each denominator in Ω will therefore assume the form

$$\sqrt{(Sk \cos N)^2 + (Sk \sin N)^2 + (Sk' \sin N')^2}.$$

When we form these three squares we find that every term of the form h cos $(N_\mu + N_\nu)$ in the first square is destroyed by a corresponding term $-h \cos (N_\mu + N_\nu)$ in the second square. Hence the sum of these two squares will only contain terms of the form

$$h \cos (N_\mu - N_\nu).$$

Since in each value (15) of N we have

$$i_1 + i_2 + i_3 + \ldots\ldots + i_{3n} = 1,$$

we shall have in $N_\mu - N_\nu$

$$\Sigma i = 0.$$

Also, since in N' the sum of these coefficients is zero, it follows that the same thing will hold true of the third of the preceding squares. The denominator in question may therefore be expressed in the form

$$\sqrt{Sk \cos N},$$

in which each N is of the form

$$i_1\lambda_1 + i_2\lambda_2 + \ldots\ldots + i_{3n}\lambda_{3n},$$

where

$$i_1 + i_2 + i_3 + \ldots\ldots + i_{3n} = 0.$$

The possibility of developing the reciprocal of this denominator in the usual way depends upon the condition that the constant term of $Sk \cos N$ is larger than the sum of the coefficients of all the other terms, a condition which, so far as we yet know, is fulfilled by all the planets and satellites of our system. Representing this constant term by k_0, and the quotient of the sum of all the other terms divided by k_0 by Δ, so that

$$Sk \cos N = k_0(1 + \Delta)$$

the developed expression for Ω will be

$$\Omega = \Sigma \frac{m_i m_j}{k_0^{\frac{1}{2}}} (1 - \tfrac{1}{2}\Delta + \frac{1.3}{2.4}\Delta^2 - \text{etc.}).$$

When we develop the powers of Δ this equation will reduce itself to the form

$$\Omega = Sh \cos (i_1\lambda_1 + i_2\lambda_2 + i_3\lambda_3 + \ldots\ldots + i_{3n}\lambda_{3n}), \qquad (33)$$

each λ being, as before, of the form

$$\lambda_i = l_i + b_i t,$$

while in each term

$$i_1 + i_2 + i_3 + \ldots\ldots + i_{3n} = 0.$$

To form the second part of Ω_j and of Ω'_j in (23) and (24) we have to differentiate the expressions (12) twice with respect to the time, and once with respect to the arbitrary constants which enter into them. Putting, as before, for brevity,

$$N = i_1\lambda_1 + i_2\lambda_2 + \ldots\ldots + i_{3n}\lambda_{3n}$$
$$b = i_1 b_1 + i_2 b_2 + \ldots\ldots + i_{3n} b_{3n},$$

we have

$$\frac{\partial^2 \xi_i}{\partial t^2} = - S b^2 k_i \cos N$$
$$\frac{\partial^2 \eta_i}{\partial t^2} = - S b^2 k_i \sin N \qquad (34)$$
$$\frac{\partial_2 \zeta_i}{\partial t^2} = - S b'^2 k'_i \sin N'.$$

For the other derivatives which enter into Ω'_j we have

$$\frac{\partial \xi_i}{\partial l_j} = - S i_j\, k_i \sin N$$
$$\frac{\partial \eta_i}{\partial l_j} = S i_j\, k_i \cos N \qquad (34)'$$
$$\frac{\partial \zeta_i}{\partial l_j} = S j_j k'_i \cos N'.$$

Forming the sum of the products which enter into Ω_j, in the manner represented in § 4, it becomes

$$\sum_{i=1}^{i=n} S_\mu S_\nu \Big\{ (i_j k_i)_\nu (b^2 k_i)_\mu \sin (N_\nu - N_\mu)$$
$$+ \tfrac{1}{2}(j_j k'_i)_\nu\, (b'^2 k'_i)_\mu\, (\sin (N'_\nu - N'_\mu) - \sin (N'_\nu + N'_\mu)) \Big\}. \quad (35)$$

This expression reduces to the form $S H \cos N$, where in each value of N we have

$$\Sigma i = 0.$$

In this expression it may be worth while to give the complete value of H corresponding to any value of N. The value of the latter is completely determined by the indices i_1, i_2, etc., which multiply λ_1, λ_2, etc., in its expression. Let then

$$N = i_1\lambda_1 + i_2\lambda_2 + i_3\lambda_3 + \ldots\ldots + i_{3n}\lambda_{3n}$$

represent the value of N for which we wish to find the corresponding value of $H_j(i_1 i_2 i_3 \ldots\ldots i_{3n})$ by means of (35). The required term will be found by taking in (35) all combinations of ν and μ for which we have

$$N_\nu - N_\mu = N,$$
$$N'_\nu - N'_\mu = N,$$
$$\text{or } N'_\nu + N'_\mu = N.$$

Let us represent the combination of indices ν in N_ν by k_1, k_2, etc., and those in N'_ν by j_1, j_2, etc., so that we have

$$N_\nu = \mu_1\lambda_1 + \mu_2\lambda_2 + \ldots\ldots + \mu_{3n}\lambda_{3n},$$
$$N'_\nu = j_1\lambda_1 + j_2\lambda_2 + \ldots\ldots + j_{3n}\lambda_{3n}.$$

Then, in order that the sum or difference of these angles and of N_μ may make N, according to the formulæ just written, we must have

$$N_\mu = (\mu_1 - i_1)\lambda_1 + (\mu_2 - i_2)\lambda_2 + \ldots\ldots + (\mu_{3n} - i_{3n})\lambda_{3n},$$

and

$$N'_\mu = (j_1 - i_1)\lambda_1 + (j_2 - i_2)\lambda_2 + \ldots\ldots + (j_{3n} - i_{3n})\lambda_{3n},$$

or

$$N'_\mu = (i_1 - j_1)\lambda_1 + (i_2 - j_2)\lambda_2 + \ldots\ldots + (i_{3n} - j_{3n})\lambda_{3n}.$$

For the corresponding coefficients of the time b, we have

$$b_\mu = (\mu_1 - i_1)b_1 + (\mu_2 - i_2)b_2 + \ldots\ldots + (\mu_{3n} - i_{3n})b_{3n}$$
$$b'_\mu \pm (j_1 - i_1)b_1 \pm (j_2 - i_2)b_2 \pm \ldots\ldots \pm (j_{3n} - i_{3n})b_{3n}.$$

Affecting k and k' with the proper indices, as explained in § 4, the part of the coefficient $H_j(i_1, i_2 \ldots\ldots i_{3n})$ corresponding to any one value of the angle N_ν, will be

$$\sum_{i=1}^{i=n} \mu_j k_i(\mu_1, \mu_2, \ldots\ldots)\, k_i(\mu_1 - i_1, \mu_2 - i_2, \ldots\ldots)\, b_\mu^2$$
$$+ \tfrac{1}{2} \sum_{i=1}^{i=n} j_j k'_i(j_1, j_2, \ldots\ldots) b'^2_\mu \left\{ k'_i(j_1 - i_1, j_2 - i_2, \ldots\ldots) - k'_i(i_1 - j_1, i_2 - j_2, \ldots\ldots) \right\}$$

where the values of b_μ and b'_μ are those just given. The complete value of $H_j(i_1, i_2, \ldots)$ will be found by taking the sum of all the terms which we can form by giving to μ_1, μ_2, etc., j_1, j_2, $\ldots\ldots j_{3n}$, in these expressions, all admissible combinations of values, that is, the complete expression will be given by writing before the first line the symbols

$$\sum_{\mu_1=-\infty}^{\mu_1=\infty} \; \sum_{\mu_2=-\infty}^{\mu_2=\infty} \; \ldots\ldots \; \sum_{\mu_{3n}=-\infty}^{\mu_{3n}=\infty}$$

and before the second one

$$\sum_{j_1=-\infty}^{j_1=\infty} \quad \sum_{j_2=-\infty}^{j_2=\infty} \cdots\cdots \sum_{j_{3n}=-\infty}^{j_{3n}=\infty}$$

Differentiating (33) with respect to l_j, we have

$$\frac{\partial \Omega}{\partial l_j} = - S i_j h \sin N. \tag{36}$$

By the substitution of these expressions (23) now assumes the form

$$\frac{dc_j}{dt} = - S h'_j \sin N, \tag{37}$$

putting for brevity

$$h' = i_j h + H_j.$$

By the fundamental hypothesis that the adopted expressions for ξ, η, and ζ are first approximations to the true values of those quantities, it follows that in adding (35) and (36) all the terms which are not of the order of those neglected in the first approximation destroy each other, so that h' is of the order of the quantities neglected in that approximation.

To form the equations (24) we differentiate (12) with respect to c, whereby, omitting the index i with which ξ, η, ζ, k, and k' are always to be considered as affected, we find

$$\begin{aligned} \frac{\partial \xi}{\partial c_j} &= S \frac{\partial k}{\partial c_j} \cos N + t\, S k \frac{\partial b}{\partial c_j} \sin N \\ \frac{\partial \eta}{\partial c_j} &= S \frac{\partial k}{\partial c_j} \sin N + t\, S k \frac{\partial b}{\partial c_j} \cos N \\ \frac{\partial \zeta}{\partial c_j} &= S \frac{\partial k'}{\partial c_j} \sin N' + t\, S k \frac{\partial b'}{\partial c_j} \cos N'. \end{aligned} \tag{37'}$$

The sum of the products of these expressions by (34) which enter into (24) is

$$\begin{aligned} -\sum_{i=1}^{i=n} S^2_{\mu,\nu} \Big\{ & (b^2 k)_\mu \frac{\partial k_\nu}{\partial c_j} \cos (N_\nu - N_\mu) - t\, (b^2 k)_\mu \frac{\partial b_\nu}{\partial c_j} \sin (N_\nu - N_\mu) \\ & + \tfrac{1}{2} (b'^2 k')_\mu \frac{\partial k'_\nu}{\partial c_j} \Big(\cos (N'_\nu - N'_\mu) - \cos (N'_\nu + N'_\mu) \Big) \\ & - \tfrac{1}{2} t\, (b'^2 k')_\mu \frac{\partial b'_\nu}{\partial c_j} \Big(\sin (N_\nu - N_\mu) - \sin (N'_\nu + N'_\mu) \Big) \Big\}, \end{aligned}$$

while by differentiating (33) we find

$$\frac{\partial \Omega}{\partial c_j} = S \Big(\frac{\partial h}{\partial c_j} \cos N - t\, h \frac{\partial b}{\partial c_j} \sin N \Big). \tag{37''}$$

Taking the difference of these two expressions, the equations (24) will assume the form

$$\frac{dl_i}{dt} = - S h'' \cos N + t\, S h''' \sin N. \tag{38}$$

the quantities h'' and h''' being formed by a process similar to that used in forming h'. We have now to integrate the expressions (37) and (38), and substitute the resulting values of c_i and l_i in the expressions (12). Representing the perturbations of each quantity by the sign δ, we shall have to increase each value of λ by the quantity

$$\delta\lambda_i = \delta l_i + t\delta b_i.$$

We here have the time t outside the signs *sin* or *cos* in both δl_i, from the integration of (38), and in $t\delta b_i$. We must next find the sum of the terms thus introduced into $\delta\lambda_i$. Differentiating this expression we have

$$\delta\frac{d\lambda_i}{dt} = \frac{dl_i}{dt} + t\,\frac{db_i}{dt} + \delta b_i. \tag{39}$$

We have now to form the sum of the terms in the second member of this equation which are multiplied by t. Beginning with the second, we have, omitting the index of b

$$\frac{db}{dt} = \frac{\partial b}{\partial c_1}\frac{dc_1}{dt} + \frac{\partial b}{\partial c_2}\frac{dc_2}{dt} + \text{etc.}$$

Substituting for $\frac{dc_i}{dt}$ their values in (37), this equation becomes

$$\frac{db}{dt} = S\left\{ h'_1\frac{\partial b}{\partial c_1} + h'_2\frac{\partial b}{\partial c_2} + \dots\dots + h_{3n}\frac{\partial b}{\partial c_{3n}} \right\} \sin N,$$

which, after multiplying by t, is to be added to the last member of (38). But it will be more convenient, instead of using h' and h''' in these expressions, to retain the expressions $\frac{d^2\xi}{dt^2}$, $\frac{d^2\eta}{dt^2}$, and $\frac{d^2\zeta}{dt^2}$ in their present analytical form. Representing them, for brevity, by ξ'', η'', and ζ'', the equations (23) and (24) become

$$\begin{aligned} \frac{dc_j}{dt} &= \frac{\partial\Omega}{\partial l_j} - \sum_{i=1}^{i=n}\left\{ \xi''_i\frac{\partial\xi_i}{\partial l_j} + \eta''_i\frac{\partial\eta_i}{\partial l_j} + \zeta''_i\frac{\partial\zeta_i}{\partial l_j} \right\} \\ \frac{dl_j}{dt} &= -\frac{\partial\Omega}{\partial c_j} + \sum_{i=1}^{i=n}\left\{ \xi''_i\frac{\partial\xi_i}{\partial c_j} + \eta''_i\frac{\partial\eta_i}{\partial c_j} + \zeta''_i\frac{\partial\zeta_i}{\partial c_j} \right\}. \end{aligned} \tag{40}$$

If in the first of these equations we substitute for the derivatives their values in (34)′ and (36), it becomes

$$\frac{\partial c_j}{dt} = -\,S\left\{ i_j h - \Sigma(\xi''_i i_j k_i) \right\} \sin N + \Sigma(\eta''_i i_j k_i)\cos N + \Sigma(\zeta''_i j_j k'_i)\cos N'.$$

Substituting in the first of the above expressions for $\frac{db}{dt}$, we have

$$\begin{aligned} \frac{db}{dt} = &-S\left\{ i_1\frac{\partial b}{\partial c_1} + i_2\frac{\partial b}{\partial c_2} + \dots\dots + i_{3n}\frac{\partial b}{\partial c_{3n}} \right\} h\sin N \\ &+ S\left\{ \Sigma k_i\xi''_i\left(i_1\frac{\partial b}{\partial c_1} + i_2\frac{\partial b}{\partial c_2} + \dots\dots + i_{3n}\frac{\partial b}{\partial c_{3n}} \right) \right\} \sin N \\ &- S\left\{ \Sigma k_i\eta''_i\left(i_1\frac{\partial b}{\partial c_1} + i_2\frac{\partial b}{\partial c_2} + \dots\dots + i_{3n}\frac{\partial b}{\partial c_{3n}} \right) \right\} \cos N \\ &- S\left\{ \Sigma k'_i\zeta''_i\left(j_1\frac{\partial b}{\partial c_2} + j_2\frac{\partial b}{\partial c_2} + \dots\dots + j_{3n}\frac{\partial b}{\partial c_{3n}} \right) \right\} \cos N'. \end{aligned} \tag{41}$$

We have next, in the second of equations (40) to substitute the expressions for the derivatives in (37)′ and (37)″, retaining only the terms multiplied by t. This gives by substituting for b its developed expression

$$b = i_1 b_1 + i_2 b_2 + \ldots\ldots + i_{3n} b_{3n}$$

$$\begin{aligned}
\frac{1}{t}\frac{dl_i}{dt} = & \; S\left\{ i_1 \frac{\partial b_1}{\partial c_i} + i_2 \frac{\partial b_2}{\partial c_i} + \ldots\ldots + i_{3n} \frac{\partial b_{3n}}{\partial c_i} \right\} h \sin N \\
& - S\left\{ \Sigma \xi''_i k_i \left(i_1 \frac{\partial b_1}{\partial c_i} + i_2 \frac{\partial b_2}{\partial c_i} + \ldots\ldots + i_{3n} \frac{\partial b_{3n}}{\partial c_i} \right) \right\} \sin N \\
& + S\left\{ \Sigma \eta''_i k_i \left(i_1 \frac{\partial b_1}{\partial c_i} + i_2 \frac{\partial b_2}{\partial c_i} + \ldots\ldots + i_{3n} \frac{\partial b_{3n}}{\partial c_i} \right) \right\} \cos N \\
& + S\left\{ \Sigma \zeta''_i k'_i \left(j_1 \frac{\partial b_1}{\partial c_i} + j_2 \frac{\partial b_2}{\partial c_i} + \ldots\ldots + j_{3n} \frac{\partial b_{3n}}{\partial c_i} \right) \right\} \cos N'.
\end{aligned} \qquad (42)$$

Adding this expression to (41), we find that the sum reduces to a series of terms each of which has a factor of the form

$$\frac{\partial b_i}{\partial c_j} - \frac{\partial b_j}{\partial c_i}.$$

By (31′) these factors are all zero. Hence the terms of (39) multiplied by t destroy each other, and we have

$$\delta \frac{d\lambda_i}{dt} = \left(\frac{dl_i}{dt}\right) + \delta b_i, \qquad (43)$$

the parenthesis around $\frac{dl_i}{dt}$ indicating that all the terms multiplied by the time in that expression are to be omitted; in other words, that, in taking the derivatives of Ω, ξ, η, and ζ with respect to c_i, we are only to consider the coefficients h, k, and k' as functions of these quantities, and are not to vary b_1, b_2, etc.

§ 7. *Form of the Second Approximation.*

The rest of our process is now as follows: By integrating (37) and (38), the last member of (38) being omitted, we have

$$\delta c_j = S \frac{h'_j}{b} \cos N$$

$$(\delta l_j) = - S \frac{h''_j}{b} \sin N.$$

The co-ordinates ξ, η, and ζ in (12) being expressed as functions of the quantities c_j and l_j, we are to suppose these quantities increased by their perturbations, that is, we are to find

$$\delta\xi = \Sigma \frac{\partial \xi}{\partial c_j} \delta c_j + \Sigma \frac{\partial \xi}{\partial l_j} \delta l_j,$$

or, since we have replaced l_i by λ_i,

$$\delta\xi = \Sigma \frac{\partial \xi}{\partial c_j} \delta c_j + \Sigma \frac{\partial \xi}{\partial \lambda_j} \delta \lambda_j.$$

In (43) we have

$$\delta b_i = \Sigma_j \frac{\partial b_i}{\partial c_j} \delta c_j = S \sum_{j=1}^{j=3n} \frac{h'_j}{b} \frac{\partial b_i}{\partial c_j} \cos N,$$

and, integrating,

$$\delta \lambda_i = (\delta l_i) + \int \delta b_i dt$$
$$= - S \left\{ \frac{h''_i}{b} - \sum_{j=1}^{j=3n} \frac{h'_j}{b^2} \frac{\partial b^i}{\partial c_j} \right\} \sin N,$$

which, for brevity, we may represent by

$$\delta \lambda_i = S_\nu L_i \sin N, \tag{44}$$

putting

$$L_i = - \frac{h''_i}{b} + \sum_{j=1}^{j=3n} \frac{h'_j}{b^2} \frac{\partial b_i}{\partial c_j}.$$

In adding the effect of the perturbations δc_i to ξ, η, and ζ, we are to vary only k, the expressions for $\delta\xi$, etc., being

$$\delta\xi = S_\mu \left\{ \delta k \cos N - k \sin N (i_1 \delta\lambda_1 + i_2 \delta\lambda_2 + \ldots\ldots + i_{3n} \delta\lambda_{3n}) \right\}$$
$$\delta\eta = S_\mu \left\{ \delta k \sin N + k \cos N (i_1 \delta\lambda_1 + i_2 \delta\lambda_2 + \ldots\ldots + i_{3n} \delta\lambda_{3n}) \right\}$$
$$\delta\zeta = S_\mu \left\{ \delta k' \sin N' + k' \cos N' (j_1 \delta\lambda_1 + j_2 \delta\lambda_2 + \ldots\ldots + j_{3n} \delta\lambda_{3n}) \right\}$$

We are to put in these expressions

$$\delta k = \Sigma_i \frac{\partial k}{\partial c_i} \delta c_i$$
$$= S_\nu \left(\Sigma_i \frac{h'_i}{b} \frac{\partial k'}{\partial c_i} \right) \cos N, \tag{45}$$

and the values of $\delta\lambda$ in (44). We thus find

$$\delta\xi = \tfrac{1}{2} S^2_{\mu,\nu} \left\{ \Sigma_i \left(\frac{h'_i}{b} \frac{\partial k}{\partial c_i} \right)_\nu + k_\mu (i_1 L_1 + i_2 L_2 + \ldots\ldots + i_{3n} L_{3n})_\nu \right\} \cos (N_\mu + N_\nu)$$
$$+ \tfrac{1}{2} S^2_{\mu,\nu} \left\{ \Sigma_i \left(\frac{h'_i}{b} \frac{\partial k}{\partial c_i} \right)_\nu - k_\mu (i_1 L_1 + i_2 L_2 + \ldots\ldots + i_{3n} L_{3n})_\nu \right\} \cos (N_\mu - N_\nu)$$

$$\delta\eta = \tfrac{1}{2} S^2_{\mu,\nu} \left\{ \Sigma_i \left(\frac{h'_i}{b} \frac{\partial k}{\partial c_i} \right)_\nu + k_\mu (i_1 L_1 + i_2 L_2 + \ldots\ldots + i_{3n} L_{3n})_\nu \right\} \sin (N_\mu + N_\nu)$$
$$+ \tfrac{1}{2} S^2_{\mu,\nu} \left\{ \Sigma_i \left(\frac{h'_i}{b} \frac{\partial k}{\partial c_i} \right)_\nu - k_\mu (i_1 L_1 + i_2 L_2 + \ldots\ldots + i_{3n} L_{3n})_\nu \right\} \sin (N_\mu - N_\nu)$$

$$\delta\zeta = \tfrac{1}{2} S^2_{\mu,\nu} \left\{ \Sigma_i \left(\frac{h'_i}{b} \frac{\partial k'}{\partial c_i} \right)_\nu + k'_\mu (j_1 L_1 + j_2 L_2 + \ldots\ldots + j_{3n} L_{3n})_\nu \right\} \sin (N'_\mu + N_\nu)$$
$$+ \tfrac{1}{2} S^2_{\mu,\nu} \left\{ \Sigma_i \left(\frac{h'_i}{b} \frac{\partial k'}{\partial c_i} \right)_\nu - k'_\mu (j_1 L_1 + j_2 L_2 + \ldots\ldots + j_{3n} L_{3n})_\nu \right\} \sin (N'_\mu - N_\nu)$$

Since, in N_μ we have $\Sigma i = 1$,
while in N_ν " " $\Sigma i = 0$,

it follows that all these terms will be of the same form with those already contained in ξ, η, and ζ (12).

In the preceding integration we have tacitly supposed the coefficient of the time, b, never to vanish in any case. But some of the values of N will necessarily be zero, and in this case, instead of having

$$\int k\, dt \cos N = \frac{k}{b} \sin N,$$

we must put

$$\int k\; dt \cos N = kt.$$

The only terms of this form are found in δl. If, in (38), we represent the coefficient of the vanishing term by h''_0, we shall have for the terms in question

$$\delta l = -h''_0 t.$$

This adds to λ the same expression, and is equivalent to diminishing b by the quantity h''_0. We make this change not only in the original terms of ξ, η, and ζ, but also in the terms of $\delta\xi$, $\delta\eta$, and $\delta\zeta$, because the change will only affect them by quantities of the second order, which we have rejected throughout.

Making these changes, the expressions

$$\xi + \delta\xi, \qquad \eta + \delta\eta, \qquad \text{and } \zeta + \delta\zeta,$$

will now satisfy the differential equations (11) to quantities of the second order, while their form will still be in all respects the same as in (12). As we have made this one approximation without changing the form of the original integrals, so may we make any number of successive approximations. We may, therefore, regard the form

$$\begin{aligned}\xi &= Sk \cos (i_1\lambda_1 + i_2\lambda_2 + \ldots\ldots + i_{3n}\lambda_{3n})\\ \eta &= Sk \sin (i_1\lambda_1 + i_2\lambda_2 + \ldots\ldots + i_{3n}\lambda_{3n})\\ \zeta &= Sk' \sin (j_1\lambda_1 + j_2\lambda_2 + \ldots\ldots + j_{3n}\lambda_{3n}),\end{aligned}$$

where each λ is of the form

$$\lambda_i = l_i + b_i t,$$

l_i being an arbitrary constant, and k, k', and b_i being each functions of $3n$ other arbitrary constants, while

$$\begin{aligned} i_1 + i_2 + \ldots\ldots + i_{3n} &= 1,\\ \text{and } j_1 + j_2 + \ldots\ldots + j_{3n} &= 0,\end{aligned}$$

in each separate term under the sign S, to be a general form in which the relative co-ordinates of n planets, revolving in nearly circular orbits with a nearly uniform motion, may be developed when the approximations are continued indefinitely. This may, therefore, be regarded as the general form of the integrals of planetary motion.

§ 8. *General Theorem.*

If we express the relative living force of the entire system in terms of the canonical elements, the coefficients of the time b_1, b_2, ... b_{3n} will each be equal to the negative *of the derivative of the constant term of the living force with respect to its corresponding canonical element.* That is to say, if we represent the constant term of the living force by V, and suppose V to be expressed in terms of the canonical elements, we shall have

$$b_1 = -\frac{\partial V}{\partial c_1}$$
$$b_2 = -\frac{\partial V}{\partial c_2}$$
$$\vdots \qquad \vdots$$
$$b_{3n} = -\frac{\partial V}{\partial c_{3n}}.$$

From the expressions (9) for x, and the corresponding expressions for y and z, it will be seen that the expression for the relative living force is

$$\begin{aligned} &\tfrac{1}{2}\left(\frac{\alpha_{10}}{\sqrt{m_0}}\xi'_1 + \frac{\alpha_{20}}{\sqrt{m_0}}\xi'_2 + \ldots\ldots\right)^2 \\ + &\tfrac{1}{2}\left(\frac{\alpha_{11}}{\sqrt{m_1}}\xi'_1 + \frac{\alpha_{21}}{\sqrt{m_1}}\xi'_2 + \ldots\ldots\right)^2 \\ + &\quad \text{etc.} \qquad \text{etc.} \qquad \text{etc.} \\ + &\text{ corresponding terms in } \eta' \text{ and } \zeta'. \end{aligned}$$

Here the coefficients of ξ', etc., are those which we have shown to form an orthogonal system, and, by the properties of such a system, the expression reduces to

$$\tfrac{1}{2}\,\Sigma_i\,(\xi'^2_i + \eta'^2_i + \zeta'^2_i).$$

Substituting for ξ', η', and ζ' their periodic expressions

$$\begin{aligned} \xi' &= -\,Sbk \sin N \\ \eta' &= \quad Sbk \cos N \\ \zeta' &= \quad Sb'k' \cos N', \end{aligned}$$

the constant term of the living force is found to be

$$V = \tfrac{1}{2}\,S'(b^2k^2 + \tfrac{1}{2}\,b'^2k'^2),$$

the sign S' having the signification given on page 12. Compare this expression with that of c_i in (21). Multiply each c_i by its corresponding b_i, and add all the products, remembering that

$$b = i_1b_1 + i_2b_2 + \text{etc. for } \xi \text{ and } \eta, \text{ and}$$
$$b = j_1b_1 + j_2b_2 + \text{etc. for } \zeta.$$

We thus find, from the expression for V just given,

$$2\,V = b_1c_1 + b_2c_2 + b_3c_3 + \ldots\ldots + b_{3n}c_{3n}.$$

Differentiating this expression with respect to c_i and substituting $\frac{\partial b_i}{\partial c_j}$ for $\frac{\partial b_j}{\partial c_i}$, we have

$$2\frac{\partial V}{\partial c_i} = b_i + c_1\frac{\partial b_i}{\partial c_1} + c_2\frac{\partial b_i}{\partial c_2} + \ldots\ldots + c_{3n}\frac{\partial b_i}{\partial c_{3n}}. \qquad (46)$$

We have now to show that b is a homogeneous function of the degree -3 in $(c_1, c_2, \ldots\ldots c_{3n})$. Let us represent such a function of the nth degree by $[c^{(n)}]$.

Let us represent the linear elements of the system by a_1, a_2, etc. Since x, y, z, and ξ, η, ζ, are all linear co-ordinates, we have in the expressions (16) of the latter

$$k = [a^{(1)}].$$

Every time we differentiate these expressions with respect to the time, we multiply the coefficients by b, a linear function of b_1, b_2, etc. Hence

$$\frac{d^2\xi}{dt^2} = [a^{(1)}, b^{(2)}].$$

The form of the potential Ω shows that

$$\Omega = [a^{(-1)}],$$

a result which arises from the law of attraction proportional to the inverse square of the distance. Whence

$$\frac{\partial \Omega}{\partial \xi} = [a^{(-2)}].$$

In order that the differential equation $\frac{d^2\xi}{dt^2} = \frac{\partial \Omega}{\partial \xi}$ may be satisfied identically we must have

$$[a^{(1)}, b^{(2)}] = [a^{(-2)}],$$

or

$$b^{(2)} = [a^{(-3)}] \text{ or } b = [a^{(-\frac{3}{2})}].$$

The expression (21) for c_i, k being linear in a, is of the form

$$c_i = [b^{(1)}\ a^{(2)}] = [a^{(\frac{1}{2})}] = [b^{(-\frac{1}{3})}].$$

Hence, when we express b_i in terms of c_1, c_2, etc., we must have

$$b_i = [c^{(-3)}].$$

The fundamental property of homogeneous functions now gives

$$\Sigma_j\, c_j \frac{\partial b_i}{\partial c_j} = -3b_i.$$

Substituting in (46), we find

$$b_i = -\frac{\partial V}{\partial c_i},$$

which is the theorem enunciated.

This theorem cannot be directly employed to obtain the values of b_i, for the reason that V cannot be determined as a function of the canonical constants until the equations of motion are completely integrated.

§ 9. *Summary of Results.*

The following is a brief summary of some of the results which follow from the preceding investigation.

We first suppose that we have found expressions for ξ, η, and ζ of the form (12), such as identically satisfy the differential equations (11). We also conceive the quantities k and b as expressed in terms of $3n$ canonical constants $c_1, c_2, c_3 \ldots\ldots c_{3n}$, so chosen that the expression

$$(c_j, l_k) = \sum_{i=1}^{i=n} \left\{ \frac{\partial \xi_i}{\partial c_j} \frac{\partial \xi'_i}{\partial l_k} - \frac{\partial \xi'_i}{\partial c_k} \frac{\partial \xi'_i}{\partial l_j} + \frac{\partial \eta_i}{\partial c_j} \frac{\partial \eta'_i}{\partial l_k} - \text{etc.} \right\}$$

shall reduce to unity when $k = j$, and shall vanish whenever any other of the $6n$ quantities $c_1 \ldots\ldots c_{3n}$, $l_1 \ldots\ldots l_{3n}$ is substituted for l_k. Then:—

Theorem I.—If, taking the entire series of $3n$ co-ordinates represented by $\xi_1 \ldots\ldots \xi_n, \eta_1 \ldots\ldots \eta_n, \zeta_1 \ldots\ldots \zeta_n$, we multiply the square of each coefficient k by the coefficient of the time in the corresponding angle $i_1\lambda_1 + i_2\lambda_2 +$ etc. (that is, by the corresponding quantity $i_1b_1 + i_2b_2 +$ etc., or $j_1b_1 + j_2b_2 +$ etc.), and by the coefficient i_j or j_j of any one of the λ's, as λ_j, which λ is to be the same throughout, then all the constants c, except c_j, will identically disappear from the sum of all these products, which sum will reduce identically to $2c_j$. This theorem is expressed in equation (21).

Theorem II.—The $3n$ coefficients of the time, b_1, b_2, etc., considered as functions of c_1, c_2, etc., fulfil the $\frac{3n(3n-1)}{2}$ conditions expressed by

$$\frac{\partial b_i}{\partial c_j} = \frac{\partial b_j}{\partial c_i},$$

where i and j may have any values at pleasure from 1 to $3n$. They are therefore all the partial derivatives of some one function of $c_1, c_2 \ldots\ldots c_{3n}$.

Theorem III.—This function is the negative of the constant term of the expression for the living force in terms of c_1, c_2, etc., as shown in the last section.

Theorem IV.—The sum of the canonical elements $c_1, c_2 \ldots\ldots c_{3n}$ is equal to the "constant of areas," this constant being either the sum of the canonical areolar velocities on the plane of XY, or, which is the same, the sum of the products obtained by multiplying the actual areolar velocity of each body around any point, fixed with reference to the centre of gravity of the system, by the mass of the body.

This theorem is demonstrated as follows: The sum

$$\sum_{i=0}^{i=n} m_i (x_i y'_i - x'_i y_i)$$

is known to be a constant by the principle of conservation of areas. From the expression (9) for x_i, and the corresponding expression for y_i, introducing the quantity α_{0i} as in (8), we have

$$(x_i y'_i - x'_i y_i) = \sum_{j=0}^{j=n} \sum_{k=0}^{k=n} \frac{\alpha_{ji}\,\alpha_{ki}}{m^2_i} (\xi_j \eta'_k - \xi'_j \eta_k);$$

multiplying by m_i, and then summing with respect to i, we have

$$\Sigma m_i (x_i y'_i - x'_i y_i) = \sum_{j=0}^{j=n} \sum_{k=0}^{k=n} \left\{ \sum_{i=0}^{i=n} \frac{\alpha_{ji}\alpha_{ki}}{m_i} \right\} (\xi_j \eta'_k - \xi'_j \eta_k).$$

By the condition of the orthogonal system (8) the sum in brackets vanishes whenever j is different from k, and becomes unity when these indices are equal. Moreover in (5) ξ'_0 and η_0 vanish whenever the origin of co-ordinates is fixed relatively to the centre of gravity of the system. The right-hand member of the last equation therefore becomes

$$\sum_{j=1}^{j=n} (\xi_j \eta'_j - \xi'_j \eta_j).$$

Substituting for ξ, η, ξ', and η' their expressions (16), the constant term of this expression becomes

$$S'bk^2.$$

But if we add all the values of c_j in (21), noting that by the form of the general integrals we have

$$i_1 + i_2 + i_3 + \ldots\ldots + i_{3n} = 1$$
$$j_1 + j_2 + j_3 + \ldots\ldots + j_{n3} = 0,$$

we find, also,

$$\Sigma_j c_j = S'bk^2,$$

and hence

$$\Sigma (\xi\eta' - \xi'\eta) = \Sigma c.$$

Theorem V.—The constant part of the living force, which is itself equal to the constant H in the integral of living forces, usually expressed in the form

$$\Omega - T = H,$$

is represented by

$$\tfrac{1}{2}(b_1c_1 + b_2c_2 + \ldots\ldots + b_{3n}\, c_{3n}),$$

as already shown in § 9.

The constant part of Ω itself is therefore equal to

$$b_1c_1 + b_2c_2 + \ldots\ldots + b_{3n}\, c_{3n}.$$

The equality of H to the constant part of T may be shown by the preceding theory, or it may be easily deduced directly from the theorem of living forces as shown by Jacobi. (*Vorlesungen über Dynamik*, p. 29.)

The conditions that the Lagrangian coefficients (a_i, l_j), the sum of the canonical areolar velocities, and the difference between the potential and living force, are all constant, give rise to a number of relations between the quantities b, k, and their derivatives with respect to c, which I have not yet found of any use in the operations of integration. I therefore omit to cite them, especially as their complete expressions are rather complex.

The forms which we have been considering are those in which it would be necessary to develop the expressions for co-ordinates of the planets, if we wished these expressions to hold true for all time. The usual expressions are sufficiently correct for a few centuries, but fail entirely when we extend the time beyond certain limits. But, in the case of the planetary system, we are obliged to adhere to them for the reason that formulas developed in multiples of the 23* independent arguments of that system would be unmanageable in practice. But, in the case of the subsidiary systems, as the Tellurian and Jovian for instance, the secular

* A linear relation of which we have not spoken must subsist between the quantities b_1, b_2, etc., which reduces the number of really independent arguments to $3n$—1.

variations of the orbits are so rapid that the approximation in powers of the time fails even for present uses. Hence, the lunar theory, considered as a problem of three bodies only, is always treated in a manner analogous to that in which the general theory of planetary motion has been considered in the present paper, the three arguments introduced by the moon being her mean longitude, and the longitudes of her node and perigee. In the theory of Delaunay the analogy in question is most easily seen. His L, G, H, represent three of our canonical elements c_i, the constant term of R, to which he constantly approximates, is the constant part of so much of the expression for the living force as contains L, G, and H, by differentiating which with respect to the latter quantities, he obtains the expressions for the motions of the three arguments.

The theory of Jupiter's satellites has been treated by M. Souillart in such a manner that the co-ordinates may contain, instead of the longitudes of the perijoves, the varying angles on which these longitudes depend. His analytical theory is given in the *Annales de l'Ecole Normale Supérieure*, Vol. 2, 1865.

It may be hoped that the general view of the subject taken in the present paper will afford a means of introducing a more rigorous system of integration in such cases. One of the special problems growing out of this general theory will be the determination of the coefficients of the time, b_1, b_2, etc., either in terms of the canonical constants c_1, c_2, etc., or of the largest of the coefficients k, in the expressions for the co-ordinates of the several planets. These coefficients are, approximately, the mean distances of the planets. The quantities b ought, perhaps, to appear as the roots of an equation of the $3nth$ degree, but the writer has not yet succeeded in forming any expression fitted to give rise to such an equation, except one in which only the squares of the quantities in question appear.

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267

THE

HAIDAH INDIANS

OF

QUEEN CHARLOTTE'S ISLANDS, BRITISH COLUMBIA.

WITH A

BRIEF DESCRIPTION OF THEIR CARVINGS, TATTOO DESIGNS, ETC.

BY

JAMES G. SWAN,

PORT TOWNSEND, WASHINGTON TERRITORY.

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ADVERTISEMENT.

THIS Memoir was referred for examination to Dr. James C. Welling, LL.D., President of Columbian University, Washington, D. C., and to Dr. George A. Otis, of the Surgeon General's Office, U. S. Army.

Their report states that "the Memoir is a valuable contribution to our general knowledge of anthropology and archæology, while yielding besides a special contingent to the ethnology of the North American continent. Under the latter of these heads it raises some questions which seem of great significance, and which it is to be hoped will lead to further investigation."

JOSEPH HENRY,

Secretary S. I.

SMITHSONIAN INSTITUTION,
Washington, July, 1874.

THE HAIDAH INDIANS OF QUEEN CHARLOTTE'S ISLANDS.

QUEEN CHARLOTTE'S ISLANDS are a group in the Pacific Ocean, lying off the northwest coast of North America about seventy-five miles northwest of Vancouver's Island, between latitude 51° 30′ and 54° 20′ north, and at a distance from the mainland varying from one hundred miles at their southern extremity to about sixty miles at the northern portion of the group.

They were first discovered by Captain Cook, R. N., in the year 1776, and it is said that he landed on the most northerly portion near a spot now known as Cook's Inlet. Captain Juan Perez, a Spanish navigator, had sighted this land two years previously, but it was not taken formal possession of by either the English or Spanish until 1787, when Captain Dixon took possession in the name of King George the Third, and named the group after the consort of the King, "Queen Charlotte's Islands."

These Islands form together a healthy picturesque territory, rich in natural resources, and well adapted to colonization. Nevertheless, for the space of nearly a century no attempt has been made by the English to colonize them. There they lie waste and fallow, yet marvellously productive, and awaiting nothing but capital, enterprise, and skill to return manifold profit to those who will develop their resources.

The names of this group are North, Graham's, Moresby's, and Prevost.

Graham's and Moresby's Islands are the largest, and constitute at least 95 per cent. of the whole area of the group.

North and Prevost Islands, one at the extreme northwest, and the other at the extreme southeast of the group, are quite small, being only a few miles in area.

There are a great number of small islands and islets around the main group, particularly on the eastern side. Some of these islets are of considerable extent. but are of minor importance when compared with the main group.

The general direction of Queen Charlotte's Islands is northwest and southeast, following the general outline of the coast in that region of the continent.

The widest portion is at the northern end of Graham's Island, a little north of the 54° parallel, and measures, from Cape Fife on the east, to Cape Knox on the west, about sixty nautical miles.

From the 54° parallel the group narrows towards its southern extremity till it is reduced, at Prevost Island, to about one mile.

The whole length of the group from North Point to Cape St. James, its southern extremity, is about one hundred and sixty miles. The islands of the group are separated by three channels. Parry Passage, at the north, separates North Island from Graham's, Skidegate Channel separates Graham's and Moresby's Islands, and Stewart Channel separates Moresby's and Prevost Islands.

These Islands are inhabited by a tribe of Indians called Haida or Hydah, who in manners and customs seem somewhat different from the neighboring tribes of the mainland, and those of Vancouver's Island. The name is spelled Hyder, Haida, or Haidah. I have adopted the latter style as it is more expressive of the true pronunciation of the natives.

In general appearance the Haidahs resemble the natives of the northeastern coast of Asia, who have a marked resemblance to the Tartar hordes and who seem to have extended along the Siberian coast, the Aleutian Islands, and down the American shores as far south as Queen Charlotte's Islands, where this peculiar type of the Indian race ceases, and is succeeded immediately by the Selish or flat-head branch of the North American Indians, who have been classed by Morgan as the Ganowanian family or Bow and Arrow people. I apply the term *Selish* in this paper to the tribes of Washington Territory and British Columbia south of the 51° parallel of north latitude.

The distinctive features of these two classes of Indians are apparent to the most casual observer. The Haidah, Chimsean, and other tribes north of Vancouver's Island, who are termed by the residents of Puget Sound "Northern Indians," are, as a general rule, of larger stature, better proportion, and lighter complexion than the Selish.

Although there are numerous instances of well-developed individuals among the Vancouver Island tribes, and of small-sized individuals among the Northern, yet the general appearance of the Northern Indians, both men and women, is much larger and finer. This difference is particularly marked in the females. Those of the Haidah and other northern tribes are tall and athletic, while the Selish women are shorter and more given to corpulency.

The Haidah Indians, living on an island separated from the mainland by a wide and stormy strait, are necessarily obliged to resort to canoes as a means of travel, and are exceedingly expert in their construction and management.

Some of their canoes are very large and capable of carrying one hundred persons with all their equipments for a long voyage. But those generally used will carry from twenty to thirty persons; and in these conveyances they make voyages of several hundred miles to Victoria on Vancouver's Island, and from thence to the various towns on Puget Sound.

These canoes are made from single logs of cedar, which attains an immense size on Queen Charlotte's Islands. Although not so graceful in model as the canoes of the west coast of Vancouver's Island and Washington Territory, which are commonly called Chenook canoes, yet they are most excellent sea boats, and capable of being navigated with perfect safety through the storms and turbulent waters of the northwest coast.

The Haidahs bring with them as articles of traffic, furs of various kinds, dogfish, and seal oil, and carvings in wood and stone, as well as ornaments in silver of excellent workmanship, such as bracelets, finger-rings, and ear ornaments.

A peculiar kind of slate-stone is found on Queen Charlotte's Islands, very soft when first quarried, and easily carved into fanciful figures of various kinds, but growing very hard upon exposure to the air, and after being rubbed with oil, which seems to harden and polish it.

These stone carvings are eagerly purchased by persons looking for Indian curiosities, and are generally regarded by casual observers as idols, or objects of worship, or indicative in some manner of their secret or mystic rites. This, however, is an error. None of the tribes of the northwest coast worship idols or any visible symbol of their secret religion, which is confined to the totem, or tomanawas, or guardian spirit of each individual Indian.

But the custom which prevails among them, and seems to be a distinctive feature of this tribe, is that of tattooing their bodies with various designs, all of which are fanciful representations of animals, birds or fishes, either an attempt to represent in a grotesque form those which are known and commonly seen, or their mythological and legendary creations. A recent visit of a party of these Indians to Port Townsend has enabled me to study carefully a variety of their carvings and tattoo marks, and to ascertain with accuracy their true meaning and signification.

I have forwarded to the Smithsonian Institution, to accompany this memoir, several carvings in wood and stone; and, in order the better to describe them, I have made sketches illustrative of these carvings and also of various tattoo designs, which were copied by me from the persons of the Indians, and also have caused photographs to be taken to still further illustrate this subject.

The first of these carvings which I shall describe is of wood (Plate 2, fig. 1). It is intended to represent one of the carved posts or pillars which are raised in front of the houses of the chiefs or principal men. These pillars are sometimes from fifty to sixty feet high, elaborately carved at a cost of hundreds of blankets; some of the best ones even costing several thousand dollars, consequently, only the most wealthy individuals of the tribe are able to purchase the best specimens.

These pillars are carved out of a single cedar tree, the back hollowed out so as to relieve the weight when raising it in a perpendicular position. They are deeply and firmly set in the earth directly in front of the lodge, and a circular opening near the ground constitutes the door of entrance to the house. The Chimsean Indians, at Fort Simpson, and the Sitka tribes have this style of carved posts, but they set them a short distance from the front of their houses.

The figures carved on these posts are the family totems or heraldic designs of the family occupying the house, and as these Indians build large wooden lodges capable of containing several families, the carvings may be said to indicate the family names of the diffierent occupants.

The chief or head man owns the house, and the occupants are his family and relatives, each one of whom will have on some part of the body a representation in tattooing of the particular figure which constitutes his or her family name or connection.

The chief will have all the figures tattooed on his body to show his connection with the whole.

The principal portion of the body tattooed is the back of the hand and forearm; and a Haidah, particularly the women, can be readily designated from any other northern tribe by this peculiarity.

The carving which I shall next describe is the wooden figure on the left of Sketch No. 2. This has four figures, one above the other. The lowest one is the beaver *Tsching*. On his head sits the mythological mother of the Haidah tribe, who is named *Itl-tads-dah*. In her arms she holds the young crow *Keet-kie*, and on her head is seated the crow *Hoo-yéh*, bearing in his beak the new moon *Koong*. His head is surmounted by the *Tadn-skillik*, a peculiar shaped hat worn only by chiefs or persons of importance. On the top of the *Tadn-skillik* is seated the bear *Hoorts*.

The legend connected with this carving is, that the beaver *Tsching* occupies himself by eating the moon, and when he has finished his meal and obliterated it, *Itl-tads-dah* sends out *Hoo-yéh*, the crow, to hunt for a new moon which he brings home in his bill. The duty of *Hoorts* the bear is to keep watch that all goes on well.

The second carving is of stone (Plate 1, fig. 1), and consists of *Tsching* the beaver, *Skams-kwin* the eagle, and *Itl-tads-dah* the grandmother. In the under lip of the old woman is seen the *staie*, an oblong piece of wood or ivory which is inserted in the under lip, and increased in size till the lip is distorted and stretched out of all shape.

This practice was formerly universal, but of late years has fallen somewhat into disuse, particularly with those females who have visited Victoria and seen the customs of civilization.

Carving No. 2 is of stone, and represents two figures, the lower one is *Hoorts* the bear holding in his paws the *Stoo* or crayfish. The upper figure is the *Tsching* or *Tsing*, the beaver, holding the *Tl-kam-kostan* or frog in his paws.

The Indian, however rude or grotesque his carvings or paintings may be, is always true to nature. He knows that the bears eat crabs, crayfish, and other littoral marine crustacea, and that the frog is the fresh-water companion of the beaver. Hence, if the carver had reversed the grouping, he would have been laughed at by his friends, for the Indians are keen critics of each other's work, and prone to ridicule.

Stone carving No. 3 represents three figures. The lower one is the *Tahn* or sea-lion; on his head is the *Wasko*, a mythological animal of the wolf species similar to the *Chu-chu-hu-uxl* of the Makah Indians. Above the *Wasko* is the bear, surmounted by a head resembling a human head, but intended to represent the young bear.

The other stone carving (Plate 5, No. 5) is unfinished. It represents two figures: the lower one, the bear, and the upper one, the *Scana* or killer (*Orca ater*).

With the exception of the first-named carving, I did not learn of any legend or allegorical history connected with these carvings of the Haidahs. But they will be of interest and value to study at some future opportunity.

The drawings of tattoo designs which accompany the carvings were copied by me from the persons of the Indians who came to my office for that purpose.

The first one (Plate 4, fig. 1) is the *Kahatta* or codfish. This was tattooed on the breast of Kitkūn, a chief of the Laskeek village of Haidahs, on the east side of Moresby's Island.

Kitkūn and his brother Ḡenés-kelos—a carver and tattooer—*Kit-kā-gens*, one of the head men of the band, and Captain Skedance, chief of the Koona village, with their party gave me the information and descriptions, and from their persons I made the drawings.

Fig. 2 (tattoo mark) is the *Oolala*, a mythological being, half man, half bird, similar in all respects to the Thunder bird of the Makah Indians. It lives on high mountains enveloped in clouds and mist, causing the loud thunder and sharp lightning, and destructive alike to man or beast.

Fig. 3 (Plate 4) is called *Wásko*, another mythological being of the antediluvian age. This represents the ancestors of the present race of wolves. It is similar to the *Chu-chu-hu-uxl* of the Makahs, and the tradition is, that after the primitive race had produced the present genus of wolf, the Wasko were transformed into the killer (*orca ater*). The sharp teeth and powerful jaws of the killer, resembling more the mouth of a carnivorous land animal than any of the inhabitants of the water, was undoubtedly the origin of the fable.

Scammon, in his Cetacea of the Northwest Coast, styles them the cannibals of the whale tribe. The *Wasko*, as I have copied it, was tattooed on the back of the chief *Kitkūn*.

Fig. 4 (Plate 4) is the *Scana* or killer (*Orca ater*).

Fig. 5 is the *Koone* or whale.

Plate 5, Fig. 6, is the *Tl-kam-kostan* or frog.

Fig. 7 is the *Thlama* or skate.

Fig. 8, *mama-thlon-tona* or humming bird.

Plate 3, Fig. 9, is the fish eagle (*Koot*). This drawing was made by Ḡeneskelos, the painter and tattooer of the tribe.

Plate 6, Fig. 10, is the *Chimose* or *Tchimose*, a fabulous animal supposed to drift about in the ocean like a log of wood, floating perpendicularly, and believed by the Haidahs to be very destructive to canoes or to Indians who may fall into its clutches. The *tahdn-skillik* or hat shown in the drawing indicates this animal to belong to the genii or more powerful of these mythological beings.

Fig. 11 is the crow, *Hooyeh*. This is sometimes drawn with a double head.

Fig. 12 is the bear, *Hoorts*.

Fig. 13 is a young skate, the *Billachie* of the Makahs and the *Cheetka* of the Haidahs. The young skate has on each side of its body an elliptical brown spot surrounded by a ring of bright yellow, and a brown ring outside of all. As the skate grows large this spot disappears. I have noticed it only on very small ones, and the Haidahs informed me that it is from this peculiar spot that they got their elliptical designs, which are to be seen in many of their paintings, and particularly in Fig. 12.

Figs. 14, 15, and 16 (Plate 7), representing the *Skamsom* or thunder bird, squid (*octopus*), *noo*, and the frog, *Tl-kam-kostan*, were copied from the tattooed marks on Kitkagens; the *skamson* or *skamsquin* on his back, the *noo* on front of each thigh, and the *Tl-kam-kostan* on each ankle.

The designs which I have copied and described are but a portion of the whole which were tattooed on the persons of this party; but the limited time they remained did not enable me to make a very extended examination. Enough, however, has been obtained to show that this subject is one of great ethnological value, and if followed up with zeal and intelligence would be certain to produce interesting results.

The method by which I determined with accuracy the meaning of these various carvings and tattoo designs was by natural objects, by alcoholic specimens of frogs and crayfish, by dried specimens, by carvings of bears and seals, and by pictures, and by the mythological drawings of similar objects which I had previously obtained and determined among the Makahs.

The Haidahs, in explaining to me the meaning of their various designs, pointed to the articles I had, and thus proved to me what they meant to represent.

The tattoo marks of the codfish, squid, humming-bird, etc., never could have been determined from any resemblance to those objects, but by having the specimens and pictures before me they could easily point each one out. Nor was I satisfied until I had submitted my drawings to other Indians, and proved by their giving the same names to each, that my first informant had told me correctly. The allegorical meaning, however, will require for determination time and careful study. Indians are very peculiar in giving information relative to their myths and allegories. Even when one is well acquainted with them and has their confidence, much caution is required, and it is useless to attempt to obtain any reliable information unless they are in the humor of imparting it.

I have observed another peculiarity among the Haidahs. They do not seem to have any particular standard style of drawing their figures; consequently, unless a person is familiar enough with the general idea to be conveyed, it would be difficult to determine the meaning either of a carving or drawing, unless the Indian was present to explain what he intended to represent. For instance, Figs. 6 and 16 are drawn by two different Indians, and both represent the frog. The bear, beaver, and Wasko or wolf, are different in the carvings from the tattoo designs, and so of other tattoo figures. Still, there are certain peculiarities which, once known, will enable one readily to determine what the correct meaning is. I have even known the Indians themselves to be at a loss to tell the meaning of a design. I will cite one instance illustrative of this. One of the Haidahs brought me a bone which he had rudely carved to resemble an animal; I pronounced it without hesitation to be a lizard. He said he would leave it with me till the next day, and would then tell me what it was. I showed it to several Indians in the mean time, and they thought as I did, that it was a lizard or newt. Any person on the Atlantic coast would have pronounced it an alligator. After we had exhausted our guessing, the Indian who carved it said it was an otter, and pointed to its teeth which were the only distinguishing features to prove that it was not a lizard or a crocodile.

The carvings of the pillars are thought by many persons to resemble Chinese or

Japanese work, and in order to satisfy myself upon that point, I showed the carvings to a party of very intelligent Japanese who visited Port Townsend several months since. They examined them carefully and critically, and pronounced them entirely unlike anything they had ever seen in their own country. In fact, they seemed as much interested with the specimens as our own people. I have seen similar carvings by the natives of the Feejee Islands, but on the northwest coast they are confined almost exclusively to the Haidahs on Queen Charlotte's Island, and to the Chimseans on the mainland. The carvings I particularly allude to are those representing several figures one above the other, as shown by the sketches and photographs of the carved posts or pillars placed before the entrances to their houses.

The limited time the Haidahs were at Port Townsend did not enable me to ascertain the origin of this system of carving, or of their custom of tattooing their bodies; what little information I did obtain was given with evident reluctance; but, as we became more acquainted and they began to understand what my object was in obtaining information, they became more communicative, and promised me that this present summer (1874) they would again be here and would bring more carvings and would give me all the information I wished.

Plate No. 2, fig. 8, shows a tattoo design of a halibut, and a painting on a buckskin cape representing the thunder bird of the Sitka Indians, worn by a medicine man during his incantations.

The belief in the thunder bird is common with all the tribes of the northwest coast, and is pictured by each tribe according to their fancy. I have traced this allegory from the Chenooks, at the mouth of the Columbia, through all the coast tribes to Sitka. The general idea is the same throughout; it is a belief in a supernatural being of gigantic stature, who resides in the mountains and has a human form. When he wishes for food he covers himself with wings and feathers as one would put on a cloak. Thus accoutred, he sails forth in search of prey. His body is of such enormous size that it darkens the heavens, and the rustling of his wings produces thunder.

The lightning is produced by a fish, like the Hypocampus, which he gets from the ocean and hides among his feathers. When he sees a whale he darts one of these animals down with great velocity, and the lightning is produced by the creature's tongue, which is supposed to be like that of the serpent. This is the general idea of the mythological legend, slightly altered in the narrative by different tribes and differently depicted by various painters.

The Haidahs seem to have the greatest variety of designs, and they seem to be the principal tribe who tattoo themselves to any extent. Where they acquired the practice or from whom it was learned, it will be difficult to determine. This is an interesting ethnological question, and worthy of further investigation.

Among other customs of the Haidahs which I observed is the practice of gambling, which is common among all the North American Indians.

In my paper on the Indians of Cape Flattery, published by the Smithsonian Institution (No. 220), I have given an account of the gambling implements of the Makahs, which consist of circular disks of wood, highly polished and marked on the edges to designate their value. The Haidahs, instead of disks, use sticks or pieces of wood four or five inches long, and a quarter of an inch thick. These sticks are rounded and beautifully polished. They are made of yew, and each stick has some designating mark upon it. There is one stick entirely colored and one entirely plain. Each player will have a bunch of forty or fifty of these sticks, and each will select either of the plain sticks as his favorite, just as in backgammon or checkers the players select the black or white pieces. The Indian about to play, takes up a handful of these sticks, and, putting them under a quantity of finely-separated cedar bark, which is as fine as tow and kept constantly near him, he divides the pins into two parcels which he wraps up in the bark and passes them rapidly from hand to hand under the tow, and finally moves them round on the ground or mat on which the players are always seated, still wrapped in the fine bark, but not covered by the tow. His opponent watches every move that is made from the very first with the eagerness of a cat, and finally, by a motion of his finger, indicates which of the parcels the winning stick is in. The player, upon such indication, shakes the sticks out of the bark, and with much display and skill throws them one by one into the space between the players till the piece wanted is reached, or else, if it is not there, to show that the game is his. The winner takes one or more sticks from his opponent's pile, and the game is decided when one wins all the sticks of the other.

As neither of the players can see the assortment of the sticks, the game is as fair for one as the other, and is as simple in reality as "odd or even" or any child's game. But the ceremony of manipulation and sorting the sticks under the bark tow gives the game an appearance of as much real importance as some of the skilful combinations of white gamblers.

The tribes north of Vancouver's Island, so far as my observation has extended, use this style of sticks in gambling, while the Selish or Flat-heads use the disks. Some persons have termed this game Odd and Even, and others have designated it Jack Straws; but the game as played by the Haidahs is as I have described it.

Kitkūn, the chief whom I have alluded to, came to my office one day with one of his tribe, and took quite an interest in explaining the game. The two men played slowly at first, the Chief explaining as the game proceeded, till finally they played with their usual earnestness and rapidity, and I found that the game, with its accompaniment of singing and beating time, was quite as exciting and as interesting as any Indian game I ever witnessed. Sometimes the game is played between only two persons, at other times a dozen may be seen seated on each side, particularly when different bands meet. Then the excitement is intense, and the game is kept up day and night without intermission, and some Indians lose everything they possess, and come out of the play stark naked and remain in a state of nudity till some friend gives them a blanket or an old shirt.

It is probable that the Haidahs have other gambling games, but I have seen only this kind, and the game which Kitkūn explained to me was played with a bunch of sticks which I obtained in Sitka, showing that the northern tribes have the same game with sticks, in common, as the Selish or Flat-head Indian tribes have a common game with disks.

The Haidah Indians have another custom which I have not observed among any of the tribes of the northwest coast, with the exception of these people. It is the practice of cremation or burning the bodies of any of their friends who may die while absent from their homes. An instance of this kind came under my observation at Port Townsend, W. T., on Sunday, March 29th, 1874. A large party of men, women, and children, numbering about one hundred and fifty persons, had been encamped for a couple of weeks on the beach. One of the men who had been at work at the saw-mill in Port Discovery, some seven or eight miles distant from Port Townsend, had died there, and his body had been brought around to Port Townsend. On the morning of the day named, the party broke up their camp and moved in slow procession in six large canoes to Point Wilson, near Port Townsend, where a pile of drift logs was formed into a sort of altar and the body placed upon it, and the whole reduced to ashes; the women singing their death songs, amid howlings, beating of tambourines, and other savage displays. When the whole was burned, one old woman gathered the charred bones and placed them in a box, and the whole party left for Victoria, British Columbia, on their way home to Queen Charlotte's Islands.

I asked one of the Indians why they burned the body. He replied that if they buried it in a strange land their enemies would dig it up and make charms with it to destroy the Haidah tribe. This is the only instance of the kind which has come under my own immediate observation, but I have been informed by other persons that they have observed the same practice on other occasions, but I am not prepared to say whether cremation is a general custom among the Haidahs, or only confined to particular cases like the one I have described.

The Haidahs are one of the most interesting tribes I have met with on the northwest coast. Their insular position and the marked difference in their manners and customs from the Indians of the mainland give me reason to think that very interesting and valuable results in ethnology can be had by a thorough investigation among the villages on the islands. Their carved images, their manufactures in wood and stone, and in silver ornaments, and other evidences of their present skill, and the rich stores of material of a former age to be found in the shell heap remains, are matters well worthy of the careful consideration of those who desire to make up a history of the coast tribes of the northwest. British Columbia is, as it were, sandwiched between Alaska and Washington Territory, and a description of the coast Indians from the Columbia River to the Siberian borders, cannot be complete without including the Indians of Vancouver's Island, Queen Charlotte's Islands, and the adjacent mainland.

I am of the opinion that it will be found more economical and attended with better and more satisfactory results, to have such investigations pursued by persons resident on the northwest coast, rather than to entrust them to the very limited visits of scientific expeditions. Investigations of this kind require time and careful study before correct results can be arrived at.

A knowledge of the habits, manners, and customs of the natives, and a general understanding of the language, is of the first importance. The person making the investigation should be his own interpreter, and these requisites can be attained only by a long residence and observation among these Indians. The impressions of casual travellers are not always reliable, nor are the interpreters who generally accompany scientific expeditions always capable of understanding correctly what they are required to translate.

It is interesting to read the reports and observations of the early voyages of Cook, La Perouse, Portlock and Dixon, Marchand, and others who have visited Queen Charlotte's Island, and see how little they really knew or understood about these natives.

The best account that I have seen, and that is but a meagre one, is in Marchand's Voyage Round the World, performed during the years 1770 '71, '72, in the "Solide," a ship fitted out in France for the purpose of trading on the Northwest coast of America. But Marchand and all the other early voyagers labored under a very great difficulty; they did not understand the language of the natives, and their only means of intercourse was by signs. Hence we find the accounts of the voyages of every nation, Spanish, Portuguese, French, and English, full of theories, and scarce any two alike. When the narrators confine themselves to descriptions of things which they saw, such as the dwellings, carvings, canoes, and other manufactures, and the usual appearance of the natives, their accounts generally agree; but when they commence to form hypotheses on imaginary meanings of the things they saw, they are lamentably at fault.

The following description of a house at Cloak Bay, on North Island, the most northerly island of the group, gives a general idea of a Haidah house of the present day. I quote from Marchand:—

"The form of these habitations is that of a regular parallelogram, from forty-five to fifty feet in front, by thirty-five in depth. Six, eight, or ten posts, cut and planted in the ground on each front, form the enclosure of a habitation, and are fastened together by planks ten inches in width, by three or four in thickness, which are solidly joined to the posts by tenons and mortises; the enclosures, six or seven feet high, are surmounted by a roof, a little sloped, the summit of which is raised from ten to twelve feet above the ground. These enclosures and the roofing are faced with planks, each of which is about two feet wide. In the middle of the roof is made a large square opening, which affords, at once, both entrance to the light, and issue to the smoke. There are also a few small windows open on the sides. These houses have two stories, although one only is visible, the second is under ground, or rather its upper part or ceiling is even with the surface of the place in which the posts are driven. It consists of a cellar about five feet in depth, dug in the inside of the habitation, at the distance of six feet from the walls throughout the whole of the circumference. The descent to it is by three or four steps made in the platform of earth which is reserved between the foundations of the walls and the cellar; and these steps of earth well beaten, are cased with planks which prevent the soil from falling in. Beams laid across, and covered with thick planks, form the upper floor of this subterraneous story, which preserves from moisture the upper story, whose floor is on a level with the ground. This cellar is the winter habitation."

The entrance door of their edifices is thus described:—

"This door, the threshold of which is about a foot and a half above the ground, is of an elliptical figure; the great diameter, which is given by the height of the opening, is not more than three feet, and the small diameter, or the breadth, is not more than two. This opening is made in the thickness of a large trunk of a tree which rises perpendicularly in the middle of one of the fronts of the habitation, and occupies the whole of its height; it imitates the form of a gaping human mouth, or rather that of a beast, and it is surmounted by a hooked nose about two feet in length proportioned in point of size to the monstrous face to which it belongs. * * * * Over the door is the figure of a man carved, in a crouching attitude, and above this figure rises a gigantic statue of a man erect, which terminates the sculpture and the decoration of the portal. The head of this statue is dressed with a cap in the form of a sugar-loaf, the height of which is almost equal to that of the figure itself. On the parts of the surface which are not occupied by the capital subjects, are interspersed carved figures of frogs or toads, lizards, and other animals."

This description by Marquand is that of the houses of the present inhabitants. The hooked nose mentioned is the *Skamsquin* or *eagle*; and the sugar-loaf hat is the *Tadn skillik.*

If Marquand had been able to procure the services of a skilled interpreter, he and his officers could have ascertained the true meaning of these emblems as easily as I have done; but not being able to exchange ideas with the natives, they came to their conclusions, and framed their theories by a series of guesses; and as all the early explorers formed their theories of the Indians upon the same lucid basis, it is not to be wondered at that so much of error has found place in all their narratives. It is, however, a source of surprise, that, since the time of those old voyagers, a lapse of nearly a century, no one has attempted to give a description of those islanders, or to explain the simple meaning of their devices. The Queen Charlotte's group presents to-day as fresh a field for the ethnologist and archæologist as if no explorers had ever set foot upon their shores.

Of the extent and nature of these carvings, Marquand adds:—

"These works of sculpture cannot undoubtedly be compared in any respect to the master-pieces of ancient Greece and Rome. But can we avoid being astonished to find them so numerous on an island which is not, perhaps, more than six leagues in circumference, where population is not extensive, and among a nation of hunters?" The writer was alluding to North Island, one of the smallest of the group; and when it is remembered that in every village on every one of the islands of the group these sculptures are quite as abundant, some idea can be formed of the number to be seen on Queen Charlotte's Islands. "Is not our astonishment increased," adds Marquand, "when we consider the progress these people have made in architecture? What instinct, or, rather, what genius, it has required to conceive and execute solidly, without the knowledge of the succors by which mechanism makes up for the weakness of the improved man, those edifices, those heavy frames of buildings of fifty feet in extent by eleven in elevation! Men who choose not to be astonished at anything will say, the beaver also builds his house; yes, but he does not adorn it; nature, however, has given the beaver the instrument necessary for building it; she has certainly placed the man of the forest in the middle of the materials with which to construct his; but he has been under the necessity of creating the varying tools without which he could not employ those materials. A sharp stone, hafted on a branch of a tree, the bone of a quadruped, the bone of one fish, and the rough skin of another, form instruments more fit to exercise patience than to help industry, and which would have been ineffectual in seconding his efforts, if fire which he discovered, and the action of which he learnt to regulate and direct, had not come to the assistance of his genius, and of the art which he executes through the impulse of genius."

When we examine the whole of the operations necessary for constructing and ornamenting one of the edifices which I have just described, when we reflect on this assemblage of useful arts, and of those which are merely agreeable, we are forced to acknowledge that these arts have not taken birth on the small islands where they are cultivated; they come from a greater distance.

Marquand observes that "the distinction between the winter and summer habitations of the Queen Charlotte Islanders, recalls to mind the custom of the Kamtschadales, who have their *balagans* for summer and their *jourts* for winter; the former erected on posts or pillars, twelve or thirteen feet in height, and the latter dug in the ground and covered with a roof: it is even remarked that some of the *balagans* have oval doors."

The country of these Kamtschadales, as we know, is a peninsula of northeastern Asia, and seems to show that this style of houses of northern Asia must have been introduced by immigration at some remote period from that region. In fact everything seems to prove that Asia peopled the northwest coast of America, the buildings, the manners and customs and general appearance of the natives from Vancouver's Island to the Siberian Coast, are very similar, and in certain respects nearly identical.

Marquand thinks, and my own observations certainly verify the theory, "that it is not without the sphere of probability, that the northwest coast should reckon three species of inhabitants; of the first date, the men who might belong originally to the very soil of America, if we adopt the opinion, that this large country had its own men or aborigines, as it has its animals and its plants," a view which is coincided in by Sir Charles Lyell, Agassiz, Forshey, Morton, Squire, and other eminent authorities. This first class of inhabitants I have in this paper termed Selish, or Flat Heads.

The second species are the Asiatics of the north, whose transmigration seems to have been retarded at Queen Charlotte's Islands, and to have stopped at Vancouver's Island; and lastly, and of the third date, the Mexicans, who fled for refuge to the coast after the destruction of their empire, and whopeopled the Californias, and wandered north and mingled with the Selish. Marquand says, "that everywhere on the Queen Charlotte's Islands appear the traces of an ancient civilization; everything indicates that the men with whom they had the opportunity of being acquainted have belonged to a great people, who were fond of the agreeable arts, and knew how to multiply the productions of them."

I feel a great confidence that in the shell heap remains to be found on those islands, as well as in the caves and the mausoleums of the dead, may be discovered relics of antiquity which will well repay the archæologist for exploring them; and that on these islands may be discovered those evidences which will form the missing link in the chain of testimony which will add to the history of the origin of the North American Indians, and perhaps enable us to trace with greater certainty those ancient annals which are now hidden in mist and obscurity, and only darkly hinted at in the shadowy legends and mythological lore crooned over by the ancient men and women, and handed down to after generations, who add to every fresh recital an additional sprinkling of the dust of obscurity.

I have already, in my former writings on the Indians of the northwest coast,[1] alluded to the Mexican terminal *tl*, as occurring in the vocabularies of the Chinooks, Chihalis, Quenáiūlt, and Makah Indians of the west coast of Washington Territory, a fact noticed by Anderson—who compiled the vocabulary of the Nootkan language, which is in the Journal of Cook's Third Voyage, and in that of Marquand and others. A reference to my vocabulary of the Makah Indians (Smithsonian Contributions to Knowledge, 220) will show it to be rich in words having that terminal. Hence the supposition that while the Selish retained their identity as separate and distinct from the Asiatic tribes, they did receive an influx from the hordes of Mexico, and from them obtained words which have become engrafted into their language during a lapse of centuries, just as we can now perceive the use of English words already among those Coast Indians, who for many years have had intercourse with the traders of the Hudson's Bay Company, and the use of certain Russian words among the natives of Alaska, from their intercourse with the traders of the Russian American Fur Company.

But the vocabularies of the early voyagers are not correct. No two of them are alike, a fact which is to be attributed, in part, to there being at that time no recognized standard for spelling Indian words, and in part to the difficulty of understanding the natives. I will illustrate this by a remarkable error. The word Nootka, as it is usually spelled, or Nūtka, as it should be spelled, is not the name of a place or a people; and it is surprising to me how the intelligent persons who, for so long a time, made "Nootka" their head-quarters, and named the tribe Nootka Indians, and even the authors of the treaty (the Nootkan Treaty), between Great Britain and Spain, should not have discovered the error.

The mistake arose in this way. The Indians have a custom of forming a ring, taking hold of each other's hands, and running or dancing in a circle. This is termed "*Nootka*," and was explained to me by a Clyoquot Indian who resides near Nootka, and who could speak English. He said, if you run round your house, or round a canoe, or dance round in a circle, we say "*Nootka;*" and he remarked that, probably the Indians were dancing on the beach at the time the ethnologist of Cook's Expedition was asking the name of the country, or the people; and the Indian, thinking he asked what the people were doing on the beach, said NOOTKA,

[1] "The Northwest Coast, or Three Years in Washington Territory," Harper & Bros., 1857; and "The Indians of Cape Flattery," Smithsonian Institution (220).

and the white people having called the place and people Nootka, the Indians took no pains to undeceive them. This is very common for Indians to do, even with their own names, or the names of their friends. If a stranger, and particularly a white man, makes a mistake in pronouncing or applying an Indian name, they think it a good joke, and wish to perpetuate it. For instance, a white man asked an Indian, "what is your name?" He replied, "*Halo*," which means, I have none. The man thought that was the Indian's name, and always called him Halo. The tribe liked the joke, and to this day this Indian is known among the whites as Halo, and is so called by his tribe.

Numberless instances could be adduced to show this very common custom of the coast Indians, to take no pains to correct mistakes in language, but to consider such errors as good jokes which are to be kept in perpetuity.

This illustration will serve to show how easy and natural it was for the white man to make the mistake; and how very natural it was for the Indians to keep up the error with every succeeding party of white men who visited them. They thought if Captain Cook called the place Nootka, it must be so, whether the Indians called it so or not. The correct name of the place is Mōwatchat, or Bowatchat, which means, the place of the deer, from Bō kwítch, a deer, which word has been changed in the Jargon to Mowitch, a deer. Since the white men have called the place for so many years Nootka, the Indians speak of it to a white man under that name, just as they speak of the towns which have been settled by the whites, as Victoria, or Port Townsend, or Dungeness, but among themselves they invariably call the place and people by their Indian names, and the Nootkans always laugh at the mistake the white man made in naming them and their country after a dance.

I will not, at this time, press further this discussion upon a subject which to perfectly understand will need extended observations to be made upon the spot, and would require an explanation that would carry me beyond the limits to which I purpose to confine myself in this present paper. I trust that it will be sufficient for me to have shown that the subject of the carvings in wood and stone and precious metals, the paintings and tattoo marks of the Haidahs, is one of very great interest, and one which not only never has been properly explained, but never properly understood.

When we reflect on the great number of centuries during which all knowledge of the interior of the Pyramids of Egypt was hidden from the world, until the researches of Belzoni discovered their secret treasures, and until Champollion, by aid of the Rosetta stone, was enabled to decipher their hieroglyphical writings, may we not hope that the knowledge of the ancient history of the natives of the northwest coast, which has so long been an enigma, may be traced out by means of the explanation of the meaning of the symbols such as I have been enabled to discover in part, and have in this paper described?

This very brief memoir, made during the visit of a party of Haidah Indians for a few weeks in Port Townsend, will serve to show what could be effected if the Government would empower some person here, and appropriate sufficient funds to be expended in these ethnological and archæological researches.

Port Townsend is a place peculiarly adapted to the prosecution of these investigations. Its near proximity to Victoria, where hundreds, and sometimes thousands of the northern Indians congregate every spring for purposes of trade, will enable the observer to collect rich stores of material, in addition to what may be obtained here by the same Indians when they visit Puget Sound.

These Indians, heretofore, have disposed of all their curiosities and other products in Victoria before coming to the American side. But I am of the opinion that hereafter they will bring their wares to Port Townsend, having found by the experience of the past summer that they can dispose of all their manufactures here. During the past summer we have had Indians in Port Townsend from Kwe-nai-ūlt, Kwillehuyte, and Cape Flattery, on the American coast, and from Nittinat, Clyoquot, Nootka, and other tribes on the west coast of Vancouver's Island, as well as the Haidahs, Chimseans, and other tribes north of Vancouver's Island as far as Sitka. A steamship leaves Puget Sound once every month for Sitka, and the United States Revenue vessels of this district make frequent excursions as far north as Behring's Strait. Arrangements could undoubtedly be made by which an authorized person could have conveyance to any point north that it might be desirable to visit, and could remain as long as required.

The field of observation on the northwest coast is very extensive, and cannot be exhausted for many years. It is a field that would yield such rich returns to ethnology, as well as to every other branch of natural science, as would amply repay any outlay that the Government might make. The history of the coast tribes is becoming of more importance every year, and a connected description of the Aleuts and other coast tribes of Alaska, the tribes of Western British Columbia, Washington, and Oregon would not only be interesting, but would be valuable in assisting to solve that perplexing question of the origin of the North American Indian.

INDEX.

July, 1874.

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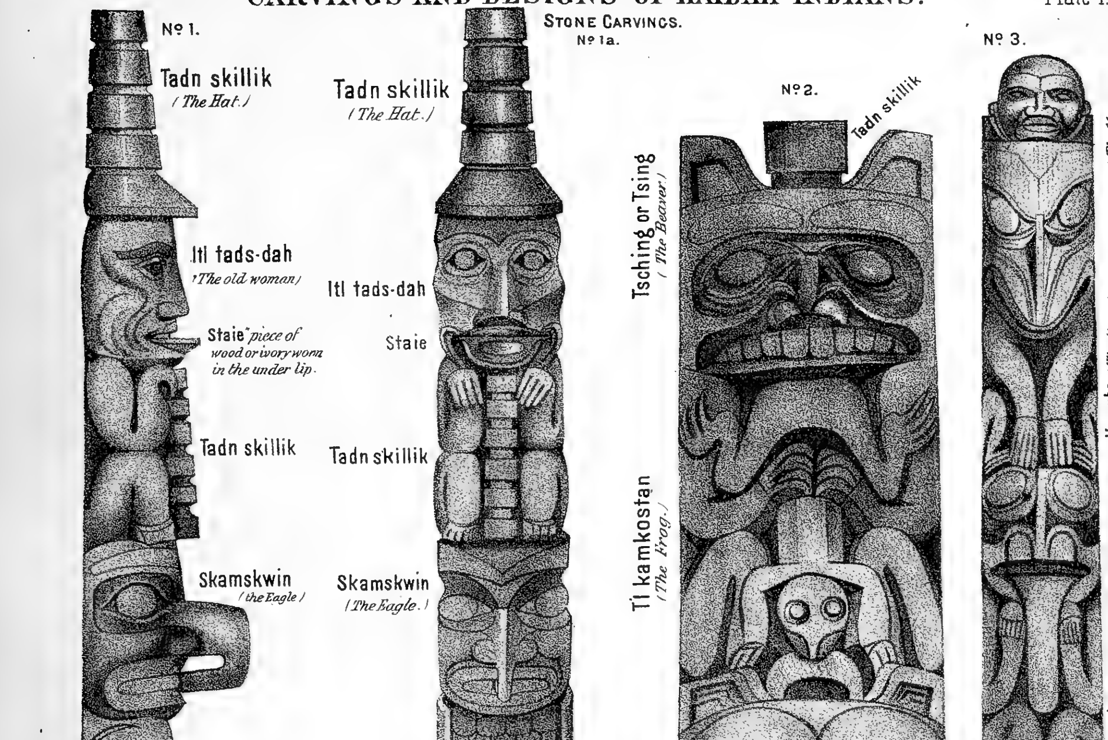
Y

CARVINGS AND DESIGNS OF HAIDAH INDIANS.

Plate 1.



Carvings by Haidah Indians of Queen Charlotte's Islands, British Columbia, representing the carved posts set up in front of their Lodges showing the Totems or heraldic design of the families occupying the house. Descriptions given by Kit-kun Chief of the Laskeek village Geneskelos, a brother of Kit-kun & Capt. Skedance Chief of the Koona Village, east coast of Moresby's Island.

Drawn by J.G. Swan Port Townsend, W.T. May 1873.

CARVINGS AND DESIGNS OF HAIDAH INDIANS.

WOOD CARVINGS.

No 1.

Hoorts
(The Bear.)

Tadn skillik
hat worn by Chiefs.

Hooyeh *or*
Hooyah the Crow.

Koong
(The new moon.)

Heai
(The wings.)

Itl tads dah
the mother of the Haidah Indians (ancient Legend.

Staie *the piece worn in the underlip.*

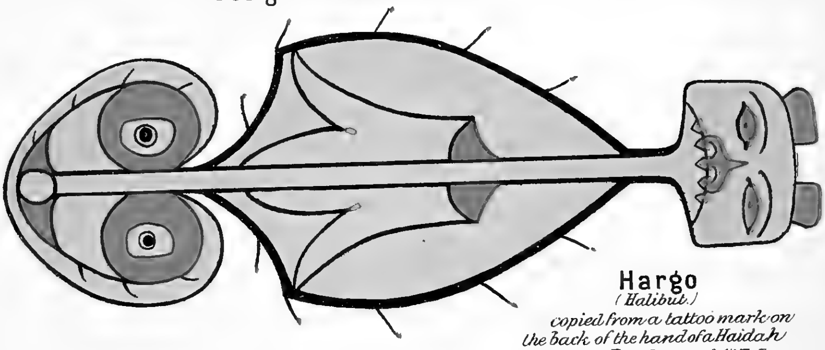
Keetkie
(The young Crow.)

Tsching
or
Tschung the beaver "teeth"

Koota
(The Lip.)

Door *or*
entrance to the Lodge.

Designs No 8.



Hargo
(Halibut.)
copied from a tattoo mark on the back of the hand of a Haidah woman at Port Townsend, W.T. June 1873.

Whale's head.

Hah hake to ak
(or Lightning Fish.)
The medicine man puts his head through the centre of the cape and the ends hang down before and behind.

Buckskin Cape
worn by a medicine man Tarkoo Indians Alaska Territory. **The Thunder Bird** *copied from a cape brought from Sitka. J. G. Swan. Port Townsend July 1873.*

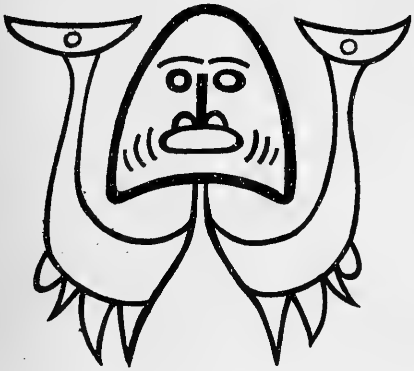
Designs, Fig 9.

Kōōt.
(The Fish Eagle.)

Painted by Ōeneskels
a Haidah Chief and Principal
tattoo and painter of the tribe.
Painted at Port Townsend, W.T.
May 10th 1873.

1. Kahatta.

(Codfish.)

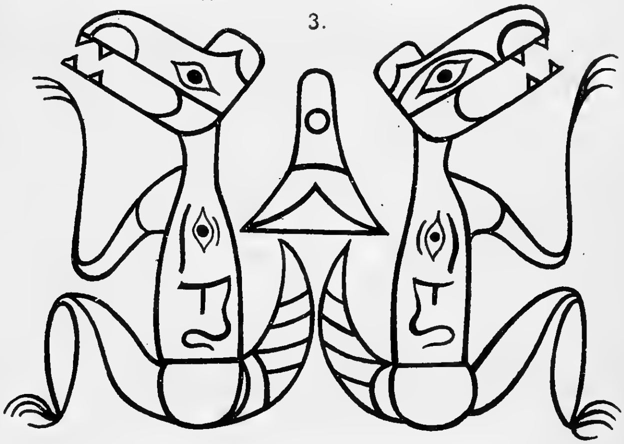


Tattoo Mark on the breast of Kitkūn one of the Haidah Chiefs, copied from life by J. G. Swan at Port Townsend. May 1873.

Wasko

a mythological being of the wolf species similar to the Chu-chu-huuxl of the Makah Indians, an antidiluvian demon, supposed to live in the mountains.

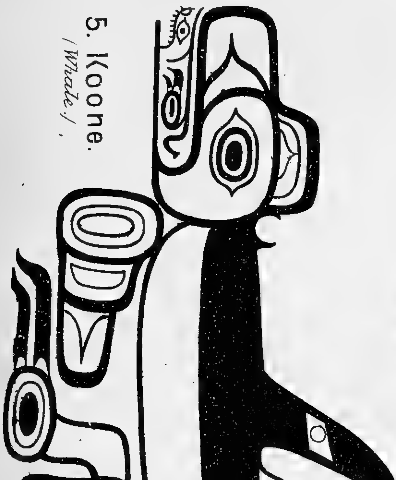
3.



This sketch was copied from the tattoo mark on the back of Kitkūn, a Haidah Chief, and taken by me in my office, Port Townsend W.T. May 10th 1873.

5. Koone.

(Whale.)



2. Oolala.

This is a mythological being of the belief of the Haidah Indians of Queen Charlotte's Islands half man and half bird, supposed by them to live on the mountains and to live on whales or Indians, a Skookum or Evil Spirit. It is similar to the Theukloots or Dukwally of the Makah.

Copied from a drawing made by Geneskelos, brother of Kitkūn one of the Carvers and Tattooers of the Haidah tribe, May 1873.

4. Scana.

(Killer.)

CARVINGS AND DESIGNS OF HAIDAH INDIANS.

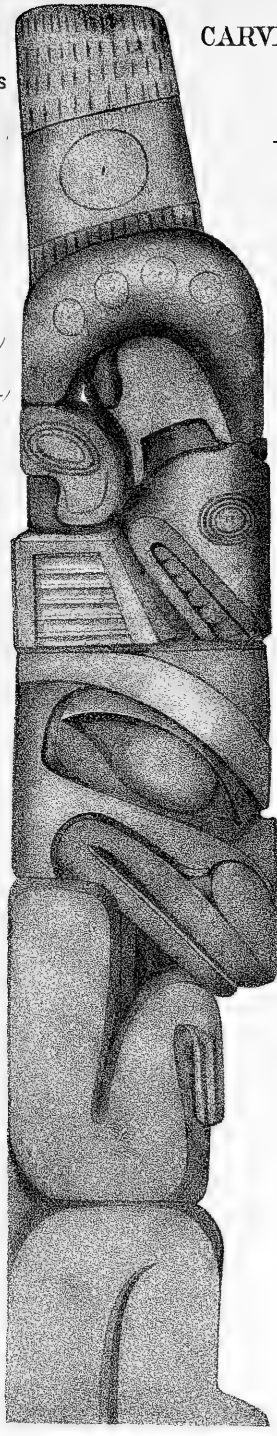
Plate 5.

STONE CARVINGS
No. 5.

Skana
(The Killer.)

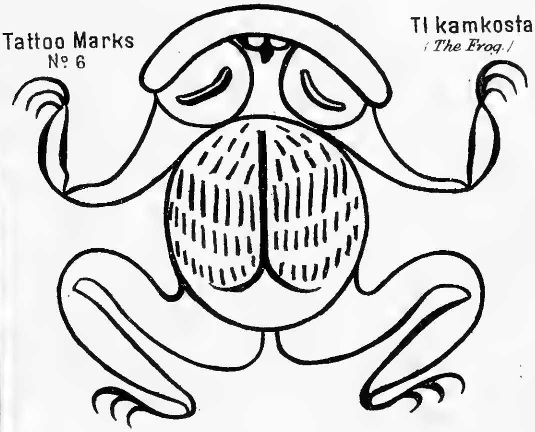
(Orca ater.)

Hoorts
(The Bear.)



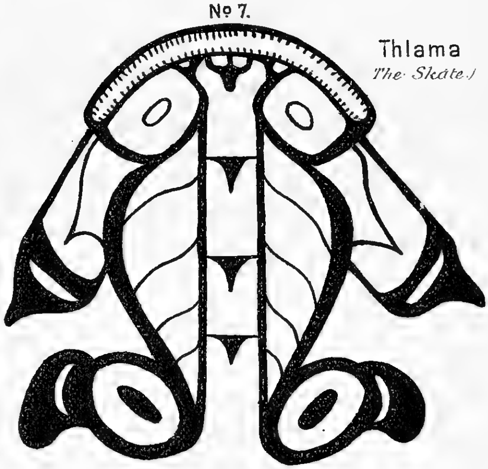
Tattoo Marks
No. 6

Tl kamkostan
(The Frog.)



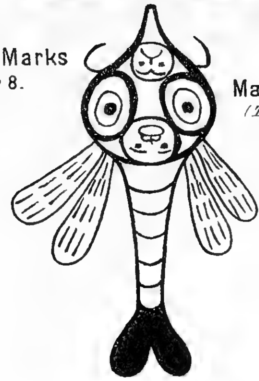
Tattoo Marks
No. 7.

Thlama
(The Skate.)

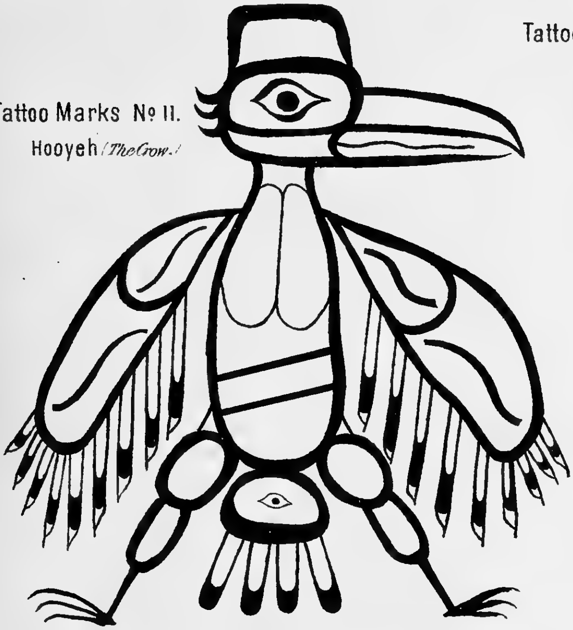


Tattoo Marks
No. 8.

Mama-Thlontona
(The Humming Bird.)



Tattoo Marks No 11.
Hooyeh (The Crow.)

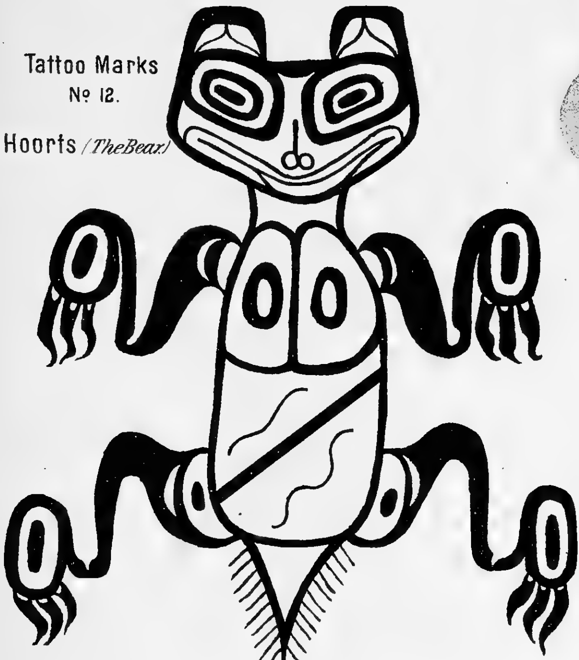


Tattoo Marks No 10

Tadn-Skillik. (The Hat.)

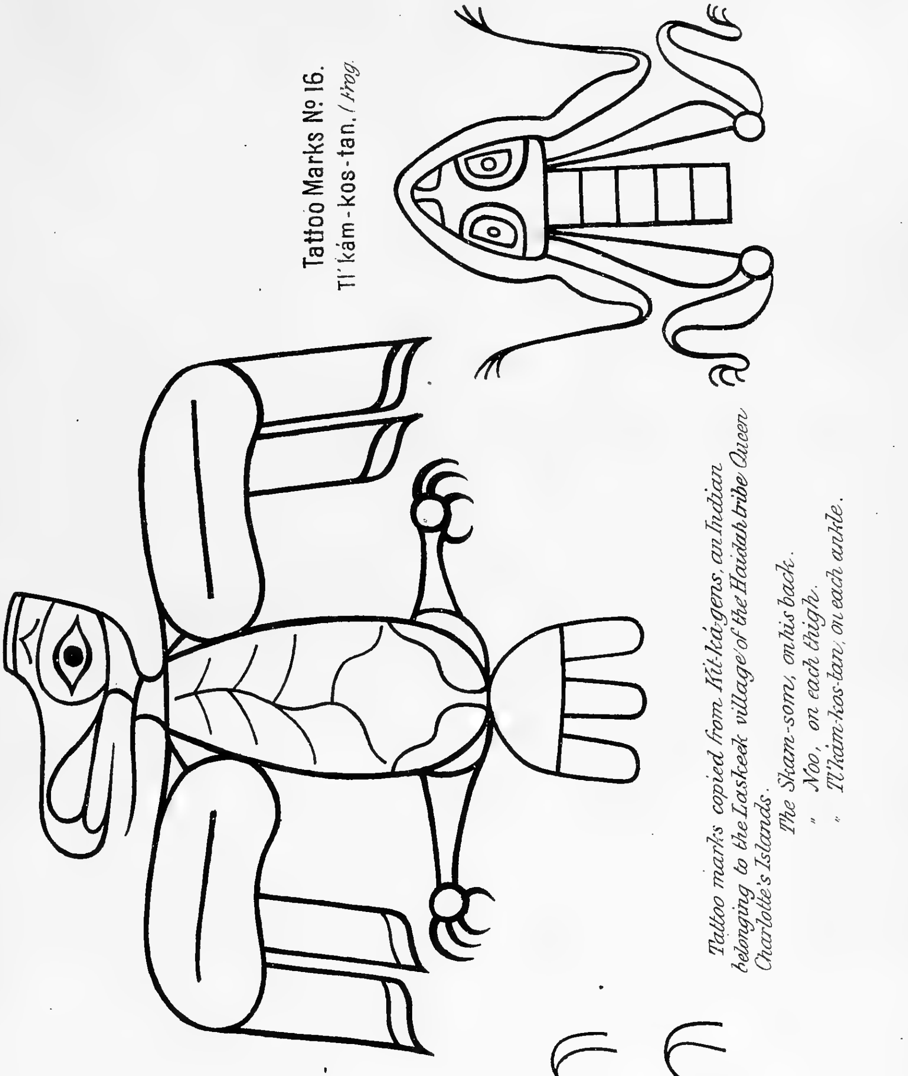
Tchimose a mythological animal residing in the ocean.

Tattoo Marks No 12.
Hoorts (The Bear.)



No 13.

Cheetka-Haidah.
Billachie Makah
(young Skate.)
Natural Size. Showing the oval spots which the Indians try to represent in various paintings as for instance in the drawing of the bear on the left of this.



Tattoo Marks No 14, Skam-som. (The Thunder Bird.)

Tattoo Marks No 15, Noo- (Squid octopus.)

Tattoo Marks No 16. Tl'kám-kos-tan, (Frog.

Tattoo marks copied from Kit-kä-gens, an Indian belonging to the Laskeek village of the Haidah tribe Queen Charlotte's Islands.

The Skam-som, on his back.

" Noo, on each thigh.

" Tl'kám-kos-tan, on each ankle.

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE

277

TABLES, DISTRIBUTION, AND VARIATIONS

OF THE

ATMOSPHERIC TEMPERATURE

IN THE

UNITED STATES,

AND SOME ADJACENT PARTS OF AMERICA.

COLLECTED BY THE SMITHSONIAN INSTITUTION, AND DISCUSSED UNDER THE DIRECTION OF

JOSEPH HENRY, SECRETARY.

BY

CHARLES A. SCHOTT,

ASSISTANT U. S. COAST SURVEY; MEMBER NAT. ACAD. OF SCIENCES; PHIL. SOCS. OF PHILADELPHIA AND WASHINGTON, AND OF ACADEMY OF SCIENCES OF CATANIA, SICILY.

WASHINGTON CITY:
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1876.

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COLLINS, PRINTER, 705 JAYNE STREET.

CONTENTS.

ADVERTISEMENT.

At the commencement of the operations of the Smithsonian Institution a system of meteorology was established, carried on by voluntary observers, which was continued for more than twenty years until it was transferred to the Signal Service of the United States Army in 1874 to be continued by means of the annual appropriations of Congress. This system included observations on the temperature, pressure, aqueous precipitation, moisture of the air, and winds.

The object now of the Smithsonian Institution is to render the results of these observations accessible to meteorologists by their reduction, discussion, and publication; but to give greater value to this work it has been thought advisable to incorporate in it all accessible and reliable meteorological observations that have been made in the United States since the early settlement of this country.

The first part of the general work, that on the aqueous precipitation, was published in 1872, that which relates to the winds is now in the press, and the other parts will follow in succession.

The present memoir relating to the temperatures contains the results of all observations to the end of the year 1870, from the following sources:—

1st. The registers of the Smithsonian Institution, embracing upwards of 300 folio volumes.

2d. The joint publications of the Institution and of the Patent Office and Department of Agriculture.

3d. All the publications and unpublished records of the meteorological system of the United States Army.

4th. The records of the United States Lake Survey under the Engineer Department of the United States Army.

5th. The records of the United States Coast Survey, under the Treasury Department.

6th. The volumes compiled by Dr. F. B. Hough from observations made under the direction of the Regents of the University of the State of New York.

7th. The records made in Pennsylvania under the direction of the Franklin Institute of Philadelphia.

8th. The transactions of various societies and periodical publications.

The first part of the work was the formation of an extended series of classified tables derived from the foregoing sources, and the second the deduction from these consolidated tables, of average temperatures. The first of these series, owing to its great bulk, must for the present remain in manuscript. It can, however, be consulted at any time at the Institution. The second series, which is given in the following pages, consisting of average temperatures, is sufficient to furnish all necessary information for the study of our climate as far as it depends upon temperature.

All the materials were placed in charge of Mr. Charles A. Schott, Assistant United States Coast Survey, to be reduced and discussed under his direction by trained computers, at the expense of the income of the Smithson fund. He was ably assisted by Mr. E. H. Courtenay, of the United States Coast Survey.

The character of Mr. Schott for scientific knowledge, sagacity, and skill in the line of investigation, and scrupulous accuracy as exhibited in the previous meteorological publications of the Institution, give assurance that the work here presented to the public is a valuable contribution to the knowledge of the climate of the United States.

JOSEPH HENRY,
Secretary Smithsonian Institution.

WASHINGTON, D. C.,
January, 1876.

SECTION I.

TABLES, DISTRIBUTION, AND VARIATIONS OF THE ATMOSPHERIC TEMPERATURE IN THE UNITED STATES,

AND SOME ADJACENT PARTS OF AMERICA.

GENERAL REMARKS.

THE laws of the distribution of winds, rain, and heat of a large portion of North America, embracing the normal or statical values as well as their variations with seasons and for longer periods of years, form part of those studies with whose results we are most directly concerned. Although this ground has been gone over many times and must continue to be cultivated, the continued accumulation of new materials enables the investigator gradually to present his results in a more precise form and to enter more fully into detail or local discussions. Whatever imperfections the available records may possess, their effect in the mean values will constantly diminish with the increase of reliable modern observations; moreover, they could not be dispensed with on account of inaccuracies, since they form the only material in our possession for the discussion of such subjects as possible changes in climate since the first settlement of the States. In the following work we shall therefore be chiefly occupied with the establishment of tabular results comparable among themselves, with obtaining mean or normal values or the so-called constants of temperature, as factors of the climate, and with the range of the fluctuations, daily, annual, and secular, also with the generalization of the results either in analytical or graphical form.

The advantages gained by an early discussion of observations beyond putting us in possession of results for immediate use are several; light is thrown on the reliability of the records, their sufficiency or insufficiency for our present or future wants, and the kind of results they are or are not capable of yielding, is indicated. Besides improvements in methods of observing and in instrumental means are likely to result, as well as incitements of the observer to renewed efforts.

Our earliest records of temperature, the results of which are given in the following tables, date about a quarter of a century after the invention of Fahrenheit's thermometer,[1] and with few exceptions all the observers in this country have made

[1] The following information is extracted from Gehler's Physikalisches Wörterbuch, Leipzig, 1839. * * * To Daniel G. Fahrenheit, of Dantzic (Prussia), is due the merit of having constructed,

use of his scale, in consequence of which all tabular quantities and results presented in this paper have reference to this graduation. For the sake of uniformity, records originally given in Réaumur or Centigrade scale have been converted into that of Fahrenheit, and however advisable otherwise it might have been to adopt the Centigrade scale, such a step was forbidden by the great labor and consequent expense which the conversion would have entailed.

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on proper principles, thermometers upon which reliance could be placed; his earlier instruments were filled with alcohol, but about the year 1714 he used mercury for this purpose. According to his own account, he recognized three principal points, viz.: his so-called absolute zero, representing the extreme cold experienced by him in the severe winter of 1709 and erroneously supposed to indicate the greatest cold, the freezing point of water, and a point representing the heat of the human body; in practice, however, he made use of the freezing point as well as of the boiling point of water, with the fixity of which latter he became acquainted in 1714. Supposing the volume of mercury at the temperature represented by his zero point to be 11124 parts, he noticed an expansion of 32 parts at the temperature of freezing water, and of 212 parts at the temperature of boiling water, and accordingly adopted the numbers 32 and 212 to indicate these temperatures. Before Fahrenheit's instruments came into general use, Réaumur brought out his spirit thermometers graduated between the freezing and boiling points of water from 0 to 80, and shortly after, Celsius, about 1742, introduced the Centigrade division between the same points. The spirit thermometers used in the preceding century had arbitrary scales, and were not generally directly comparable. * * * Fahrenheit had already noticed the effect of a change in the atmospheric pressure on the position of the boiling point, but the proper allowance or reduction to a standard pressure was not satisfactorily ascertained in his time. It would seem that allowance was made for the expansion of the glass tube in the above-mentioned experiment, since the dilatation of mercury is nearly 0.0001 of its volume for 1° Fah. All of the thermometric scales mentioned are intended to measure equal increments of heat by equal increments in their scale readings, but for the purpose of comparison and discussion it is much to be desired that all should agree to use the same scale, the Centigrade scale being the one most likely to take the place of the others.

In connection with the cold indicated by the zero of Fahrenheit's scale it may be remarked as an *accidental* circumstance, that it may and has been taken *roughly* to be that of the mean annual temperature of the pole, hence the possibility of representing approximately the annual mean temperature in the latitude φ by the simple expression $81°.5 \cos \varphi$ *without* the addition of a constant.

TABULATION

OF

RESULTING MEAN TEMPERATURES

FROM

OBSERVATIONS EXTENDING OVER A SERIES OF YEARS, FROM THE EARLIEST TO NEARLY THE PRESENT TIME,

FOR

EACH MONTH, SEASON, AND THE YEAR,

PRINCIPALLY FOR

STATIONS IN NORTH AMERICA.

EXPLANATIONS AND REMARKS

ON THE

CONSOLIDATED TABLES OF RESULTING MEAN TEMPERATURES FOR EACH MONTH, SEASON, AND THE YEAR.

THAT part of the tables which refers to the United States is arranged in alphabetical order according to states and territories, and the names in each subdivision are given alphabetically. For all stations beyond the limits of the United States it was considered more advantageous to adopt a geographical arrangement, but the alphabetical sequence of stations under each geographical district is preserved.

The tables contain: The number and name of each station, its latitude and longitude, its elevation above the sea when known, its mean temperatures for each month, each season, and for the whole year, the beginning and ending of the series of observations, its actual extent, the observing hours, the name of the observer with references.

The geographical positions are given to the nearest minute of arc, as far as known, the longitudes are counted as usual west of Greenwich. The positions which became known through the operations of the United States Coast Survey are reliable, as well as those given upon the authorities of the United States Lake Survey, officers of the United States Army, directors of astronomical observatories, and, in general, all those positions which have been determined by direct astronomical observations and those connected with the General Land Office. Positions given on the authority of the observer, and these are by far the most numerous, are less trustworthy, since most of these were taken from State or county maps having no adequate astronomical basis. The results for longitude depending on the electric telegraph are of so recent date that but few maps have as yet incorporated them. Although no pains have been spared to render these geographical positions as trustworthy as possible, they are, in general, when taken from maps evidently in the given latitudes affected with a probable uncertainty of from $\pm 3'$ to $\pm 5'$ and in the given longitudes with a probable uncertainty of from $\pm 5'$ to $\pm 8'$. Fortunately for the immediate wants of the discussion of temperature a moderate approximation to the true position suffices. The elevations of the observing stations depend in all cases upon the statements of observers; these also no doubt require considerable improvement, as but few depend upon direct hypsometric measures or on measured differences of level from known railroad or canal levels; those depending on barometric observations can only be regarded as rough approximations. Heights near tide-water may be considered to be reliable.

Unless otherwise stated, the mean tabular values of the temperature, always expressed in degrees of the Fahrenheit scale, refer to the *observing hours* noted, and are consequently uncorrected for daily variation. In all cases where the observing hours were variable or were changed during the series, the results were referred either to those observing hours maintained for the longest period or to those susceptible of the greater accuracy, or else all were corrected for daily fluctuation. The means for correcting observed values, taken at stated epochs of the day and for any month, were furnished by the discussion of the daily variation, but the stations available for such discussions are comparatively so very few in number, and are almost wanting for the western part of the United States, that but a small portion of our results could be so corrected. If we had better and more complete materials for daily variation, it would undoubtedly have been preferable to correct all tabular results for this inequality, but in their absence it was deemed advisable to attempt no more than to present the results *in any one series* for a *uniform set* of hours of observation, correcting as stated in all cases where the observer has changed his times of observation; this gives us the advantage of effecting hereafter a more satisfactory reduction to the mean of twenty-four hours whenever we come into possession of new and, it is to be hoped, automatic registers.

Respecting the results obtained under the University System of the State of New York, the daily mean was directed[1] to be found by adding to the morning observation twice the afternoon observation, and twice the evening observation to that of next morning, and dividing their sum by six. This may be symbolically expressed by $\frac{1}{6}\{\odot_r + 3_a \text{ bis} + (\odot_s + 1^h) \text{ bis} + \odot_r\}$; the morning observation was to be taken a little before sunrise. The means given in the table were made out in accordance with this rule.[2]

With respect to the Smithsonian system of meteorological observations, the result of the three hours 7 A. M. 2 and 9 P. M. was found to approximate less closely to the true daily mean than the result obtained by adding twice the reading at 9 P. M. to the readings at 7 A. M. and 2 P. M. and dividing this sum by four. The latter rule was therefore adopted, and is symbolically indicated by $\frac{1}{4}\{7_m + 2_a + 9_a \text{ bis}\}$. In the column headed observing hours the symbols $\odot_r$ and $\odot_s$ stand for sunrise and sunset; the affixes m. and a. to any given hour indicate morning and afternoon respectively; N. and Mdt. stand for noon and midnight; M. and E. for morning and evening; Max. and Min. for mean from maximum and minimum readings;

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[1] F. B. Hough, p. iv of the introduction to the results of meteorological observations made in obedience to instructions from the Regents of the University at sundry Academies in the State of New York, Albany, 1855.

[2] It should also be mentioned that for these Academy stations the monthly means are made up from the half-monthly means, there is therefore a slight inconsistency in the results for the months having an odd number of days (the first 15 days having been united into a mean for all months, excepting February). The October mean is most affected, less so May and March; the amount generally less than 0°.1 is small enough to be neglected.

" bis" attached to any hour indicates that the reading at this hour received double weight as explained above.

Respecting the corrections necessary to refer monthly and annual means depending on observations at certain hours to what they would have been had the observations been made hourly and continued day and night, the reader is referred to the discussion of the daily variation of the temperature. In this discussion it is shown that the mean of hourly observations represents the average temperature of the day within about 0°.01 Fah.

The following table of corrections for daily variation to means resulting from observations at certain hours was prepared directly from observations extending over a series of years at Toronto, Mohawk, New Haven, and Philadelphia; it is inserted here on account of its frequent application to our tabular results, either to refer them to the mean of the day or to a uniform set of hours, in which latter case the table can be made readily to apply. This table of corrections was found to answer well enough for the Eastern and Western States lying within the range of latitudes of the four stations; for Southern States and for the elevated western portion of the United States other less reliable corrections had to be supplied.

Table of corrections for daily variation of temperature, derived from observations made at Toronto, Mohawk, New Haven, and Philadelphia; for every hour and for various combinations of hours, in degrees of Fahrenheit.

Hours.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
Mid't	+1.6	+2.2	+2.8	+3.7	+4.7	+5.2	+5.2	+4.7	+4.2	+3.2	+2.0	+1.4	+3.41
1_m	+2.0	+2.7	+3.4	+4.6	+5.6	+6.3	+6.0	+5.4	+4.6	+3.8	+2.1	+1.8	+4.02
2_m	+2.2	+3.1	+3.9	+5.3	+6.4	+7.1	+6.7	+6.0	+5.2	+4.3	+2.5	+2.1	+4.57
3_m	+2.5	+3.6	+4.3	+5.7	+7.2	+7.8	+7.3	+6.5	+5.7	+4.7	+2.9	+2.4	+5.05
4_m	+2.7	+3.9	+4.7	+6.2	+7.8	+8.3	+7.8	+7.0	+6.2	+5.1	+3.2	+2.6	+5.46
5_m	+3.0	+4.2	+5.2	+6.5	+7.8	+8.1	+7.8	+7.2	+6.6	+5.4	+3.4	+2.8	+5.67
6_m	+3.0	+4.5	+5.4	+6.3	+6.4	+6.4	+6.3	+6.5	+6.4	+5.5	+3.5	+3.1	+5.27
7_m	+3.1	+4.6	+4.7	+4.7	+4.0	+3.8	+3.7	+4.5	+4.7	+4.6	+3.4	+3.1	+4.08
8_m	+2.8	+3.5	+2.7	+2.4	+1.5	+1.1	+1.1	+1.8	+2.2	+2.6	+2.4	+2.7	+2.24
9_m	+1.4	+1.3	+0.5	0.0	—0.9	—1.2	—1.2	—0.6	—0.2	+0.2	+0.7	+1.3	+0.11
10_m	—0.4	—0.9	—1.6	—2.0	—2.8	—3.2	—3.2	—2.8	—2.5	—2.1	—1.1	—0.5	—1.93
11_m	—1.9	—2.7	—3.2	—3.7	—4.4	—4.8	—4.9	—4.6	—4.4	—3.9	—2.6	—2.0	—3.60
Noon.	—3.2	—4.1	—4.5	—5.1	—5.7	—6.1	—6.2	—5.9	—5.7	—5.3	—3.8	—3.2	—4.91
1_a	—4.0	—5.1	—5.4	—6.2	—6.8	—7.1	—7.1	—6.9	—6.8	—6.2	—4.5	—4.0	—5.84
2_a	—4.5	—5.6	—6.1	—7.0	—7.5	—7.8	—7.6	—7.5	—7.4	—6.8	—4.8	—4.3	—6.42
3_a	—4.4	—5.7	—6.2	—7.2	—7.8	—8.1	—7.8	—7.8	—7.6	—6.7	—4.7	—4.1	—6.51
4_a	—3.8	—5.2	—5.8	—7.1	—7.8	—8.0	—7.5	—7.6	—7.4	—6.1	—3.8	—3.3	—6.12
5_a	—2.5	—3.9	—4.7	—6.3	—7.2	—7.2	—6.9	—6.8	—6.2	—4.4	—2.4	—2.0	—5.04
6_a	—1.5	—2.3	—2.9	—4.6	—5.5	—5.7	—5.4	—5.1	—4.0	—2.5	—1.3	—1.2	—3.51
7_a	—0.7	—1.2	—1.5	—2.2	—2.9	—3.3	—3.0	—2.5	—1.6	—1.0	—0.5	—0.6	—1.74
8_a	—0.1	—0.2	—0.4	—0.2	—0.2	—0.4	—0.2	+0.1	+0.3	+0.2	+0.1	—0.1	—0.09
9_a	+0.4	+0.5	+0.9	+1.2	+1.5	+1.6	+1.8	+1.7	+1.6	+1.1	+0.7	+0.3	+1.11
10_a	+0.9	+1.1	+1.5	+2.2	+2.7	+3.0	+3.1	+2.9	+2.7	+1.9	+1.1	+0.7	+1.99
11_a	+1.2	+1.7	+2.2	+3.0	+3.8	+4.3	+4.2	+3.8	+3.5	+2.6	+1.5	+1.0	+2.73
$\odot_r$	+3.0	+4.5	+5.3	+6.4	+7.8	+8.1	+7.8	+7.1	+6.5	+5.3	+3.4	+2.9	+5.68
$\odot_s$	—2.7	—3.0	—2.8	—2.8	—2.2	—1.5	—1.3	—2.4	—3.7	—3.7	—2.9	—2.7	—2.64
Max.	—4.5	—5.8	—6.2	—7.3	—7.9	—8.2	—7.8	—7.8	—7.7	—6.9	—4.9	—4.3	—6.62
Min.	+3.3	+4.6	+5.4	+6.5	+7.9	+8.4	+7.9	+7.2	+6.7	+5.6	+3.6	+3.2	+5.87
Max. & Min.	—0.6	—0.6	—0.4	—0.4	0.0	+0.1	+0.1	—0.3	—0.5	—0.6	—0.6	—0.6	—0.37
$\odot_r$ $\odot_s$	+0.2	+0.7	+1.3	+1.8	+2.8	+3.3	+3.2	+2.4	+1.4	+0.8	+0.2	+0.1	+1.52
$\odot_r$ 9_a	+1.7	+2.5	+3.1	+3.8	+4.6	+4.9	+4.8	+4.4	+4.0	+3.2	+2.1	+1.6	+3.39
6_m 1_a	—0.5	—0.3	0.0	0.0	—0.2	—0.3	—0.4	—0.2	—0.2	—0.4	—0.5	—0.4	—0.28
7_m 2_a	—0.7	—0.5	—0.7	—1.2	—1.7	—2.0	—2.0	—1.5	—1.3	—1.1	—0.7	—0.6	—1.17
7_m 9_a	+1.7	+2.6	+2.8	+3.0	+2.7	+2.7	+2.8	+3.1	+3.1	+2.9	+2.0	+1.7	+2.60
8_m 2_a	—0.8	—1.1	—1.7	—2.3	—3.0	—3.3	—3.3	—2.9	—2.6	—2.1	—1.2	—0.8	—2.09
8_m 7_a	+1.0	+1.2	+0.6	+0.1	—0.7	—1.1	—0.9	—0.4	+0.3	+0.8	+0.9	+1.1	+0.24
$\odot_r$ 9_m 3_a	0.0	0.0	—0.1	—0.3	—0.3	—0.4	—0.4	—0.4	—0.4	—0.4	—0.2	0.0	—0.24
$\odot_r$ N. $\odot_s$	—1.0	—0.9	—0.7	—0.5	0.0	+0.2	+0.1	—0.4	—1.0	—1.2	—1.1	—1.0	—0.62
$\odot_r$ 1_a 9_a	—0.2	0.0	+0.3	+0.5	+0.8	+0.9	+0.8	+0.6	+0.4	+0.1	—0.1	—0.3	+0.32
$\odot_r$ 1_a 10_a	0.0	+0.2	+0.5	+0.8	+1.2	+1.3	+1.3	+1.0	+0.8	+0.3	0.0	—0.1	+0.61
$\odot_r$ 2_a $\odot_s$	—1.4	—1.4	—1.2	—1.1	—0.6	—0.4	—0.4	—0.9	—1.5	—1.7	—1.4	—1.4	—1.13
$\odot_r$ 2_a 9_a	—0.4	—0.2	0.0	+0.2	+0.6	+0.6	+0.7	+0.4	+0.2	—0.1	—0.2	—0.4	+0.12
$\odot_r$ 3_a 9_a	—0.3	—0.2	0.0	+0.1	+0.5	+0.5	+0.6	+0.3	+0.2	—0.1	—0.2	—0.3	+0.09
6_m N. 6_a	—0.6	—0.6	—0.7	—1.1	—1.6	—1.8	—1.8	—1.5	—1.1	—0.8	—0.5	—0.4	—1.05
6_m 2_a 9_a	—0.4	—0.2	+0.1	+0.2	+0.1	+0.1	+0.2	+0.2	+0.2	—0.1	—0.2	—0.3	—0.01
6_m 2_a 10_a	—0.2	0.0	+0.3	+0.5	+0.5	+0.5	+0.6	+0.6	+0.6	+0.2	—0.1	—0.2	+0.28
7_m N. 6_a	—0.5	—0.6	—0.9	—1.7	—2.4	—2.7	—2.6	—2.2	—1.7	—1.1	—0.6	—0.4	—1.45
7_m 1_a 8_a	—0.3	—0.2	—0.4	—0.6	—1.0	—1.2	—1.2	—0.8	—0.6	—0.5	—0.3	—0.3	—0.62
7_m 1_a 9_a	—0.2	0.0	+0.1	—0.1	—0.4	—0.6	—0.5	—0.2	—0.2	—0.2	—0.1	—0.2	—0.22
7_m 2_a 5_a	—1.3	—1.6	—2.0	—2.9	—3.6	—3.7	—3.6	—3.3	—3.0	—2.2	—1.3	—1.1	—2.46
7_m 2_a 6_a	—1.0	—1.1	—1.4	—2.3	—3.0	—3.2	—3.1	—2.7	—2.3	—1.6	—0.9	—0.8	—1.95
7_m 2_a 7_a	—0.7	—0.7	—1.0	—1.5	—2.1	—2.4	—2.3	—1.8	—1.4	—1.1	—0.6	—0.6	—1.36
7_m 2_a 9_a	—0.3	—0.2	—0.2	—0.4	—0.7	—0.8	—0.7	—0.4	—0.4	—0.4	—0.2	—0.3	—0.41
7_m 3_a 9_a	—0.3	—0.2	—0.2	—0.4	—0.8	—0.9	—0.8	—0.5	—0.4	—0.3	—0.2	—0.2	—0.43
8_m 2_a 6_a	—1.1	—1.5	—2.1	—3.1	—3.8	—4.1	—4.0	—3.6	—3.1	—2.2	—1.2	—0.9	—2.56

Table of corrections for daily variation of temperature, etc.—Continued.

Hours.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
$8_m\ 2_a\ 8_a$	−0.6	−0.8	−1.3	−1.6	−2.1	−2.4	−2.2	−1.9	−1.6	−1.3	−0.8	−0.5	−1.42
$8_m\ 2_a\ 9_a$	−0.4	−0.5	−0.8	−1.1	−1.5	−1.7	−1.6	−1.3	−1.2	−1.0	−0.6	−0.4	−1.02
$8_m\ 2_a\ 10_a$	−0.3	−0.3	−0.6	−0.8	−1.1	−1.2	−1.1	−0.9	−0.8	−0.8	−0.4	−0.3	−0.73
9_m N. 9_a	−0.5	−0.8	−1.0	−1.3	−1.7	−1.9	−1.9	−1.6	−1.4	−1.3	−0.8	−0.5	−1.23
$9_m\ 3_a\ 9_a$	−0.9	−1.3	−1.6	−2.0	−2.4	−2.6	−2.4	−2.2	−2.0	−1.8	−1.1	−0.8	−1.76
$\odot_r\ 9_m\ 3_a\ 9_a$	+0.1	+0.2	+0.1	+0.1	+0.2	+0.1	+0.1	+0.1	+0.1	0.0	0.0	+0.1	+0.10
$\odot_r$ N. $2_a\ 6_a$	−1.6	−1.9	−2.1	−2.6	−2.7	−2.9	−2.8	−2.9	−2.6	−2.3	−1.6	−1.5	−2.29
$\odot_r$ N. $\odot_s\ 10_a$	−0.5	−0.4	−0.1	+0.2	+0.6	+0.9	+0.9	+0.4	−0.1	−0.4	−0.5	−0.6	+0.03
$\odot_r\ 2_a\ \odot_s\ 9_a$	−0.9	−0.9	−0.7	−0.5	−0.1	+0.1	+0.2	−0.3	−0.7	−1.0	−0.9	−0.9	−0.56
[1]	−0.9	−0.9	−0.6	−0.5	0.0	+0.3	+0.5	−0.2	−0.8	−1.1	−0.8	−0.7	−0.48
$3_m\ 9_m\ 3_a\ 9_a$	0.0	−0.1	−0.1	−0.1	0.0	0.0	0.0	0.0	−0.1	−0.2	−0.1	0.0	−0.06
$6_m\ 9_m\ 3_a\ 6_a$	−0.4	−0.5	−0.8	−1.4	−2.0	−2.1	−2.0	−1.7	−1.4	−0.9	−0.5	−0.2	−1.16
$6_m\ 9_m\ 3_a\ 9_a$	+0.1	+0.2	+0.1	+0.1	−0.2	−0.3	−0.2	−0.1	+0.1	0.0	0.0	+0.2	0.00
$7_m\ 2_a\ 9_a$ bis	−0.1	0.0	+0.1	0.0	−0.1	−0.2	−0.1	+0.1	+0.1	0.0	0.0	−0.1	−0.03

[1] For New York University System; derived from observations at Toronto and Mohawk.

Respecting the column headed References the following abbreviations were used:—

S. O.	for Smithsonian system of observations.
S. Coll.	for Smithsonian collection in general.
Sm. Con. to. Knowl.	for Smithsonian Contributions to Knowledge.
P. O. and S. I. Vol. I,	for Patent Office and Smithsonian Institution systems.
Ar. Met. Regs.	for Army Meteorological Registers.
MS. from S. G. O.	for Manuscript from Surgeon-General's Office.
Am. Alm	for American Almanac.
Agl. Rep.	for Agricultural Report.
Reg. Rep.	for Regents' Report.
N. Y. Univ. Syst.	for New York University System.

And various others whose meaning is sufficiently apparent

TABLES OF MEAN TEMPERATURE

FOR

EACH MONTH, SEASON, AND THE YEAR AT VARIOUS STATIONS, PRINCIPALLY IN NORTH AMERICA.

EXPRESSED IN DEGREES AND FRACTIONS OF THE FAHRENHEIT SCALE.

ICELAND.

NAME OF STATION.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Eya Fiord	65°42′	18°05′	..	25°.70	18°.50	20°.66	27°.50	36°.14	43°.52	46°.94	46°.94	43°.16	34°.34	25°.88	18°.32
2. Reikjavik	64 09	21 55	..	29.82	28.31	29.86	36.46	44.80	51.58	56.19	52.86	46.45	36.91	30.45	29.41

GREENLAND.

NAME OF STATION.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Friedrichsthal . .	60 05	44 50	..	19.62	18.72	22.10	27.50	..	..	..	..	..	32.45	35.15	29.75
2. Godthaab . . .	64 10	52 10	..	12.38	12.56	15.60	22.01	32.16	39.09	41.92	40.84	35.65	29.84	21.94	17.49
3. Jacobshavn . . .	69 12	50 58	..	0.05	— 2.20	5.90	16.92	31.77	40.32	45.27	41.67	34.25	26.37	11.52	4.55
4. Lichtenau . . .	60 22	45 40	..	19.74	23.	27.63	32.43	39.27	43.09	45.37	41.09	39.70	35.58	26.13	22.41
5. Lichtenfels . . .	63 00	51 20	..	11.59	13.05	17.71	24.03	32.47	38.73	43.07	40.39	34.77	28.60	21.20	13.93
6. Nye Hernhut . .	64 10	51 40	..	9.05	22.10	21.65	24.80	32.00	40.10	40.33	37.40	34.03	32.90	15.80	11.75
7. Omenak	70 41	52 00	..	— 6.25	— 8.95	— 1.30	13.77	29.97	38.75	43.02	40.55	32.90	22.55	13.77	— 0.17
8. Port Foulke[2] . .	78 18	73 00	0	—26.0	—24.9	—22.3	—11.0	+23.8	+33.9	+40.5	(+36.1)	+22.6	+7.6	+ 2.8	—12.8
9. Upernavik . . .	72 47	56 03	..	—12.32	—18.40	— 9.85	+ 2.75	26.15	36.27	39.42	38.52	30.87	19.62	10.17	— 6.70
10. Van Rensselaer Harbor	78 37	70 53	0	—28.20	—26.45	—34.90	—10.35	+13.40	30.10	38.20	31.80	13.45	—3.60	—21.95	—31.15
11. Wolstenholme Sound	76 33	68 56	..	—25.07	—34.02	—17.47	— 3.74	25.82	39.73	40.52	33.67	26.76	11.32	—18.60	—27.05

BRITISH NORTH AMERICA.—ARCTIC REGION.

NAME OF STATION.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Arctic Ocean . .	74 41	101 22	..	—36.71	—41.12	—31.95	— 7.13	..	..	..	..	17.88	4.06	—20.18	—30.45
2. Assistance Bay . .	74 40	94 16	..	—29.00	—29.80	—22.40	— 3.20	12.50	34.30	37.80	..	21.30	1.50	— 6.70	—21.40
3. Batty Bay . . .	73 12	91 10	..	—19.92	—18.19	—17.00	+ 2.14	..	..	..	..	22.59	8.53	—11.27	—15.45
4. Bay of Mercy . .	74 06	117 54	..	—35.59	—32.15	—26.91	— 1.38	10.24	31.50	36.72	33.25	22.34	— 1.15	—15.86	—23.04
5. Beechey Island . .	74 30	91 5[illegible]	..	—33.00	—25.44	—12.98	+ 1.85	18.92	36.77	39.40	34.25	20.50	10.78	+ 6.78	—23.89
6. Boothia Felix . .	69 59	92 01	..	—28.69	—32.02	—29.01	— 2.54	15.65	34.16	41.26	38.69	25.41	9.07	— 5.42	—22.43
7. Dealy Island . .	74 52	108 30	..	—36.13	—30.42	—19.17	— 2.47	16.09	33.04	36.42	33.01	18.80	—0.56	—12.07	—26.00
8. Disaster Bay . .	75 31	92 10	..	—36.38	—39.23	—29.87	+ 4.84	9.36	27.93	38.09	36.27	17.01	9.52	—17.20	—26.61
9. Fort Anderson . .	68 30	134 30	..	—38.05	—28.78	—24.80	+ 5.28	25.65	54.28	65.50	..	35.83	17.85	— 2.33	—31.23
10. Fort Confidence .	66 54	118 49	500	—26.79	—19.48	—18.92	+ 4.36	27.68	46.69	52.90	45.20	37.66	22.12	— 1.71	—22.71
11. Griffith's Island .	74 36	95 30	..	—31.90	—32.90	—25.70	— 7.00	23.00	35.00?	38.50?	36.30?	20.20	0.30	— 6.90	—22.20
12. Igloolik	69 21	81 53	..	—17.07	—20.41	—19.75	— 1.68	24.85	32.16	40.04	37.77	24.45	12.79	—19.37	—27.80
13. Melville Island . .	74 47	110 48	..	—30.09	—32.19	—18.10	— 8.37	16.66	36.24	42.41	32.68	22.54	—3.46	—20.60	—21.79
14. Northumberland Sound	76 52	97 00	..	—40.00	—28.57	—16.69	— 7.60	14.74	29.86	35.69	33.80	18.48	—0.40	— 5.64	—34.49
15. Peel River[4] . . .	67 32	134 30	..	—24.45	—24.19	—13.88	+15.03	34.06	54.09	58.60	50.90	35.75	12.12	—11.84	—23.47
16. Port Kennedy . .	72 01	94 14	0	—34.4	—37.1	—18.2	— 2.8	+15.3	+35.3	+40.1	36.95	25.4	7.4	—11.7	—33. 6
17. Port Bowen . . .	73 14	88 56	..	—28.91	—27.32	—28.38	— 6.50	17.65	36.12	37.29	35.77	25.88	10.85	— 5.00	—19.05
18. Port Leopold . .	73 31	90 18	..	—35.70	—35.20	—22.80	—10.10	..	..	..	..	..	9.70	—14.50	—36.40
19. Prince of Wales' Strait	72 47	117 34	..	—32.44	—37.67	—28.82	— 4.70	18.85	36.09	37.54	37.15	20.20	—0.23	—10.17	—23.36
20. Repulse Bay[6] . .	66 32	86 56	15	—29.32	—26.68	—28.10	— 3.95	17.88	31.38	41.46	..	28.57	12.56	+ 0.68	—19.27
21. Repulse Bay[7] . .	66 32	86 56	10	—32.4	—36.4	—16.9	+ 4.7	24.0	37.7	43.5	..	25.2	12.0	—19.8	—25.4

BRITISH NORTH AMERICA.—SOUTH OF LATITUDE 66° 30′.

NAME OF STATION.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Abbittibe	48 50	77 45	..	+ 2.21	— 2.91	14.16	21.74	30.65	64.58	71.35	61.08	50.40	37.35	23.51	+ 0.04
2. Athabasca Lake .	58 43	111 48	700	—23.0	+ 4.8	+ 2.4	35.1	44.8	53.9	..	..	..	21.5	9.8	+ 0.4
3. Bedfont House . .	57 23	102 59	..	—19.0	—16.7	— 5.0	11.5	24.5	..	..	..	..	26.0	+ 1.5	—18.0
4. Caribou Castle . .	53 48	56 47	..	+ 0.33	10.67	15.56	35.98	42.59	55.29	51.79	..	..	34.49	24.05	10.00
5. Carlton House . .	52 51	106 13	1100	..	..	11.92	29.75	47.92	..	..	..	..	..	..	..
6. Cumberland House	53 57	102 20	900	— 5.	— 2.	6.	25.	50.	59.	70.	60.	48.	39.	11.	5.
7. Cumberland House	53 57	102 20	900	—13.2	— 1.1	12.1	35.0	50.0	58.8	61.8	56.2	47.0	36.9	13.0	3.2
8. Cumberland House	53 57	102 20	900	— 0.89	— 8.06	18.30	27.01	52.59	..	..	62.84	44.50	33.15	21.48	7.94
9. Edmondton House	53 40	112 45	1800	11.05	14.32	..	..	..	..	..	..	..	..	..	..
10. Fort à la Corne . .	53 10	104 30	.	..	..	..	..	..	..	..	..	..	..	19.95	1.45
11. Fort Chipewayan .	58 43	111 15	700	— 8.76	— 4.01	+ 3.08	19.80	45.40	55.00	63.00	58.10	43.53	33.00	19.13	2.76

[1] Observations in "morning and evening," from October, 1796, to May, 1802, and from July, 1816, to June, 1821; from September, 1841, to June, 1845, at 10_m and 10_a.
[2] Value for August interpolated.
[3] Observations made every four hours.
[4] Fort McPherson.
[5] From 6 to 12 observations daily.
[6] Fort Hope.
[7] Fort Hope. The September and October observations, made at 8_m 8_a, have been referred to 8_m 2_a 8_a by means of the "Boothia Felix" table. Correction to scale at —35° = —4°.5; at 0° correction supposed 0, and a proportional amount between 0° and —35° applied.

ICELAND.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	28°.10	45°.80	34°.46	20°.84	32°.30	....	2 0	......	Van Scheels.	Dove, Rep. Br. Assoc. 1847.
2	37.04	53.54	37.94	29.18	39.43	Jan. 1823; July, 1837	14 6	max. & min.	Thorstenson.	Dove, Rep. Br. Assoc. 1847.

GREENLAND.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	22.70	..	....	0 7	......	....	Dove, Rep. Br. Assoc. 1847.
2	23.26	40.62	29.14	14.14	26.79	Oct. 1796; June, 1845	14 6	M. E.[1]	Bull, Muhlenpfort Bloch.	Dove, Rep. Br. Assoc. 1847.
3	18.20	42.42	24.05	0.80	21.37	Aug. 1842; July, 1846	4 0	M. N.	....	Dove, 1857.
4	33.11	43.18	33.80	21.72	32.95	July, 1841; Aug. 1843	2 0	......	....	Dove, Rep. Br. Assoc. 1847.
5	24.74	40.73	28.19	12.86	26.63	Jan. 1846; July, 1852	6 6	......	....	Dove, 1857.
6	26.15	39.28	27.58	14.30	26.83	July, 1842; June, 1843	1 0	......	Koegel.	Dove. Rep. Br. Assoc. 1848.
7	14.15	40.77	23.07	— 5.12	18.22	Aug. 1833; July, 1838	5 0	M. N.	....	Dove, 1857.
8	— 3.17	(36.83)	11.00	—21.23	(+5.86)	Sept. 1860; July, 1861	0 11	bi-hourly	Dr. I. I. Hayes.	Sm. Con. to Knowl. 1867.
9	+ 6.35	38.07	20.22	—12.47	13.04	Aug. 1833; July, 1838	5 0	M. N.	....	Dove, 1857.
10	—10.62	33.37	— 4.03	—28.60	— 2.47	Sept. 1853; Apr. 1855	1 8	hourly.	Dr. E. K. Kane.	Sm. Con. to Knowl. 1859.
11	+ 1.54	37.97	+ 6.49	—28.71	+ 4.32	Aug. 1849; July, 1850	1 0	[3]	Rae.	Richardson.

BRITISH NORTH AMERICA.—ARCTIC REGION.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	+ 0.59	—36.09	..	Sept. 1853; Apr. 1854	0 8	......	Kellett.	"Voyage of Resolute."
2	— 4.37	..	+ 5.37	—26.73	..	Sept. 1850; July, 1851	0 11	tri-hourly.	Penny.	Sutherland.
3	..	..	+ 6.62	—17.85	..	....	0 8	......	....	Dove, 1857.
4	— 6.02	33.82	+ 1.78	—30.26	— 0.17	Sept. 1851; Apr. 1853	1 7	......	McClure.	Armstrong's Personal Narrative.
5	+ 2.60	36.81	12.69	—27.44	+ 6.16	....	1 0	tri-hourly.	....	Dove, 1857.
6	— 5.30	38.04	9.69	—27.71	+ 3.68	Oct. 1829; Mar. 1832	2 6	hourly.	Ross.	Ross.
7	— 1.85	34.16	+ 2.06	—30.85	+ 0.88	Sept. 1852; Aug. 1853	1 0	......	Kellett.	"Voyage of Resolute."
8	— 5.22	34.10	3.11	—34.07	— 0.52	....	1 0	......	....	Dove, 1857.
9	+ 2.04	..	17.12	—32.69	..	May, 1863; Apr. 1864	0 11	7_m 2_a 9_a bis	M. M. McLeod.	S. O.
10	+ 4.37	48.26	19.36	—22.99	12.25	....	1 0	15 observations daily.	....	Dove, 1857.
11	— 3.23	36.60?	4.53	—29.00	+ 2.22	....	1 0	......	Austin.	"Voyage of Resolute."
12	+ 1.14	36.66	5.96	—21.76	+ 5.50	Sept. 1822; Aug. 1823	1 0	bi-hourly.	Parry.	Parry.
13	— 3.27	37.11	— 0.51	—28.02	+ 1.33	Sept. 1819; Aug. 1820	1 0	bi-hourly.	Parry.	Parry.
14	— 3.18	33.12	4.15	—34.35	— 0.07	....	1 0	......	....	Dove, 1857.
15	11.74	54.53	12.01	—24.04	13.56	Feb. 1863; Dec. 1865	2 7	7_m 2_a 9_a	A. Flett.	S. Coll. and S. O.
16	— 1.90	37.45	7.03	—35.03	1.89	Aug. 1858; Aug. 1859	1 1	[5]	Sir F. L. McClintock.	Sm. Con. to Knowl. 1862.
17	— 5.74	36.39	10.58	—25.09	4.03	Sept. 1824; Aug. 1825	1 0	bi-hourly.	Parry.	Parry.
18	..	..	..	—35.77	..	Oct. 1848; Apr. 1849	0 7	......	....	Belcher.
19	— 4.89	36.93	3.27	—31.16	+ 1.04	Aug. 1850; Aug. 1851	1 1	......	McClure.	"Voyage of Resolute."
20	— 4.72	..	13.94	—25.09	..	Sept. 1846; July, 1847	0 11	tri-hourly.	Rae.	Rae.
21	+ 3.93	..	+ 5.80	—31.40	..	Sept. 1853; July, 1854	0 11	8_m 2_a 8_a	Dr. J. Rae.	S. Coll.

BRITISH NORTH AMERICA.—SOUTH OF LATITUDE 66° 30′.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	22.18	65.67	37.09	— 0.22	31.18	Sept. 1867; May, 1869	1 8	7_m 2_a 9_a bis hourly	J. Lockhart.	S. Coll. and S. O.
2	27.43	..	..	— 5.93	..	Oct. 1843; June, 1844	0 9		Richardson.	Blodget's Clim.
3	10.33	..	..	—17.90	..	Oct. 1795; May, 1796	0 8	......	Thompson.	S. Coll.
4	31.38	..	..	+ 7.00	..	Oct. 1777; July, 1778	0 10	[8]	....	Cartwright's Labrador.
5	29.86	..	..	..	..	1827	0 3	max. & min.	Richardson.	Franklin.
6	27.00	63.00	32.67	— 0.67	30.50	Oct. 1789; Sept. 1790	1 0	......	Thompson.	S. Coll.
7	32.37	58.93	32.30	— 3.70	29.98	Sept. 1819; Aug. 1820	1 0	......	....	Dove, Rep. Br. Assoc. 1847.
8	32.63	..	33.04	— 0.34	..	Aug. 1839; Sept. 1840	0 10	8_m 8_a[9]	Lewis.	Richardson.
9	..	..	..	..	..	1827	0 2	max. & min.	Drummond.	Franklin.
10	..	..	..	..	..	1864	0 2	7_m 2_a 9_a bis	....	S. O.
11	22.76	58.70	31.89	— 3.34	27.50	1825; 1839	3 6	8_m 8_a[10]	Keith and Stewart.	Richardson.

[8] Observations made at daylight, warmest time of day, and after dark.

[9] Corrected for daily variation by means of Dove's Toronto Table.

[10] The means for 1825–6 are derived from the daily extremes, those for 1838–39 from observations at 8_m 8_a. They have been corrected for daily variation by means of the Toronto formula.

BRITISH NORTH AMERICA.—SOUTH OF LATITUDE 66° 30′.

NAME OF STATION.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
12. Fort Churchill . .	58°50′	94°30′	20	—28.°	—20.°	12.°	20.°	38.°	50.°	58.°	50.°	42.°	28.°	5.°	—18.°
13. Fort Churchill . .	58 50	94 30	20	—21.21	— 7.31	— 4.63	16.29	28.42	44.69	56.80	53.39	36.03	26.50	3.32	—14.00
14. Fort Enterprise. .	64 28	113 06	850	—15.57	—25.88	—13.48	5.78	31.20	..	..	..	31.59	21.75	— 1.70	—30.54
15. Fort Franklin . .	65 12	122 45	230	—22.34	—16.75	— 5.39	12.35	35.18	48.02	52.10	50.56	41.00	22.47	— 0.11	—10.89
16. Fort Nascopie . .	54 25	65 22	..	—10.1	+ 1.7	8.0	17.4	31.0	43.3	..	..	..	28.8	15.8	— 2.8
17. Fort Norman . .	64 30	125 00	200	—23.05	—12.93	— 9.48	14.28	47.68	..	..	..	..	..	..	..
18. Fort Prince of Wales	59	..	..	—25.6	—17.5	— 9.2	21.2	38.0	50.0	56.4	53.0	44.0	28.0	1.7	—15.5
19. Fort Rae. . . .	62 46	109 01	..	—23.15	—23.15	— 2.68	18.64	41.53	..	..	..	..	23.65	+ 1.08	—17.91
20. Fort Reliance . .	62 46	109 00	650	—25.01	—18.85	—10.47	8.23	36.03	..	..	..	..	..	13.44	—17.07
21. Fort Resolution .	61 10	113 50	500	..	—25.60	9.95	12.88	40.14	..	..	..	..	26.06	12.04	— 2.59
22. Fort Simpson[3] . .	62 10	121 20	300	—13.46	—10.43	+ 4.47	25.94	47.89	63.50	60.81	53.16	[48.00]	23.20	7.52	— 9.22
23. Fort Simpson . .	62 10	121 20	300	— 7.6	— 2.3	— 6.5	32.8	52.2	..	..	..	..	31.2	6.4	—18.6
24. Fort Simpson . .	62 10	121 20	300	—18.13	—12.87	11.90	24.27	46.77	61.80	..	..	..	27.00	4.27	—14.47
25. Fort Simpson . .	62 10	121 20	300	—15.43	— 9.98	+ 3.87	26.13	49.45	64.87	..	..	44.91	25.45	— 1.21	—15.97
26. Hebron	58 20	63 30	..	— 5.24	— 5.31	4.62	16.83	33.01	36.61	43.57	49.10	38.84	29.43	23.58	5.18
27. Hebron	58 20	63 30	..	— 5.03	— 0.04	9.93	21.76	32.69	41.41	47.41	48.04	39.89	29.59	19.36	3.83
28. Isthmus Bay. . .	53 47	56 30	..	8.55	7.10	24.79	27.76	36.14	45.59	..	..	..	..	..	11.89
29. Kinogumissee . .	49 50	84 00	1000	3.27	10.70	11.21	33.29	42.30	62.28	64.25	61.35	48.47	38.37	22.85	11.12
30. Little Whale River[5]	56 02	77 30	12	— 9.88	—12.05	14.63	20.45	33.08	37.95	50.83	47.20	[38.94]	32.13	17.15	— 2.15
31. Moose Factory . .	51 15	80 45	30	— 7.28	— 4.95	9.05	25.53	39.33	52.56	59.12	56.67	45.83	36.20	21.70	4.52
32. Moose Factory . .	51 15	80 45	30	—10.86	— 4.85	14.29	15.80	40.40	44.96	56.40	58.40	47.62	37.17	18.54	— 4.54
33. Nain	57 10	61 50	..	—11.87	+ 3.87	6.35	27.50	37.17	43.47	50.45	51.80	44.82	33.12	23.00	6.80
34. Nain	57 10	61 50	..	..	..	..	..	..	..	..	..	..	..	..	..
35. Nain	57 10	61 50	..	— 4.33	— 3.21	8.74	19.21	31.66	37.44	44.03	51.01	41.04	26.03	24.71	7.70
36. Nain	57 10	61 50	..	— 3.84	— 0.69	9.46	22.66	32.83	41.78	48.22	51.10	42.21	32.13	22.28	3.38
37. Nain	57 10	61 50	..	0.95	3.51	7.52	29.97	36.23	42.53	50.18	50.99	44.98	33.98	26.51	6.51
38. Norway House . .	53 50	98 00	..	— 7.13	— 2.36	7.58	27.40	44.62	54.99	63.55	61.13	46.40	31.09	12.48	1.06
39. Okhak	57 45	63 20	..	2.15	1.95	8.25	29.0	38.25	44.65	51.65	52.0	44.45	31.15	22.4	8.45
40. Okhak	57 45	63 20	..	— 5.33	— 2.04	11.28	23.92	33.14	43.00	49.46	51.31	41.90	30.33	21.99	4.06
41. Oxford House . .	55 00	95 00	400	—22.06	— 1.90	8.57	28.62	38.01	..	..	..	..	17.53	13.29	—23.06
42. Pelly Banks . . .	62 45	130 45	1400	—21.95	—14.73	— 0.99	20.44	..	..	..	..	..	..	..	—13.98
43. Red River Settlement	49 05	97 00	600	..	14.05	16.72	41.41	..	57.16	63.08	..	50.06	32.30	16.00	5.82
44. Red River Settlement	49 05	97 00	653	— 1.79	— 1.09	18.25	33.38	51.62	62.82	67.50	64.62	54.91	40.93	18.79	— 0.46
45. Rigolet	53 30	58 21	..	— 1.68	+ 1.57	20.36	27.05	33.95	42.36	..	..	..	..	22.35	3.28
46. Rigolet	53 30	58 21	..	— 0.81	+ 2.87	13.43	26.62	34.69	41.66	51.69	50.96	41.70	32.18	21.84	4.18
47. Rupert House . .	51 30	78 40	20	— 4.09	— 0.68	7.64	21.05	41.51	..	..	..	..	34.80	23.33	15.59
48. Victoria	48 55	123 22	64	38.09	42.22	44.79	48.67	55.51	..	..	..	..	..	..	..
49. Winnepeg . . .	49 52	97 00	650	8.96	5.78	13.36	39.46	56.61	61.65	66.20	64.35	55.73	39.99	25.70	8.23
50. Winowkupa . . .	53	57	..	9.70	— 0.07	15.15	24.32	42.83	..	..	..	..	32.03	19.83	— 3.85
51. Winter Island . .	66 10	83 10	..	—22.96	—24.97	—11.64	5.51	23.09	33.97	36.34	36.60	31.06	12.51	7.75	—12.94
52. York Factory . .	57 00	92 26		— 5.12	— 6.60	4.77	19.21	33.53	47.67	59.99	54.85	41.90	33.43	25.17	3.73

NEW FOUNDLAND.

NAME OF STATION.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. St. John's[9]. . . .	47 34	52 40	140	23.34	20.86	24.20	33.38	39.26	48.00	56.10	57.86	52.96	44.44	33.96	25.32
2. St. John's[10] . . .	47 34	52 40	170	23.77	23.49	30.33	35.47	44.46	52.75	59.49	60.31	55.83	44.27	36.25	27.95
3. St. John's	47 34	52 40	..	..	..	..	..	..	..	..	..	..	..	..	..

[1] Morning, afternoon, and evening.

[2] Corrected for daily variation by means of Dove's Toronto Table.

[3] Series much broken. Mean for September interpolated.

[4] Observations made at daylight, warmest time of day, and after dark.

[5] Value for September interpolated.

[6] Hours of Observation 7_m 8_m N. 4_a $5 \cdot 5_a$.

[7] Daily means derived from $\frac{7t_1 + 7t_2 + 10t_3}{24}$, t_1 t_2 t_3 representing the observations at the above hours; the instrument used was a Negretti and Zambra maximum and minimum thermometer, tested at Kew.

BRITISH NORTH AMERICA.—SOUTH OF LATITUDE 66° 30′.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
12	23°.33	52°.67	25°. 00	—22°.00	19°.75	1769	1 0	......	....	Dove, Rep. Br. Assoc. 1847.
13	13.36	51.63	21.95	—14.17	18.19	Feb. 1838; May, 1839	1 3	[1]	Harding.	Richardson.
14	7.83	..	17.21	—24.00	..	Sept. 1820; May, 1821	0 9	......	Franklin.	Richardson.
15	14.05	50.23	21.12	—16.66	17.18	Sept. 1825; May, 1827	1 9	18 times daily	Franklin.	Dove, Rep. Br. Assoc. 1847.
16	18.80	..	..	— 3.73	..	Oct. 1864; June, 1865	0 9	$7_m\ 2_a\ 9_a$	H. Connolly.	S. Coll.
17	17.49	..	..	..	..	1862	0 5	$7_m\ 2_a\ 9_a$ bis	A. Flett.	S. O.
18	16.67	53.13	24.57	—19.53	18.71	1768; 1769	1 0	......	Wales.	Williams' History of Vermont.
19	19.16	..	..	—21.40	..	Oct. 1859; May, 1863	1 5	$7_m\ 2_a\ 9_a$ bis	L. Clarke, Jr.	P. O. and S. I. Vol. 1, and S. O.
20	11-26	..	..	—20.31	..	Nov. 1833; Mar. 1835	1 0	15 times daily	Back.	Dove, Rep. Br. Assoc. 1847.
21	20.99	..	..	..	..	....	0 7	$8_m\ 8_a$[2]	....	Richardson.
22	26.10	59.16	[26.24]	—11.04	[25.12]	1837; 1840	2 6	$8_m\ 8_a$	McPherson.	Edin. N. Phil. Journ. Jan. 1841.
23	26.17	..	..	— 9.50	..	Oct. 1851; May, 1852	0 8	$8_m\ 2_a\ 8_a$	B. R. Ross.	S. Coll.
24	27.65	..	..	—15.16	..	Mar. 1856; Apr. 1859	2 1	max. & min.	B. R. Ross.	P. O. and S. I. Vol. 1.
25	26.48	..	23.05	—13.79	..	Sept. 1859; Apr. 1862	1 5	$7_m\ 2_a\ 9_a$ bis	B. R. Ross, A. Flett, W. W. Kirkby.	P. O. and S. I. Vol. 1, and S. O.
26	18.15	43.09	30.62	— 1.79	22.52	....	2 0	......	....	Dove, Rep. Br. Assoc. 1847.
27	21.46	45.62	29.61	— 0.41	24.07	Sept. 1842; Aug. 1848	6 0	$6_m\ 7_m$ N $6_a\ 7_a$	....	Dove, 1857.
28	29.56	..	..	9.18	..	Dec. 1785; June, 1786	0 7	[4]	....	Cartwright's Labrador.
29	28.93	62.63	36.56	8.36	34.12	Sept. 1860; Apr. 1863	1 6	$7_m\ 2_a\ 9_a$ bis	T. Richards.	S. O.
30	22.72	45.33	[29.41]	— 8.03	[22.36]	Nov. 1861; Dec. 1862	1 1	"	W. Dickson.	S. O.
31	24.64	56.12	34.58	— 2.57	28.19	Sept. 1857; May, 1862	2 5	"	J. McKenzie.	P. O. and S. I. Vol. 1, and S. O.
32	23.50	53.25	34.44	— 6.75	26.11	Sept. 1858; Aug. 1859	1 0	$\odot_r\ 2_a\ 10_a$	J. McKenzie.	P. O. and S. I. Vol. 1.
33	23.67	48.57	33.65	— 0.40	26.37	Aug. 1777; Aug. 1780	3 1	8_m N. $4_a\ 8_a$	M. de la Trobe.	
34	23.90	48.38	33.44	0.60	26.58	....	..	......	....	Bridgewater Treatises.
35	19.87	44.16	30.59	+ 0.05	23.67	Sept. 1841; June, 1843	1 10	......	....	Dove.
36	21.65	47.03	32.21	— 0.38	25.13	Sept. 1841; July, 1852	9 6	[6]	....	Dove, 1857.
37	24.57	47.90	35.16	3.66	27.82	....	3 0	8_m N. $4_a\ 8_a$	....	Dove, Rep. Br. Assoc. 1847.
38	26.53	59.89	29.99	— 2.81	28.40	1841; 1847	7 0	max. & min.	Ross.	MS. in S. Coll.
39	25.17	49.43	32.67	4.18	27.86	1777; 1780	2 0	8_m N. $4_a\ 8_a$	....	Dove, Rep. Br. Assoc. 1847.
40	22.78	47.92	31.41	— 1.10	25.25	....	..	......	....	Dove, 1857.
41	25.07	..	..	—15.67	..	Oct. 1833; May, 1834	0 8	7_m N. 8_a[2]	....	Richardson.
42	..	..	..	—16.89	..	Dec. 1848; Apr. 1849	0 5	$\odot_r\ 3_a$ dusk[2]	Campbell.	Richardson.
43	..	..	32.79	..	..	1844	0 9	$\odot_r\ 9_m\ 3_a\ 9_a$	....	MS. in S. Coll.
44	34.42	64.98	38.21	— 1.11	34.12	June, 1855; Sept. 1861	4 4	$7_m\ 2_a\ 9_a$	D. Gunn.	P. O. and S. I. Vol. 1, and S. O.
45	27.12	..	..	+ 1.06	..	Nov. 1857; June, 1859	1 4	$\odot_r\ \odot_s$	H. Connolly.	P. O. and S. I. Vol. 1.
46	24.91	48.10	31.91	2.08	26.75	July, 1860; June, 1863	2 5	$7_m\ 2_a\ 9_a$ bis	H. Connolly.	S. O.
47	23.40	..	..	3 61	..	1839; 1840	0 8	$\odot_r\ 1.5_a\ \odot_s$[2]	....	Richardson.
48	49.66	..	..	..	..	1864	0 5	$8_m\ 3_a\ 10_a$[7]	Dr. D. Walker.	MS. in S. Coll.
49	36.48	64.07	40.47	7.66	37.17	Jan. 1869; Dec. 1870	1 3	$7_m\ 2_a\ 9_a$ bis	J. Stewart.	S. O.
50	27.43	..	..	1.93	..	Oct. 1865; May, 1866	0 8	"	H. Connolly.	S. O.
51	5.65	35.64	17.11	—20.29	9.53	Aug. 1821; July, 1822	1 0	bi-hourly	Parry.	Parry.
52	19.17	54.17	33.50	— 2.66	26.05	June, 1830; May, 1831	1 0	M. N. E.[8]	Charles.	Richardson.

NEW FOUNDLAND.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	32.28	53.99	43.79	23.17	38.31	Jan. 1834; Dec. 1838	5 0	max. & min.	J. Templeman.	Printed Sheet.
2	36.75	57.52	45.45	25.07	41.20	Aug. 1849; Feb. 1869	7 1	......	G. R. Kennedy, J. Delaney & sons, E. M. J. Delaney, R. C. Caswell.	Sm. Coll., New Foundland Alm. 1862, P. O. and S. I. Vol. 1., and S. O.
3	..	..	..	..	40.80	1855; 1858	3 0	......	....	Trans. Nova Scotia Inst. Nat. Sci. Vol. 1.

[8] "The exact hours of morning and evening are not specified; they have been corrected by Dove's table on the supposition that the hours were $\odot_r$ and $\odot_s$."

[9] Colonial Secretary's Office.

[10] Observations made in several localities (for the most part at "Colonial Building"), and at various hours. They have been corrected for daily variation by means of the general table.

PROVINCE OF NOVA SCOTIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Albion Mines	45°34′	62°42′	120	19°.15	19°.42	27°.30	37°.43	48°.73	58°.63	66°.39	65°.54	56°.30	46°.47	35°.75	23°.98
2. Caledonia Coal Mine	46 12	59 57	60	19.27	19.70	24.23	32.77	41.42	54.15	60.55	64.15	57.03	45.67	36.22	24.88
3. Halifax	44 39	63 35	8	23.44	23.65	29.96	38.13	48.36	56.90	64.51	63.74	57.96	48.91	39.34	28.75
4. Halifax	44 39	63 35	..	..	..	..	..	..	..	..	..	..	..	..	..
5. Halifax[2]	44 39	63 35	..	23.75	24.50	29.00	38.50	47.75	56.25	62.00	63.25	57.25	46.50	39.00	26.25
6. Halifax	44 39	63 35	130	20.20	23.31	27.47	37.26	47.97	58.92	63.98	64.15	58.31	46.11	36.04	25.18
7. Windsor	44 59	64 07	200	26.84	29.01	36.33	48.96	61.05	70.47	75.82	75.02	66.68	54.26	40.61	32.12
8. Windsor	44 59	64 07	200	23.27	22.49	30.63	38.07	48.48	60.35	66.05	64.68	57.25	46.26	37.31	25.54
9. Wolfville	45 06	64 25	80	21.73	23.84	28.98	39.86	50.06	60.03	66.22	65.26	57.24	47.28	38.18	26.36

PRINCE EDWARD ISLAND.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Charlottetown	46 12	63 00	..	17.91	23.52	27.81	37.60	51.59	60.19	69.48	67.68	59.49	45.79	37.49	28.60

PROVINCE OF NEW BRUNSWICK.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Fredericton	45 57	66 40	..	17.	24.	33.	40.	37.	48.5	65.5	69.75	61.5	47.5	31.	13.5
2. St. John	45 22	66 04	135	18.21	21.97	27.81	36.35	46.33	54.49	59.27	59.01	54.80	44.53	35.59	22.96

PROVINCE OF QUEBEC (CANADA EAST).

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Fort Coulonge	45 55	77 04	250	11.33	15.72	28.74	40.55	54.30	65.40	69.40	66.46	56.28	45.05	31.30	17.01
2. Island of St. Helen[5]	45 30	73 33	60	13.53	17.68	24.90	38.37	53.97	64.73	68.91	68.04	57.62	46.50	31.58	19.66
3. Montreal	45 31	73 33	60	14.66	18.13	28.43	41.94	58.06	68.12	78.89	69.67	60.23	47.43	33.83	18.96
4. Montreal	45 31	73 34	57	15.00	17.51	29.45	43.53	58.14	68.37	73.14	70.79	60.64	46.46	33.71	19.07
5. Montreal	45 31	73 33	..	14.52	16.20	28.63	41.84	58.99	71.01	74.46	73.12	62.42	47.05	33.97	19.29
6. Montreal	45 31	73 33	50	15.00	16.40	28.40	39.80	55.40	66.20	71.00	68.40	55.80	44.60	34.40	17.80
7. Montreal	45 31	73 33	118	12.29	17.27	27.05	40.76	55.59	67.01	70.98	68.32	60.21	47.66	35.50	19.65
8. Montreal	45 31	73 33	..	..	..	..	..	..	..	..	..	..	..	..	..
9. Nicolet	46 14	72 32	..	13.26	13.26	27.22	39.48	52.69	63.58	68.50	67.83	57.90	44.32	32.27	17.24
10. Quebec	46 49	71 12	..	10.	10.	22.	40.	52.	67.	69.	67.	51.	44.	36.	20.
11. Quebec	46 49	71 12	300	9.88	12.79	24.36	38.66	52.88	63.69	66.81	65.51	56.25	44.13	31.54	17.28
12. Quebec[6]	46 48	71 12	330	..	..	..	..	..	..	..	..	..	..	..	..
13. Quebec[6]	46 48	71 12	330	..	..	..	..	..	..	63.93	63.65	50.21	45.28	..	..
14. Quebec	46 49	71 12	..	10.98	14.83	28.38	39.40	53.58	65.27	71.29	70.77	57.50	43.70	34.32	12.64
15. Quebec	46 49	71 12	..	15.91	12.65	22.66	39.65	54.84	63.95	73.40	66.88	62.38	42.80	33.13	13.89
16. Quebec	46 49	71 12	..	..	..	..	..	..	..	..	..	..	..	..	..
17. St. Anne	47 24	70 05	175	11.05	18.35	25.18	36.23	..	..	..	..	..	..	..	22.00
18. St. Martin[8]	45 32	73 46	118	10.94	16.56	25.26	39.78	54.77	65.42	71.48	67.32	58.60	46.22	31.73	16.33
19. Sherbrook[9]	45 25	71 53	..	18.5	11.9	22.9	35.9	38.9	..	64.3	56.7	..	..	..	..
20. Stanbridge	45 08	73 00	222	14.68	16.90	25.43	39.81	54.32	64.07	68.32	65.71	56.87	44.18	33.15	19.27

[1] Observations for 1853–54, at 7_m 2_a 9_a.

[2] Results from three observations daily, at hours not stated.

[3] At the even hours. The values for 2_m and 4_m were interpolated from the readings at midn't and 6_m, and by means of a minimum thermometer.

[4] Corrected for daily variation by means of the general table.

[5] At the Barracks, R. A., opposite Montreal. During the first year, the observations were made bi-hourly, at the *even* hours; during the second, bi-hourly, at the *odd* hours.

[6] Cape Diamond.

PROVINCE OF NOVA SCOTIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	37°.82	63°.52	46°.17	20°.85	42°.09	1843;	1854	11	1	$\odot_r\ 9_m\ 3_a\ 9_a$[1]	H. Poole.	MS. in S. Coll.
2	32.81	59.62	46.31	21.28	40.00	Jan. 1867;	Dec. 1869	3	0	max. & min.	H. Poole.	Trans. Nova Scotia Inst. Nat. Sci. Vol. II.
3	38.82	61.72	48.74	25.28	43.64	Oct. 1845;	Feb. 1861	10	6	$6_m\ 3_a\ 8_a$	Generd, C. Harrison.	Dove; Board of Trade First Paper; P. O. and S. I. Vol. I, and S. O.
4	..	..	..	..	43.65	1860;	1863	4	0	......	....	Trans. Nova Scotia Inst. Nat. Sci. Vol. I.
5	38.42	60.50	47.58	24.83	42.83	Jan. 1863;	Dec. 1866	4	0	......	Colonel Myers.	Trans. Nova Scotia Inst. Nat. Sci. Vols. I and II.
6	37.57	62.35	46.82	22.90	42.41	Jan. 1867;	Dec. 1869	3	0	bi-hourly[3]	F. Allison.	Trans. Nova Scotia Inst. Nat. Sci. Vol. II.
7	48.78	73.77	53.85	29.32	51.43	Jan. 1794;	Dec. 1811	17	4	......	....	S. Coll.
8	39.06	63.69	46.94	23.77	43.36	May, 1867;	June, 1863	3	5	$7_m\ 2_a\ 9_a$	Profs. J. D. Everett, H. How, and J. M. Hensley.	P. O. and S. I. Vol. I, and S. O.
9	39.63	63.84	47.57	23.98	43.75	Sept. 1855;	Dec. 1870	11	6	[4]	A. P. S. Stuart, C. F. Hartt, D. F. Higgins.	P. O. and S. I. Vol. I, and S. O.

PRINCE EDWARD ISLAND.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	39.00	65.78	47.59	23.34	43.93	....		1	0	......	....	Dove, 1857.

PROVINCE OF NEW BRUNSWICK.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	36.67	61.25	46.67	18.17	40.69	....		1	0	......	....	Dove, Rep. Br. Assoc. 1848.
2	36.83	57.59	44.97	21.05	40.11	Dec. 1863;	Dec. 1870	7	0	$6_m\ 2_a\ 10_a$	G. Murdoch.	S. O.

PROVINCE OF QUEBEC (CANADA EAST).

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	41.20	67.09	44.21	14.69	41.80	Jan. 1824;	Dec. 1831	8	0	$\odot_r$ N. $\odot_s$	Severight.	S. Coll.
2	39.08	67.23	45.23	16.96	42.12	Aug. 1839;	July, 1841	2	0	......	J. S. McCord.	Printed Report, Montreal, 1842.
3	42.81	72.23	47.16	17.25	44.86	1826;	1840	15	0	max. & min.	J. S. McCord.	Drake.
4	43.71	70.77	46.94	17.19	44.65	Jan. 1826;	Dec. 1852	27	0	$7_m\ 3_a$	W. S. Kakel.	Hall's MS. Phil. Mag.
5	43.15	72.86	47.81	16.67	45.12	Jan. 1845;	Dec. 1853	9	0	$8_m\ 1_a\ 6_a$	L. A. H. Latour.	MS. in S. Coll.
6	41.20	68.53	44.93	16.40	42.77	Jan. 1846;	Dec. 1850	5	0	......	Dr. Bethune.	S. Coll.
7	41.13	68.77	47.79	16.40	43.52	Sept. 1855;	June, 1863	6	5	$7_m\ 2_a\ 9_a$	Dr. A. Hall.	P. O. and S. I. Vol. I, and S. O.
8	..	..	..	..	41.45	1857;	1861	4	0	......	....	Trans. Nova Scotia Inst. Nat. Sci. Vol. I.
9	39.80	66.64	44.83	14.59	41.46	Jan. 1838;	Dec. 1846	9	0	$6_m\ 3_a$	Desanniers.	S. Coll.
10	38.00	67.67	43.67	13.33	40.67	1743;	1744	1	0	......	Gautier.	Sill. Journal.
11	38.63	65.34	43.97	13.32	40.31	Jan. 1809;	Dec. 1818	10	0	......	Dr. Sparks.	S. Coll.
12	..	..	..	..	37.19	1828;	1836	9	0	[7]	Watt.	"
13	..	..	..	..	..	1829		0	4	......	....	"
14	40.45	69.11	45.17	12.82	41.89	1845;	1847	2	0	......	....	Dove, 1853.
15	39.05	68.08	46.10	14.15	41.85	....		..		......	....	Bouchette.
16	38.84	68.00	46.04	14.18	41.76	....		..		......	....	Bridgewater Treatises.
17	..	..	..	17.13	..	Dec. 1866;	Apr. 1867	0	5	$7_m\ 2_a\ 9_a$ bis	J. O'Donohue.	S. O.
18	39.94	68.07	45.52	14.61	42.03	Jan. 1851;	Jan. 1862	10	1	$7_m\ 2_a\ 9_a$	Dr. C. Smallwood.	S. Coll., P. O. and S. I. Vol. I, and S. O.
19	32.57	..	..	..	..	1836		0	7	$\odot_r\ 1_a\ 9_a$	Z. Thompson.	S. Coll.
20	39.85	66.03	44.73	16.95	41.89	Mar. 1856;	Dec. 1870	11	4	$7_m\ 2_a\ 9_a$ bis	J. C. Baker, A. H. I. Gilmour.	P. O. and S. I. Vol. I, and S. O.

[7] Hours of observation $6_m\ 9_m$ N. $3_a\ 6_a\ 9_a$.—Captain Lefroy, in the "Canadian Journal" for November, 1852, notes a diminution of 2°.5 in the mean annual temperature, resulting from the last five years of this series, when compared with that for the first four years. It appears to be due to a change in the hours of observation.

[8] Observations for 4 years 6 months of this series were made at $6_m\ 2_a\ 10_a$. They were referred to $7_m\ 2_a\ 9_a$ by means of the general table.

[9] Observations for the first five months at "Hatley," a few miles to the southwest of "Sherbrook."

PROVINCE OF ONTARIO (CANADA WEST).

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Ancaster	43°15′	80°07′	..	27°.50	25°.45	33°.79	43°.80	54°.60	63°.20	68°.73	66°.42	59°.01	47°.34	37°.64	30°.23
2. Brantford	43 08	80 14	..	27.00	25.87	35.88	51.50	61.75	72.62	78.75	75.38	63.13	49.00	37.44	28.22
3. Clifton[1]	43 05	79 06	..	..	26.60	36.57	39.27	50.89	68.61	73.83	70.69	60.30	47.98	39.50	28.60
4. Fort William	48 23	89 22	660	5.70	8.22	22.72	31.42	48.87	58.73	62.19	58.84	48.16	41.88	23.43	18.16
5. Hamilton	43 15	79 57	300	26.43	26.29	33.73	43.68	55.60	66.47	72.46	70.44	61.86	49.65	39.84	29.93
6. Kingston	44 13	76 29	300	16.0	20.5	32.0	48.0	56.0	63.0	68.5	68.0	62.5	46.0	32.5	26.5
7. Kingston	44 13	76 29	..	18.99	9.88	27.01	40.01	58.01	65.99	70.00	67.01	59.99	49.01	36.99	25.99
8. Kingston	44 13	76 29	..	..	..	..	..	..	..	..	..	..	..	..	..
9. Kingston	44 13	76 29	294	..	..	..	..	..	..	..	..	..	..	..	..
10. Kingston	44 13	76 29	294	20.98	23.14	34.00	40.20	59.62	63.49	66.26	68.53	59.07	48.09	38.34	19.07
11. Lake Temiscamingue	47 19	79 31	630	9.23	18.44	24.41	39.04	49.35	62.75	67.28	65.58	53.39	40.83	25.97	17.68
12. Michipicoten	47 56	85 06	660	10.63	16.66	26.09	34.66	51.88	55.00	57.03	60.04	49.67	44.92	29.01	22.38
13. Michipicoten	47 56	85 06	660	8.72	12.62	23.84	39.00	52.30	59.00	70.01	64.68	57.11	46.32	32.33	22.21
14. Michipicoten[3]	47 56	85 06	660	5.79	6.09	16.62	36.05	42.12	[55.52]	59.03	60.80	51.00	42.82	29.62	14.69
15. Niagara	43 09	79 06	270	..	27.05	30.81	43.57	49.67	61.80	..	..	..	51.17	38.47	34.60
16. Penetangushene	44 48	80 00	600	22.50	21.23	30.82	37.48	55.09	67.85	73.15	68.72	54.93	48.83	37.85	24.38
17. Toronto	43 39	79 23	342	22.24	19.17	29.41	40.44	..	..	..	..	..	..	34.75	26.01
18. Toronto[5]	43 39	79 23	342	23.13	23.03	29.57	41.09	51.52	61.60	67.30	66.06	58.17	45.80	36.73	26.05

ALABAMA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Ashville	33 50	86 19	..	32.75	51.13	42.46	49.73	63.50	70.93	72.63	74.33	67.46	60.56	46.27	45.70
2. Auburn	32 36	85 31	821	42.98	49.50	53.01	64.35	71.36	77.66	80.08	79.12	76.48	62.88	56.65	48.96
3. Bon Secour[6]	30 18	87 46	..	50.45	56.17	62.73	..	..	..	80.10	79.03	78.49	..	58.51	54.17
4. Cahawba	32 19	87 11	160	..	..	..	..	..	..	82.25	80.56	75.39	57.41	57.48	..
5. Carlowville	32 05	87 08	400	46.98	52.89	58.02	63.47	71.86	78.58	81.82	80.42	74.54	64.98	54.32	48.76
6. Coatopa[7]	32 40	88 15	350	..	49.98	53.13	60.55	71.45	76.23	80.35	79.84	74.10	66.70	53.03	43.78
7. Elyton, near	33 30	86 54	..	..	46.00	50.03	59.29	70.19	76.59	81.21	79.34	72.79	63.57	49.78	40.08
8. Erie	32 45	87 31	..	52.21	57.20	66.54	66.74	76.20	81.38	84.78	82.72	76.99	67.02	55.32	54.30
9. Erie	32 45	87 31	..	45.62	51.86	58.92	63.92	73.83	75.70	80.81	81.51	75.19	64.80	53.20	47.24
10. Eutaw[8]	32 50	88 00	..	41.27	52.22	58.04	65.68	73.58	79.93	82.40	80.69	73.73	61.84	50.47	45.20
11. Florence	34 47	87 41	..	45.5	42.8	63.0	63.5	70.0	77.3	77.0	78.7	72.6	59.0	56.5	44.3
12. Fort Morgan[9]	30 14	88 01	20	55.29	50.34	56.16	65.11	74.97	80.01	82.18	81.38	76.96	70.94	60.86	56.84
13. Fort Morgan	30 14	88 01	20	58.96	55.50	63.61	69.33	71.04	80.86	85.34	86.64	82.95	71.83	60.93	55.84
14. Greene Springs	32 50	87 46	500	43.60	49.49	56.01	62.75	70.79	76.99	79.58	78.77	73.09	61.90	52.07	45.77
15. Greensboro[11]	32 43	87 40	350	45.39	50.47	56.16	61.90	70.31	76.92	79.31	78.28	72.22	61.97	52.60	47.21
16. Huntsville	34 45	86 40	600	42.06	42.59	51.34	61.30	67.25	74.23	76.39	76.24	70.15	59.50	49.74	41.81
17. Mobile	30 41	88 02	15	51.3	53.7	59.4	67.1	74.1	77.8	79.8	79.4	76.1	65.7	57.0	52.3
18. Mobile	30 41	88 02	15	55.25	55.57	65.64	70.00	76.37	82.17	82.41	82.76	77.59	67.95	59.92	54.32
19. Monroe	32 23	86 40	..	..	56.99	62.97	71.97	73.00	75.98	78.98	79.99	..	61.99	..	..
20. Monroeville	31 32	87 28	150	47.91	56.40	62.78	65.59	73.50	78.31	79.99	80.15	76.13	69.46	56.38	52.73
21. Montgomery	32 23	86 18	162	46.98	52.73	60.88	63.80	75.49	77.62	..	..	73.40	61.40	50.19	50.18
22. Moulton	34 29	87 23	643	41.66	47.47	52.63	61.46	68.49	74.17	77.20	76.48	70.19	56.95	48.33	42.93
23. Mount Airy	32 20	86 52	..	47.73	..	60.96	..	..	78.91	82.45	85.85	77.80	66.22	54.69	..
24. Mt. Vernon Arsenal	31 05	88 02	200	49.98	54.20	60.09	66.60	74.05	78.48	80.15	79.85	76.17	66.03	56.84	51.37
25. Newbern	32 38	87 37	..	..	..	..	..	..	..	..	..	..	..	51.89	47.94
26. Opelika, near	32 38	85 25	..	45.77	50.70	56.88	62.84	68.96	77.74	80.18	78.41	74.81	62.31	52.08	46.93
27. Orville	32 20	87 20	200	..	..	..	..	..	..	..	..	..	61.97	56.45	45.00

[1] Near Niagara Falls. This series has been formed by combining the observations at "Clifton" with those at "Suspension Bridge, N. Y." They were made at various hours, and have been corrected for daily variation by means of the general table.

[2] Corrected for daily variation by means of Dove's Toronto table.

[3] Value for June interpolated.

[4] "The readings were recorded regularly at 8_m N. 5_a 8_a. When the highest or lowest temperature for the day occurred at other periods it was registered."

[5] Magnetic and Meteorological Observatory, in the grounds of the University of Toronto. The hours of observation for 1840 are not known, but the results can differ little from the true mean of the day; from January, 1841, to June, 1842, the observations were taken bi-hourly; from July 1, 1842, to June 30, 1848, hourly. Afterwards, to the end of 1852, the observing hours were irregular; not less than six readings were taken daily, and some hourly and bi-hourly. From January, 1853, to the end of the series, the observations were taken regularly at 6_m 8_m 2_a 4_a 10_a and M., "excepting on Sundays, Christmas day, and Good Friday, when the instruments were read at 6_m 2_a only. These latter readings, though recorded in the daily register, are not

PROVINCE OF ONTARIO (CANADA WEST).

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	44°.06	66°.12	48°.00	27°.73	46°.48	Jan. 1835; Dec. 1845	11 0	9_m 9_a	Craigie.	S. Coll.
2	49.71	75.58	49.86	27.03	50.54	Nov. 1836; Dec. 1844	8 2	......	McDougal.	" "
3	42.24	71.04	49.26	..	..	May, 1867; Dec. 1870	1 6	......	W. M. Jones.	S. O.
4	34.34	59.92	37.82	10.69	35.69	....	..	8_m 8_a[2]	....	Richardson.
5	44.34	69.79	50.45	27.55	48.03	Jan. 1846; Dec. 1859	13 6	9_m 9_a	Dr. W. Craigie.	Can. Journ. Feb. 1854, and P. O. and S. I. Vol. 1.
6	45.33	66.50	47.00	21.00	44.96	July, 1843; Feb. 1845	1 8	......	Smith.	MS. in S. Coll.
7	41.68	67.67	48.66	18.29	44.07	....	1 0	......	....	Dove, 1857.
8	..	..	..	..	42.77	1856; 1858	3 0	......	....	Trans. Nova Scotia Inst. Nat. Sci. Vol. 1.
9	..	..	..	..	44.56	1856; 1861	6 0	9.5_m 3.5_a	J. Williamson.	S. Coll.
10	44.61	66.09	48.50	21.06	45.07	Jan. 1859; Dec. 1860	2 0	"	"	" "
11	37.60	65.20	40.06	15.12	39.50	....	..	$\odot_r$ N. $\odot_s$[2]	Severight.	Richardson.
12	37.54	57.36	41.20	16.56	38.16	....	..	8_m 8_a	Keith.	"
13	38.38	64.56	45.25	14.52	40.68	1847	1 0	8_m 2_a	Swanston.	Regent's Report.
14	31.60	[58.45]	41.15	8.86	[35.01]	Nov. 1860; Mar. 1866	1 5	7_m 2_a 9_a bis	C. Rankin.	S. O.
15	41.35	..	..	..	..	Feb. 1861; June, 1863	0 10	7_m 1_a 9_a	H. Phillipps.	S. O.
16	41.13	69.91	47.20	22.70	45.24	May, 1825; Apr. 1826	1 0	max. & min.[4]	Todd.	Franklin's Second Journey.
17	..	..	..	22.47	..	Jan. 1831; Dec. 1839	4 0	......	Dade.	Up. Can. Med. Journ.
18	40.73	64.99	46.90	24.07	44.17	Jan. 1840; Dec. 1870	31 0	......	....	....

ALABAMA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	51.90	72.63	58.10	43.19	56.45	1857	1 0	......	T. M. Barker.	P. O. and S. I. Vol. 1.
2	62.91	78.95	65.34	47.15	63.59	Jan. 1855; Jan. 1858	3 0	7_m 2_a 9_a	Prof. J. Darby.	" " " "
3	..	..	..	53.60	..	Nov. 1866; Sept. 1868	1 0	7_m 2_a 9_a bis	W. J. Vankirk.	S. O.
4	..	..	63.43	..	..	1859	0 5	7_m 2_a 9_a	Dr. M. Troy.	P. O. and S. I. Vol. 1.
5	64.45	80.27	64.61	49.54	64.72	June, 1856; Dec. 1870	7 2	7_m 2_a 9_a bis	Dr. H. L. Alison.	P. O. and S. I. Vol. 1, and S. O.
6	61.71	78.81	64.61	..	..	Aug. 1859; Dec. 1870	1 0	"	Rev. S. U. Smith, Dr. S. K. Jennings.	" " " " "
7	59.84	79.05	62.05	..	..	1870	0 11	"	E. B. Shields.	S. O.
8	69.83	82.96	66.44	54.57	68.45	May, 1824; June, 1825	1 2	6_m N. 4_a	Osborn.	S. Coll.
9	65.56	79.34	64.40	48.24	64.38	1849; 1852	3 8	$\odot_r$ 9_m 3_a 9_a	Jennings and Osborn.	" "
10	65.77	81.01	62.01	46.23	63.75	1850; 1853	2 2	"	A. Winchell.	" "
11	65.50	77.67	62.70	44.20	62.52	1849	1 0	......	B. R. Gifford.	" "
12	65.41	81.19	69.59	54.16	67.59	Jan. 1835; Dec. 1867	2 10	[10]	Assistant Surgeon.	Ar. Met. Reg. 1855, and MS. from S. G. O.
13	67.99	84.28	71.90	56.77	70.24	1848; 1850	..	hourly.	Officers of U. S. C. S.	S. Coll.
14	63.18	78.45	62.35	46.29	62.57	Jan. 1854; Dec. 1870	10 0	7_m 2_a 9_a bis	H. Tutwiler and J. W. A. Wright.	P. O. and S. I. Vol. 1, and S.
15	62.79	78.17	62.26	47.69	62.73	June, 1856; Jan. 1870	6 6	"	R. B. Waller, Dr. S. K. Jennings.	" " " " "
16	59.96	75.62	59.80	42.15	59.38	1829; 1842	13 0	......	Allan.	Drake.
17	66.87	79.00	66.27	52.43	66.14	....	10 0	......	....	Patent Office Report.
18	70.67	82.45	68.49	55.05	69.16	Apr. 1840; Feb. 1870	3 4	7_m 2_a 9_a	Dr. S. B. North, L. B. Taylor.	Am. Alm. 1842 and foll., and S. O.
19	69.31	78.32	..	..	..	....	0	"	....	Dove, 1857.
20	67.29	79.48	67.32	52.35	66.61	1849; 1853	3 11	$\odot_r$ 9_m 3_a 9_a	Cumming.	S. Coll.
21	66.72	..	61.66	49.96	..	Mar. 1849; Apr. 1861	1 5	[10]	Swan & J. A. Shepherd	" "
22	60.86	75.95	58.49	44.02	59.83	Mar. 1859; Dec. 1869	3 8	7_m 2_a 9_a bis	A. J. Harris, A. D. Hunt, T. M. Peters, J. Shackelford.	P. O. and S. I. Vol. 1, and S. O.
23	..	82.40	66.24	..	..	1850; 1851	0 8	$\odot_r$ 9_m 3_a 9_a	Percivall.	S. Coll.
24	66.91	79.49	66.35	51.85	66.15	Aug. 1840; Nov. 1860	19 4	[10]	Assistant Surgeon.	Ar. Met. Regs. 1855, and 1860, and MS. from S. G. O.
25	..	..	..	..	..	1850	0 2	$\odot_r$ 9_m 3_a 9_a	A. Winchell.	S. Coll.
26	62.89	78.78	63.07	47.80	63.13	Mar. 1867; Dec. 1869	2 7	7_m 2_a 9_a bis	E. B. & J. H. Shields.	S. O.
27		..	..	..	..	1859	0 3	7_m 2_a 9_a	Dr. S. K. Jennings.	P. O. and S. I. Vol. 1.

included in the hourly means of the month." From 1841 to 1863, inclusive, the observations have been corrected for daily variation, but since the correction to the mean of any one month amounts, in maximo, to only about $\pm$°.1, and for the year to but + °.02, it has been omitted from 1864–1870. The duties of the observatory are carried on by the director, G. T. Kingston, A.M., assisted by Messrs. Walker, Menzies, Stewart, and Davidson.

[6] Observations in 1867–68 at Fish River, or Bolivar, 5 miles N.W. of Bon Secour. [7] Observations in August, 1859, at Livingston, 5 miles to the S.

[8] Observations in 1853 at 7_m 2_a 9_a. No correction for change of hours has been applied. [9] Observations in 1867 at Fort Gaines some miles to the west.

[10] Observations at various hours; they have been referred to the mean of the day, making use of the "Fort Morgan table."

[11] Observations from January, 1868, to October, 1869, inclusive, "6 miles east of Havana;" and from November, 1869, to January, 1870, inclusive, "near Greensboro." All the stations are within a radius of a few miles, and have about the same elevation.

ALABAMA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
28. Prairie Bluff	32°08′	87°32	..	46°.15	58°.05	57°.48	65°.08	71°.33	80°.93	81°.98	81°.43	76°.00	65°.70	57°.65	..
29. Selma	32 25	87 01	200	49.69	50.71	57.43	62.83	74.02	77.99	80.66	79.18	73.77	64.70	54.91	48°.22
30. Springhill	30 41	88 07	157	53.46	53.21	60.74	73.34	87.07	88.95	91.26	88.09	82.81	71.38	64.67	55.70
31. Springhill College	30 41	88 07	157	..	..	..	..	..	77.54	..	..	..	..	..	..
32. Tuscaloosa[1]	33 12	87 39	245	46.11	41.88	52.90	..	..	77.47	81.53	83.27	78.00	64.23	51.06	44.90
33 Tuskegee	32 25	85 46	..	..	..	59.16	58.70	63.74	73.67	..	..	..	..	..	..
34. Wewokaville	33 18	86 12	..	44.21	47.20	..	..	..	..	..	82.80	76.20	..	..	..
35. Yorkville	33 24	88 18	..	..	..	..	..	.	..	..	86.29	79.93	68.45	55.06	..

ALASKA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Fort Kadiak	57 48	152 21	..	33.06	26.51	33.99	38.72	44.11	49.21	56.03	55.71	52.13	45.02	38.03	32.29
2. Fort Kenai[2]	60 33	151 18	..	..	..	..	..	..	..	59.59	60.18	..	..	..	..
3. Fort St. Michael	63 28	161 52	..	— 2.57	21.37	20.12	25.75	39.28	50.27	52.15	54.55	..	32.47	4.23	1.00
4. Fort Tongass	54 46	130 30	20	33.96	36.28	38.52	44.87	50.28	56.42	58.71	59.09	53.12	48.81	41.05	38.07
5. Fort Wrangel	56 28	132 23	..	25.01	32.38	31.81	43.80	50.54	55.99	58.25	58.26	51.83	45.07	37.63	36.06
6. Fort Yukon	66 34	145 18	..	—26.85	—26.44	—11.16	12.66	41.24	53.49	65.75	59.90	38.66	21.60	— 8.28	—18.43
7. Fort Yukon	66 34	145 18	412	—29.5	—11.6	+ 0.6	..	+41.3	..	..	..	..	..	..	..
8. Illoolook[4]	53 54	166 24	..	29.82	31.80	30.79	35.72	41.28	46.21	50.60	51.91	43.66	36.72	32.90	29.64
9. Illoolook	53 54	166 24	..	32.45	32.22	30.65	32.45	37.17	43.02	47.73	53.15	49.32	40.10	29.75	31.55
10. Illoolook	53 54	166 24	..	35.1	34.0	28.5	35.7	..	..	..	..	..	39.0	35.3	30.3
11. Kotzebue Sound	..	163 00	..	..	..	..	..	..	..	52.33	43.	34.04	..	..	..
12. Kotzebue Sound	66 58	165 07	15	—12.01	—15.49	— 6.00	14.49	29.99	38.77	50.04	43.94	38.39	25.00	1.10	5.24
13. Nulato	64 42	157 55	..	—17.70	—12.60	+14.87	26.40	46.47	..	..	..	..	..	..	— 9.33
14. Point Clarence	60 35	165 00	..	—11.06	+ 0.74	+ 4.59	11.50	32.83	40.41	51.91	44.91	40.68	22.62	0.63	0.29
15. Point Providence[6]	64 14	173 03	..	20.50	16.00	6.26	21.49	29.50	38.14	..	..	..	25.49	17.51	3.74
16. St. Paul's Island	57 15	170 00	40	30.52	24.68	30.79	32.63	38.28	44.89	..	..	..	..	33.53	29.22
17. Sitka	57 03	135 20	20	35.73	36.32	39.70	42.85	48.80	54.95	58.53	59.02	53.87	46.49	40.82	34.61
18. Sitka	57 03	135 20	20	29.57	30.67	34.02	39.89	46.00	52.47	55.08	55.10	50.05	44.03	37.69	35.91
19. Sitka[7]	57 03	135 20	20	30.39	31.69	34.32	39.58	45.84	50.60	54.24	54.43	50.59	43.85	37.27	31.76
20. Sitka	57 03	135 20	20	34.96	36.76	38.04	43.67	47.37	53.82	56.86	57.34	53.34	48.20	40.81	35.40
21. Unalaklik	63 51	160 44	..	—10.40	..	..	..	..	..	..	..	..	..	6.47	3.13

ARIZONA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Camp Bowie	32 10	109 50	..	44.31	48.68	54.95	62.41	70.66	79.68	78.23	77.09	75.01	66.78	55.63	48.62
2. Camp Colorado	34 08	114 18	..	54.08	58.83	64.66	71.26	79.23	86.96	92.23	91.06	83.70	72.11	63.84	51.98
3. Camp Crittenden	31 43	110 35	..	42.13	45.00	51.87	61.89	69.41	79.25	77.36	74.53	73.30	61.33	53.64	42.11
4. Camp Date Creek[8]	34 18	112 40	3726	43.52	47.35	51.73	61.49	70.38	81.16	83.69	81.66	76.41	63.48	53.21	45.71
5. Camp El Dorado	35 45	114 50	..	52.92	53.20	..	74.85	80.34	88.78	94.17	..	..	..	..	..
6. Camp Goodwin	32 52	109 51	..	44.63	49.84	56.27	65.47	74.83	82.91	87.06	83.52	79.58	69.00	55.08	46.09
7. Camp Grant[9]	32 54	110 40	..	47.12	51.49	57.77	66.25	76.62	85.55	87.53	83.69	79.18	70.34	58.24	48.17
8. Camp Hualpai[10]	34 15	114	..	37.02	..	..	59.40	64.26	71.81	73.76	71.36	..	..	48.47	35.67
9. Camp Lincoln	34 52	111 35	..	..	..	..	..	..	64.40	..	77.38	72.68	63.69	53.69	..
10. Camp Lowell Tucson	32 13	110 53	..	49.16	50.89	58.77	67.11	76.58	85.54	87.04	83.98	80.77	72.19	61.41	50.67
11. Camp McDowell	33 46	111 36	..	50.36	53.95	59.04	69.69	78.89	88.60	92.42	89.58	83.83	73.22	60.90	52.49
12. Camp Reno	33 56	111 20	..	47.85	50.91	62.48	68.48	78.85	89.56	91.35	88.11	85.42	71.38	61.20	48.19
13. Camp Skull Valley	34 45	112 30	5000	42.16	39.03	42.37	57.83	..	..	..	..	..	..	..	..

1 University of Alabama.

2 Formerly Fort Nicholas.

3 "Observations in summer at 6_m 6_a; in winter as early as the thermometer could be read in the morning, and as late in the evening.—Dove's corrections for these hours at Toronto have been applied."

4 Old style. The difference in the calendars is 12 days, but the Russians carrying their time *eastward* and we *westward*, one day must be subtracted, thus making our account 11 days nominally in advance of the Russian. The Observations for 1866–67, and probably for the other years of the series, were made 8_m N. 8_a.

ALABAMA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
28	64°.63	81°.45	66°.45	..	..	1867	0 11	$7_m\ 2_a\ 9_{a\ bis}$	W. Henderson, R. M. Reynolds.	S. O.
29	64.76	79.28	64.46	49°.54	64°.51	Apr. 1858; Dec. 1870	1 11	$7_m\ 2_a\ 9_a$	Dr. S. K. Jennings, C. F. Fahs, R. B. Deans.	P. O. and S. I. Vol. 1, and S. O.
30	73.72	89.43	72.95	54.12	72.56	1841	1 0	9_m N. $3_a\ 9_a$	Fabre.	Printed Journal.
31	..	..	..	..	..	1866	0 1	$6_m\ 2_a$	A. Cornette.	S. O.
32	..	80.76	64.43	44.30	..	Jan. 1854; Mar. 1855	0 11	$7_m\ 2_a\ 9_a$	Prof. M. Tuomey, and G. Benagh.	P. O. and S. I. Vol. 1.
33	60.53	..	..	..	..	1842	0 4	7_m	Jennings.	Regents' Report.
34	..	..	..	..	..	Aug. 1849; Feb. 1854	0 4	$7_m\ 2_a\ 9_a$	B. T. Holley.	S. Coll.
35	..	..	67.81	..	..	1854	0 4	$8_m\ 2_a\ 8_a$	Dr. J. W. Payne.	P. O. and S. I. Vol. 1.

ALASKA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	38.94	53.65	45.06	30.62	42.07	Apr. 1869; Aug. 1870	1 5	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
2	..	..	..	..	..	1870	0 2	"	" "	" "
3	28.38	52.32	..	6.60	..	Oct. 1865; Aug. 1866	0 11	$7_m\ 2_a\ 9_{a\ bis}$	H. M. Bannister, J. M. Bean.	S. O.
4	44.56	58.07	47.66	36.10	46.60	June, 1868; Sept. 1870	2 4	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
5	42.05	57.50	44.84	31.15	43.89	May, 1868; Sept. 1870	1 10	"	" "	" "
6	14.25	59.71	17.33	—23.91	16.84	....	..	3	....	Richardson.
7	..	..	..	..	..	1861	0 4	$7_m\ 2_a\ 9_a$	R. Kennicott.	S. Coll.
8	35.93	49.57	37.76	30.42	38.42	Oct. 1827; Mar. 1867	7 1	M. N. E.	Bishop Veniamisnoff, I. Shayatnikoff	Ex. Doc. (H.) No. 177 40th Cong. 2d Sess.
9	33.42	47.97	39.72	32.07	38.30	....	2 0	$8_m\ 1_a\ 9_a$ [5]	....	Dove, 1857.
10	..	..	..	33.13	..	Oct. 1867; Apr. 1868	0 7	$7_m\ 2_a\ 9_a$	Dr. P. Panshin.	U. S. Coast Survey.
11	..	..	..	..	..	1826; 1827	0 3	max. & min.	Beechey.	Dove, Rep. Br. Assoc. 1848.
12	12.83	44.25	21.50	— 7.42	17.79	....	1 0	hourly.	....	Dove, 1857.
13	29.25	..	..	—13.21	..	Dec. 1866; May, 1867	0 6	$9_m\ 1_a\ 8_a$	W. H. Dall.	S. O.
14	16.31	45.74	21.31	— 3.34	20.01	July, 1850; June, 1852	2 0	hourly.	....	Dove, 1857.
15	19.08	..	..	13.41	..	....	0 9	"	....	" "
16	33.90	..	..	28.14	..	Nov. 1869; Dec. 1870	0 10	$7_m\ 2_a\ 9_a$	Assistant Surgeon, C. Bryant.	MS. from S. G. O. and U.S.C.S.
17	43.78	57.50	47.06	35.55	45.97	1833; 1842	9 9	9_m N. $3_a\ 9_a$	Wrangel, Veniamisnoff, Cygnaeus.	Dove, 1853.
18	39.97	54.22	43.92	32.05	42.54	Mar. 1842; 1848	5 6	hourly.	....	" "
19	39.91	53.09	43.90	31.28	42.05	May, 1847; Sept. 1867	16 11	"	....	Annales de L'Observatoire Physique Central de Russie, and Ex. Doc. (H.) No. 177, 40th Cong. 2d Sess.
20	43.03	56.01	47.45	35.71	45.55	Nov. 1867; Dec. 1870	3 2	$7_m\ 2_a\ 9_a$	Assistant Surgeon, C. Bryant.	MS. from S. G. O. and S. O.
21	..	..	..	..	..	Nov. 1866; Jan. 1867	0 3	9_m N. 8_a	F. Westdaht.	S. O.

ARIZONA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	62.67	78.33	65.81	47.20	63.50	Aug. 1867; Dec. 1870	3 5	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
2	71.72	90.08	73.22	54.96	72.50	Jan. 1869; Dec. 1870	2 0	"	" "	" "
3	61.06	77.05	62.76	43.08	60.99	Apr. 1868; Dec. 1870	2 8	"	" "	" "
4	61.20	82.17	64.37	45.53	63.32	May, 1867; Dec. 1870	3 8	"	" "	" "
5	..	..	..	..	..	1867	0 6	"	" "	" "
6	65.52	84.50	67.89	46.85	66.19	Jan. 1866; May, 1870	3 10	"	" "	" "
7	66.88	85.59	69.25	48.93	67.66	Dec. 1860; Dec. 1870	4 10	"	" "	" "
8	..	72.31	..	..	..	1870	0 8	"	" "	" "
9	..	..	63.35	..	..	1868	0 5	"	" "	" "
10	67.49	85.52	71.46	50.24	68.68	Nov. 1866; Dec. 1870	4 0	"	" "	" "
11	69.21	90.20	72.65	52.27	71.08	Sept. 1866; Dec. 1870	4 3	"	" "	" "
12	69.94	89.67	72.67	48.98	70.31	Jan. 1869; Feb. 1870	1 2	"	" "	" "
13	..	..	..	..	..	1867	0 4	"	" "	" "

5 Corrected for daily variation. 6 In Siberia.

7 Old style. The observations were taken at the Magnetic and Meteorological Observatory on Japonski Island. From May, 1847, to March, 1849, and for 1862 they were made hourly; from June, 1849, to Dec. 1856, 17 observations were taken daily, hourly, from 6_m to 10_a; for the years 1857–1861, and 1863–64, 19 observations were taken each day, hourly, from 4_m to 10_a. The observing hours in 1867 not stated, but the corrections to them must be very small. The series has been corrected for daily variation by means of the Sitka table by Schott.

8 In 1867–68 called "Camp McPherson." 9 Formerly "Fort Breckenridge." 10 Also called "Fort Tollgate."

ARIZONA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
14. Camp Verde	34°32′	111°54′	..	44°.57	48°.49	53°.45	61°.63	71°.55	80°.80	87°.31	79°.56	75°.71	62°.13	51°.53	41°.64
15. Camp Wallen	31 31	110 11	..	44.88	46.53	54.14	60.64	67.53	77.42	78.72	74.92	71.69	63.61	52.30	48.54
16. Camp Willow Grove	35 34	113 27	..	36.58	38.70	44.01	51.24	59.35	71.15	76.02	73.16	68.99	57.99	44.06	41.49
17. Fort Buchanan	31 40	110 55	5330	39.69	44.62	50.84	59.37	67.83	77.29	75.30	75.79	72.57	62.55	48.54	40.29
18. Fort Canby[1]	35 43	109 10	6500	24.04	31.29	39.50	47.30	54.58	67.22	70.51	67.69	58.64	47.36	37.57	26.37
19. Fort Mojavé	35 06	114 35	604	52.23	56.42	64.06	73.67	80.38	90.02	94.51	93.25	84.15	74.84	61.73	53.50
20. Fort Whipple	34 27	112 20	5700	35.40	39.20	42.29	52.39	66.34	72.09	73.63	70.98	64.73	55.85	44.94	35.43
21. Tubac	31 40	111 00	3000	51.14	55.56	..	..	..	..	..	..	81.15	72.38	57.99	56.68

ARKANSAS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Camden	33 32	92 48	..	..	..	..	..	..	..	..	..	..	..	57.16	..
2. Fayetteville	36 02	94 12	1350	..	..	..	..	..	..	..	..	..	61.15	51.80	34.85
3. Flippin's Barrens[2]	36 20	92 23	1000	40.63	43.13	52.66	64.30	71 24	75.70	82.48	77.95	..	..	43.28	25.71
4. Fort Smith	35 23	94 29	460	38.17	44.33	50.92	62.35	69.10	76.32	80.23	78.88	72.76	60.43	48.77	39.15
5. Fort Wayne	36 25	94 38	..	40.90	51.73	55.88	62.86	67.80	75.89	77.37	76.92	68.58	60.19	44.28	38.53
6. Helena, near	34 36	90 36	..	41.17	44.87	53.89	61.76	69.02	75.25	80.92	80.14	72.67	58.32	52.54	43.23
7. Jacksonport	35 40	91 15	..	..	..	..	..	..	..	81.90	79.17	..	..	..	..
8. Little Rock	34 40	92 12	..	39.81	49.62	49.64	62.58	70.07	81.61	80.82	82.27	75.71	66.20	50.97	43.20
9. Springhill	33 34	93 35	..	48.75	51.55	60.75	71.15	76.70	..	..	..	..	62.50	60.83	..
10. Washington, near	33 44	93 41	660	42.96	47.60	53.84	63.06	69.87	76.32	79.87	78.37	72.42	60.60	50.59	43.28

CALIFORNIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Alcatraz Island	37 49	122 25	..	53.18	54.82	54.69	55.49	55.94	56.61	57.77	57.80	59.40	60.31	58.99	55.18
2. Angel Island[4]	37 51	122 26	30	50.58	53.04	55.15	58.10	60.13	61.51	63.91	63.14	62.71	61.05	58.27	52.66
3. Auburn	38 53	121 04	1176	..	..	..	65.70	60.40	..	..	90.39	81.53	81.65	60.97	55.16
4. Benicia Barracks[5]	38 03	122 09	64	47.43	50.94	53.93	58.34	60.92	66.47	67.78	66.75	66.18	63.32	55.27	47.88
5. Cahto	39 15	123 17	2000	49.03	49.28	47.25	53.70	59.18	65.45	76.08	72.75	65.35	60.07	54.08	45.72
6. Camp Babbitt	36 22	119 17	..	47.91	51.77	55.87	64.96	74.30	75.32	82.02	81.00	..	64.50	50.65	48.59
7. Camp Bidwell	41 50	120 10	4680	30.42	32.66	38.95	48.22	57.17	66.36	73.87	73.14	63.04	50.41	41,48	33.82
8. Camp Cady	34 58	116 32	3000	46.13	51.04	58.76	70.08	76.78	88.31	92.72	88.90	79.75	64.17	51.92	42.94
9. Camp Far West	39 07	121 18	175	45.33	48.45	51.29	59.20	67.00	71.66	75.53	76.29	69.34	65.35	52.30	44.85
10. Camp Gaston	41 01	123 34	..	44.33	45.57	50.22	56.12	62.48	67.86	73.96	72.37	66.10	57.67	50.43	46.21
11. Camp Independence	36 50	118 11	4800	37.87	41.29	48.07	57.50	65.42	76.14	81.01	79.61	71.72	59.16	48.07	38.97
12. Camp Lincoln	41 50	124 05	..	45.70	46.49	48.03	54.92	58.11	57.75	62.02	58.82	58.35	55.47	51.54	49.33
13. Camp Union	38 32	121 30	54	46.80	47.77	53.45	62.45	70.24	73.10	76.69	74.09	70.29	63.50	51.39	49.68
14. Camp Wright	39 48	123 17	..	40.41	44.34	47.59	55.22	63.03	70.15	77.73	76.11	67.67	59.03	49.62	42.69
15. Chico	39 43	121 48	150	47.83	50.88	51.30	60.13	67.40	76.30	85.78	81.55	71.70	62.65	53.68	45.44
16. Clayton	37 56	121 55	76	50.78	52.33	49.78	57.10	..	..	..	..	..	..	..	..
17. Crescent City	41 45	124 12	12	42.93	..	..	..	..	..	..	..	..	..	..	..
18. Downieville	39 33	120 49	2200	..	..	..	..	..	..	..	70.13	59.30	50.80	42.38	36.19
19. Drum Barracks	33 47	118 17	32	55.29	55.34	56.35	61.12	63.93	68.16	72.83	74.68	70.82	66.91	61.39	56.02
20. Folsom	38 40	121 10	..	..	..	55.03	58.57	63.64	68.70	80.50	77.54	74.80	62.82	..	..
21. Fort Bragg	39 56	123 55	..	47.69	47.17	49.11	50.19	54.36	57.98	59.64	57.34	57.81	54.13	49.56	49.27
22. Fort Crook	41 07	121 29	3390	29.59	34.41	40.76	49.05	56.91	64.85	72.36	71.64	63.19	50.91	41.49	33.52
23. Fort Humboldt[7]	40 45	124 10	50	47.29	47.55	49.22	51.84	55.00	58.20	58,09	58.15	57.67	54.05	51.25	46.17
24. Fort Jones[7]	41 36	122 52	2570	32.19	38.13	44.75	52.09	57.62	67.45	73.38	72.52	65.68	51.27	40.09	31.92
25. Fort Miller[7]	37 00	119 40	402	47.61	53.09	57.80	64.70	70.70	82.86	88.53	85.71	77.46	67.86	54.92	47.47

[1] Old Fort Defiance. The observations previous to 1855, were taken at $\odot_r$ 9_m 3_a 9_a, and have been referred to 7_m 2_a 9_a by means of the general table.

[2] Observations in 1859 at Yellville, some miles to the southwest.

[3] Observations at various hours; they have been corrected for daily variation by means of the general table.

[4] Also called Camp Reynolds.

ARIZONA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series Begins.	Series Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
14	62°.21	82°.56	63°.12	44°.90	63°.20	Dec. 1868;	Dec. 1870	2 1	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
15	60.77	77.02	62.53	46.65	61.74	Nov. 1866;	Sept. 1869	2 10	"	" "	" "
16	51.53	73.44	57.01	38.92	55.23	Feb. 1868;	Sept. 1869	1 8	"	" "	" "
17	59.35	76.13	61.22	41.53	59.56	Aug. 1857;	June, 1861	3 11	"	" "	Ar. Met. Reg. 1860, and MS. from S. G. O.
18	47.13	68.47	47.86	27.23	47.67	Dec. 1851;	Nov. 1863	8 11	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
19	72.70	92.59	73.57	54.05	73.23	June, 1859;	Dec. 1870	6 5	"	" "	Ar. Met. Reg. 1860, and MS. from S. G. O.
20	53.67	72.23	55.17	36.68	54.44	Jan. 1865;	Dec. 1870	4 9	"	" "	MS. from S. G. O.
21	..	..	70.51	54.46	..	Sept. 1867;	Feb. 1868	0 6	"	" "	" "

ARKANSAS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series Begins.	Series Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1855		0 1	$7_m\ 2_a\ 9_a$	J. J. McElrath.	P. O. and S. I. Vol. I.
2	..	..	..	..	..	1870		0 3	$7_m\ 2_a\ 9_a$ bis	C. L. McClung.	S. O.
3	62.73	78.71	..	36.49	..	Nov. 1859;	Aug. 1860	0 10	"	W. B. Flippin.	" "
4	60.79	78.48	60.65	40.55	60.12	Jan. 1840;	Dec. 1870	19 3	[5]	Assistant Surgeon, Dr. Shumard, F. Springer.	Ar. Met. Regs. 1851, 1855, 1860, S. Coll., S. O. and MS. from S. G. O.
5	62.18	76.73	57.68	43.72	60.08	1840		1 0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1851.
6	61.56	78.77	61.18	43.09	61.15	Dec. 1865;	Dec. 1870	3 2	$7_m\ 2_a\ 9_a$ bis	O. F. Russell.	S. O.
7	..	..	..	..	..	1859		0 2	$7_m\ 2_a\ 9_a$	Dr. G. A. Martin.	P. O. and S. I. Vol. I.
8	60.76	81.57	64.29	44.21	62.71	Jan. 1840;	Dec. 1867	2 1	"	Anthony and Dr. W. J. Goulding.	Am. Alm. 1842, Ar. Met. Reg. 1851 and S. Coll.
9	69.53	..	..	..	..	Oct. 1859;	May, 1860	0 7	$7_m\ 3_a$	P. F. Finley.	P. O. and S. I. Vol. I, and S. O.
10	62.26	78.19	61.20	44.61	61.56	Jan. 1840;	Dec. 1870	22 1	[5]	Dr. N. D. Smith, Assis. Surg., H. Bishop, and Dr. A. P. Moore.	S. Con. to Know. 1860, S. O. MS. from S. G. O.

CALIFORNIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series Begins.	Series Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	55.37	57.39	59.57	54.39	56.68	Feb. 1860;	Dec. 1870	8 6	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
2	57.79	62.85	60.68	52.09	58.35	Dec. 1867;	Dec. 1870	3 1	"	" "	" " "
3	..	..	74.72	..	..	Aug. 1859;	May, 1860	0 7	2_a	R. Gordon.	P. O. and S. I. Vol. I, and S. O.
4	57.73	67.00	61.59	48.75	58.77	Nov. 1849;	Dec. 1870	15 7	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860 and MS. from S. G. O.
5	53.38	71.43	59.83	48.01	58.16	Dec. 1869;	Dec. 1870	1 1	$7_m\ 2_a\ 9_a$ bis	Dr. Thornton and daughter.	S. O.
6	65.04	79.45	..	49.42	..	Nov. 1863;	Feb. 1866	1 8	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
7	48.11	71.12	51.64	32.30	50.79	Nov. 1863;	Dec. 1870	4 9	"	" "	" " "
8	68.54	89.98	65.28	46.70	67.63	Jan. 1868;	Dec. 1870	3 0	"	" "	" " "
9	59.16	74.49	62.33	46.21	60.55	Jan. 1850;	Mar. 1852	1 11	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
10	56.27	71.40	58.07	45.37	57.78	Sept. 1861;	Dec. 1870	8 8	$7_m\ 2_a\ 9_a$	" "	MS. from S. G. O.
11	57.00	78.92	59.65	39.38	58.74	Nov. 1862;	Dec. 1870	5 5	"	" "	" " "
12	53.69	59.53	55.12	47.17	53.88	Sept. 1866;	May, 1869	2 8	"	" "	" " "
13	62.05	74.63	61.73	48.08	61.62	Apr. 1864;	Aug. 1865	1 4	"	" "	" " "
14	55.28	74.66	58.77	42.48	57.80	Aug. 1864;	Dec. 1870	6 0	"	" "	" " "
15	59.61	81.21	62.68	48.05	62.89	Nov. 1869;	Dec. 1870	1 2	$7_m\ 2_a\ 9_a$ bis	W. F. Cheney.	S. O.
16	..	..	..	..	..	1870		0 4	"	C. L. McClung.	" "
17	..	..	..	..	..	1860		0 1	"	R. B. Randall.	" "
18	..	..	50.83	..	..	Nov. 1859;	Dec. 1860	0 7	"	Dr. T. R. Kibbe.	P. O. and S. I. Vol. I, and S. O.
19	60.47	71.89	66.37	55.55	63.57	May, 1864;	Dec. 1870	5 11	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
20	59.08	75.58	..	..	..	1861		0 8	[6]	S. V. Blakeslee.	S. O.
21	51.22	58.32	53.83	48.04	52.85	Dec. 1860;	Sept. 1864	3 4	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
22	48.91	69.62	51.86	32.51	50.72	Jan. 1858;	Apr. 1869	10 4	"	" "	Ar. Met. Reg. 1860 and MS. from S. G. O.
23	52.02	58.15	54.32	47.00	52.87	Jan. 1854;	Dec. 1869	11 9	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
24	51.49	71.12	52.35	34.08	52.26	Jan. 1853;	June, 1858	5 0	"	" "	Ar. Met. Regs. 1855 and 1860.
25	64.40	85.70	66.75	49.39	66.56	Aug. 1851;	Aug. 1864	7 6	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.

[5] Observations prior to 1855 at $\odot_r\ 9_m\ 3_a\ 9_a$; a correction was applied, making use of the Key West Table, to refer them to $7_m\ 2_a\ 9_a$. The *annual* mean is not affected by this change of hours.

[6] Observing hours irregular; corrected for daily variation.

[7] Observations previous to 1855 at $\odot_r\ 9_m\ 3_a\ 9_a$, referred to $7_m\ 2_a\ 9_a$.

CALIFORNIA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
26. Fort Point[1]	37°48′	122°29′	27	50°.59	51°.81	53°.15	55°.52	57°.61	58°.93	59.86	58°.84	59°.31	58°.36	56°.44	52°.22
27. Fort Reading[2]	40 28	122 13	674	44.31	49.78	55.83	59.31	65.47	77.69	82.96	80.16	72.61	64.52	52.30	43.10
28. Fort Ross	38 33	123 15	..	47.18	48.04	49.95	51.26	55.32	56.90	57.82	58.39	55.97	53.42	50.90	48.91
29. Fort Tejon	34 53	118 55	3240	43.61	46.34	50.10	54.98	60.01	71.49	76.62	75.61	68.35	58.75	48.49	42.05
30. Fort Ter-Waw	41 30	123 52	..	43.72	47.84	49.15	51.70	54.35	59.63	59.79	60.92	59.92	54.91	50.41	45.11
31. Fort Yuma[3]	32 46	114 44	200	56.20	60.97	66.62	74.02	79.57	89.55	94.25	92.42	87.25	75.65	64.08	56.72
32. Indian Valley	40 07	120 50	3280	..	..	..	..	..	..	..	..	..	..	50.65	39.20
33. Los Angeles	34 03	118 15	457	58.83	55.12	58.33	..	..	73.05	75.01	..	..	..	..	60.87
34. Mare Island, Naval Hospital	38 06	122 15	30	48.46	52.43	57.00	..	..	..	71.28	69.60	66.35	64.45	63.08	51.20
35. Marsh Ranche	37 53	121 42	..	42.25	..	52.15	57.38	64.35	73.38	80.95	79.37	..	..	55.38	53.25
36. Marysville	39 09	121 34	80	45.39	51.03	54.23	60.08	66.29	72.71	77.64	74.84	72.97	63.90	54.07	45.46
37. Meadow Valley[4]	39 56	121 02	3700	32.54	35.14	41.09	47.01	53.04	60.59	66.97	64.71	59.08	50.15	40.57	33.72
38. Monterey[5]	36 37	121 52	40	50.04	50.35	52.13	54.56	57.05	58.67	60.05	60.47	59.95	57.94	54.01	50.14
39. Murphy's	38 08	120 28	2200	38.19	42.98	48.92	54.13	55.50	62.48	75.73	76.93	64.58	55.60	..	42.95
40. New San Diego	32 43	117 10	10	54.59	56.01	57.30	60.86	66.38	67.57	68.71	70.90	68.18	65.16	60.89	53.30
41. Paradise City	37 36	121 04	125	44.98	45.12	..	..	..	..	..	..	..	..	..	..
42. Point San José	37 48	122 26	..	51.61	55.11	55.33	58.78	55.96	..	..	59.12	60.76	59.01	56.36	50.83
43. Presidio[6]	37 47	122 28	150	49.69	51.01	52.34	54.52	55.37	56.91	57.62	57.87	59.13	58.01	54.70	50.25
44. Rancho de Jurupa	34 02	117 27	1000	53.31	53.89	56.89	64.42	63.56	71.83	76.22	74.51	74.07	66.90	56.52	52.37
45. Rancho del Chino	33 59	117 44	1000	55.43	56.82	56.57	60.75	63.75	68.76	72.54	72.63	70.06	68.58	60.39	53.61
46. Sacramento	38 34	121 26	52	46.39	50.52	54.44	59.42	63.65	70.05	72.79	70.74	68.82	62.85	53.49	46.85
47. San Benito	36 08	121 02	140	46.46	46.77	53.84	56.80	59.58	65.61	68.27	67.00	..	62.26	54.97	54.47
48. San Diego	32 42	117 14	150	53.55	54.60	57.11	60.72	62.59	66.68	70.32	72.02	69.38	65.16	59.04	54.11
49. San Francisco	37 48	122 25	130	48.81	50.81	53.24	55.24	56.40	57.90	57.98	58.24	59.73	58.82	54.89	50.66
50. San Joaquin	33 38	117 48	..	49.3	57.4	56.6	65.5	74.9	88.5	..	82.9	78.1	67.1	56.6	49.7
51. San Luis Rey	33 13	117 20	20	52.01	50.74	54.33	..	..	..	70.64	73.71	73.50	65.53	58.50	50.60
52. Santa Barbara	34 24	119 43	20	..	..	58.38	64.05	63.33	67.54	66.63	70.33	67.00	..	..	..
53. Santa Catilina Island	33 26	118 30	..	..	58.96	58.74	..	..	..	..	..	..	..	..	..
54. Santa Clara[9]	37 20	121 54	100	48.95	52.53	56.13	..	..	..	..	..	63.29	61.67	53.33	46.26
55. Silver Creek	40 00	120 40	3700	..	35.48	..	..	..	..	..	..	62.00	51.55	38.48	33.95
56. Sonoma	38 18	122 27	100	50.96	52.84	53.04	57.47	..	..	..	..	..	..	53.81	49.16
57. Stockton[10]	37 57	121 15	..	44.95	50.51	55.17	59.04	64.92	68.89	71.99	70.34	67.93	62.66	58.63	49.19
58. Stony Point	38 40	122 50	500	..	..	..	..	..	..	68.50	..	68.25	..	..	..
59. Union Ranche	39 25	121 30	..	45.37	47.70	53.37	58.57	63.80	74.80	81.29	79.21	73.53	63.65	52.77	46.45
60. Vacaville	38 21	121 58	175	50.49	52.69	54.71	60.81	65.68	72.15	74.73	72.23	73.80	68.58	61.00	48.03
61. Visalia	36 22	119 16	2500	44.82	51.27	50.48	59.22	68.50	75.40	84.85	82.08	70.73	59.98	50.30	40.05
62. Watsonville	36 56	121 43	45	52.99	54.59	55.87	58.57	60.38	62.40	66.39	65.52	..	60.15	56.08	49.57
63. Yerba Buena Island	37 48	122 22	..	51.97	52.17	53.95	55.85	57.27	58.38	61.80	60.79	61.17	61.02	57.49	50.46

COLORADO.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Central City[11]	39 52	105 31	..	24.05	..	..	38.53	49.27	62.73	67.90	..	56.33	..	35.83	37.30
2. Denver	39 45	105 01	5250	26.57	32.75	31.85	46.90	60.28	67.13	72.68	67.70	61.26	48.78	39.22	22.45
3. Fort Garland[12]	37 32	105 40	8365	18.46	23.37	33.63	42.75	52.41	62.23	66.61	64.34	55.61	43.97	30.88	20.05

[1] Observations of one series, two years and four months, at $7_m\ 2_a\ 9_a$, were referred to 6_m N. 6_a and combined with the other series.

[2] Observations for one year and two months at $7_m\ 2_a\ 9_a$, referred to $\odot_r\ 9_m\ 3_a\ 9_a$. [3] Observations previous to 1855 at $\odot_r\ 9_m\ 3_a\ 9_a$, referred to $7_m\ 2_a\ 9_a$.

[4] Observations for four months in morning and evening; assumed to be at $\odot_r$ and $\odot_s$, and referred to $7_m\ 2_a\ 9_{a\ bis}$.

[5] Observations for four years and one month at $\odot_r\ 9_m\ 3_a\ 9_a$, referred to $7_m\ 2_a\ 9_{a\ bis}$.

[6] Observations prior to 1855 at $\odot_r\ 9_m\ 3_a\ 9_a$; a correction was applied, making use of the Key West Table, to refer them to $7_m\ 2_a\ 9_a$. The *annual* mean is not affected by this change of hours.

CALIFORNIA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
26	55°.43	59°.21	58°.04	51°.54	56°.05	Jan. 1860; Dec. 1870	10 11	6_m N. 6_a	Assistant Surgeon, F. P. Thompson, W. Knapp, H. E. Uhrlandt.	MS. from S. G. O. and U. S. Coast Survey.
27	60.20	80.27	63.14	45.73	62.34	Apr. 1852; Mar. 1856	3 10	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860.
28	52.18	57.70	53.43	48.04	52.84	Jan. 1837; Dec. 1840	4 0	$7_m\ 2_a\ 6_a$	" "	Dove, S. Coll.; and Ar. Met. Reg. 1855.
29	55.03	74.57	58.53	44.00	58.03	Mar. 1855; Aug. 1864	6 9	$7_m\ 2_a\ 9_a$	" "	Ar. Met. Reg. 1860, and MS. from S. G. O.
30	51.73	60.11	55.08	45.56	53.12	Apr. 1859; Oct. 1861	2 3	"	" "	" " " "
31	73.40	92.07	75.66	57.96	74.77	Dec. 1850; Dec. 1870	14 11	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
32	..	..	..	..	..	1870	0 2	$7_m\ 2_a\ 9_{a\ bis}$	M. E. Pulsifer.	S. O.
33	..	..	..	58.27	..	June, 1847; Mar. 1848	0 6	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
34	..	..	64.63	50.70	..	Jan. 1868; Sept. 1870	1 0	"	J. M. Brown, W. E. Taylor.	S. O.
35	57.96	77.90	..	..	..	May, 1867; May, 1868	0 10	$7_m\ 2_a\ 9_{a\ bis}$	F. M. Rogers.	" "
36	60.20	75.06	63.65	47.29	61.55	May, 1857; Aug. 1863	3 0	"	W. C. Belcher.	P. O. and S. I. Vol. 1, and S. O.
37	47.05	64.09	49.93	33.80	48.72	Jan. 1860; June, 1866	3 11	"	J. H. Whitlock and M. D. Smith.	S. O.
38	54.58	59.73	57.30	50.18	55.45	May, 1847; Dec. 1870	12 5	"	Assistant Surgeon, and Dr. C. A. Canfield.	Ar. Met. Reg. 1855, MS. from S. G. O., P. O. and S. I. Vol. 1, S. O.
39	52.85	71.71	..	41.37	..	Mar. 1868; Mar. 1869	1 0	"	E. Cutting.	S. O.
40	61.51	69.06	64.74	54.63	62.49	Dec. 1864; Dec. 1870	1 9	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
41	..	..	..	..	..	1869	0 2	$7_m\ 2_a\ 9_{a\ bis}$	J. W. A. Wright.	S. O.
42	56.69	..	58.71	52.52	..	Oct. 1865; Dec. 1870	1 6	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
43	54.08	57.47	57.28	50.32	54.79	Oct. 1847; Dec. 1870	19 0	"	" "	Ar. Met. Regs. 1855 and 1860, MS. from S. G. O. and S.O.
44	61.62	74.19	65.83	53.19	63.71	Oct. 1852; Mar. 1854	1 6	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
45	60.36	71.31	66.34	55.29	63.32	July, 1851; Aug. 1852	1 2	"	" "	" " " "
46	59.17	71.19	61.72	47.92	60.00	July, 1849; Mar. 1867	14 0	[7]	Assist. Surgeon, Drs. F. W. Hatch and T. M. Logan.	Ar. Met. Reg. 1855, MS. from S. G. O., Am. Alm., P. O. and S. I. Vol. 1., and S. O.
47	56.74	66.96	..	49.23	..	May, 1861; July, 1863	1 9	$7_m\ 2_a\ 7_{a\ bis}$	Dr. C. A. Canfield.	S. O.
48	60.14	69.67	64.53	54.09	62.11	July, 1849; Dec. 1870	20 10	[8]	Assistant Surgeon, A Cassidy, and W. Knapp.	Ar. Met. Regs. 1855 and 1860, MS. from S. G. O., and U. S. Coast Survey.
49	54.96	58.04	57.81	50.09	55.23	Jan. 1854; Sept. 1868	11 2	$7_m\ 2_a\ 9_{a\ bis}$	Drs. H. Gibbons and W. O. Ayres.	P. O. and S. I. Vol. 1. and S. O.
50	65.67	..	67.27	52.13	..	....	1 5	......	....	Pat. Off. Rep.
51	..	..	65.84	51.12	..	July, 1850; Mar. 1851	0 9	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
52	61.92	68.17	..	..	..	1864	0 7	$7_m\ 2_a\ 9_{a\ bis}$	Dr. W. W. Hays.	S. O.
53	..	..	..	..	..	1864	0 2	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
54	..	..	59.43	49.25	..	Sept. 1859; Mar. 1861	0 7	"	Prof. O. S Frambes.	P. O. and S. I. Vol. 1, and S. O.
55	..	..	50.68	..	..	Sept. 1862; Feb. 1863	0 5	$7_m\ 2_a\ 9_{a\ bis}$	M. D. Smith.	S. O.
56	..	..	..	50.99	..	Nov. 1850; Apr. 1851	0 6	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
57	59.71	70.41	63.07	48.22	60.35	Jan. 1854; June, 1867	1 11	[7]	Dr. R. K. Reid, W. M. Trivett, Assis. Surg.	P. O. and S. I. Vol. 1, S. O., and MS. from S. G. O.
58	..	..	..	..	..	1869	0 2	$7_m\ 2_a\ 9_{a\ bis}$	Dr. Thornton.	S. O.
59	58.58	78.43	63.32	46.51	61.71	Mar. 1858; Jan. 1863	3 7	"	J. Slaven, W. L. and E. S. Dunkum.	P. O. and S. I. Vol. 1, and S. O.
60	60.40	73.04	67.79	50.40	62.91	Feb. 1869; Apr. 1870	1 3	"	Prof. J. C. Simmons.	S. O.
61	59.40	80.78	60.34	45.38	61.47	1870	1 0	"	J. W. Blake.	" "
62	58.27	64.77	..	52.38	..	Jan. 1869; Dec. 1870	1 10	"	Dr. A. J. Compton.	" "
63	55.69	60.32	59.89	51.53	56.86	Feb. 1869; Dec. 1870	1 10	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.

COLORADO.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	Apr. 1861; Jan. 1862	0 8	$7_m\ 2_a\ 9_a$	Dr. W. T. Ellis.	S. O.
2	46.34	69.17	49.75	27.26	48.13	Jan. 1859; Dec. 1870	1 6	$7_m\ 2_a\ 9_{a\ bis}$	D. C. Collier, W. N. Byers, F. J. Stanton, S. T. Sopris.	P. O. and S. I. Vol. 1, and S. O.
3	42.93	64.39	43.49	20.63	42.86	Sept. 1852; Dec. 1870	15 3	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.

7 Observing hours irregular; corrected for daily variation.

8 Observing hours irregular; corrected for daily variation, making use of the Key West Table.

9 University of the Pacific.

10 State Insane Asylum, except for three months of 1863 when the observations were taken at Camp Stamford Stockton.

11 Observations for April and May, 1861, were made at Mountain City, a few miles to the southeast.

12 Observations from September, 1852, to July, 1858, were made at old Fort Massachusetts, a few miles east of Fort Garland.

COLORADO.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
4. Fort Lyon[1]	38°08′	102°50′	4000	26°.01	33°.65	39°.68	49°.72	64°.74	74°.80	79°.65	76°.13	64°.33	49°.08	39°.08	27°.37
5. Fort Morgan	40 15	103 46	4500	19.78	33.67	30.52	47.20	58.25	71.00	78.99	79.85	70.65	57.41	..	29.31
6. Fort Reynolds	38 15	104 12	..	32.26	36.23	41.67	51.73	63.13	72.50	78.79	73.94	64.38	50,98	39.78	27.06
7. Fort Sedgwick	40 58	102 23	3600	26.23	31.60	34.65	46.25	59.49	70.88	78.81	72.21	60.62	49.62	40.20	28.51
8. Golden City	39 44	105 18	5240	..	..	..	49.77	61.00	67.57	73.33	74.73	65.80	..	..	..
9. Montgomery	39 00	106 00	..	17.86	24.45	19.78	29.75	41.28	..	..	..	..	..	..	19.58

CONNECTICUT.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Brookfield	41 27	73 24	100	33.10	30.79	31.85	45.24	57.23	68.32	72.40	70.46	63.54	50.85	40.24	30.82
2. Canton	41 52	72 55	750	27.87	25.11	29.63	40.57	54.15	58.93	68.79	64.03	59.67	50.24	39.10	29.51
3. Colebrook	42 00	73 03	1210	20.89	23.31	28.76	43.12	53.84	64.55	69.38	67.13	59.40	47.30	36.61	24.67
4. Columbia	41 41	72 18	..	25.88	28.87	33.94	45.76	56.52	65.87	70.62	68.87	61.73	51.13	40.65	29.25
5. Farmington, near[2]	41 42	72 50	..	42.09	49.07	56.33	62.58	69.10	77.52	81.37	78.25	71.17	63.44	50.17	42.48
6. Fort Trumbull	41 21	72 05	23	30.48	31.68	37.42	47.78	57.71	67.40	72.61	71.58	64.69	54.07	43.88	33.27
7. Georgetown	41 15	73 25	300	16.28	..	27.41	46.03	50.63	64.79	71.45	66.30	61.53	50.02	40.10	27.86
8. Goshen[3]	41 48	72 07	561	26.55	26.12	34.00	45.92	56.11	65.26	70.53	69.06	60.89	49.95	39.89	29.05
9. Hartford	41 46	72 41	60	29.11	29.32	37.71	48.30	57.66	66.87	72.14	70.25	62.58	51.39	41.12	31.25
10. Knight Hospital	41 18	72 55	..	32.08	..	..	..	60.35	65.76	75.68	75.77	65.52	56.80	49.24	35.95
11. Litchfield	41 45	73 12	800	24.02	26.19	32.92	38.88	51.45	62.58	68.06	64.39	58.48	49.44	35.52	25.08
12. Lynde Point Lt. Ho.	41 16	72 20	10	26.96	28.82	33.43	44.09	54.33	63.31	71.10	69.56	63.14	53.59	42.71	30.73
13. Middletown	41 33	72 39	175	26.23	28.93	33.86	45.66	56.24	66.34	70.96	68.97	61.43	50.80	38.95	28.67
14. New Haven	41 18	72 57	45	26.46	28.08	36.03	46.96	57.28	66.96	71.69	70.24	62.49	51.06	40.28	30.42
15. New London	41 21	72 07	90	28.42	29.75	36.32	45.47	56.28	66.28	71.79	69.17	63.27	52.87	42.68	32.34
16. North Colebrook	42 01	73 06	..	..	..	..	..	52.48	63.35	66.96	..	..	..	..	..
17. North Greenwich	41 04	73 40	300	..	..	..	..	..	..	..	..	..	..	..	29.53
18. Norwich	41 32	72 04	50	24.65	28.21	30.65	45.15	55.51	67.47	73.87	69.92	64.43	51.25	41.32	30.68
19. Plymouth	41 40	73 04	..	26.10	26.29	27.98	41.70	56.42	62.18	68.83	67.80	57.85	48.74	38.97	25.97
20. Pomfret	41 51	71 56	587	22.89	28.07	30.99	43.30	53.77	63.17	68.12	65.82	58.88	48.46	42.36	26.28
21. Salisbury	41 59	73 25	737	24.65	25.28	34.65	44.44	56.32	65.87	70.44	68.06	60.09	50.18	39.23	27.54
22. Sharon	41 52	73 28	200	24.90	26.15	34.42	45.64	57.65	65.96	70.11	68.00	61.14	49.96	39.29	28.73
23. Southington	41 35	72 54	..	..	..	..	49.48	59.11	70.93	73.82	71.94	63.83	52.90	41.04	30.11
24. Wallingford	41 27	72 50	133	24.42	27.85	34.79	44.72	54.99	65.77	69.76	67.36	60.49	50.82	39.28	28.40
25. Warren Centre	41 44	73 20	..	21.70	20.66	35.31	41.21	52.41	64.31	67.67	67.34	58.41	48.32	45.46	27.23
26. Waterbury	41 33	73 02	363	24.52	27.55	33.62	44.93	54.26	64.78	70.92	69.05	60.32	45.22	38.01	24.65
27. West Cornwall	41 53	73 22	1000	24.00	22.41	38.23	41.10	56.70	64.83	71.17	67.17	59.70	51.01	38.35	21.91
28. Windsor	41 55	72 39	..	..	..	31.00	..	..	66.34	..	70.00	..	..	..	..

DAKOTA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Fort Abercrombie	46 27	96 21	..	4.53	8.44	17.41	39.37	59.20	69.73	73.33	69.75	58.88	44.39	28.17	10.88
2. Fort Buford	48 01	103 58	1900	8.07	13.28	18.15	45.61	57.47	67.84	72.77	67.94	55.93	42.25	29.39	13.93
3. Fort Dakota	43 30	96 45	..	17.25	17.65	22.65	41.55	58.55	..	..	..	53.90	44.13	28.32	15.45
4. Fort Pierre	44 23	100 20	1456	7.33	23.20	33.21	47.60	61.08	71.52	78.28	70.51	62.56	52.52	30.96	11.35
5. Fort Randall	43 01	98 37	1245	18.70	22.80	23.45	45.26	61.12	71.61	78.06	74.17	63.48	49.31	34.39	21.29
6. Fort Ransom	46 35	97 47	..	6.98	10.20	16.42	43.73	59.07	65.62	70.34	65.27	57.41	39.16	28.03	13.96
7. Fort Rice	46 32	100 33	..	13.23	16.29	26.12	45.37	59.14	68.15	74.76	67.14	54.28	40.45	29.11	17.64
8. Fort Stevenson[6]	47 36	101 10	..	5.23	11.79	22.51	44.96	58.08	69.33	77.41	69.76	57.18	44.23	31.87	13.02
9. Fort Sully	44 50	100 35	..	16.65	20.57	23.25	44.98	60.14	69.21	76.82	72.09	60.62	45.85	35.42	24.54
10. Fort Totten	47 56	99 16	..	−0.52	7.41	13.47	46.19	59.22	67.52	69.59	65.82	58.67	38.33	27.57	12.48
11. Fort Wadsworth	45 43	97 10	..	5.21	9.43	10.96	40.22	55.33	65.17	70.39	67.27	58.99	43.45	30.40	12.91
12. Yankton Indian Agency[7]	42 52	98 24	1900	17.66	27.30	37.68	50.89	61.86	71.29	74.30	74.43	58.58	51.24	32.98	20.43

[1] Observations from January, 1861, to May, 1862, were made at Fort Wise or old Fort Lyon, some miles to the southeast of the present fort.

[2] The observations were made six miles S. of Farmington.

[3] The observations are stated to have been made in Windham Co. as indicated by the given position and height, but perhaps a mistake of 1° in Long. has been made.

[4] The observations were made at variable hours, the means being corrected for daily variation.

COLORADO.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
4	51°.38	76°.86	50°.83	29°.01	52°.02	Jan. 1861;	Dec. 1870	5 5	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
5	45.32	76.61	..	27.59	..	Dec. 1866;	Apr. 1868	1 3	"	" "	" " "
6	52.18	75.08	51.71	31.85	52.70	May, 1868;	Dec. 1870	2 8	"	" "	" " "
7	46.80	73.97	50.15	28.78	49.92	Apr. 1867;	Dec. 1870	3 6	"	" "	" " "
8	..	71.88	..	..	..	May, 1860;	Apr. 1867	0 6	"	M. L. Blunt, J. McDonald, E.L.Berthoud	S. O.
9	30.27	..	..	20.63	..	Dec. 1863;	May, 1864	0 6	$7_m\ 2_a\ 9_a$ bis	J. Luttrell.	" "

CONNECTICUT.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	44.77	70.39	51.54	31.57	49.57	Oct. 1868;	Dec. 1870	2 2	$7_m\ 2_a\ 9_a$ bis	S. W. Roe.	S. O.
2	41.45	63.92	49.67	27.50	45.63	Dec. 1861;	July, 1863	1 7	"	J. Case.	" "
3	41.91	67.02	47.77	22.96	44.91	Sept. 1860;	Nov. 1870	9 9	"	C. Rockwell.	" "
4	45.41	68.45	51.17	28.00	48.26	Dec. 1856;	Dec. 1870	13 8	"	W. H. Yeomans.	P. O. and S. I. Vol. 1, and S. O.
5	62.67	79.05	61.59	44.55	61.96	May, 1838;	Apr. 1841	3 0	3_a	Smith.	Pat. Off. Rep. 1851.
6	47.64	70.53	54.21	31.81	51.05	Jan. 1833;	Dec. 1870	23 8	$7_m\ 2_a\ 9_a$	Rev. E. Dewhurst and Assistant Surgeon.	Ar. Met. Regs. 1840, '51, & '55, MS. from S. G. O., and S. O.
7	41.36	67.51	50.55	..	..	Mar. 1856;	Jan. 1857	0 11	"	A. B. Hull.	P. O. and S. I. Vol. 1.
8	45.34	68.28	50.24	27.24	47.78	Jan. 1829;	Dec. 1850	22 0	$\odot_r$ N.	Clark.	MS. in S. Coll.
9	47.89	69.75	51.70	29.89	49.81	Oct. 1806;	July, 1852	16 7	$9_m\ 3_a$	Rev. A. Flint and Hoadley.	Med. and Agr. Reg. Bost. Vol. 1, 1806–7, and MS. in S. Coll.
10	..	72.40	57.19	..	..	May, 1863;	Jan. 1864	0 9	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
11	41.08	65.01	47.81	25.10	44.75	Jan. 1850;	Dec. 1852	3 0	......	Hendrick.	Regent's Rep.
12	43.95	67.99	53.15	28.84	48.48	Jan. 1854;	May, 1861	6 10	$7_m\ 2_a\ 9_a$	J. Rankin.	P. O. and S. I. Vol. 1, and S. O.
13	45.25	68.76	50.39	27.94	48.09	1849;	Dec. 1870	14 8	$7_m\ 2_a\ 9_a$ bis	Cutter and Prof. J. Johnston.	S. Coll., P. O. and S. I. Vol. 1, and S. O.
14	46.76	69.63	51.28	28.32	49.00	July, 1778;	Oct. 1865	86 0	[4]	Various observers.	Trans. Con. Acad. Vol. 1, Part 1, New Haven, 1866.
15	46.02	69.08	52.94	30.17	49.55	Mar. 1849;	Nov. 1858	9 2	$7_m\ 2_a\ 9_a$	Rev. T. Edwards.	S. Coll., & P. O. & S. I. Vol. 1.
16	..	..	..	..	..	1849		0 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Cobb.	S. Coll.
17	..	..	..	..	..	1870		0 1	$7_m\ 2_a\ 9_a$ bis	W. P. Alcott.	S. O.
18	43.77	70.42	52.33	27.85	48.59	Mar. 1856;	Feb. 1858	2 0	$7_m\ 2_a\ 9_a$	N. Scholfield.	P. O. and S. I. Vol. 1.
19	42.03	66.27	48.52	26.12	45.74	June, 1862;	May, 1864	2 0	$7_m\ 2_a\ 9_a$ bis	D. W. Learned.	S. O.
20	42.69	65.70	49.90	25.75	46.01	Mar. 1853;	Apr. 1869	16 0	"	Rev. D. Hunt.	S. Coll., P. O. and S. I. Vol. 1, and S. O.
21	45.14	68.12	49.83	25.82	47.23	Jan. 1844;	Dec. 1854	11 0	$\odot_r\ 9_m\ 3_a\ 9_a$	Dr. O. Plumb.	S. Coll., & P. O. & S. I. Vol. 1.
22	45.90	68.02	50.13	26.59	47.66	Jan. 1816;	Dec. 1836	20 11	6_m N. 6_a	Gov. Smith.	MS. in S. Coll.
23	..	72.23	52.59	..	..	1870		0 9	$7_m\ 2_a\ 9_a$ bis	L. Andrews.	S. O.
24	44.83	67.63	50.20	26.89	47.39	Apr. 1856;	July, 1862	6 4	$7_m\ 2_a\ 9_a$	B. F. Harrison.	P. O. and S. I. Vol. 1, and S. O.
25	42.98	66.44	50.73	23.20	45.84	1849		1 0	......	Hendrick.	Regent's Rep.
26	44.27	68.25	47.85	25.57	46.49	Jan. 1867;	Aug. 1869	2 4	[5]	Rev. R. G. Williams.	S. O.
27	45.34	67.72	49.69	22.77	46.38	1854		1 0	$7_m\ 2_a\ 9_a$	Z. L. Gold.	P. O. and S. I. Vol. 1.
28	..	..	..	..	..	1850;	1852	0 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Phelps.	S. Coll.

DAKOTA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	38.66	70.94	43.81	7.95	40.34	Feb. 1859;	Dec. 1870	10 1	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860, and MS. from S. G. O.
2	40.41	69.52	42.52	11.76	41.05	Sept. 1866;	Dec. 1870	4 2	"	" "	MS. from S. G. O.
3	40.92	..	42.12	16.78	..	Sept. 1866;	May, 1869	0 10	"	" "	" " "
4	47.30	73.44	48.68	13.96	45.84	Jan. 1854;	May, 1857	2 5	"	F. Behman, Assistant Surgeon.	P. O. and S. I. Vol. 1, Ar. Met. Reg. 1860.
5	43.28	74.61	49.06	20.93	46.97	Nov. 1856;	Dec. 1870	12 8	"	Assistant Surgeon.	Ar. Met. Reg. 1860, and MS. from S. G. O.
6	39.74	67.08	41.53	10.38	39.68	Dec. 1868;	Dec. 1870	2 1	"	" "	" " " "
7	43.54	70.02	41.28	15.72	42.64	July, 1868;	Dec. 1870	2 3	"	" "	" " " "
8	41.85	72.17	44.43	10.01	42.11	Sept. 1866;	Dec. 1870	2 11	"	" "	" " " "
9	42.79	72.71	47.30	20.59	45.85	Jan. 1866;	Dec. 1870	2 7	"	" "	" " " "
10	39.63	67.64	41.52	6.46	38.81	Aug. 1869;	Dec. 1870	1 5	"	" "	" " " "
11	35.50	67.61	44.28	9.18	39.14	Sept. 1866;	Dec. 1870	3 3	"	" "	" " " "
12	50.14	73.34	47.60	21.80	48.22	Nov. 1859;	Dec. 1862	1 11	$7_m\ 2_a\ 9_a$ bis	F. Norvell, H. G. Williams, G. M. Lamson.	P. O. and S. I. Vol. 1, and S. O.

[5] There were from three to seventeen observations daily, between 6_m and 10_a; corrected for daily variation by means of the New Haven Table. Thermometer tested.

[6] Observations prior to August, 1867, at Fort Berthold, a few miles to the southwest.

[7] Also called "Greenwood." Observations in 1862, at Yankton, to the east.

DELAWARE.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Dover	39°10′	75°30′	40	..	..	..	..	..	..	..	76°.80	67°.48	58°.19	46°.28	35°.60
2. Fort Delaware[1]	39 35	75 34	10	32°.26	33°.80	40°.08	51°.59	63°.44	72°.25	77°.61	75.84	69.60	57.32	45.90	36.62
3. Georgetown	38 43	75 22	..	44.00	33.65	45.06	56.15	61.02	77.36	78.64	76.78	71.49	60.13	46.54	43.90
4. Milford	38 55	75 25	20	40.87	34.58	42.74	54.97	62.17	74.68	77.74	75.62	66.12	51.81	41.22	38.20
5. Newark	39 38	75 47	120	28.61	32.95	36.74	48.68	59.53	69.47	74.71	73.26	64.63	52.58	44.14	36.57
6. Wilmington	39 44	75 33	..	..	..	..	..	..	..	..	..	..	..	..	..
7. Wilmington	39 44	75 33	115	27.62	32.16	42.10	51.89	64.24	71.91	74.78	74.00	66.46	51.40	43.06	35.36

DISTRICT OF COLUMBIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Georgetown	38 55	77 04	..	33.85	36.29	45.63	53.36	64.85	72.66	76.33	76.31	69.13	59.40	46.97	37.18
2. Washington	38 53	77 02	30	27.27	40.29	42.84	53.25	62.97	72.36	75.01	76.01	68.63	53.69	42.41	33.98
3. Washington	38 54	77 02	30	41.4	36.5	45.7	60.2	71.4	75.2	79.9	79.7	70.3	56.5	43.3	39.5
4. Washington	38 54	77 02	75	34.09	36.82	45.36	55.70	66.26	74.44	78.26	76.28	67.76	56.70	44.83	37.41
5. Washington	38 55	77 02	110	35.3	37.	46.5	54.0	61.7	76.	74.8	76.5	68.0	53.5	47.5	41.7
6. Washington	38 53	77 01	80	27.21	37.71	44.45	56.51	64.76	69.59	77.88	75.53	66.11	55.61	40.83	31.57
7. Washington	38 53	77 01	80	35.10	35.41	46.08	52.31	60.45	73.32	75.40	72.02	68.07	48.80	43.73	35.70
8. Washington	38 54	77 03	110	36.0	36.4	44.8	58.0	68.8	75.9	78.3	77.0	70.1	57.6	47.9	40.1
9. Washington	38 53	77 02	40	31.96	35.65	43.27	52.63	64.17	74.06	78.50	74.60	67.93	55.45	51.01	35.77
10. Washington	38 54	77 03	110	32.43	34.40	40.49	51.75	61.81	70.93	75.89	74.28	67.47	54.67	44.35	34.23
11. Washington	38 54	77 03	110	37.19	34.65	41.79	51.88	61.79	72.67	78.28	76.23	68.78	54.75	44.21	34.87

FLORIDA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Belair	30 23	84 17	70	52.25	59.18	61.08	66.22	75.73	79.88	82.08	81.29	77.70	69.43	58.83	58.48
2. Cedar Keys[6]	29 07	83 03	35	56.33	58.47	64.37	68.68	75.88	79.84	82.03	81.27	79.40	71.96	63.73	58.82
3. Chattahoochie Ars.	30 42	84 50	180	..	..	..	..	71.68	79.40	83.10	79.68	..	..	..	..
4. Fairview (near Palatka)	29 36	81 37	152	58.37	56.96	61.97	67.76	73.81	78.88	81.99	80.91	76.65	70.89	61.76	55.57
5. Fernandina	30 40	81 28	25	50.96	57.60	61.27	65.58	71.73	77.60	79.87	85.89	76.96	71.56	65.47	53.89
6. Fort Barrancas[7]	30 21	87 18	20	52.71	55.27	61.26	68.47	75.51	80.59	82.20	82.00	78.41	69.55	60.79	55.13
7. Fort Brooke	27 57	82 26	20	60.99	63.00	66.87	71.88	76.64	79.58	80.96	80.63	79.42	73.86	67.29	61.99
8. Fort Dallas[8]	25 48	80 13	20	66.10	66.16	70.30	74.97	74.40	80.99	82.17	82.48	80.59	77.91	73.45	69.37
9. Fort Deynaud	26 45	81 30	..	60.04	64.41	67.79	71.98	76.96	79.53	79.76	80.51	80.14	71.95	71.52	64.75
10. Fort Fanning	29 35	82 56	50	58.52	57.97	67.04	70.72	76.26	79.32	82.05	82.40	80.55	72.16	60.55	54.93
11. Fort Gamble	30 20	84 00	50	55.54	60.71	69.06	71.27	75.42	80.04	79.79	79.74	79.06	68.25	60.04	55.82
12. Fort Hamer	27 30	82 30	20	..	..	..	..	77.55	80.34	80.96	83.64	82.24	..	..	..
13. Fort Heiloman	29 48	82 05	25	56.32	56.45	63.33	70.68	75.65	81.88	80.25	79.71	77.07	71.57	59.57	51.94
14. Fort Henderson	30 51	82 09	25	55.64	58.27	64.46	70.52	76.26	82.03	80.16	79.76	77.54	69.85	59.94	51.20
15. Fort Jefferson	24 38	82 52	11	70.96	70.67	73.22	74.43	79.59	83.31	84.79	84.62	83.86	80.12	74.84	71.71
16. Fort King	29 12	82 12	50	58.41	58.13	64.38	71.41	76.59	79.90	80.80	80.59	78.21	70.56	63.18	58.55
17. Fort Marion[9] (St. Augustine)	29 54	81 19	25	56.79	59.85	63.25	68.75	74.06	79.32	80.91	80.86	79.04	72.57	64.10	58.12
18. Fort Meade	27 45	81 47	80	58.40	63.23	69.02	69.89	76.69	78.24	79.76	80.03	79.18	73.81	68.48	60.15
19. Fort Micanopy	29 35	82 31	78	60.36	60.29	67.43	72.05	76.92	79.38	80.22	79.42	77.95	70.52	60.96	55.94
20. Fort Myers	26 40	81 56	50	62.86	66.08	69.85	73.26	79.20	80.96	82.38	82.89	81.24	76.43	72.53	65.75
21. Fort Pierce	27 28	80 18	30	62.45	64.80	69.05	73.13	77.36	79.80	82.61	83.02	81.43	75.07	69.57	65.72
22. Fort Russell[10]	29 15	82 15	50	61.40	56.30	69.70	71.64	76.10	79.30	84.44	83.76	78.48	68.79	61.23	57.56
23. Fort Shannon	29 34	81 48	25	58.00	59.00	64.69	71.64	76.43	79.37	81.66	80.38	79.09	71.07	61.89	58.63

[1] Observations in 1854, at $\odot_r$ 9_m 3_a 9_a; they were referred to 7_m 2_a 9_a by means of the general table. The observations of 1866 and 1867 were combined with those made at Delaware City.

[2] The observations have been corrected for daily variation. The series is much broken and many of the monthly means are imperfect, so that the results afford only a tolerable approximation to the truth. [3] Corrected for daily variation by means of the general table.

[4] The observations were made bi-hourly, at 0.2^h A. M., 2.2^h A. M., and so on.

[5] The observations were made tri-hourly at Mid., 3 A. M., 6 A. M., and so on. [6] Also called Atsuna Otie.

DELAWARE.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	57°.32	..	..	1870		0 5	$7_m\ 2_a\ 9_{a\ bis}$	J. H. Bateman.	S. O.
2	51°.70	75°.23	57.61	34°.23	54°.69	Feb. 1825;	Sept. 1870	18 10	$7_m\ 2_a\ 9_a$	Assistant Surgeon, J. M. Vanhekle.	Ar. Met. Regs. 1855 and 1860; MS. from S. G. O., and S. O.
3	54.08	77.59	59.39	40.52	57.89	July, 1857;	Dec. 1858	1 6	$8_m\ 1_a\ 6_a$	Dr. D. W. Mauld.	P. O. and S. I. Vol. 1.
4	53.29	76.01	53.05	37.88	55.06	Dec. 1857;	Dec. 1870	2 2	$7_m\ 2_a\ 9_{a\ bis}$	A. C. Whittier, W. R. Phillips, R. A. Martin.	P. O. and S. I. Vol. 1, and S. O.
5	48.32	72.48	53.78	32.71	51.82	July, 1847;	Feb. 1858	4 3	[2]	E. E. Norton, Crawford, and others.	P. O. & S. I. Vol. 1, and S. Coll.
6	..	..	..	..	51.30	Aug. 1834;	July, 1835	1 0	......	....	Am. Almanac.
7	52.74	73.56	53.64	31.71	52.91	Jan. 1864;	Oct. 1865	1 10	$7_m\ 2_a\ 9_{a\ bis}$	Dr. U. D. Hedges.	S. O.

DISTRICT OF COLUMBIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	54.61	75.10	58.50	35.77	56.00	Dec. 1859;	Feb. 1863	3 1	$7_m\ 2_a\ 9_{a\ bis}$	Rev. C. B. Mackee.	P. O. and S. I. Vol. 1, and S. O.
2	53.02	74.46	54.91	33.85	54.06	Jan. 1820;	Dec. 1821	2 0	[3]	J. Q. Adams, J. Meigs.	Col. Force's Rec., and MS. in S. Coll.
3	59.10	78.27	56.70	39.13	58.30	Apr. 1823;	Dec. 1824	1 6	$7_m\ 9_m$ N. 4_a	Jules de Wallenstein.	Trans. Am. Phil. Soc. Vol. 2, 1825.
4	55.77	76.33	56.43	36.11	56.16	Jan. 1823;	Dec. 1834	12 3	$7_m\ 2_a\ 9_a$	Assist. Surgeon, Rev. R. Little.	Ar. Met. Reg. 1855.
5	54.1	75.8	56.3	38.0	56.0	Jan. 1828;	Dec. 1829	2 0	max. & min.	....	From J. Elliot's Hist. Sketches of the 10 miles square.
6	55.24	74.33	54.18	32.16	53.98	July, 1838;	Dec. 1840	2 6	$3_m\ 9_m\ 3_a\ 9_a$	Lieut. J. M. Gilliss, U. S. N.	Pub. Doc. 2d Sess. 28th Con. Vol. x, 1845.
7	52.95	73.58	53.53	35.40	53.87	Jan. 1841;	June, 1842	1 1	[4]	" " "	" " " " "
8	57.20	77.07	58.53	37.50	57.58	Jan. 1846;	Dec. 1849	4 0	$9_m\ 3_a\ 9_a$	U. S. Naval Obs'y.	Am. Alm. 1848 and foll.
9	53.36	75.72	58.13	34.46	55.42	Aug. 1850;	Dec. 1859	8 10	$7_m\ 2_a\ 9_a$	Smithsonian Inst.	S. Coll., P. O. and S. I. Vol. 1.
10	51.35	73.70	55.50	33.69	53.56	Jan. 1862;	Dec. 1870	9 0	[5]	Prof. J. R. Eastman.	U. S. Naval Obs'y.
11	51.82	75.73	55.91	35.57	54.76	Jan. 1868;	Dec. 1870	3 0	max. & min.	" " " "	" " "

FLORIDA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	67.68	81.08	68.65	56.64	68.51	Oct. 1856;	May, 1861	3 10	$7_m\ 2_a\ 9_a$	B. F. Whitner.	P. O. and S. I. Vol. 1, and S. O.
2	69.64	81.05	71.70	57.87	70.06	Aug. 1851;	July, 1867	11 4	"	Judge A. Steele, Assistant Surgeon, and W. C. Andrass.	Ar. Met. Reg. 1855, P. O. and S. I. Vol. 1, S. Coll., and S. O.
3	..	80.73	..	..	..	May, 1869;	Aug. 1870	0 4	$7_m\ 2_a\ 9_{a\ bis}$	M. Martin.	S. O.
4	67.85	80.59	69.77	56.97	68.79	Feb. 1869;	Nov. 1870	1 6	"	G. D. Robinson, and W. M. L. Fiske.	" "
5	66.19	81.12	71.33	54.15	68.20	July, 1863;	July, 1867	1 6	$7_m\ 2_a\ 9_a$	H. M. Corey.	MS. from S. G. O., and S. O.
6	68.41	81.60	69.58	54.37	68.49	Jan. 1822;	Dec. 1860	20 2	"	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
7	71.80	80.39	73.52	61.99	71.92	Jan. 1825;	July, 1869	27 11	"	" "	" " "
8	73.22	81.88	77.32	67.21	74.91	Feb. 1839;	Oct. 1870	6 11	"	Assist. Surg., W. H. Hunt.	Ar. Met. Regs. 1855 and 1860, and S. O.
9	72.24	79.93	74.54	63.07	72.45	Feb. 1855;	Apr. 1858	2 5	"	Assistant Surgeon.	Ar. Met. Reg. 1860.
10	71.34	81.26	71.09	57.14	70.21	Oct. 1840;	Jan. 1843	2 4	"	" "	Ar. Met. Reg. 1855.
11	71.92	79.86	69.12	57.36	69.57	Jan. 1840;	Dec. 1842	2 3	"	" "	" " "
12	..	81.65	..	..	..	1850		0 5	$⊙_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1850.
13	69.89	80.61	69.40	54.90	68.70	Jan. 1838;	May, 1841	2 7	$7_m\ 2_a\ 9_a$	" "	Ar. Met. Reg. 1855.
14	70.41	80.65	69.11	55.04	68.80	Oct. 1838;	Dec. 1839	1 0	"	" "	" " "
15	75.75	84.24	79.61	71.11	77.68	Feb. 1861;	Dec. 1870	8 1	"	....	MS. from S. G. O.
16	70.79	80.43	70.65	58.36	70.06	Oct. 1832;	Feb. 1843	6 1	"	Assistant Surgeon.	Ar. Met. Reg. 1855.
17	68.69	80.36	71.90	58.25	69.80	Oct. 1824;	Oct. 1870	25 4	"	Assist. Surg., Dr. P. B. Mauran, and G. W. Atwood.	Ar. Met. Reg. 1855, P. O. and S. I. Vol. 1, MS. from S.G.O., and S. O.
18	71.87	79.34	73.82	60.59	71.41	May, 1851;	Nov. 1854	3 7	$⊙_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
19	72.13	79.67	69.81	58.86	70.12	July, 1838;	Dec. 1842	4 5	$7_m\ 2_a\ 9_a$	" "	" " "
20	74.10	82.08	76.73	64.90	74.45	Jan. 1851;	June, 1858	7 6	"	" "	Ar. Met. Regs. 1855 and 1860.
21	73.18	81.81	75.36	64.32	73.67	Jan. 1840;	May, 1858	8 4	"	" "	" " " "
22	72.48	82.50	69.50	58.42	70.72	July, 1838;	June, 1842	1 10	"	" "	Ar. Met. Reg. 1855.
23	70.92	80.47	70.68	58.54	70.15	Jan. 1838;	Jan. 1850	4 5	"	" "	" " "

[7] The first seven years of this series were observed at Cantonment Clinch, three miles from Pensacola and fourteen miles from Fort Barrancas.

[8] The observations were made at Fort Lauderdale from Jan. to Sept. 1839, and from July to Sept. 1840. This post is a few miles N. of Fort Dallas and the same distance from the sea.

[9] The observations composing this series were made at Fort Marion and St. Augustine; principally at Fort Marion.

[10] The observations composing this series were made at Forts Russell, Harley, and Wheelock, the same position being given for all.

FLORIDA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
24. Fort Wacohootee	29°28′	82°25′	50	59°.13	55°.58	67°.21	69°.67	72°.00	75°.00	80°.00	78°.00	77°.00	65°.67	59°.33	56°.33
25. Fort Wacassassa	29 30	82 45	45	58.53	57.59	66.93	70.50	74.13	77.32	79.66	79.56	78.62	69.74	59.63	56.58
26. Gainesville	29 38	82 20	184	53.96	58.73	61.21	67.18	73.97	78.13	79.37	78.35	76.40	68.65	61.11	57.56
27. Gordon	29 52	82 21	..	53.07	61.48	66.00	72.90	73.95	79.23	81.73	81.20	79.75	70.38	63.50	55.94
28. Hibernia	30 04	81 42	15	59.85	..	..	..	..	..	..	..	..	..	..	59.47
29. Jacksonville	30 20	81 39	20	55.51	57.27	62.76	69.45	75.59	79.53	81.73	81.69	78.67	69.78	61.67	54.09
30. Key West	24 33	81 48	10	70.04	70.68	73.79	76.29	80.20	82.15	83.31	83.52	82.53	79.12	75.59	72.83
31. Key West	24 33	81 48	10	69.18	70.51	72.70	75.65	79.21	82.66	83.84	83.54	82.29	78.70	74.66	71.63
32. Key West	24 33	81 48	10	64.92	71.18	76.09	77.62	82.25	83.54	85.09	84.99	..	80.30	..	70.93
33. Knox Hill[2]	30 40	85 58	148	48.66	55.40	62.52	66.31	75.34	77.93	79.26	79.58	77.23	67.96	59.72	55.12
34. Lake City[3]	30 12	82 38	185	56.15	56.94	62.51	68.98	75.27	80.73	79.82	80.28	77.94	69.12	59.35	59.18
35. Manatee	27 30	81 45	6	66.64	63.08	66.57	70.80	76.78	82.74	82.73	83.40	80.60	75.30	65.98	63.45
36. Micanopy	29 30	82 18	78	55.23	61.45	67.22	69.42	75.99	80.70	80.79	80.14	77.31	71.87	60.05	60.32
37. Mosquito Inlet (12 miles N. W. of)	29 12	81 02	10	..	..	..	..	..	..	78.12	79.89	77.20	73.88	62.80	54.18
38. Newport	30 10	84 15	..	..	..	..	..	73.36	77.15	79.37	79.51	75.36	67.38	56.83	48.90
39. New Smyrna	29 00	80 56	20	62.27	63.64	67.57	73.14	74.88	78.91	80.04	78.94	78.29	72.06	67.15	63.49
40. Ocala	29 11	82 09	..	61.89	62.73	63.18	67.17	72.86	79.62	81.13	82.35	79.24	69.40	59.73	57.45
41. Orange Grove	27 28	82 35	10	..	..	..	67.08	75.89	79.89	81.38	81.81	80.00	74.99	..	..
42. Pensacola	30 25	87 13	..	56.17	57.87	64.51	68.67	76.49	80.69	84.92	83.57	78.90	71.00	61.29	57.84
43. Picolata	29 57	81 36	25	61.21	56.80	64.30	72.60	73.46	78.60	81.70	80.50	77.88	70.67	61.04	57.86
44. Port Orange	29 04	80 57	..	59.17	59.07	63.99	68.76	74.83	78.40	82.01	81.37	79.41	72.96	64.34	58.48
45. Seville	30 29	84 07	..	51.32	51.54	58.55	59.60	69.36	75.90	76.40	73.15	71.61	62.78	55.19	49.25
46. Warrington[4]	30 21	87 17	12	53.02	57.10	63.19	69.12	75.74	81.16	83.84	82.90	78.97	70.30	61.58	56.51
47. White Springs	30 24	82 56	..	..	..	..	..	..	80.13	84.20	..	..	..	..	..

GEORGIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Athens	33 58	83 25	850	44.58	45.99	53.63	61.43	68.40	75.09	76.33	75.81	71.60	59.39	51.31	47.61
2. Atlanta	33 45	84 24	1050	40.90	43.45	51.14	58.01	65.65	71.71	77.50	75.40	68.86	57.55	48.92	41.22
3. Augusta[6]	33 29	81 51	150	47.06	49.86	55.85	63.92	72.97	79.13	81.30	78.04	74.56	63.66	49.68	43.53
4. Augusta Arsenal	33 28	81 53	350	47.20	50.57	55.67	65.10	72.28	79.12	82.16	79.85	73.95	63.68	53.85	46.68
5. Berne	30 50	81 50	25	52.03	49.25	54.08	61.15	70.83	75.97	79.64	77.40	71.93	63.56	52.96	47.73
6. Boston	30 42	83 50	..	47.45	54.35	..	..	..	..	..	..	..	..	..	..
7. Brunswick	31 05	81 30	..	51.3	56.0	59.3	66.7	75.3	75.0	82.0	82.0	80.0	68.0	58.3	52.3
8. Catawba	32 40	84 52	..	..	..	..	..	..	82.0	..	..	..	..	..	..
9. Clarksville	34 40	83 31	1632	40.40	45.97	48.93	55.33	..	70.93	72.82	72.45	65.86	55.05	46.01	44.42
10. Columbus	32 29	84 59	..	..	..	..	62.92	..	..	..	..	..	..	..	..
11. Culloden	32 51	84 06	825	46.17	52.33	59.70	64.36	73.89	77.73	79.63	76.97	72.27	64.01	55.84	48.76
12. Cuthbert	31 44	84 50	..	..	..	..	..	..	79.60	83.78	79.10	..	..	..	..
13. Dalton	34 47	85 00	775	39.90	44.87	49.30	..	..	..	..	..	..	..	..	..
14. Factory Mills	33 40	84 46	..	..	..	47.96	54.97	..	..	..	..	..	..	..	..
15. Griffin	33 03	84 15	..	..	..	..	60.26	..	..	..	..	..	..	..	..
16. Hillsborough	33 10	83 38	566	48.82	44.47	55.36	62.81	71.89	77.65	..	..	74.13	59.41	50.48	51.77
17. La Grange	33 02	85 01	..	47.87	..	..	..	..	..	..	..	..	..	..	..
18. Macon	32 50	83 40	..	44.60	47.63	59.73	62.38	70.85	..	..	..	..	..	..	..
19. Macon (Lewis High School)	32 47	83 47	1300	50.95	48.03	54.45	63.70	68.70	78.09	80.88	80.10	..	..	50.23	42.75
20. Macon	32 50	83 38	339	49.83	49.05	55.15	61.95	67.03	..	..	..	..	..	..	42.48
21. Milledgeville	33 05	83 12	577	..	..	60.68	65.12	72.39	80.16	77.19	81.07	74.15	59.47	57.90	48.95

[1] Corrected for daily variation by the Key West table. [2] Also called Orange Hill.
[3] Also called Alligator. [4] This series is composed of observations made at the Navy Yard and U. S. Naval Hospital.

FLORIDA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
24	69°.63	77°.67	67°.33	57°.01	67°.91	Jan. 1841;	Mar. 1842	1	3	$\odot_r\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
25	70.52	78.85	69.33	57.57	69.07	Oct. 1840;	Dec. 1842	2	3	$7_m\ 2_a\ 9_a$	" "	" " "
26	67.45	78.62	68.72	56.75	67.89	Feb. 1856;	Feb. 1861	4	9	"	J. B. Bailey.	P. O. and S. I. Vol. 1, and S. O.
27	70.95	80.72	71.21	56.83	69.93	Apr. 1866;	Jan. 1868	1	3	$7_m\ 2_a\ 9_a$ bis	H. B. Scott.	S. O.
28	..	..	..	..	..	Dec. 1857;	Jan. 1858	0	2	$7_m\ 2_a\ 9_a$	F. L. Batchelder.	P. O. and S. I. Vol. 1.
29	69.27	80.98	70.04	55.62	68.98	Feb. 1839;	Dec. 1870	12	4	$7_m\ 2_a\ 9_a$ bis	Dr. A. S. Baldwin.	MS. in S. Coll., P. O. and S. I. Vol. 1, and S. O.
30	76.76	82.99	79.08	71.18	77.50	1823;	1836	9	0	$\odot_r\ 2_a\ 10_a$ max. & min.	Whitehead.	Manuscript.
31	75.85	83.35	78.55	70.44	77.05	Jan. 1830;	Dec. 1870	26	6	[1]	Assist. Surg., Coll'tor of Customs, J. and W. A. Whitehead, W. C. Dennis, A. Gordon, G. T. Ferguson, J. G. Oltmanns.	Ar. Met. Regs. 1855 and 1860, MS. from S. G. O., Am. Alm. 1835, and foll., MS. in S. Coll., P. O. and S. I. Vol. 1, and S. O.
32	78.65	84.54	..	69.01	..	June, 1851;	May, 1852	0	10	hourly.	U. S. Coast Survey.	Manuscript.
33	68.06	78.92	68.30	53.06	67.09	July, 1851;	Dec. 1855	4	5	[1]	J. Newton.	S. Coll., P. O. & S. I. Vol. 1.
34	68.92	80.28	68.80	57.42	68.85	Mar. 1857;	Jan. 1869	4	0	$7_m\ 2_a\ 9_a$	E. R. Ives.	P. O. and S. I. Vol. 1, and S. O.
35	71.38	82.96	73.96	64.39	73.17	Jan. 1869;	July, 1870	1	7	$7_m\ 2_a\ 9_a$ bis	B. A. Coachman.	S. O.
36	70.88	80.54	69.74	59.00	70.04	June, 1858;	Dec. 1859	1	7	$7_m\ 2_a\ 9_a$	Dr. J. B. Bean.	P. O. and S. I. Vol. 1.
37	..	..	71.29	..	..	1870		0	6	$7_m\ 2_a\ 9_a$ bis	S. N. Chamberlin.	S. O.
38	..	78.68	66.52	..	..	1870		0	8	"	C. Bucher.	" "
39	71.86	79.30	72.50	63.13	71.70	Jan. 1840;	Oct. 1853	3	0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
40	67.74	81.03	69.46	60.69	69.73	Jan. 1869;	Sept. 1870	1	5	$7_m\ 2_a\ 9_a$ bis	E. Barker.	S. O.
41	..	81.03	..	..	..	1870		0	7	"	W. J. Clark.	" "
42	69.89	83.06	70.40	57.29	70.16	Aug. 1849;	Dec. 1852	3	5	$\odot_r$ N. $\odot_s$	Pearson.	Manuscript.
43	70.12	80.27	69.86	58.62	69.72	Sept. 1840;	Sept. 1841	1	1	$\odot_r\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
44	69.19	80.59	72.24	58.91	70.23	Jan. 1867;	Apr. 1870	2	10	$7_m\ 2_a\ 9_a$ bis	Dr. and Mrs. J. W. Hawks.	S. O.
45	62.50	75.15	63.19	50.70	62.89	1859		0	9	7_m	L. Gibbon.	P. O. and S. I. Vol. 1.
46	69.35	82.63	70.28	55.54	69.45	Oct. 1849;	Dec. 1860	10	9	[1]	J. Pearson, W. Johnson and others.	S. Coll., P. O. and S. I, Vol. 1.
47	..	..	..	..	..	1870		0	2	$7_m\ 2_a\ 9_a$ bis	R. W. Adams.	S. O.

GEORGIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	61.15	75.74	60.77	46.06	60.93	Jan. 1845;	Sept. 1859	6	6	[5]	McCoy, Prof. J. D. Easter.	Southern Cultivator, and P. O. and S. I. Vol. 1.
2	58.27	74.87	58.44	41.86	58.36	Jan. 1859;	Dec. 1870	5	2	$7_m\ 2_a\ 9_a$ bis	Dr. J. G. Westmoreland, Assist. Surg., F. Deckner & son.	P. O. and S. I. Vol. 1, S. O., and MS. from S. G. O.
3	64.25	79.49	62.63	46.82	63.30	Jan. 1839;	July, 1868	7	5	[6]	Drs. M. and S. H. Holbrook, W. H. Dougherty, W. Haines, S. Elliott.	Am. Alm., P. O. and S. I. Vol. 1, and S. O.
4	64.35	80.38	63.83	48.15	64.18	Jan. 1826;	Dec. 1870	21	7	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855, and MS. from S. G. O.
5	62.02	77.67	62.82	49.67	63.04	June, 1869;	Dec. 1870	1	7	$7_m\ 2_a\ 9_a$ bis	H. L. Hillyer.	S. O.
6	..	..	..	..	..	1861		0	2	"	W. Blewett.	" "
7	67.10	79.67	68.77	53.20	67.18	June, 1838;	May, 1839	1	0	$8_m\ 2_a\ 6_a$	J. Bancroft.	Am. Alm.
8	..	..	..	..	..	1853		0	1	$7_m\ 2_a\ 9_a$	Shields.	S. Coll.
9	..	72.07	55.64	43.60	..	June, 1847;	Apr. 1861	2	3	[5]	Campbell and J. Vanburen.	Pat. Off. Rep., S. O., and P. O. and S. I. Vol. 1.
10	..	..	..	..	..	1870		0	1	$7_m\ 2_a\ 9_a$ bis	N. J. Fogarty.	S. O.
11	65.98	78.11	64.04	49.09	64.31	May, 1852;	June, 1854	2	2	[5]	Prof. J. Darby.	S. Coll., & P. O. & S. I. Vol. 1.
12	..	80.83	..	..	..	1860		0	3	$7_m\ 2_a\ 9_a$ bis	C. C. Seavey.	S. O.
13	..	..	..	..	..	1861		0	3	"	Dr. J. R. McAfie.	" "
14	..	..	..	..	..	1857		0	2	$7_m\ 2_a\ 9_a$	F. T. Simpson.	P. O. and S. I. Vol. 1.
15	..	..	..	..	..	1851		0	1	$\odot_r\ 2_a\ 9_a$	....	S. Coll.
16	63.35	..	61.34	48.35	..	Sept. 1857;	June, 1858	0	10	$7_m\ 2_a\ 9_a$	E. S. Glover.	P. O. and S. I. Vol. 1.
17	..	..	..	..	..	1855		0	1	$\odot_r$ N. $\odot_s$	....	" " "
18	64.32	..	..	..	..	1868		0	5	$7_m\ 2_a\ 9_a$ bis	J. A. Rockwell.	S. O.
19	62.28	79.69	..	47.24	..	Nov. 1868;	Aug. 1869	0	10	"	Misses S. G. Whiting, and S. M. Proctor.	" "
20	61.38	..	..	47.12	..	Dec. 1868;	May, 1869	0	6	"	J. F. Adams.	" "
21	66.06	79.47	63.84	..	..	Oct. 1843;	Dec. 1849	1	1	$\odot_r\ 9_m\ 3_a\ 9_a$	J. R. Catting & Jacobs.	MS. in S. Coll. and S. Coll.

[5] Corrected for daily variation.

[6] Observations of 1839 and for four months of 1868 at Summerville, about one mile south of Augusta.

GEORGIA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
22. Oglethorpe B'ks	32°05′	81°07′	40	52°.03	54°.05	58°.76	66°.89	75°.60	80°.31	82°.67	81°.43	77°.49	67°.26	57°.85	50°.97
23. Penfield	33 38	83 09	724	47.59	45.93	50.74	61.21	69.02	76.85	80.25	78.58	71.02	62.22	50.06	42.47
24. Perry	32 28	83 43	280	42.64	53.50	63.08	64.35	73.67	78.99	81.37	78.57	74.57	67.55	53.26	50.65
25. Powelton	33 25	82 50	620	..	..	..	..	74.55	76.71	79.72	75.80	72.33	..	52.17	..
26. Quitman (ten miles S. W. of)	30 40	83 40	..	..	..	..	..	..	..	..	..	..	..	..	49.28
27. Richmond Hill	33 26	81 53	275	..	..	..	..	..	..	82.70	..	..	..	..	..
28. St. Mary's	30 44	81 34	15	..	..	..	..	72.38	77.39	80.55	80.38	76.48	69.56	57.97	49.12
29. Savannah	32 05	81 06	42	51.29	54.31	59.73	66.97	74.47	79.38	81.67	80.77	75.90	66.71	57.83	52.09
30. Sparta	33 15	82 54	550	43.66	48.89	54.08	61.50	71.33	76.08	80.18	78.28	73.49	61.95	52.90	46.34
31. The Rock[1]	32 52	84 23	833	42.87	47.95	55.68	63.59	70.35	77.34	78.63	74.80	72.49	61.50	51.62	44.09
32. Thomson	33 29	82 25	..	..	49.78	57.98	63.65	74.34	..	..	..	..	..	..	54.23
33. Thornhill	31 37	81 11	10	..	..	..	..	..	79.47	79.57	82.13	76.06	69.10	..	..
34. Whitemarsh Island	32 00	81 00	18	48.20	53.16	57.64	64.59	72.86	77.85	80.12	79.60	75.09	65.59	57.56	51.74
35. Zebulon	33 06	84 21	..	43.85	51.77	56.09	61.88	71.75	79.86	81.68	78.48	72.06	66.64	53.69	48.99

IDAHO.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Camp Connor	..	..	..	11.38	12.51	..	..	..	..	..	..	..	..	..	20.03
2. Cantonment Loring[2]	43 04	112 27	4700	24.31	24.06	25.23	42.71	..	..	..	63.39	59.62	47.97	34.67	22.50
3. Chelemta Depot	48 42	116 19	1796	..	..	..	..	..	..	..	71.6	58.1	49.1	40.1	..
4. Fort Boisé	43 40	116 00	..	26.50	32.89	40.90	52.56	62.62	70.68	78.38	76.05	63.75	52.84	42.33	30.05
5. Fort Lapwai	46 18	116 54	..	29.78	36.09	41.36	53.70	63.89	70.26	77.59	72.86	62.40	51.27	41.62	33.46
6. Lapwai[3]	46 18	116 54	2000	31.83	38.50	42.75	52.75	57.50	68.87	70.13	72.00	64.00	48.13	41.50	40.40

ILLINOIS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Albion	38 24	88 04	..	..	..	..	40.81	..	..	..	..	..	..	..	..
2. Alto[4]	41 45	89 00	..	19.53	24.05	30.85	45.77	56.57	68.45	73.17	68.70	59.90	47.37	35.85	23.59
3. Alton	38 53	90 14	650	34.05	33.66	41.13	48.01	62.30	73.93	76.53	75.69	66.65	51.10	43.84	28.32
4. Andalusia[5]	41 25	90 45	686	23.17	25.83	36.14	47.64	58.95	69.78	75.82	72.17	63.57	51.57	38.24	26.00
5. Athens	39 57	89 45	800	31.16	29.78	39.25	47.29	60.14	70.11	73.16	71.36	62.78	51.42	42.98	26.24
6. Athens[6]	39 57	89 45	800	25.12	29.24	39.08	52.17	63.00	72.01	77.68	75.36	68.56	55.40	40.49	29.81
7. Augusta[7]	40 12	90 58	500	25.52	29.08	38.28	50.94	61.77	70.56	75.19	72.75	65.27	52.49	40.23	28.42
8. Aurora	41 46	88 17	696	21.26	24.08	34.90	46.23	57.14	67.72	73.29	68.29	58.81	49.55	41.37	23.19
9. Batavia[8]	41 52	88 16	636	21.17	27.41	36.83	43.87	58.25	67.75	73.58	70.28	62.71	48.23	33.42	24.25
10. Belleville	38 29	89 58	600	30.88	31.38	45.03	56.03	70.72	75.03	79.81	79.27	70.83	59.84	46.43	40.27
11. Belvidere	42 16	88 48	810	19.54	21.98	31.57	44.84	58.16	66.29	73.09	68.14	60.01	44.89	34.03	21.82
12. Brighton	39 00	90 13	..	27.64	31.72	38.07	45.47	63.54	74.55	81.87	76.99	67.63	56.76	37.37	32.49
13. Bruce[9]	41 09	88 50	550	..	..	..	..	59.25	63.30	..	..	...	..	43.56	15.63
14. Carthage	40 23	91 17	..	24.53	30.10	42.64	46.65	66.97	70.25	79.14	75.56	66.11	52.59	39.07	24.89
15. Centralia	38 31	89 08	..	27.53	37.40	..	..	..	..	..	..	..	..	..	..
16. Channahon	41 26	88 12	630	..	..	36.50	50.97	58.20	70.70	..	..	..	..	..	..
17. Charleston	39 30	88 10	..	27.93	29.45	35.31	53.31	64.96	71.39	77.18	71.21	67.35	54.13	41.31	26.28
18. Chicago[10]	41 54	87 38	600	23.01	24.96	32.01	45.31	53.34	61.59	70.34	68.34	60.19	48.41	36.36	26.38
19. Clinton	40 09	88 57	430	20.72	25.75	35.41	52.65	..	..	..	..	..	..	..	19.95
20. Coloma (near)	38 14	89 16	405	29.15	32.55	37.57	51.48	59.67	70.60	75.72	72.60	64.23	51.24	42.59	30.98
21. Decatur	39 51	88 57	685	27.53	28.38	34.45	52.85	65.23	72.05	77.98	71.75	67.20	49.65	38.99	28.26

[1] The results previous to 1854 are defective on account of frequent blanks in the record. In 1856 and 1859 the observations were made at Thomaston, about three miles N. E. of The Rock.

[2] Old Fort Hall.

[3] Observations assumed to have been taken at or in the vicinity of the Fort.

[4] Also called Rochelle.

[5] Observations previous to 1866 were made at Edgington, about one mile to the west of Andalusia.

GEORGIA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
22	67°.08	81°.46	67°.53	52°.35	67°.11	Jan. 1832;	Dec. 1870	12 4	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855 and MS. from S. G. O.
23	60.32	78.56	61.10	45.33	61.33	1852;	Dec. 1870	2 7	$7_m\ 2_a\ 9_{a\ bis}$	Prof. S. P. Sanford and Willis.	S. O. and S. Coll.
24	67.03	79.64	65.13	48.93	65.18	Apr. 1851;	1853	2 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Cooper.	S. Coll.
25	..	77.41	..	..	..	1852		0 6	"	Pendleton.	" "
26	..	..	..	..	..	1870		0 1	$7_m\ 2_a\ 9_{a\ bis}$	J. L. Cutler.	S. O.
27	..	..	..	..	..	1854		0 1	$7_m\ 2_a\ 9_a$	W. Schley, Jr.	P. O. and S. I. Vol. I.
28	..	79.44	68.00	..	..	1870		0 8	$7_m\ 2_a\ 9_{a\ bis}$	E. Barker.	S. O.
29	67.06	80.61	66.81	52.56	66.76	Jan. 1819;	Oct. 1859	26 1	$7_m\ 2_a\ 7_a$	A.G. Pemler, Dr. J. F. Posey, and Williams.	Am. Alm. 1838 and foll. especially 1856, MS. in S. Coll., and P. O. and S. I. Vol. I.
30	62.30	78.18	62.78	46.30	62.39	1850;	Apr. 1861	9 0	$7_m\ 2_a\ 9_a$	Dr. E. M. Pendleton.	P.O. and S. I. Vol. I, S. O., and S. Coll.
31	63.21	76.92	61.87	44.97	61.74	May, 1839;	Dec. 1859	7 5	"	Dr. J. Anderson.	MS. in S. Coll., P. O. and S. I. Vol. I.
32	65.32	..	..	..	..	Dec. 1858;	May, 1859	0 5	"	....	P. O. and S. I. Vol. I.
33	..	80.39	..	..	..	1849		0 5	$\odot_r\ 9_m\ 3_a\ 9_a$	Grant.	S. Coll.
34	65.03	79.19	66.08	51.03	65.33	Apr. 1849;	Apr. 1861	11 9	$7_m\ 2_a\ 9_a$	R. T. Gibson.	P. O. and S. I. Vol. I, S. O., and S. Coll.
35	63.24	80.01	64.13	48.20	63.90	Jan. 1856;	Mar. 1857	2 9	"	Mrs. J. T. Arnold.	P. O. and S. I. Vol. I.

IDAHO.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	14.64	..	Dec. 1864;	Feb. 1865	0 3	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
2	..	..	47.42	23.62	..	Aug. 1849;	Apr. 1850	0 9	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
3	..	..	49.10	..	..	1860		0 4	$7_m\ 2_a\ 9_a$	....	Rep. of N. W. Bound Com.
4	52.03	75.04	52.97	29.81	52.46	Feb. 1864;	Dec. 1870	5 10	"	Assistant Surgeon.	MS. from S. G. O.
5	52.98	73.57	51.76	33.11	52.86	Jan. 1864;	Dec. 1870	5 11	"	Spalding.	MS. from S. G. O.
6	51.00	70.33	51.21	36.91	52.36	1837;	1841	2 2	......	"	Wilkes.

ILLINOIS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1857		0 1	$7_m\ 2_a$	E. P. Thompson.	P. O. and S. I. Vol. I.
2	44.40	70.11	47.71	22.39	46.15	July, 1866;	Dec. 1870	4 2	$7_m\ 2_a\ 9_{a\ bis}$	Dr. Carey.	S. O.
3	50.48	75.38	53.86	32.01	52.93	May, 1849;	Dec. 1851	1 6	$\odot_r\ 9_m\ 3_a\ 9_a$	Johnson.	MS. in S. Coll.
4	47.58	72.59	51.13	25.00	49.07	Mar. 1857;	Dec. 1870	9 1	$7_m\ 2_a\ 9_{a\ bis}$	Dr. E. H. Bowman.	P. O. and S. I. Vol. I, and S. O.
5	48.89	71.54	52.39	29.06	50.47	1847;	1850	3 3	$\odot_r\ 9_m\ 3_a\ \odot_s$	Prof. J. Hall.	Pat. Off. Rep.
6	51.42	75.02	54.82	28.06	52.33	Jan. 1851;	Dec. 1858	7 11	$7_m\ 2_a\ 9_a$	" " "	S. Coll., P. O. and S. I. Vol. I.
7	50.33	72.83	52.66	27.67	50.87	Aug. 1833;	Dec. 1870	26 9	$7_m\ 2_a\ 9_{a\ bis}$	Dr. S. B. Mead.	MS. in S. Coll.
8	46.09	69.77	49.91	22.84	47.15	Oct. 1857;	Dec. 1870	7 4	"	A. J. Babcock, Dr. A. Spaulding and wife.	P. O. and S. I. Vol. I, and S. O.
9	46.32	70.54	48.12	24.28	47.31	Jan. 1854;	July, 1861	3 8	$7_m\ 2_a\ 9_a$	Prof. W. Coffin, T. Mead, and F. Crandon.	" " " " "
10	57.26	78.04	59.03	34.18	57.13	May, 1860;	Dec. 1862	2 1	$7_m\ 2_a\ 9_{a\ bis}$	N. T. Baker, J. J. R. Patrick.	S. O.
11	44.86	69.17	46.31	21.11	45.36	Apr. 1868;	Dec. 1870	2 9	"	G. B. Moss.	" "
12	49.03	77.80	53.92	30.62	52.84	June, 1856;	Feb. 1859	2 9	$7_m\ 2_a\ 9_a$	Rev. W. V. Eldridge.	S. Coll., P. O. and S. I. Vol. I.
13	..	..	..	..	..	Nov. 1859;	June, 1860	0 4	"	Dr. G. O. Smith.	P. O. and S. I. Vol. I, and S. O.
14	52.09	74.98	52.59	26.51	51.54	Aug. 1858;	Dec. 1859	1 2	$7_m\ 1_a\ 7_a$	Mrs. E. M. A. Belle.	P. O. and S. I. Vol. I.
15	..	..	..	..	..	1865		0 2	$7_m\ 2_a\ 9_{a\ bis}$	H. A. Schauber.	S. O.
16	48.56	..	..	..	..	1861		0 4	"	I. Fitch.	" "
17	51.19	73.26	54.26	27.89	51.65	Apr. 1870;	Dec. 1870	0 9	"	C. Gramesby.	" "
18	43.55	66.76	48.32	24.78	45.85	July, 1832;	Dec. 1870	17 3	"	Assist. Surg., S. Meacham, S. Brooks, I. I. Langguth, and others.	Rec. of Mech. Inst. and S. O.
19	..	..	..	22.14	..	Dec. 1864;	May, 1866	0 5	$7_m\ 9_a$	C. N. Moore.	S. O.
20	49.57	72.97	52.69	30.89	51.53	June, 1865;	Nov. 1870	5 5	$7_m\ 2_a\ 9_{a\ bis}$	W. C. Spencer.	" "
21	50.84	73.93	51.95	28.06	51.19	Oct. 1869;	Dec. 1870	1 3	"	T. Dudley.	" "

6 Observations previous to Feb. 1853, at other hours; they were referred to $7_m\ 2_a\ 9_a$.

7 Observations previous to April, 1853, at $\odot_r\ 9_m\ 3_a\ 9_a$; they were referred to $7_m\ 2_a\ 9_{a\ bis}$.

8 Observations at three stations within a radius of a few miles.

9 Also called High Open Prairie.

10 Observations previous to 1844 were made at Fort Dearborn.

ILLINOIS.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
22. Edgar Co. (near S. W. corn.)	39°30′	88°56′	..	33°.42	17°.25	35°.42	44°.37	53°.61	..	..	..	..	..	..	..
23. Effingham	39 07	88 32	592	30.73	..	..	..	62.73	73°.40	77°.45	79°.65	..	..	..	..
24. Elgin	42 03	88 16	777	23.01	20.62	36.85	45.13	56.99	66.26	70.26	69.40	59°.91	48°.63	34°.59	22°.11
25. Elmira	41 10	89 50	..	20.76	26.92	33.53	48.72	61.15	70.52	75.26	70.96	62.94	48.76	38.01	23.35
26. Evanston (N. W. University)	42 03	87 39	618	23.49	25.86	34.32	45.63	55.89	66.15	70.20	70.43	66.75	49.63	39.78	23.89
27. Farm Ridge	41 13	88 53	600	20.90	26.05	40.00	46.73	62.43	66.10	69.48	68.13	59.08	49.86	31.50	18.73
28. Fort Armstrong	41 30	90 40	528	22.80	24.68	37.83	51.06	62.67	71.39	76.48	74.48	62.98	52.26	39.02	27.16
29. Fremont Centre	42 18	88 06	736	19.73	23.43	33.93	36.56	53.41	67.61	75.22	71.56	65.82	49.45	30.28	32.24
30. Galesburg (Univrs.)	40 55	90 24	795	21.41	26.10	33.22	49.01	59.63	70.41	74.06	71.75	63.69	49.93	38.75	26.40
31. Golconda	37 23	88 30	..	35.05	41.29	45.34	58.31	65.89	75.18	81.76	80.59	72.07	58.97	46.17	36.31
32. Granville	41 14	89 15	..	..	..	..	..	55.56	..	..	..	..	..	..	..
33. Havana	40 18	90 05	475	..	..	..	..	..	..	..	..	66.15	52.28	41.04	25.85
34. Hennepin	41 15	89 20	..	26.85	28.90	32.85	54.78	67.75	74.83	80.45	74.28	67.93	53.73	41.45	25.90
35. Highland[1]	38 44	89 40	620	32.77	35.18	44.52	57.50	67.62	75.54	79.55	77.97	70.88	55.95	42.98	34.44
36. Hillsborough	39 12	89 26	..	..	25.39	39.40	..	..	..	..	..	..	..	..	..
37. Hoyleton	38 26	89 17	480	25.70	..	..	49.03	62.27	73.63	79.30	75.65	68.48	48.75	42.25	28.85
38. Jacksonville[2]	39 45	90 12	676	28.99	24.27	41.48	55.18	61.69	75.13	74.45	72.52	65.53	54.97	44.89	34.76
39. Joliet	41 30	88 05	..	29.39	31.57	..	52.79	56.07	..	73.35	68.65	..	40.75	..	..
40. King's Mill	42 05	88 33	..	26.78	24.20	26.78	42.48	53.23	63.15	68.90	69.08	..	.	.	..
41. Lawn	40 59	89 38	..	..	..	27.25	49.78	..	..	..	..	..	..	..	..
42. Lebanon	38 35	89 49	500	30.37	35.09	43.63	55.40	65.20	73.95	75.75	77.32	69.25	57.40	46.28	39.88
43. Lee Centre	41 45	89 17	..	..	..	..	..	..	..	..	..	..	..	33.98	20.55
44. Loami	39 40	89 51	675	26.13	30.36	32.47	52.27	58.90	71.68	76.18	74.34	64.57	51.09	40.36	25.68
45. Louisville	38 45	88 30	..	33.71	34.39	38.48	55.00	66.25	73.16	78.67	76.14	67.15	50.59	42.34	31.34
46. Magnolia (near)	41 15	89 15	300	15.93	25.78	34.98	47.29	35.72	71.61	85.10	66.40	..	..	41.65	25.95
47. Manchester	39 31	90 34	683	26.41	30.65	38.55	52.04	62.90	71.88	76.11	73.72	66.00	53.56	40.47	29.58
48. Manlius	41 24	88 36	..	..	..	..	..	..	..	..	..	..	..	33.90	..
49. Marengo	42 14	88 34	842	19.42	23.81	33,14	43.78	55.36	67.37	72.16	68.29	60.39	48.89	33.78	26.05
50. Mattoon	39 29	88 23	740	30.00	28.85	34.73	53.18	66.80	73.48	78.42	75.52	67.77	51.48	40.87	30.34
51. Meeker's Store	37 24	89 20	487	36.80	34.25	47.55	55.40	..	..	73.17	76.85	67.72	58.22	46.63	44.63
52. Milford	41 33	88 40	..	17.72	29.28	39.69	49.04	58.80	68.76	76.71	73.93	58.22	57.06	36.90	26.90
53. Mound City	37 06	89 12	..	44.75	41.63	47.18	..	..	..	..	..	77.37	..	48.75	46.66
54. Mount Sterling	39 58	90 47	..	26.04	30.46	36.68	52.92	62.99	73.54	80.03	74.87	65.52	53.27	42.18	28.53
55. Monroe	42 08	87 55	600	29.49	30.21	34.25	43.06	53.17	68.67	70.96	68.07	61.11	49.35	43.56	22.06
56. Murrayville	39 35	90 14	683	..	..	..	51.30	65.14	74.87	72.08	74.37	73.84	54.97	..	..
57. Nachusa Nursery	41 50	89 23	..	..	27.41	..	47.53	54.89	66.00	71.43	..	..	..	..	..
58. Naperville	41 46	88 06	..	22.35	24.53	..	..	..	..	74.99	72.21	60.29	47.51	..	17.00
59. Olney	38 44	88 03	..	..	..	..	..	..	..	..	..	63.13	54.88	..	..
60. Oquawka	40 55	90 59	..	..	..	..	..	..	..	79.83	72.93	68.30	55.43	43.35	27.95
61. Orchard Farm	40 36	89 45	..	24.35	30.55	37.87	49.52	61.71	68.87	72.33	71.94	63.28	50.58	37.29	29.46
62. Osceola	41 12	89 46	..	22 69	28.53	39.14	50.78	61.64	70.13	74.55	73.60	64.55	54.70	33.95	20.23
63. Ottawa	41 20	88 47	500	23.48	26.70	35.62	45.78	59.82	69.98	74.55	71.63	63.91	52.49	37.26	25.79
64. Pana	39 23	89 05	735	29.23	30.75	36.28	54.24	66.18	71.60	76.76	74.85	66.55	50.12	39.67	28.91
65. Paris	39 37	87 41	600	..	..	..	..	..	..	..	..	63.48	..	..	..
66. Pekin	40 35	89 38	..	21.62	26.04	36.58	49.00	60.74	70.53	74.77	71.43	65.43	50.63	37.78	24.52
67. Peoria	40 43	89 30	512	25.06	28.67	37.98	51.05	62.87	72.14	77.11	74.12	66.37	52.63	39.81	28.47
68. Pleasant Ridge Nursery	41 15	89 36	550	22.75	28.42	32.96	47.98	59.31	69.52	73.66	70.29	62.13	48.13	39.34	25.99
69. Quincy	39 55	91 25	650	..	31.88	37.55	45.09	62.62	73.29	79.30	72.88	68.38	55.45	43.58	28.45
70. Ridge Farm	39 53	87 38	3120	..	..	..	..	59.75	69.35	81.19	69.43	60.88	50.80	..	..
71. Riley	42 11	88 35	760	17.54	22.87	31.88	43.53	55.71	65.60	70.04	67.82	60.08	46.54	33.56	21.93
72. Rock Island Arsenal	41 32	90 31	528	22.49	25.88	33.24	49.24	60.96	72.92	77.54	75.89	63.94	51.26	39.89	24.49
73. Rushville	40 05	90 39	..	..	..	..	..	..	72.00	79.13	..	..	..	..	..
74. Sandwich	41 40	88 35	575	21.12	25.59	33.94	43.18	58.61	68.31	72.73	70.27	62.23	48.46	36.45	22.39
75. South Pass[3] (near)	37 28	89 14	650	36.98	38.23	43.66	56.15	66.35	75.66	76.84	79.70	73.35	51.80	43.13	37.62
76. Springfield	39 48	89 40	550	24.85	29.67	35.81	48.98	60.31	71.21	77.25	73.59	64.06	42.41	40.34	28.33

[1] Observations after 1860 made at 7_m 2_a 9_a, were referred to 6_m 9_m N. 3_a.

ILLINOIS.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
22	44°.47	..	..	..	..	1858	0 5	$\odot_r$	J. W. Brown.	P. O. and S. I. Vol. I.
23	..	76°.83	..	..	..	May, 1869; Jan. 1870	0 5	$7_m\ 2_a\ 9_{a\ bis}$	W. Thompson.	S. O.
24	46.32	68.64	47°.71	21°.91	46°.15	Jan. 1858; July, 1862	4 0	"	J. B. Newcomb.	P. O. and S. I. Vol. I, and S. O.
25	47.80	72.25	49.90	23.68	48.41	May, 1862; Aug. 1870	5 10	"	O. A. Blanchard.	S. O.
26	45.28	68.93	52.05	24.41	47.67	Feb. 1858; Dec. 1870	4 1	"	C. E. Smith, J. H. Gill, O. Marcy, and others.	P. O. and S. I. Vol. I, and S. O.
27	49.72	67.90	46.81	21.89	46.58	Feb. 1860; Dec. 1860	0 10	"	E. Baldwin.	S. O.
28	50.52	74.12	51.42	24.88	50.23	Jan. 1824; Dec. 1835	11 6	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
29	41.30	71.46	48.52	25.13	46.60	Jan. 1857; Mar. 1858	1 3	"	I. H. Smith.	P. O. and S. I. Vol. I.
30	47.29	72.07	50.79	24.64	48.70	Feb. 1861; Dec. 1870	9 7	$7_m\ 1_a\ 9_a$	W. Livingstone.	S. O.
31	56.51	79.18	59.07	37.55	58.08	Jan. 1866; Sept. 1870	4 9	$7_m\ 2_a\ 9_{a\ bis}$	W. V. Eldridge.	" "
32	..	..	..	..	..	1857	0 1	$7_m\ 2_a\ 9_a$	J. L. Jenkins.	P. O. and S. I. Vol. I.
33	..	..	53.16	..	..	1870	0 4	"	J. Cochrane.	S. O.
34	51.79	76.52	54.37	27.22	52.48	1870	1 0	"	E. Osborn.	" "
35	56.55	77.69	56.60	34.13	56.24	Jan. 1841; Mar. 1864	15 1	$6_m\ 9_m$ N. 3_a	Dr. Ryhiner, A. F. Bandelier.	MS. in S. Coll. and S. O.
36	..	..	..	..	..	1858	0 2	$7_m\ 2_a\ 9_a$	J. S. Titcomb.	P. O. and S. I. Vol. I.
37	..	76.19	53.16	..	..	Apr. 1854; June, 1866	1 0	$7_m\ 2_a\ 7_{a\ bis}$	J. Ellsworth, O. J. Marsh.	S. O.
38	52.78	74.03	55.13	29.34	52.82	Apr. 1849; Mar. 1862	2 11	"	T. Dudley and Coffin.	P. O. and S. I. Vol. I, S. O., and S. Coll.
39	..	..	..	..	..	Oct. 1843; July, 1845	0 8	$\odot_r\ 9_m\ 3_a\ 9_a$	Dr. M. K. Brownson.	MS. in S. Coll.
40	40.83	67.04	..	..	..	1869	0 8	$7_m\ 2_a\ 9_{a\ bis}$	Dr. A. Spaulding and wife.	S. O.
41	..	..	..	..	..	1867	0 2	"	A. H. Thompson.	" "
42	54.74	75.67	57.64	35.11	55.79	Nov. 1859; June, 1862	1 8	"	N. E. Cobleigh.	P. O. and S. I. Vol. I, and S. O.
43	..	..	..	..	..	1860	0 2	"	E. D. Strauss.	S. O.
44	47.88	74.07	52.01	27.39	50.34	Jan. 1866; Sept. 1869	2 9	"	T. Dudley.	" "
45	53.24	75.99	53.36	33.15	53.93	Mar. 1869; Dec. 1870	1 10	"	Dr. D. H. Chase.	" "
46	39.33	74.37	..	22.55	..	Nov. 1866; Aug. 1868	1 4	"	H. A. Smith.	" "
47	51.16	73.90	53.34	28.88	51.82	July, 1854; Dec. 1870	15 6	$7_m\ 1_a\ 9_a$	J. Grant & daughter.	P. O. and S. I. Vol. I, and S. O.
48	..	..	..	..	..	1860	0 1	$7_m\ 2_a\ 9_{a\ bis}$	S. L. Shotwell.	S. O.
49	44.09	69.27	47.69	23.09	46.04	Apr. 1856; Mar. 1869	5 6	"	O. P. & J. S. Rogers.	" "
50	51.57	75.81	53.37	29.73	52.62	Aug. 1869; Dec. 1870	1 5	"	Dr. W. E. Henry.	" "
51	..	..	57.52	38.56	..	Mar. 1861; Feb. 1862	0 10	"	R. Meeker.	" "
52	49.18	73.13	50.73	24.63	49.42	1854	1 0	......	Hendrick.	Regents' Rep.
53	..	..	..	44.35	..	Sept. 1862; Mar. 1863	0 6	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
54	50.86	76.15	53.66	28.34	52.25	Jan. 1866; Dec. 1870	4 11	$7_m\ 2_a\ 9_{a\ bis}$	Rev. A. Duncan.	S. O.
55	43.49	69.23	51.34	27.25	47.83	1849; 1850	1 5	$\odot_r\ 9_m\ 3_a\ 9_a$	Main.	S. Coll.
56	..	73.77	..	..	..	1865	0 7	$7_m\ 1_a\ 9_a$	J. Grant & daughter.	S. O.
57	..	..	..	..	..	Apr. 1863; May, 1867	0 7	$7_m\ 2_a\ 9_{a\ bis}$	J. T. Little.	" "
58	..	..	..	21.29	..	July, 1859; Feb. 1860	0 7	$7_m\ 2_a\ 9_a$	M. S. & L. Ellsworth.	P. O. and S. I. Vol. I. and S. O.
59	..	..	..	..	..	1860	0 2	$7_m\ 2_a\ 9_{a\ bis}$	H. A. Brickenstein.	S. O.
60	..	..	55.69	..	..	1870	0 6	"	H. N. Patterson.	" "
61	49.70	71.05	50.38	28.12	49.81	Jan. 1860; Mar. 1864	4 0	"	J. H. Riblet.	" "
62	50.52	72.76	51.07	23.82	49.54	Jan. 1860; May, 1861	1 5	"	Dr. J. S. Pashley.	" "
63	47.07	72.05	51.22	25.32	48.92	1852: Nov. 1870	18 9	"	Dr. J. O. Harris, Mrs. E. A. Merwin, and Meacham.	P. O. and S. I. Vol. I, S. O., S. Coll.
64	52.23	74.40	52.11	29.63	52.09	June, 1869; Dec. 1870	1 7	"	Dr. T. Finley.	S. O.
65	..	..	..	..	..	1868	0 1	"	C. Lee.	" "
66	48.77	72.24	51.28	24.06	49.09	Jan. 1855; Oct. 1865	6 10	"	J. H. Riblet.	MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
67	50.63	74.46	52.94	27.40	51.36	Jan. 1856; Dec. 1870	14 9	"	Dr. F. Brendel, M. A. Breed.	P. O. and S. I. Vol. I, and S. O.
68	46.75	71.16	49.87	25.72	48.37	July, 1863; July, 1870	7 1	"	V. Aldrich.	S. O.
69	48.42	75.16	55.80	..	..	Feb. 1850; Dec. 1870	0 11	"	F. J. Hearne and Giddings.	S. O. and S. Coll.
70	..	73.32	..	..	..	1868	0 6	"	B. C. Williams.	S. O.
71	43.71	67.82	46.73	20.78	44.76	Apr. 1856; Dec. 1870	12 0	"	E. Babcock, J. W. James.	" "
72	47.81	75.45	51.70	24.29	49.81	Feb. 1866; Dec. 1870	4 6	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
73	..	..	..	..	..	1833	0 2	......	Mead.	S. Coll.
74	45.24	70.44	49.05	23.03	46.94	Dec. 1858; Apr. 1870	11 2	$7_m\ 2_a\ 9_{a\ bis}$	Dr. N. E. Ballou.	P. O. and S. I. Vol. I, and S. O.
75	55.39	77.40	56.09	37.61	56.62	Dec. 1857; Feb. 1870	3 11	"	H. C. Freeman and wife, F. Baker, and S. C. Spaulding.	MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
76	48.37	74.02	48.94	27.62	49.74	Jan. 1865; Aug. 1870	5 7	"	G. M. Brinkerhoff.	S. O.

[2] Observations previous to 1861 at other hours; they were referred to $7_m\ 2_a\ 9_{a\ bis}$.

[3] Observations for 1862–3–4 are not very reliable.

ILLINOIS.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
77. Upper Alton[1]	38°57′	90°04′	650	29°.43	34°.39	43°.47	52°.02	63°.53	73°.16	76°.65	75°.05	67°.87	53°.59	40°.70	31°.39
78. Upper Alton	38 57	90 04	650	26.05	27.14	32.64	52.64	63.97	71.73	77.84	73.36	67.39	53.64	40.86	30.81
79. Vandalia	38 58	89 05	..	..	..	..	..	..	78.61	75.57	..	..	..	..	..
80. Wapella	44 14	88 58	..	..	27.78	47.10	..	..	..	..	..	..	..	..	..
81. Warsaw (near)	40 21	91 23	550	25.36	29.23	37.45	50.15	61.78	70.50	74.67	72.88	65.57	51.67	37.48	29.14
82. Waterloo	38 20	90 10	..	25.86	37.26	44.52	53.41	64.74	79.47	82.79	80.45	70.79	59.32	45.78	31.36
83. Waukegan	42 21	87 55	646	..	..	35.90	41.72	51.08	..	..	..	..	..	..	..
84. Waverly	39 36	89 58	680	26.26	30.81	39.33	50.62	63.61	70.84	74.35	73.35	67.74	50.40	39.72	29.38
85. Waynesville	40 16	89 07	..	29.89	24.27	43.05	51.66	57.36	72.21	75.54	73.21	65.98	53.48	33.78	31.50
86. West Salem	38 30	88 00	..	27.97	34.22	44.43	54.49	67.11	74.26	78.80	75.14	68.55	57.18	42.36	33.98
87. West Urbana	40 09	88 17	550	24.27	27.97	39.63	47.11	60.48	70.34	76.74	74.23	66.06	51.96	38.41	29.94
88. Wheaton	41 49	88 06	682	28.49	21.41	36.22	51.70	56.09	68.17	72.04	70.62	61.39	49.10	36.11	24.97
89. Willow Creek Nursery	41 45	88 56	1040	18.70	26.75	..	..	..	..	70.93	69.43	60.83	..	37.25	..
90. Winnebago	42 17	89 12	900	19.19	21.80	31.83	44.67	57.69	67.13	71.59	68.94	60.81	47.04	34.60	21.02
91. Woodstock	42 18	88 24	..	..	28.60	40.13	47.11	63.02	67.78	72.85	70.13	60.66	49.11	..	..
92. Wyanet (four miles N. W. of)	41 30	89 45	..	21.72	26.76	33.16	49.03	59.11	60.11	75.09	71.20	62.91	50.43	39.68	24.09
93. York Neck.	40 05	91 33	..	23.90	33.35	38.55	49.00	62.90	72.05	73.25	72.30	70.15	52.00	41.30	25.65

INDIANA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Annapolis	39 52	87 12	3090	..	..	..	..	..	..	..	..	..	55.38	39.23	24.88
2. Anoma	38 45	85 33	..	..	38.42	40.51	53.57	60.42	73.33	74.39	..	..	54.51	51.79	25.29
3. Aurora	39 04	84 55	509	28.95	33.79	40.59	52.90	62.44	73.36	79.04	74.42	67.45	52.67	41.59	29.90
4. Balbac	40 30	85 00	1000	24.27	21.15	32.35	55.05	..	..	..	..	..	..	..	..
5. Bloomingdale (Friends' Acad.)	39 48	87 00	600	24.23	33.20	..	..	65.75	74.90	79.58	72.88	..	..	..	..
6. Bloomington	39 12	86 33	771	35.71	35.22	41.30	48.97	60.88	70.68	80.15	71.49	52.06	51.23	41.44	27.48
7. Cadiz[3] (one mile S. of)	39 55	85 20	1060	23.85	27.96	35.56	47.19	57.93	65.70	70.33	67.71	60.03	47.31	37.08	27.17
8. Cannelton	37 58	86 45	400	30.39	38.17	44.04	54.00	64.20	72.55	75.47	73.61	66.80	56.10	45.50	37.48
9. Columbia City	41 10	85 25	..	23.61	27.33	32.98	48.38	56.32	71.27	75.30	70.29	62.65	50.29	39.77	27.23
10. Evansville	38 00	87 30	390	32.45	38.84	44.24	51.60	63.56	73.70	79.00	76.39	70.69	57.59	43.10	42.63
11. Farmers' Institute	40 20	86 57	..	..	..	..	..	60.97	71.23	69.08	68.40	70.15	50.10	..	..
12. Fort Wayne	41 05	85 04	..	..	..	..	..	58.10	70.34	..	..	..	..	..	25.23
13. Greencastle	39 39	86 49	..	24.50	35.00	41.55	..	61.91	69.43	..	..	..	..	..	..
14. Green Mount	39 52	84 58	..	33.38	35.05	..	..	..	..	..	..	..	..	..	..
15. Harveysburg	39 59	87 16	3090	26.25	28.15	33.44	51.26	61.54	72.09	75.37	73.22	65.63	43.48	37.45	30.98
16. Indianapolis	39 47	86 09	698	26.45	30.87	37.64	49.94	60.45	71.73	74.58	71.60	64.63	50.43	40.82	28.80
17. Jalapa	40 40	85 48	..	34.58	33.95	32.05	..	56.13	67.20	78.76	68.53	59.46	49.31	42.09	27.49
18. Jeffersonville	38 19	85 42	400	48.	45.	45.	59.	69.	80.	79.	82.	70.	60.	53.	37.
19. Kendallville	41 21	85 14	975	..	31.46	40.47	50.48	60.12	71.77	78.95	75.70	66.67	..	..	..
20. Kentland	40 47	87 22	725	31.00	31.89	31.28	46.98	57.00	65.84	71.32	73.25	63.88	44.03	34.60	27.50
21. Laconia[4]	38 05	86 03	..	35.18	34.05	39.80	56.05	65.40	71.95	76.75	75.55	67.83	51.64	42.67	33.52
22. Lafayette	40 25	86 52	620	29.73	32.38	31.35	47.58	61.18	69.80	71.20	74.25	..	..	..	30.70
23. Laporte	41 37	86 43	550	28.19	26.40	36.25	47.27	61.26	68.69	72.99	70.73	64.67	48.84	40.90	26.49
24. Laporte	41 37	86 43	550	25.0	28.0	36.0	40.0	50.0	60.0	64.0	65.0	54.0	45.0	34.0	20.0
25. Lo.	41 13	85 10	..	..	..	..	..	55.29	..	..	..	..	..	..	..
26. Logansport	40 45	86 19	600	24.15	30.36	37.97	49.98	60.84	70.59	77.50	73.58	64.48	52.03	38.02	28.40
27. Madison	38 45	85 20	450	32.87	31.53	43.53	55.82	62.87	71.11	80.08	75.31	69.56	56.27	39.24	37.33

[1] Observations at $6_m\ 2_a\ 6_a$, from Nov. 1, 1851, to May, 1853, subsequently at $7_m\ 2_a\ 9_a$; no correction for change of hours has been applied.
[2] Observations previous to 1857 were made at irregular hours; the series has been corrected for daily variation.

ILLINOIS.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
77	53°.01	74°.95	54°.05	31°.74	53°.44	1849;	1854	4 4	$\odot_r\ 9_m\ 3_a\ 9_a$	James.	S. Coll.
78	49.75	74.31	53.96	28.00	51.51	Jan. 1854;	Apr. 1864	5 5	$7_m\ 2_a\ 9_a$	Dr. L. James and Anna C. Trifle.	P. O. and S. I. Vol. 1, and S. O.
79	..	..	..	..	..	1865		0 2	$7_m\ 2_a\ 9_a$ bis	J. A. Sanborn.	S. O.
80	..	..	..	..	..	1868		0 2	"	T. L. Groff.	" "
81	49.79	72.68	51.57	27.91	50.49	May, 1840;	Dec. 1870	9 10	2	Ben. Whitaker.	MS. in S. Coll., P. O. and S. I. Vol. 1, and S. O.
82	54.22	80.91	58.63	31.49	56.31	Mar. 1865;	Dec. 1870	3 0	$7_m\ 2_a\ 9_a$ bis	H. Künster, F. Sum, Dr. C. Jozelle.	S. O.
83	42.90	..	..	..	..	1849		0 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Joslyn.	S. Coll.
84	51.19	72.85	52.62	28.82	51.37	Apr. 1862;	Dec. 1865	3 5	$7_m\ 2_a\ 9_a$ bis	T. Dudley.	S. O.
85	50.69	73.65	51.08	28.55	50.99	Jan. 1858;	Mar. 1859	1 3	$7_m\ 2_a\ 9_a$	J. E. Cantril.	P. O. and S. I. Vol. 1.
86	55.34	76.07	56.03	32.06	54.87	Feb. 1856;	Oct. 1860	4 5	"	H. A. Titze.	P. O. and S. I. Vol. 1, and S. O.
87	49.07	73.77	52.14	27.39	50.59	Apr. 1857;	Dec. 1859	2 9	"	Dr. J. Twain.	P. O. and S. I. Vol. 1.
88	48.00	70.28	48.87	24.96	48.03	Dec. 1857;	Dec. 1861	2 7	$7_m\ 2_a\ 9_a$ bis	Prof. G. H. Collier.	P. O. and S. I. Vol. 1, and S. O.
89	..	..	..	..	..	Jan. 1860;	Nov. 1861	0 9	"	E. E. Bacon.	S. O.
90	44.73	69.22	47.48	20.67	45.53	Jan. 1858;	Dec. 1870	12 9	"	J. W. Tolman and daughter.	P. O. and S. I, Vol. 1, and S. O.
91	50.09	70.25	..	..	..	Sept. 1859;	Apr. 1861	1 0	"	G. R. Bassett.	" " " " " "
92	47.10	68.80	51.01	24.19	47.77	June, 1864;	Dec. 1870	6 4	"	E. S. Phelps and daughter.	S. O.
93	50.15	72.53	54.48	27.63	51.20	Jan. 1864;	Dec. 1870	2 0	......	V. P. Gay.	MS. in S. Coll.

INDIANA

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1870		0 3	$7_m\ 2_a\ 9_a$ bis	R. S. Robertson.	S. O.
2	51.50	..	..	..	..	1849;	1850	0 10	$\odot_r\ 9_m\ 3_a\ 9_a$	Thomson.	S. Coll.
3	51.98	75.61	53.90	30.88	53.09	Jan. 1859;	Dec. 1870	5 9	$7_m\ 2_a\ 9_a$ bis	G. Sutton.	P. O. and S. I. Vol. 1, and S. O.
4	..	..	..	..	..	1866		0 4	"	Miriam Griest.	S. O.
5	..	75.79	..	..	..	Feb. 1864;	July, 1865	0 8	"	W. H. and Mary A. Hobbs.	" "
6	50.38	74.11	48.24	32.80	51.38	Mar. 1868;	Sept. 1869	1 3	"	C. M. Dodd & others.	" "
7	46.89	67.91	48.14	26.33	47.32	Dec. 1854;	Mar. 1865	9 7	"	W. Dawson and T. B. Redding.	S. Coll. and S. O.
8	54.08	73.88	56.13	35.35	54.86	Jan. 1857;	Apr. 1869	3 4	"	H. Smith, Jr., and P. Smith.	P. O. and S. I. Vol. 1, and S. O.
9	45.89	72.29	50.90	26.06	48.79	Sept. 1865;	Dec. 1870	5 0	"	Dr. F. McCoy and daughter, Dr. W. J. Maxwell.	S. O.
10	53.13	76.36	57.13	37.97	56.15	Mar. 1857;	Sept. 1858	1 7	$7_m\ 2_a\ 9_a$	J. F. Crisp.	P. O. and S. I. Vol. 1.
11	..	69.57	..	..	..	1865		0 6	$7_m\ 2_a\ 9_a$ bis	I. E. Windle.	S. O.
12	..	..	..	..	..	May, 1849;	Dec. 1870	0 3	"	R. S. Robertson and Huestes.	S. O. and S. Coll.
13	..	..	..	..	..	1843;	1854	0 5	$7_m\ 2_a\ 9_a$	Profs. C. J. Downey and J. Tingley.	Newspaper slip, P. O. and S. I. Vol. 1, and S. Coll.
14	..	..	..	..	..	1860		0 2	$7_m\ 2_a\ 9_a$ bis	J. Haines.	S. O.
15	48.75	73.56	48.85	28.46	49.91	Feb. 1869;	Sept. 1870	1 6	"	B. C. Williams.	" "
16	49.34	72.64	51.96	28.71	50.66	Jan. 1864;	Dec. 1870	6 5	"	W. W. Butterfield and others.	" "
17	..	71.50	50.29	32.01	..	June, 1868;	June, 1869	1 0	"	Dr. A. C. Irwin.	" "
18	57.67	80.33	61.00	43.33	60.58	1819		1 0	$7_m\ 2_a\ 9_a$	....	Rep. Brit. Assoc. 1847.
19	50.36	75.47	..	..	..	1854		0 8	"	J. Knauer and W. B. Coventing.	P. O. and S. I. Vol. 1.
20	45.09	70.14	47.50	30.13	48.22	Feb. 1869;	Dec. 1870	0 11	$7_m\ 2_a\ 9_a$ bis	D. Spitler.	S. O.
21	53.75	74.75	54.05	34.25	54.20	July, 1869;	Dec. 1870	1 6	"	A. Crozier.	" "
22	46.70	71.75	..	30.94	..	May, 1854;	Jan. 1870	0 11	"	A. H. Bixby and J. W. Newton.	P. O. and S. I. Vol. 1, and S. O.
23	48.26	70.80	51.47	27.03	49.39	1849;	Dec. 1870	2 6	"	F. G. Andrew and Newkirk.	S. O. and S. Coll.
24	42.00	63.00	44.33	24.33	43.41	1851		1 0	......	Reid.	Pat. Off. Rep.
25	..	..	..	..	..	1861		0 1	9_a	Dr. W. W. Spratt.	S. O.
26	49.60	73.89	51.51	27.64	50.66	July, 1854;	June, 1863	5 2	$7_m\ 2_a\ 9_a$ bls	E. L. Berthaud, C. B. Laselle, I. Bartlett, and T. B. Helen.	MS. in S. Coll. and S. O.
27	54.07	75.50	55.02	33.91	54.63	Nov. 1854;	July, 1866	2 10	"	C. Barnes, and Rev. S. Collins.	P. O. and S. I. Vol. 1, and S. O.

[3] Observations after February, 1863, were made at *Newcastle* very near *Cadiz*.

[4] Also called *Tobacco Landing*.

INDIANA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
28. Merom	39°05′	87°30′	..	28°.54	33°.87	38°.20	51°.76	62°.03	72°.29	78°.93	76°.44	64°.99	52°.93	43°.16	30°.52
29. Michigan City	41 42	86 49	622	24.28	29.30	36.05	44.63	56.46	67.48	72.95	70.80	63.72	47.87	35.69	27.60
30. Milton	39 47	85 06	800	30.20	29.31	38.53	52.61	62.24	71.13	75.52	73.13	67.80	50.26	42.09	31.52
31. Mishawaka[1]	41 39	86 08	..	..	..	..	43.84	63.21	64.97	73.31	70.72	62.27	51.11	43.72	..
32. Mount Carmel	39 25	84 52	900	31.18	30.83	36.00	51.85	65.13	70.77	76.31	75.98	67.74	50.14	38.85	29.85
33. Mount Hope[2]	39 47	85 33	800	31.88	29.75	38.09	50.28	61.63	69.97	75.32	74.44	66.45	49.29	40.51	28.18
34. Muncie	40 12	85 20	1000	25.54	30.73	35.70	49.08	60.32	70.75	75.16	70.71	62.27	49.03	40.17	29.38
35. New Albany	38 19	85 50	353	26.85	39.56	40.03	51.46	61.98	71.76	76.90	73.06	68.61	51.57	43.72	35.40
36. New Harmony	38 10	87 54	350	34.11	41.53	52.56	56.04	67.64	76.36	78.85	75.50	65.65	55.72	43.27	37.36
37. New Harmony	38 10	87 54	350	31.32	36.29	43.77	55.26	65.53	73.20	78.53	76.04	68.92	54.44	44.25	35.13
38. Newport	39 57	84 54	..	..	..	..	..	..	..	..	..	..	48.08	43.28	..
39. Pennville	40 20	85 00	1000	19.80	31.45	42.50	51.88	63.35	70.24	71.83	70.19	..	..	..	21.15
40. Rensselaer	40 56	87 05	725	22.99	28.00	34.91	47.39	59.24	70.73	75.02	71.70	65.24	47.49	36.98	24.67
41. Richmond[3]	39 50	84 51	850	26.25	31.04	39.45	50.01	60.59	70.08	73.85	71.44	65.88	52.20	39.48	30.19
42. Rockville (one mile N. of)	39 47	87 10	1100	25.90	28.50	36.40	50.40	60.30	67.40	74.70	71.50	65.90	50.90	40.50	28.90
43. Rockville	39 46	87 10	1100	25.59	29.15	36.65	52.13	62.88	68.00	72.20	72.05	63.68	46.43	40.10	27.65
44. South Bend	41 39	86 12	600	21.14	29.14	35.38	46.99	61.07	68.93	72.47	71.34	62.60	47.81	38.74	29.74
45. Spiceland	39 51	85 26	1025	25.57	30.62	36.69	50.36	60.28	70.55	74.74	71.29	64.36	49.47	40.13	29.23
46. Vevay	38 45	85 05	525	29.38	35.76	43.47	56.13	63.78	74.62	79.09	75.51	69.35	53.89	42.90	32.31
47. Warsaw	41 14	85 52	..	..	..	..	..	..	..	..	..	..	..	..	29.90

INDIAN TERRITORY.

1. Armstrong Acad.[5]	34 07	96 12	..	47.36	46.56	53.22	63.02	69.90	77.08	80.72	82.56	74.24	66.17	53.19	42.14
2. Baptist Mission	35 00	97 00	..	..	..	..	..	..	..	..	..	..	..	47.75	38.55
3. Caney[6]	..	..	..	..	..	53.42	64.83	70.05	76.40	82.23	76.03	68.97	55.90	43.23	..
4. Fort Arbuckle	34 29	97 17	1000	38.09	45.14	53.35	61.33	69.95	77.12	82.29	81.24	73.76	61.61	49.65	39.04
5. Fort Gibson	35 48	95 20	560	38.81	41.83	51.50	62.53	69.21	76.33	80.84	80.22	73.43	61.29	49.61	40.12
6. Fort Sill	34 45	98 38	..	..	..	..	62.83	73.21	77.23	82.14	78.64	74.99	56.17	46.97	..
7. Fort Towson	34 00	95 12	300	42.96	45.91	53.31	63.85	69.53	76.67	80.56	79.53	72.36	60.84	50.08	42.35
8. Fort Washita	34 11	96 38	645	41.69	47.30	54.01	63.27	70.39	76.72	81.21	80.97	74.80	62.64	51.62	41.60
9. Good Water Mission	33	95 25	..	..	..	..	..	..	83.60	94.43	..	..	..	..	..
10. Lee's Creek	35 30	94 30	..	..	..	48.70	..	..	..	..	..	..	..	..	..

IOWA.

1. Algona	43 05	94 15	1500	11.69	17.93	26.60	42.15	58.15	67.51	71.62	68.47	59.64	44.51	31.59	19.56
2. Algona (ten miles S. W. of)	42 55	94 17	1500	10.82	16.04	21.10	41.70	55.20	66.79	72.58	67.28	56.12	44.75	31.98	17.94
3. Ames (six miles N. of)	42 07	93 35	790	..	..	26.40	..	..	..	..	..	62.63	..	..	..
4. Atalissa	41 31	91 08	..	..	25.19	24.13	44.98	50.08	..	..	..	..	..	..	..
5. Bangor	42 10	93 09	..	26.58	..	35.03	50.35	62.88	..	73.68	71.90	61.95	..	..	..
6. Bellevue	42 15	90 25	..	16.98	22.53	34.38	43.96	58.26	68.49	73.44	69.51	61.41	49.21	33.64	20.16

[1] This series includes observations in Sept. Oct. and Nov. 1858, and May, 1859, at *Notre Dame*, about three and half miles N. W. of *Mishawaka*.

[2] Observations in Feb. March, April, and May, 1868, were made at *Carthage*, about one and half miles S. E. of *Mount Hope*.

[3] Observations from May to August, 1849, both inclusive, were made at *Walnut Hills*, about one and half miles N. W. of *Richmond*.

INDIANA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
28	50°.66	75°.89	53°.69	30°.98	52°.81	June, 1866; Dec. 1870	4 3	$7_m\ 2_a\ 9_a$ bis	T. Holmes, and B. F. McHenry.	S. O.
29	45.71	70.41	49.09	27.06	48.07	Jan. 1857; Sept. 1860	2 9	$7_m\ 2_a\ 9_a$	C. S. Woodward, W. Woodbridge, and H. Blake.	P. O. and S. I. Vol. 1, and MS. from U. S. Lake Survey.
30	51.13	73.26	53.38	30.34	52.03	Jan. 1853; Dec. 1855	3 0	“	Dr. V. Kersey.	P. O. & S. I. Vol. 1, and S. Coll.
31	..	69.67	52.37	..	..	Sept. 1858; Oct. 1859	0 10	“	G. C. Meinfield, and T. Vagnier.	P. O. and S. I. Vol. 1.
32	50.99	74.35	52.24	30.62	52.05	June, 1869; Dec. 1870	1 7	$7_m\ 2_a\ 9_a$ bis	J. A. Applegate and daughter.	S. O.
33	50.00	73.24	52.08	29.94	51.32	Feb. 1868; Dec. 1870	2 6	“	C. M. Hobbs and D. Deem.	“ “
34	48.37	72.21	50.49	28.55	49.90	Oct. 1863; May, 1870	4 7	“	E. J. Rice and Dr. G. W. H. Kemper.	“ “
35	51.16	73.91	54.63	33.94	53.41	Apr. 1856; Mar. 1869	4 3	“	C. Barnes, and D. E. L. Crozier.	S. O. and P. O. and S. I. Vol. 1.
36	58.75	76.90	54.88	37.67	57.05	1826; 1828	2 5	......	Troost.	Dove, 1857.
37	54.85	75.92	55.87	34.25	55.22	1850; Dec. 1870	19 5	$7_m\ 2_a\ 9_a$ bis	J. Chapell Smith.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
38	..	..	..	..	..	Nov. 1851; Nov. 1853	1 3	$7_m\ 2_a\ 9_a$	Roberts.	S. Coll.
39	52.58	70.75	..	24.13	..	May, 1864; Aug. 1865	0 1	$7_m\ 2_a\ 9_a$ bis	Miriam Griest.	S. O.
40	47.18	72.48	49.90	25.22	48.70	July, 1864; Oct. 1870	3 11	“	Dr. J. H. Loughridge.	“ “
41	50.02	71.79	52.52	29.16	50.87	1849; Aug. 1868	12 3	[4]	W. W. Austin, J. Moore, J. Haines, E. W. Rambo, J. Valentine.	P. O. and S. I. Vol. 1, S. O., & S. Coll.
42	49.03	71.20	52.43	27.77	50.11	Jan. 1862; Dec. 1866	5 0	......	H. H. Anderson.	MS. in S. Coll.
43	50.55	70.75	50.07	27.46	49.71	Jan. 1860; Dec. 1864	1 4	$7_m\ 2_a\ 9_a$ bis	H. H. and Mary A. Anderson.	S. O.
44	47.81	70.91	49.72	26.67	48.78	May, 1862; June, 1865	3 0	“	J. H. Dayton, R. Burroughs.	“ “
45	49.11	72.19	51.32	28.47	50.27	May, 1863; Dec. 1870	7 8	“	W. Dawson.	“ “
46	54.46	76.41	55.38	32.48	54.68	Aug. 1864; Dec. 1870	5 11	“	C. G. Boerner.	“ “
47	..	..	..	..	..	1870	0 1	“	G. R. Thralls.	“ “

INDIAN TERRITORY.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	62.05	80.12	64.53	45.35	63.01	1850; 1853	2 5	$\odot_r\ 9_m\ 3_a\ 9_a$	Brown.	S. Coll.
2	..	..	..	..	..	1860	0 2	$7_m\ 2_a\ 9_a$ bis	H. F. Buckner.	S. O.
3	62.77	78.22	56.03	..	..	1860	0 9	$7_m\ 2_a\ 9_a$	J. B. Hitchcock.	“ “
4	61.54	80.22	61.67	40.76	61.05	Oct. 1850; Aug. 1870	12 2	[4]	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
5	61.08	79.13	61.44	40.25	60.48	July, 1827; June, 1857	29 10	[4]	“ “	Ar. Met. Regs. 1855 and 1860, and S. Coll.
6	..	79.34	59.38	..	..	1870	0 8	$7_m\ 2_a\ 9_a$	“ “	MS. from S. G. O.
7	62.23	78.92	61.09	43.74	61.50	Jan. 1832; Apr. 1854	18 3	[4]	“ “	Ar. Met. Reg. 1855.
8	62.56	79.63	63.02	43.53	62.18	Jan. 1843; Mar. 1861	16 3	[4]	“ “	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
9	..	..	..	..	..	1860	0 2	$7_m\ 2_a\ 9_a$ bis	S. McBeth.	S. O.
10	..	..	..	..	..	1861	0 1	$7_m\ 2_a\ 9_a$	J. B. Hitchcock.	“ “

IOWA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	42.30	69.20	45.25	16.39	43.29	June, 1861; Dec. 1870	7 8	$7_m\ 2_a\ 9_a$ bis	Dr. F. McCoy and daughter, and J. H. Warren.	S. O.
2	39.33	68.88	44.28	14.93	41.86	Sept. 1866; Aug. 1870	3 10	“	P. Dorweiler.	“ “
3	..	..	..	..	..	Sept. 1869; Mar. 1870	0 2	“	J. M. Cotton.	“ “
4	39.73	..	..	..	..	1867	0 4	“	B. Carpenter.	“ “
5	49.42	..	..	..	..	Aug. 1861; July, 1862	0 7	“	J. M. Gidley.	“ “
6	45.53	70.48	48.09	19.89	46.00	Jan. 1856; Aug. 1860	4 6	“	J. C. Tory.	P. O. and S. I, Vol. 1. and S. O.

[4] Observations corrected for daily variation by means of the general table.

[5] Observations at $7_m\ 2_a\ 9_a$ after March, 1853. No correction for change of hours has been applied.

[6] Also called "Eh-yoh-hee."

IOWA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
7. Boonesboro	42°04′	93°55′	1160	15°.64	21°.94	31°.68	44°.62	62°.44	67°.70	76°.45	65°.82	59°.47	44°.68	35°.26	23°.29
8. Border Plains	42 24	94 05	..	18.47	20.09	35.54	41.93	57.84	69.89	76.05	72.37	64.57	51.25	34.10	20.20
9. Bowen's Prairie	42 16	91 09	800	20.92	23.93	29.41	47.44	60.84	69.15	72.22	69.47	60.85	45.27	34.68	21.19
10. Burlington	40 49	91 07	600	25.91	30.39	45.93	47.65	65.02	68.63	78.59	74.24	63.66	50.60	41.23	24.48
11. Brookside[1]	42 25	92 00	..	15.32	19.92	27.65	45.50	58.99	68.33	73.54	69.38	61.39	46.36	33.77	19.08
12. Ceres	42 49	91 12	825	13.75	18.44	28.90	44.01	56.55	68.67	71.55	69.54	63.41	50.69	38.19	20.49
13. Clarinda	40 44	95 02	..	23.48	24.03	..	..	..	..	..	..	..	..	..	25.88
14. Clinton (or Lyons[2])	41 50	90 10	630	20.69	24.20	32.19	47.45	58.65	68.79	73.74	71.43	63.46	49.33	36.81	25.06
15. Council Bluffs	41 16	95 51	1327	18.43	27.14	37.26	52.37	62.90	73.77	76.24	76.44	65.93	52.00	36.45	20.60
16. Dakota	42 43	94 12	..	7.07	16.59	23.64	38.32	51.29	67.90	70.62	70.32	60.53	49.33	36.73	19.23
17. Davenport	41 30	90 39	737	19.18	24.09	32.21	46.30	59.07	69.60	74.21	70.98	62.88	48.38	37.12	23.98
18. Des Moines City[3]	41 36	93 38	780	23.51	26.67	35.59	54.47	59.92	67.91	76.27	71.23	62.32	46.57	36.88	26.00
19. Dubuque	42 30	90 40	680	20.31	23.62	33.57	48.02	60.40	70.14	74.22	70.76	63.18	48.76	35.55	23.71
20. Fairfield	41 01	91 57	940	21.0	23.0	35.0	61.0	68.0	69.0	75.0	72.0	70.0	52.0	33.0	20.0
21. Fairfield	41 01	91 57	940	23.28	25.56	38.43	47.14	59.49	71.08	77.07	72.32	64.40	52.47	35.38	26.24
22. Fayette Village	42 51	91 51	1000	..	23.35	38.78	46.80	61.48	66.55	69.85	66.68	57.85	45.94	33.06	11.26
23. Forrestville	42 40	91 32	..	14.12	19.66	32.45	46.76	57.66	65.27	70.72	68.32	58.45	49.32	33.53	21.73
24. Fort Atkinson	43 09	92 00	700	20.95	20.12	29.43	49.73	58.38	64.77	72.47	68.57	61.30	45.40	31.02	20.14
25. Fort Croghan	41 21	95 23	1250	24.90	13.78	12.86	48.63	58.22	68.25	73.77	69.46	63.80	..	..	..
26. Fort Dodge	42 31	94 12	944	15.66	21.70	27.07	42.49	58.15	71.13	76.36	71.62	62.61	51.44	33.43	19.56
27. Fort Madison[4]	40 37	91 28	600	23.12	27.56	37.56	49.85	62.57	72.81	77.58	73.81	65.59	52.28	38.65	25.70
28. Franklin	42 45	92 11	..	15.64	21.22	33.03	43.82	57.35	69.68	73.33	69.29	61.59	50.74	32.93	20.25
29. Grant City	42 15	94 53	..	17.70	22.92	25.42	46.97	62.74	69.62	75.46	71.49	62.90	44.48	34.02	22.34
30. Guttenberg	42 46	91 09	690	14.06	20.82	27.74	43.33	56.34	66.37	71.25	65.94	57.56	44.94	33.95	19.22
31. Guttenberg (near)	42 46	91 14	800	15.87	20.64	25.88	44.80	59.33	68.55	66.28	69.90	64.98	46.56	34.92	16.77
32. Harris Grove[5]	41 39	95 47	900	18.19	26.74	30.67	45.76	58.55	66.83	74.13	69.30	60.48	49.79	37.54	24.44
33. Hesper	43 30	91 46	720	13.23	19.90	26.80	..	..	..	69.38	67.35	56.88	49.00	30.40	17.50
34. Independence	42 29	91 57	850	15.38	21.82	27.31	45.61	59.01	68.57	73.72	69.15	61.19	46.15	35.20	20.35
35. Iowa City	41 37	91 30	621	19.94	23.32	32.50	47.35	58.84	68.90	73.64	71.22	63.86	49.00	35.99	24.80
36. Iowa Falls[6]	42 32	93 21	..	15.56	21.99	26.68	45.20	59.67	70.05	74.66	70.80	63.31	47.89	34.65	20.65
37. Keokuk	40 25	91 21	600	26.53	32.37	39.09	50.37	60.82	73.13	76.43	74.74	67.41	55.60	39.13	29.21
38. Lizard	42 30	94 25	..	..	24.63	..	..	..	..	..	..	..	..	..	..
39. Manchester	42 29	91 38	925	19.40	14.98	25.55	46.90	56.00	63.73	71.55	63.13	61.00	47.66	35.43	17.27
40. Maquoketa	42 04	90 41	..	..	26.42	34.94	..	..	..	..	..	..	..	..	..
41. Marble Rock	42 58	92 52	..	..	..	..	..	..	70.00	71.08	70.90	61.60	52.28	40.63	20.75
42. Mineral Ridge	42 11	93 55	1200	20.23	25.93	28.20	45.20	..	..	71.65	74.32	63.28	41.83	31.23	25.78
43. Monticello	42 15	91 15	880	16.26	22.47	29.53	46.62	58.80	68.14	73.48	69.03	60.63	46.52	35.03	19.91
44. Mount Vernon	41 58	91 28	..	17.63	22.25	30.40	46.95	58.57	68.34	73.11	69.48	61.76	47.89	34.99	20.98
45. Muscatine	41 26	91 05	586	20.69	24.76	34.58	48.25	58.25	67.09	71.22	68.94	62.12	49.09	35.21	23.52
46. Mount Pleasant	42 57	91 37	..	19.41	28.68	33.56	46.08	62.75	72.10	76.93	72.87	66.71	46.58	33.85	22.72
47. Newton	41 42	93 03	1400	20.15	..	..	..	..	..	..	71.23	60.45	40.80	30.63	22.65
48. North Union (near)[7]	42 58	91 50	1250	19.95	22.89	27.52	49.24	63.74	69.99	74.69	71.26	64.39	45.64	35.14	20.92
49. Onowa City	42 02	96 09	1000	..	28.33	31.23	44.05	59.00	72.65	74.48	71.33	68.03	..	..	..
50. Osage	43 17	92 49	..	9.58	17.20	..	45.80	57.75	67.78	76.29	66.50	55.96	49.50	..	19.10
51. Pella	41 30	92 55	730	17.35	22.36	32.33	49.78	59.92	69.58	74.07	71.19	63.83	49.90	33.01	22.16
52. Pleasant Plain	41 07	91 55	950	20.08	24.94	35.50	46.76	61.49	71.07	74.75	72.10	64.47	49.79	35.09	24.16
53. Poultney	42 40	91 21	..	12.62	16.57	31.41	48.05	60.32	67.29	71.78	69.69	63.12	47.16	33.77	20.99
54. Quasqueton	42 23	91 23	888	13.06	16.38	28.51	51.30	61.02	70.70	74.97	71.39	65.77	50.03	33.66	22.03
55. Rockford	43 03	92 56	..	7.38	18.28	37.63	..	..	..	..	67.48	54.35	46.98	34.03	18.90
56. Rolfe	42 50	94 28	..	12.17	17.57	29.01	43.13	60.97	68.12	75.19	69.39	56.45	42.44	29.49	18.44
57. Rossville	43 10	91 21	1400	22.17	18.27	36.92	40.40	55.51	66.05	72.32	71.11	59.40	46.64	31.29	19.66
58. Sac City	42 25	95 00	900	..	..	..	49.64	63.77	..	..	..	..	48.54	39.14	22.00
59. Sioux City	42 35	96 27	1258	16.67	19.29	32.85	43.27	56.99	69.17	71.72	70.13	62.16	47.32	29.10	24.05
60. St. Mary's	41 00	95 45	1200	17.01	32.41	..	..	..	..	..	..	..	..	41.60	31.00

[1] Also called *Byron*. [2] Observations in 1857–58 were made at *Camanche*, about three miles southwest from *Clinton*.
[3] Observations previous to 1865 were made at *Fort Des Moines*, about two miles east of *Des Moines City*.

IOWA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
7	46°.25	69°.99	46°.47	20°.29	45°.75	Nov. 1867;	Dec. 1870	2	6	$7_m\ 2_a\ 9_a$ bis	E. Babcock.	S. O.
8	45.10	72.77	49.97	19.59	46.86	July, 1856;	Sept. 1859	3	3	$7_m\ 2_a\ 9_a$	W. K. Goss.	P. O. and S. I. Vol. I.
9	45.90	79.28	46.93	22.01	46.28	Feb. 1853;	Dec. 1870	3	3	$7_m\ 2_a\ 9_a$ bis	S. Woodworth, Bidwell, and Farwell.	S. O. and S. Coll.
10	52.87	73.82	51.83	26.93	51.36	Feb. 1859;	May, 1868	1	9	"	J. M. Corse, and L. P. Love.	P. O. and S. I. Vol. I, and S. O.
11	44.05	70.42	47.17	18.11	44.94	Apr. 1862;	Dec. 1870	8	3	"	A. C. Wheaton.	S. O.
12	43.15	69.92	50.76	17.56	45.35	May, 1865;	May, 1868	3	1	"	J. M. Hagensick.	" "
13	..	..	..	24.46	..	Jan. 1865;	Feb. 1866	0	3	"	Dr. S. H. Kridelbaugh.	" "
14	46.10	71.32	49.87	23.32	47.65	Apr. 1856;	Dec. 1870	10	5	"	N. H. Parker.	P. O. and S. I. Vol. I, and S. O.
15	50.84	75.48	51.46	22.06	49.96	Jan. 1820;	Dec. 1825	6	0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Army Register.
16	37.75	69.61	48.86	14.30	42.63	Apr. 1867;	Mar. 1868	1	0	$7_m\ 2_a\ 9_a$ bis	W. O. Atkinson.	S. O.
17	45.86	71.60	49.46	22.42	47.33	Apr. 1858;	Dec. 1870	9	3	"	A. J. Finley, W. P. Dunwoody, J. Chamberlain, D. S. Sheldon.	P. O. and S. I. Vol. I, and S. O.
18	49.99	71.80	48.59	25.39	48.94	Oct. 1843;	June, 1867	3	10	"	J. A. Nash, & Assist. Surg.	Ar. Met. Reg. 1855, and S. O.
19	47.33	71.71	49.16	22.55	47.69	Jan. 1851;	Dec. 1870	18	10	"	Asa Horr.	MS. in S. Coll., S. O., P. O. and S. I. Vol. I, and S. Coll.
20	54.67	72.00	51.67	21.33	49.92	1855		1	0	......	Dr. J. M. Schaffer.	P. O. and S. I. Vol. I.
21	48.35	73.49	50.79	25.03	49.41	Apr. 1856;	Dec. 1859	3	7	$7_m\ 2_a\ 9_a$	" " "	" " " "
22	49.02	67.69	45.62	..	..	Oct. 1859;	Nov. 1860	1	1	$7_m\ 2_a\ 9_a$ bis	J. M. McKenzie.	P. O. and S. I. Vol. I, and S. O.
23	45.62	68.10	47.10	18.51	44.83	June, 1859;	Apr. 1863	3	2	"	D. Sheldon.	" " " " "
24	45.85	68.60	45.91	20.40	45.19	Jan. 1842;	May, 1846	4	5	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
25	39.90	70.49	..	..	..	Jan. 1843;	Oct. 1843	0	9	"	" "	" " "
26	42.57	73.04	49.16	18.97	45.94	Aug. 1851;	Mar. 1869	4	1	$7_m\ 2_a\ 9_a$ bis	Assistant Surgeon and C. N. Jorgenson.	Ar. Met. Reg. 1855, and S. O.
27	49.99	74.73	52.17	25.46	50.59	Mar. 1848;	Dec. 1870	21	10	6_m N. 7_a	D. McCready.	MS. in S. Coll., S. O., and P. O. and S. I. Vol. I.
28	44.73	70.77	48.42	19.04	45.74	May, 1856;	Apr. 1862	4	4	$7_m\ 2_a\ 9_a$	D. and Mrs. C. Beal.	P. O. and S. I. Vol. I, and S. O.
29	45.04	72.19	47.13	20.99	46.34	Jan. 1869;	Dec. 1870	1	11	$7_m\ 2_a\ 9_a$ bis	E. Miller and wife.	S. O.
30	42.47	67.85	45.48	18.03	43.46	July, 1866;	Dec. 1870	4	6	"	J. P. Dickinson.	" "
31	43.34	68.24	48.82	17.76	44.54	Aug. 1864;	Mar. 1866	1	7	"	P. Dorweiler.	" "
32	44.99	70.09	49.27	23.12	46.87	May, 1866;	Dec. 1870	4	5	"	J. T. Stern.	" "
33	..	..	45.43	16.88	..	July, 1860;	Mar. 1861	0	9	"	H. B. Williams.	" "
34	43.98	70.48	47.51	19.18	45.29	Nov. 1861;	Dec. 1870	7	4	"	D. S. Deering.	" "
35	46.23	71.25	49.62	22.69	47.45	May, 1856;	Dec. 1870	11	6	"	Prof. T. S. Parvin, H. H. Fairall, Dr. W. Reynolds.	Printed Slip, S. Coll., P. O. & S. I. Vol. I, and S. O.
36	43.85	71.86	48.62	19.40	45.93	Nov. 1863;	Dec. 1870	6	9	"	N. Townsend.	S. O.
37	50.09	74.77	54.05	29.37	52.07	1851;	Jan. 1855	2	5	$\odot_r\ 9_m\ 3_a\ 9_a$	Dr. and Mrs. J. E. Ball.	P. O. & S. I. Vol. I, & S. Coll.
38	..	..	..	..	..	1869		0	1	$7_m\ 2_a\ 9_a$ bis	J. J. Bruce.	S. O.
39	42.82	66.14	48.03	17.22	43.55	Sept. 1865;	Nov. 1866	1	3	"	A. Mead.	" "
40	..	..	..	..	..	1857		0	2	$\odot_r$ N. 10_a	E. F. Hobart.	P. O. and S. I. Vol. I.
41	..	70.66	51.50	..	..	1867		0	7	$7_m\ 2_a\ 9_a$ bis	H. Wadey.	S. O.
42	..	..	45.45	23.98	..	Apr. 1869;	Mar. 1870	0	10	"	A. L. Sullivan.	" "
43	44.98	70.22	47.39	19.55	45.54	July, 1864;	Dec. 1870	6	2	"	C. Mead.	" "
44	45.31	70.31	48.21	20.29	46.03	Oct. 1856;	Dec. 1870	10	1	"	Profs. B. W. Smith and A. Collier.	P. O. and S. I. Vol. I. and S. O.
45	47.03	69.08	48.81	22.99	46.98	Jan. 1839;	Nov. 1870	27	6	"	T. S. Parvin.	Am. Alm. 1839 and foll., MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
46	47.46	73.97	49.05	23.60	48.52	Dec. 1863;	Sept. 1864	0	10	"	Rev. E. L. Briggs and daughter.	S. O.
47	..	..	43.96	..	..	Aug. 1869;	Jan. 1870	0	6	"	A. Failer.	" "
48	46.83	71.98	48.39	21.25	47.11	Jan. 1869;	Dec. 1870	2	0	"	F. McClintock.	" "
49	44.76	72.82	..	..	..	1864		0	8	"	Dr. R. Stebbins.	" "
50	..	70.19	..	15.29	..	Apr. 1866;	Feb. 1867	0	10	"	A. Bush and F. Marsh.	" "
51	47.34	71.61	48.91	20.62	47.12	Jan. 1852;	Mar. 1856	4	3	$7_m\ 2_a\ 9_a$	E. H. A. Scheeper.	P. O. and S. I. Vol. I, and MS. in S. Coll.
52	47.92	72.64	49.78	23.06	48.35	Jan. 1856;	Sept. 1865	9	6	$7_m\ 2_a\ 9_a$ bis	T. McConnell.	P. O. and S. I. Vol. I, and S. O.
53	46.59	69.59	48.02	16.73	45.23	July, 1853;	June, 1859	3	4	$7_m\ 2_a$ a9	Rev. B. F. Odell.	P. O. & S. I. Vol. I, & S. Coll.
54	46.94	72.35	49.82	17.16	46.57	Dec. 1853;	June, 1856	2	4	"	Dr. E. C. Bidwell.	" " " " "
55	..	..	45.12	14.85	..	1868		0	8	$7_m\ 2_a\ 9_a$ bis	H. Wadey.	S. O.
56	44.37	70.90	42.79	16.06	43.53	Feb. 1868;	Jan. 1870	2	0	"	O. J. Strong.	" "
57	44.28	69.83	45.78	20.03	44.98	Nov. 1857;	Dec. 1859	2	0	$7_m\ 2_a\ 9_a$	C. D. Beeman.	P. O. and S. I. Vol. I.
58	..	..	..	..	..	1870		0	5	$7_m\ 2_a\ 9_a$ bis	D. B. Nelson.	S. O.
59	44.37	70.34	46.19	20.00	45.22	Aug. 1857;	Mar. 1863	3	6	"	Dr. J. J. Saville and A. J. Millard.	MS. from S. G. O., S. O., and P. O. and S. I. Vol. I.
60	..	..	..	26.81		Nov. 1853;	Feb. 1854	0	4	$7_m\ 2_a\ 9_a$	D. E. Read.	P. O. & S. I. Vol. I, & S. Coll.

[4] Four miles northwest from town on the Bluff Prairie.

[5] Also called *Logan*.

[6] Also called *Spring Grove*.

[7] The observations in 1870 were made at *West Union*, two miles west of *North Union*.

IOWA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
61. Vawter's Grove[1]	41°18′	94°34′	1500	17°.02	24°.87	29°.46	46°.16	59°.53	69°.96	75°.87	70°.56	60°.29	48°.79	36°.60	22°.88
62. Vernon Springs	43 20	92 12	..	..	17.83	28.15	50.61	57.36	64.48	70.00	69.85	61.28	47.05	29.05	23.63
63. Vinton	42 10	92 02	607	..	..	..	..	60.68	66.65	72.68	73.43	61.70	41.30	31.43	23.58
64. Waukon	43 16	91 29	..	15.00	19.90	25.83	45.85	59.13	65.58	..	68.20	58.28	36.95	28.76	17.70
65. Washington	41 17	91 45	..	..	..	..	..	..	..	..	74.25	68.22	..	..	..
66. Waterloo	42 31	92 24	666	17.46	21.76	28.48	45.24	58.17	67.46	72.68	68.56	60.75	47.29	35.99	20.67
67. Webster City	42 28	93 49	1500	18.10	24.28	26.28	49.76	63.75	69.93	75.28	66.65	62.95	47.48	32.56	21.15
68. Whiteboro	41 40	95 44	..	8.48	22.43	39.93	42.23	62.25	69.55	80.20	65.90	53.38	48.05	33.55	20.19
69. Woodbine	41 45	95 42	..	20.24	25.98	28.03	47.57	61.21	67.22	72.81	69.96	61.13	43.47	36.21	23.04
70. Woodlands, The	43 00	93 00	..	19.24	22.38	25.68	49.09	61.97	69.27	73.58	68.37	62.01	46.00	34.67	23.52

KANSAS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Atchison	39 34	95 08	1000	23.61	30.15	35.40	51.80	62.28	72.40	77.76	74.41	66.80	53.08	41.07	27.41
2. Avon[2]	38 12	95 35	775	..	..	..	58.43	61.20	70.28	..	..	..	..	..	..
3. Baxter Springs	37 01	94 44	..	33.26	38.46	46.85	57.20	69.33	76.43	82.65	79.75	71.75	58.49	47.04	34.84
4. Burlingame	38 45	95 45	..	30.22	32.47	45.90	52.72	64.65	73.37	78.68	75.10	67.86	55.69	40.15	27.04
5. Council City	38 42	95 50	..	35.70	29.58	35.23	41.59	55.78	72.05	80.38	74.51	..	..	..	..
6. Council Grove	38 40	96 30	1480	28.27	34.70	38.99	52.99	63.94	73.03	79.22	76.72	67.49	55.77	44.77	30.72
7. Crawfordsville (ne'r)	37 31	94 55	..	31.93	40.58	43.58	..	66.88	69.83	75.04	77.85	..	45.53	42.95	31.45
8. Douglas	37 33	97 01	..	..	..	..	..	..	..	..	74.34	66.77	56.30	45.87	30.91
9. Douner's Station	38 48	99 51	..	..	32.63	45.56	49.06	64.53	..	..	..	..	57.17	44.27	40.04
10. Emporia	38 25	96 12	..	..	..	..	..	65.98	..	..	..	..	..	..	..
11. Fort Atkinson (Ark. Riv.)	37 47	100 14	2330	33.43	35.18	44.61	55.15	64.81	73.02	79.21	79.13	70.73	56.98	36.24	27.52
12. Fort Dodge	37 30	100 00	..	30.89	38.38	44.00	53.95	66.83	73.13	82.63	76.96	67.50	55.56	44.81	34.14
13. Fort Harker[3]	38 44	98 15	..	26.93	34.55	32.64	54.24	64.91	73.70	79.33	72.47	63.32	56.23	43.53	24.79
14. Fort Hays	38 59	99 20	2107	30.28	36.43	41.16	51.91	66.07	75.60	81.74	78.22	67.88	52.51	43.94	32.45
15. Fort Larned	38 10	98 57	1932	28.03	35.97	36.09	53.57	65.97	75.22	79.85	77.10	69.56	56.10	43.32	31.03
16. Fort Leavenworth[4]	39 21	94 54	896	27.43	31.29	41.62	54.76	64.69	72.70	77.94	75.09	67.51	54.79	40.76	29.33
17. Fort Riley (Kans. Riv.)	39 03	96 35	1300	25.28	32.63	41.81	55.15	66.73	75.83	81.69	78.45	71.02	56.30	41.69	28.78
18. Fort Scott	37 45	94 45	1000	32.73	34.98	43.13	55.72	65.44	72.11	77.22	75.53	68.62	55.28	41.92	31.09
19. Gardner	38 47	95 00	800	..	27.15	42.15	58.58	70.50	78.53	80.64	78.68	70.66	59.60	41.38	33.18
20. Holton	39 27	95 48	1172	24.87	32.04	40.02	52.07	64.05	74.14	80.78	75.45	65.35	51.90	40.42	29.00
21. Junction City	39 02	96 51	..	..	..	..	47.93	67.03	76.73	..	..	..	..	..	..
22. Lawrence	38 58	95 12	850	30.44	33.19	43.70	52.57	64.03	72.96	78.98	75.52	66.85	52.15	40.24	31.30
23. Leavenworth City[5]	39 15	94 52	896	26.09	29.67	38.77	52.25	61.59	71.97	77.21	73.54	64.48	52.38	39.19	30.32
24. Lecompton	39 03	95 09	825	24.35	35.69	50.13	58.25	..	..	79.94	78.16	69.29	57.59	43.83	25.07
25. Le Roy	38 03	95 37	..	30.95	36.63	35.95	54.74	63.05	70.05	79.00	81.73	67.13	48.44	39.78	31.65
26. Manhattan[6]	39 13	96 39	1000	26.85	31.20	40.68	51.55	63.62	73.95	79.63	75.85	67.08	53.82	40.67	29.72
27. Mapleton	38 04	94 51	..	38.88	..	..	..	63.17	76.22	82.93	79.74	70.87	..	..	37.19
28. Moneka	38 19	94 49	..	..	..	..	..	70.55	72.09	82.76	69.40	68.87	..	..	..
29. Mountain City	..	..	..	20.80	30.40	32.07	..	..	..	..	55.48	49.65	39.85	31.10	27.53
30. Neosho Falls	38 03	95 31	..	29.54	35.11	42.89	55.62	65.57	73.98	79.13	77.98	69.39	52.23	41.85	27.90
31. Olatha	38 53	94 51	..	24.84	32.29	37.17	50.73	61.16	71.89	77.48	74.12	65.41	52.30	40.71	27.16
32. Paola (three and a half miles N. W. of)	37 36	94 57	875	30.45	35.65	38.50	56.55	65.28	71.10	77.60	76.47	66.51	51.24	42.09	30.09
33. Topeka	39 03	95 39	..	..	23.81	48.13	53.69	62.23	75.24	..	..	..	..	..	..
34. Williamstown	39 03	95 20	915	..	..	..	..	..	..	..	73.85	68.90	57.10	45.88	29.65
35. Wyandotte City	39 08	94 40	707	32.05	36.10	48.53	..	..	..	..	76.82	68.91	54.89	45.92	21.71

[1] Also called *Fontanelle*. [2] Also called "near Burlington." [3] Also called Ellsworth.

[4] Observations in April, 1858, at Cayuga, about five miles northwest of Fort Leavenworth, are included in this series.

IOWA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
61	45°.05	72°.13	48°.56	21°.59	46°.83	May, 1866;	Dec. 1870	4	8	$7_m\ 2_a\ 9_a$ bis	A. F. Bryant.	S. O.
62	45.37	68.11	45.79	..	..	Apr. 1861;	June, 1863	1	1	"	G. Marshall.	" "
63	..	70.92	40.81	..	..	1869		0	8	"	J. Wood.	" "
64	43.60	..	41.33	17.53	..	Apr. 1869;	Dec. 1870	1	3	"	E. M. Hancock.	" "
65	..	..	..	..	..	1861		0	2	"	....	" "
66	43.96	69.57	48.01	19.96	45.38	Jan. 1863;	Aug. 1870	6	5	"	L. H. Doyle.	" "
67	46.60	70.62	47.66	21.18	46.51	1870		0	9	"	C. L. Croft.	" "
68	48.14	71.88	44.99	17.03	45.51	Dec. 1867;	Nov. 1868	1	0	"	D. R. Witter.	" "
69	45.60	70.00	46.94	23.09	46.41	Jan. 1869;	Dec. 1870	1	9	"	" " "	" "
70	45.58	70.41	47.56	21.71	46.31	Jan. 1869;	Dec. 1870	2	0	"	H. Wadey.	" "

KANSAS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	49.83	74.86	53.65	27.06	51.35	May, 1865;	Dec. 1870	5	2	$7_m\ 2_a\ 9_a$ bis	Dr. H. B. Horn and daughter.	S. O.
2	..	..	..	..	..	1866		0	3	"	A. Crocker.	" "
3	57.79	79.61	59.09	35.52	58.00	July, 1867;	Dec. 1870	3	6	"	Messrs. Ingraham & Hyland.	" "
4	54.42	75.72	54.57	29.91	53.66	Jan. 1858;	Mar. 1861	3	3	"	E. and L. Fish.	P. O. and S. I. Vol. 1, and S. O.
5	44.20	75.65	..	..	..	Feb. 1857;	Jan. 1858	0	8	$7_m\ 2_a\ 9_a$	E. Fish.	P. O. and S. I. Vol. 1.
6	51.97	76.32	56.01	31.23	53.88	Apr. 1865;	Dec. 1870	5	9	$7_m\ 2_a\ 9_a$ bis	Dr. A. Woodworth.	S. O.
7	..	74.24	..	34.65	..	June, 1869;	May, 1870	0	10	"	P. Daniels.	" "
8	..	..	56.31	..	..	1870		0	5	"	Dr. W. W. Lamb.	" "
9	53.05	..	..	..	..	Oct. 1867;	May, 1868	0	7	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
10	..	..	..	..	..	1862		0	1	$7_m\ 2_a\ 9_a$ bis	C. F. Oakfield.	S. O.
11	54.86	77.12	54.65	32.04	54.67	Nov. 1850;	Sept. 1853	2	11	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
12	54.93	77.57	55.96	34.47	55.73	Nov. 1867;	Dec. 1870	3	2	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
13	50.60	75.17	54.36	28.76	52.22	Nov. 1866;	Dec. 1870	1	6	"	....	" " "
14	53.05	78.52	54.78	33.05	54.85	Aug. 1867;	Dec. 1870	3	5	"	....	" " "
15	51.88	77.39	56.33	31.68	54.32	Sept. 1860;	Dec. 1870	9	0	"	....	" " "
16	53.69	75.24	54.35	29.35	53.16	Jan. 1830;	Dec. 1870	39	11	"	Assistant Surgeon.	MS. from S. G. O. and Ar. Met. Regs. 1855 and 1860.
17	54.56	78.66	56.34	28.90	54.62	Nov. 1853;	Dec. 1870	16	10	"	Assist. Surg., T. R. Drew, E. E. Lee, J. H. Prince, and J. Schaffer.	Ar. Met. Regs. 1855 and 1860, MS. from S. G. O. and S.O.
18	54.76	74.95	55.27	32.93	54.48	Jan. 1843;	Mar. 1853	10	3	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
19	57.08	79.28	57.21	..	..	Apr. 1860;	Feb. 1862	1	3	$7_m\ 2_a\ 9_a$ bis	G. F. Merriam, J. Scott, J. S. Gardner.	S. O.
20	52.05	76.79	52.56	28.63	52.51	May, 1867;	Dec. 1870	3	8	"	Dr. J. Walters, W. H. Gilman.	P. O. and S. I. Vol. 1, and S. O.
21	..	..	..	..	..	1862		0	3	"	Dr. E. W. Seymour.	S. O.
22	53.43	75.82	53.08	31.64	53.49	July, 1857;	Dec. 1870	7	9	"	G. W. Brown, W. J. R. Blackburn, W. G. Soule, A. W. Fuller, G.W. Hollingsworth, Prof. F. H. Snow.	P. O. and S. I. Vol. 1, and S. O.
23	50.87	74.24	52.02	28.69	51.45	Nov. 1857;	Dec. 1870	7	6	"	H. D. McCarty, M. Shaw, Dr. J. Stayman, F. B. Stowell.	" " " " "
24	..	..	56.90	28.37	..	July, 1859;	Feb. 1861	1	1	"	Dr. W. T. Ellis.	" " " " "
25	51.25	76.93	51.78	33.08	53.26	Jan. 1867;	Apr. 1870	1	9	"	J. G. Shoemaker.	S. O.
26	51.95	76.48	53.86	29.26	52.89	Mar. 1857;	Dec. 1870	11	10	"	I. T. Goodnow, Rev. N. O. Preston, H. L. Denison, B. F. Mudge and wife.	P. O. and S. I. Vol. 1, and S. O.
27	..	79.63	..	..	..	Dec. 1857;	Sept. 1858	0	7	$7_m\ 2_a\ 9_a$	Dr. S. O. Himoe.	P. O. and S. I. Vol. 1.
28	..	74.75	..	..	..	1859		0	5	$7_m\ 2_a$	J. O. Wattles.	" " " "
29	..	..	40.20	26.24	..	Aug. 1860;	Mar. 1861	0	8	$7_m\ 2_a\ 9_a$ bis	Dr. W. T. Ellis.	S. O.
30	54.69	77.03	54.49	30.85	54.27	Mar. 1859;	Apr. 1870	3	9	"	B. F. Goss, Mrs. E. W. Groesbeck.	P. O. and S. I. Vol. 1, and S. O.
31	49.69	74.50	52.81	28.10	51.27	May, 1864;	Dec. 1870	6	7	"	W. Beckwith.	S. O.
32	53.44	75.06	53.28	32.06	53.46	May, 1869;	Dec. 1870	1	8	"	L. D. Walrad.	" "
33	54.68	..	..	..	..	1858		0	5	$7_m\ 2_a\ 9_a$	F. W. Giles.	P. O. and S. I. Vol. 1.
34	..	..	57.29	..	..	1870		0	5	$7_m\ 2_a\ 9_a$ bis	J. M. Cotton & wife.	S. O.
35	..	..	56.57	29.95	..	Aug. 1859;	Mar. 1860	0	8	"	J. H. Millar.	P.O. and S. I. Vol. 1, and S. O.

[5] This series includes observations made at the Leavenworth City High School in April, May, October, November, and December, 1868.

[6] Observations after 1864 were made at Manhattan College, about one mile southeast of Manhattan.

KENTUCKY.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Arcadia	37°34′	84°42′	900	36°.00	36°.18	40°.53	56°.25	67°.08	73°.15	74°.95	66°.45	65°.80	53°.21	42°.87	35°.56
2. Ballardsville	38 25	85 22	461	30.60	33.23	40.65	56.20	64.61	75.24	78.14	76.21	69.57	58.32	44.54	34.52
3. Bardstown (St. Jos. Coll.)	37 51	85 32	..	37.13	37.07	46.74	55.50	65.38	74.04	76.59	73.75	66.82	55.38	44.48	37.57
4. Beech Fork	37 45	85 12	..	..	..	..	..	..	72.28	77.13	75.50	64.23	55.10	39.88	31.28
5. Bowling Green	37 01	86 31	450	35.12	40.09	48.70	55.63	65.51	73.36	77.85	76.15	70.18	56.30	44.77	38.01
6. Chilesburg	38 04	84 18	900	31.30	36.41	42.68	54.36	61.30	70.36	76.28	72.94	67.42	53.49	43.54	33.77
7. Clinton	36 40	89 07	..	40.27	39.96	42.68	54.92	65.69	74.48	82.33	73.50	65.55	54.74	43.40	32.30
8. Danville	37 40	84 48	900	35.49	39.47	45.51	57.14	66.20	74.41	77.25	75.07	70.42	57.94	47.33	38.56
9. Lexington	38 07	84 32	950	..	..	..	..	..	69.85	74.98	72.67	68.54	51.15	47.59	..
10. Lebanon	37 37	85 17	717	..	..	..	54.59	64.18	..	77.24	73.35	..	49.70	46.28	..
11. London	37 08	84 08	1100	34.38	..	44.70	..	..	75.30	75.80	72.58	..	..	44.18	..
12. Louisville	38 18	85 50	450	36.37	37.22	47.09	54.50	65.54	70.72	75.94	75.23	69.08	55.42	42.88	38.44
13. Maysville	38 44	83 41	630	34.43	36.73	..	..	..	..	..	..	..	51.56	46.17	37.01
14. Millersburg	38 23	84 09	804	29.61	33.27	42.72	52.45	63.91	73.61	76.85	75.39	66.80	55.61	45.23	36.87
15. Newport Barracks	39 06	84 29	500	31.91	35.46	43.47	53.89	64.10	73.00	77.16	75.01	68.50	55.53	44.25	35.06
16. Nicholasville	37 56	84 38	940	35.78	38.03	42.67	54.35	63.77	70.21	73.54	74.57	68.81	57.05	44.39	40.90
17. Nolin	37 34	85 54	..	..	..	..	57.21	65.39	..	..	..	..	..	..	..
18. Ohio River[1]	39 04	84 40	812	..	..	..	..	60.10	75.45	72.22	73.95	66.60	..	..	..
19. Paris	38 15	84 17	810	27.83	34.70	41.17	51.39	62.06	70.76	75.62	71.88	64.54	53.14	41.49	34.81
20. Pleasant Valley M'ls	38 10	83 49	..	..	..	..	..	..	..	..	73.18	66.73	47.18	46.59	..
21. Prospect Hill	38 40	83 33	700	36.18	35.60	44.16	51.16	61.01	72.69	72.85	73.57	64.74	52.26	46.65	35.70
22. Springdale	38 07	85 44	570	32.08	36.23	43.39	54.01	62.39	70.35	74.43	72.48	66.89	53.29	43.73	35.18
23. Taylor Barracks	..	..	..	..	..	..	..	..	..	..	..	..	65.91	47.10	32.57
24. Taylorsville	38 02	85 25	600	..	..	..	..	63.75	74.85	80.35	..	..	..	..	..

LOUISIANA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Baton Rouge	30 26	91 11	41	53.06	55.31	61.89	69.08	75.74	80.73	81.90	81.45	77.39	67.47	59.52	54.22
2. Benton	32 30	93 45	..	47.85	51.23	58.66	64.55	71.94	80.14	82.41	81.19	75.63	63.78	55.79	49.88
3. Black River Plant'n	31 30	91 46	108	49.05	57.74	61.47	64.46	74.44	79.33	81.77	82.23	75.21	66.45	53.27	52.25
4. Camp Lawrence	30 26	91 18	41	..	..	..	..	..	..	..	80.00	74.64	..	..	..
5. Camp Salubrity	31 40	93 15	80	53.75	60.00	60.50	70.50	73.00	80.00	85.75	80.59	75.51	65.25	57.75	49.75
6. Cheneyville (near)	31 00	92 18	..	..	..	59.10	67.10	75.55	79.10	81.18	81.60	79.33	..	..	..
7. Collins	30 30	90 20	20	..	..	..	..	..	..	..	..	..	..	59.73	49.75
8. Fort Jackson[3]	29 21	89 27	0	58.82	58.86	62.54	72.02	77.08	82.76	82.95	81.84	80.32	72.65	63.71	58.76
9. Fort Jessup	31 35	93 25	80	50.64	52.71	59.16	67.87	73.80	80.32	82.33	81.43	76.13	65.96	56.67	50.23
10. Fort Pike	30 10	89 38	10	55.18	56.72	62.82	70.64	77.06	82.31	83.54	83.22	79.31	70.67	62.84	55.69
11. Fort Sabine	29 45	93 50	10	51.60	43.82	59.12	70.26	..	79.05	79.53	78.35	72.39	71.37	64.62	53.84
12. Fort Wood	30 09	89 47	20	54.89	56.56	60.30	71.11	78.11	81.50	82.96	82.34	79.04	68.84	62.40	55.19
13. Jackson	30 51	91 09	100	47.6	49.4	56.6	65.4	70.8	78.7	81.7	79.9	75.1	67.4	50.0	48.4
14. Monroe	32 31	92 07	100	39.3	49.7	68.4	70.5	75.7	80.4	82.45	80.0	72.1	57.7	48.1	42.6
15. New Orleans	29 56	90 03	25	56.75	58.39	66.58	72.41	77.26	81.78	82.22	82.12	79.42	69.71	58.71	52.26
16. New Orleans	29 56	90 03	25	54.75	57.90	63.69	68.67	75.76	80.69	82.13	80.43	78.84	69.48	61.07	55.36
17. New Orleans	29 56	90 03	25	56.6	54.4	61.5	67.4	73.8	78.5	80.0	79.5	77.3	69.3	57.6	56.4
18. New Orleans	29 56	90 03	25	59.0	56.0	66.5	67.0	74.0	79.3	78.7	81.0	78.4	66.7	63.6	57.3
19. New Orleans	29 56	90 03	25	55.4	60.8	61.3	71.5	78.3	82.6	84.6	83.7	78.8	67.8	61.6	56.6
20. Petite Coquille	..	..	..	..	..	..	68.00	69.80	74.25	..	..	..	..	..	..
21. Rapides	31 08	92 20	76	53.5	54.0	62.2	67.1	73.2	79.3	80.5	80.5	75.6	66.5	57.5	51.9
22. St. Francisville	30 49	91 22	80	..	..	..	..	..	..	..	..	..	..	..	50.89
23. Trinity[5] (near)	31 37	91 47	68	38.14	53.16	61.59	61.27	72.79	82.92	84.57	81.66	..	66.65	..	50.99
24. Vidalia Plantation	31 35	91 30	200	..	..	..	67.73	72.85	..	..	..	..	..	..	..
25. West Feliciana	30 40	91 20	96	50.6	54.6	59.3	65.9	72.5	77.7	79.7	78.6	75.5	66.6	56.7	51.7

[1] Eight miles above Cincinnati.

[2] Observations corrected for daily variation. The value of this series is much impaired on account of great irregularity in the hours of observation.

KENTUCKY.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	54°.62	71°.52	53°.96	35°.91	54°.00	July, 1840;	Dec. 1870	1 7	$7_m\ 2_a\ 9_{a\ bis}$	Rev. J. A. Sheperd and H. Shriver.	MS. in S. Coll. and S. O.
2	53.82	76.53	57.48	32.78	55.15	May, 1853;	Jan. 1862	3 7	"	Dr. J. Swain.	P. O. and S. I. Vol. 1, S. O., & S. Coll.
3	55.87	74.79	55.56	37.26	55.87	Jan. 1858;	Oct. 1861	2 9	"	J. H. Lünemann and T. H. Miles.	P. O. and S. I. Vol. 1, and S. O.
4	..	74.97	53.07	..	..	1860		0 7	"	Dr. C. D. Chase.	S. O.
5	56.61	75.79	57.08	37.74	56.81	1849;	Oct. 1855	4 4	$\odot_r\ 9_m\ 3_a\ 9_a$	Younglove and F. C. Herrick.	P. O. & S. I. Vol. 1, and S. Coll.
6	52.78	73.19	54.82	33.83	53.65	Mar. 1865;	Dec. 1870	5 9	$7_m\ 2_a\ 9_{a\ bis}$	Dr. S. D. Martin.	S. O.
7	54.43	76.77	54.56	37.51	55.82	May, 1868;	May, 1869	1 1	"	Rev. T. H. Cleland.	" "
8	56.28	75.58	58.56	37.84	57.07	Feb. 1853;	Dec. 1870	12 7	"	Prof. O. Beatty.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
9	..	72.50	55.76	..	..	Aug. 1859;	July, 1869	0 6	"	Rev. S. R. Williams and N. Williams.	P. O. and S. I. Vol. 1, and S. O.
10	..	..	..	..	..	1843		0 6	$\odot_r\ 9_m\ 3_a\ 9_a$	Thebaud.	Manuscript.
11	..	74.56	..	..	..	June, 1865;	Mar. 1866	0 6	$7_m\ 2_a\ 9_{a\ bis}$	W. S. Doak.	S. O.
12	55.71	73.96	55.79	37.34	55.70	1851;	Feb. 1870	4 6	"	Rev. S. R. Williams, E. N. Woodruff, S. Manly, and C. B. Blackburn.	P. O. and S. I. Vol. 1, S.O., and S. Coll.
13	..	..	..	36.06	..	1852;	1853	0 7	$7_m\ 2_a\ 9_a$	Berthoud.	S. Coll.
14	53.03	75.28	55.88	33.25	54.36	June, 1853;	Apr. 1862	4 10	$7_m\ 2_a\ 9_{a\ bis}$	Rev. J. Miller, Rev. G. S. Savage.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
15	53.82	75.06	56.09	34.14	54.78	July, 1847;	Dec. 1870	23 0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
16	53.60	72.77	56.75	38.24	55.34	Jan. 1861;	June, 1863	2 3	$7_m\ 2_a\ 9_{a\ bis}$	J. McD. Matthews.	S. O.
17	..	..	..	..	..	1858		0 2	$7_m\ 2_a\ 9_a$	J. Grinnell.	P. O. and S. I. Vol. 1.
18	..	73.87	..	..	..	1861		0 5	$7_m\ 2_a\ 9_{a\ bis}$	M. G. Williams.	S. O.
19	51.54	72.75	53.06	32.45	52.45	Jan. 1856;	Dec. 1859	4 0	$7_m\ 2_a\ 9_a$	Dr. L. G. Ray.	P. O. and S. I. Vol. 1.
20	..	..	53.50	..	..	1850		0 4	"	Bixby.	S. Coll.
21	52.11	73.04	54.55	35.83	53.88	1849;	1851	1 9	$\odot_r\ 9_m\ 3_a\ 9_a$ [2]	Beatty.	" "
22	53.26	72.42	54.64	34.50	53.71	July, 1841;	Dec. 1870	27 8		Mrs. L. Young.	P. O. and S. I. Vol. 1, MS. in S. Coll., and S. O.
23	..	..	..	..	..	1870		0 3	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
24	..	..	..	..	..	1866		0 3	$7_m\ 2_a\ 9_{a\ bis}$	H. C. Mathis.	S. O.

LOUISIANA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	68.90	81.36	68.13	54.20	68.15	Jan. 1822;	Dec. 1860	28 0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
2	65.05	81.25	65.07	49.65	65.25	May, 1867;	Nov. 1870	2 11	$7_m\ 2_a\ 9_{a\ bis}$	J. H. Carter.	S. O.
3	66.79	81.11	64.98	53.01	66.47	Oct. 1856;	May, 1859	2 7	$7_m\ 2_a\ 9_a$	Dr. A. R. Kilpatrick.	P. O. and S. I. Vol. 1.
4	..	..	..	..	..	1858		0 2	"	Assistant Surgeon.	Ar. Met. Reg. 1860.
5	68.00	82.11	66.17	54.50	67.70	July, 1844;	June, 1845	1 0	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1860.
6	67.25	80.63	..	..	..	1870		0 7	$7_m\ 2_a\ 9_{a\ bis}$	R. S. Jackson.	S. O.
7	..	..	..	..	..	1870		0 2	"	H. C. Collins.	" "
8	70.55	82.52	72.23	58.81	71.03	Jan. 1822;	Mar. 1835	4 10	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
9	66.94	81.36	66.25	51.19	66.44	Jan. 1823;	Dec. 1845	22 11	"	" "	" " "
10	70.17	83.02	70.94	55.86	70.00	Oct. 1824;	Dec. 1870	15 8	"	" "	Ar. Met. Reg. 1855 and MS. from S. G. O.
11	..	78.98	69.46	49.75	..	July, 1837;	June, 1838	0 11	"	" "	Ar. Met. Reg. 1855.
12	69.84	82.27	70.09	55.55	69.44	July, 1832;	Apr. 1846	6 2	"	" "	" " "
13	64.27	80.10	64.17	48.47	64.25	1839;	1841	3 0	$\odot_r\ 2_a\ \odot_s$	Carpenter.	Sill. Journal.
14	71.53	80.95	59.30	43.87	63.91	1808;	1819	10 0	"	....	Dr. Barton.
15	72.08	82.04	69.28	55.80	69.80	....		3 0	$8_m\ 2_a\ 8_a$ [4]	....	Rep. Brit. Assoc. 1847.
16	69.37	81.08	69.80	56.00	69.06	Jan. 1826;	Dec. 1870	32 9		Assist. Surg., D. T. Lillie, Dr. E. H. Barton, J. Harrison, E. L. Ranlett.	Ar. Met. Regs. 1855 and 1860, MS. from S. G. O., Am. Alm. 1842, and foll., Printed Slip in S. Coll., P. O. and S. I. Vol. 1, and S. O., and MS.
17	67.57	79.33	68.07	55.80	67.69	1833;	1850	18 0	......	....	Barton's Rep. 1851.
18	69.17	79.67	69.57	57.43	68.96	1849		1 0	......	....	Rep. of Board of Health, 1850.
19	70.37	83.63	69.40	57.60	70.25	1807;	1810	3 0	......		Barton's Rep. 1851.
20	..	..	..	..	..	1820		0 3	$\odot_r\ \odot_s$	Dr. E. H. Belle.	S. Coll.
21	67.50	80.10	66.53	53.13	66.81	1833;	1850	10 0	$\odot_r\ 2_a\ \odot_s$	Voorhies.	Barton's Rep. 1851.
22	..	..	..	..	..	1856		0 1	$\odot_r\ 1_a\ 9_a$	B. R. Gifford.	P. O. and S. I. Vol. 1.
23	65.22	83.05	..	47.43	..	Dec. 1856;	Oct. 1860	1 1	$7_m\ 2_a\ 9_a$	Dr. E. Merrill.	P. O. and S. I. Vol. 1, and S. O.
24	..	..	..	..	..	1867		0 2	$7_m\ 2_a\ 9_{a\ bis}$	Rev. A. K. Teele.	S. O.
25	65.90	78.67	66.27	52.30	65.78	1820;	1833	13 0	$\odot_r\ 2_a\ \odot_s$	Barton.	Barton's Rep. 1851.

[3] Previous to July, 1831, the observations were made at Fort St. Philip, one mile N. W. of Fort Jackson.

[4] Corrected for daily variation by the Fort Morgan Table.

[5] In 1860, the observations were made at Moss Grove Plantation, near Trinity.

MAINE.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Augusta	44°19′	69°47′	..	19°.87	27°.00	32°.20	38°.67	50°.30	65°.61	68°.65	65°.86	60°.39	50°.50	42°.55	21°.58
2. Bangor	44 49	68 46	40	21.87	17.57	33.27	41.01	53.92	62.73	66.76	64.51	..	..	35.37	21.07
3. Bath	43 55	69 49	50	23.22	23.32	31.65	41.86	52.37	61.32	68.71	66.06	59.23	47.74	35.90	25.10
4. Belfast	44 26	69 00	..	15.58	20.49	28.74	41.25	54.21	62.88	68.34	65.70	58.43	46.38	36.08	19.95
5. Bethel	44 20	70 51	650	14.10	18.68	26.63	38.40	49.62	61.80	67.27	63.97	56.57	47.12	33.23	22.68
6. Biddeford	43 30	70 27	45	21.70	25.01	33.22	42.89	53.96	67.02	71.22	69.77	60.56	49.78	38.49	25.63
7. Blue Hill	44 25	68 34	50	..	..	..	..	..	..	67.05	..	..	..	..	..
8. Brunswick	43 54	69 57	74	20.10	22.93	31.54	42.56	52.69	62.29	67.44	65.60	58.28	47.78	36.71	24.86
9. Bucksport	44 40	68 48	90	24.57	28 12	34.85	44.15	55.86	60.73	74.08	71.27	63.59	52.65	40.69	26.36
10. Carmel	44 47	69 00	175	13.59	14.48	26.90	39.32	54.83	64.32	72.35	64.04	55.03	45.27	33.91	18.33
11. Castine	44 23	68 47	50	21.41	22.30	30.38	41.43	50.53	59.43	64.82	64.66	58.39	48.44	38.06	25.57
12. Cornish	43 44	70 51	784	18.47	21.16	28.32	40.58	52.53	63.51	68.56	66.05	58.20	45.92	34.53	21.77
13. Dennysville	44 53	67 14	..	19.13	20.06	29.06	39.66	50.42	59.84	65.67	63.87	56.67	46.69	35.76	23.20
14. Dexter	45 02	69 18	650	14.53	21.15	27.21	39.34	52.51	62.12	66.99	66.76	58.74	46.25	34.94	21.21
15. East Exeter (or Exeter)	45 00	69 10	190	18.84	19.99	30.73	42.15	..	62.22	67.30	66.67	57.58	..	..	..
16. Eastport	44 54	66 59	40	20.0	22.7	28.8	39.5	48.2	55.5	63.8	63.7	56.2	46.1	35.7	24.5
17. East Wilton	44 36	70 14	..	..	..	..	..	..	..	..	..	..	..	37.05	..
18. Fort Fairfield	46 46	67 49	415	15.16	13.10	24.40	35.90	47.70	57.05	62.83	64.70	49.13	39.92	29.15	12.53
19. Fort Kent	47 15	68 35	575	10.76	11.26	23.26	35.08	46.78	59.00	62.51	63.45	51.18	39.58	27.52	10.86
20. Fort Preble	43 39	70 14	31	22.54	24.61	32.62	43.22	52.84	63.31	68.57	66.64	59.66	49.14	38.01	26.88
21. Fort Sullivan	44 54	66 59	70	22.06	23.23	30.57	40.11	48.67	56.24	61.99	62.23	57.14	47.73	37.27	25.56
22. Foxcraft	45 12	69 13	..	..	..	31.83	..	53.70	59.78	66.70	65.64	55.03	47.70	..	..
23. Fryeburg	44 00	71 04	..	11.18	15.93	23.75	45.08	53.61	..	..	..	..	..	..	..
24. Gardiner	44 14	69 48	76	17.94	20.72	29.49	41.24	52.69	63.06	68.64	66.47	58.07	46.58	35.31	22.14
25. Hampdon	44 43	68 50	180	8.88	21.00	29.64	43.78	51.88	62.29	63.21	67.67	56.75	44.12	30.30	21.64
26. Hancock Barracks (Houlton)	46 07	67 49	620	14.87	16.68	27.09	39.43	51.18	61.15	66.09	64.73	56.16	43.71	30.99	18.60
27. Hiram	43 51	70 52	400	17.01	18.39	28.23	39.26	51.45	61.33	67.17	64.11	56.29	44.54	33.17	20.91
28. Houlton	46 07	67 49	..	..	..	..	36.17	48.21	61.25	67.79	66.74	..	..	..	..
29. Kennebec Arsenal	44 19	69 46	..	22.95	15.51	28.40	40.74	52.54	64.59	69.47	65.49	58.91	47.02	37.25	25.98
30. Lee	45 25	68 18	..	13.08	21.62	27.71	41.85	50.20	64.14	66.92	65.34	56.23	45.16	35.69	22.45
31. Linneus	46 04	67 58	..	17.20	..	..	..	..	..	..	63.90	..	..	..	..
32. Lisbon[2]	44 04	70 07	130	18.46	22.67	29.23	41.55	54.08	63.53	68.92	67.24	58.21	47.62	37.63	22.66
33. Newcastle	44 07	69 36	88	..	..	..	..	..	..	...	..	..	44.06	..	..
34. North Bridgeton	44 02	70 48	300	14.05	22.83	28.00	38.55	51.62	61.85	70.57	65.65	58.17	47.77	34.25	23.05
35. Oldtown[3]	44 58	68 40	137	16.24	17.17	25.07	37.38	48.97	58.75	66.79	63.88	55.49	45.07	32.49	18.32
36. Oxford[4]	44 08	70 33	182	19.06	18.15	28.48	40.35	52.54	64.44	68.94	65.87	56.71	44.63	33.81	20.72
37. Patten	46 00	68 27	..	..	..	22.90	35.23	..	..	65.21	..	52.63	42.90	38.35	..
38. Pembroke	44 55	67 09	40	19.23	19.00	32.70	40.50	54.15	58.58	..	62.50	56.78	..	..	..
39. Perry	45 00	67 05	100	19.76	23.17	28.82	38.89	49.11	57.59	63.29	61.55	55.67	46.21	35.62	24.11
40. Portland	43 39	70 15	87	19.26	21.46	29.72	40.05	50.58	60.27	66.30	64.68	57.45	45.39	34.41	23.85
41. Portland[6]	43 39	70 15	50	19.46	21.25	29.89	40.12	50.32	60.31	66.28	64.59	57.66	46.27	35.54	24.35
42. Prospect	44 28	68 46	207	..	..	30.93	40.02	..	..	..	..	..	..	..	..
43. Rumford	44 30	70 37	600	..	24.75	24.77	39.60	51.85	66.38	66.00	67.35	54.43	46.15	37.55	21.75
44. Saco	43 31	70 26	69	21.08	21.29	31.21	43.69	54.28	65.06	70.31	68.44	60.92	47.18	37.18	25.34
45. South Thomaston	44 04	69 08	50	22.96	24.96	29.49	39.12	50.90	63.37	66.74	63.84	56.51	48.63	37.05	21.03
46. Standish	43 45	70 37	280	19.89	22.18	27.71	41.51	52.84	65.18	69.97	67.33	59.49	44.74	35.24	22.28
47. Steuben	44 31	67 58	50	19.10	21.34	28.52	38.66	48.74	58.57	63.73	62.30	55.65	45.42	35.81	22.75
48. Surry	44 30	68 30	50	..	..	..	..	..	66.15	..	68.53	60.20	50.15	38.28	26.43
49. Topsham	43 54	69 57	60	16.59	25.23	31.49	37.27	47.92	..	67.82	..	..	37.56	35.58	19.21
50. Vassalboro	44 27	69 42	..	17.84	19.01	29.35	40.57	54.06	62.18	64.92	66.64	56.28	46.53	36.83	21.10
51. West Waterville	44 33	69 46	250	18.18	21.89	29.77	42.10	53.20	65.10	69.91	67.09	59.20	46.15	35.14	22.78
52. Williamsburg	45 21	69 06	..	13.94	16.68	24.33	38.29	50.33	61.55	66.93	63.59	50.57	45.05	32.72	17.80
53. Windham	43 46	70 28	..	16.43	20.70	30.86	38.52	57.89	64.01	68.93	67.28	59.14	47.45	34.56	25.63

[1] Hours of observation 7_m 1_a 6_a. Observations corrected for daily variation by means of the general table.

[2] Observations from Dec. 1865, to May, 1867, at Webster, about three miles east of Lisbon.

[3] The observations for 1870 were made at Orono, about three miles southeast of Oldtown.

MAINE.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.	mos.	Observing hours.	Observer.	References.
1	40°.39	66°.71	51°.15	22°.82	45°.27	Nov. 1849;	Mar. 1864	1	2	$6_m\ 2_a\ 9_a$	G. E. Brackett and others.	Pat. Off. Rep. 1851 and S. O.
2	42.73	64.67	..	20.17	..	1843;	June, 1860	1	2	$7_m\ 2_a\ 9_a$	Young.	S. O. and Manuscript.
3	41.96	65.36	47.62	23.88	44.71	Jan. 1832;	July, 1842	10	7	$\odot_r\ 2_a\ \odot_s$	John Hayden.	Am. Alm. 1842 and S. Coll.
4	41.40	65.64	46.96	18.67	43.17	July, 1859;	June, 1866	4	3	7_m N. 6_a	G. E. Brackett.	P. O. and S. I. Vol. 1, MS. in S. Coll., and S. O.
5	38.22	64.35	45.64	18.49	41.68	Jan. 1861;	Feb. 1862	1	2	$7_m\ 2_a\ 9_{a\ bis}$	A. G. Gaines.	S. O.
6	43.36	69.33	49.61	24.11	46.60	Jan. 1848;	June, 1852	4	5	$\odot_r\ 1\frac{1}{2}_a\ \odot_s$	J. G. Garland.	Am. Alm. 1850.
7	..	..	..	..	..	1864		0	1	$7_m\ 2_a\ 9_{a\ bis}$	H. H. Osgood.	S. O.
8	42.26	65.11	47.59	22.63	44.40	Jan. 1807;	Dec. 1859	51	3		Prof. P. Cleaveland.	Sm. Con. to Knowl.
9	44.95	68.69	52.31	26.35	48.07	Jan. 1849;	Feb. 1853	4	2	$9_m\ 3_a$	R. Buck.	S. Coll.
10	40.35	66.90	44.74	15.47	41.87	Jan. 1852;	Jan. 1857	4	10	$7_m\ 2_a\ 9_a$	J. J. Bell.	P. O. and S. I. Vol. 1, & S. Coll.
11	40.78	62.97	48.30	23.09	43.79	Jan. 1810;	Dec. 1849	40	0	......	Judge Nelson.	S. Coll.
12	40.48	66.04	46.22	20.47	43.30	Jan. 1856;	Dec. 1870	14	10	$7_m\ 2_a\ 9_{a\ bis}$	G. W. Guptill, S. West.	P. O. and S. I. Vol. 1, and S. O.
13	39.71	63.13	46.37	20.80	42.50	Jan. 1816;	Dec. 1855	40	0	max. & min.	T. Lincoln.	S. Coll.
14	39.69	65.29	46.64	18.96	42.65	June, 1860;	June, 1863	3	0	$7_m\ 2_a\ 9_{a\ bis}$	B. F. Wilbur.	S. O.
15	..	65.40	..	..	..	Jan. 1858;	Sept. 1861	1	0	$7_m\ 2_a\ 9_a$	S. Gilman, J. B. Wilson.	P. O. and S. I. Vol. 1, and S. O.
16	38.83	61.00	46.00	22.40	42.06	Jan. 1833;	Dec. 1834	2	0	......	....	Am. Alm. 1836.
17	..	..	..	..	..	1861		0	1	$7_m\ 2_a\ 9_{a\ bis}$	H. Reynolds.	S. O.
18	36.00	61.53	39.40	13.60	37.63	Jan. 1842;	Aug. 1843	1	8	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
19	35.04	61.65	39.43	10.96	36.77	Jan. 1842;	Aug. 1845	3	0	"	" "	" " "
20	42.89	66.17	48.94	24.68	45.67	Jan. 1824;	Dec. 1870	26	2	$7_m\ 2_a\ 9_a$	" "	Ar. Met. Reg. 1855, and MS. from S. G. O.
21	39.78	60.15	47.38	23.62	42.73	Jan. 1822;	Dec. 1870	23	9	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	" " " "
22	..	64.04	..	..	..	June, 1863;	Mar. 1864	0	7	$7_m\ 2_a\ 9_{a\ bis}$	M. Pitman.	S. O.
23	40.81	..	..	..	..	1856		0	5	$7_m\ 2_a$	Dr. E. B. Barrows.	P. O. and S. I. Vol. 1.
24	41.14	66.06	46.65	20.27	43.53	Jan. 1837;	Dec. 1870	30	11	$7_m\ 2_a\ 9_{a\ bis}$	R. H. and F. Gardiner.	P. O. and S. I. Vol. 1, S. Coll., and S. O.
25	41.77	64.39	43.72	17.17	41.76	Aug. 1843;	July, 1844	1	0	$\odot_r\ 9_m\ 3_a\ 9_a$	J. Herrick.	Am. Alm. 1846.
26	39.23	63.99	43.62	16.72	40.89	Jan. 1829;	Dec. 1870	18	5	$7_m\ 2_a\ 9_a$	Assit. Surg., C. H. Fernald.	Ar. Met. Regs. 1855 and S. O.
27	39.65	64.20	44.67	18.77	41.82	Jan. 1831;	1864	34	0	max. & min.	G. Wadsworth,	MS. in S. Coll.
28	..	65.26	..	..	..	1849		0	5	$\odot_r\ 9_m\ 3_a\ 9_a$	M. Welch.	S. Coll.
29	40.56	66.52	47.73	21.48	44.07	May, 1857;	Aug. 1858	1	4	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860.
30	39.92	65.47	45.69	19.05	42.53	June, 1864;	Sept. 1867	2	11	$7_m\ 2_a\ 9_{a\ bis}$	E. Pitman, B. H. Towle.	S. O.
31	..	..	..	..	..	Aug. 1863;	Jan. 1864	0	2	$7_m\ 2_a\ 9_a$	A. G. Young and daughter.	" "
32	41.62	66.56	47.82	21.26	44.32	Apr. 1859;	Dec. 1870	8	5	$7_m\ 2_a\ 9_{a\ bis}$	A. P. Moore, A. Robinson.	P. O. and S. I, Vol. 1. and S. O.
33	..	..	..	..	..	1859		0	1	$7_m\ 2_a\ 9_a$	C. L. Nichols.	P. O. and S. I. Vol. 1.
34	39.39	66.02	46.73	19.98	43.03	1861		1	0	$7_m\ 2_a\ 9_{a\ bis}$	Dr. M. Gould.	S. O.
35	37.14	63.14	44.35	17.24	40.47	Jan. 1849;	Dec. 1870	6	5	$\odot_r\ 9_m\ 3_a\ 9_a$	Rev. S. H. Merrill, M. C. Fernald.	P. O. and S. I, Vol. 1, S. O, and Manuscript.
36	40.46	66.42	45.05	19.31	42.81	Feb. 1860;	Dec. 1870	4	0	$7_m\ 2_a\ 9_{a\ bis}$	H. D. Smith, G. W. Verrill, Jr.	S. O.
37	..	..	44.63	..	..	1849;	1850	0	6	$\odot_r\ 9_m\ 3_a\ 9_a$	S. Eveleth.	S. Coll.
38	42.45	..	..	..	..	1862		0	8	$7_m\ 2_a\ 9_{a\ bis}$	E. Dewhurst.	S. O.
39	38.94	60.81	45.83	22.35	41.98	July, 1849;	July, 1865	14	1	$7_m\ 2_a\ 9_a$	W. D. Dana.	P. O. and S. I. Vol. 1, S. O., and Manuscript.
40	40.12	63.75	45.75	21.52	42.78	1815;	1852	35	6	$\odot_r$ N. 8_a	Moody.	Manuscript.
41	40.11	63.73	46.49	21.69	43.00	Jan. 1820;	Dec. 1859	37	3	"	Becket, H. Willis.	P. O. and S. I. Vol. 1, and S. Coll.
42	..	..	..	..	..	1867		0	2	$7_m\ 2_a\ 9_{a\ bis}$	V. G. Eaton.	S. O.
43	38.74	66.58	46.04	..	..	Oct. 1866;	Apr. 1869	1	2	"	W. Pettingill.	" "
44	43.06	67.94	48.43	22.57	45.50	July, 1843;	June, 1848	5	0	$7_m\ 2_a\ 7_a$	J. M. Batchelder.	Am. Alm. 1845 and foll.
45	39.84	64.65	47.40	22.98	43.72	1849;	1855	2	2	$\odot_r\ 9_m\ 3_a\ 9_a$	J. Bartlett.	P. O. & S. I. Vol. 1, & S. Coll.
46	40.69	67.49	46.49	21.45	44.03	May, 1865;	Jan. 1870	4	0	$7_m\ 2_a\ 9_{a\ bis}$	J. P. Moulton.	S. O.
47	38.64	61.53	45.63	21.06	41.72	Aug. 1854;	Apr. 1870	15	6	"	J. D. Parker.	P. O. and S. I. Vol. 1. and S. O.
48	..	..	49.54	..	..	1870		0	6	"	O. H. & L. S. Tupp.	S. O.
49	38.89	..	..	20.34	..	Nov. 1859;	Dec. 1861	1	4	"	W. Johnson.	P. O. and S. I. Vol. 1, and S. O.
50	41.33	64.58	46.55	19.32	42.94	Aug. 1859;	July, 1863	3	5	"	J. Van Blascom.	" " " " "
51	41.69	67.37	46.83	20.95	44.21	Dec. 1863;	Dec. 1870	7	1	"	B. F. Wilbur.	S. O.
52	37.65	64.02	42.78	16.14	40.15	June, 1863;	Dec. 1870	4	0	"	E. and H. W. Pitman.	" "
53	42.42	66.74	47.05	20.92	44.28	1849;	Feb. 1856	4	0	$7_m\ 2_a\ 9_a$	S. A. Eveleth.	P. O. & S. I. Vol. 1, & S. Coll.

[4] The observations for 1860–61 were made at Norway, about three miles northeast of Oxford.

[6] Observations from Jan. 1820, to Dec. 1852, probably included in the preceding series.

MARYLAND.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Agricultural College	38°59′	76°57′	..	34°.69	39°.29	46°.37	55°.82	61°.62	73°.35	72°.73	75°.22	70°.67	61°.57	47°.25	40°.55
2. Annapolis	38 58	76 30	20	33.85	36.19	41.85	52.41	62.73	73.45	77.83	75.85	69.14	56.87	46.59	37.80
3. Baltimore	39 17	76 37	80	32.52	33.67	41.45	50.84	62.38	70.34	75.61	74.28	66.58	54.29	44.35	35.15
4. Baltimore	39 17	76 37	80	33.10	34.30	42.40	53.00	63.20	71.60	76.60	74.50	67.70	55.80	45.00	37.80
5. Bladensburg	38 57	76 56	75	31.23	33.62	40.63	51.54	62.32	71.66	75.75	74.35	63.56	54.31	43.43	33.84
6. Calvert College (New Windsor)	39 31	77 06	..	30.16	34.95	41.67	..	..	..	75.12	..	..	..	..	37.38
7. Catonsville[2] (St. Timothy's Hall)	39 17	76 42	500	27.14	27.63	34.75	48.47	56.94	68.79	74.64	69.02	66.36	53.24	44.39	31.14
8. Chestertown (Wash. Coll.)	39 13	76 04	85	30.20	33.56	41.10	50.98	63.51	71.45	75.81	74.67	69.00	56.35	45.75	36.04
9. Cumberland	39 39	78 45	..	27.75	28.43	35.14	45.38	55.62	66.89	69.52	67.14	59.22	46.91	38.25	29.83
10. Elkton	39 38	75 50	40	..	..	..	..	..	..	70.7	..	..	..	..	32.0
11. Emmettsburg[3]	39 43	77 20	498	29.75	31.15	36.74	49.56	58.35	69.05	74.14	71.93	64.14	50.93	42.01	30.34
12. Eyrie House (Mt. Savage)	39 42	78 52	1818	30.6	26.3	40.2	51.9	61.6	64.2	69.5	70.7	65.4	51.7	44.3	32.9
13. Fallston	39 30	76 24	300	..	..	..	..	..	..	..	..	68.70	58.20	46.63	35.08
14. Fort McHenry	39 16	76 35	36	33.00	34.57	42.27	53.22	63.54	72.56	77.35	75.34	68.65	56.75	45.71	35.93
15. Fort Severn	38 59	76 29	20	33.34	34.84	42.96	54.24	64.82	73.06	78.22	76.17	69.02	57.73	46.90	36.81
16. Fort Washington	38 42	77 04	60	36.24	38.57	46.19	56.22	67.56	76.02	79.93	76.97	69.57	59.13	47.03	37.58
17. Frederick City	39 24	77 24	274	31.47	33.69	40.32	50.67	62.31	71.76	76.30	72.15	65.96	53.72	44.60	34.16
18. Hagerstown	39 39	77 43	..	..	..	..	..	..	71.45	..	..	..	..	..	..
19. Isthmus	38 45	76 15	..	..	..	..	54.6	..	..	78.4	77.8	..	58.2	..	40.2
20. Leitersburg	39 42	77 30	..	28.46	32.72	41.45	48.39	60.81	69.19	73.06	71.58	63.58	52.93	39.98	31.03
21. Leonardtown	38 17	76 37	..	39.10	38.19	49.92	52.09	64.25	72.07	75.44	74.41	69.61	51.71	44.25	37.44
22. Nottingham	38 42	76 43	..	..	31.38	46.52	..	..	..	..	..	..	..	..	..
23. Port Deposit	39 37	76 06	..	..	..	..	..	..	74.21	78.27	..	..	..	..	..
24. Ridge	38 06	76 21	..	26.12	43.28	41.83	49.90	65.51	78.72	84.12	..	73.14	59.25	48.29	34.60
25. St. Mary's City	38 10	76 28	45	35.24	36.85	42.72	53.89	61.89	72.64	76.14	78.00	70.50	57.84	47.23	38.88
26. Schellman Hills (near Sykesville)	39 25	77 00	700	30.65	32.13	40.28	50.35	62.19	69.85	73.28	71.20	65.13	53.81	43.34	33.55
27. Union Bridge	39 34	76 10	400	..	..	..	..	65.50	..	..	..	..	..	..	..
28. Woodlawn	39 39	76 04	..	30.51	32.44	38.97	51.57	59.74	71.28	75.24	72.25	66.77	53.11	43.47	32.30
29. Woodstock	39 19	76 51	400	..	..	..	..	..	..	..	..	..	..	..	32.17

MASSACHUSETTS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Amherst (College)	42 22	72 34	267	22.99	23.31	33.02	44.77	55.72	65.07	69.94	67.73	59.45	47.33	37.19	26.14
2. Amherst (College)	42 22	72 34	267	22.91	24.82	31.57	44.28	56.01	65.29	69.90	67.21	59.76	48.68	38.55	26.01
3. Andover	42 38	71 10	..	24.54	25.64	33.27	45.27	55.95	66.57	70.66	69.97	61.28	49.21	37.44	29.85
4. Baldwinsville	42 37	72 04	847	17.97	24.24	29.25	42.19	55.55	63.60	68.19	67.62	59.36	42.82	37.84	24.04
5. Barnstable	41 42	70 19	20	30.23	27.93	..	..	..	..	..	..	..	..	..	..
6. Bird Island	42 21	71 01	..	31.90	..	41.00	..	..	..	68.90	69.80	..	56.31	47.56	40.85
7. Boston	42 21	71 03	82	26.38	27.91	35.36	45.64	55.83	65.53	71.49	69.01	62.20	51.04	39.87	29.96
8. Bradford	42 46	71 05	..	25.42	30.26	32.16	46.98	57.92	64.91	75.49	70.74	61.07	54.59	42.68	36.95
9. Bridgewater	42 02	71 00	150	24.41	26.70	34.39	43.97	52.33	64.22	69.52	65.29	61.36	49.96	40.46	29.31
10. Byfield	42 44	70 56	..	..	..	..	43.18	53.97	..	..	..	..	..	..	..
11. Cambridge	42 23	71 07	60	28.99	31.18	37.09	47.99	58.66	67.26	72.92	70.91	62.01	51.57	41.12	30.91
12. Cambridge	42 23	71 07	60	28.0	30.7	36.5	48.5	58.5	68.5	73.7	72.5	64.0	50.7	37.0	31.5
13. Cambridge	42 23	71 07	60	22.50	23.90	32.90	45.10	54.40	66.10	69.60	69.40	60.00	50.10	40.20	29.04

[1] Corrected for daily variation by means of the general table.

[2] Previous to 1865 the observations were made at Oakland, about five miles S. E. of Catonsville.

MARYLAND.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	54°.60	73°.77	59°.83	38°.18	56°.60	Feb. 1861;	July, 1862	1	2	$7_m\ 2_a\ 9_a$ bis	Dr. M. Jones.	S. O.
2	52.33	75.71	57.53	35.95	55.38	Nov. 1855;	Dec. 1870	13	10	"	Dr. A. Zumbrock, & W. R. Goodman.	P. O. and S. I. Vol. 1, and S. O.
3	51.56	73.41	55.07	33.78	53.46	Jan. 1817;	Aug. 1859	18	9	[1]	L. Brantz, Dr. Edmondson, Prof. N. M. Meyer, and A. Zumbrock.	Printed Journ. in S. Coll., P. O. and S. I. Vol. 1, S. Coll., and printed record.
4	52.87	74.23	56.17	35.07	54.58	....		22	0	......	....	Pat. Off. Rep.
5	51.50	73.89	53.77	32.90	53.02	Dec. 1854;	Aug. 1865	9	4	$7_m\ 2_a\ 9_a$ bis	B. O. Lowndes	P. O. and S. I. Vol. 1, and S. O.
6	..	..	..	34.16	..	1852;	1853	0	5	$\odot_r\ 9_m\ 3_a\ 9_a$	Nelson.	S. Coll.
7	46.72	70.82	54.66	28.64	50.21	Dec. 1857;	Feb. 1868	3	0	$7_m\ 2_a\ 9_a$ bis	G. S. Grape, E. L. Raulett, F. Reed, P. Tabb, and L. R. Cofran.	P. O. and S. I. Vol. 1, and S. O.
8	51.86	73.98	57.03	33.27	54.04	June, 1855;	July, 1864	3	8	"	Prof. J. R. Dutton & others.	" " " " "
9	45.38	67.85	48.13	28.67	47.51	Jan. 1859;	Dec. 1870	11	5	7_m	....	MS. in S. Coll.
10	..	..	..	..	..	Dec. 1843;	July, 1849	0	2	$\odot_r\ 9_m\ 3_a\ 9_a$	F. Finch.	Manuscript.
11	48.22	71.71	52.36	30.41	50.67	Nov. 1866;	Dec. 1870	4	2	$7_m\ 2_a\ 9_a$ bis	E. Smith, and P. C. H. Jourdan.	S. O.
12	51.23	68.13	53.80	29.93	50.77	Jan. 1846;	Sept. 1846	0	9	$\odot_r\ 3_a\ 11_a$	T. C. Atkinson.	MS. in S. Coll.
13	..	..	57.84	..	..	1870		0	4	$7_m\ 2_a\ 9_a$ bis	G. G. Curtis.	S. O.
14	53.01	75.08	57.04	34.50	54.91	Jan. 1831;	Dec. 1870	36	0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, MS. from S. G. O., and MS. in S. Coll.
15	54.01	75.82	57.88	35.00	55.68	Jan. 1822;	July, 1845	7	5	"	" "	Ar. Met. Reg. 1855.
16	56.66	77.64	58.58	37.46	57.58	Jan. 1824;	Sept. 1870	15	6	"	" "	Ar. Met. Reg. 1855, and MS. from S. G. O.
17	51.10	73.40	54.76	33.11	53.09	1851;	June, 1870	15	6	$7_m\ 2_a\ 9_a$ bis	H. E. & J. K. Henshaw, H. M. Baer, and Jones.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
18	..	..	..	..	..	1852		0	1	$\odot_r\ 9_m\ 3_a\ 9_a$	Carter.	S. Coll.
19	..	..	..	..	..	Apr. 1843;	July, 1845	0	6	"	R. Banning.	Manuscript.
20	50.22	71.28	52.16	30.74	51.10	Oct. 1851;	June, 1862	4	7	$7_m\ 2_a\ 9_a$ bis	J. E. Bell.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
21	55.42	73.97	55.19	38.24	55.71	Jan. 1858;	Sept. 1859	1	0	$7_m\ 2_a\ 9_a$	Dr. A. McWilliams.	P. O. and S. I. Vol. 1.
22	..	..	..	..	..	1849		0	2	$\odot_r\ 9_m\ 3_a\ 9_a$	Dalrymple.	S. Coll.
23	..	..	..	..	..	1850		0	2	"	Thorpe.	" "
24	52.41	..	60.23	34.67	..	May, 1856;	June, 1867	1	1	$7_m\ 2_a\ 9_a$	T. G. Stagg.	P. O. and S. I. Vol. 1.
25	52.83	75.59	58.52	36.99	55.98	Dec. 1859;	Feb. 1870	6	8	$7_m\ 2_a\ 9_a$ bis	Rev. J. Stephenson.	P. O. and S. I. Vol. 1, and S. O.
26	50.94	71.44	54.09	32.11	52.15	Jan. 1846;	Dec. 1865	19	8	"	Miss H. M. Baer.	P. O. and S. I. Vol. 1, MS. in S. Coll., and S. O.
27	..	..	..	..	..	1864		0	1	"	W. Gillingham.	S. O.
28	50.09	72.92	54.45	31.75	52.30	Mar. 1865;	Dec. 1870	5	9	"	J. O. McCormick.	" "
29	..	..	..	..	..	1870		0	1	"	A. X. Valente.	" "

MASSACHUSETTS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	44.17	67.58	47.99	24.15	45.97	Jan. 1836;	Dec. 1853	17	6	......	Prof. E. S. Snell.	MS., Ag'l. Rep., and S. Coll.
2	43.95	67.47	49.00	24.58	46.25	Jan. 1854;	Dec. 1870	16	11	$7_m\ 2_a\ 9_a$ bis	" " " "	P. O. and S. I. Vol. 1, and S. O.
3	44.83	69.07	49.31	26.68	47.47	Jan. 1798;	Dec. 1808	11	0	$\odot_r$ max.	French.	Mem. Am. Acad.
4	42.33	66.47	46.67	22.08	44.39	Mar. 1863;	Sept. 1865	2	3	$7_m\ 2_a\ 9_a$ bis	Rev. E. Dewhurst.	S. O.
5	..	..	..	..	..	1854		0	2	$7_m\ 2_a\ 9_a$	R. R. Gifford.	P. O. and S. I. Vol. 1.
6	..	..	..	..	..	1843;	1844	0	9	6_m N. 6_a	Clark.	Manuscript.
7	45.61	68.68	51.04	28.08	48.35	Feb. 1806;	Apr. 1858	38	5	[4]	J. P. Hall, and R. T. Paine.	Med. and Agr. Reg. Bost. Vol. 1, 1806–7, Sill. Journ., MS. in S. Coll., P. O. and S. I. Vol. 1, and Memoirs Americaines.
8	45.69	70.38	52.78	30.88	49.93	1772		1	0	6_m N. 6_a [4]	Williams.	Phil. Soc. Trans.
9	43.56	66.34	50.59	26.81	46.83	Apr. 1856;	June, 1861	3	4		L. A. Darling and others.	P. O. and S. I. Vol. 1, and S. O.
10	..	..	..	..	..	1851		0	2	$\odot_r\ 9_m\ 3_a\ 9_a$	Root.	S. Coll.
11	47.91	70.36	51.57	30.36	50.05	Jan. 1742;	Dec. 1773	32	0	......	Winthrop.	Am. Alm. 1837, p. 176.
12	47.83	71.57	50.57	30.07	50.01	July, 1780;	Dec. 1783	3	0	......	Rev. E. Wigglesworth.	Mems. Am. Acad.
13	44.13	68.37	50.10	25.15	46.94	Jan. 1784;	Dec. 1788	5	0	......	Williams.	Am. Alm. 1837, p. 176.

3 The observations were partly made at Mount St. Mary's College, about one mile S. W. of Emmettsburg.

4 Observations corrected for daily variation by means of the general table.

MASSACHUSETTS.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
14. Cambridge	42°23′	71°07′	60	25°.25	26°.28	34°.39	44°.40	56°.01	66°.74	71°.86	69°.82	61°.89	50°.18	39°.28	29°.34
15. Canton	42 10	71 08	90	22.67	32.26	..	..	..	..	..	..	..	..	39.02	28.66
16. Chelsea	42 25	71 00	40	24.05	28.48	35.91	44.34	58.24	68.27	71.57	68.90	62.83	54.63	40.57	29.37
17. Clinton	42 25	71 42	..	22.95	30.93	33.60	..	56.30	65.18	67.63	69.20	57.75	48.58	..	..
18. Concord	42 29	71 22	..	25.1	29.0	30.1	42.6	..	..	..	..	..	..	..	..
19. Danvers	42 35	70 58	..	25.19	28.34	..	..	..	..	..	..	..	..	..	28.95
20. Deerfield	42 32	72 36	..	22.24	22.29	30.28	42.97	55.38	65.77	70.28	68.20	60.43	45.57	37.35	26.61
21. Duxbury	42 02	70 41	..	..	..	..	..	53.16	66.33	71.12	..	..	..	..	..
22. East Douglas	42 05	71 42	..	..	..	38.98	48.61	52.47	71.34	71.15	69.70	..	..	..	..
23. Fall River	41 43	71 09	200	..	..	..	..	..	..	..	..	..	..	42.48	34.30
24. Falmouth	41 33	70 37	20	..	..	30.48	..	..	..	..	..	..	..	..	..
25. Fitchburg	42 35	71 50	484	23.80	31.35	35.80	44.82	54.25	66.05	70.47	67.65	61.57	52.82	39.95	25.88
26. Fort Independence	42 22	71 02	50	26.85	27.72	35.00	45.34	56.23	64.30	71.66	69.46	62.89	52.76	41.64	31.24
27. Fort Sewall	42 30	70 50	..	21.81	28.01	38.02	48.62	55.17	58.17	..	..	59.54	43.40	41.43	31.32
28. Fort Warren	42 19	70 55	..	27.83	27.99	33.14	44.49	53.93	65.19	70.88	69.96	62.33	51.64	41.59	30.08
29. Framingham	42 19	71 26	150	22.76	24.16	32.89	44.43	55.09	65.56	69.01	67.17	59.06	47.81	36.97	24.65
30. Georgetown	42 43	71 00	225	22.57	25.68	32.57	44.94	52.21	65.26	68.71	68.52	60.33	47.02	38.35	26.44
31. Grafton	42 13	71 41	..	20.40	31.07	32.75	42.15	51.62	62.95	..	..	..	..	..	..
32. Harwich	41 41	70 04	..	..	..	..	..	..	63.83	70.50	70.50	63.66	..	..	..
33. Hinsdale	42 27	73 08	1360	24.13	21.15	23.87	42.08	53.65	64.76	69.59	66.27	58.54	43.08	33.00	23.17
34. Ipswich	42 41	70 50	50	30.0	30.0	38.0	48.0	56.5	68.0	70.5	70.0	63.5	51.6	39.0	37.0
35. Kingston	42 00	70 48	65	28.05	28.65	31.47	43.53	51.89	64.02	70.12	67.98	61.97	51.16	41.87	31.14
36. Lawrence	42 42	71 10	143	23.21	25.65	31.23	42.19	53.21	64.26	69.13	67.86	59.83	47.98	38.41	26.32
37. Lenox	42 20	73 18	1000	22.77	16.77	29.92	37.24	51.51	63.27	64.92	64.36	54.62	42.86	32.79	21.93
38. Leominster	42 31	71 44	..	29.5	..	..	..	..	..	..	..	..	..	..	..
39. Lowell	42 38	71 19	..	24.26	25.10	34.26	44.11	56.00	66.56	73.50	70.46	62.69	50.19	40.10	29.19
40. Lunenburgh	42 35	71 43	450	25.06	26.11	33.79	44.71	55.71	66.37	71.07	65.69	61.13	50.16	39.60	28.39
41. Lynn	42 28	70 57	..	17.14	19.97	24.47	44.03	56.90	66.42	71.25	67.86	62.18	50.68	39.51	36.01
42. Medfield	42 11	71 18	..	23.81	26.10	34.53	43.69	54.48	64.69	68.92	68.09	59.21	49.17	38.56	29.68
43. Mendon	42 06	71 34	..	24.35	24.10	32.03	44.00	54.44	64.53	70.47	67.70	59.93	48.53	38.78	27.00
44. Milton	42 16	70 44	115	27.00	27.59	32.34	44.89	54.44	65.61	70.70	69.32	61.13	50.20	39.15	28.85
45. Nantucket	41 17	70 06	30	32.19	33.62	37.75	45.15	54.39	64.71	71.09	69.88	64.37	55.38	45.22	38.52
46. Nantucket	41 17	70 06	30	32.07	31.98	36.56	44.59	52.76	63.17	70.10	68.84	64.13	55.36	45.63	36.57
47. New Bedford	41 39	70 56	90	28.79	29.44	35.50	44.66	54.24	63.50	69.12	68.23	62.05	52.29	42.48	32.40
48. Newbury	42 47	70 54	25	23.30	25.80	32.63	45.07	53.49	66.26	70.59	67.40	57.29	46.62	38.11	27.20
49. Newburyport	42 48	70 52	46	23.14	23.54	30.79	42.99	53.57	64.02	70.10	65.95	61.41	49.59	38.88	28.06
50. North Attleboro'	41 59	71 20	175	23.01	27.19	32.40	45.29	57.31	69.02	73.44	67.39	63.07	51.15	40.47	28.55
51. North Billerica	42 35	71 17	135	24.62	27.13	31.57	45.21	54.71	67.20	72.10	69.07	61.25	48.55	38.01	26.55
52. Northampton	42 19	72 38	100	..	..	40.23	48.25	59.53	..	72.89	71.03	60.99	51.87	..	24.59
53. Pittsfield	42 27	73 15	1084	..	23.30	28.20	34.41	..	64.42	67.28	64.32	57.33	49.11	31.10	26.17
54. Plainfield	42 31	72 56	..	..	25.85	23.23	..	..	..	..	..	..	..	..	..
55. Princeton	42 28	71 53	1113	20.24	17.61	25.58	41.18	52.83	62.85	69.46	64.38	58.73	49.16	37.45	24.45
56. Richmond	42 23	73 22	1100	21.80	24.17	30.83	44.01	57.83	68.18	71.57	68.70	62.22	49.55	36.03	25.60
57. Roxbury	42 21	71 04	82	..	..	40.94	47.88	53.23	70.47	72.23	71.27	63.40	52.90	48.17	..
58. Salem	42 31	70 53	75	25.59	27.85	35.56	46.16	56.86	67.22	72.41	70.60	63.00	51.36	39.82	30.48
59. Sandwich	41 45	70 30	20	26.23	29.73	37.48	45.01	53.78	61.42	69.16	70.29	59.40	50.92	43.43	32.17
60. Southwick	42 03	72 46	265	21.05	..	32.60	41.77	60.88	69.44	..	..	54.35	..	36.32	24.71
61. Springfield	42 06	72 35	199	24.37	26.21	34.25	46.37	58.77	69.93	73.28	70.99	61.82	50.43	39.90	28.15
62. Taunton	41 54	71 06	..	..	22.78	30.43	..	62.69	69.90	77.13	69.47	63.40	54.27	43.20	29.52
63. Topsfield	42 39	70 56	..	25.27	27.21	33.52	44.75	54.30	64.90	69.91	68.32	60.53	48.87	40.49	28.32
64. Warwick	42 41	72 20	..	18.20	20.00	27.80	43.60	..	63.85	69.30	69.05	59.10	47.30	35.50	27.60

1 Observations corrected for daily variation by means of the general table.

MASSACHUSETTS.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
14	44°.93	69°.47	50°.45	26°.96	47°.95	Jan. 1790; Dec. 1870	48 5	$7_m\ 2_a\ 9_a$	Profs. Farrar, Bond, and others.	Am. Almanac 1837, MS. in S. Coll., Am. Almanac 1843 and foll. especially 1854, and S. O.
15	..	..	..	27.86	..	Dec. 1856; Jan. 1858	0 6	"	D. H. Ellis.	P. O. and S. I. Vol. 1.
16	46.16	69.58	52.68	27.30	48.93	Jan. 1861; June, 1865	3 4	$\odot_r\ 9_m\ 3_a\ 9_a$	W. F. Patton, J. L. Fox, and J. Beale, Surgeons.	MS. in S. Coll. and S. O.
17	..	67.34	..	..	..	May, 1860; Mar. 1861	0 9	$7_m\ 2_a\ 9_{a\ bis}$	Dr. G. M. Morse.	S. O.
18	..	..	..	..	..	1806	0 4	$\odot_r\ 2_a^1$	Dr. I. Hurd.	Med. and Agr. Reg. Bost. Vol. 1, 1806–7.
19	..	..	..	27.49	..	Dec. 1858; Feb. 1859	0 3	$7_m\ 2_a\ 9_a$	A. W. Mack.	P. O. and S. I. Vol. 1.
20	42.88	68.08	47.78	23.71	45.61	Apr. 1806; Nov. 1818	3 4	1	E. Hoyt and Hitchcock.	Med. and Agr. Reg. Bost. Vol 1, 1806–7, and Sill. Journ.
21	..	..	..	..	..	1849	0 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Ritchie.	S. Coll.
22	46.69	70.73	..	..	..	1849	0 6	"	Rice.	" "
23	..	..	..	..	..	1861	0 2	$7_m\ 2_a\ 9_{a\ bis}$	C. C. Terry.	S. O.
24	..	..	..	..	..	1863	0 1	"	Dr. N. Barrows.	" "
25	44.96	68.06	51.45	27.01	47.87	Jan. 1861; Nov. 1861	0 11	"	G. Raymond.	" "
26	45.52	68.47	52.43	28.60	48.76	Jan. 1824; Dec. 1870	26 7	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
27	47.27	..	48.12	27.05	..	Sept. 1864; June, 1865	0 10	"	....	MS. from S. G. O.
28	43.85	68.68	51.85	28.63	48.25	Oct. 1862; Dec. 1870	7 8	"	....	" " "
29	44.14	67.25	47.95	23.86	45.80	1843; 1852	5 10	$\odot_r\ 9_m\ 3_a\ 9_a$	Hyde.	S. Coll.
30	43.24	67.50	48.57	24.90	46.05	Feb. 1865; Dec. 1870	4 2	$7_m\ 2_a\ 9_{a\ bis}$	H. M. Nelson.	S. O.
31	42.17	..	..	..	..	1861	0 6	"	Rev. H. W. Scandlin.	" "
32	..	68.28	..	..	..	1847; 1848	0 8	$\odot_r$ N. $\odot_s$	Brooks.	Pat.Off. Rep. 1851.
33	39.87	66.87	44.87	22.82	43.61	July, 1868; Dec. 1870	2 3	$7_m\ 2_a\ 9_{a\ bis}$	Rev. E. Dewhurst.	S. O.
34	47.50	69.50	51.37	32.33	50.18	....	3 0	......	....	Rep. Brit. Asso. 1847.
35	42.30	67.37	51.67	29.28	47.65	July, 1866; Dec. 1870	4 6	$7_m\ 2_a\ 9_{a\ bis}$	G. S. Newcomb.	S. O.
36	42.21	67.08	48.74	25.06	45.77	Jan. 1856; Dec. 1870	14 0	"	J. Fallon.	P. O. and S. I. Vol. 1, and S. O.
37	39.56	64.18	43.42	20.49	41.91	Jan. 1837; Dec. 1838	2 0	......	Metcalf.	Rep. Brit. Asso. 1847.
38	..	..	..	..	..	1806	0 1	$\odot_r\ 2_a^1$	A. Bigelow.	Med. and Agr. Journ. Bost. Vol. 1, 1806–7.
39	44.79	70.17	50.99	26.18	48.03	Jan. 1846; Dec. 1852	7 0	$7_m\ 2_a$	R. and J. R. Moor.	Am. Alm. 1848 and foll.
40	44.74	67.71	50.30	26.52	47.32	Jan. 1838; Dec. 1870	33 0	$7_m\ 2_a\ 9_a$	G. A. Cunningham.	S. Coll. and S. O.
41	41.80	68.51	50.79	24.37	46.37	1849; 1853	1 7	$\odot_r\ 9_m\ 3_a\ 9_a$	Batcheder.	S. Coll.
42	44.23	67.23	48.98	26.53	46.74	Jan. 1821; Dec. 1832	12 0	$\odot_r\ 2_a\ 9_a$	Sanders.	Am. Alm. 1834.
43	43.49	67.57	49.08	25.15	46.32	Jan. 1833; Dec. 1870	35 0	$7_m\ 2_a\ 9_{a\ bis}$	Dr. J. G. Metcalf.	Am. Alm. 1843 and foll., MS. in S. Coll., P. O. and S. I. Vol. 1, and S. O.
44	43.89	68.54	50.16	27.81	47.60	Jan. 1867; Dec. 1870	3 8	"	A. K. Teele.	S. O.
45	45.76	68.56	54.99	34.78	51.02	Jan. 1827; Dec. 1853	9 3	......	W. Mitchell.	MS. in S. Coll.
46	44.64	67.37	55.04	33.54	50.15	Jan. 1854; Mar. 1861	6 3	$7_m\ 2_a\ 9_a$	" "	P.O. and S. I. Vol. 1, and S. O.
47	44.80	66.95	52.27	30.21	48.56	Oct. 1812; Dec. 1870	58 1	$\odot_r\ 2_a \odot_s\ 10_a$	S. Rodman and E. T. Tucker.	Sill Journ., MS. in S. Coll., P. O. and S. I. Vol. 1, S. Coll., and S. O.
48	43.73	68.08	47.34	25.43	46.15	May, 1864; Dec. 1870	5 5	$7_m\ 2_a\ 9_{a\ bis}$	J. H. Caldwell.	S. O.
49	42.45	66.69	49.96	24.91	46.00	Mar. 1806; Sept. 1868	6 1	1	Dr. H. C. Perkins.	Med. and Agr. Journ. Boston Vol. 1, 1806–7, P. O. and S. I, Vol. 1, S. Coll., and MS.
50	45.00	69.95	51.56	26.25	48.19	1850; Mar. 1857	7 2	$7_m\ 2_a\ 9_a$	H. Rice.	P. O. and S. I. Vol. 1, & S. Coll.
51	43.83	69.46	49.27	26.10	47.16	Feb. 1866; Dec. 1870	4 11	$7_m\ 2_a\ 9_{a\ bis}$	Rev. E. Nason.	S. O.
52	49.34	..	..	..	..	1844; 1845	0 8	6_m N. 6_a	Plant.	Manuscript.
53	..	65.34	45.85	..	..	1851; 1853	1 3	$6_m\ 2_a\ 10_a$	Benjamin.	Manuscript and S. Coll.
54	..	..	..	..	..	1857	0 2	$7_m\ 9_m$ N. 9_a	F. Shaw.	P. O. and S. I. Vol. 1.
55	39.86	65.56	48.45	20.77	43.66	Nov. 1853; Dec. 1857	3 8	$7_m\ 2_a\ 9_a$	J. Brooks.	P. O. & S. I. Vol. 1, & S. Coll.
56	44.22	69.48	49.27	23.86	46.71	1851; Dec. 1870	14 10	"	W. Bacon.	S. O., S. Coll., and P. O. and S. I. Vol. 1.
57	47.35	71.32	54.82	..	..	1849	0 9	$\odot_r\ 9_m\ 3_a\ 9_a$	Kent.	S. Coll.
58	46.19	70.08	51.39	27.97	48.91	Jan. 1786; Dec. 1828	43 0	8_m N. $\odot_s\ 10_a$	Dr. Holyoke.	Am. Alm. 1834, 1837.
59	45.42	66.96	51.25	29.38	48.25	May, 1863; Apr. 1865	1 11	$7_m\ 2_a\ 9_{a\ bis}$	Dr. N. Barrows.	S. O.
60	45.08	..	..	..	..	1849; 1851	1 0	$\odot_r\ 9_m\ 3_a\ 9_a$	Holcomb.	S. Coll.
61	46.46	71.40	50.72	26.24	48.71	Jan. 1848; Dec. 1866	9 11	1	L. C. Allin, F. A. Brewer, J. Weatherhead.	P. O. and S. I. Vol. 1, S. O., Manuscript, and S. Coll.
62	..	72.17	53.62	..	..	May, 1854; Mar. 1856	0 10	$7_m\ 2_a\ 9_a$	A. Schlegel.	P. O. and S. I. Vol. 1.
63	44.19	67.71	49.96	26.93	47.20	Apr. 1860; Dec. 1870	9 9	$7_m\ 2_a\ 9_{a\ bis}$	N. B. Brown, J. H. Caldwell, and A. M. Merriam.	S. O.
64	..	67.40	47.30	21.93	..	June, 1806; Sept. 1807	1 3	$\odot_r\ 2_a^1$	....	Med. and Agr. Reg. Bost. Vol. 1, 1806–7.

MASSACHUSETTS.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June	July.	August.	Sept.	Oct.	Nov.	Dec.
65. Watertown Arsenal[1]	42°21′	71°11′	100	25°.85	25°.86	33°.14	45°.75	55°.59	66°.02	71°.61	70°.19	61°.83	49°.42	37°.78	28°.27
66. West Denis	41 40	70 11	25	..	..	..	..	..	..	..	..	60.77	50.50	..	..
67. Westfield	42 06	72 45	180	26.64	29.39	37.55	47.90	60.98	68.04	74.39	69.35	60.39	51.25	38.95	32.04
68. Westfield	42 06	72 45	180	22.48	25.48	32.91	45.16	55.92	64.59	69.58	66.94	59.57	48.55	38.31	27.22
69. West Stockbridge	42 16	73 22	..	..	19.51	..	..	..	69.72	..	..	..	..	..	..
70. Weymouth	42 12	70 56	150	22.06	33.90	33.09	42.51	53.98	63.99	69.78	66.46	60.99	51.00	40.15	29.29
71. Williamstown (Will. Coll.)	42 43	73 13	686	21.63	22.92	30.93	43.60	55.78	65.56	69.66	66.52	58.81	46.92	36.34	25.28
72. Wood's Hole	41 32	70 40	25	30.58	28.80	37.05	44.54	55.59	66.84	70.99	69.95	64.84	53.82	43.62	36.48
73. Worcester (State Lun. As.)	42 16	71 49	528	23.74	25.60	33.10	45.75	56.18	65.84	70.94	67.71	60.89	49.74	39.26	27.67

MICHIGAN.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Adrian	41 58	84 11	1240	23.80	22.03	28.03	46.65	58.10	67.18	..	..	..	..	..	..
2. Ann Harbor	42 19	83 44	891	21.39	20.74	30.75	47.85	58.61	68.89	72.07	69.72	63.05	50.49	37.86	26.77
3. Battle Creek	42 22	85 15	750	24.45	25.98	34.19	44.55	58.19	69.79	73.89	71.44	63.46	49.61	38.21	28.35
4. Benzonia	44 37	86 08	620	22.18	21.40	28.63	44.63	59.18	..	..	..	..	..	39.05	27.98
5. Brooklyn	42 06	83 36	1020	19.8	25.9	36.4	..	..	..	..	..	..	..	..	..
6. Carp Lake Mine[4]	46 52	89 54	1440	15.23	21.85	22.98	36.50	..	..	68.53	67.88	53.03	41.98	29.84	15.50
7. Central Mine	47 00	88 54	1177	14.24	12.01	21.51	34.02	48.18	58.93	64.58	60.63	52.80	39.79	29.08	17.26
8. Clinton	42 05	84 00	750	25.15	32.52	39.52	44.08	56.79	..	..	..	54.31	43.67	40.73	26.28
9. Coldwater	41 59	85 02	..	26.71	26.38	27.96	46.32	57.75	65.44	72.52	68.08	60.94	45.75	35.63	34.35
10. Cooper[5]	42 25	85 38	690	21.21	24.46	30.42	45.09	54.55	67.97	73.80	69.90	62.86	49.00	34.58	28.22
11. Copper Falls Mine	47 26	88 22	1250	8.15	6.85	18.05	31.85	46.70	56.70	65.85	61.35	50.40	42.00	28.90	17.60
12. Dearbornville	42 20	83 18	..	24.99	21.26	33.79	43.42	54.73	64.82	69.95	65.32	58.00	51.76	35.01	24.26
13. Detroit	42 20	83 03	597	25.84	25.89	34.11	46.18	56.09	65.43	69.60	69.11	58.51	49.85	38.14	28.09
14. Eagle River	47 25	88 26	627	10.93	11.13	18.93	38.63	49.50	61.46	68.16	61.08	54.61	47.21	29.63	17.85
15. Eureka Valley	47 06	88 51	800	17.57	19.59	23.98	35.73	51.25	59.08	66.80	64.78	50.18	40.68	29.33	21.80
16. Flint	43 02	83 42	..	22.85	19.68	33.15	48.07	59.80	66.90	74.12	70.93	64.39	49.06	36.92	25.03
17. Forestville	43 38	82 39	600	..	..	..	..	..	66.8	70.1	..	..	..	..	..
18. Fort Brady	46 30	84 28	600	16.73	15.89	24.77	38.39	49.67	59.57	65.50	63.10	54.75	43.88	32.60	21.44
19. Fort Gratiot	42 59	82 29	598	25.42	25.39	32.72	44.30	54.26	63.79	69.81	67.95	60.01	48.78	38.28	27.19
20. Fort Mackinac	45 51	84 40	728	19.10	17.27	25.69	37.32	48.18	57.72	64.90	64.17	55.30	45.32	34.14	23.14
21. Fort Wayne	42 20	83 05	..	34.21	29.91	..	..	59.83	64.96	74.32	75.10	65.46	53.49	36.92	35.90
22. Fort Wilkins	47 28	88 02	630	23.40	21.40	28.93	38.07	48.42	56.68	63.55	62.17	55.79	42.91	30.17	20.55
23. Grand Haven	43 05	86 15	588	25.80	25.53	32.98	45.25	56.08	65.40	70.12	70.27	60.38	49.83	38.00	28.73
24. Grand Rapids	43 00	85 42	780	23.29	24.71	30.94	45.63	57.49	67.28	73.59	68.38	61.07	47.79	36.79	25.86
25. Holland	42 49	86 08	..	24.71	26.51	32.10	44.31	54.58	66.01	70.48	65.82	58.15	47.70	37.78	28.24
26. Homestead	44 36	86 02	..	21.50	23.47	25.65	41.47	51.65	65.64	67.13	62.09	59.76	46.29	37.62	25.65
27. Jackson	42 17	84 27	..	..	25.77	..	..	..	..	..	..	..	..	..	..
28. Lake George	46 15	85 00	..	..	..	..	..	49.79	..	66.15	66.69	54.21	..	..	..
29. Lansing (State Agr. Coll.)	42 46	84 36	895	23.61	25.36	32.50	46.59	56.51	67.20	70.65	67.43	59.88	45.72	37.29	25.90
30. Laphamsville	43 00	85 30	650	28.90	32.65	39.33	43.87	54.38	64.10	69.50	66.24	64.26	49.59	35.23	26.14
31. Litchfield	42 05	84 46	1040	21.35	24.37	29.16	44.63	55.74	67.22	72.74	67.45	59.95	47.12	36.18	23.34
32. Macon	42 05	83 52	..	..	..	..	..	..	..	..	..	..	..	..	23.13
33. Manchester	42 11	84 06	..	..	..	..	..	58.08	70.98	66.60	66.65	..	..	..	..

[1] Observations after 1844 were made at West Newton, about two miles West of Watertown Arsenal, by J. H. Bixby.

[2] Observations corrected for daily variation by means of the general table.

[3] The names of the observers from 1839 to 1859 are not given.

MASSACHUSETTS.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
65	44°.83	69°.27	49°.68	26°.66	47.°61	Jan. 1837;	Dec. 1870	10 0	2	Assist. Surg., and J. H. Bixby.	Ar. Met. Reg. 1855, and S. O.
66	..	..	..	..	..	1864		0 2	$7_m\ 2_a\ 9_a$ bis	E. Tappan.	S. O.
67	48.81	70.59	50.20	29.36	49.74	....		2 0	......	....	Dove, 1857.
68	44.66	67.04	48.81	25.06	46.39	Nov. 1824;	May, 1866	12 11	2	Rev. E. Davis.	P. O. and S. I. Vol. 1, S. O., Sill. Journ., and Manuscript.
69	..	..	..	..	..	June, 1849;	Feb. 1855	0 2	$7_m\ 2_a\ 9_a$	....	P. O. & S. I. Vol. 1, & S. Coll.
70	43.19	66.74	50.71	28.42	47.27	May, 1856;	Jan. 1859	1 9	2	Dr. N. O. Tinell.	P. O. and S. I. Vol. 1.
71	43.44	67.25	47.36	23.28	45.33	Jan. 1816;	Dec. 1870	36 8	$7_m\ 2_a\ 9_a$	Profs. C. Dewey and E. Kellogg, A. Hopkins and others.	MS. communicated to S. I. by E. W. Morley, P. O. and S. I. Vol. 1, and S. O.
72	45.73	69.26	54.09	31.95	50.26	Aug. 1852;	Apr. 1855	1 10	"	R. R. Gifford.	P. O. & S. I. Vol. 1, & S. Coll.
73	45.01	68.16	49.96	25.67	47.20	Jan. 1839;	Dec. 1870	31 9	2	H. C. Prentiss, F. H. Rice, J. Draper.[3]	Am. Alm. 1842 and foll., P. O. and S. I. Vol. 1, S. O., and Rep. Brit. Assoc. 1847.

MICHIGAN.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	44.26	..	..	..	..	1870		0 6	$7_m\ 2_a\ 9_a$ bis	....	S. O.
2	45.74	70.23	50.47	22.97	47.35	June, 1852;	Dec. 1870	4 10	$7_m\ 2_a\ 9_a$	L. Woodruff, Prof. N. C. Winchell & wife.	P. O. and S. I. Vol. 1, S. O., & S. Coll.
3	45.64	71.71	50.43	26.26	48.51	Mar. 1849;	Dec. 1859	10 9	"	D. W. M. Campbell.	P. O. & S. I. Vol. 1, & S. Coll.
4	44.15	..	..	23.85	..	1870		0 7	$7_m\ 2_a\ 9_a$ bis	W. Wilson.	S. O.
5	..	..	..	..	..	Mar. 1853;	Mar. 1854	0 4	$7_m\ 2_a\ 9_a$	Dr. M. K. Taylor.	P. O. and S. I. Vol. 1.
6	..	..	41.62	17.53	..	July, 1864;	Apr. 1865	0 10	$7_m\ 2_a\ 9_a$ bis	Dr. E. Ellis.	S. O.
7	34.57	61.38	40.56	14.50	37.75	May, 1867;	Dec. 1870	3 7	"	G. H. Whittlesey.	" "
8	46.80	..	46.24	27.98	..	1850;	1852	0 11	$\odot_r\ 9_m\ 3_a\ 9_a$	Wainwright.	S. Coll.
9	44.01	68.68	47.44	29.15	47.32	July, 1868;	Dec. 1870	2 6	$7_m\ 2_a\ 9_a$ bis	N. L. Southworth.	S. O.
10	43.35	70.56	48.81	24.63	46.84	June, 1854;	Mar. 1867	7 1	"	Mrs. O. C. Walker & Dr. M. Chase.	P. O. and S. I. Vol. 1, and S. O.
11	32.20	61.30	40.43	10.87	36.20	Dec. 1855;	Aug. 1857	1 9	$7_m\ 2_a\ 9_a$	C. S. Whittlesey.	MS. in S. Coll. and P. O. and S. I. Vol. 1.
12	43.98	66.70	48.26	23.50	45.61	1836;	1839	3 9	"	Assistant Surgeon.	Army Register.
13	45.46	68.05	48.82	26.61	47.24	Apr. 1836;	Dec. 1867	30 3	6	Various observers.	Ar. Met. Regs. 1855, S. Coll., U. S. Lake Survey, MS. and Rep. of 1867 and 1868, P. O. and S. I. Vol. 1, and S. O.
14	35.69	63.57	43.82	13.30	39.09	Dec. 1855;	Dec. 1856	1 1	$7_m\ 2_a\ 9_a$	Mrs. M. A. Goff.	P. O. and S. I. Vol. 1.
15	36.99	63.55	40.06	19.65	40.06	Jan. 1862;	Feb. 1864	1 5	$7_m\ 2_a\ 9_a$ bis	W. Van Orden.	S. O.
16	47.01	70.65	50.12	22.52	47.58	Jan. 1854;	Dec. 1855	2 0	$7_m\ 2_a\ 9_a$	Drs. D. Clark and M. Miles.	P. O. and S. I. Vol. 1.
17	..	..	..	..	..	1858		0 2	$6_m\ 9_m\ 3_a\ 6_a$	C. N. Turnbull.	MS. from U. S. Lake Survey.
18	37.61	62.72	43.74	18.02	40.52	Jan. 1823;	Dec. 1870	32 1	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
19	43.76	67.18	49.02	26.00	46.49	Apr. 1830;	Aug. 1859	17 5	"	Assist. Surg. & Lieut. C. N. Turnbull.	P. O. and S. I. Vol. 1, Ar. Met. Reg. 1855, and U. S. Lake Survey, and MS.
20	37.06	62.26	44.92	19.84	41.02	Sept. 1825;	Apr. 1861	27 6	"	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
21	..	71.46	51.96	33.34	..	May, 1862;	Feb. 1863	0 10	"	....	MS. from S. G. O.
22	38.47	60.80	42.96	21.78	41.00	June, 1844;	June, 1846	2 1	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
23	44.77	68.60	49.40	26.69	47.36	Sept. 1859;	July, 1863	3 11	$7_m\ 2_a\ 9_a$	H. Squier.	U. S. Lake Survey, Rep. of 1867.
24	44.69	69.75	48.55	24.62	46.90	1849;	Dec. 1870	11 3	$7_m\ 2_a\ 9_a$ bis	A. O. Courrier, L. H. Strong, E. A. Strong, & Dr. E. S. Holmes.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
25	43.66	67.44	47.88	26.49	46.37	June, 1856;	Dec. 1870	8 3	"	L. H. Streng.	P. O. and S. I, Vol. 1. and S. O.
26	39.59	64.95	47.89	23.54	43.99	Jan. 1865;	Feb. 1870	2 9	"	G. E. Steele.	S. O.
27	..	..	..	..	..	1865		0 1	"	Dr. F. M. Reasner.	" "
28	..	..	..	..	..	1859		0 4	......	Capt. A. W. Whipple, and E. Perrault.	P. O. and S. I. Vol. 1.
29	45.20	68.43	47.63	24.96	46.55	Dec. 1858;	Dec. 1870	7 3	$7_m\ 2_a\ 9_a$ bis	J. C. Holmes, C. Abbe, and R. C. Kedzie.	" " " "
30	45.86	66.61	49.69	29.23	47.85	Dec. 1850;	Nov. 1851	1 0	......	Wetmore.	Pat. Off. Rep.
31	43.18	69.14	47.75	23.02	45.77	July, 1866;	Dec. 1870	4 6	$7_m\ 2_a\ 9_a$ bis	R. Bullard.	S. O.
32	..	..	..	..	..	1870		0 1	"	D. Howell.	" "
33	..	68.08	..	..	..	1865		0 4	"	Dr. F. M. Reasner.	" "

[4] The observations in 1864 were made at Garlick, about two miles east of Carp Lake Mine.

[5] The observations in 1866–7 were made at Kalamazoo, about five miles west of Cooper.

[6] Observations corrected for daily variation.

MICHIGAN.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
34. Marquette . . .	46°32′	87°35′	710	18°.65	17°.92	25°.74	37°.72	49°.22	59°.89	65°.08	64°.72	56°.66	45°.00	32°.73	22°.13
35. Mill Point . . .	43 06	86 10	..	20.62	22.70	29.57	42.93	50.82	62.71	65.82	64.78	56.07	47.15	34.01	26.37
36. Monroe[1]	41 56	83 27	551	25.60	23.85	35.19	46.78	57.35	68.19	73.04	70.55	61.11	49.47	38.83	28.03
37. Muskegon . . .	43 15	86 16	..	29.79	27.92	32.60	50.22	63.35	67.48	76.44	73.47	67.93	46.69	38.37	29.83
38. Newark	42 30	86 00	..	..	..	..	46.62	..	..	..	..	..	..	..	..
39. New Buffalo . .	41 50	86 46	661	29.14	24.94	38.09	46.34	58.01	67.38	71.19	68.77	61.57	50.22	38.12	28.64
40. Northport[2] . . .	45 08	85 40	592	22.54	22.08	26.21	39.23	50.00	60.40	68.20	64.18	58.78	47.09	36.75	25.77
41. Old Mission . . .	44 45	85 30	600	..	..	..	..	50.88	57.85	67.23	66.40	63.15	39.18	..	..
42. Ontonagon . . .	46 53	89 30	620	16.41	15.57	21.80	36.91	48.26	59.49	64.89	63.50	55.98	43.79	33.25	20.46
43. Otsego	42 30	85 42	..	27.95	31.03	34.99	45.53	54.34	65.31	70.32	67.35	61.99	47.45	40.83	30.83
44. Pennsylvania Mine .	47 20	88 15	1200	22.00	17.70	19.35	34.30	48.03	..	..	..	..	..	..	..
45. Pleasanton . . .	44 29	86 10	750	21.79	20.40	25.56	40.05	55.16	60.92	66.51	63.69	58.44	39.41	30.47	25.75
46. Pontiac	42 40	83 21	927	21.49	26.28	34.09	45.28	57.47	68.24	68.81	68.20	56.98	44.87	36.77	25.55
47. Portage Lake[3] . .	47 10	88 37	670	10.9	14.2	26.7	36.8	46.8	62.4	..	62.4	..	..	..	..
48. Port Huron . . .	42 58	82 27	606	29.08	24.39	35.62	43.28	52.89	64.85	71.90	68.80	63.63	49.32	35.07	31.26
49. Redford Centre .	42 25	83 20	650	..	..	..	..	..	67.80	69.70	69.95	..	..	..	..
50. Romeo	42 44	83 02	714	13.23	14.86	24.83	45.79	54.23	68.46	72.68	66.79	59.87	49.94	35.80	22.30
51. St. James . . .	45 44	85 00	596	20.36	15.48	24.64	39.04	50.35	59.65	66.53	66.55	59.60	47.87	35.48	24.76
52. St. Mary's River .	46 20	84 10	585	..	..	..	..	..	55.59	..	..	..	..	..	..
53. Saginaw	43 27	84 00	650	..	..	37.19	41.39	53.30	60.57	..	..	..	..	..	..
54. Saugatuck . . .	42 40	86 12	..	23.03	22.31	31.91	49.35	55.57	65.22	75.04	72.09	68.00	54.56	41.93	29.89
55. Sault de St. Marie .	46 29	84 29	600	19.45	18.55	27.90	40.45	49.90	60.70	64.90	62.90	55.60	42.60	30.70	22.95
56. Sugar Island . .	46 29	84 20	574	20.05	21.73	28.22	33.48	..	..	..	..	..	..	32.60	22.79
57. Tawas City . . .	44 16	83 31	583	21.56	23.67	30.20	39.80	50.75	62.03	67.49	66.68	58.88	48.06	36.89	25.91
58. Thunder Bay Island	45 02	83 17	610	23.29	22.67	27.72	37.14	47.02	57.12	64.19	65.26	58.29	46.73	36.41	26.71
59. Woodmere Cem'ry (near Detroit) .	42 20	83 03	562	22.68	23.43	30.30	48.69	60.98	68.36	72.98	70.99	66.00	53.04	38.33	27.00
60. Ypsilanti	42 15	83 40	750	24.42	26.73	34.19	44.56	58.16	65.30	70.03	68.95	58.81	48.62	37.61	28.10

MINNESOTA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Afton	44 53	92 50	950	11.78	14.77	20.17	42.88	56.09	66.12	70.23	66.05	59.86	42.53	32.43	14.99
2. Alexandria . . .	45 52	95 22	1225	..	..	..	..	..	..	..	..	..	..	..	12.48
3. Beaver Bay . . .	47 12	91 18	1270	12.87	14.37	22.36	36.22	47.02	55.92	62.03	61.62	52.76	41.56	30.96	16.32
4. Beaver River Valley	47 11	91 25	950	..	..	31.18	..	51.33	61.08	63.13	59.90	48.95	..	..	..
5. Bowles' Creek . .	44 55	92 55	650	9.80	..	..	..	..	..	..	..	..	..	..	..
6. Buchanan . . .	47 33	92 00	..	22.12	10.50	30.32	37.72	49.85	..	..	..	..	..	..	25.44
7. Burlington . . .	47 01	91 42	645	17.57	14.25	29.86	34.86	47.09	55.91	62.52	62.04	54.38	41.63	28.69	13.34
8. Cass Lake . . .	47 30	94 31	1450	13.12	4.28	..	..	..	..	60.31	60.94	43.98	..	..	3.61
9. Chatfield	43 50	92 14	900	14.98	20.63	32.65	46.17	56.48	64.91	71.27	69.26	57.24	46.48	33.82	12.31
10. Clearwater Lake .	45 12	94 06	975	..	..	..	..	..	..	..	65.31	..	..	..	..
11. Danville	..	..	..	5.03	13.47	35.17	38.54	..	67.36	..	..	..	..	..	..
12. Fond du Lac . .	46 48	92 03	660	14.97	20.27	30.05	33.80	48.09	61.53	63.91	..	..	43.56	37.93	12.19
13. Forest City . . .	45 11	94 30	..	10.18	15.60	27.87	43.36	57.06	66.40	69.08	66.89	57.83	44.79	30.21	15.47
14. Fort Ridgeley . .	44 30	94 45	1230	10.70	14.80	25.89	43.69	59.31	68.72	73.52	69.62	60.85	47.37	31.24	16.05
15. Fort Ripley (Gaines)	46 10	94 24	1130	7.41	11.89	23.98	40.82	54.80	65.97	70.50	66.18	56.52	44.77	28.26	11.08
16. Fort Snelling . .	44 53	93 10	820	13.23	17.25	29.96	46.05	59.35	68.92	74.04	70.19	59.31	47.27	31.78	16.90
17. Grand Portage . .	47 50	89 50	[4]	..	..	..	..	46.73	54.20	59.45	59.15	50.15	..	..	..
18. Hastings	44 44	92 54	..	..	..	..	..	..	70.50	69.72	68.55	59.07	46.32	30.23	21.80
19. Hazlewood (or "Oomahoo")	..	..	..	5.92	9.43	20.48	40.15	55.81	68.18	72.93	69.03	56.93	47.20	29.33	17.54
20. Hennepin Co. . .	45 00	93 20	..	11.6	23.0	24.1	41.3	58.0	67.1	66.5	67.2	67.3	47.7	38.4	9.3
21. Itasca	45 16	93 32	856	3.85	17.12	27.32	44.77	50.15	69.60	67.25	..	..	..	29.85	14.95
22. Kandotta . . .	45 45	94 55	..	8.25	11.75	..	..	..	..	..	..	..	..	..	..
23. Koniska	45 10	94 10	..	12.01	13.17	25.21	43.38	57.12	63.15	68.24	62.58	57.58	40.07	30.40	16.86

[1] This series includes observations made in December at Brest, about five miles northeast of Monroe.

[2] This series includes observations made in March, 1862, at Grand Traverse Lt. Ho., about five miles northeast of Northport.

MICHIGAN.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
34	37°.56	63°.23	44°.80	19°.57	41°.29	Sept. 1857;	Dec. 1867	10 4	$7_m\ 2_a\ 9_a$	H. S. & F. M. Bacon, P. White, and G. H. Baker.	U. S. Lake Survey, Rep. of 1867–8, P. O. and S. I. Vol. I, and S. O.
35	41.11	64.44	45.74	23.23	43.63	July, 1860;	June, 1862	2 0	$7_m\ 2_a\ 9_a$ bis	L. M. S. Smith.	S. O.
36	46.44	70.59	49.80	25.83	48.17	Jan. 1849;	Dec. 1870	11 9	"	J. Lane, H. J. and F. E. Whelpley and others.	U. S. Lake Survey, Rep. of 1867–8, P. O. and S. I. Vol. I., S. O., and S. Coll.
37	48.72	72.46	51.00	29.18	50.34	Oct. 1868;	Aug. 1870	1 10	"	H. A. Pattison.	S. O.
38	..	..	..	..	..	1856		0 1	$7_m\ 2_a\ 9_a$	L. H. Streng.	P. O. and S. I. Vol. I.
39	47.48	69.11	49.97	27.57	48.53	Jan. 1858;	May, 1862	2 10	$7_m\ 1_a\ 9_a$	J. B. Crosby.	P. O. and S. I. Vol. I. and S. O.
40	38.48	64.26	47.54	23.46	43.43	Mar. 1862;	Dec. 1870	4 8	$7_m\ 2_a\ 9_a$ bis	Rev. G. N. Smith, & H. R. Shetterly.	S. O.
41	..	63.83	..	..	..	1869		0 6	"	C. P. Avery.	" "
42	35.66	62.63	44.34	17.48	40.03	Aug. 1859;	Dec. 1870	11 5	"	H. Shelby, H. B. Smith, & Dr. E. Ellis.	U. S. Lake Survey, Rep. of 1867 and 1868, and S. O.
43	44.95	67.66	50.09	29.94	48.16	Apr. 1867;	Sept. 1870	3 6	"	Dr. M. Chase & wife.	S. O.
44	33.89	..	..	..	..	1869		0 5	"	R. H. Griffith.	" "
45	40.26	63.71	42.77	22.65	42.35	Mar. 1869;	Aug. 1870	1 6	"	J. D. Millard.	" "
46	45.61	68.42	46.21	24.44	46.17	Mar. 1864;	Aug. 1865	1 6	"	J. A. Weeks.	" "
47	36.77	..	..	..	..	Jan. 1854;	Aug. 1862	0 7	$\odot_r$ N. $\odot_s$	C. H. Palmer and J. B. Minick.	MS. in S. Coll. and S. O.
48	43.93	68.52	49.34	28.24	47.51	May, 1857;	July, 1859	2 1	$7_m\ 2_a\ 9_a$	J. Allen.	P. O. and S. I. Vol. I.
49	..	69.15	..	..	..	1861		0 3	$7_m\ 2_a\ 9_a$ bis	Dr. C. S. Smith.	S. O.
50	41.62	69.31	48.54	16.80	44.07	Jan. 1856;	Mar. 1857	1 2	$7_m\ 1_a\ 9_a$	D. S. L. Andrews.	P. O. and S. I. Vol. I.
51	38.01	64.24	47.65	20.20	42.53	Sept. 1852;	May, 1856	3 3	$7_m\ 2_a\ 9_a$	J. J. Strong.	" " " "
52	..	..	..	..	..	1859		0 1	......	....	" " " "
53	43.96	..	..	..	..	1849		0 4	$\odot_r\ 9_m\ 3_a\ 9_a$	Birney.	S. Coll.
54	45.61	70.78	54.83	25.08	49.08	Feb. 1854;	May, 1856	2 1	$7_m\ 2_a\ 9_a$	L. H. Streng.	P. O. and S. I. Vol. I.
55	39.42	62.83	42.97	20.32	41.38	Sept. 1823;	June, 1825	1 10	"	Col. Cutler.	MS. in S. Coll.
56	..	..	..	21.52	..	Nov. 1863;	Apr. 1868	0 11	$7_m\ 2_a\ 9_a$ bis	J. W. Church and J. W. Paxton.	MS. from U. S. Lake Survey, and S. O.
57	40.25	65.40	47.94	23.71	44.33	Sept. 1858;	Dec. 1867	9 4	$7_m\ 2_a\ 9_a$	J. Oliver and C. H. Whittemore.	U. S. Lake Survey, Rep. of 1867–68.
58	37.29	62.19	47.14	24.22	42.71	Aug. 1858;	Dec. 1870	9 3	"	J. W. Paxton & others.	Survey of N. and N. W. Lakes, Rep. of 1867, MS, and S. O.
59	46.66	70.78	52.46	24.37	48.57	Feb. 1870;	Dec. 1870	0 11	$7_m\ 2_a\ 9_a$ bis	F. W. Higgins.	S. O.
60	45.64	68.09	48.35	26.42	47.13	Jan. 1859;	Sept. 1864	4 11	"	C. S. Woodward.	P. O. and S. I. Vol. I, and S. O.

MINNESOTA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	39.71	67.47	44.94	13.85	41.49	Apr. 1865;	Julv 1870	3 5	$7_m\ 2_a\ 9_a$ bis	Dr. B. F. Babcock & wife.	S. O.
2	..	..	..	..	..	1868		0 1	"	S. Bloomfield.	" "
3	35.20	59.86	41.76	14.52	37.84	Nov. 858;	Dec. 1870	10 11	"	T. Clarke, and C. Wieland.	P. O. and S. I. Vol. I, and S. O.
4	..	61.37	..	..	..	1860		0 6	"	H. Wieland.	S. O.
5	..	..	.	..	..	1866		0 1	"	A. Stouffer.	" "
6	39.30	..	..	19.35	..	Dec. 1857;	May, 1858	0 6	7_m N. $3_a\ 9_a$	S. Walsh.	P. O. and S. I. Vol. I.
7	37.27	60.16	41.57	15.05	38.51	Jan. 1858;	Sept. 1860	2 8	$7_m\ 2_a\ 9_a$	A. A. Hibberd.	P. O. and S. I. Vol. I, and S. O.
8	..	..	..	7.00	..	1852;	1853	0 6	$\odot_r\ 9_m\ 3_a\ 9_a$	Barnard.	S. Coll.
9	45.10	68.48	45.85	15.97	43.85	May, 1859;	May, 1861	1 9	$7_m\ 2_a\ 9_a$ bis	T. F. Thickstun.	P. O. and S. I. Vol. I, & S. O.
10	..	..	..	..	..	1868		0 1	"	S. Bloomfield.	S. O.
11	..	..	..	..	..	1868		0 5	"	T. A. Kellett.	" "
12	37.31	..	..	15.81	..	1849;	1850	0 11	$\odot_r\ 9_m\ 3_a\ 9_a$	Holt.	S. Coll.
13	42.76	67.46	44.28	13.75	42.06	June, 1858;	May, 1866	5 10	$7_m\ 2_a\ 9_a$ bis	A. C. & H. L. Smith.	P. O. and S. I. Vol. I, and S. O.
14	42.96	70.62	46.49	13.85	43.48	July, 1853;	Apr. 1867	13 4	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
15	39.87	67.55	43.18	10.13	40.18	July, 1849;	Dec. 1870	19 6	"	" "	" " " "
16	45.12	71.05	46.12	15.79	44.52	Oct. 1819;	Dec. 1870	42 2	"	" "	" " " "
17	..	57.60	..	..	..	1867		0 5	$7_m\ 2_a\ 9_a$ bis	R. Bardon.	S. O.
18	..	69.59	45.21	..	..	1861		0 7	"	T. F. Thickstun.	" "
19	38.81	70.05	44.49	10.96	41.08	Aug. 1860;	July, 1862	1 10	"	S. R. Riggs and A. W. Higgins.	" "
20	41.13	66.93	51.13	14.63	43.46	Dec. 1864;	Dec. 1865	1 1	4_m N. 8_a	J. B. Clough.	Graphical Rec. in S. Coll.
21	40.75	..	..	11.97	..	Nov. 1860;	Mar. 1863	0 10	$7_m\ 2_a\ 9_a$ bis	O. H. Kelly.	S. O.
22	..	..	..	..	..	1859		0 2	$7_m\ 2_a\ 6_a$	A. Whitefield.	P. O. and S. I. Vol. I.
23	41.90	64.66	42.68	14.01	40.81	Jan. 1869;	Dec. 1870	1 9	$7_m\ 2_a\ 9_a$ bis	T. M. and Mary H. Young.	S. O.

[3] This series includes observations made in August, 1862, at Houghton, about four miles southwest of Portage Lake.

[4] Altitude 12½ feet above Lake Superior.

MINNESOTA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
24. Lac qui parle[1]	45°00′	95°30′	946	8°.85	13°.26	26°.48	42°.78	56°.25	66°.32	72°.14	68°.28	57°.13	45°.79	28°.05	13°.29
25. Lake Winibigoshish	47 30	94 40	..	—8.83	6.67	24.57	..	51.19	..	..	..	..	..	24.03	2.45
26. Litchfield	45 12	94 45	..	..	..	..	..	..	..	71.48	63.89	62.65	46.53	38.24	17.72
27. Madelia	44 00	94 30	..	12.18	14.10	18.86	45.62	62.16	69.24	73.84	69.47	64.76	43.34	32.29	20.06
28. Manketo	44 08	94 02	2	..	..	..	..	..	..	..	69.58	..	..	..	..
29. Minneapolis	44 58	93 15	856	9.89	14.58	21.47	41.94	56.96	67.10	71.25	66.68	58.92	44.71	32.35	14.13
30. New Ulm	44 19	94 30	821	11.25	16.52	22.79	43.50	59.34	69.58	74.73	70.67	62.29	47.49	34.65	16.12
31. Pembina	48 58	97 02	900	7.84	18.54	18.19	36.73	52.78	66.85	74.47	69.93	..	..	..	..
32. Princeton	45 34	93 38	..	8.96	13.33	31.54	36.47	56.32	67.28	73.88	67.98	58.65	45.36	27.39	12.35
33. Red Lake	48 30	95 30	..	..	..	..	38.37	..	..	..	..	..	..	..	..
34. Red Wing	44 33	92 30	800	9.25	17.90	16.75	40.26	46.70	68.10	71.17	72.87	..	..	33.05	10.86
35. St. Anthony's Falls	45 00	93 15	820	5.09	19.00	30.72	45.62	57.31	64.33	73.61	70.40	58.75	51.63	38.78	25.22
36. St. Cloud	45 39	94 12	..	8.72	8.57	21.58	34.58	58.88	69.00	68.88	66.11	52.43	..	..	..
37. St. Joseph	48 55	98 00	..	—1.18	6.33	20.62	43.16	52.28	65.77	68.30	66.63	54.68	45.19	25.01	13.35
38. St. Paul	44 56	93 05	800	11.37	16.94	23.06	43.04	57.47	66.65	70.64	66.81	58.30	44.09	32.55	16.96
39. Sandy Lake	45 46	93 01	1300	13.93	17.08	29.68	38.23	50.15	60.94	67.69	65.47	58.10	43.36	22.83	9.70
40. Sauk Centre	45 43	94 56	1125	12.80	..	..	..	..	..	..	..	..	..	..	..
41. Sections 17 & 22[3]	45 43	95 30	..	7.90	10.38	28.43	41.39	60.90	..	..	..	..	..	..	11.03
42. Sibley	44 30	94 12	..	8.89	13.37	19.54	41.87	58.24	68.13	72.79	68.36	59.68	45.33	32.89	15.00
43. Stillwater	45 04	92 45	756	..	..	..	..	..	..	..	..	..	..	28.34	..
44. Tamarack[4]	44 58	93 38	..	11.98	21.88	26.90	46.18	57.00	70.92	..	..	..	..	..	20.17
45. Travers des Sioux	44 21	94 00	1500	..	..	..	43.02	..	..	72.57	..	..	..	..	..
46. Wabashaw	44 30	92 15	850	21.58	11.29	35.80	..	56.64	70.47	72.16	71.76	..	..	..	25.83
47. White Bear Lake	45 37	95 30	..	2.73	..	19.20	..	..	..	..	..	..	..	..	3.67
48. White Earth	47 40	96 20	1670	3.50	10.35	21.43	..	..	..	..	..	56.83	33.88	23.75	13.78
49. Zapham	46 10	96 00	850	15.95	5.04	..	..	..	67.01	69.86	..	..	..	24.02	15.21

MISSISSIPPI.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Academus, P. H.	32	89	..	..	52.48	58.62	..	75.65	..	..	..	..	..	..	..
2. Bay of St. Louis	30 20	89 18	20	..	..	..	68.80	78.76	78.92	82.23	81.48	77.80	..	..	..
3. Brookhaven[5] (near)	31 34	90 24	430	48.96	51.07	58.14	64.36	70.75	77.25	80.23	79.93	73.32	62.76	54.30	46.20
4. Clinton	32 20	90 20	..	..	..	..	..	..	..	..	..	..	..	..	43.95
5. Columbus	33 31	88 28	227	43.29	47.83	53.59	62.66	70.28	77.21	80.27	79.21	73.52	60.81	52.15	45.37
6. Early Grove	35 00	90 00	484	..	..	..	..	..	..	..	..	..	..	..	36.80
7. East Pascagoula	30 20	88 33	10	..	..	..	..	76.96	81.95	83.93	83.78	80.04	69.95	60.94	..
8. Enterprise[6]	32 12	88 50	285	50.88	51.50	54.60	62.63	73.83	79.25	85.50	84.00	75.63	65.88	54.26	40.80
9. Fayette	31 43	91 07	..	45.55	55.93	51.93	61.98	67.93	74.67	75.34	75.65	73.10	59.18	51.77	46.66
10. Garlandsville	32 14	89 06	..	48.54	49.53	61.11	69.69	77.71	83.00	85.63	87.10	82.77	69.97	56.05	49.36
11. Grenada	33 48	89 50	..	44.41	47.57	54.38	62.54	67.36	76.11	80.31	79.34	73.70	62.54	55.44	46.87
12. Hernando	34 48	90 00	275	..	..	..	..	..	..	..	..	..	59.18	56.87	35.46
13. Holly Springs	34 45	89 25	..	..	55.02	60.87	62.83	70.46	79.15	81.91	80.65	73.63	62.50	..	..
14. Jackson	32 29	90 12	350	46.86	52.60	58.64	62.06	71.25	75.95	79.57	80.43	75.09	63.43	55.41	48.44
15. Kingston	31 24	91 26	..	48.64	59.67	55.33	..	..	..	..	..	..	64.31	..	50.23
16. Lake Washington	33 00	91 06	..	..	50.18	62.19	63.35	72.90	77.33	81.73	81.27	..	..	..	..
17. Marion C. H.	32 25	89 46	168	48.15	48.67	55.50	63.97	72.65	79.00	79.33	82.10	74.48	60.48	55.38	49.25
18. Monticello	31 34	90 04	600	48.53	51.63	..	..	..	81.85	83.95	79.95	73.05	62.80	52.95	47.23
19. Natchez	31 34	91 27	264	48.89	52.35	58.59	65.80	72.07	78.62	80.89	79.93	75.73	64.94	55.70	50.04
20. Natchez[7]	31 34	91 27	264	51.68	53.21	60.49	69.25	74.05	80.23	81.76	80.97	76.86	66.10	57.29	50.23
21. Oxford	34 23	89 29	300	36.03	39.05	48.30	67.03	73.54	76.06	79.24	..	74.63	61.94	54.64	42.78
22. Pass Christian	30 20	89 12	20	..	..	..	..	..	83.20	84.00	80.90	79.34	68.20	..	..
23. Paulding	32 02	89 03	215	47.84	53.48	59.57	66.32	74.75	80.42	81.91	81.55	76.73	69.03	56.01	50.94
24. Philadelphia	32 48	89 06	550	45.20	49.20	51.90	60.73	70.48	73.98	79.23	79.28	74.45	64.43	52.60	42.35
25. Port Gibson	31 59	91 00	..	38.05	53.77	56.69	56.60	..	..	..	81.03	72.86	64.41	54.16	46.62
26. Salem	31	89	..	..	..	..	76.13	81.79	..	..	..	..	..	..	..
27. Ship Island	30 12	88 57	15	58.40	56.91	67.27	70.48	..	..	..	86.70	..	74.40	66.20	64.82
28. Vicksburg	32 23	90 50	350	48.01	52.75	58.79	65.27	73.30	79.94	81.41	80.21	76.20	64.77	55.66	50.59
29. Westville	31 52	89 54	..	..	..	..	..	77.85	..	87.95	83.95	78.34	63.98	62.25	44.83

[1] Also called Hazelwood. [2] Altitude 50 feet above low water in Minnesota River. [3] Township 126 N., Range 38 W.
[4] The observations in 1864 were made on the North Arm of Lake Minnetonka, one mile west of Tamarack.

MINNESOTA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
24	41°.84	68°.91	43°.66	11°.80	41°.55	Feb. 1844;	Dec. 1859	6 5	$7_m\ 2_a\ 9_a$	Rev. S. R. Riggs.	P. O. and S. I. Vol. 1, MS. in S. Coll., and S. Coll.
25	..	..	..	0.10	..	Nov. 1856;	May, 1857	0 6	"	Rev. B. F. Odell.	P. O. and S. I. Vol. 1.
26	..	..	49.14	..	..	1870		0 6	$7_m\ 2_a\ 9_{a\ bis}$	H. L. Wadsworth.	S. O.
27	42.21	70.85	46.80	15.45	43.83	Jan. 1869;	Dec. 1870	2 0	"	W. W. Murphy.	" "
28	..	..	..	..	..	1864		0 1	"	W. Kilgore.	" "
29	40.12	68.34	45.33	12.87	41.67	Nov. 1864;	Dec. 1870	6 2	"	W. Cheney.	" "
30	41.88	71.66	48.14	14.63	44.08	Feb. 1864;	Dec. 1870	6 11	"	C. Roos.	" "
31	35.90	70.42	..	..	..	1851;	1853	0 9	$\odot_r\ 9_m\ 3_a\ 9_a$	Cavilur.	S. Coll.
32	41.44	69.71	43.80	11.55	41.63	Oct. 1856;	Aug. 1860	3 9	$7_m\ 2_a\ 9_{a\ bis}$	O. E. Garrison and S. M. Byers.	P. O. and S. I. Vol. 1, and S. O.
33	..	..	..	..	..	1853		0 1	$\odot_r\ 9_m\ 3_a\ 9_a$	Spencer.	S. Coll.
34	34.57	70.71	..	12.67	..	Nov. 1855;	Aug. 1867	0 11	$7_m\ 2_a\ 9_{a\ bis}$	Rev. J. Brooks and A. M. Stephens.	P. O. and S. I. Vol. 1, and S. O.
35	44.55	69.45	49.72	16.44	45.04	Mar. 1853;	Nov. 1854	1 8	$7_m\ 2_a\ 9_a$	Dr. C. L. Anderson.	P. O. & S. I. Vol. 1, and S. Coll.
36	38.35	68.00	..	..	..	May, 1860;	Feb. 1869	1 2	$7_m\ 2_a\ 9_{a\ bis}$	O. E. Garrison.	S. O.
37	38.69	66.90	41.63	6.17	38.35	Jan. 1854;	Feb. 1855	0 11	$7_m\ 2_a\ 9_a$	Rev. D. B. Spencer, A. A. Kellum.	P. O. and S. I. Vol. 1.
38	41.29	68.03	44.98	15.09	42.32	June, 1862;	Dec. 1870	8 5	$7_m\ 2_a\ 9_{a\ bis}$	Rev. A. B. Patterson & J. W. Heimstreet.	S. O.
39	39.35	64.70	41.43	13.57	39.76	1850;	1852	1 10	$\odot_r\ 9_m\ 3_a\ 9_a$	Holt and others.	S. Coll.
40	..	..	..	..	..	1869		0 1	$7_m\ 2_a\ 9_{a\ bis}$	S. Bloomfield.	S. O.
41	43.57	..	..	9.77	..	Apr. 1861;	May, 1862	0 8	"	O. E. Garrison.	" "
42	39.88	69.76	45.97	12.42	42.01	May, 1865;	Dec. 1870	5 7	"	C.W.&C.E.Woodbury.	" "
43	..	..	..	..	..	1858		0 1	$7_m\ 2_a\ 9_a$	A Van Vorhes.	P. O. and S. I. Vol. 1.
44	43.36	..	..	18.01	..	Apr. 1863;	June, 1864	0 9	$7_m\ 2_a\ 9_{a\ bis}$	Mary A. Grave.	S. O.
45	..	..	..	..	..	1849;	1851	0 2	$\odot_r\ 9_m\ 3_a\ 9_a$	Hopkins.	S. Coll.
46	..	71.46	..	19.57	..	Dec. 1857;	Aug. 1858	0 8	$7_m\ 2_a\ 9_a$	Rev. I. Z. Hillier.	P. O. and S. I. Vol. 1.
47	..	..	..	..	..	Dec. 1860;	Mar. 1861	0 3	$\odot_r$ N. $\odot_s$	O. E. Garrison.	S. O.
48	..	..	38.15	9.21	..	Sept. 1869;	Mar. 1870	0 7	$7_m\ 2_a\ 9_{a\ bis}$	Dr. D. Pyle.	" "
49	..	..	..	12.07	..	Nov. 1857;	Dec. 1858	0 8	$7_m\ 2_a\ 9_a$	E. M.Wright, S Locke, and F. McMullin.	P. O. and S. I. Vol. 1.

MISSISSIPPI.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1853		0 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Robinson.	S. Coll.
2	..	80.88	..	..	..	July, 1833;	Sept. 1835	1 0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
3	64.42	79.14	63.46	48.74	63.94	Jan. 1868;	Dec. 1870	3 0	$7_m\ 2_a\ 9_{a\ bis}$	T. J. R. and Mrs. W. E. A. Keenan.	S. O.
4	..	..	..	..	..	1870		0 1	"	R. S. Jackson.	" "
5	62.18	78.90	62.16	45.50	62.19	Jan. 1855;	Dec. 1870	15 9	"	J. S. Lull.	P. O. and S. I. Vol. 1, and S. O.
6	..	..	..	..	..	1870		0 1	"	W. M. Abernethy.	S. O.
7	..	83.22	70.31	..	..	Aug. 1848;	Aug. 1853	1 11	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
8	63.69	82.92	65.26	47.73	64.90	1870		0 11	$7_m\ 2_a\ 9_{a\ bis}$	E. S. Robinson.	S. O.
9	60.61	75.22	61.35	49.38	61.64	Nov. 1866;	Dec. 1870	1 2	"	Rev. T. H. Cleveland.	" "
10	69.50	85.24	69.60	49.14	68.37	Jan. 1854;	May, 1855	1 4	$7_m\ 2_a\ 9_a$	Rev. E. S. Robinson.	P. O. and S. I. Vol. 1.
11	61.43	78.59	63.89	46.28	62.55	Mar. 1853;	Dec. 1870	4 3	$7_m\ 2_a\ 9_{a\ bis}$	A. Moore & Waddell.	S. Coll., S. O., MS. from S. G. O.
12	..	..	..	..	..	1859		0 3	$7_m\ 2_a\ 9_a$	Dr. W. M. Johnston.	P. O. and S. I. Vol. 1.
13	64.72	80.57	..	..	..	Aug. 1867;	Sept. 1868	0 10	"	....	MS. from S. G. O.
14	63.98	78.65	64.64	49.30	64.14	1849;	Dec. 1855	4 2	$\odot_r\ 9_m\ 3_a\ 9_a$	A. R. Green, and Hatch & Co.	S. Coll., P. O. and S. I. Vol. 1.
15	..	..	..	52.85	..	Oct. 1866;	Mar. 1867	0 5	$7_m\ 2_a\ 9_{a\ bis}$	J. E. Smith.	S. O.
16	66.15	80.11	..	..	..	1854		0 7	$7_m\ 2_a\ 9_a$	Rev. J. A. Shepherd.	P. O. and S. I. Vol. 1.
17	64.04	80.14	63.45	48.69	64.08	Mar. 1868;	Mar. 1870	1 5	$7_m\ 2_a\ 9_{a\ bis}$	Dr. T. W. Florer.	S. O.
18	..	81.92	62.93	49.13	..	June, 1860;	Feb. 1861	0 9	"	Prof. J. R. Cribbs.	" "
19	65.49	79.81	65.46	50.43	65.30	Feb. 1799;	May, 1870	15 5	"	W. Dunbar, J. E. Smith, & R. McCary.	MS. in S. Coll., Phil. Trans. 1809, P. O. and S. I. Vol. 1, MS. from S. G. O., & S. O.
20	67.93	80.99	66.75	51.71	66.84	Jan. 1836;	June, 1851	14 3	6_m N. 6_a	Dr. H. Tooley.	MS. in S. Coll.
21	62.96	..	63.74	39.29	..	Sept. 1854;	June, 1856	1 9	$7_m\ 2_a\ 9_a$	Prof. L. Harper.	P. O. and S. I. Vol. 1.
22	..	82.70	..	..	..	July, 1843;	July, 1860	0 11	$\odot_r\ 9_m\ 3_a\ 9_a$	Rev. J. A. Shepherd and Assist. Surg.	MS. in S. Coll., Ar. Met. Reg. 1855.
23	66.88	81.29	67.26	50.75	66.55	Feb. 1858;	July, 1869	2 9	$7_m\ 2_a\ 9_a$	Rev. E. L. Robinson.	P. O. and S. I. Vol. 1, and S. O.
24	61.04	77.50	63.83	45.58	61.99	Feb. 1870;	Dec. 1870	0 10	$7_m\ 2_a\ 9_{a\ bis}$	Ida S. and Lucy A. Bowden.	S. O.
25	..	..	63.81	46.15	..	Aug. 1855;	Apr. 1857	0 11	$7_m\ 2_a\ 9_a$	Prof. J. B. Elliott.	P. O. and S. I. Vol. 1.
26	..	..	..	..	..	1849		0 2	$\odot_r\ 9_m\ 3_a\ 9_a$	Moore.	S. Coll.
27	..	..	..	60.04	..	Aug. 1867;	Apr. 1868	0 8	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
28	65.79	80.52	65.54	50.45	65.57	Dec. 1840;	May, 1870	8 11	"	N. Hatch.	Am. Alm. 1843 & fol., MS. from S. G. O., P. O. & S. I. Vol. 1, & S. Coll.
29	..	..	68.19	..	..	Dec. 1859;	May, 1860	0 7	"	J. R. Cribbs.	P. O. and S. I. Vol. 1, and S. O.

5 In 1868, the observations were made two miles southwest, and afterwards two miles east of Brookhaven.

6 Also called Fellowship.

7 The temperature recorded at 6 P. M., is probably too high, being nearly as high as at noon.

MISSOURI.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Allentown	38°29′	90°45′	..	27°.77	34°.36	40°.15	53°.15	62°.19	70°.44	75°.01	72°.37	64°.42	51°.04	42°.58	30°.64
2. Athens[1]	40 30	91 45	482	27.89	35.13	42.36	51.16	61.74	72.29	80 30	78.00	75.40	54.35	46.30	28.42
3. Bolivar	37 35	93 30	1000	36.45	37.85	41.25	57.63	66.23	72.05	78.10	81.10	68.75	53.00	47.60	34.17
4. Brunswick	39 24	93 05	..	40.25	42.50	47.00	63.50	67.50	73.00	81.00	77.50	70.00	55.50	41.25	47.25
5. Canton	40 07	91 34	..	18.75	28.83	..	48.48	56.79	75.75	79.33	77.60	..	..	..	..
6. Cape Girardeau	37 20	89 34	..	34.30	35.14	38.29	46.06	60.23	70.74	76.03	74.58	69.46	57.24	42.13	38.72
7. Carrollton	39 20	93 28	..	..	..	14.10	50.10	..	..	..	..	..	..	..	..
8. Cassville	36 41	93 56	..	36.00	42.60	49.94	58.70	66.04	75.09	80.65	76.74	67.61	57.87	46.66	32.59
9. Corning	40 17	95 33	[2]	..	..	..	54.43	..	..	..	71.40	67.55	54.53	42.60	26.87
10. Dundee	38 30	91 10	536	28.50	33.80	38.70	51.20	71.75	74.95	81.40	79.65	..	..	..	..
11. East Prairie	36 50	89 20	..	36.37	39.89	46.29	56.32	64.24	71.46	78.42	76.38	67.33	53.50	42.52	33.84
12. Easton	39 46	94 42	..	24.17	29.27	42.22	53.96	68.15	75.78	76.42	74.54	67.11	53.14	41.94	21.95
13. Edinburg	40 06	93 50	..	17.80	..	..	..	..	..	..	..	..	..	41.63	29.12
14. Hannibal	39 44	91 23	..	23.16	37.30	43.35	52.41	61.79	73.40	82.13	83.20	69.30	53.19	43.15	33.80
15. Harrisonville	38 38	94 25	..	26.55	33.57	37.65	52.96	63.64	72.19	77.08	74.11	67.11	53.00	41.87	28.57
16. Hematite	38 11	90 37	475	37.23	38.29	41.17	55.28	66.41	73.00	79.85	76.15	66.73	53.88	44.21	32.37
17. Hermitage	37 56	93 15	..	28.30	33.43	42.37	51.32	62.62	70.91	77.59	73.96	65.86	51.07	41.37	31.53
18. Hornersville	36 05	90 05	..	38.00	46.49	53.99	63.11	74.28	78.95	83.23	79.53	73.88	61.80	48.50	42.39
19. Jefferson Barracks	38 28	90 15	472	32.47	35.34	45.26	57.03	66.83	74.63	78.90	76.92	68.47	56.35	43.27	34.06
20. Jefferson City	38 35	92 16	650	30.18	35.01	41.34	53.33	66.50	73.49	80.79	76.41	65.39	52.74	42.78	30.27
21. Kansas City	39 05	94 40	710	31.90	38.53	41.00	57.05	66.48	72.38	78.85	74.23	67.68	55.35	45.05	29.28
22. Keysterville	39 27	93 03	..	..	..	..	..	62.37	69.45	74.88	77.25	..	44.80	..	..
23. Laborville	38 33	90 43	..	29.08	38.50	40.38	52.18	66.90	74.90	..	..	..	..	..	33.78
24. Oregon	39 59	95 09	1100	23.67	31.83	31.82	50.66	62.94	72.05	78.32	74.06	64.99	53.09	41.48	28.98
25. Palmyra, St. Paul's Coll.	39 47	91 37	..	..	..	..	39.90	57.00	71.99	76.87	71.69	67.42	58.20	36.90	23.22
26. Paris (near)	39 30	92 00	700	25.91	34.49	43.83	55.08	64.07	71.92	71.33	72.95	64.05	53.14	43.56	28.46
27. Rhineland	38 42	91 46	[4]	..	38.13	46.60	55.78	67.70	..	..	..	..	..	43.15	22.45
28. Rocheport	38 55	92 38	..	..	..	38.55	60.99	66.44	81.26	..	..	..	..	..	..
29. Rolla (3½ mil. W. of)	37 58	91 44	950	32.20	35.97	43.95	52.16	62.68	70.60	77.77	74.51	66.95	52.73	43.04	33.18
30. Springfield	37 12	93 12	..	38.86	30.80	48.50	54.74	..	..	74.16	70.88	71.07	53.57	40.89	40.11
31. St. Joseph	39 45	94 53	..	33.14	35.42	38.52	56.36	63.53	70.99	77.14	76.09	67.09	50.88	35.38	34.39
32. St. Louis[5]	38 37	90 12	481	31.06	34.59	43.40	56.33	65.55	74.17	78.13	76.05	68.55	55.16	43.94	33.05
33. Stockton	37 43	93 48	800	..	42.44	52.68	63.45	72.53	..	85.90	75.79	68.24	52.75	46.87	26.39
34. Tower Grove	38 36	90 20	500	27.87	33.11	42.12	54.03	63.48	70.35	75.09	75.59	67.03	53.65	41.60	37.96
35. Union	38 25	91 07	616	27.67	34.74	37.59	56.73	61.21	73.07	79.28	72.20	61.63	54.23	44.68	33.62
36. Warrensburg	38 45	93 40	600	33.88	33.43	38.10	53.85	65.23	71.90	80.99	77.22	64.98	56.08	41.93	25.93
37. Warrenton	38 50	91 15	[6]	30.79	33.90	43.12	55.64	64.24	72.87	77.69	75.37	66.27	53.33	41.35	31.64
38. Wyaconda Prairie	40 12	91 37	..	23.76	28.59	36.33	48.81	63.83	71.44	76.82	72.99	67.24	49.82	38.57	26.57

MONTANA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Baton City	..	..	..	..	27.88	..	..	..	..	..	..	..	..	..	..
2. Camp Baker	..	..	..	..	..	..	..	..	..	..	..	..	39.12	..	..
3. Camp Cook	47 48	109 38	..	15.20	21.76	25.24	47.64	60.28	68.62	72.36	71.48	56.31	47.75	35.37	21.09
4. Cantonment Stevens	46 16	114 00	3412	13.3	31.2	39.4	48.3	56.3	64.2	71.9	72.6	56.7	45.9	34.1	30.2
5. Deer Lodge City	46 26	112 32	4240	20.63	25.00	26.80	43.43	54.00	61.83	65.41	58.52	50.72	37.02	33.50	21.05
6. Fort Benton.	47 50	110 39	2730	19.43	29.67	23.13	52.91	58.05	71.65	77.60	64.19	62.20	48.15	35.81	26.33
7. Fort C. F. Smith	45 20	107 56	..	18.43	26.62	25.47	48.43	55.29	68.52	73.03	77.80	61.38	53.88	45.35	31.39
8. Fort Ellis	45 32	111 12	4800	23.26	29.48	28.43	44.00	58.20	65.60	69.65	64.64	54.61	43.23	35.97	25.44
9. Fort Shaw	47 30	111 42	6000	18.26	30.63	31.63	48.95	55.98	66.12	71.10	65-28	57.21	47.33	38.67	27.33
10. Port Union	48 03	104 00	2000	12.29	21.44	28.54	50.87	53.78	65.84	..	67.50	56.80	45.30	26.20	..
11. Helena City	46 37	112 00	4150	11.21	20.96	21.98	37.95	41.35	56.80	78.05	76.00	57.70	48.18	40.95	25.30
12. Missoula	46 45	113 45	3300	..	..	..	..	..	..	..	..	..	..	36.63	20.45

[1] This series is considered not very reliable.

[2] Altitude 25 feet above high water in Missouri River.

[3] Observations corrected for daily variation.

MISSOURI.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	51°.83	72°.61	52°.68	30°.92	52°.01	Apr. 1864;	Dec. 1870	6 2	$7_m\ 2_a\ 9_a$ bis	A. Fendler.	S. O.
2	51.75	76.86	58.68	30.48	54.44	Mar. 1863;	July, 1866	2 4	"	J. T. Caldwell.	" "
3	55.04	77.08	56.45	36.16	56.18	Dec. 1868;	Jan. 1870	1 2	"	J. A. Race.	" "
4	59.33	77.17	55.58	43.33	58.85	1845		1 0	$8_m\ 2_a$	Blue.	Pat. Off. Rep.
5	..	77.56	..	..	..	May, 1867;	Apr. 1868	0 7	$7_m\ 2_a\ 9_a$ bis	G. P. Ray.	S. O.
6	48.19	73.78	56.28	36.05	53.58	Oct. 1856;	Jan. 1858	1 0	$\odot_r\ 9_m\ 3_a\ 9_a$	Rev. J. Knoud.	P. O. and S. I. Vol. I.
7	..	..	..	..	..	1860		0 2	$\odot_r\ \odot_s$	O. J. Kerby.	S. O.
8	58.23	77.49	57.38	37.06	57.54	Aug. 1859;	June, 1861	1 7	$7_m\ 2_a\ 9_a$ bis	M. S. Wyzick.	P. O. and S. I. Vol. I, and S. O.
9	..	..	..	54.89	..	1870		0 6	"	H. Martin.	S. O.
10	53.88	78.67	..	..	..	1860		0 8	"	S. S. Bailey.	" "
11	55.62	75.42	54.45	36.70	55.55	Jan. 1868;	Dec. 1870	3 0	[3]	A. Miller.	" "
12	54.78	75.58	54.06	25.13	52.39	Sept. 1864;	Nov. 1866	1 8	$7_m\ 2_a\ 9_a$ bis	P. B. Sibley.	" "
13	..	..	..	..	..	Nov. 1866;	Jan. 1867	0 3	"	J. E. Vertrees.	" "
14	52.52	79.58	55.21	31.42	54.68	Mar. 1853;	Nov. 1854	1 5	"	O. H. P. Lear.	P. O. and S. I. Vol. I, and S. O.
15	51.42	74.46	53.99	29.56	52.36	June, 1863;	Sept. 1870	7 2	"	J. Christian.	S. O.
16	54.29	76.33	54.94	35.96	55.38	Apr. 1868;	Dec. 1870	2 9	"	J. M. Smith.	" "
17	52.10	74.15	52.77	31.09	52.53	Sept. 1867;	Dec. 1869	2 3	"	Dr. W. and Miss Isabella Moore.	" "
18	63.79	80.57	61.39	42.29	62.01	Jan. 1860;	Apr. 1861	1 2	"	W. Horner.	" "
19	56.37	76.82	56.03	33.96	55.79	Jan. 1827;	July, 1862	32 11	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
20	53.72	76.90	53.64	31.82	54.02	Feb. 1868;	Dec. 1870	2 8	$7_m\ 2_a\ 9_a$ bis	N. De Wyl.	S. O.
21	54.84	75.15	56.03	33.24	54.82	Feb. 1870;	Dec. 1870	0 11	"	S. W. Salisbury.	" "
22	..	73.86	..	..	..	1869		0 5	"	C. Veatch.	" "
23	53.15	..	..	33.79	..	Dec. 1863;	June, 1864	0 7	"	W. Meier.	" "
24	48.47	74.81	53.19	28.16	51.16	Jan. 1867;	Dec. 1870	3 11	"	W. Kaucher.	" "
25	..	73.52	54.17	..	..	June, 1856;	Sept. 1857	1 1	$\odot_r\ 9_m\ 3_a\ 9_a$	G. P. Comings.	P. O. and S. I. Vol. I.
26	54.33	72.07	53.58	29.62	52.40	Aug. 1859;	Jan. 1862	1 11	$7_m\ 2_a\ 9_a$ bis	W. F. Maxey.	P. O. and S. I. Vol. I, and S. O.
27	56.69	..	..	..	..	Nov. 1859;	May, 1860	0 6	"	C. Vogel.	" " " " "
28	55.33	..	..	..	..	1856		0 4	$7_m\ 2_a\ 9_a$	Dr. C. Q. Chandler.	P. O. and S. I. Vol. I.
29	52.93	74.29	54.24	33.78	53.81	May, 1867;	Dec. 1870	3 8	$7_m\ 2_a\ 9_a$ bis	H. Ruggles.	S. O.
30	..	..	55.18	36.59	..	July, 1857;	Apr. 1858	0 10	$\odot_r\ 9_m\ 3_a\ 9_a$	J. A. Stephens.	P. O. and S. I. Vol. I.
31	52.80	74.74	51.12	34.32	53.24	May, 1857;	Aug. 1870	2 1	$7_m\ 2_a\ 9_a$ bis	E. B. Neeley and H. Bullard.	P. O. and S. I. Vol. I, and S. O.
32	55.09	76.12	55.88	32.90	55.00	Jan. 1830;	Dec. 1870	41 0	[3]	Drs. G. Engelmann, A. Wislizenus, B. B. Brown, A. Fendler, J. H. Lüneman, and others.	Ar. Met. Regs. 1855 and 1860, MS. in S. Coll., St. Louis Med. & Surg. Journ., Trans. St. Louis Acad. Sci., S. O. P. O. and S. I. Vol. I, and Sill Journ.
33	62.89	..	55.95	..	..	Aug. 1859;	Feb. 1861	1 0	$7_m\ 2_a\ 9_a$ bis	W. Wells.	P. O. and S. I, Vol. I, and S. O.
34	53.21	73.68	54.09	32.98	53.49	Jan. 1861;	Jan. 1864	2 5	"	A. Fendler.	S. O.
35	51.84	74.85	53.51	32.01	53.05	Mar. 1866;	June, 1867	1 4	"	Dr. W., and Miss I. Moore.	" "
36	52.39	76.70	54.33	31.08	53.63	July, 1868;	Aug. 1869	1 2	"	J. E. Pollock.	" "
37	54.33	75.31	53.65	32.11	53.85	Oct. 1859;	July, 1863	3 11	"	M. A. Tidswell and M. F. Hamacker.	P. O. and S. I. Vol. I, and S. O.
38	49.66	73.75	51.88	26.31	50.40	Mar. 1862;	Dec. 1868	5 2	"	G. P. Ray.	S. O.

MONTANA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1868		0 1	$7_m\ 2_a\ 9_a$ bis	Dr. H. M. Lehman.	S. O.
2	..	..	..	..	..	1870		0 1	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
3	44.39	70.82	46.48	19.35	45.26	Sept. 1866;	Sept. 1869	2 10	"	" "	" " "
4	48.00	69.57	45.57	24.90	47.01	1853;	1854	1 0	......	Burr.	Blodget's Climatology.
5	41.41	61.92	40.41	22.23	41.49	Jan. 1869;	Dec. 1870	2 0	$7_m\ 2_a\ 9_a$ bis	G. Stuart.	S. O.
6	44.70	71.15	48.72	25.14	47.43	Nov. 1869;	Dec. 1870	1 2	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
7	43.06	73.12	53.54	25.48	48.80	Sept. 1866;	June, 1868	1 10	"	" "	" " "
8	43.54	66.63	44.60	26.06	45.21	Aug. 1868;	Dec. 1870	2 5	"	" "	" " "
9	45.22	67.50	47.74	25.41	46.47	Sept. 1867;	Dec. 1870	3 4	"	" "	" " "
10	44.40	..	42.77	..	..	Jan. 1854;	Jan. 1858	0 11	"	E. T. Denig, F. G. Riter.	P. O. and S. I. Vol. I.
11	33.76	70.28	48.94	19.16	43.04	Jan. 1866;	Mar. 1868	1 7	$7_m\ 2_a\ 9_a$ bis	A. C. Wheaton.	S. O.
12	..	..	..	..	..	1870		0 2	"	J. M. Minnesinger.	" "

[4] Altitude 300 feet above Missouri River.
[5] This series includes observations at the St. Louis Arsenal, from Jan. 1843, to Dec. 1856.
[6] Altitude 825 feet above the Gulf.

NEBRASKA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Bellevue	41°08′	95°55′	..	21°.80	26°.84	37°.05	48°.81	61°.79	71°.05	76°.02	72°.65	65°.10	50°.42	37°.65	25°.20
2. Brownville	40 24	95 40	..	28.02	26.92	42.89	..	64.18	74.51	79.56	76.53	66.97	53.89	32.70	24.67
3. Dakota	42 25	96 25	1090	17.11	24.35	35.56	44.76	63.32	68.20	74.32	73.99	..	50.59	36.35	22.42
4. Decatur	42 00	96 16	[1]	..	..	30.95	46.98	60.15	66.18	71.60	..	..	..	..	..
5. De Sota	41 31	96 05	1100	17.29	24.18	28.11	46.63	60.66	70.06	75.11	70.69	60.67	48.20	36.05	23.26
6. Fontanelle	41 32	96 27	1000[2]	16.90	22.74	29.85	45.90	59.78	71.16	72.77	71.61	61.81	45.23	33.65	23.44
7. Fort Calhoun[3]	41 30	96 02	1327	18.95	26.64	36.90	51.74	64.16	74.15	76.34	76.20	65.48	52.77	37.33	22.06
8. Fort Childs	40 40	99 41	..	7.71	17.50	..	..	..	..	..	..	..	..	..	..
9. Fort Kearney[4]	40 38	98 57	2360	19.99	25.57	34.70	46.92	57.96	69.89	75.01	72.34	62.57	50.51	34.71	20.17
10. Fort McPherson	41 00	100 30	..	28.72	34.14	37.03	49.66	63.45	71.63	79.97	74.68	63.88	51.64	40.94	30.82
11. Glendale, near	40 55	96 05	1010	16.56	23.65	29.91	46.82	59.03	68.94	75.87	71.99	59.95	48.14	34.95	23.41
12. Ionia	42 41	96 50	2500	..	..	..	..	..	..	..	73.03	..	..	..	..
13. Lincoln	40 50	96 45	1647	..	..	..	51.16	..	..	..	..	..	..	..	..
14. Nebraska City	40 41	95 51	1005	..	..	..	..	64.07	71.45	78.88	74.95	63.23	51.53	39.39	16.03
15. Nebraska City	40 41	95 51	1225	25.83	29.81	36.31	53.92	63.50	72.06	77.78	72.48	64.43	50.32	37.95	25.28
16. New Castle	42 37	96 47	800	..	..	..	..	..	70.80	78.15	68.15	62.48	..	36.00	29.20
17. Nursery Hill	40 40	96 13	1266	21.63	29.45	32.05	45.70	63.38	..	..	..	..	..	..	..
18. Omaha[5]	41 15	95 56	1300	20.07	28.23	33.41	48.42	63.37	72.11	76.99	73.67	64.10	49.59	39.60	21.79
19. Omaha Agency[6]	42 07	96 22	..	21.54	27.81	34.37	48.60	63.99	70.47	78.19	72.76	62.73	51.20	38.78	26.85
20. Peru	40 29	95 45	1000	27.70	30.35	33.18	..	..	69.94	..	..	..	..	..	..
21. Richland[7]	41 22	96 16	1350	17.26	23.82	31.63	45.91	61.77	70.87	75.08	72.42	62.86	49.02	35.09	21.41
22. Rock Bluff	40 56	95 50	1100	..	28.20	..	..	..	..	..	..	..	55.70	36.57	22.13

NEVADA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Camp Halleck	40 42	115 30	5600	24.49	28.57	37.03	46.23	53.09	63.95	69.73	69.19	58.82	47.34	38.65	29.46
2. Camp McDermit	41 58	117 40	4700	27.59	31.23	36.07	46.17	54.68	64.46	73.52	72.61	62.09	49.90	40.38	29.24
3. Camp McGarry	41 40	119 00	6000	21.82	27.25	27.65	39.47	46.77	54.38	63.77	66.23	56.65	47.56	38.02	26.44
4. Camp Winfield Scott	41 34	117 30	..	28.11	29.81	35.36	48.71	56.11	67.55	77.78	76.92	63.63	51.31	36.71	36.31
5. Fort Churchill	39 17	119 19	4284	32.08	35.57	43.84	52.55	60.95	70.75	78.37	76.41	67.61	53.00	42.47	35.99
6. Fort Ruby	40 01	115 35	5922	27.44	29.86	37.46	45.45	58.08	64.89	72.65	73.82	62.72	51.21	40.57	32.46
7. Star City	40 30	118 10	7500	..	..	..	..	..	..	..	..	..	49.73	43.18	20.65

NEW HAMPSHIRE.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Charlestown	43 15	72 23	..	..	..	..	41.97	..	..	69.96	68.11	..	45.67	..	26.51
2. Claremont	43 24	72 21	536	18.35	22.47	30.79	43.51	54.96	65.27	69.21	66.56	58.48	46.53	37.11	23.68
3. Concord	43 12	71 29	374	20.84	22.73	31.49	43.21	56.17	65.86	69.91	66.80	59.15	48.82	37.96	24.87
4. Contoocooksville	43 15	71 42	450	..	..	..	..	..	..	..	..	..	..	39.83	28.88
5. Dover	43 13	70 54	150	24.00	23.60	31.80	42.70	53.70	63.90	70.40	64.70	58.80	46.40	35.50	25.20
6. Dublin	42 54	72 03	1869	18.52	21.58	27.70	36.99	49.14	63.18	67.15	64.18	57.37	45.44	33.67	21.14
7. Dunbarton	43 06	71 35	750	27.74	24.78	30.08	42.60	54.54	66.44	72.84	70.25	61.20	48.89	36.65	26.38
8. Epping	43 03	71 05	..	..	..	..	..	..	..	..	..	..	..	..	..
9. Exeter	42 59	71 00	[8]	19.89	21.20	31.41	40.85	54.47	63.81	69.89	67.82	59.00	49.22	38.06	25.33
10. Farmington	43 22	71 07	300	22.20	..	..	..	..	..	..	..	..	..	..	..
11. Farmouth[9]	43 51	71 19	450	23.98	22.15	26.41	43.19	55.50	69.09	71.32	68.20	57.99	45.38	33.13	24.00
12. Fort Constitution	43 04	70 42	40	24.89	26.26	34.37	43.26	53.50	62.34	67.06	65.06	59.12	49.64	38.89	28.74
13. Francestown	42 59	71 48	..	18.58	24.29	30.08	42.00	53.50	64.09	69.32	68.15	59.45	47.09	38.19	29.46
14. Great Falls[10]	43 15	70 55	250	21.32	20.25	31.96	41.73	56.83	64.78	75.50	68.90	60.98	51.01	38.16	22.13
15. Hanover (Dartmouth Coll.)	43 42	72 17	530	16.24	15.47	26.15	37.66	52.53	61.69	65.68	63.34	55.55	44.30	32.31	17.08
16. Hanover[11]	43 42	72 17	530	17.62	18.89	29.10	40.10	53.40	62.70	67.15	65.60	56.33	44.18	33.76	20.99
17. Keene	42 56	72 16	..	..	..	..	41.20	54.60	..	68.79	70.40	..	44.80	31.20	25.50

[1] 35 feet above Missouri River. [2] 1025 feet in 1868–69. [3] Old Council Bluffs.

[4] Observations for 1849–54 at $\odot_r$ 9_m 3_a 9_a; they were referred to 7_m 2_a 9_a by means of the general table.

[5] Observations from Jan. 1859 to July, 1860, at "Pioneer Grove," near Omaha, to the northwest, at an elevation of 1400 feet. Observations for Nov. and Dec. 1868, at an elevation of 900 feet; for 1869–70 at "Omaha Barracks."

NEBRASKA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	49°.22	73°.24	51°.06	24°.61	49°.53	June, 1857;	Dec. 1870	12 4	$7_m 2_a 9_a$ bis	W. Hamilton and E. E. Caldwell.	P. O. and S. I. Vol. 1. and S. O.
2	..	76.87	51.19	26.54	..	May, 1858;	Oct. 1859	1 2	$7_m 2_a 9_a$	C. B. Smith.	P. O. and S. I. Vol. 1.
3	47.88	72.17	..	21.29	..	Oct. 1867;	Aug. 1869	1 7	$7_m 2_a 9_a$ bis	H. H. Brown.	S. O.
4	46.03	..	..	..	..	1869		0 5	"	Dr. S. C. Case.	" "
5	45.13	71.95	48.31	21.58	46.74	Apr. 1867;	Dec. 1870	3 8	"	C. Seltz.	" "
6	45.18	71.85	46.90	21.03	46.24	Jan. 1859;	Nov. 1869	2 8	"	J. Evans, H. Gibson.	P. O. and S. I. Vol. 1, and S. O.
7	50.93	75.56	51.86	22.55	50.23	Jan. 1820;	Dec. 1826	7 0	$7_m 2_a 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
8	..	..	..	..	..	1849		0 2	$\odot_r 9_m 3_a 9_a$	" "	S. Coll.
9	46.53	72.41	49.26	21.91	47.53	Jan. 1849;	Jan. 1868	15 11	$7_m 2_a 9_a$	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
10	50.05	75.43	52.15	31.23	52.21	Nov. 1866;	Dec. 1870	3 5	"	" "	MS. from S. G. O.
11	45.25	72.27	47.68	21.21	46.60	Aug. 1861;	Oct. 1869	4 0	$7_m 2_a 9_a$ bis	Dr. A. L. & J. E. Child.	S. O.
12	..	..	..	..	..	1865		0 1	"	L. T. Hill.	" "
13	..	..	..	..	..	1870		0 1	"	Dr. G. A. Goodrich.	" "
14	..	75.09	51.38	..	..	1859		0 8	$7_m 2_a 9_a$	E. E. Mason.	P. O. and S. I. Vol. 1.
15	51.24	74.11	50.90	26.97	50.81	July, 1868;	Dec. 1870	2 3	$7_m 2_a 9_a$ bis	P. Zahner.	S. O.
16	..	72.37	..	..	..	1870		0 6	"	L. H. Smith.	" "
17	47.04	..	..	..	..	1865		0 5	"	R. O. Thompson.	" "
18	48.40	74.26	51.10	23.36	49.28	June, 1858;	Dec. 1870	4 0	$7_m 2_a 9_a$	J. T. Allan, W. N. Byers, Assis. Surg., J. G. Rain, C. B. Wells.	P. O. and S. I. Vol. 1, S. O., and MS. from S. G. O.
19	48.99	73.81	50.90	25.40	49.77	Aug. 1867;	Dec. 1870	3 1	$7_m 2_a 9_a$ bis	W. Hamilton.	S. O.
20	..	..	..	..	..	June, 1867;	June, 1869	0 5	"	J. M. McKenzie.	" "
21	46.44	72.79	48.99	20.83	47.26	June, 1858;	Mar. 1870	11 3	"	J. S. & A. M. J. Bowen.	P. O. and S. I. Vol. 1, and S. O.
22	..	..	..	..	..	Oct. 1860;	Feb. 1861	0 4	$7_m 2_a 9_a$	H. C. Pardee.	S. O.

NEVADA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	45.45	67.62	48.27	27.51	47.21	Oct. 1867;	Dec. 1870	3 2	$7_m 2_a 9_a$	Assistant Surgeon.	MS. from S. G. O.
2	45.64	70.20	50.79	29.35	49.00	Dec. 1865;	Dec. 1870	4 8	"	" "	" " "
3	37.96	61.46	47.41	25.17	43.00	Nov. 1865;	Nov. 1868	2 10	"	" "	" " "
4	46.73	74.08	50.55	31.41	50.69	Dec. 1866;	July, 1870	3 6	"	" "	" " "
5	52.45	75.18	54.36	34.55	54.13	Oct. 1860;	May, 1869	7 10	"	" "	" " "
6	47.00	70.45	51.50	29.92	49.72	Jan. 1863;	Oct. 1868	5 3	"	" "	" " "
7	..	..	..	..	..	1865		0 3	$7_m 2_a 9_a$ bis	R. C. Johnson.	S. O.

NEW HAMPSHIRE.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1843;	1844	0 5	......	....	Manuscript.
2	43.09	67.01	47.37	21.50	44.74	Sept. 1857;	Nov. 1868	9 7	$7_m 2_a 9_a$ bis	F. A. Freeman, A. Chase, & S. O. Mead.	P. O. and S. I. Vol. 1, and S. O.
3	43.62	67.52	48.64	22.81	45.65	Jan. 1828;	May, 1870	22 2	$7_m 2_a 9_a$	J. C. Knox, J. Farmer, Dr. Prescott, H. E. Sawyer, J. T. Wheeler.	P. O. & S. I. Vol. 1, S. O., S. Coll., and Am. Alm. 1837 & foll.
4	..	..	..	..	..	1870		0 2	$7_m 2_a 9_a$ bis	E. D. Couch.	S. O.
5	42.73	66.33	46.90	24.27	45.06	Jan. 1833;	July, 1843	10 7	$\odot_r 1_a 10_a$	A. A. Tufts.	Am. Alm. 1836–7 and foll.
6	37.94	64.84	45.49	20.41	42.17	Jan. 1849;	Aug. 1853	4 8	$\odot_r 9_m 3_a 9_a$	Leonard.	S. Coll.
7	42.41	69.84	48.91	26.30	46.87	Mar. 1868;	Dec. 1870	2 10	$7_m 2_a 9_a$ bis	A. Colby.	S. O.
8	..	..	..	..	44.76	1833;	1834	2 0	......	Plummer.	Am. Alm.
9	42.24	67.17	48.76	22.14	45.08	1849;	May, 1863	6 11	$7_m 2_a 9_a$ bis	Rev. S. W. Leonard, E. Nason.	S. O. and S. Coll.
10	..	..	..	..	..	1861		0 1	......	L. Bell.	S. O.
11	41.70	69.54	45.50	23.38	45.03	Feb. 1867;	Dec. 1870	1 4	$7_m 2_a 9_a$ bis	A. Brewster.	" "
12	43.71	64.82	49.22	26.63	46.09	Jan. 1822;	Sept. 1853	25 2	$7_m 2_a 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
13	41.86	67.19	48.24	24.11	45.35	Mar. 1853;	May, 1858	2 3	"	A. H. Bixby, Dr. M. N. Root, & Sawyer.	P. O. & S. I. Vol. 1, & S. Coll.
14	43.15	69.73	50.05	21.23	46.13	1853;	Jan. 1857	1 2	"	G. B. & H. E. Sawyer, Titcomb.	" " " "
15	38.78	63.57	44.05	16.26	40.67	Nov. 1834;	Dec. 1854	4 0	$\odot_r 1\frac{1}{2}_a 9\frac{1}{2}_a$	Prof. I. Young, A. A. Young.	P. O. and S. I. Vol. 1, Am. Alm. 1837 and foll.
16	40.87	65.15	44.76	19.17	42.49	1835;	1854	20 0	"	Young.	Manuscript.
17	..	..	..	..	..	1843		0 7	$\odot_r 9_m 3_a 9_a$	Whalock.	" "

6 Observations for 1867 at "Blackbird Hills," a few miles to the southwest of the mission.

7 Also known as "Elkhorn City."

8 Nason gives altitude 125 feet above river bed.

9 Also called *Tamworth.*

10 This series is composed of observations at Great Falls by H. E. Sawyer, and at Salmon Falls, about two miles southeast of Great Falls, by G. B. Sawyer.

11 Observations from January, 1835, to December, 1837, probably included in preceding series.

NEW HAMPSHIRE.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
18. Littleton[1] . . .	44°20′	71°49′	..	17°.57	18°.40	24°.44	38°.62	52°.84	58°.91	66°.60	65°.81	55°.58	46°.60	33°.90	15°.09
19. Londonderry . .	42 53	71 20	300	22.64	24.38	31.89	43.48	56.21	66.36	71.69	68.41	61.09	50.61	38.87	26.91
20. London Ridge . .	43 20	71 25	475	23.70	30.77	38.45	49.18	62.23	67.20	74.08	72.85	70.25	..	42.28	33.03
21. Manchester . . .	42 59	71 28	300	23.84	26.38	34.06	45.01	64.34	67.54	72.94	69.67	62.11	51.09	40.22	27.48
22. Mason	42 45	71 45	..	29.10	31.70	30.15	43.60	..	66.10	68.80	67.90	..	..	..	26.20
23. Mt. Washington .	44 16	71 18	6285	..	..	..	..	..	43.58	49.39	47.68	..	..	..	..
24. North Barnstead[3] .	43 22	71 15	..	21.65	24.74	31.03	43.27	54.49	64.04	69.00	68.12	60.86	48.29	38.77	25.44
25. Portsmouth . . .	43 05	70 46	12	25.45	27.75	30.85	47.15	57.10	65.80	69.65	68.15	60.35	48.80	34.80	26.20
26. Portsmouth . . .	43 05	70 46	38	21.62	27.48	36.00	43.07	53.00	63.96	69.37	67.64	59.64	47.63	36.36	26.35
27. Salisbury . . .	43 23	71 45	..	18.83	20.32	31.42	42.15	..		..	..	61.55	47.43	36.27	27.30
28. Shelburne . . .	44 23	71 14	700	16.32	19.26	27.44	39.80	52.07	62.91	69.36	64.18	55.46	43.78	33.35	20.21
29. Stratford	44 40	71 39	1000	13.27	17.17	24.92	37.37	50.84	61.36	65.21	62.27	54.46	42.21	31.37	16.07
30. Wakefield . . .	43 34	71 07	..	28.00	28.80	39.25	49.80	61.20	73.40	79.40	77.20	67.60	52.80	44.20	31.80
31. West Enfield . .	43 38	72 07	..	20.10	20.11	27.25	39.07	51.77	63.86	68.73	65.48	58.26	45.58	31.86	19.53
32. Whitefield . . .	44 23	71 39	1332	22.50	16.35	24.18	43.65	53.23	64.48	67.61	62.42	57.68	43.43	31.36	21.73

NEW JERSEY.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Bloomfield[5] . . .	40 48	74 12	120	28.58	30.58	36.01	47.36	57.60	69.16	73.99	71.01	64.60	54.19	43.65	33.67
2. Branchburg Township[6]	40 36	74 44	..	27.35	34.40	33.78	..	59.78	75.25	76.40	72.30	64.40	51.68	48.00	30.85
3. Burlington . . .	40 04	74 51	60	28.87	31.39	39.10	49.85	60.17	70.09	74.57	71.36	65.54	54.43	44.46	33.39
4. Chester[7]	40 00	74 57	..	27.79	31.22	38.29	50.01	59.62	69.82	74.98	72.61	65.34	52.20	42.83	31.96
5. Dover	40 54	74 34	619	26.99	28.31	35.59	46.59	54.92	66.65	72.70	69.94	62.57	52.62	43.77	29.65
6. Elwood	39 34	74 42	..	26.08	23.91	39.80	46.40	56.23	67.90	76.85	72.48	65.88	51.55	43.08	28.70
7. Freehold	40 15	74 16	..	30.35	31.62	39.32	46.48	57.13	68.14	72.34	71.01	64.03	53.98	42.93	34.30
8. Greenwich . . .	39 24	75 20	30	30.97	33.94	39.68	51.53	60.43	71.00	75.74	73.02	66.73	53.71	44.19	34.50
9. Haddonfield . .	39 53	75 02	50	29.61	31.94	38.31	50.54	59.41	70.06	74.66	72.19	65.47	52.23	42.98	32.59
10. Lambertsville . .	40 23	74 57	96	29.55	29.85	37.90	48.86	60.20	70.16	75.09	72.14	64.40	51.60	42.30	32.57
11. Lesser Cross Roads	40 41	74 39	..	36.13	31.73	..	..	..	.	..	..	..	..	39.88	33.40
12. Long Branch . .	40 18	73 58	10	..	..	..	..	..	..	..	..	..	..	..	35.48
13. Middletown . . .	40 24	74 07	50	34.80	35.48	41.81	53.10	61.47	66.83	71.93	72.23	66.40	57.37	45.73	34.80
14. Moorestown . . .	39 58	74 57	104	29.18	..	46.41	62.17	68.03	74.74	72.69	65.16	..	..	..	32.70
15. Mount Holly . .	39 59	74 48	30	29.60	33.51	39.67	50.98	60.35	69.03	73.03	71.65	65.31	54.37	44.59	34.58
16. Navesink Highlands	40 24	73 59	111	29.50	36.45	38.20	47.88	54.23	67.23	70.30	..	..	..	..	..
17. Newark	40 44	74 10	35	31.63	25.90	34.45	45.62	56.31	66.01	70.51	69.04	60.71	49.86	39.92	29.05
18. Newark	40 44	74 10	35	29.36	30.65	37.40	48.28	57.91	67.51	72.93	70.61	63.60	52.31	43.22	32.25
19. New Brunswick .	40 30	74 27	90	27.12	29.46	35.67	50.11	58.36	68.30	74.07	71.09	63.66	51.90	41.99	30.93
20. Newfield	39 40	74 50	125	35.18	31.49	36.97	48.78	59.73	72.83	77.45	73.43	65.87	55.42	41.94	32.61
21. New Germantown .	40 41	74 45	320	32.59	30.63	32.88	49.87	58.89	70.11	73.06	71.62	64.41	50.54	39.09	29.59
22. New Stone . . .	40 40	75 00	..	..	..	..	..	59.05	71.50	73.30	73.65	..	..	..	..
23. Newton	41 04	74 45	659	28.71	28.71	30.83	47.34	55.96	64.78	69.40	..	..	..	..	..
24. Paterson	40 56	74 10	60	26.58	29.45	35.69	49.11	58.77	69.49	74.37	70.97	64.77	51.27	41.66	30.52
25. Rio Grande . . .	39 01	74 53	13	37.92	36.03	36.17	47.95	57.47	70.54	76.37	73.92	67.44	53.19	42.78	35.13
26. Seaville	39 11	74 45	18	26.26	37.35	40.17	51.16	53.38	70.98	76.72	74.48	69.69	53.54	44.48	28.36
27. Sergeantsville . .	40 27	74 57	..	28.54	31.39	38.65	43.02	60.42	69.61	74.86	76.45	71.17	62.83	43.46	36.62
28. South Orange . .	41 45	74 15	..	..	..	..	..	..	..	..	..	64.47	54.57	42.35	31.64
29. Trenton	40 14	74 45	60	31.80	33.11	39.24	52.08	60.05	70.55	75.21	73.33	66.22	54.20	44.29	33.06
30. Vineland . . .	39 29	75 01	119	33.51	31.23	37.83	49.53	59.77	72.99	78.60	74.70	66.41	53.12	42.57	31.76
31. Woodstown . . .	39 39	75 19	30	..	..	..	..	..	..	..	..	..	45.33	47.84	31.96

[1] This series is composed of observations at Littleton, by R. C. Whiting, and at North Littleton, about one mile north of Littleton, by R. Smith.

[2] The observing hours were $\odot_r$ 2_a. The observations were corrected for daily variation by means of the general table.

[3] Also called *Barnstead.*

[4] Observations corrected for daily variation by means of the general table.

[5] The observations in March, 1849, were made at Belleville, about three miles northeast of Bloomfield.

NEW HAMPSHIRE.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.	mos.	Observing hours.	Observer.	References.
18	38°.63	63°.77	45°.36	17°.02	41°.20	Mar. 1863;	July, 1864	1	5	$7_m\ 2_a\ 9_{a\ bis}$	R. C. Whiting, R. Smith.	S. O.
19	43.86	68.82	50.19	24.64	46.88	Mar. 1849;	Feb. 1857	5	10	$7_m\ 2_a\ 9_a$	R. C. Mack.	P. O. and S. I. Vol. 1, & MS.
20	49.95	71.38	..	29.17	..	Jan. 1862;	Feb. 1863	1	0	$7_m\ 2_a\ 9_{a\ bis}$	D. I. S. French.	S. O.
21	47.80	70.02	51.14	25.90	48.72	Jan. 1845;	Mar. 1860	14	1	$\odot_r\ 2_a\ \odot_s$	S. N. Bell.	P. O. & S. I. Vol. 1, S. Coll., & S. O.
22	..	67.60	..	29.00		Jan. 1806;	June, 1807	0	10	[2]	....	Med. and Agr. Reg. Bost. Vol. 1, 1806–7.
23	..	46.88	..	..	..	1853;	1859	0	3	$7_m\ 2_a\ 9_a$	J. S. Hall, Noyes.	P. O. & S. I. Vol. 1, & Print. Reg.
24	42.93	67.05	49.31	23.94	45.81	Feb. 1860;	Dec. 1868	8	8	$7_m\ 2_a\ 9_{a\ bis}$	C. H. Pittman.	S. O.
25	45.03	67.87	47.98	26.47	46.84	Feb. 1806;	Sept. 1807	1	5	[2]	C. Peirce.	Med. and Agr. Reg. Bost. Vol. 1, 1806–7.
26	44.02	66.99	47.88	25.15	46.01	Jan. 1839;	July, 1868	9	11	$\odot_r\ 9_m\ 3_a\ 9_a$	J. Hatch, Surg. Delaney and Chase.	MS. in S. Coll. and S. O.
27	..	..	48.42	22.15	..	Nov. 1861;	Oct. 1870	0	8	$7_m\ 2_a\ 9_{a\ bis}$	E. D. Couch.	S. O.
28	39.77	65.48	44.20	18.60	42.01	Dec. 1856;	May, 1869	6	9	[4]	F. Odell.	P. O. and S. I. Vol. 1, and S. O.
29	37.71	62.95	42.68	15.50	39.71	Aug. 1855;	Dec. 1870	13	4	$7_m\ 2_a\ 9_{a\ bis}$	W. B. G., B. G. & B. Brown, A. Wiggin.	" " " "
30	50.08	76.67	54.87	29.53	52.79	1846;	1850	5	0	N.	Dow.	Manuscript.
31	39.36	66.02	45.23	19.91	42.63	Sept. 1856;	Dec. 1858	2	3	$7_m\ 2_a\ 9_a$	N. Purmort.	P. O. and S. I. Vol. 1.
32	40.35	64.84	44.16	20.19	42.39	June, 1869;	Dec. 1870	1	7	$7_m\ 2_a\ 9_{a\ bis}$	L. D. Kidder.	S. O.

NEW JERSEY.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.	mos.	Observing hours.	Observer.	References.
1	46.99	71.39	54.15	30.94	50.87	Mar. 1849;	Dec. 1862	10	7	$7_m\ 2_a\ 9_a$	R. L. Cooke, and Merrick.	P. O. and S. I. Vol. 1, S. O., & S. Coll.
2	..	74.65	54.69	30.87	..	Nov. 1866;	Oct. 1870	1	1	$7_m\ 2_a\ 9_{a\ bis}$	J. Fleming, and W. T. Kerr.	S. O.
3	49.71	72.01	54.81	31.22	51.94	Mar. 1849;	Mar. 1868	13	3	"	Rev. A. Frost, Dr. E. R. Schmidt, and J. C. Deacon.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
4	49.31	72.47	53.46	30.32	51.39	May, 1863;	Dec. 1870	7	3	"	T. S. and T. J. Beans.	S. O.
5	45.70	69.76	52.99	28.32	49.19	Oct. 1866;	Jan. 1869	2	4	"	H. Shriver.	" "
6	47.48	72.41	53.50	26.23	49.91	Mar. 1868;	Nov. 1868	0	9	"	J. S. Tritts.	" "
7	47.64	70.50	53.65	32.09	50.97	Jan. 1857;	Feb. 1862	5	0	"	O. R. Willis.	P. O. and S. I, Vol. 1. and S. O.
8	50.55	73.25	54.88	33.14	52.95	Jan. 1864;	Dec. 1870	7	0	"	Rebecca C. Sheppard.	S. O.
9	49.42	72.30	53.56	31.38	51.67	Jan. 1864;	Dec. 1870	6	9	"	J. S. Lippincott, S. Wood, & J. Boadle.	" "
10	48.99	72.46	52.77	30.66	51.22	Jan. 1843;	Dec. 1859	17	0	$7_m\ 2_a\ 9_a$	L. H. Parson.	Am. Alm. 1845 & foll., MS. in S. Coll., & P. O. & S. I. Vol. 1.
11	..	..	..	33.75	..	Oct. 1869;	Feb. 1870	0	4	$7_m\ 2_a\ 9_{a\ bis}$	J. Fleming.	S. O.
12	..	..	..	..	..	1861		0	1	"	H. A. Stokes.	" "
13	52.13	70.33	56.50	35.03	53.50	June, 1831;	Mar. 1849	3	2	$7_m\ 2_a\ 9_a$	Colb and Jenkins.	Sill. Journ. and S. Coll.
14	58.87	70.86	..	..	..	July, 1849;	Aug. 1868	0	10	$7_m\ 2_a\ 9_{a\ bis}$	Miss E. E. Thornton & J. W. Lippincott.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
15	50.33	71.24	54.76	32.56	52.22	Jan. 1861;	Mar. 1868	7	1	"	Dr. M. J. Rhees.	S. O.
16	46.77	..	..	..	..	1861		0	7	"	Prof. L. Harper.	" "
17	45.46	68.52	50.16	28.86	48.25	1829;	1850	22	0	$\odot_r$ N.	....	Pat. Off. Rep. 1851.
18	47.86	70.35	53.04	30.75	50.50	May, 1843;	Dec. 1870	24	5	[8]	W. A. Whitehead.	MS. in S. Coll., printed slip, P. O. and S. I, Vol. 1, & S. O.
19	48.05	71.15	52.52	29.17	50.22	Mar. 1863;	May, 1870	6	1	$7_m\ 2_a\ 9_{a\ bis}$	G. W. Thompson, G. H. Cook, E. H. Bogardus, & J. E. Hasbrouck.	S. O.
20	48.49	74.57	54.41	33.09	52.64	Oct. 1867;	July, 1870	2	10	"	E. D. Couch.	" "
21	47.21	71.60	51.35	30.94	50.27	Oct. 1868;	Dec. 1870	2	2	"	A. B. Noll.	" "
22	..	72.82	..	..	..	1867		0	4	"	J. Fleming.	" "
23	44.71	..	..	..	..	1869		0	7	"	Dr. T. Ryerson.	" "
24	47.86	71.61	52.57	28.85	50.22	Oct. 1863;	Dec. 1870	6	8	"	W. Brooks.	" "
25	47.20	73.61	54.47	36.36	52.91	Apr. 1868;	Dec. 1870	2	5	"	Mrs. J. R. Palmer.	" "
26	48.24	74.06	55.90	30.66	52.21	Jan. 1865;	Apr. 1868	2	0	"	B. Cole.	" "
27	47.36	73.64	59.15	32.18	53.08	Jan. 1857;	Mar. 1858	1	3	$7_m\ 2_a\ 9_a$	J. T. Sergeant.	P. O. and S. I. Vol. 1.
28	..	..	53.80	..	..	1870		0	4	$7_m\ 2_a\ 9_{a\ bis}$	Dr. W. J. Chandler.	S. O.
29	50.46	73.03	54.90	32.66	52.76	Jan. 1840;	Dec. 1870	11	0	[8]	Dr. F. A. Ewing, and E. R. Cook.	Am. Alm. 1842 and S. O.
30	49.04	75.43	54.03	32.17	52.67	Aug. 1867;	Dec. 1870	3	5	$7_m\ 2_a\ 9_{a\ bis}$	Dr. J. Ingram.	S. O.
31	..	..	..	..	..	1859		0	3	$7_m\ 2_a\ 9_a$	G. Watson.	P. O. and S. I. Vol. 1.

[6] The observations composing this series were made at Branchburg Township, Mechanicsville, and Beadington, all within a radius of about three miles.
[7] The observations previous to 1865 were made at the junction of the Delaware and Rancocus Rivers, about four miles northwest of Chester.
[8] Observations corrected for daily variation by means of the general table.

NEW MEXICO.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Abiquin	36°15′	106°30′	6500	..	..	..	..	..	..	74°.06	70°.87	64°.86	53°.28	..	..
2. Albuquerque[1]	35 06	106 38	5032	32°.77	38°.19	47°.09	56°.07	65°.92	74°.24	78.36	76.22	68.80	56.88	43°.29	33°.39
3. Camp Cimarron	..	..	..	..	..	..	..	..	69.99	70.98	74.47	67.01	..	..	..
4. Camp Plummer	36 18	106 42	..	16.67	18.10	25.64	42.40	50.05	62.18	66.87	..	..	47.10	29.44	30.37
5. Camp Rio Mimbres	32 32	107 56	..	..	..	45.08	59.03	66.32	..	..	..	..	..	..	..
6. Cantonment Burgwin[2]	36 26	105 30	7900	21.81	28.97	37.55	45.92	54.45	65.48	68.52	64.62	56.32	46.72	32.18	20.89
7. Cebolleta	35 15	107 20	6200	32.90	35.93	44.50	51.36	61.65	72.52	77.45	75.65	68.45	59.06	41.03	30.49
8. Doña Ana	32 26	106 48	4000	..	..	..	..	69.89	78.94	82.22	81.50	..	..	..	..
9. El Paso	31 44	106 32	3830	45.75	49.25	60.36	74.31	77.92	87.36	88.53	87.06	85.22	70.00	..	38.37
10. Fort Bascom	35 24	103 50	..	36.21	45.41	53.25	61.26	75.03	77.83	81.23	81.83	77.43	60.74	54.27	41.66
11. Fort Bayard	32 46	108 30	4450	36.38	39.56	43.97	51.67	58.49	69.25	71.13	69.91	66.61	57.87	45.86	38.68
12. Fort Conrad	33 47	106 48	4576	36.26	41.99	51.31	60.87	66.70	74.21	79.06	77.04	69.99	58.20	43.60	38.40
13. Fort Craig[3]	33 36	107 00	4576	38.03	44.00	53.19	61.30	71.09	79.30	81.89	79.12	72.24	60.30	47.09	36.84
14. Fort Cummings	32 32	107 40	..	46.80	49.14	54.94	64.30	72.40	77.88	81.08	78.42	76.52	66.60	59.83	46.66
15. Fort Fauntleroy[4]	35 29	108 23	..	24.06	..	..	49.50	62.19	70.48	74.17	71.66	61.08	51.54	36.66	32.46
16. Fort Fillmore[5]	32 14	106 42	3937	43.57	48.10	55.42	63.90	72.30	81.78	82.95	81.65	76.33	65.82	51.18	43.67
17. Fort Lowell	36 39	106 40	..	19.91	20.95	33.65	41.07	..	..	..	61.93	54.69	44.25	31.19	20.44
18. Fort McRae	33 18	107 03	4500	38.53	40.41	49.47	61.70	72.13	78.53	81.37	78.03	73.80	61.43	48.59	38.73
19. Fort Selden	32 23	106 55	..	44.12	48.06	55.45	63.55	72.89	81.53	82.57	80.27	74.77	63.54	51.89	43.10
20. Fort Stanton	33 29	105 38	..	34.61	38.10	44.52	52.15	61.06	68.39	69.40	67.74	61.38	51.97	41.56	35.24
21. Fort Sumner	34 25	104 08	..	39.27	40.76	47.68	56.44	68.54	77.67	78.78	78.07	71.92	59.56	47.26	39.65
22. Fort Thorn[5]	32 40	107 09	4500	37.56	41.98	51.03	61.19	68.33	77.84	80.88	77.14	69.38	58.24	44.83	36.66
23. Fort Union[5]	35 54	104 57	6670	32.03	35.43	40.82	49.08	58.83	66.49	69.87	67.46	61.55	51.35	41.56	33.03
24. Fort Webster	32 43	108 10	6350	35.96	40.48	46.20	53.10	59.44	70.11	75.15	69.89	63.08	53.85	43.62	42.82
25. Fort West	33 00	108 39	..	..	..	53.22	57.64	67.56	77.34	77.44	77.05	..	45.80	..	..
26. Fort Wingate	35 30	107 45	..	30.14	36.57	43.48	50.47	60.58	69.43	73.80	70.87	64.19	54.63	41.05	31.68
27. Laguna	35 03	107 14	6000	38.91	46.24	..	..	..	..	..	..	..	57.43	46.38	40.10
28. Las Vegas	35 35	105 16	6418	33.36	31.20	37.23	47.07	56.41	67.82	71.41	73.01	66.47	48.88	32.98	21.73
29. Los Pinos	34 51	106 39	5000	33.07	39.78	50.49	56.18	67.20	75.96	79.72	76.45	60.53	55.83	41.31	33.16
30. Rayado	36 27	104 55	6000	..	..	..	..	61.62	71.48	..	..	..	..	..	..
31. Santa Fé[6]	35 41	106 02	6846	28.38	33.21	40.73	50.27	59.17	69.36	72.13	70.01	63.79	51.79	38.44	29.25
32. Socorro	34 05	106 50	4560	37.60	38.05	48.74	57.31	65.69	76.46	79.60	80.48	73.61	60.38	42.60	33.30

NEW YORK.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Adirondack	44 00	74 05	..	..	..	24.49	33.79	48.03	57.87	64.18	60.65	..	..	..	..
2. Albany	42 39	73 44	130	25.00	26.00	34.00	48.50	59.25	66.25	73.50	71.50	62.50	49.75	38.16	27.00
3. Albany	42 39	73 44	130	22.90	26.75	32.11	49.02	60.32	68.67	71.26	72.06	64.01	51.33	41.47	29.34
4. Albany	42 39	73 44	130	22.49	26.46	34.44	47.71	59.23	69.87	74.08	70.99	62.88	49.94	37.46	28.31
5. Albany (Academy)	42 39	73 44	130	24.37	24.72	35.03	47.74	60.06	68.13	72.24	70.17	61.38	49.48	39.16	28.40
6. Albany	42 39	73 44	130	24.14	28.94	34.35	44.00	56.31	66.60	71.78	67.75	59.44	51.42	39.09	27.75
7. Albany (Dudley Observatory)	42 40	73 45	..	21.71	23.33	30.43	45.22	58.08	69.31	74.36	70.50	61.49	47.68	37.59	25.54
8. Albany	42 39	73 45	75	23.38	28.00	38.50	56.80	..	..	72.65	72.90	70.26	50.78	44.35	37.10
9. Albany	42 39	73 44	130	23.29	24.88	33.68	46.87	59.06	68.26	72.90	70.13	61.26	48.97	38.44	27.60
10. Albion	43 14	78 14	505	32.85	31.34	40.26	48.48	58.71	67.08	72.26	70.81	62.35	53.76	42.47	34.80
11. Albion	43 14	78 14	505	31.80	29.21	35.46	43.17	56.32	69.05	73.14	70.90	62.77	50.04	43.37	30.47
12. Alexander	42 53	78 18	..	..	..	..	..	58.37	66.21	71.45	..	..	..	..	..
13. Alfred	42 15	77 50	..	17.19	24.44	29.40	..	..	..	..	..	..	..	..	..
14. Amenia	41 50	73 33	540	21.79	20.12	35.56	41.54	56.66	66.55	67.88	67.86	57.76	46.99	45.15	28.24
15. Angelica	42 18	78 03	1500	16.59	20.84	26.09	41.74	54.12	65.56	71.28	65.63	60.05	46.23	35.42	25.15
16. Auburn	42 55	76 35	650	24.37	25.08	33.51	45.26	54.84	64.47	69.38	68.23	59.45	48.23	37.75	29.54
17. Auburn	42 55	76 35	650	24.39	25.38	32.77	44.98	60.33	68.73	72.38	72.29	63.86	50.42	38.74	28.79
18. Auburn	42 55	76 35	650	23.65	24.44	32.92	44.81	55.98	65.58	70.75	68.97	59.75	47.83	37.33	29.55
19. Baldwinsville	43 09	76 20	..	22.62	24.69	30.39	42.09	53.75	64.17	68.79	66.03	59.08	47.29	37.72	26.76

[1] Observations for four years, Sept. 1849, to Dec. 1854, $\odot_r\ 9_m\ 3_a\ 9_a$; they were referred to $7_m\ 2_a\ 9_a$.

[2] Observations for May and June, 1850, at Taos. For seven months of the series, the observing hours were $\odot_r\ 9_m\ 3_a\ 9_a$; a correction was applied to refer them to $7_m\ 2_a\ 9_a$.

[3] Observations for nine months of 1854, at $\odot_r\ 9_m\ 3_a\ 9_a$; referred to $7_m\ 2_a\ 9_a$.

[4] Also known as Fort Lyon.

[5] Observations prior to 1855, at $\odot_r\ 9_m\ 3_a\ 9_a$; referred to $7_m\ 2_a\ 9_a$.

[6] From January, 1855, to September, 1867, inclusive, the observations were made at Fort Marcy, about one mile from Santa Fé. Previous to 1855, the observing hours were $\odot_r\ 9_m\ 3_a\ 9_a$; they have been referred to $7_m\ 2_a\ 9_a$.

NEW MEXICO.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1851	0 4	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
2	56°.36	76°.27	56°.32	34°.78	55°.93	Sept. 1849; July, 1867	14 5	$7_m\ 2_a\ 9_a$	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
3	..	71.81	..	..	..	1868	0 4	"	" "	MS. from S. G. O.
4	39.36	..	..	21.71	..	Oct. 1867; July, 1868	0 10	"	" "	" " "
5	56.81	..	..	..	..	1864	0 3	"	" "	" " "
6	45.97	66.21	45.07	23.89	45.29	May, 1850; Apr. 1860	5 11	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
7	52.50	75.21	56.18	33.11	54.25	Dec. 1849; Sept. 1851	1 10	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
8	..	80.89	..	..	..	1851	0 4	"	" "	" " "
9	70.86	87.65	..	44.46	..	Aug. 1850; Aug. 1851	1 0	"	" "	" " "
10	63.18	80.30	64.15	41.09	62.18	Feb. 1864; Oct. 1870	3 10	$7_m\ 2_a\ 9_a$	" "	MS. from S. G. O.
11	51.38	70.10	56.78	38.21	54.12	Mar. 1867; Dec. 1870	3 10	"	" "	" " "
12	59.63	76.77	57.26	38.88	58.14	Oct. 1851; Mar. 1854	2 6	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
13	61.86	80.10	59.88	39.62	60.37	Apr. 1854; Dec. 1870	13 10	$7_m\ 2_a\ 9_a$	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
14	63.88	79.13	67.65	47.53	64.55	Mar. 1869; Nov. 1870	1 9	"	" "	MS. from S. G. O.
15	..	72.10	49.76	..	..	Oct. 1860; Sept. 1861	0 10	"	" "	" " "
16	63.87	82.13	64.44	45.11	63.89	Sept. 1851; May, 1861	9 8	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
17	..	..	43.38	20.43	..	Aug. 1868; Apr. 1869	0 9	"	" "	MS. from S. G. O.
18	61.10	79.31	61.27	39.22	60.23	Mar. 1864; Dec. 1870	3 1	"	" "	" " "
19	63.96	81.46	63.40	45.09	63.48	Nov. 1865; Dec. 1870	4 8	"	" "	" " "
20	52.58	68.51	51.64	35.98	52.18	Aug. 1855; Dec. 1870	9 11	"	" "	Ar. Met. Reg. 1860, and MS. from S. G. O.
21	57.55	78.17	59.58	39.89	58.80	Apr. 1864; July, 1869	5 0	"	" "	MS. from S. G. O.
22	60.18	78.62	57.48	38.73	58.75	Jan. 1854; Jan. 1859	5 0	"	" "	Ar. Met. Regs. 1855 and 1860.
23	49.58	67.94	51.49	33.50	50.63	Aug. 1851; Dec. 1870	17 3	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
24	52.91	71.72	53.52	39.75	54.48	Feb. 1852; Dec. 1853	1 11	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
25	59.47	77.28	..	..	..	1863	0 7	$7_m\ 2_a\ 9_a$	" "	MS. from S. G. O.
26	51.51	71.37	53.29	32.80	52.24	Nov. 1862; Dec. 1870	7 7	"	" "	" " "
27	..	..	..	41.75	..	Oct. 1851; Feb. 1852	0 5	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
28	46.90	70.75	49.44	28.76	48.96	Jan. 1850; July, 1851	1 7	"	" "	" " "
29	57.96	77.38	52.56	35.34	55.81	Jan. 1863; May, 1866	2 9	$7_m\ 2_a\ 9_a$	" "	MS. from S. G. O.
30	..	..	..	..	..	1851	0 2	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.
31	50.06	70.50	51.34	30.28	50.54	Jan. 1849; Dec. 1870	18 6	$7_m\ 2_a\ 9_a$	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
32	57.25	78.85	58.86	36.32	57.82	Nov. 1849; Aug. 1851	1 9	$\odot_r\ 9_m\ 3_a\ 9_a$	" "	Ar. Met. Reg. 1855.

NEW YORK.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	35.44	60.90	..	..	..	1852	0 6	$6_m\ 2_a\ 10_a$	....	MS. in S. Coll.
2	47.25	70.42	50.14	26.00	48.45	Jan. 1795; Dec. 1796	1 11	max. & min.	De Witt.	" " "
3	47.15	70.66	52.27	26.33	49.10	Jan. 1813; Dec. 1814	2 0	$7_m\ 3_a\ 9_a$	Dr. Eyhts.	" " "
4	47.13	71.65	50.09	25.75	48.65	Jan. 1820; Dec. 1825	6 0	$7_m\ 2_a\ 9_a$	Dr. Beach.	" " "
5	47.61	70.18	50.01	25.83	48.41	Jan. 1826; Dec. 1849	24 0	[7]	Various observers.	N. Y. Univ. Syst. 1855.
6	44.89	68.71	49.98	26.94	47.63	Jan. 1850; Dec. 1852	3 0	$6_m\ 2_a\ 10_a$	....	MS. in S. Coll.
7	44.58	71.39	48.92	23.53	47.10	Jan. 1862; Dec. 1870	9 0	$8_m\ 7_a$	Various observers.	Annals of the Dudley Observ'y Vol. 2.
8	..	..	55.13	29.49	..	Jan. 1865; Apr. 1866	1 1	$7_m\ 2_a\ 9_a$ bis	H. M. Paine.	S. O.
9	46.54	70.43	49.56	25.26	47.95	Jan. 1795; Dec. 1870	45 11	[8]	Various observers.	Consolidated series.
10	49.15	70.05	52.86	33.00	51.26	1845; 1848	....	......	McHarf.	Dove.
11	44.98	71.03	52.06	30.49	49.64	1849; 1853	2 8	$\odot_r\ 9_m\ 3_a\ 9_a$[9]	Munger.	MS. in S. Coll.
12	..	..	..	..	..	1851	0 3	$6_m\ 2_a\ \odot_s$	....	" " "
13	..	..	..	..	..	1852	0 3	$6_m\ 2_a\ 10_a$	....	" " "
14	44.59	67.43	49.97	23.38	46.34	Jan. 1849; July, 1850	1 1	[7]	A. Winchell.	N. Y. Univ. Syst. 1855.
15	40.65	67.49	47.23	20.86	44.06	May, 1854; Dec. 1870	3 4	$7_m\ 2_a\ 9_a$	Dr. E. M. Alba, C. P. Arnold.	P. O. and S. I. Vol. 1, and S. O.
16	44.54	67.36	48.48	26.33	46.68	Jan. 1827; Dec. 1849	22 0	[7]	Various observers.	N. Y. Univ. Syst. 1855.
17	46.03	71.13	51.01	26.19	48.59	Jan. 1860; Dec. 1865	6 0	$7_m\ 2_a\ 9_a$ bis	J. B. Dill.	S. O.
18	44.57	68.43	48.30	25.88	46.80	Jan. 1827; Dec. 1865	28 0	[8]	Various observers.	Consolidated series.
19	42.08	66.33	48.03	24.69	45.28	1849; May, 1867	16 0	[8]	J. Bowman.	MS. in S. Coll., P. O. and S. I. Vol. 1, and S. O.

7 Daily means computed by the formula $\frac{a + 2b + 2c + a'}{6}$ where a represents an observation a little before sunrise, b one at 3_a, c one at one hour after sunset, and a' the morning observation on the following day. The results thus obtained appear, on the average, to be about 0°.5 too high.

8 Corrected for daily variation by means of the general table.

9 Observations at $9_m\ 3_a\ 9_a$ in May, June, September, October, 1850, and March, 1851; subsequently at $7_m\ 2_a$.

NEW YORK.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
20. Barnesville	42°38′	74°26′	1200	..	..	30°.48	47°.28	60°.20	72°.68	..	..	..	..	..	..
21. Beaver Brook	41 30	74 37	700	..	..	24.95	44.62	59.28	68.14	76°.00	71°.17	65°.15	53°.43	38°.66	24°.32
22. Belleville (Union Acad.)	43 47	76 06	300	23°.73	22°.92	32.64	48.18	56.50	64.68	69.59	66.13	60.04	48.98	37.77	25.93
23. Bellport	40 44	72 52	15	31.12	30.70	37.29	45.01	54.35	64.32	69.17	68.58	62.10	53.14	42.54	33.63
24. Beverly	41 22	73 56	180	24.79	27.94	35.25	46.89	57.55	66.87	72.37	69.05	62.34	50.76	41.09	29.06
25. Blackwell's Island[3]	40 45	73 58	29	22.31	30.64	33.67	46.99	56.20	68.48	74.66	72.24	66.95	54.13	43.95	35.06
26. Bloomingdale	40 49	73 58	..	32.77	28.86	40.77	51.95	60.88	69.44	74.22	74.04	69.26	53.45	47.40	33.93
27. Bridgewater	42 52	75 17	1286	20.64	21.89	29.88	42.29	52.98	59.58	66.64	62.90	55.44	44.66	31.42	23.68
28. Brooklyn	40 41	73 58	125	..	..	..	..	..	74.03	77.03	74.60	65.94	57.81	46.26	35.38
29. Buffalo	42 53	78 53	623	23.41	21.13	35.49	40.69	55.29	67.44	71.55	69.99	59.89	48.75	37.22	22.85
30. Buffalo Barracks	42 53	78 52	660	27.00	24.62	30.85	44.10	52.96	64.16	68.35	68.51	61.87	45.55	35.53	29.55
31. Buffalo	42 53	78 52	569	24.36	26.39	31.37	43.63	53.59	65.04	69.58	68.58	61.19	49.51	40.13	28.40
32. Buffalo	42 53	78 52	600	24.75	26.52	32.61	43.08	53.06	64.30	70.34	68.56	61.78	49.96	39.25	28.48
33. Buffalo	42 53	78 52	600	24.72	27.49	32.05	43.12	53.19	63.79	69.65	68.43	60.94	48.91	38.75	28.09
34. Caldwell	43 24	73 43	300	..	..	..	..	..	..	74.03	70.48	62.63	49.35	..	..
35. Cambridge (Washington Co. Acad.)	43 00	73 25	500	22.44	21.45	32.69	44.19	55.99	64.82	68.88	66.09	58.29	46.76	36.56	26.21
36. Canajoharie (Acad.)	42 51	74 42	284	20.97	19.61	30.46	47.29	58.33	64.06	70.34	67.36	58.69	49.06	37.87	25.26
37. Canandaigua (Aca.)	42 55	77 16	590	23.34	21.09	31.84	45.94	55.92	65.70	69.49	66.80	57.32	47.85	36.14	26.68
38. Canton	44 36	75 11	304	17.94	14.44	26.04	42.65	57.18	67.20	72.50	68.89	60.42	48.74	36.48	21.15
39. Cazenovia (Acad.)[1]	42 55	75 51	1260	21.43	22.21	29.85	42.87	53.09	61.99	66.71	64.61	57.66	45.84	35.63	24.69
40. Champion	43 57	75 41	..	11.35	24.30	..	..	..	..	..	..	..	..	..	..
41. Charlotte[5]	43 15	77 37	273	25.47	27.88	32.93	44.57	54.69	66.33	70.65	69.76	62.22	50.68	40.83	29.23
42. Chatham	42 24	73 36	..	25.57	23.52	30.40	45.05	56.90	68.71	72.00	69.36	61.24	48.19	45.57	20.56
43. Cherry Valley Acad.	42 48	74 45	1335	22.03	21.66	30.30	43.64	53.84	63.48	67.68	65.58	57.82	45.81	34.36	25.34
44. Clinton (Hamilton Coll.)	43 03	75 24	1127	21.78	24.25	30.28	43.70	56.55	65.84	72.46	69.39	61.54	49.75	37.92	28.44
45. Clockville	43 00	75 48	1300	..	24.63	28.25	40.33	49.47	66.90	..	..	..	..	..	..
46. Clyde (near)	43 05	76 54	400	23.82	27.35	30.96	44.77	53.65	63.61	66.77	65.25	59.47	50.62	37.38	31.95
47. Constableville	43 33	75 27	..	..	..	..	..	..	62.04	68.85	64.89	60.74	..	..	..
48. Constantia	43 15	76 02	424	..	..	..	..	..	..	..	..	62.87	..	..	..
49. Cooperstown	42 42	74 57	1300	27.80	19.48	24.73	46.50	58.63	71.88	73.35	69.13	60.65	46.22	34.83	26.06
50. Cuba	42 12	78 18	1502	18.10	22.48	28.02	40.41	51.21	62.60	63.52	63.22	55.12	40.19	32.61	23.58
51. Dansville	42 35	77 44	714	28.82	31.53	32.35	46.87	52.20	65.22	68.95	68.01	60.80	52.12	37.50	34.03
52. Delhi (Delaware Acad.)	42 16	74 58	1384	22.82	28.58	33.59	39.49	55.30	68.05	68.95	64.69	55.86	45.92	37.01	31.45
53. Depauville (1 mile north of)	44 06	76 06	350	19.24	20.76	29.20	42.82	53.10	64.85	69.57	66.49	60.32	46.36	35.96	23.72
54. East Hampton (Clin. Acad.)	40 58	72 28	16	30.13	30.75	36.36	44.43	53.18	62.80	69.68	68.51	62.54	52.13	42.27	33.45
55. Eden (Brown Cottage)	42 30	79 07	700	13.25	32.05	25.99	41.70	54.07	63.75	72.47	68.26	62.60	48.63	36.30	34.55
56. Ellisburg	43 47	76 08	250	23.74	22.82	33.42	48.65	57.49	64.73	69.73	66.94	61.34	48.72	38.39	26.53
57. Elmira	42 05	76 50	860	19.50	26.66	32.15	39.85	56.09	62.80	67.81	64.29	58.55	51.02	33.90	32.86
58. Fairfield Academy	43 05	74 55	1185	19.73	19.73	29.85	42.57	53.91	62.53	66.39	65.79	57.53	46.02	34.50	23.98
59. Falconer	42 05	79 10	..	23.44	27.90	32.01	..	..	..	..	..	.	..	..	..
60. Fishkill Landing	41 30	73 59	42	25.15	27.51	34.86	47.47	58.77	68.45	73.49	70.48	63.49	52.79	41.15	30.08
61. Flatbush (Erasmus Hall)[6]	40 39	73 58	54	30.47	31.57	38.38	48.41	58.36	67.51	73.32	71.34	64.48	53.68	43.94	34.31
62. Flushing[7]	40 46	73 48	..	32.57	29.12	33.80	49.65	62.38	72.55	76.73	74.13	66.10	55.50	41.98	31.09
63. Fordham (St. John's Coll.)	40 54	73 50	147	21.35	32.81	37.11	..	..	..	75.42	..	65.21	53.15	44.35	30.16
64. Fort Ann	43 22	73 28	1430	34.55	36.05	45.31	56.49	60.37	76.53	78.18	75.10	60.84	45.45	42.68	29.98
65. Fort Columbus	40 42	74 01	23	29.87	30.53	37.96	48.47	59.43	69.46	75.09	73.38	65.96	54.57	43.64	33.50
66. Fort Edward	43 13	73 33	175	25.31	21.00	33.13	45.45	57.79	69.96	70.74	67.57	60.85	49.09	36.06	27.60

[1] Corrected for daily variation by means of the general table.

[2] Daily means computed by the formula $\frac{a + 2b + 2c + a'}{6}$ where a represents an observation a little before sunrise, b one at 3_a, c one at one hour after sunset, and a' the morning observation on the following day. The results thus obtained appear, on the average, to be about 0°.5 too high.

[3] New York, Penitentiary Hospital.

NEW YORK.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
20	45°.99	..	..	..	..	1870	0 4	$7_m\ 2_a\ 9_a$ bis [1]	G. S. France.	S. O.
21	42.95	71°.77	52°.41	..	..	1854	0 10		C. S. Woodard.	P. O. and S. I. Vol. I.
22	45.77	66.80	48.93	24°.19	46°.42	Jan. 1830; Dec. 1844	9 0	[2]	Various observers.	N. Y. Univ. Syst. 1855.
23	45.55	67.36	52.59	31.82	49.33	Aug. 1857; June, 1862	4 11	$7_m\ 2_a\ 9_a$ bis [1]	H. W. Titus.	S. O.
24	46.56	69.43	51.40	27.26	48.66	1851; Dec. 1870	17 3		T. B. Arden.	MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
25	45.62	71.79	55.01	29.34	50.44	Jan. 1856; Nov. 1857	1 11	$7_m\ 2_a\ 9_a$	Dr. W. W. Sanger.	P. O. and S. I. Vol. I.
26	51.20	72.57	56.70	31.85	53.08	1846	1 0	$\odot_r\ 2_a\ \odot_s$ [1]	Earle.	Dove.
27	41.72	63.04	43.84	22.07	42.67	Jan. 1833; Dec. 1837	4 0		Various observers.	N. Y. Univ. Syst. 1855.
28	..	75.22	56.67	..	..	Aug. 1849; Dec. 1870	0 9	$7_m\ 2_a\ 9_a$ bis	Bea & son, J. P. Mailler.	MS. in S. Coll. and S. O.
29	43.82	69.66	48.62	22.46	46.14	Jan. 1831; Dec. 1832	2 0	[2]	Various observers.	N. Y. Univ. Syst. 1855.
30	42.64	67.01	47.65	27.06	46.09	July, 1841; Aug. 1845	4 7	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
31	42.86	67.73	50.28	26.38	46.81	July, 1859; Dec. 1867	8 6	$7_m\ 2_a\ 9_a$ [1]	E. Dorr.	U. S. Lake Survey, 1855.
32	42.92	67.73	50.33	26.58	46.89	Jan. 1854; Dec. 1870	12 7		W. Ives, E. O. Salisbury.	Climate copy of Buffalo 1867, P. O. and S. I. Vol. I, and S. O.
33	42.79	67.29	49.53	26.77[7]	46.59	Jan. 1831; Dec. 1870	27 8	[1]	Various observers.	Consolidated series.
34	..	..	..	..	..	1870	0 4	$7_m\ 2_a\ 9_a$ bis	A. M. Strong.	S. O.
35	44.29	66.60	47.20	23.37	45.36	Jan. 1827; Dec. 1841	14 0	[2]	Various observers.	N. Y. Univ. Syst. 1855.
36	45.36	67.25	48.54	21.95	45.77	Jan. 1830; Dec. 1835	3 0	[2]	" "	" " " " "
37	44.57	67.33	47.10	23.70	45.68	Jan. 1829; Dec. 1838	10 0	[2]	H. Howe.	" " " " "
38	41.96	69.53	48.55	17.84	44.47	Aug. 1853; Aug. 1858	3 10	$7_m\ 2_a\ 9_a$ [2]	E. W. Johnson.	P. O. and S. I. Vol. I, & S. Coll.
39	41.94	64.44	46.38	22.78	43.88	Jan. 1830; Dec. 1870	27 7		Various observers.	N. Y. Univ. Syst. 1855, P. O. and S. I. Vol. I, and S. O.
40	..	..	..	..	..	1844	0 2	{ $7_m\ 9_m$ N. / $4_a\ 7_a\ 9_a$ }	Dr. F. B. Hough.	MS. in S. Coll.
41	44.06	68.91	51.24	27.53	47.93	July, 1859; Dec. 1867	8 6	$7_m\ 2_a\ 9_a$	A. Mulligan.	U. S. Lake Survey, Rep. 1867, and MS.
42	44.12	70.02	51.67	23.22	47.26	1849; 1854	1 11	[1]	C. T. Chase.	P. O. & S. I. Vol. I, and S. Coll.
43	42.59	65.58	46.00	23.01	44.30	Jan. 1827; Dec. 1845	15 0	[2]	Various observers.	N. Y. Univ. Syst. 1855.
44	43.51	69.23	49.74	24.82	46.82	Jan. 1852; Mar. 1865	6 10	$7_m\ 2_a\ 9_a$ bis	Prof. O. Root, Dr. H. M. Paine.	P. O. and S. I. Vol. I, MS. in S. Coll., and S. O.
45	39.35	..	..	..	..	1850	0 5	$\odot_r\ 9_m\ 3_a\ 9_a$	Chapman.	S. Coll.
46	43.13	65.21	49.16	27.71	46.30	Jan. 1861; June, 1862	1 6	$7_m\ 2_a\ 9_a$ bis	M. Mackie.	S. O.
47	..	65.26	..	..	..	1851; 1853	0 4	$\odot_r\ 9_m\ 3_a\ 9_a$	Fairchild.	S. Coll.
48	..	..	..	..	..	1861	0 1	$7_m\ 2_a\ 9_a$ bis	S. Clark.	S. O.
49	43.29	71.45	47.23	24.45	46.61	Oct. 1869; Dec. 1870	1 3	"	G. Pomeroy Keese.	" "
50	39.88	63.11	42.64	21.39	41.76	1840; 1841	2 0	$10_m\ 10_a$	Fallcott.	Regents' Report.
51	43.81	67.39	50.14	31.46	48.20	Jan. 1861; Dec. 1863	0 10	$7_m\ 2_a\ 9_a$ bis [2]	J. J. Brown.	S. O.
52	42.79	67.23	46.26	27.62	45.98	Jan. 1828; Dec. 1852	3 0		S. C. Johnson, D. Shepard.	N. Y. Univ. Syst. 1855, and MS. in S. Coll.
53	41.71	66.97	47.55	21.24	44.37	Feb. 1865; Dec. 1870	5 11	$7_m\ 2_a\ 9_a$ bis	H. Haas.	S. O.
54	44.66	67.00	52.31	31.44	48.85	Jan. 1827; Dec. 1843	17 0	[2]	Various observers.	N. Y. Univ. Syst. 1855.
55	40.59	68.16	49.18	26.62	46.14	Mar. 1856; Dec. 1857	1 1	$7_m\ 2_a\ 9_a$ [2]	S. & A. S. Landon.	P. O. and S. I. Vol. I.
56	46.52	67.13	49.48	24.36	46.87	....	10 0		....	Dove, 1857.
57	42.70	64.97	47.82	26.34	45.46	Jan. 1852; Oct. 1852	0 10	$6_m\ 2_a\ 10_a$ [2]	Various observers.	MS. in S. Coll.
58	42.11	64.90	46.02	21.15	43.54	Jan. 1827; Dec. 1849	20 10		" "	N. Y. Univ. Syst. 1855, and MS. in S. Coll.
59	..	..	..	..	..	1854	0 3	$7_m\ 2_a\ 9_a$	L. A. Langdon.	P. O. and S. I. Vol. I.
60	47.03	70.81	52.48	27.58	49.47	Jan. 1854; Oct. 1866	10 5	$7_m\ 2_a\ 9_a$ bis	W. H. Denning, W. Harkness.	MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
61	48.38	70.72	54.03	32.12	51.31	Jan. 1826; Dec. 1870	39 9	[2]	Various observers.	N. Y. Univ. Syst. 1855, MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
62	48.61	74.47	54.53	30.93	52.13	July, 1855; Dec. 1870	1 0	$7_m\ 2_a\ 9_a$	" "	P. O. and S. I. Vol. I, and MS. from S. G. O.
63	..	..	54.24	28.11	..	Feb. 1856; Mar. 1862	1 0	$7_m\ 2_a\ 9_a$ bis	J. Aubier, Prof. J. Monroe.	P. O. and S. I. Vol. I, and S. O.
64	54.06	76.60	49.66	33.53	53.46	Nov. 1863; May, 1866	2 0	"	P. A. McMoore.	S. O.
65	48.62	72.64	54.72	31.30	51.82	Oct. 1821; Dec. 1870	48 8	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. and MS. from S. G. O.
66	45.46	69.42	48.67	24.64	47.05	Nov. 1857; May, 1870	2 2	"	Prof. S. Tias, J. S. Cooley.	P. O. and S. I. Vol. I, and S. O.

[4] Observations after 1849, at $7_m\ 2_a\ 9_a$; they were referred to the New York Academy system by means of the general table.

[5] Observations previous to June, 1860, at $6_m\ 9_m\ 3_a\ 6_a$; referred to $7_m\ 2_a\ 9_a$.

[6] Observations after 1849, at $7_m\ 2_a\ 9_a$; referred to the New York Academy System.

[7] Observations at Flushing, Willett's Point and Fort Schuyler combined.

NEW YORK.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
67. Fort Hamilton .	40°36′	74°02′	25	30°.06	30°.79	37°.41	47°.59	58°.11	68°.43	73°.97	73°.17	66°.43	55°.02	44°.52	33°.73
68. Fort Niagara . .	43 15	79 05	263	26.71	26.98	33.34	43.32	54.59	65.12	70.53	69.56	61.62	50.49	39.75	29.17
69. Fort Ontario . .	43 34	76 12	295	24.21	23.26	30.94	42.87	51.76	62.23	69.57	68.28	61.56	48.49	38.55	26.74
70. Fort Porter . .	42 50	78 55	660	24.32	25.58	30.90	41.26	52.26	66.09	72.03	70.16	62.92	50.83	39.37	27.77
71. Fort Wood . .	40 42	74 11	..	30.42	26.57	36.36	45.09	55.72	67.45	73.34	71.67	63.78	55.44	42.02	32.24
72. Fredonia (Acad.) .	42 26	79 21	715	28.37	27.75	35.16	45.85	56.67	65.23	70.66	68.47	61.01	50.93	39.71	31.06
73. Friendship . . .	42 12	78 10	1536	15.75	29.72	27.71	43.05	47.95	65.90	66.18	65.23	56.93	45.65	38.07	22.52
74. Gaines (Academy)	43 16	78 15	427	25.37	28.38	34.46	46.54	54.48	62.99	71.76	66.48	59.83	47.69	35.25	28.45
75. Geneva	42 53	77 00	567	21.10	24.87	31.61	43.82	54.09	65.78	71.89	68.09	61.51	49.91	39.34	28.79
76. Germantown . .	42 05	73 52	..	20.62	25.15	34.12	45.62	55.06	68.76	73.19	65.30	61.10	51.45	40.70	25.82
77. Glasco	42 00	74 00	150	31.93	26.28	30.20	48.25	55.20	71.75	72.95	69.20	61.35	50.00	38.58	28.28
78. Goshen (Farmer's Hall)	41 23	74 20	425	25.66	26.31	36.51	47.42	56.22	64.73	68.70	67.64	59.76	48.81	38.79	28.01
79. Gouverneur . .	44 20	75 27	400	17.23	18.17	28.56	42.89	54.81	64.11	69.70	66.71	56.67	45.59	33.73	20.94
80. Greenville (Acad.)	42 24	74 02	..	30.27	27.48	33.78	40.18	62.51	66.78	68.88	68.72	61.73	51.26	36.96	28.13
81. Hamilton (Acad.)	42 48	75 29	1127	22.91	22.95	31.80	45.43	54.97	63.08	67.36	65.86	58.28	45.88	35.64	26.36
82. Hamilton . . .	42 48	75 29	1127	21.32	26.60	31.52	40.79	55.20	62.06	67.75	65.14	58.71	49.48	35.76	25.55
83. Hartwick (Sem.) .	42 37	75 00	1100	24.27	25.22	33.89	44.42	56.48	65.08	68.25	66.72	58.75	48.46	38.11	28.19
84. Havana	42 30	73 30	1041	25.13	..	...	..	..	..	..	..	..	..	..	..
85. Henrietta . . .	43 03	77 39	600	29.70	28.48	38.44	48.31	58.70	64.95	69.76	66.57	60.07	51.31	39.48	30.76
86. Hermitage . . .	42 45	78 16	1500	23.26	23.44	26.74	39.40	50.74	60.57	64.49	64.31	56.31	46.62	35.46	26.64
87. Homer (Courtland Acad.)	42 38	76 11	1096	22.90	22.51	31.12	42.40	53.93	61.67	65.92	64.22	56.45	46.53	35.81	26.96
88. Houseville . . .	43 40	75 32	900	20.92	21.40	28.37	38.89	51.56	64.97	69.16	65.18	57.79	46.81	34.28	20.24
89. Hudson (Acad.) .	42 14	73 47	150	25.19	25.78	34.85	47.61	58.93	67.62	71.53	70.06	61.91	50.33	38.92	28.52
90. Huntingdon . .	40 52	73 27	50	26.	29.	24.	49.	63.	65.	75.	71.	69.	54.	42.	31.
91. Ithaca (Acad.) .	42 25	76 30	417	27.78	27.78	34.90	46.73	57.82	65.42	70.78	68.68	60.35	49.20	38.97	31.02
92. Jamaica (Union Hall)	40 42	73 48	30	29.42	29.34	37.64	47.25	56.96	65.71	71.23	70.58	62.79	51.85	41.72	32.51
93. Jamestown . . .	42 06	79 16	1364	20.20	24.58	32.68	43.38	57.16	65.98	68.67	66.26	60.94	48.39	36.62	29.28
94. Jericho	40 47	71 33	..	..	..	..	44.11	..	..	..	..	..	..	..	..
95. Johnstown (Acad.)	42 59	74 22	[2]250	21.27	22.14	31.68	43.50	55.89	64.76	68.89	67.70	58.16	46.73	34.97	24.83
96. Kinderhook (Aca.)	42 22	73 23	125	22.90	23.32	33.74	46.30	57.26	65.44	70.15	68.47	60.30	47.54	38.28	25.24
97. Kingston (Acad.)	41 55	74 00	188	26.66	27.31	37.20	49.37	59.53	67.22	72.76	70.93	62.29	50.54	41.02	30.90
98. La Fargeville . .	44 12	76 00	..	26.00	32.67	32.67	42.67	58.00	65.00	72.00	66.33	62.00	51.33	32.67	24.00
99. Lansingburgh (Acad.)	42 45	73 40	30	22.67	24.83	34.34	47.00	58.67	67.48	71.68	69.89	61.89	49.96	38.21	26.63
100. Ledyard (Cayuga Acad.)	42 43	76 42	447	28.70	28.18	36.91	46.59	56.55	66.15	72.27	70.71	62.96	50.53	40.60	29.80
101. Leroy	42 57	78 03	..	..	..	..	41.87	56.90	71.50	77.20	..	..	..	..	..
102. Lewiston (S. High School) . . .	43 09	79 04	280	27.23	26.92	34.80	46.32	56.91	64.80	71.56	69.94	61.88	50.10	39.70	29.94
103. Leyden	43 34	75 22	1312	22.76	16.01	25.58	40.25	52.73	57.82	66.33	61.35	59.05	39.74	28.53	23.52
104. Liberty	41 45	74 46	1474	18.19	20.13	26.71	39.95	51.59	62.62	68.79	64.34	56.63	47.84	33.95	26.32
105. Lima	42 53	77 40	..	22.63	30.75	..	..	..	..	..	..	..	..	..	..
106. Lisle	42 21	76 02	..	..	..	..	..	53.39	..	..	..	..	..	..	..
107. Little Genesee .	42 00	78 15	1500	22.13	23.58	28.65	43.26	52.38	65.44	68.97	64.97	58.50	45.27	35.58	24.47
108. Lockport[4] . . .	43 09	78 44	..	24.2	27.6	33.2	40.4	53.7	66.3	68.8	66.7	59.6	49.9	43.9	34.4
109. Lodi[5]	42 36	76 50	1000	23.43	24.09	30.19	42.02	56.57	67.49	72.25	68.36	62.18	49.37	37.05	26.43
110. Lowville (Acad.) .	43 47	75 30	847	19.75	21.49	29.78	43.70	54.59	62.61	67.91	64.84	57.43	45.80	34.45	23.40
111. Ludlowville . .	42 33	76 35	600	28.40	27.63	26.83	45.90	55.85	66.68	70.73	69.28	..	..	..	..
112. Luzerne . . .	43 18	73 50	500	..	..	..	..	..	..	..	..	..	..	35.33	24.10
113. Lyons	43 04	77 02	..	24.90	26.22	31.80	42.64	54.73	63.06	67.12	66.39	57.94	49.67	38.04	28.90
114. McGrawville . .	42 34	76 11	1450	9.23	30.52	25.65	35.72	51.98	61.16	70.01	64.66	59.43	46.48	35.46	32.07
115. Madison Barracks[6]	43 57	76 04	262	21.79	23.81	32.89	44.35	54.56	64.49	69.08	68.96	60.62	49.49	37.88	25.87
116. Madrid	44 43	75 09	280	16.73	18.06	29.62	40.39	56.53	66.62	72.34	69.18	59.06	46.49	35.10	22.13

[1] Daily means computed by the formula $\frac{a + 2b + 2c + a'}{6}$ where a represents an observation a little before sunrise, b one at 3_a, c one at one hour after sunset, and a' the morning observation on the following day. The results thus obtained appear, on the average, to be about 0°.5 too high.

NEW YORK.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
67	47°.70	71°.86	55°.32	31°.53	51°.69	Jan. 1843;	Dec. 1870	27 2	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. and MS. from S. G. O.
68	43.75	68.40	50.62	27.62	47.60	Jan. 1829;	Dec. 1867	22 3	"	L. Leffman, Assistant Surgeon.	Ar. Met. Reg. 1855, and U. S. Lake Survey, Rep. of 1867–8.
69	41.86	66.69	49.53	24.74	45.71	Jan. 1843;	Dec. 1870	11 1	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855–60.
70	41.47	69.43	51.04	25.89	46.96	Jan. 1849;	Dec. 1870	8 9	$7_m\ 2_a\ 9_a$	Hosmer.	MS. from S. G. O. and S. Coll.
71	45.72	70.82	53.75	29.74	50.01	1837;	1838	2 0	"	Assistant Surgeon.	Army Register.
72	45.89	68.12	50.55	29.06	48.41	Mar. 1829;	Feb. 1864	20 9	[1]	Various observers.	N. Y. Univ. Syst. 1855, MS. in S. Coll., and S. O.
73	39.57	65.77	46.88	22.66	43.72	Nov. 1866;	Nov. 1867	0 11	$7_m\ 2_a\ 9_a$ bis	G. W. Fries.	S. O.
74	45.16	67.08	47.59	27.40	46.81	Jan. 1839;	Dec. 1842	4 0	[1]	Various observers.	N. Y. Univ. Syst. 1855.
75	43.17	68.59	50.25	24.92	46.73	Feb. 1852;	Aug. 1868	6 3	$7_m\ 2_a\ 9_a$ bis	" "	P. O. and S. I. Vol. I, MS. in S. Coll., and S. O.
76	44.93	69.08	51.08	23.86	47.24	May, 1866;	May, 1868	2 0	"	S. W. Roe.	S. O.
77	44.55	71.30	49.98	28.83	48.66	Jan. 1870;	Dec. 1870	0 11	"	D. B. Hendricks.	" "
78	46.72	67.02	49.12	26.66	47.38	Jan. 1835;	Dec. 1849	11 0	[1]	Various observers.	N. Y. Univ. Syst. 1855.
79	42.09	66.84	45.33	18.78	43.26	Jan. 1831;	Dec. 1870	28 8	$7_m\ 2_a\ 9_a$ bis	" "	N. Y. Univ. Syst. 1855 and P. O. and S. I. Vol. I, and S. O.
80	45.49	68.13	49.98	28.63	48.06	1826		1 0	[1]	E. B. Wheeler.	N. Y. Univ. Syst. 1855.
81	44.07	65.43	46.60	24.07	45.04	Jan. 1827;	Dec. 1849	18 0	"	Various observers.	" " " "
82	42.50	64.98	47.98	24.49	44.99	Sept. 1850;	Dec. 1852	2 4	$6_m\ 2_a\ 10_a$	" "	Manuscript.
83	44.93	66.68	48.44	25.89	46.49	Jan. 1826;	Dec. 1850	16 0	[1]	" "	N. Y. Univ. Syst. 1855.
84	..	..	..	..	..	1860		0 1	$7_m\ 2_a\ 9_a$ bis	E. C. Frost.	S. O.
85	48.48	67.09	50.29	29.65	48.88	Jan. 1835;	June, 1862	5 6	[1]	J. S. Whitaker, E. D. Ransom, A. S. Wadsworth.	N. Y. Univ. Syst. 1855, & S. O.
86	38.96	63.12	46.13	24.45	43.16	Nov. 1860;	Aug. 1864	3 10	$7_m\ 2_a\ 9_a$ bis	A. A. Hibberd.	S. O.
87	42.48	63.94	46.26	24.12	44.20	Feb. 1829;	Feb. 1856	21 8	[1]	Various observers.	N. Y. Univ. Syst. 1855, P. O. & S. I. Vol. I, & MS. in S. Coll.
88	39.61	66.44	46.29	20.85	43.30	1849;	Oct. 1870	9 4	$7_m\ 2_a\ 9_a$ bis	W. D. Yale.	P. O. and S. I. Vol. I, S. O., & S. Coll.
89	47.13	69.74	50.39	26.50	48.44	Jan. 1827;	Jan. 1870	19 9	[1]	Various observers.	N. Y. Univ. Syst. 1855, MS. in S. Coll. and S. O.
90	45.33	70.33	55.00	28.67	49.84	Sept. 1821;	Aug. 1822	1 0	......	....	Sketch of Long Island.
91	46.48	68.29	49.51	28.86	48.29	Jan. 1827;	Dec. 1852	20 10	[1]	Various observers.	N. Y. Univ. Syst. 1855, and MS. in S. Coll.
92	47.28	69.17	52.12	30.42	49.75	Jan. 1826;	Dec. 1850	25 0	[1]	" "	N. Y. Univ. Syst. 1855.
93	44.41	66.97	48.65	24.69	46.18	Jan. 1852;	Mar. 1866	3 4	$7_m\ 2_a\ 9_a$ bis	Dr. S. W. Roe & others.	MS. in S. Coll. and S. O.
94	..	..	..	..	..	1849		0 1	......	Wills.	S. Coll.
95	43.69	67.12	46.62	22.75	45.04	Jan. 1828;	Dec. 1845	16 0	[1]	Various observers.	N. Y. Univ. Syst. 1855.
96	45.77	68.02	48.71	23.82	46.58	Jan. 1830;	Dec. 1846	17 0	[1]	T. Metcalf.	" " " "
97	48.70	70.30	51.28	28.29	49.64	Sept. 1828;	Nov. 1869	19 10	[1]	Various observers.	N. Y. Univ. Syst. 1855, and S. O.
98	44.45	67.78	48.67	27.56	47.11	1851		1 0	$\odot_r$ N. $\odot_s$	Rothers	Pat. Off. Rep.
99	46.67	69.68	50.02	24.71	47.77	Jan. 1826;	Dec. 1852	23 0	[1]	Various observers.	N. Y. Univ. Syst. 1855, and Reg. Rep.
100	46.68	69.71	51.36	28.89	49.16	Jan. 1830;	Dec. 1850	13 0	[1]	" "	N. Y. Univ. Syst. 1855.
101	..	..	..	..	..	1854		0 4	$7_m\ 2_a$	L. F. Munger.	P. O. and S. I. Vol. I.
102	46.01	68.77	50.56	28.03	48.34	May, 1830;	Dec. 1849	18 8	[1]	Various observers.	N. Y. Univ. Syst. 1855.
103	39.52	61.83	42.44	20.76	41.14	Mar. 1869;	July, 1870	1 2	$7_m\ 2_a\ 9_a$ bis	C. Collins Merriam.	S. O.
104	39.42	65.25	46.14	21.55	43.09	Jan. 1852;	Apr. 1856	2 3	[3]	Various observers.	P. O. & S. I. Vol. I, & MS. in S. Coll.
105	..	..	..	..	..	1861		0 2	$7_m\ 2_a\ 9_a$ bis	Prof. S. A. Lattimer.	S. O.
106	..	..	..	..	..	1849		0 1	$\odot_r\ 7_m\ 3_a\ 9_a$	Mitchell.	S. Coll.
107	41.43	66.46	46.45	23.39	44.43	Feb. 1866;	Dec. 1870	4 11	$7_m\ 2_a\ 9_a$ bis	D. Edwards.	S. O.
108	42.43	67.27	51.13	28.73	47.39	Nov. 1848;	Dec. 1870	4 6	[3]	J. G. Trevor, Giddings, B. W. Clark.	MS. in S. Coll. and S. O.
109	42.93	69.37	49.53	24.65	46.62	1849;	Jan. 1858	8 8	$7_m\ 2_a\ 9_a$	J. Lefferts.	P. O. & S. I. Vol. I, & S. Coll.
110	42.69	65.12	45.89	21.55	43.81	Jan. 1827;	Dec. 1857	24 3	[1]	Various observers.	N. Y. Univ. Syst. 1855, MS. in S. Coll, & P. O. & S. I. Vol. I.
111	42.86	68.90	..	..	..	1869		0 8	$7_m\ 2_a\ 9_a$ bis	C. P. Murphy.	S. O.
112	..	..	..	..	..	1870		0 2	"	A. M. Strong.	" "
113	43.06	65.52	48.55	26.67	45.95	Jan. 1861;	Aug. 1862	2 8	"	E. W. Sylvester.	" "
114	37.78	65.28	47.12	23.94	43.53	Sept. 1856;	Sept. 1857	0 11	$7_m\ 2_a\ 9_a$	J. M. Smith.	P. O. and S. I. Vol. I.
115	43.93	67.51	49.33	23.82	46.15	Jan. 1824;	Dec. 1870	18 3	[3]	Assistant Surgeon.	Ar. Met. Reg.
116	42.18	69.38	46.88	18.97	44.35	Jan. 1849;	Jan. 1859	5 7	$7_m\ 2_a\ 9_a$	E. A. Dayton.	P. O. and S. I. Vol. I, & S. Coll.

[2] Altitude 688 feet, according to Regents' Report.

[3] Corrected for daily variation by means of the general table.

[4] Series approximately corrected for daily variation; observations often interrupted and hours of observation changed.

[5] Also called *Townsendville* and *Covert.*

[6] Observations previous to 1829 not very reliable.

NEW YORK.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
117. Malone (Franklin Acad.)	44°50′	74°18′	703	18°.24	24°.48	31°.42	45°.07	53°.01	60°.22	66°.90	[illegible]°.45	55°.17	46°.92	32°.85	21°.22
118. Marathon	42 25	76 02	1200	..	..	25.53	..	56.73	59.43	69.62	..	..	..	..	..
119. Martinsburgh	43 43	75 28	..	..	..	..	50.30	55.60	64.93	..	..	..	..	..	..
120. Mexico (Acad.)	43 27	76 14	331	21.90	23.39	30.88	41.93	52.23	62.84	66.89	65.86	58.63	46.40	34.78	25.95
121. Middlebury (Aca.)	42 48	78 08	800	26.27	26.28	33.96	45.59	56.00	63.89	68.75	66.91	59.14	48.00	37.22	29.17
122. Milo	42 39	77 01	868	28.53	21.25	25.43	44.38	55.14	66.12	68.74	67.09	61.24	45.96	35.44	27.71
123. Millville (Acad.)	43 10	78 20	600	26.00	26.36	32.28	45.55	54.69	63.23	68.24	67.73	59.50	46.63	37.76	28.99
124. Minaville	42 54	74 15	..	20.44	16.93	25.70	42.40	57.02	68.64	73.52	69.92	61.28	46.67	34.08	20.92
125. Mohawk	43 00	75 02	435	20.87	22.69	28.04	42.33	54.89	64.59	69.64	67.73	58.77	47.93	36.87	23.12
126. Montgomery (Aca.)	41 32	74 13	300	25.36	27.02	36.63	47.63	58.36	65 98	72.34	70.31	62.51	49.23	39.47	29.03
127. Moriches[2]	40 47	72 48	13	30.81	33.49	38.39	49.14	58.45	69.07	74.40	72.86	66.60	54.27	44.24	34.10
128. Morley	44 40	75 00	..	18.87	19.58	25.01	..	..	68.05	71.17	68.70	56.33	42.20	38.33	17.59
129. Morrisania (Fairmount Inst.)	40 50	73 54	150	24.93	28.72	32.27	46.00	57.82	70.39	75.77	74.75	67.31	55.51	43.24	37.49
130. Mt. Pleasant (Aca.)	41 03	73 52	125	27.96	29.39	38.04	48.34	57.87	67.68	71.40	71.12	62.49	50.63	40.29	30.24
131. Newark Valley	44 20	76 30	..	24.14	20.69	27.05	41.77	54.65	65.52	70.80	66.45	58.74	45.22	35.03	26.43
132. Newburgh (Acad.)	41 31	74 00	74	28.29	27.60	36.13	48.27	59.02	68.21	72.75	71.05	64.20	52.52	42.03	29.81
133. New York	40 42	74 01	56	25.25	27.27	38.75	49.32	65.97	80.37	81.05	80.82	67.10	54.27	40.10	36.50
134. New York	40 42	74 01	56	30.20	30.80	38.50	49.10	59.60	69.10	74.90	73.30	65.90	54.30	43.50	33.90
135. New York (D. & D. Inst.)	40 50	73 56	25	30.52	31.04	37.49	48.45	58.85	69.74	75.04	73.07	65.54	53.69	44.38	34.23
136. New York (U. S. Nav. Hosp.)	40 41	73 57	56	29.61	31.39	37.91	48.70	58.68	70.43	75.07	73.20	65.31	53.94	44.42	33.11
137. New York[3]	40 45	73 58	42	28.83	31.86	37.28	49.29	58.74	70.15	75.30	73.39	65.49	53.50	43.47	31.92
138. New York[4]	40 45	73 58	42	29.78	31.41	37.63	48.78	58.76	69.69	75.06	73.28	65.59	53.71	46.25	33.16
139. Nichols	42 01	76 28	800	24.22	26.10	32.52	44.14	55.79	65.47	69.81	67.13	59.65	47.89	37.86	28.23
140. North Argyle	43 18	73 30	290	..	..	..	44.30	60.30	65.70	70.98	68.90	..	..	..	..
141. North Granville (Acad.)	43 23	73 17	250	20.67	20.09	31.29	43.63	56.15	66.50	70.82	68.28	58.72	47.70	35.89	24.79
142. North Hammond	44 23	75 45	..	19.18	19.56	27.12	42.10	56.62	68.70	73.19	69.77	62.28	49.53	36.18	22.01
143. North Nassau	42 32	73 38	..	23.98	27.90	36.48	43.95	..	65.50	70.19	65.13	57.69	46.65	39.45	22.73
144. North Salem (Aca.)	41 20	73 34	361	26.55	26.07	35.55	46.12	56.70	66.07	71.71	69.00	60.65	49.67	39.11	28.69
145. North Volney	43 20	76 28	..	27.34	21.10	29.62	42.20	58.54	67.00	72.31	68.36	61.54	47.54	35.87	25.92
146. Oaklands	42 53	74 31	480	28.49	27.69	36.32	37.68	53.37	68.00	72.80	68.50	60.65	49.28	45.40	28.95
147. Ogdensburgh (Acad.)	44 40	75 28	232	20.08	20.20	30.51	40.05	52.95	64.45	68.68	67.92	57.65	48.51	39.36	22.88
148. Oneida	43 04	75 38	500	23.33	24.32	30.45	44.66	55.70	65.37	70.14	67.69	60.77	48.39	37.82	27.12
149. Onondaga (Acad.)	42 56	76 08	1260	25.28	25.67	33.81	45.97	58.01	65.49	68.91	68.05	59.75	48.26	36.54	29.12
150. Oswego	43 25	76 34	232	24.12	25.43	31.32	42.10	52.88	63.15	69.57	68.10	61.28	49.74	40.40	28.05
151. Ovid (Seneca Coll. Inst.)	42 41	76 52	800	20.33	25.25	26.35	41.53	53.26	65.08	72.70	68.78	61.77	47.85	38.61	29.08
152. Oxford (Acad.)	42 23	75 40	961	22.90	23.59	31.98	43.98	55.33	63.44	67.98	65.81	58.18	46.58	35.59	26.09
153. Oyster Bay (Acad.)	40 52	73 32	50	27.48	34.14	38.94	49.31	57.58	67.17	72.57	70.30	64.02	54.00	43.27	33.96
154. Palermo	43 20	76 16	327	20.84	21.99	28.01	42.23	53.76	64.40	69.19	66.72	58.74	46.65	36.10	24.55
155. Palmyra	43 04	77 13	466	23.85	25.06	34.92	45.78	57.78	67.00	69.46	67.26	60.04	48.00	39.63	29.17
156. Penn Yan	42 42	77 04	740	25.60	25.54	33.40	44.16	55.28	64.42	69.22	66.81	59.48	47.88	38.22	28.44
157. Perry City	42 27	76 47	800	..	..	..	..	..	..	..	..	63.95	..	..	..
158. Plainville	43 00	76 16	..	33.86	32.55	28.76	37.07	53.97	62.71	..	66.94	60.04	..	..	..
159. Plattsburgh (Acad. and Barracks[6])	44 41	73 26	186	18.68	19.54	28.51	41.52	54.76	64.34	68.73	66.90	59.01	46.09	35.45	23.15
160. Pompey (Acad.)	42 52	76 02	1300	21.43	21.75	29.28	40.80	52.33	61.65	65.95	64.29	55.55	44.46	32.71	24.07

[1] Daily means computed by the formula $\frac{a + 2b + 2c + a'}{6}$ where a represents an observation a little before sunrise, b one at 3_a, c one at one hour after sunset, and a' the morning observation on the following day. The results thus obtained appear, on the average, to be about 0°.5 too high.

[2] Also called *Brookhaven*.

NEW YORK.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
117	43°.17	64°.19	44°.98	21°.31	43°.41	Jan. 1839;	Dec. 1842	3	0	[1]	Various observers.	N. Y. Univ. Syst. 1855.
118	..	..	..	..	..	1863		0	4	$7_m\ 2_a\ 9_a$ bis	L. Swift.	S. O.
119	..	..	..	..	..	1844				{ $7_m\ 9_m$ N. $4_a\ 7_a\ 9_a$	Dr. F. B. Hough.	MS. in S. Coll.
120	41.68	65.20	46.60	23.75	44.31	Jan. 1837;	Jan. 1857	14	11	[1]	Various observers.	N. Y. Univ. Syst. 1855, MS. in S. Coll., & P. O. & S. I. Vol. I.
121	45.18	66.52	48.12	27.24	46.77	Jan. 1826;	Dec. 1848	19	0		" "	N. Y. Univ. Syst. 1855.
122	41.65	67.32	47.55	25.83	45.59	May, 1869;	Dec. 1870	1	8	$7_m\ 2_a\ 9_a$ bis	G. D. Baker.	S. O.
123	44.17	66.40	47.96	27.12	46.41	Jan. 1840;	Dec. 1847	8	0	[1]	Various observers.	N. Y. Univ. Syst. 1855.
124	41.71	70.69	47.34	19.43	44.80	July, 1867;	Dec. 1870	3	6	$7_m\ 2_a\ 9_a$ bis	J. W. Bussing.	S. O.
125	41.75	67.32	47.86	22.23	44.79	June, 1860;	Mar. 1869	6	3	hourly.	J. Lewis, M.D.	S. Coll.
126	47.54	69.54	50.40	27.14	48.66	Jan. 1828;	Dec. 1842	13	0	[1]	Various observers.	N. Y. Univ. Syst. 1855.
127	48.66	72.11	55.04	32.80	52.15	Mar. 1864;	Dec. 1870	6	9	$7_m\ 2_a\ 9_a$ bis	E.A. Smith & daughter.	S. O.
128	..	69.31	45.62	18.68	..	1849;	1850	0	10	$\odot_r\ 9_m\ 3_a\ 9_a$	....	S. Coll.
129	45.36	73.64	55.35	30.38	51.18	Jan. 1856;	Jan. 1858	1	7	$7_m\ 2_a\ 9_a$	J. S. Norton, J. Zaepffel.	P. O. and S. I. Vol. I.
130	48.08	70.07	51.14	29.20	49.62	Jan. 1831;	July, 1849	13	1	[1]	Various observers.	N.Y. Univ. Syst. 1855, & S. Coll.
131	41.16	67.59	46.33	23.75	44.71	Mar. 1868;	Dec. 1870	2	7	$7_m\ 2_a\ 9_a$ bis	Rev. S. Johnson.	S. O.
132	47.81	70.67	52.92	28.57	49.99	Jan. 1828;	Dec. 1870	27	1	[1]	Various observers.	N. Y. Univ. Syst. 1855, MS. in S. Coll., and S. O.
133	51.35	80.75	53.82	29.67	53.90	May, 1782;	June, 1784	2	2	......	De La Lerve.	Cotté.
134	49.07	72.43	54.57	31.63	51.92	....		30	0	......	....	Pat. Off. Rep.
135	48.26	72.62	54.54	31.93	51.83	Jan. 1844;	Dec. 1870	21	8	$7_m\ 2_a\ 9_a$ bis	Prof. O. W. Morris.	MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
136	48.43	72.90	54.56	31.37	51.81	1849;	Sept. 1870	12	0	$\odot_r\ 9_m\ 3_a\ 9_a$	T. L. Smith.	S. O.
137	48.44	72.95	54.15	30.87	51.60	Jan. 1854;	June, 1870	8	7	$7_m\ 2_a\ 9_a$ bis	Various observers.	P. O. and S. I, Vol. I, and S. O.
138	48.39	72.68	55.18	31.45	51.92	Jan. 1844;	Dec. 1870	21	11	[5]	" "	Consolidated series.
139	44.15	67.47	48.47	26.18	46.57	Jan. 1857;	Dec. 1870	14	0	$7_m\ 2_a\ 9_a$ bis	R. Howell.	MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.
140	..	68.53	..	..	..	1864		0	5	"	G. M. Hunt.	S. O.
141	43.69	68.53	47.44	21.85	45.38	Jan. 1835;	Dec. 1849	14	0	[1]	J. C. Parker, E. T. Mack.	N. Y. Univ. Syst. 1855.
142	41.95	70.55	49.33	20.25	45.52	June, 1866;	Dec. 1870	4	7	$7_m\ 2_a\ 9_a$ bis	C. A. Wooster.	S. O.
143	..	66.94	47.93	24.87	..	1850;	1851	1	4	$\odot_r\ 9_m\ 3_a\ 9_a$	Ball.	S. Coll.
144	46.12	68.93	49.81	27.10	47.99	Jan. 1829;	Jan. 1857	22	11	[1]	Various observers.	N. Y. Univ. Syst. 1855, P. O. and S. I. Vol. I, MS. in S. Coll.
145	43.45	69.22	48.32	24.79	46.45	Mar. 1868;	Dec. 1870	2	4	$7_m\ 2_a\ 9_a$ bis	J. M. Patrick.	S. O.
146	42.46	69.77	51.78	28.38	48.10	1849;	1850	2	0	......	....	Observations, N. Y. State Agr. Society, 1850 (p. 43).
147	41.17	67.02	48.51	21.05	44.44	Jan. 1838;	Dec. 1852	3	8	[1]	Prof. J. H. Coffin, Griest.	N. Y. Univ. Syst. 1855, MS. in S. Coll.
148	43.60	67.73	48.99	24.92	46.31	Jan. 1862;	Dec. 1870	8	9	$7_m\ 2_a\ 9_a$ bis	Dr. S. Spooner.	S. O.
149	45.93	67.48	48.18	26.69	47.07	Jan. 1826;	Dec. 1844	16	0	[1]	Various observers.	N. Y. Univ. Syst. 1855.
150	42.10	66.94	50.47	25.87	46.35	July, 1849;	Dec. 1870	18	7	$7_m\ 2_a\ 9_a$ bis	J. S. Hart, W. S. Malcom.	P. O. and S. I. Vol. I, S.O., and S. Coll.
151	40.38	68.85	49.41	24.89	45.88	Nov. 1855;	Jan. 1858	2	3	$7_m\ 2_a\ 9_a$	J. W. Chickering.	P. O. and S. I. Vol. I.
152	43.76	65.74	46.78	24.19	45.12	Jan. 1828;	Dec. 1852	21	8	[1]	Various observers.	N. Y. Univ. Syst. 1855, and MS. in S. Coll.
153	48.61	70.01	53.76	31.86	51.06	Jan. 1834;	Dec. 1837	2	0	[1]	G. B. Docharty, N. H. Wells.	N. Y. Univ. Syst. 1855.
154	41.33	66.77	47.16	22.46	44.43	Jan. 1860;	Dec. 1870	10	11	$7_m\ 2_a\ 9_a$ bis	E. B. Bartlett.	S. O.
155	46.16	67.91	49.22	26.03	47.33	Jan. 1835;	Sept. 1865	2	7	"	J. F. Cogswell, S. Hyde.	N. Y. Univ. Syst. 1855, S. O., and S. Coll.
156	44.28	66.82	48.53	26.53	46.54	Jan. 1829;	Dec. 1859	31	0	$\odot_r\ 2_a\ \odot_s$	Dr. H. P. Sartwell.	Reg. Rep., MS. in S. Coll., & P. O. and S. I. Vol. I.
157	..	..	..	..	..	1869		0	1	$7_m\ 2_a\ 9_a$ bis	C. P. Murphy.	S. O.
158	39.93	..	..	..	..	Aug. 1856;	June, 1857	0	8	$7_m\ 2_a\ 9_a$	J. H. Norton.	P. O. and S. I. Vol. I.
159	41.60	66.66	46.85	20.46	43.89	Jan. 1839;	Dec. 1870	15	9	$\odot_r\ 9_m\ 3_a\ 9_a$	Various observers.	Ar. Met. Reg., MS. from S. G. O., N. Y. Univ. Syst. 1855, P. O. and S. I. Vol. I, and MS. in S. Coll.
160	40.80	63.96	44.24	22.42	42.85	Jan. 1826;	Jan. 1858	21	1	[1]	" "	N.Y. Univ. Syst. 1855, MS. in S. Coll., & P. O. & S. I. Vol. I.

[3] The observations for this series were made at *Columbia College*, *Lewis M. Rutherfurd's Observatory*, *Rutgers Female College*, *St. Francis Xavier's College*, *No. 232 Fifth Avenue*, and one other location, not given.

[4] This series is composed of the three preceding series, corrected for daily variation. The observations for this series were made at various hours, $\odot_r\ 9_a\ 3_a\ 9_a$ predominating.

[5] Corrected for daily variation by means of the general table. They were referred to $\odot_r\ 9_a\ 3_a\ 9_a$ by means of the general table.

NEW YORK.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
161. Pompey Hill	42°52′	76°09′	1737	..	..	..	..	50°.07	65°.55	69°.82	..	..	..	..	..
162. Potsdam (St. Lawr. Acad.)	44 40	75 01	394	18°.41	18°.78	29°.96	43°.75	55.03	63.96	68.39	66°.75	57°.37	44°.99	33°.72	22°.11
163. Poughkeepsie (Dutchess Acad.)	41 40	73 55	..	26.29	27.27	36.26	49.92	59.81	68.39	73.60	72.24	64.01	52.01	41.51	30.78
164. Poughkeepsie	41 42	73 56	..	..	..	39.14	..	55.83	..	75.27	..	..	..	..	..
165. Prattsburgh (Franklin Acad.)	42 34	77 20	1494	24.47	24.61	32.99	46.15	52.88	61.28	66.77	65.86	57.47	45.93	35.21	28.19
166. Red Hook (Acad.)	41 58	73 52	..	24.66	26.06	35.83	49.14	58.00	66.98	71.88	68.64	61.61	50.41	39.59	27.58
167. Rochester	43 08	77 40	506	25.49	25.91	32.73	45.21	56.23	65.63	70.38	68.10	60.43	48.53	38.09	27.97
168. Rockland (Female Inst.)	41 09	74 00	81	..	34.75	37.10	51.78	59.55	..	..	..	..	..	..	..
169. Rouse's Point	44 59	73 22	117	18.02	18.91	29.21	40.23	54.66	64.63	68.89	66.81	57.59	46.45	36.53	21.74
170. Sackett's Harbor	43 55	76 07	266	21.14	24.14	30.36	43.64	54.37	65.20	70.06	70.26	61.56	50.07	40.77	25.87
171. Sag Harbor	41 00	72 18	40	31.00	31.88	33.69	45.97	56.79	68.40	73.73	70.86	65.41	55.55	44.73	34.38
172. Salem (Wash. Ac.)	43 09	73 20	..	22.42	22.75	32.57	45.65	57.03	65.94	69.29	69.55	60.06	46.63	38.55	28.31
173. Saratoga	43 04	73 47	960	19.74	29.66	29.70	41.41	56.17	64.68	72.30	69.90	60.83	47.31	37.96	26.29
174. Schenectady (Ac.)	42 47	73 57	300	22.09	21.79	30.43	44.58	59.05	66.67	70.15	68.09	59.84	47.09	37.54	29.22
175. Seneca Falls	42 54	76 50	463	25.72	28.54	32.31	42.69	55.58	66.21	71.08	68.51	61.17	51.76	33.31	23.89
176. Sennett	42 57	76 32	..	..	..	..	40.07	..	..	..	..	..	..	..	..
177. Sherburne	42 40	75 31	..	..	..	36.50	46.65	54.70	65.98	64.95	65.80	65.48	..	..	..
178. Sing Sing	41 09	73 52	125	32.34	34.20	38.68	46.53	59.31	70.35	74.40	70.54	64.95	51.14	46.97	32.24
179. Skaneateles	42 55	76 26	932	23.55	27.06	30.02	43.07	53.41	63.09	67.88	65.18	60.72	47.27	37.18	26.25
180. Sloansville	42 41	74 31	..	27.97	24.95	24.25	42.18	55.00	..	..	..	..	..	..	..
181. Smithville	43 52	76 06	300	21.38	21.01	28.60	42.08	52.40	63.57	70.71	67.70	60.04	47.59	40.14	22.61
182. Somerville	44 10	75 00	412	18.51	22.81	26.87	40.80	54.41	67.66	71.98	68.49	60.20	48.54	37.16	18.04
183. South Alabama	43 03	78 25	..	..	..	..	..	..	..	..	..	..	..	34.57	33.61
184. South Edmeston	42 40	75 19	..	23.13	26.77	31.40	44.88	54.79	66.57	70.25	67.29	54.09	50.66	41.78	23.12
185. South Hartford	43 18	73 25	500	20.81	24.41	32.09	47.80	59.11	70.52	74.85	71.94	63.45	50.25	38.96	25.52
186. South Trenton	43 13	75 15	835	19.10	21.08	25.97	39.01	51.66	66.06	69.29	65.38	60.39	45.27	34.28	22.90
187. Spencertown (Ac.)	42 19	73 41	750	18.31	24.42	28.14	43.54	53.00	64.47	72.54	67.11	60.74	48.55	37.14	25.09
188. Springville (Acad.)	42 30	78 42	500	24.88	25.95	30.75	45.45	53.14	61.62	67.51	64.18	57.61	46.23	37.50	28.41
189. Stapleton (Stat. Isl.)	40 39	74 04	50	27.13	25.00	..	..	..	..	..	..	..	57.00	45.05	30.50
190. Suffern	41 07	74 08	..	..	..	33.88	..	..	..	..	..	..	..	..	..
191. Syracuse (Acad.)	43 02	76 14	407	24.15	26.62	32.25	42.41	55.50	65.58	70.82	68.60	61.38	50.44	36.36	29.95
192. Theresa	44 12	75 48	365	15.59	20.17	27.09	41.92	54.68	64.20	68.51	67.46	58.96	45.23	35.38	23.94
193. Throgg's Neck	40 48	73 47	44	28.41	30.34	34.95	47.71	57.39	68.59	73.72	72.05	65.82	53.00	42.89	31.11
194. Troy (Rensselaer Inst.)	42 44	73 41	58	22.16	25.31	33.85	44.92	57.26	68.01	73.80	71.06	61.69	50.63	39.76	26.71
195. Union Springs	42 48	76 14	400	..	..	..	..	..	..	..	65.22	..	..	..	..
196. Utica	43 05	75 13	473	23.28	24.28	32.43	45.20	56.68	64.67	69.28	67.57	59.58	48.58	36.83	26.56
197. Wales	42 46	78 34	..	..	..	..	..	49.84	..	..	..	..	..	..	..
198. Wampsville	43 07	75 48	500	21.72	24.32	30.31	42.66	55.98	64.61	70.29	66.42	59.45	47.87	38.05	25.57
199. Warsaw	42 44	78 10	..	..	..	38.73	45.73	54.85	..	..	..	..	..	..	..
200. Waterbury	42 30	76 45	800	25.40	22.73	24.41	43.46	54.89	65.51	69.36	65.93	58.93	44.13	33.14	25.22
201. Waterford	42 47	73 43	70	21.97	24.63	31.08	44.89	56.36	66.37	71.31	68.63	62.05	49.71	38.30	25.95
202. Watertown	43 58	75 54	268	12.87	19.12	25.71	46.05	54.31	64.84	72.79	67.64	62.93	48.43	35.76	17.69
203. Waterville	42 54	75 25	1223	25.04	26.03	29.76	39.27	49.81	66.37	69.91	67.28	57.35	44.99	44.17	24.29
204. Watervliet Arsenal	42 43	73 50	50	23.27	23.84	34.02	45.98	59.08	68.62	74.00	71.14	62.00	49.50	38.95	27.26
205. Waverly	42 22	78 59	1300	..	30.00	..	..	..	..	..	..	..	..	..	..
206. Wellsville	42 07	78 00	1480	21.47	26.93	29.51	39.74	50.23	63.57	71.19	65.59	59.63	46.20	37.14	34.20
207. West Day	43 20	74 08	1200	..	..	29.10	42.60	51.90	68.80	70.30	67.00	59.40	50.00	..	..
208. West Point (Military Acad.)	41 24	73 57	167	28.68	29.60	37.85	49.27	60.68	69.64	74.51	72.57	65.10	54.26	42.96	32.49
209. White Plains	41 02	73 46	..	27.51	29.65	34.40	47.56	57.00	67.38	70.92	69.97	63.04	52.28	42.81	31.05
210. Whitestown (Oneida Inst. of Science, and Ind.)	43 08	75 20	824	19.68	20.85	29.12	43.74	56.48	64.53	71.41	65.99	58.50	47.09	34.57	23.97
211. Wilson	43 17	78 50	250	26.55	26.88	31.06	42.61	54.56	64.16	71.38	70.51	60.47	48.93	38.60	29.82
212. Youngsville	41 47	74 55	1000	15.08	31.28	29.48	37.22	52.16	61.34	68.36	66.02	57.56	44.96	36.50	24.26

[1] Daily means computed by the formula $\frac{a + 2b + 2c + a'}{6}$ where a represents an observation a little before sunrise, b one at 3_a, c one at one hour after sunset, and a' the morning observation on the following day. The results thus obtained appear, on the average, to be about 0°.5 too high.

NEW YORK.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
161	..	..	..	..	..	1856	0 3	$7_m\ 2_a\ 9_a$	J. F. Kendall.	P. O. and S. I. Vol. I.
162	42°.91	66°.37	45°.36	19°.77	43°.60	Jan. 1828; Dec. 1848	21 0	1	Various observers.	N. Y. Univ. Syst. 1855.
163	48.66	71.41	52.51	28.11	50.17	Feb. 1828; Apr. 1870	18 0	1	" "	" " " " "
164	..	..	..	..	..	1849	0 3	$7_m\ 9\frac{1}{2}_m\ 3_a\ 9_a$	Warring.	S. Coll.
165	44.01	64.64	46.20	25.76	45.15	Jan. 1829; Dec. 1846	10 0	1	Various observers.	N. Y. Univ. Syst. 1855.
166	47.66	69.17	50.54	26.10	48.37	Jan. 1830; Dec. 1842	12 0	1	" "	" " " " "
167	44.72	68.04	49.02	26.46	47.06	Jan. 1830; Dec. 1870	38 9	2	" "	P. O. and S. I. Vol. I, S. O., MS. in S. Coll, Reg. Rep., & N. Y. Univ. Syst. 1855.
168	49.48	..	..	..	..	1869	0 4	$7_m\ 2_a\ 9_a$ bis	C. De La Verny.	S. O.
169	41.37	66.78	46.86	19.56	43.64	Mar. 1845; Sept. 1862	8 6	2	John Bratt.	MS. in S. Coll. & MS. from S. G. O.
170	42.79	68.51	50.80	23.72	46.45	Aug. 1849; Dec. 1867	8 10	$7_m\ 2_a\ 9_a$	H. Metcalf, Platt.	U. S. Lake Survey, Rep. of 1867–68 and S. Coll.
171	45.48	71.00	55.23	32.42	51.03	Oct. 1849; Dec. 1858	9 1	"	E. N. Byram.	P. O. and S. I. Vol. I, & S. Coll.
172	45.08	68.26	48.41	24.49	46.56	Jan. 1828; Dec. 1847	10 0	1	Various observers.	N. Y. Univ. Syst. 1855.
173	42.43	68.96	48.70	25.23	46.33	Dec. 1856; Jan. 1858	1 2	$7_m\ 2_a\ 9_a$	W. H. Riker.	P. O. and S. I. Vol. I.
174	44.69	68.30	48.16	24.37	46.38	Jan. 1829; Dec. 1864	4 0	1	Various observers.	N. Y. Univ. Syst. 1855, & S. O.
175	43.53	68.60	48.75	26.05	46.73	1849; July, 1864	4 11	$7_m\ 2_a\ 9_a$ bis	P. Cowing, Fairchild.	S. Coll. and S. O.
176	..	..	..	..	..	1857	0 1	$7_m\ 2_a\ 9_a$	H. B. Fellows.	P. O. and S. I. Vol. I.
177	45.95	65.58	..	..	..	1865	0 7	$7_m\ 2_a\ 9_a$ bis	Rev. J. R. Haswell.	S. O.
178	48.17	71.76	54.35	32.93	51.80	Mar. 1849; 1852	2 8	$\odot_r\ 9_m\ 3_a\ 9_a$	Mannie.	S. Coll.
179	42.17	65.38	48.39	25.62	45.39	Jan. 1861; Dec. 1867	5 11	$7_m\ 2_a\ 9_a$ bis	W. M. Beauchamp.	S. O.
180	40.48	..	..	..	..	May, 1868; Jan. 1870	0 5	"	G. W. Potter.	" "
181	41.03	67.33	49.26	21.67	44.82	Mar. 1849; May, 1856	4 2	$7_m\ 2_a\ 9_a$	J. E. Breed.	MS. in S. Coll., and P. O. and S. I. Vol. I.
182	40.69	69.38	48.63	19.79	44.62	1849; 1852	3 1	$\odot_r\ 9_m\ 3_a\ 9_a$	Hough.	S. Coll. and Reg. Rep.
183	..	..	..	..	..	1852	0 2	"	Bemis.	S. Coll.
184	43.69	68.04	48.84	24.34	46.23	1850; 1853	1 11	"	Beardsley.	" "
185	46.33	72.44	50.89	23.58	48.31	Aug. 1863; Dec. 1870	7 2	$7_m\ 2_a\ 9_a$ bis	G. M. Ingalsbe.	S. O.
186	38.88	66.91	46.65	21.03	43.37	Feb. 1865; Dec. 1870	5 9	"	Capt. S. Barrows.	" "
187	41.56	68.04	48.81	22.61	45.25	July, 1854; June, 1861	4 0	$7_m\ 2_a\ 9_a$	Various observers.	P. O. and S. I. Vol. I, S. O., and MS. in S. Coll.
188	43.11	64.44	47.11	26.41	45.27	Jan. 1830; Dec. 1850	7 0	1	" "	N. Y. Univ. Syst. 1855.
189	..	..	..	27.54	..	Oct. 1867; Feb. 1868	0 5	$7_m\ 2_a\ 9_a$ bis	S. L. Hillier.	S. O.
190	..	..	..	..	..	1863	0 1	"	J. H. Warren.	" "
191	43.39	68.33	49.39	26.91	47.00	Jan. 1843; Dec. 1852	3 5	$6_m\ 2_a\ 10_a$	L. W. Conkey, Drumore.	N. Y. Univ. Syst. 1855 and S. Coll.
192	41.23	66.72	46.52	19.90	43.59	Mar. 1861; Feb. 1866	4 9	$7_m\ 1_a\ 9_a$	S. O. Gregory.	S. O.
193	46.68	71.45	53.90	29.95	50.50	Dec. 1863; Dec. 1870	6 6	$7_m\ 2_a\ 9_a$ bis	F. Morris.	" "
194	45.34	70.96	50.69	24.73	47.93	Jan. 1854; Dec. 1868	6 3	"	Various observers.	P. O. and S. I. Vol. I, and S. O.
195	..	..	..	..	..	1861	0 1	"	J. S. Allen.	S. O.
196	44.77	67.17	48.33	24.71	46.25	Jan. 1826; Dec. 1870	27 2	1	Various observers.	N. Y. Univ. Syst. 1855, S. Coll., Am. Alm. 1843, Reg. Rep., S. O., and P. O. and S. I. Vol. I.
197	..	..	..	..	..	1854	0 1	7_m	Carpenter.	S. O.
198	42.98	67.11	48.46	23.87	45.60	Jan. 1854; Dec. 1861	6 10	$7_m\ 2_a\ 9_a$ bis	Dr. S. Spooner.	P. O. and S. I. Vol. I, and S. O.
199	46.44	..	..	..	..	1865	0 3	"	J. P. Morse.	S. O.
200	40.92	66.93	45.40	24.45	44.43	Jan. 1869; Oct. 1870	1 9	"	D. Trowbridge.	" "
201	44.11	68.77	50.02	24.18	46.77	Jan. 1856; May, 1863	6 3	"	J. C. House.	P. O. and S. I. Vol. I, and S. O.
202	42.02	68.42	49.04	16.56	44.01	1856	1 0	$7_m\ 2_a\ 9_a$	Dr. P. O. Williams.	P. O. and S. I. Vol. I.
203	39.61	67.85	48.84	25.12	45.35	1849; 1851	1 7	$\odot_r\ 9_m\ 3_a\ 9_a$	Lower.	S. Coll.
204	46.36	71.25	50.15	24.79	48.14	Jan. 1824; Dec. 1854	30 9	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
205	..	..	..	..	..	1861	0 1	"	W. Flint, J. Curtiss.	S. O.
206	39.83	66.78	47.66	27.53	45.45	Jan. 1857; Apr. 1858	1 2	"	H. M. Sheerar.	P. O. and S. I. Vol. I.
207	41.20	68.70	..	..	..	1858	0 8	$\odot_r$ N. $\odot_s$	J. M. Young.	MS. in S. Coll.
208	49.27	72.24	54.11	30.26	51.47	Jan. 1824; Dec. 1870	46 5	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855, and MS. from S. G. O.
209	46.32	69.42	52.71	29.40	49.46	Jan. 1854; Dec. 1870	8 9	$7_m\ 2_a\ 9_a$ bis	Prof. O. R. Willis, Jenkins.	S. O. and S. Coll.
210	43.11	67.31	46.72	21.50	44.66	Jan. 1834; Dec. 1840	7 0	1	Various observers.	N. Y. Univ. Syst. 1855.
211	42.74	68.68	49.33	27.75	47.13	Jan. 1860; Dec. 1864	4 3	$7_m\ 2_a\ 9_a$ bis	Dr. E. S. Holmes.	S. O.
212	39.62	65.24	46.34	23.54	43.69	....	3 0	$6_m\ 1_a\ 9_a$	J. Hamam.	" "

2 Corrected for daily variation by means of the general table.

NORTH CAROLINA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Asheville	35°33′	82°30′	2200	39.°02	37°.41	43°.96	53°.10	60°.75	68°.38	72°.40	70°.90	65°.95	53°.07	43°.77	37°.31
2. Attaway Hill	35 25	80 00	850	38.53	41.80	46.76	56.75	63.66	73.64	77.42	75.84	69.18	56.95	44.92	38.97
3. Beaufort	34 43	76 39	20	47.04	47.54	51.68	56.23	67.72	74.09	78.02	83.42	74.60	62.84	56.52	50.15
4. Bethmont	36	79	..	39.34	35.34	42.36	50.14	59.17	66.50	71.80	71.80	65.00	49.50	48.50	42.75
5. Chapel Hill (Univ. of N. C.)	35 58	78 54	..	40.40	44.96	49.84	59.31	67.39	75.79	78.38	76.22	70.84	59.70	50.84	43.40
6. Davidson College	35 30	80 44	850	43.74	41.42	48.01	58.30	66.56	73.92	77.57	80.33	64.24	57.23	45.46	43.20
7. Fort Johnston	33 55	78 01	20	49.10	50.58	56.39	64.26	73.04	79.09	81.64	80.25	76.09	67.13	59.29	52.29
8. Fort Macon	34 42	76 40	20	44.72	43.95	49.97	59.97	68.95	77.29	80.02	79.74	74.84	64.58	56.56	48.09
9. Gaston (or Green Plains)	36 28	77 38	..	36.82	42.06	47.91	54.38	65.70	74.18	77.92	76.07	68.40	57.51	47.28	40.08
10. Goldsboro'	35 25	77 51	102	41.38	47.60	50.20	60.16	68.67	76.96	81.19	78.38	72.66	61.78	50.45	43.73
11. Jackson	36 20	77 25	..	41.06	46.52	52.83	58.50	69.68	76.49	79.31	..	..	60.74	49.01	25.92
12. Kenansville (Webster Inst.)	34 58	77 50	60	46.35	42.78	48.56	57.46	66.67	74.78	78.66	78.34	68.75	56.84	47.03	39.53
13. Lake Scuppernong	35 50	76 18	25	41.23	44.69	50.87	54.74	68.35	72.75	78.50	74.47	68.54	61.10	51.29	45.78
14. Marlborough	35 36	77 30	..	48.11	40.96	49.77	62.33	68.19	77.01	..	79.09	..	..	..	..
15. Morgantown	35 49	81 32	1135	38.79	38.29	50.51	54.62	66.24	72.73	80.04	..	..	..	..	50.77
16. Mount Olive	35 14	77 55	100	..	..	..	..	..	..	81.28	80.08	69.33	56.33	..	..
17. Murfreesboro'	36 26	77 01	..	40.74	44.95	49.21	57.02	66.46	75.60	77.34	76.45	68.61	58.22	49.15	42.61
18. Oxford	36 22	78 29	..	38.87	42.56	46.59	57.50	65.61	74.80	79.97	74.96	69.99	55.53	46.57	37.74
19. Raleigh	35 48	78 38	317	37.84	43.82	47.28	58.15	65.33	75.52	79.75	76.44	72.10	58.09	49.18	38.76
20. Rutherfordton	35 24	81 48	800	..	..	..	..	..	76.96	74.35	76.55	69.85	56.61	52.07	42.28
21. Scuppernong	35 50	76 18	20	..	48.11	53.00	60.89	68.87	73.43	79.15	76.22	71.65	..	..	..
22. Statesville	35 49	80 46	..	34.81	39.37	43.76	54.67	61.76	71.09	77.14	74.60	64.62	53.66	41.34	30.17
23. Thornbury	36 20	77 21	..	41.47	39.80	49.28	59.22	69.72	75.13	79.53	..	..	..	46.72	37.70
24. Trinity College	35 45	79 40	400	40.40	43.90	46.63	57.23	63.73	..	..	..	..	..	..	..
25. Warrenton	36 24	78 02	..	42.00	39.40	41.63	55.00	64.95	73.57	78.35	74.40	67.43	59.71	48.56	37.88
26. Westminster	36 02	79 52	..	..	..	.	..	..	73.85	78.42	73.55	..	..	..	..
27. Wilson	35 45	77 47	105	..	43.98	51.08	63.50	66.73	..	81.33	75.18	73.55	59.95	51.00	41.87

OHIO.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Athens	39 20	82 02	750	23.62	34.00	43.95	50.37	64.29	71.61	75.71	71.74	64.69	55.18	40.79	30.33
2. Austinburgh[1]	41 48	80 54	816	22.33	26.23	30.33	43.67	56.06	67.01	72.55	69.75	64.67	50.11	38.57	34.20
3. Avon	41 27	82 04	840	31.10	33.42	45.76	45.72	62.14	64.72	72.92	70.38	62.05	47.17	40.74	31.31
4. Bellefontaine	40 23	83 42	1031	24.89	25.05	36.61	48.89	61.12	71.38	75.80	70.65	64.45	51.93	39.28	28.82
5. Bethel	39 00	84 00	555	26.89	32.50	38.27	50.77	59.18	69.25	74.14	70.48	63.36	49.23	39.76	30.55
6. Bowling Green	41 24	83 38	700	28.97	29.28	35.85	48.91	58.76	69.14	74.43	70.80	62.89	51.09	40.44	32.05
7. Brecksville	41 22	81 40	800	24.43	32.83	..	..	..	..	..	..	..	48.62	42.41	21.98
8. Carthagena	40 28	84 33	..	..	..	..	..	..	..	..	..	70.79	55.85	43.48	28.50
9. Chilicothe	39 18	82 52	..	40.0	40.0	41.0	57.0	69.0	77.0	77.0	80.0	70.0	56.0	59.0	39.0
10. Cincinnati	39 06	84 30	540	33.50	33.15	42.94	55.35	63.33	70.86	75.47	73.25	65.46	52.30	41.71	33.09
11. Cincinnati (Woodward Coll.)	39 06	84 30	540	32.91	35.35	43.15	54.81	64.42	72.64	77.75	75.33	67.82	54.22	43.59	34.59
12. Cincinnati	39 06	84 30	540	33.70	33.40	42.90	55.20	63.60	70.90	75.60	73.20	65.20	52.40	41.60	33.70
13. Cincinnati	39 06	84 30	540	33.79	37.98	45.66	57.11	65.96	73.23	77.32	75.50	68.79	53.39	45.37	35.81
14. Cincinnati	39 06	84 30	[2]	30.76	34.87	41.24	54.15	63.44	72.64	77.21	74.96	67.59	53.41	42.57	33.61
15. Cleveland	41 30	81 42	643	25.94	28.31	34.85	47.03	56.96	67.94	71.73	69.36	63.08	51.35	40.58	30.72
16. Clifton	39 44	83 57	..	..	..	..	..	..	..	..	74.55	..	..	..	..
17. College Hill (Farmer's Coll.)	39 19	84 35	800	29.88	33.31	42.07	53.41	62.38	70.26	74.06	72.18	65.49	53.42	42.11	31.76

[1] Observations previous to 1862 were made at Jefferson, about five miles southeast of Austinburgh.

[2] Observations corrected for daily variation by means of the general table.

NORTH CAROLINA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	52°.60	70°.56	54°.26	37°.91	53°.83	Aug. 1857;	Dec. 1870	4 5	$7_m\ 2_a\ 9_{a\ bis}$	W. W. McDowell, E. J. Krow, and E. J. Aston.	S. O. and P. O. and S. I. Vol. I.
2	55.72	75.63	57.02	39.77	57.04	Apr. 1861;	Dec. 1870	4 7	"	F. J. Kron.	S. O.
3	58.54	78.51	64.65	48.24	62.48	June, 1863;	Dec. 1864	1 4	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
4	50.56	70.03	54.33	39.14	53.52	1850		1 0	$\odot_r$	Bingham.	Pat. Off. Rep. 1851.
5	58.85	76.80	60.46	42.92	59.76	Jan. 1820;	May, 1870	20 0	$7_m\ 2_a\ 9_{a\ bis}$	Caldwell, Prof. J. Phillips, D. S. Patrick.	Rep. Brit. Assoc. 1847, Am. Alm. 1847 and foll., Dove, MS. in S. Coll., and S. O.
6	57.62	77.27	55.64	42.79	58.33	Nov. 1857;	Dec. 1859	1 10	$7_m\ 2_a\ 9_a$	Prof. W. C. Kerr.	P. O. and S. I. Vol. I.
7	64.56	80.33	67.50	50.66	65.76	Jan. 1822;	July, 1845	15 10	"	Assistant Surgeon.	Ar. Met. Reg. 1855.
8	59.63	79.02	65.33	45.59	62.39	Oct. 1833;	Aug. 1849	5 3	"	" "	" " "
9	56.00	76.06	57.73	39.65	57.36	Oct. 1856;	Mar. 1861	4 6	"	Dr. G. F. Moore.	P. O. and S. I. Vol. I, and S. O.
10	59.68	78.84	61.63	44.24	61.10	Jan. 1856;	Dec. 1870	6 5	$7_m\ 2_a\ 9_{a\ bis}$	Prof. D. Morrelle and Prof. E. W. Adams.	" " " " " "
11	60.34	..	..	37.83	..	1852;	1854	2 0	$7_m\ 2_a\ 9_a$	Guald.	S. Coll.
12	57.56	77.26	57.54	42.89	58.81	Jan. 1860;	May, 1870	3 0	$7_m\ 2_a\ 9_{a\ bis}$	Prof. N. B. Webster, and J. N. Sprunt.	S. O.
13	57.99	75.24	60.31	43.90	59.36	1849;	1853	3 0	$\odot_r\ 9_m\ 3_a\ 9_a$	Shepherd.	S. Coll.
14	60.10	..	..	..	..	1858		0 7	$7_m\ 2_a\ 9_a$	....	P. O. and S. I. Vol. I.
15	57.12	..	..	42.62	..	Dec. 1867;	July, 1868	0 8	"	....	MS. from S. G. O.
16	..	..	..	..	..	1869		0 4	$7_m\ 2_a\ 9_{a\ bis}$	E. D. Pearsall.	S. O.
17	57.56	76.46	58.66	42.77	58.86	Oct. 1856;	Apr. 1861	4 3	$7_m\ 2_a\ 9_a$	Rev. N. McDowell.	P. O. and S. I. Vol. I, and S. O.
18	56.57	76.58	57.36	39.72	57.56	July, 1866;	Dec. 1870	4 1	$7_m\ 2_a\ 9_{a\ bis}$	J. H. Mill and Dr. W. R. Hicks.	S. O.
19	56.92	77.24	59.79	40.14	58.52	Aug. 1866;	June, 1869	2 11	"	F. P. Brewer.	" "
20	..	75.95	59.51	..	..	1849		0 7	$\odot_r\ 9_m\ 3_a\ 9_a$	Galloway.	S. Coll.
21	60.92	76.27	..	..	..	1853		0 8	$7_m\ 2_a\ 9_a$	Hardison.	" "
22	53.40	74.28	53.21	34.78	53.92	June, 1866;	Dec. 1870	4 0	$7_m\ 2_a\ 9_{a\ bis}$	Col. T. P. Allison.	S. O.
23	59.41	..	..	39.66	..	Jan. 1854;	Apr. 1855	1 1	$7_m\ 2_a\ 9_a$	Rev. T. Fitzgerald & Prof. D. Morrelle.	P. O. and S. I. Vol. I.
24	55.86	..	..	..	..	Jan. 1861;	May, 1869	0 5	$7_m\ 2_a\ 9_{a\ bis}$	O. W. Carr, E. D. Pearsall, & others.	S. O.
25	53.86	75.44	58.57	39.76	56.91	Aug. 1857;	Dec. 1870	1 2	"	Dr. W. M. Johnston and H. A. Foote.	P. O. and S. I. Vol. I, and S. O.
26	..	75.27	..	..	..	1843		0 3	$\odot_r$ N. $\odot_s$	J. Watkins.	S. Coll.
27	60.44	..	61.50	..	..	1866		0 10	$7_m\ 2_a\ 9_{a\ bis}$	E. W. Adams.	S. O.

OHIO.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	52.87	73.02	53.55	29.32	52.19	1849;	1852	1 8	$\odot_r\ 9_m\ 3_a\ 9_a$	Mathew.	S.Coll. and MS.
2	43.35	69.77	51.12	27.59	47.96	Mar. 1856;	Dec. 1867	5 7	$7_m\ 2_a\ 9_{a\ bis}$	J. D. Herrick, J. G. Dale, G. S. S. Griffing, and E. D. Winchester.	P. O. and S. I. Vol. I, and S. O.
3	51.21	69.34	49.99	31.94	50.62	Nov. 1858;	Dec. 1859	1 2	$7_m\ 2_a\ 9_a$	Rev. L. T. Ward.	P. O. and S. I. Vol. I.
4	48.87	72.61	51.89	26.25	49.91	Dec. 1855;	Dec. 1870	3 7	"	J. Shaw, W. Barringer.	P. O. and S. I, Vol. I. and S. O.
5	49.41	71.29	50.78	29.98	50.37	Feb. 1860;	Dec. 1870	9 4	$7_m\ 2_a\ 9_{a\ bis}$	G. W. Crane.	S. O.
6	47.84	71.46	51.47	30.10	50.22	July, 1857;	Dec. 1870	10 3	"	Dr. W. R. Peck, J. Clarke.	P. O. and S. I. Vol. I, MS. in S. Coll., and S. O.
7	..	..	..	26.41	..	Oct. 1859;	Feb. 1861	0 5	"	Rev. S. L. Hillier, L. L. Willis.	P. O. and S. I. Vol. I. and S. O.
8	..	..	56.71	..	..	1870		0 4	"	R. Müller.	S. O.
9	55.67	78.00	61.67	39.67	58.75	1819		1 0	$7_m\ 2_a\ 9_a$	....	Rep. Brit. Asso. 1847.
10	53.87	73.19	53.16	33.25	53.37	1806;	1813	8 0	......	Mansfield and Drake.	Drake.
11	54.13	75.24	55.21	34.28	54.72	Jan. 1819;	Dec. 1870	36 8	[2]	Prof. Ray, G. H. Phillips, and others.	MS. in S. Coll., Blodget's Clim. Drake, View of Cinn., P. O. and S. I. Vol. I, and S. O.
12	53.90	73.23	53.07	33.60	53.45	1835;	1848	14 0	......	....	Drake.[3]
13	56.24	75.35	55.83	35.86	55.85	1843;	1853	9 0	max. & min.	Lea.	Warder Hort. Reg.
14	52.94	74.94	54.52	33.08	53.87	Jan. 1860;	Dec. 1870	10 1	$7_m\ 2_a\ 9_{a\ bis}$	G. W. Harper.	S. O.
15	46.28	69.68	51.67	28.32	48.99	1850;	Dec. 1870	17 1	[2]	G. A. & Mrs. Hyde, B. A. Stanard, and Wade.	U. S. Lake Survey, MS. & Rep. of 1867–8, P. O. and S. I. Vol. I, S. O., and S. Coll.
16	..	..	..	..	..	1870		0 1	[2]	....	S. O.
17	52.62	72.17	53.67	31.65	52.53	Jan. 1814;	Dec. 1870	47 10	$\odot_r$ N. $\odot_s$	Jackson, Profs. R. S. Bosworth & J. H. Wilson, L. D. Tuckerman & J. W. Hammitt.	P. O. and S. I. Vol. I, S. O., and S. Coll.

[3] As quoted by Dove.

[4] Altitude given as 305 feet above low-water in the Ohio River.

OHIO.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
18. Columbus[1]	39°57′	82°59′	834	30°.94	36°.44	42°.26	53°.12	65°.30	70°.98	77°.64	74°.69	60°.72	49°.80	42°.34	35°.28
19. Coshocton	40 18	81 53	765	29.38	29.88	..	..	..	..	..	..	..	54.32	40.55	36.20
20. Croton	40 13	82 38	..	28.55	32.56	37.08	50.68	60.15	68.30	72.25	71.71	62.95	51.20	37.78	31.84
21. Cuyahoga Falls	41 10	81 33	..	18.40	..	..	52.70	..	73.53	..	..	..	..	40.13	25.55
22. Dayton (Cooper Sem.)	39 44	84 08	860	27.36	30.80	29.00	55.23	59.55	72.76	74.64	70.69	64.11	55.01	42.44	..
23. East Cleveland	41 31	81 40	683	27.71	28.67	34.89	48.00	53.45	63.41	67.13	66.44	61.95	48.02	37.81	32.05
24. East Fairfield[3]	40 47	80 45	1152	25.45	29.94	35.06	48.73	56.99	66.50	70.35	68.97	62.59	49.67	40.18	29.89
25. Eaton	39 44	84 35	1400	23.95	30.15	36.10	49.50	60.10	73.40	71.50	..	64.70	50.45	40.80	30.08
26. Edgerton	41 29	84 45	831	..	..	33.65	..	..	..	73.25	..	61.58	..	..	..
27. Edinburg	41 09	81 10	520	34.06	22.11	33.57	41.94	55.23	68.17	72.71	68.90	63.80	51.69	35.52	35.23
28. Elmwood	40 05	82 00	900	..	..	..	..	..	71.14	77.01	73.39	66.98	54.75	41.43	30.55
29. Fort Washington	..	..	..	40.17	42.12	50.90	60.16	..	75.90	79.17	80.90	72.18	58.14	53.19	38.11
30. Freedom	41 16	81 12	1100	27.32	26.39	34.55	46.68	62.19	68.51	72.71	70.30	61.13	49.29	39.77	30.95
31. Fremont	41 22	83 07	..	..	..	..	..	..	..	..	..	..	..	..	33.10
32. Gallipolis	38 50	82 05	600	29.78	35.11	41.44	53.91	61.87	70.65	75.72	72.79	68.98	53.84	43.57	34.68
33. Gambier (Kenyon Coll.)[4]	40 24	82 23	1000	29.94	28.23	36.61	46.10	61.54	69.85	73.55	68.59	62.99	49.54	41.34	28.41
34. Garretsville	41 18	81 08	900	..	..	..	..	..	..	69.73	70.20	62.67	..	38.55	35.18
35. Germantown[5]	39 36	84 20	720	22.57	30.11	35.69	53.46	61.28	70.17	76.36	72.01	67.09	52.56	40.41	27.99
36. Gilmore	40 18	81 20	1180	33.30	32.93	31.78	50.28	62.55	69.99	74.91	73.85	..	44.53	..	34.28
37. Granville	40 03	82 30	995	26.23	27.84	34.76	47.06	55.44	63.93	67.17	65.56	58.33	46.15	36.75	29.74
38. Hillsboro'	39 10	83 27	1150	29.07	31.59	38.24	51.32	60.46	68.29	72.88	70.16	63.81	50.79	40.33	30.90
39. Hiram	41 20	81 10	1290	22.59	27.57	33.37	44.32	54.92	68.03	72.63	67.66	62.74	51.00	36.58	31.28
40. Hudson (W. Reserve Coll.)	41 16	81 27	1137	28.40	30.45	38.63	48.76	57.72	65.94	70.91	69.51	62.05	49.68	37.09	29.91
41. Huron	41 25	82 34	..	..	30.50	40.35	47.02	57.39	69.33	..	..	..	..	..	..
42. Iberia	40 44	82 47	1160	..	..	..	..	..	..	..	..	63.09	47.65	44.88	..
43. Jackson (Jackson C.)	39 02	82 32	700	33.21	34.16	40.73	52.37	62.14	70.74	75.19	72.25	66.62	51.87	43.61	31.33
44. Jackson (Monroe C.)	39 40	80 56	540	34.80	31.80	40.73	52.18	63.23	70.96	76.88	69.59	64.96	51.51	40.33	34.20
45. Jacksonburg	39 30	84 20	1152	33.36	32.90	35.54	51.76	61.29	69.49	77.02	74.62	66.45	51.85	41.31	29.69
46. Keene	40 23	81 53	1000	28.97	34.17	40.40	48.41	60.77	69.89	74.38	72.47	66.06	51.06	43.62	29.84
47. Kelley's Island	41 36	82 43	587	26.60	28.71	33.69	45.33	57.37	68.21	73.56	72.22	65.22	52.76	41.73	30.26
48. Kenton	40 40	83 33	1562	30.00	33.41	36.63	48.06	54.96	72.14	79.73	74.50	67.01	52.29	40.21	31.24
49. Kingston	39 26	82 49	692	26.94	33.62	39.34	53.37	59.57	70.44	74.28	70.84	66.71	51.45	42.09	30.54
50. Lafayette	40 50	84 10	..	20.02	33.70	..	..	..	..	..	..	..	..	..	..
51. Lancaster	39 42	82 31	926	31.02	..	..	51.93	60.44	73.53	75.07	71.72	64.01	51.02	39.17	37.58
52. Lebanon	39 26	84 09	828	34.66	34.25	42.77	54.38	62.76	70.46	73.50	71.15	65.12	52.10	49.89	28.01
53. Lewisville	40 12	82 58	760	..	..	..	..	..	..	..	66.44	61.22	..	..	..
54. Little Mountain	41 38	81 16	6	25.53	27.94	29.79	46.26	55.75	65.74	69.83	69.57	62.66	49.73	41.44	28.15
55. Madison[7]	41 48	81 06	620	26.54	27.43	34.23	45.32	55.64	65.43	70.41	68.26	62.07	50.42	39.19	30.86
56. Mansfield	40 48	82 30	900	25.41	33.12	41.70	..	..	61.06	72.92	75.23	..	52.16	39.01	28.23
57. Margaretta	41 27	82 46	850	27.54	27.67	33.43	46.89	58.88	68.37	75.28	71.81	64.18	49.61	39.35	29.63
58. Marietta[8]	39 28	81 26	670	31.12	33.94	41.60	52.68	61.67	69.28	73.12	71.47	64.60	52.03	41.93	33.45
59. Marion	40 37	83 07	1077	24.82	28.12	34.72	48.86	57.23	67.66	72.81	68.90	62.96	48.56	38.49	27.68
60. Martin's Ferry	40 10	80 45	..	27.59	35.18	34.98	50.41	54.58	71.93	..	..	..	..	..	..
61. Montville (or Medina)	41 07	81 52	1255	29.45	29.24	36.42	45.84	57.19	65.57	70.07	68.85	62.30	50.94	38.27	31.38
62. Mount Auburn Inst.[9]	39 07	84 31	10	31.20	33.48	38.11	54.55	63.42	73.16	77.46	76.19	70.50	56.19	42.92	34.87

[1] The observations composing this series were made at the State Library and Camp Dennison.

[2] Observations corrected for daily variation by means of the general table.

[3] Also called Elk Run.

[4] Observations previous to 1869 were made at Mount Vernon, about five miles west of Gambier.

[5] Observations in Jan. and Febr. were made at Franklin, about six miles southeast of Germantown.

[6] Altitude 600 feet above Lake Erie.

OHIO.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
18	53°.56	74°.44	50°.95	34°.22	53°.29	Apr. 1843;	May, 1865	3 0	2	T. Kennedy, J. Greiner, and others.	MS. from S. G. O. and S. Coll.
19	..	..	..	31.82	..	Oct. 1861;	Feb. 1862	0 5	$7_m\ 2_a\ 9_a$ bis	T. H. Johnson.	S. O.
20	49.30	70.75	50.64	30.98	50.42	Mar. 1860;	Mar. 1863	2 11	"	M. Sperry.	" "
21	..	..	..	..	..	Nov. 1864;	June, 1865	0 5	"	D. M. Rankin.	" "
22	47.93	72.70	53.85	..	..	Jan. 1845;	Nov. 1858	1 11	$7_m\ 2_a\ 9_a$	M. G. Williams, Dr. J. C. Fisher, L. Groneweg, and others.	MS. in S. Coll., P. O. and S. I. Vol. I.
23	45.45	65.66	49.26	29.48	47.46	Jan. 1840;	July, 1866	9 11	2	Mrs. M. A. Pillsbury.	S. Coll. and S. O.
24	46.93	68.61	50.81	28.43	48.69	Sept. 1859;	May, 1867	6 9	$7_m\ 2_a\ 9_a$ bis	S. B. McMillan.	P. O. and S. I, Vol. I, and S. O.
25	48.57	..	51.98	28.06	..	Dec. 1863;	July, 1865	1 1	"	Ollilippa Larsh.	S. O.
26	..	..	..	..	..	July, 1869;	Mar. 1870	0 3	"	A. B. Knight.	" "
27	43.58	69.93	50.34	30.47	48.58	Mar. 1857;	Dec. 1858	1 9	$7_m\ 2_a\ 9_a$	S. Sanford.	P. O. and S. I. Vol. I.
28	..	73.85	54.39	..	..	1870		0 7	$7_m\ 2_a\ 9_a$ bis	C. A. Stillwell.	S. O.
29	..	78.66	61.17	40.13	..	June, 1790;	Apr. 1791	0 11	3_a	Turner.	Phil. Trans.
30	47.81	70.51	50.06	28.22	49.15	May, 1859;	May, 1862	1 11	$7_m\ 2_a\ 9_a$ bis	H. M. and W. Davidson, Jr.	P. O. and S. I. Vol. I, and S. O.
31	..	..	..	..	..	1852		0 1	$\odot_r\ 1_a\ 9_a$	....	S. Coll.
32	52.41	73.05	55.46	33.19	53.53	Mar. 1854;	Dec. 1870	7 8	$7_m\ 2_a\ 9_a$ bis	Dr. G. W. Livesay, A. P. Rogers.	P. O. and S. I. Vol. I, and S. O.
33	48.08	70.66	51.29	28.86	49.72	1852;	Nov. 1870	2 6	$7_m\ 2_a\ 9_a$ bis	F. A. Benton, C. A. Stillwell, & F. K. Dunn.	P. O. and S. I. Vol. I, S. O., and S. Coll.
34	..	..	..	..	..	1861		0 5	"	W. Peirce.	S. O.
35	50.14	72.85	53.35	26.89	50.81	Jan. 1854;	Feb. 1857	3 2	$7_m\ 2_a\ 9_a$	L. Groneweg, J. S. Binkerd, and Dr. L. Schenck.	P. O. and S. I. Vol. I.
36	48.20	72.92	..	33.50	..	Jan. 1869;	Aug. 1870	1 2	$7_m\ 2_a\ 9_a$ bis	S. M. Moore.	S. O.
37	45.75	65.55	47.08	27.94	46.58	Jan. 1837;	Feb. 1857	19 10	2	Dr. Richards, Prof. S. N. Sanford, & Carter.	MS. in S. Coll., P. O. & S. I. Vol. I.
38	50.01	70.44	51.64	30.52	50.65	Jan. 1836;	Dec. 1870	32 4	2	J. McD. Mathews & C. C. Simms.	" " " " "
39	44.20	69.44	50.11	27.15	47.73	Sept. 1855;	Oct. 1860	3 9	$7_m\ 2_a\ 9_a$	Rev. S. S. Hillier, S. M. Luther.	P. O. and S. I. Vol. I, & S. O.
40	48.37	68.79	49.61	29.59	49.09	Mar. 1838;	June, 1863	9 5	2	Prof. E. Loomis, Prof. C. A. Young, E. W. Childs, and others.	Newspaper slips in S. Coll., P. O. & S. I. Vol. I, and S. O.
41	48.25	..	..	..	..	1854		0 5	7_m N. 5_a	E. W. West.	P. O. and S. I. Vol. I.
42	..	..	51.87	..	..	1859		0 3	$7_m\ 2_a\ 9_a$	S. T. Boyd.	" " " "
43	51.75	72.73	54.03	32.90	52.85	1849;	June, 1858	6 7	2	G. L. Crookham, & M. Gilmore.	S. Coll. and P. O. and S. I. Vol. I.
44	52.05	72.48	52.27	33.60	52.60	Jan. 1858;	Dec. 1859	2 0	$7_m\ 2_a\ 9_a$	E. D. Johnson.	P. O. and S. I. Vol. I.
45	49.53	73.71	53.20	31.98	52.11	May, 1868;	Dec. 1870	2 8	$7_m\ 2_a\ 9_a$ bis	Dr. J. B. Ousley.	S. O.
46	49.86	72.25	53.58	30.99	51.67	1849;	1854	3 5	$\odot_r\ 9_m\ 3_a\ 9_a$	Bidwell and Spooner.	P. O. & S. I. Vol. I, & S. Coll.
47	45.46	71.33	53.24	28.52	49.64	Apr. 1859;	Dec. 1870	11 9	$7_m\ 2_a\ 9_a$ bis	G. C. Huntington.	Printed slip in S. Coll. & S. O.
48	46.55	75.46	53.17	31.55	51.68	Apr. 1862;	Dec. 1870	4 10	"	Dr. C. H. Smith.	S. O.
49	50.76	71.85	53.42	30.37	51.60	Nov. 1863;	Dec. 1867	3 7	"	Prof. J. Haywood.	" "
50	..	..	..	..	..	1867		0 2	"	S. Knoble.	" "
51	..	73.44	51.40	..	..	Apr. 1843;	Jan. 1859	1 10	$7_m\ 2_a\ 9_a$	M. Z. Kreider, L. M. Dayton, and H. W. Jæger.	MS. in S. Coll., P. O. and S. I. Vol. I.
52	53.30	71.70	55.70	32.31	53.25	Jan. 1845;	Mar. 1850	3 0	$\odot_r\ 9_m\ 3_a\ 9_a$	J. C. Hatfield.	S. Coll.
53	..	..	..	..	..	1852		0 2	"	Bidwell.	" "
54	43.93	68.38	51.28	27.21	47.70	Jan. 1867;	Dec. 1870	3 5	$7_m\ 2_a\ 9_a$ bis	E. J. Ferris.	S. O.
55	45.06	68.03	50.56	28.28	47.98	Dec. 1854;	Feb. 1863	8 0	"	Mrs. A. C. King, Rev. S. L. Atkins.	P. O. and S. I. Vol. I, and S. O.
56	..	69.74	..	28.92	..	June, 1851;	Mar. 1852	0 9	$\odot_r\ 9_m\ 3_a\ 9_a$	Benton.	S. Coll.
57	46.40	71.82	51.05	28.28	49.39	Jan. 1868;	Dec. 1870	3 0	$7_m\ 2_a\ 9_a$ bis	T. Neill.	S. O.
58	51.98	71.29	52.85	32.84	52.24	June, 1818;	Dec. 1870	49 10	2	J. Wood, Dr. S. P. Hildreth, Dr. G. O. Hildreth, D. P. Adams, and W. H. Fuller.	Sm. Cont. to Knowl. 1868, MS. in S. Coll., and S. O.
59	46.94	69.79	50.00	26.87	48.40	Feb. 1865;	Dec. 1870	5 11	$7_m\ 2_a\ 9_a$ bis	Dr. H. A. Johnson & Kate E. Johnson.	S. O.
60	46.66	..	..	..	..	Jan. 1867;	Apr. 1869	0 10	"	C. R. and Martha B. Shreeve.	" "
61	46.48	68.16	50.50	30.02	48.79	Feb. 1857;	Feb. 1863	6 1	"	Rev. L. F. Ward, W. P. Clark.	P. O. and S. I. Vol. I, and S. O.
62	52.03	75.60	56.54	33.18	54.34	Oct. 1855;	Dec. 1870	5 4	"	E. Hannaford, Prof. S. A. Norton & others.	" " " " "

7 Observations in part of 1855 and 1856 were made at Arcola and Unionville in Lat. 41°50′, Long. 81°00′. Possibly these are different names for the same locality.

8 This series includes observations in 1860–61 at Harmar, about one and a half miles west of Marietta.

9 Observations previous to 1861 were made at Cheviot, about three miles north of Mount Vernon Institute.

10 Altitude 470 feet above low-water in the Ohio River.

OHIO.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
63. Mount Tabor	40°15′	83°40′	1094	33°.91	35°.37	39°.66	..	..	..	..	..	63°.14	53°.41	48°.70	29°.67
64. Mount Union	40 54	81 27	..	32.60	26.31	..	48°.50	61°.28	..	..	..	..	49.99	43.39	30.18
65. Newark	40 04	82 22	825	26.07	30.04	37.13	49.91	56.22	65°.45	70°.00	69°.90	61.22	52.32	38.51	32.26
66. New Athens															
(Franklin Coll.)	40 16	81 04	..	..	..	.	..	..	65.3	75.3	..	..	46.8	..	32.4
67. New Birmingham[1]	40 10	81 37	..	24.38	29.07	35.24	48.76	57.32	66.20	72.19	68.51	61.90	47.22	36.94	31.02
68. New Concord	40 03	81 44	..	33.68	32.25	38.21	..	62.37	73.32	73.48	71.95	64.01	52.01	47.17	30.52
69. New Holland[2] (1½															
miles S. W. of)	39 30	83 09	..	30.21	30.71	38.23	54.66	68.38	..	..	..	..	51.95	43.38	34.85
70. New Lisbon	40 50	80 50	961	26.20	29.45	35.76	48.93	59.70	69.92	74.55	71.04	63.58	50.51	40.31	31.08
71. New Westfield	41 24	83 46	692	..	32.90	..	50.00	59.88	66.95	77.20	76.58	66.85	53.50	38.78	34.15
72. Nicholasville	..	..	..	..	..	..	..	..	..	..	..	..	..	46.23	..
73. North Bass Island	41 42	82 46	587	28.08	27.28	31.68	47.27	62.13	68.53	73.38	73.53	68.10	51.93	39.60	30.86
74. North Bend	39 08	84 42	800	32.55	34.48	41.09	54.17	63.66	69.98	73.88	73.56	65.92	56.04	41.95	31.29
75. North Fairfield	41 10	82 36	660	28.32	29.32	34.10	48.89	58.10	68.69	74.18	72.10	65.95	51.08	40.79	28.74
76. Northwood (or	40 30	83 45	1170	32.79	31.08	39.11	32.11	57.23	71.15	76.55	71.29	..	49.93	36.09	30.50
Geneva Hall)															
77. Norton	41 04	81 37	1200	..	..	34.40	48.30	51.12	69.03	66.30	..	..	..	..	..
78. Norwalk	41 16	82 36	..	25.29	29.34	35.02	47.70	55.95	66.66	70.64	68.78	61.64	50.67	40.31	30.35
79. Oberlin	41 20	82 12	800	24.88	28.14	34.97	46.30	58.10	69.34	72.20	70.31	64.53	50.75	39.49	29.55
80. Oxford	39 30	84 44	950	26.36	31.40	38.33	50.67	60.67	71.44	76.24	73.41	66.58	51.32	40.53	29.24
81. Pennsville	39 35	81 50	555	..	..	..	..	..	72.20	75.75	72.65	66.03	55.88	..	29.60
82. Perrysburg	41 35	83 36	..	25.60	26.90	36.55	50.58	61.16	72.18	77.68	71.80	67.34	54.03	40.55	31.10
83. Portsmouth	38 42	82 53	537	33.07	36.17	44.71	54.29	64.74	72.29	75.59	74.51	65.37	57.70	44.61	36.76
84. Prospect Hill	38 40	83 33	700	36.18	35.60	44.16	51.16	61.01	72.69	72.85	73.57	64.74	52.26	46.65	35.70
85. Republic	41 09	83 00	873	..	..	..	..	..	..	..	..	62.18	51.43	..	..
86. Ripley (Brown Co.)	38 44	83 39	[4]574	35.16	35.62	43.38	56.76	63.77	73.28	76.83	74.54	64.22	54.92	42.51	34.87
87. Ripley (Huron Co.)	41 05	82 36	965	22.58	30.57	36.07	46.92	56.20	70.49	72.29	71.99	66.27	49.71	43.88	30.53
88. Rockport[5]	41 30	81 50	665	32.26	34.01	41.08	50.34	62.27	67.28	72.98	72.45	64.39	53.95	44.04	34.87
89. Saint Clairsville	40 08	80 55	600	30.77	30.91	38.27	40.39	50.30	59.43	72.54	71.77	57.38	45.31	42.40	28.01
90. Salem	40 56	80 54	950	31.83	29.35	34.30	52.45	64.35	70.05	75.33	74.10	64.45	51.63	38.93	26.90
91. Savannah	41 02	82 24	1098	25.17	28.54	35.94	48.60	59.27	68.41	73.88	71.22	64.38	51.23	38.22	29.72
92. Saybrook	41 52	80 52	650	21.32	26.87	33.90	47.73	55.75	67.18	69.36	68.69	63.93	48.44	40.01	31.50
93. Seville	41 00	81 47	1075	26.86	33.60	35.43	48.72	53.02	67.65	69.75	63.45	63.10	53.60	38.80	34.98
94. Sidney	40 18	84 09	..	18.38	39.75	35.20	40.33	56.08	67.81	74.22	70.50	64.22	53.50	38.96	21.15
95. Smithville	40 52	81 50	934	20.55	27.20	..	48.43	58.93	66.98	71.80	72.73	63.09	45.98	40.88	27.93
96. Springfield	39 54	83 46	..	38.90	..	..	52.80	66.78	72.35	77.90	..	68.65	..	..	..
97. Steubenville	40 25	80 41	670	29.76	31.95	39.53	51.54	61.91	70.77	74.94	72.09	64.79	51.87	40.91	31.95
98. Tarlton	39 37	82 45	..	30.93	35.96	41.61	46.07	58.71	64.73	69.71	64.23	64.47	49.55	38.67	30.13
99. Toledo[6]	41 40	83 33	604	26.92	29.72	35.71	46.77	58.22	68.45	72.35	69.79	62.44	50.48	39.58	30.01
100. Troy	40 03	84 11	1103	29.24	32.81	40.48	50.69	63.91	70.92	74.70	73.48	63.98	52.23	40.38	30.53
101. Twinsburg	41 22	81 30	1050	..	..	..	..	..	..	68.73	68.33	58.63	52.23	..	..
102. Urbana (Univ.)	40 06	83 43	1015	25.75	29.26	37.13	49.79	61.29	69.55	74.14	71.10	64.58	50.79	39.56	30.14
103. Welchfield	41 23	81 12	1205	26.63	27.40	34.68	44.97	57.57	66.41	71.21	69.70	61.90	48.93	37.83	30.75
104. Wellington	41 13	82 12	875	..	33.13	..	..	62.88	67.20	73.10	..	..	..	..	..
105. West Barre	41 30	84 00	..	..	..	..	..	..	74.54	69.85	..	..	..	..	..
106. West Bedford	40 18	82 01	876	14.83	38.41	33.56	..	..	..	..	..	62.48	54.62	41.83	23.99
107. Westerville	40 04	82 46	..	28.70	31.31	38.77	50.84	60.37	68.89	73.56	70.45	63.82	50.27	40.20	31.74
108. West Union	38 48	83 21	..	30.23	..	..	..	..	..	..	..	..	..	..	..
109. Williamsport															
(Monroe Co.)	39 45	80 45	..	27.00	35.10	37.05	49.70	..	..	..	..	..	..	39.20	27.35
110. Windham	41 17	81 06	..	32.36	27.42	37.02	43.56	57.09	65.37	70.80	68.12	62.24	49.64	37.61	32.50
111. Wooster	40 51	81 59	872	24.05	29.31	34.85	49.75	59.32	71.31	75.47	72.65	66.36	50.38	39.73	29.36
112. Yankeetown	40 00	84 32	700	..	..	..	..	..	69.60	..	76.40	..	..	..	..
113. Yellow Spring	39 49	83 49	..	..	..	..	..	..	..	..	..	..	47.80	37.75	..
114. Zanesfield	40 22	83 36	..	..	..	..	..	61.25	..	..	..	..	..	..	..
115. Zanesville	39 58	81 59	700	31.89	35.10	35.30	56.20	64.20	71.69	77.25	73.67	69.48	52.40	45.31	32.64

[1] Also called Milnersville.

[2] Also called Williamsport.

[3] Observations corrected for daily variation by means of the general table.

[4] Altitude 130 feet above low-water in the Ohio River.

OHIO.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
63	..	..	55°.08	32°.98	..	1849;	1850	0	7	$\odot_r\ 9_m\ 3_a\ 9_a$	Lapham.	S. Coll.
64	..	..	..	29.70	..	Dec. 1857;	May, 1860	1	2	$7_m\ 2_a\ 9_{a\ bis}$	N. Anthony.	P. O. and S. I. Vol. 1, and S. O.
65	47°.75	68°.45	50.68	29.46	49°.09	Jan. 1855;	Aug. 1863	3	9	"	L. M. Dayton & J. Dille.	" " " " "
66	..	..	..	..	..	July, 1843;	June, 1844	0	4	$\odot_r\ 9_m\ 3_a\ 9_a$	J. P. Mason.	MS. in S. Coll.
67	47.11	68.97	48.69	28.16	48.23	May, 1862;	Aug. 1870	6	3	$7_m\ 2_a\ 9_{a\ bis}$	Rev. D. Thompson.	S. O.
68	..	72.92	54.40	32.15	..	May, 1849;	Mar. 1850	0	11	$\odot_r\ 9_m\ 3_a\ 9_a$	Irvine.	S. Coll.
69	53.76	..	..	31.92	..	Oct. 1867;	Oct. 1870	1	2	$7_m\ 2_a\ 9_{a\ bis}$	J. R. Wilkinson.	S. O.
70	48.13	71.84	51.47	28.91	50.09	Jan. 1855;	Mar. 1870	13	4	"	J. F. Benner and W. R. Smiley.	MS. in S. Coll., P. O. and S. I. Vol. 1, and S. O.
71	..	73.58	53.04	..	..	Apr. 1862;	Feb. 1863	0	10	"	A. E. Jerome.	S. O.
72	..	..	..	..	..	1861		0	1	"	....	" "
73	47.03	71.81	53.21	28.74	50.20	June, 1869;	Dec. 1870	1	7	"	Dr. G. R. Morton.	" "
74	52.97	72.47	54.64	32.77	53.21	Oct. 1859;	Jan. 1869	3	8	"	A. A. & R. B. Warder.	P. O. and S. I. Vol. 1, and S. O.
75	47.03	71.66	52.61	28.79	50.02	Feb. 1867;	Dec. 1870	3	11	"	O. Burras.	S. O.
76	42.82	73.00	..	31.46	..	1852;	Mar. 1861	1	10	$7_m\ 2_a\ 9_a$	Rev. R. Shields, and J. C. Smith.	P. O. and S. I. Vol. 1, S. O., & S. Coll.
77	44.61	..	..	..	..	1861		0	5	$7_m\ 2_a\ 9_{a\ bis}$	A. S. Steever.	S. O.
78	46.22	68.69	50.87	28.33	48.53	Oct. 1854;	Dec. 1868	8	1	"	Rev. A. Newton and G. A. Hyde.	P. O. and S. I. Vol. 1, and S. O.
79	46.46	70.62	51.59	27.52	49.05	1849;	Dec. 1870	8	5	$7_m\ 2_a\ 9_a$	Profs. J. H. Fairchild, G. N. Allen, and L. Herrick.	P. O. and S. I. Vol. 1, S.O., and S. Coll.
80	49.89	73.70	52.81	29.00	51.35	Jan. 1864;	Dec. 1870	6	9	$7_m\ 2_a\ 9_{a\ bis}$	Prof. O. N. Stoddard.	S. O.
81	..	73.53	..	..	..	1870		0	6	"	J. T. Bingman.	" "
82	49.43	73.89	53.97	27.87	51.29	Mar. 1854;	Apr. 1858	4	1	$7_m\ 2_a\ 9_a$	F. & D. K. Hollenbeck.	P. O. and S. I. Vol. 1.
83	54.58	74.13	55.89	35.33	54.98	Feb. 1824;	Aug. 1865	29	9	3	Dr. G. B. Hempstead, G. H. Poe, Dr. D. B. Cotton, & L. Engelbrecht.	MS. in S. Coll., S. O., P. O. and S. I. Vol. 1, and Drake.
84	52.11	73.04	54.55	35.83	53.88	Mar. 1849;	Jan. 1851	1	9	$\odot_r\ 9_m\ 3_a\ 9_a$	Beatly.	S. Coll.
85	..	..	..	..	..	1851		0	2	"	Dorsay.	" "
86	54.64	74.88	53.88	35.22	54.66	Oct. 1857;	Dec. 1867	5	4	$7_m\ 2_a\ 9_{a\ bis}$	J. Ammon.	P. O. and S. I. Vol. 1, and S. O.
87	46.40	71.59	53.29	27.89	49.79	Apr. 1867;	Dec. 1870	2	0	"	Mrs. M. M. Marsh.	S. O.
88	51.23	70.90	54.13	33.71	52.49	Mar. 1855;	Dec. 1863	5	0	"	Prof. G. M. Barber, E. Colbrunn.	P. O. and S. I. Vol. 1, and S. O.
89	42.99	67.91	48.36	29.90	47.29	Nov. 1849;	Oct. 1851	2	0	$\odot_r\ 2_a$	Tenin.	Pat. Off. Rep.
90	50.37	73.16	51.67	29.36	51.14	1870		1	0	$7_m\ 2_a\ 9_{a\ bis}$	J. E. Pollock.	S. O.
91	47.94	71.17	51.28	27.81	49.55	Mar. 1854;	July, 1863	9	1	"	Dr. J. Ingram.	P. O. and S. I. Vol. 1, and S. O.
92	45.79	68.41	50.79	26.56	47.89	Feb. 1862;	Apr. 1866	2	5	"	Rev. L. S. Atkins, J. B. Fraser.	S. O.
93	45.72	66.95	51.83	31.81	49.08	Jan. 1861;	Dec. 1862	1	4	"	L. F. Ward.	" "
94	43.87	70.84	52.23	26.43	48.34	Sept. 1856;	Aug. 1857	1	0	$7_m\ 2_a\ 9_a$	J. Shaw.	P. O. and S. I. Vol. 1.
95	..	70.50	49.98	25.23	..	Oct. 1864;	Sept. 1865	1	1	$7_m\ 2_a\ 9_{a\ bis}$	J. H. Myers, and W. Hoover.	S. O.
96	..	..	..	..	..	Jan. 1869;	Sept. 1870	0	6	"	J. H. Henan and G. P. Hachenberg.	" "
97	50.99	72.60	52.52	31.22	51.83	Dec. 1830;	Dec. 1870	39	11	6_m N. 6_a	R. Marsh & J. B. Doyle.	MS. in S. Coll. and S. O.
98	48.80	66.22	50.90	32.34	49.56	Dec. 1850;	Nov. 1851	1	0	$\odot_r$	Julien.	Pat. Off. Rep.
99	46.90	70.20	50.83	28.88	49.20	June, 1856;	June, 1870	13	10	$7_m\ 2_a\ 9_{a\ bis}$	Dr. J. B. Trembley, H. Bennett, & Miss S. E. Bennett.	P. O. and S. I. Vol. 1, and S. O.
100	51.69	73.03	52.20	30.86	51.95	Jan. 1859;	May, 1863	4	3	"	C. L. McClurg.	" " " " " "
101	..	..	..	..	..	1860		0	4	"	N. A. Chapman.	S. O.
102	49.40	71.60	51.64	28.38	50.26	1852;	Dec. 1870	17	1	"	M. G. Williams.	S. O., P. O. and S. I. Vol. 1, and S. Coll.
103	45.74	69.11	49.55	28.26	48.17	Mar. 1857;	Mar. 1866	9	0	"	B. F. Abell.	P. O. and S. I. Vol. 1, and S. O.
104	..	..	..	..	..	1863		0	4	"	L. F. Ward.	S. O.
105	..	..	..	..	..	1853		0	2	$7_m\ 2_a\ 9_a$	Taft.	S. Coll.
106	..	..	52.98	25.74	..	Sept. 1856;	Mar. 1857	0	7	"	H. D. McCarty.	P. O. and S. I. Vol. 1.
107	49.99	70.97	51.43	30.58	50.74	Jan. 1858;	Dec. 1870	11	7	$7_m\ 2_a\ 9_{a\ bis}$	Prof. J. Haywood.	P. O. and S. I. Vol. 1, and S. O.
108	..	..	..	..	..	1861		0	1	"	Rev. W. Lundeen.	S. O.
109	..	..	..	29.82	..	Nov. 1860;	Apr. 1861	0	6	"	Dr. W. W. Spratt.	" "
110	45.89	68.10	49.83	30.76	48.64	Mar. 1857;	Dec. 1859	2	10	$7_m\ 2_a\ 9_a$	S. W. Treat.	P. O. and S. I. Vol. 1.
111	47.97	73.14	52.16	27.57	50.21	July, 1849;	Aug. 1870	6	3	$7_m\ 2_a\ 9_{a\ bis}$	M. Winger and wife and Par-dee.	S. O. and S. Coll.
112	..	..	..	..	..	1854		0	2	$7_m\ 2_a\ 9_a$	A. Jaque.	P. O. and S. I. Vol. 1.
113	..	..	..	..	..	1843		0	2	$\odot_r\ 9_m\ 3_a\ 9_a$	Phelps.	Manuscript.
114	..	..	..	..	..	1854		0	1	$7_m\ 2_a\ 9_a$	J. F. Lukins.	P. O. and S. I. Vol. 1.
115	51.90	74.20	55.73	33.21	53.76	Jan. 1819;	Nov. 1859	3	11	"	W. Peters, Dr. J. G. F. Holston, & L. M. Dayton.	MS. in S. Coll., P. O. and S. I. Vol. 1.

[5] This series includes observations in March, 1855, at Berea, about six miles southwest of Rockport.

[6] Observations previous to 1860 were made at Collingwood, about five miles northwest of Toledo.

OREGON.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Albany (near)	44°35′	122°50′	600	32°.02	39°.48	37°.93	52°.28	59°.55	..	67°.83	71°.20	62°.73	..	..	..
2. Astoria[1]	46 11	123 48	52	38.44	38.78	44.24	48.75	53.16	57°.50	60.29	60.77	58.30	52°.69	46°.23	40°.83
3. Auburn	44 35	118 06	3350	52.04	..	..	..	..	..	71.48	70.38	..	..	..	31.23
4. Block-House	44 25	123 30	..	39.38	42.83	44.49	46.83	52.13	58.58	60.59	61.78	59.31	52.19	44.91	40.52
5. Camp Harney	43 00	119 00	..	22.74	28.25	36.89	48.55	56.92	67.34	74.27	70.96	62.05	51.17	40.42	29.60
6. Camp Logan	44 16	119 14	5600	..	..	..	43.41	49.08	56.61	66.53	66.53	57.71	49.04	45.52	..
7. Camp Lyons	42 43	116 52	5500	14.87	27.19	41.82	49.23	52.52	61.29	72.25	72.69	58.31	51.56	41.85	34.14
8. Camp Three Forks	42 15	116 54	..	22.78	29.89	37.11	43.78	53.08	63.08	71.00	71.23	61.65	52.61	41.70	31.11
9. Camp Warner	42 28	119 42	..	25.08	30.38	34.17	42.40	49.79	59.15	67.62	66.61	57.23	48.32	38.25	30.26
10. Camp Watson	44 22	119 48	..	23.38	28.05	36.10	43.65	49.56	57.39	62.95	66.14	56.60	43.99	37.66	33.22
11. Corvallis	44 32	123 04	..	31.57	37.59	36.32	50.60	..	56.85	64.07	66.10	..	46.92	..	42.89
12. Eola	44 57	122 54	500	36.40	39.05	39.40	46.79	51.86	58.47	67.45	68.64	58.19	49.32	42.07	33.22
13. Fort Dalles[2]	45 33	120 50	350	31.59	38.21	45.93	53.51	61.34	67.29	73.79	72.62	63.87	54.44	42.52	33.69
14. Fort Hoskins	45 06	123 26	..	38.74	41.61	44.96	50.35	55.05	60.43	63.55	64.19	59.78	52.29	45.08	40.39
15. Fort Klamath	42 40	121 50	4200	22.78	25.21	34.06	38.81	44.60	52.26	60.92	58.77	47.98	40.65	34.60	24.98
16. Fort Lane	42 20	122 46	2000	39.29	43.52	51.78	52.45	60.23	68.66	74.55	73.09	..	60.43	40.39	32.70
17. Fort Orford[2]	42 44	124 29	50	48.73	48.17	49.95	51.13	55.06	58.66	59.57	60.92	59.19	55.82	50.42	48.77
18. Fort Stevens	46 12	123 57	..	38.28	40.76	43.41	48.95	53.58	58.70	62.89	61.37	58.18	53.59	48.90	42.59
19. Fort Umpqua	43 42	124 10	8	44.17	46.22	48.12	50.69	54.48	59.47	59.93	59.72	58.91	54.10	49.57	45.51
20. Fort Yamhill	45 21	123 15	..	37.12	39.62	43.55	47.81	53.42	56.97	60.92	61.23	58.14	51.21	43.52	38.17
21. Oregon City	45 20	122 18	200	38.60	42.00	45.20	55.90	60.90	66.30	72.27	71.63	60.20	55.80	47.23	38.93
22. Portland[3]	45 30	122 36	45	40.65	40.73	42.20	51.65	56.50	65.61	69.47	68.09	62.98	53.18	48.40	39.31
23. Salem	44 56	122 45	120	41.3	49.2	46.5	49.5	58.4	64.5	67.1	69.3	65.2	70.5	58.2	50.3
24. Salem	44 56	122 45	120	..	..	..	..	..	..	..	..	..	49.48	..	..
25. Willamette Univ.	45 22	122 23	120	39.50	..	..	..	52.23	..		..	..	..	..	..

PENNSYLVANIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Abington	41 31	75 46	1183	23.93	26.11	31.97	45.31	55.15	65.95	69.98	67.12	60.78	47.39	37.90	27.40
2. Allegheny Arsenal	40 29	79 59	704	28.89	31.67	38.84	50.36	61.49	69.90	73.58	71.59	64.15	51.45	40.38	32.04
3. Allegheny City	40 28	80 03	..	..	..	..	51.66	..	..	..	..	..	..	..	..
4. Allegheny Tunnel	40 30	78 36	2161	29.67	..	34.92	47.14	57.54	68.67	70.59	71.31	..	..	..	..
5. Altoona	40 32	78 24	1208	..	..	33.03	46.28	..	..	..	..	..	46.49	42.27	29.40
6. Ashland	40 48	76 20	1005	..	27.23	31.88	50.75	58.01	..	..	..	..	..	..	..
7. Avondell	40 27	77 22	515	27.15	25.97	35.32	45.98	57.51	68.28	73.79	70.42	61.98	49.69	41.22	26.31
8. Beaver	40 43	80 20	..	29.89	27.79	..	54.52	62.35	72.56	74.42	72.10	59.63	53.14	38.87	29.81
9. Beaver Seminary	40 43	80 23	..	32.11	30.48	37.89	48.74	60.18	67.76	74.56	71.54	62.81	50.02	40.76	31.96
10. Bedford	40 01	78 30	..	27.77	30.68	37.90	49.90	60.52	70.97	74.12	72.19	63.64	52.18	40.13	31.43
11. Berwick	41 05	76 15	583	25.21	31.29	39.36	47.63	59.76	68.60	73.00	71.05	62.08	51.94	40.94	30.91
12. Bethlehem	40 43	75 20	300	31.81	34.25	38.53	48.31	58.59	69.82	73.63	69.54	61.34	51.39	45.66	33.06
13. Blairsville	40 27	79 15	1010	22.7	28.2	34.3	42.1	52.4	54.9	64.8	66.0	52.8	47.7	40.2	28.0
14. Blooming Grove	41 23	75 09	..	21.81	23.63	29.25	43.99	52.96	64.61	68.66	64.58	59.23	44.78	35.60	24.62
15. Brookville	41 12	79 08	..	..	..	..	..	59.55	68.57	75.30	72.00	64.77	..	..	..
16. Brownsville	40 02	79 52	..	35.33	30.90	..	54.03	68.40	74.88	80.55	77.00	70.38	58.55	41.66	34.24
17. Buffalo Township	40 44	79 40	1000	..	..	..	47.80	63.03	65.13	69.08	..	..	..	..	..
18. Bustleton	40 05	75 01	..	28.25	..	..	..	..	..	..	..	..	..	..	..
19. Butler	40 54	79 50	850	28.48	32.92	39.92	49.71	60.78	71.06	74.82	71.81	64.08	54.63	41.96	30.76
20. Byberry	40 06	74 58	70	27.04	33.68	38.07	48.85	61.78	69.17	74.57	73.36	66.08	56.78	44.35	34.44
21. Canonsburg (Jefferson Coll.)	40 17	80 11	850	27.95	31.67	38.41	48.77	59.49	67.74	71.80	70.13	63.73	51.97	39.89	31.23
22. Carlisle (Barracks)	40 12	77 11	600	28.10	30.17	37.31	50.16	61.25	71.00	75.04	72.54	65.42	52.39	39.15	31.27
23. Carpenter	41 37	76 51	..	..	..	..	..	51.05	60.95	66.28	66.00	59.73	..	..	..

[1] Observations in 1850 and 1851 at $\odot_r$ 9_a 3_a 9_a, referred to 6_m N. 6_a.

[2] Observations previous to 1855 at $\odot_r$ 9_m 3_a 9_a, referred to 7_m 2_a 9_a.

OREGON.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	49°.92	..	..	..	..	Jan. 1867;	Jan. 1868	0 9	$7_m\ 2_a\ 9_{a\ bis}$	S. M. W. Hindman.	S. O.
2	48.72	59°.52	52°.41	39°.35	50°.00	Aug. 1850;	Dec. 1870	18 3	6_m N. 6_a	Assistant Surgeon, L. Wilson.	Ar. Met. Reg. 1855, and U. S. Coast Survey.
3	..	..	..	..	..	Dec. 1863;	Aug. 1864	0 4	$7_m\ 2_a\ 9_{a\ bis}$	R. B. Imside.	S. O.
4	47.82	60.32	52.14	40.91	50.30	Mar. 1858;	Dec. 1862	4 3	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860, and MS. from S. G. O.
5	47.45	70.86	51.21	26.86	49.10	Jan. 1868;	Dec. 1870	3 0	"	" "	MS. from S. G. O.
6	..	63.22	50.76	..	..	Nov. 1867;	Oct. 1868	0 8	"	" "	" " "
7	47.86	68.74	50.57	25.40	48.14	Oct. 1867;	Sept. 1868	1 0	"	" "	" " "
8	44.66	68.44	51.99	27.93	48.25	Jan. 1868;	Dec. 1869	2 0	"	" "	" " "
9	42.12	64.46	47.93	28.57	45.77	Jan. 1868;	Dec. 1870	3 0	"	" "	" " "
10	43.10	62.16	46.08	28.22	44.89	Apr. 1867;	Apr. 1869	2 1	"	" "	" " "
11	..	62.34	..	37.35	..	June, 1866;	Feb. 1868	1 1	$7_m\ 2_a\ 9_{a\ bis}$	A. D. Barnard.	S. O.
12	46.02	64.85	49.86	36.22	49.24	1870		1 0	"	T. Pearce.	" "
13	53.59	71.23	53.61	34.50	53.23	Sept. 1850;	Mar. 1866	13 2	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
14	50.12	62.72	52.38	40.25	51.37	Nov. 1856;	Mar. 1865	8 0	"	" "	Ar. Met. Reg. 1860, and MS. from S. G. O.
15	39.16	57.32	41.08	24.32	40.47	Dec. 1863;	Mar. 1866	2 4	"	" "	MS. from S. G. O.
16	54.82	72.10	..	38.50	..	Jan. 1855;	Oct. 1856	1 6	"	" "	Ar. Met. Reg. 1860.
17	52.05	59.72	55.14	48.56	53.87	June, 1852;	July, 1856	3 0	"	" "	Ar. Met. Regs. 1855 and 1860.
18	48.65	60.99	53.56	40.54	50.93	Nov. 1865;	Sept. 1868	2 8	"	" "	MS. from S. G. O.
19	51.10	59.71	54.19	45.30	52.57	Aug. 1856;	May, 1862	5 10	"	" "	Ar. Met. Reg. 1860 and MS. from S. G. O.
20	48.26	59.71	50.96	38.30	49.31	Oct. 1856;	Apr. 1866	9 5	"	" "	" " " "
21	54.00	70.07	54.41	39.84	54.58	Jan. 1849;	Dec. 1851	2 11	$\odot_r\ 2_a\ \odot_s$	Assistant Surgeon, G. M. Atkinson.	Ar. Met. Reg. 1855, and S. Coll.
22	50.12	67.72	54.85	40.23	53.23	Apr. 1858;	Dec. 1870	2 0	$7_m\ 2_a\ 9_{a\ bis}$	G. H. Stibbins, J. S. Reed, S. W. Gilliland.	P. O. and S. I. Vol. 1, and S. O.
23	51.47	66.97	64.63	46.93	57.50	Oct. 1856;	Sept. 1857	1 0	......	....	Newspaper slip and P. O. and S. I. Vol. 1.
24	..	..	..	..	..	1863		0 1	$7_m\ 2_a\ 9_{a\ bis}$	P. L. Willis.	S. O.
25	..	..	..	..	..	May, 1861;	Jan. 1864	0 2	"	T. H. Crawford.	" "

PENNSYLVANIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	44.14	67.68	48.69	25.81	46.58	Jan. 1864;	Dec. 1870	7 0	$\odot_r$ N. $\odot_s$	R. Sisson.	Table in S. Coll. and S. O.
2	50.23	71.69	51.99	30.87	51.19	Jan. 1825;	Apr. 1867	33 2	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855–60 and MS. from S. G. O.
3	..	..	..	..	..	1849		0 1	$\odot_r\ 9_m\ 3_a\ 9_a$	Stewart.	S. Coll.
4	46.53	70.19	..	..	..	1853		0 7	$7_m\ 2_a\ 9_a$	Seabrook.	" "
5	..	..	..	..	..	Oct. 1859;	Apr. 1863	0 5	$7_m\ 2_a\ 9_{a\ bis}$	W. R. Boyers, T. H. Savery.	P. O. and S. I. Vol. 1, and S. O.
6	46.68	..	..	..	..	1870		0 4	"	W. E. Honeyman.	S. O.
7	46.27	70.83	50.96	26.48	48.64	June, 1867;	Apr. 1869	1 11	"	W. E. Baker.	" "
8	..	73.03	50.55	29.16	..	1839;	1840	1 2	$7_m\ 2_a\ 9_a$	W. Allison.	Journ. Frank. Inst.
9	48.94	71.29	51.20	31.52	50.74	Oct. 1867;	Dec. 1870	3 3	$7_m\ 2_a\ 9_{a\ bis}$	Rev. R. T. Taylor.	S. O.
10	49.44	72.43	51.98	29.96	50.95	1839;	Dec. 1861	11 8	$7_m\ 2_a\ 9_a$	S. Brown, King, and Rev. H. Heckerman.	P. O. and S. I. Vol. 1, S. O. Journ. Frank. Inst., & S. Coll.
11	48.92	70.88	51.65	29.14	50.15	Jan. 1856;	Jan. 1865	6 0	$7_m\ 2_a\ 9_{a\ bis}$	J. Eggert.	P. O. and S. I. Vol. 1, and S. O.
12	48.48	71.00	52.80	33.04	51.33	1849;	1851	2 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Kluge.	S. Coll.
13	42.93	61.90	46.90	26.30	44.51	Oct. 1861;	Jan. 1865	3 0	$7_m\ 2_a\ 9_{a\ bis}$	W. R. Boyers.	S. O.
14	42.07	65.95	46.54	23.35	44.48	May, 1865;	Dec. 1870	5 6	"	J. Gratwohl.	" "
15	..	71.96	..	..	..	1854		0 5	6_m N. 6_a	D. S. Dearing.	P. O. and S. I. Vol. 1.
16	..	77.48	56.86	33.49	..	Nov. 1869;	Dec. 1870	1 1	$7_m\ 2_a\ 9_{a\ bis}$	Dr. J. A. Hubbs.	S. O.
17	..	..	..	..	..	1860		0 4	"	J. H. Baird.	" "
18	..	..	..	..	..	1854		0 1	$7_m\ 2_a\ 9_a$	J. C. Martindale.	P. O. and S. I. Vol. 1.
19	50.14	72.56	53.56	30.72	51.75	1839;	1851	5 5	"	Michling.	Journ. Frank. Inst. and MS.
20	49.57	72.37	55.74	31.72	52.35	1852;	Dec. 1863	5 11	"	J. Comley and others.	P. O. & S. I. Vol. 1, S. Coll., & S. O.
21	48.89	69.89	51.86	30.28	50.23	1839;	Dec. 1870	18 8	$7_m\ 2_a\ 9_{a\ bis}$	Various observers.	P. O. and S. I. Vol. 1., Journal Franklin Institute, and S. Coll.
22	49.57	72.86	52.32	29.85	51.15	July, 1839;	Dec. 1870	29 5	$7_m\ 2_a\ 9_a$	Assist. Surg., H. Duffield, W. C. Wilson, H. W. Cook.	Ar. Met. Reg., 1855, MS. from S. G. O., P. O. & S. I. Vol. 1, and S. Coll.
23	..	64.41	..	..	..	1862		0 5	$7_m\ 2_a\ 9_{a\ bis}$	E. L. McNutt.	S. O.

[3] Observations for ten months, of 1858 and 1859, at 6_m N. 6_a, referred to $7_m\ 2_a\ 9_{a\ bis}$.

PENNSYLVANIA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
24. Catawissa	40°58′	76°30′	..	..	..	..	..	..	68°.68	71°.28	..	60°.98	..	39°.88	..
25. Ceres	42 00	78 25	1440	23°.36	23°.55	32°.34	42°.84	56°.06	64.63	68.55	66°.62	59.01	45°.76	36.19	27°.08
26. Chambersburg	39 56	77 40	618	29.47	35.22	43.95	50.23	61.49	72.04	76.18	73.91	66.33	54.27	40.45	33.29
27. Chester (U. S. Gen. Hosp.)	39 51	75 21	..	33.86	36.21	39.91	50.35	..	..	..	..	..	..	..	38.06
28. Chromedale (or Lima)	39 55	75 25	196	29.77	31.58	38.55	47.86	59.35	69.53	74.36	70.48	63.76	53.10	43.30	33.53
29. Dyberry	41 38	75 18	..	20.13	22.36	29.15	43.37	50.76	65.14	67.16	62.54	58.21	43.98	35.19	30.58
30. Easton	40 43	75 16	340	24.29	27.13	35.81	47.56	58.69	69.33	74.43	69.64	63.56	50.72	40.36	30.37
31. Ephrata	40 11	76 11	..	29.60	31.78	37.18	51.65	59.90	72.26	77.33	72.63	67.88	54.30	44.11	32.43
32. Fallsington	40 12	74 48	30	30.14	32.15	38.28	49.56	59.60	69.20	73.65	72.28	65.20	53.80	43.30	32.87
33. Fayette Tannery (2 miles east of Connellsville)	40 02	79 32	..	28.41	30.46	36.65	49.29	57.91	67.62	72.42	69.67	63.29	49.97	40.59	31.27
34. Fleming[2]	40 55	77 53	780	24.05	28.38	35.89	47.66	58.06	67.60	71.97	67.77	61.08	49.64	38.74	29.73
35. Fountain Dale	39 44	77 18	..	35.12	32.88	36.21	49.57	59.93	69.87	74.99	71.88	63.73	50.17	40.23	30.48
36. Frankford Arsenal	40 00	75 04	30	32.36	31.86	40.73	51.04	60.73	69.43	75.44	73.01	66.11	53.96	42.41	33.71
37. Franklin	41 24	79 50	980	26.68	24.26	31.92	44.68	57.76	66.91	73.98	68.52	60.75	47.13	37.26	27.48
38. Freeport	40 41	79 41	1000	..	..	..	..	..	..	79.60	77.27	71.83	57.19	40.37	..
39. Fort Mifflin	39 52	75 13	20	32.54	31.97	40.46	50.66	61.64	71.63	76.55	74.02	68.41	55.82	45.69	34.69
40. Germantown	40 01	75 10	100	29.26	31.66	38.72	51.33	61.59	71.55	75.16	72.82	65.25	52.14	41.11	31.69
41. Gettysburg	39 49	77 15	624	27.82	30.76	38.86	49.87	60.76	69.79	73.79	71.28	63.38	50.18	40.00	31.06
42. Greencastle	39 47	77 44	650	..	..	..	..	..	..	80.90	77.77	70.50	..	..	..
43. Hamlinton	41 25	75 26	..	32.38	26.20	29.23	47.38	59.82	73.50	..	70.35	60.75	45.31	36.13	30.73
44. Harrisburg	40 16	76 53	375	30.67	32.18	40.23	51.78	63.27	73.28	78.63	74.92	67.37	54.48	44.28	33.68
45. Haverford College	40 00	75 21	400	31.42	33.41	39.08	50.82	61.50	70.81	76.54	73.62	67.60	55.46	44.35	31.65
46. Hazleton	40 58	76 00	1850	..	..	..	..	..	..	..	..	..	..	..	25.95
47. Hollidaysburg	40 28	78 23	1200	29.23	32.19	37.71	47.86	59.49	72.50	73.42	70.28	62.99	49.34	45.00	29.66
48. Honesdale	41 36	75 24	..	..	20.22	..	..	..	..	69.71	..	..	..	..	..
49. Huntingdon	40 31	78 01	734	26.35	31.59	40.98	49.81	60.76	73.02	74.41	72.89	64.68	50.58	39.75	30.71
50. Indiana	40 40	79 08	1320	27.03	31.76	36.89	50.01	62.12	67.94	72.70	68.22	60.59	56.04	42.52	29.62
51. Johnstown	40 20	78 53	1200	32.92	26.95	33.77	44.44	55.51	65.62	71.55	68.09	59.52	47.78	37.00	29.23
52. Lancaster	40 03	76 21	350	30.42	33.32	41.10	51.89	60.33	70.12	73.54	71.93	64.37	52.60	41.65	32.21
53. Lancaster Colliery	40 48	76 35	920	26.15	30.19	37.37	43.25	56.22	65.45	69.84	66.33	59.34	49.24	39.43	30.90
54. Latrobe	40 20	79 21	569	..	..	..	..	56.25	..	..	..	..	..	..	..
55. Lehigh University (S. Bethlehem)	40 38	75 22	320	23.40	19.75	35.83	42.85	55.58	68.26	73.47	70.41	61.79	49.44	41.65	26.45
56. Lewisburg Univ.	40 58	76 55	..	23.42	26.58	34.56	47.58	57.84	69.05	73.14	68.91	61.68	48.86	38.73	28.17
57. Lewistown	40 35	77 37	..	29.91	36.21	41.38	56.89	67.23	68.25	75.43	72.71	65.35	58.20	..	..
58. Linden	41 14	77 11	..	27.22	30.39	40.23	44.85	..	..	..	..	..	..	34.91	..
59. Manchester	40 32	80 03	750	34.54	37.24	40.95	45.04	58.63	70.59	75.18	71.80	62.54	50.24	45.01	32.03
60. Meadville	41 39	80 09	1088	23.25	28.45	31.89	46.31	57.43	68.77	72.22	68.09	62.42	51.09	38.76	29.84
61. Mercersburg	39 50	77 55	..	34.28	30.78	41.41	54.80	65.44	69.74	74.94	75.15	67.43	54.09	41.03	33.05
62. Mifflintown	40 32	77 28	..	26.28	32.70	41.30	52.66	60.24	70.40	71.43	69.92	61.90	53.82	38.01	30.81
63. Milford	41 18	74 50	..	..	..	..	..	..	..	68.17	67.40	..	..	..	..
64. Mooreland	40 00	75 11	250	27.81	30.80	37.48	50.22	58.00	68.92	72.96	70.87	64.62	51.65	42.04	31.28
65. Morrisville	40 13	74 52	30	30.48	29.61	38.23	50.43	62.20	70.85	74.66	71.90	65.37	53.70	42.50	31.27
66. Moss Grove	41 40	79 51	1400	24.20	25.87	30.38	44.37	57.88	68.31	72.02	69.14	60.76	48.71	38.67	26.05
67. Mount Joy	40 06	76 31	..	31.33	32.27	40.53	51.95	62.79	73.03	77.26	73.74	67.04	54.92	43.79	33.53
68. Murrysville	40 26	79 41	1000	26.74	26.47	39.84	44.63	58.04	69.40	71.89	69.88	61.80	51.30	36.39	35.72
69. Nazareth	40 43	75 21	530	24.80	27.98	36.74	47.64	59.10	68.45	72.61	69.32	61.90	49.86	40.81	30.53
70. New Castle	41 02	80 21	..	27.20	30.09	34.77	49.96	59.32	70.41	74.40	70.85	64.11	52.14	41.40	28.71
71. Newtown	40 15	74 57	..	30.76	30.40	39.09	49.31	59.46	68.60	73.94	71.55	63.17	51.33	39.74	31.37

[1] Observations were made at very irregular hours. They were corrected for daily variation by means of the general table.

[2] Observations in 1839–40–41, and from Dec. 1858, to June, 1859, a period of three years four months, were made at Bellefontaine, about four miles east of Flemming.

PENNSYLVANIA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
24	..	..	..	..	..	1870		0 4	$7_m\ 2_a\ 9_a$ bis	A. Curtis.	S. O.
25	43°.75	66°.60	46°.99	24°.66	45°.50	Jan. 1835;	Mar. 1854	9 9	[1]	H. C. King, R. P. Stevens.	P. O. and S. I. Vol. 1, Rec. in S. Coll.
26	51.89	74.04	53.68	32.66	53.07	July, 1858;	Apr. 1862	2 6	$7_m\ 2_a\ 9_a$ bis	W. Heyser.	P. O. and S. I, Vol. 1. and S. O.
27	..	..	..	36.04	..	Dec. 1863;	Apr. 1864	0 5	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
28	48.59	71.46	53.39	31.63	51.27	Jan. 1849;	Feb. 1859	9 9	"	J. Edwards.	P. O. and S. I. Vol. 1, and printed slip.
29	41.09	64.95	45.79	24.36	44.05	Jan. 1865;	Dec. 1870	5 7	$7_m\ 2_a\ 9_a$ bis	T. Day.	S. O.
30	47.35	71.13	51.55	27.26	49.32	Jan. 1855;	Dec. 1859	5 0	$7_m\ 2_a\ 9_a$	S. J. Coffin, G. R. Houghton.	P. O. and S. I. Vol. 1.
31	49.58	74.07	55.43	31.27	52.59	Nov. 1855;	Dec. 1870	4 9	$7_m\ 2_a\ 9_a$ bis	W. H. Speras.	S. O.
32	49.15	71.71	54.10	31.72	51.67	Jan. 1860;	Dec. 1870	11 0	"	E. Hanse.	" "
33	47.95	69.90	51.28	30.05	49.80	Jan. 1862;	Dec. 1870	8 11	$7_m\ 2_a\ 9_a$ bis	J. Taylor.	" "
34	47.20	69.11	49.82	27.39	48.38	Jan. 1839;	June, 1867	14 0	[3]	S. Brugger, J. I. Burrell, Atkins, Harris, Livingstone.	P. O. and S. I. Vol. 1, S. O., & Journ. Frank. Inst.
35	48.57	72.25	51.38	32.83	51.26	Dec. 1867;	Dec. 1870	2 10	$7_m\ 2_a\ 9_a$ bis	S. C. Walker.	S. O.
36	50.83	72.63	54.16	32.64	52.57	Jan. 1836;	Dec. 1843	8 0	[4]	Maj. Mordecai.	Blodget's Climatology.
37	44.79	69.80	48.38	26.14	47.28	Oct. 1867;	Dec. 1870	3 2	$7_m\ 2_a\ 9_a$ bis	Rev. M. A. Tolman.	S. O.
38	..	..	56.46	..	..	1854		0 6	$7_m\ 2_a\ 9_a$	A. D. Weir.	P. O. and S. I. Vol. 1.
39	50.92	74.07	56.64	33.07	53.67	Jan. 1822;	Oct. 1853	11 2	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
40	50.55	73.18	52.83	30.87	51.86	June, 1819;	Dec. 1870	17 1	$7_m\ 2_a\ 9_a$ bis	Haines, C. J. Wister, Jr., T. Meechan.	S. Coll. and S. O.
41	49.83	71.62	51.19	29.88	50.63	Jan. 1839;	Feb. 1865	24 2	[3]	Prof. M. Jacobs.	P. O. and S. I. Vol. 1, MS. in S. Coll., and S. O.
42	..	..	..	..	..	1870		0 3	$7_m\ 2_a\ 9_a$	S. W. Rhode.	S. O.
43	45.48	..	47.40	29.77	..	Sept. 1869;	Aug. 1870	0 11	$7_m\ 2_a\ 9_a$ bis	J. D. Stoker.	" "
44	51.76	75.61	55.38	32.18	53.73	Jan. 1840;	July, 1870	29 3	"	J. Heisely, W. O. Hickok, Dr. W. H. Egle, R. A. Martin.	P. O. and S. I. Vol. 1, MS. in S. Coll., and S. O.
45	50.47	73.66	55.80	32.16	53.02	Jan. 1854;	June, 1863	8 2	$7_m\ 2_a$	Dr. P. Swift.	P. O. and S. I. Vol. 1. and S. O.
46	..	..	..	..	..	1870		0 1	$7_m\ 2_a\ 9_a$ bis	J. Haworth.	S. O.
47	48.35	72.07	52.44	30.36	50.81	1853		1 0	$7_m\ 2_a\ 9_a$	Lowrie.	S. Coll.
48	..	..	..	..	..	1839;	1840	0 2	"	Richardson.	Journ. Frank. Inst.
49	50.52	73.44	51.67	29.55	51.29	1840;	1841	1 11	"	Miller.	" " "
50	49.67	69.62	53.05	29.47	50.45	1839;	Aug. 1858	3 11	"	White, Pector.	Journ. Frank. Inst., P. O. and S. I. Vol. 1, and S. Coll.
51	44.57	68.42	48.10	29.70	47.70	Feb. 1868;	Dec. 1870	2 11	$7_m\ 2_a\ 9_a$ bis	D. Peelor.	S. O.
52	51.11	71.86	52.87	31.98	51.96	Jan. 1839;	1850	6 5	$7_m\ 2_a\ 9_a$	Winchell, Atler.	Journ. Frank. Inst., S. Coll. & Dove, 1853.
53	45.61	67.21	49.34	29.08	47.81	Nov. 1856;	Dec. 1859	3 2	"	P. Friel.	MS. in S. Coll., and P. O. and S. I. Vol. 1.
54	..	..	..	..	..	1861		0 1	$7_m\ 2_a\ 9_a$ bis	W. R. Boyers.	S. O.
55	44.75	70.71	50.96	23.20	47.41	June, 1867;	Nov. 1868	1 6	"	Prof. A. M. Mayer, N. C. Tooker.	" "
56	46.66	70.37	49.76	26.06	48.21	Jan. 1856;	Dec. 1870	10 9	"	Prof. C. S. James.	P. O. and S. I. Vol. 1, and S. O.
57	55.17	72.13	..	..	..	1839		0 10	$7_m\ 2_a\ 9_a$	Culbertson.	Journ. Frank. Inst.
58	..	..	..	..	..	Nov. 1858;	Apr. 1859	0 5	$7_m\ 1_a\ 9_a$	J. Barrett.	P. O. and S. I. Vol. 1.
59	48.21	72.52	52.60	34.60	51.98	Mar. 1849;	Apr. 1851	2 2	$\odot_r\ 9_m\ 3_a\ 9_a$	Marks.	S. Coll.
60	45.21	69.69	50.76	27.18	48.21	1839;	Sept. 1858	5 9	$7_m\ 2_a\ 9_a$	T. F. Thickstun, Shippen, Williams.	P. O. and S. I. Vol. 1, S. Coll., and Journ. Frank. Inst.
61	55.88	73.28	54.18	32.70	53.51	1842;	1847	2 2	$\odot_r\ 2_m\ 9_a$	Green.	Manuscript.
62	51.40	70.58	51.24	29.93	50.79	1839;	1841	2 10	$7_m\ 2_a\ 9_a$	Benkird.	Journ. Frank. Inst.
63	..	..	..	..	..	1839		0 2	$7_m\ 2_a\ 7_a$	Ball.	" " "
64	48.57	70.92	52.77	29.96	50.55	June, 1864;	Dec. 1870	6 7	$7_m\ 2_a\ 9_a$ bis	Anna Spencer.	S. O.
65	50.29	72.47	58.86	30.45	51.77	Jan. 1790;	Dec. 1859	67 10	$\odot_r\ 2_a\ 10_a$	Pierce, E. Hance.	MS. in S. Coll., P. O. and S. I. Vol. 1.
66	44.21	69.82	49.38	25.37	47.20	Feb. 1852;	Feb. 1857	4 10	$7_m\ 2_a\ 9_a$	F. Schreiner.	P. O. and S. I. Vol. 1, & S. Coll.
67	51.76	74.68	55.25	32.38	53.52	Mar. 1857;	Nov. 1870	12 11	$7_m\ 2_a\ 9_a$ bis	Dr. J. R. Hoffer, Miss M. E. Hoffer.	S. O.
68	47.50	70.39	49.83	29.64	49.34	Apr. 1857;	Mar. 1868	2 4	$7_m\ 2_a\ 9_a$	T. H. & F. L. Stewart.	" "
69	47.83	70.13	50.86	27.77	49.15	Jan. 1787;	Oct. 1866	14 5	$7_m\ 2_a\ 9_a$ bis	C. J. Reichel and others.	MS. in S. Coll., S. O., P. O. and S. I. Vol. 1.
70	48.02	71.89	52.55	28.67	50.28	Jan. 1866;	Dec. 1870	5 0	"	E. M. McConnell.	S. O.
71	49.29	71.36	51.41	30.84	50.73	Feb. 1837;	Mar. 1843	6 2	$7_m\ 2_a\ 9_a$	L. H. Parsons.	MS. in S. Coll. and Journ. Frank. Inst.

[3] Observations corrected for daily variation.

[4] Observations made hourly, or else corrected for daily variation.

PENNSYLVANIA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
72. Norristown	40°08′	75°19′	153	30°.90	32°.46	39°.33	48°.26	59°.27	68°.56	73°.82	71°.89	64°.10	53°.77	43°.53	33.°40
73. Northumberland	40 55	76 49	..	24.40	30.97	40.23	52.37	61.22	69.24	73.30	71.01	62.74	50.89	38.84	30.64
74. Oil City	41 26	79 43	..	25.94	..	..	..	..	..	..	..	..	46.19	39.43	31.57
75. Oxford	39 47	75 59	575	..	..	..	..	61.35	73.55	73.30	71.38	70.63	..	..	..
76. Oakland Observ.	40 26	80 02	1026	25.80	31.17	39.81	46.51	60.43	70.23	74.27	71.70	65.73	53.75	42.68	28.84
77. Paradise[1]	40 00	76 08	..	26.21	26.63	33.12	42.29	67.92	77.50	81.96	78.25	71.58	58.88	37.58	29.46
78. Pennsville	41 00	78 38	1400	21.10	23.56	30.17	43.42	52.83	65.32	69.14	65.70	58.97	44.74	34.71	23.97
79. Philadelphia[2]	39 56	75 10	36	33.5	40.0	50.0	62.0	75.0	81.0	87.5	85.0	80.5	64.0	54.7	49.5
80. Philadelphia	39 56	75 10	36	32.14	35.45	40.38	51.05	60.05	69.64	74.08	73.03	64.03	54.61	43.89	34.68
81. Philadelphia	39 56	75 10	36	33.3	33.4	41.2	52.9	62.1	71.9	76.4	75.6	68.1	57.1	43.7	34.9
82. Philadelphia[2]	39 56	75 10	36	32.7	36.1	45.6	57.2	68.1	78.9	82.2	80.7	73.4	64.1	47.6	37.1
83. Philadelphia	39 56	75 10	36	30.7	29.7	38.9	49.2	60.7	68.3	73.8	70.2	63.4	53.2	44.5	33.9
84. Philadelphia	39 56	75 10	36	30.1	29.4	38.8	49.4	61.2	69.7	73.9	71.1	63.6	51.7	41.5	30.7
85. Philadelphia[3]	39 56	75 10	36	30.8	29.4	38.1	51.1	62.9	71.5	75.2	72.4	65.9	53.9	42.3	31.2
86. Philadelphia (Girard Coll.)	39 58	75 10	114	33.7	31.6	39.8	50.6	58.9	68.8	72.8	71.5	64.1	51.3	40.7	32.6
87. Philadelphia[4]	39 56	75 10	36	31.32	32.57	40.19	50.66	61.48	71.04	76.02	73.45	65.64	53.99	43.68	33.64
88. Philadelphia[6] (Nav. Hosp.)	39 56	75 10	36	30.79	32.71	40.10	48.57	61.26	69.62	74.83	72.86	65.18	54.45	43.29	33.26
89. Phoenixville	40 07	75 32	120	33.20	33.68	35.11	50.45	58.59	70.03	..	..	..	..	..	..
90. Pittsburg	40 27	79 59	840	29.68	31.81	38.47	49.92	60.64	70.12	75.73	71.38	65.84	52.88	43.38	33.44
91. Pocopson	39 54	75 40	218	28.80	31.14	38.12	49.02	60.06	70.47	75.86	73.64	66.20	53.18	42.85	32.15
92. Port Carbon	40 43	76 06	..	28.95	26.05	37.25	45.38	57.50	71.13	71.94	70.44	58.77	47.87	40.65	29.98
93. Pottsville	40 41	76 12	..	31.86	26.18	34.87	49.30	59.26	65.35	74.65	68.00	61.90	51.08	42.14	29.46
94. Plymouth Meeting	40 06	75 16	..	35.84	29.69	36.29	48.63	58.72	70.27	75.41	72.62	65.19	51.38	41.15	31.94
95. Punxatawney	40 59	79 00	..	..	..	..	..	..	..	..	..	58.13	42.07	34.42	..
96. Randolph	41 38	80 00	1720	21.90	20.89	33.02	43.23	57.95	68.15	74.10	68.89	65.11	51.65	35.13	28.18
97. Reading	40 20	75 55	269	29.53	31.40	37.76	51.29	59.79	69.32	74.44	71.37	63.74	53.11	42.62	31.84
98. Rose Cottage	41 07	79 09	..	26.66	30.61	36.74	51.04	..	..	61.18	64.82	56.93	51.25	..	25.14
99. Salem	41 25	75 25	1600	..	..	..	45.08	53.55	67.02	68.20	65.98	62.05	50.54	39.61	29.54
100. Shamokin	40 48	76 35	700	31.01	32.44	38.96	47.26	60.06	68.52	70.73	71.24	64.92	54.65	41.53	34.89
101. Shirleysburg	40 17	77 43	640	30.87	34.08	39.97	52.12	63.13	75.22	75.56	73.59	65.83	49.02	..	..
102. Silver Lake	41 55	76 01	..	16.83	27.10	35.56	48.43	58.39	65.00	71.55	71.16	59.16	51.20	38.16	22.40
103. Silver Spring	40 05	76 40	..	28.36	30.02	38.69	49.12	60.18	69.94	74.00	71.35	63.16	50.00	41.82	32.21
104. Sewickleyville	40 34	80 10	656	27.12	32.25	36.33	47.92	53.42	68.27	67.25	69.20	61.40	48.36	37.52	29.55
105. Somerset	40 02	79 05	2195	25.43	27.46	34.37	45.53	55.49	64.83	67.28	65.72	58.82	47.30	37.90	28.69
106. Stevensville	41 45	76 35	300	18.88	32.83		..	..	67.50	72.73	62.50	59.80	49.48	40.33	26.75
107. St. Mary's	41 25	78 45	..	..	27.20	40.02	48.28	57.62	..	75.12	..	..	..	..	..
108. St. Vincent's College	40 14	79 29	922	32.23	34.62	39.04	48.85	58.42	68.82	70.77	70.60	63.27	54.25	39.65	36.38
109. Smithport	41 54	78 33	..	33.51	29.83	32.52	45.34	54.13	62.72	67.00	64.05	55.11	48.40	32.20	25.03
110. Sugar Grove	42 00	79 24	1450	22.35	24.09	31.48	41.33	56.00	..	..	..	..	..	..	..
111. Susquehanna Depot	41 56	75 40	800	..	..	..	..	..	68.18	76.90	..	..	..	..	..
112. Tamaqua	40 49	76 00	700	..	..	30.48	47.85	59.55	69.85	..	..	61.50	..	..	..
113. Tarentum	40 37	79 46	950	28.64	32.75	39.20	46.23	60.19	68.44	72.81	70.22	62.73	50.84	39.19	34.37
114. Tioga	41 54	77 11	1000	23.30	25.26	31.99	45.40	55.56	67.07	71.86	68.33	62.56	46.66	36.70	26.76
115. Towanda (Susq. Coll. Inst.)	41 47	76 30	840	26.15	33.32	..	49.57	54.57	68.05	..	69.00	63.37	..	..	..
116. Troy Hill	40 28	80 07	937	16.40	20.72	28.35	..	..	..	..	..	..	48.50	46.18	33.85
117. Turtle Creek Valley	40 28	79 38	960	..	..	..	..	..	..	71.23	..	..	..	..	..
118. Warrior's Mark	40 41	78 09	..	..	..	35.22	44.70	58.00	67.20	74.13	..	..	..	..	..

[1] The observations from May to October, both inclusive, appear to be about 5° too high. Probably due to a bad exposure of the thermometer during those months.
[2] These observations evidently require a negative correction of about 6°.
[3] The greater part of this series is probably included in the preceding six.

PENNSYLVANIA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
72	48°.95	71°.42	53°.80	32°.25	51°.61	Aug. 1843; July, 1863	13 10	$7_m\ 2_a\ 9_a$ bis	Rev. J. C. Ralston, Rev. J. Grier, L. E. Corson.	P. O. and S. I. Vol. I, S. Coll., Blodget's Climatology, and S. O.
73	51.27	71.18	50.82	28.67	50.49	1839; 1841	3 0	$7_m\ 2_a\ 9_a$	Huston.	Journ. Frank. Inst.
74	..	..	..	..	..	Oct. 1863; Jan. 1864	0 4	$7_m\ 2_a\ 9_a$ bis	I. A. Weeks.	S. O.
75	..	72.74	..	..	..	1865	0 5	"	D. H. Duffield.	" "
76	48.92	72.07	54.05	28.60	50.91	1849; 1854	2 5	$7_m\ 2_a\ 7_a$	Wilson.	S. Coll.
77	47.78	79.24	56.01	27.43	52.61	Jan. 1835; Dec. 1858	24 0	......	J. Frantz.	MS. in S. Coll., P. O. and S. I. Vol. I.
78	42.14	66.72	46.14	22.88	44.47	July, 1864; Dec. 1870	6 6	$7_m\ 2_a\ 9_a$ bis	E. Fenton.	S. O.
79	62.3	84.5	66.4	41.0	63.6	Oct. 1748; Sept. 1749	1 0	......	Bertram Kalin, travels in N. A.	Blodget's Climatology.
80	50.49	72.25	54.18	34.09	52.75	Jan. 1758; Dec. 1777	13 0	......	....	Trans. Am. Phil. Soc. 1839.
81	52.1	74.6	56.3	33.9	54.2	Jan. 1798; Dec. 1804	7 0	......	Dr. J. R. Coxe.	Blodget's Climatology.
82	57.0	80.6	61.7	35.3	58.6	Jan. 1807; Dec. 1826	20 0	......	James Young.	Darby's U. S.
83	49.6	70.8	53.7	31.4	51.4	Jan. 1829; Dec. 1838	10 0	......	Dr. Thomas Hewson.	Trans. Am. Phil. Soc. 1839.
84	49.8	71.6	52.3	30.0	50.9	Jan. 1831; July, 1839	8 7	......	....	Journ. Frank. Inst.
85	50.7	73.0	54.0	30.5	52.1	....	57 0	......	....	P. O. Report.
86	49.77	71.03	52.03	32.63	51.36	June, 1840; June, 1845	5 1	hourly.	A. D. Bache.	Observations at the Magnetic & Meteorological Observatory, Washington, 1847, Vol. 3.
87	50.78	73.50	54.44	32.51	52.81	Feb. 1831; Dec. 1870	39 10	[5]	J. A. Kirkpatrick and daughter, A. D. Bache, Dr. Conrad, and others.	Same as above, Journ. Frank. Inst. 1861 to 1869, Blodget's Climatology, S. O., S. Coll., and Dove.
88	49.98	72.44	54.31	32.25	52.25	Apr. 1843; Dec. 1864	8 4	$\odot_r\ 9_m\ 3_a\ 9_a$	Surgeons of the Hosp.	MS. in S. Coll.
89	48.05	..	..	..	..	1869	0 6	$7_m\ 2_a\ 9_a$ bis [5]	Dr. J. L. Coffman.	S. O.
90	49.68	72.41	54.03	31.64	51.94	1839; Dec. 1870	12 3		Various observers.	Journ. Frank. Inst., S. O., P. O. and S. I. Vol. I, & S. Coll.
91	49.07	73.32	54.08	30.70	51.79	Jan. 1853; Dec. 1870	17 9	$7_m\ 2_a\ 9_a$ bis	F. Darlington.	P. O. and S. I. Vol. I, S.O., and S. Coll.
92	46.71	71.17	49.10	28.33	48.83	1839; 1840	1 4	$7_m\ 2_a\ 9_a$	Hewes.	Journ. Frank. Inst.
93	47.81	69.33	51.71	29.17	49.50	1839; July, 1858	2 0	"	Dr. A. Heger, Rev. B. R. Smyser, D. Washburn, Porter.	Journ. Frank. Inst., P. O. and S. I. Vol. I.
94	47.88	72.77	52.57	32.49	51.43	Feb. 1868; Dec. 1870	2 11	$7_m\ 2_a\ 9_a$ bis	M. H. Corson.	S. O.
95	..	..	44.87	..	..	1839	0 3	$7_m\ 2_a\ 9_a$	Smith.	Journ. Frank. Inst.
96	44.73	70.38	50.63	23.66	47.35	Aug. 1851; Feb. 1856	3 5	"	O. T. Hobbs.	P. O. & S. I. Vol. I, & S. Coll.
97	49.61	71.71	53.16	30.92	51.35	1839; Dec. 1870	6 8	$7_m\ 2_a\ 9_a$ bis	J. H. Raser, Engleman.	Journ. Frank. Inst., P. O. and & S. I. Vol. I, and S. O.
98	..	..	..	27.47	..	1839; 1840	0 11	$7_m\ 2_a\ 9_a$	Gaskel.	Journ. Frank. Inst.
99	..	67.07	50.73	..	..	Apr. 1869; Dec. 1870	0 10	$7_m\ 2_a\ 9_a$ bis	J. D. Stoker.	S. O.
100	48.76	70.16	53.70	32.78	51.35	Mar. 1860; Jan. 1863	2 10	"	P. Friel.	" "
101	51.74	74.79	..	..	..	1853	0 10	$7_m\ 2_a\ 9_a$	Brewster.	S. Coll.
102	47.46	69.24	49.51	22.11	47.08	1839; 1841	2 9	"	Rose.	Journ. Frank. Inst.
103	49.33	71.76	51.66	30.20	50.74	Mar. 1863; May, 1869	4 7	$7_m\ 2_a\ 9_a$ bis	H. I. Burckart.	S. O.
104	45.89	68.24	49.09	29.64	48.22	Oct. 1859; Jan. 1862	1 4	"	J. A. Travelli, G. H. Tracy.	P. O. and S. I. Vol. I, and S. O.
105	45.13	65.94	48.01	27.19	46.57	Dec. 1839; Dec. 1861	15 7	$7_m\ 2_a\ 9_a$	G. Mowry, Dr. F. Chorpenning.	Journ. Frank. Inst., S. Coll., P. O. and S. I. Vol. I, and S. O.
106	..	67.58	49.87	26.15	..	June, 1866; Feb. 1867	0 9	$7_m\ 2_a\ 9_a$ bis	I. R. Dutton.	S. O.
107	48.64	..	..	..	..	1849	0 5	$\odot_r\ 9_m\ 3_a\ 9_a$	Stokes.	S. Coll.
108	48.77	70.06	52.39	34.41	51.41	Jan. 1851; June, 1862	1 6	$7_m\ 2_a\ 9_a$ bis	Prof. R. Müller.	S. O.
109	44.00	64.59	45.24	29.46	45.82	1839; 1841	2 8	$7_m\ 2_a\ 9_a$	Chadwick.	Journ. Frank. Inst.
110	42.94	..	..	..	..	1854	0 5	"	W. O. Blodget.	P. O. and S. I. Vol. I.
111	..	..	..	..	..	1863	0 2	$7_m\ 2_a\ 9_a$ bis	H. H. Atwater.	S. O.
112	45.96	..	..	..	..	1870	0 5	"	J. Haworth.	" "
113	48.54	70.49	50.92	31.92	50.47	Sept. 1856; Mar. 1860	3 3	$7_m\ 2_a\ 9_a$	J. H. Baird.	P. O. and S. I. Vol. I, and S. O.
114	44.32	69.09	48.64	25.11	46.79	July, 1863; Dec. 1870	7 0	$7_m\ 2_a\ 9_a$ bis	E. T. Bentley.	S. O.
115	..	..	..	..	..	1861	0 7	"	S. J. Coffin.	" "
116	..	..	..	23.66	..	Jan. 1856; Dec. 1863	0 6	"	V. Scriba, Prof. R. Müller.	P. O. and S. I. Vol. I, and S. O.
117	..	..	..	..	..	1867	0 1	"	F. L. Stewart.	S. O.
118	45.97	..	..	..	..	1854	0 5	$7_m\ 2_a\ 9_a$	J. R. Lowrie.	P. O. and S. I. Vol. I.

[4] This series includes the preceding one.

[5] Observations corrected for daily variation.

[6] This series was not combined with the preceding one because the record appears defective. It gives the temperature at 9 P. M. lower than at sunrise, which is contrary to experience at other stations.

PENNSYLVANIA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
119. Westchester	39°58′	75°35′	541	29°.99	32°.14	37°.66	48°.70	59°.54	69°.10	74°.21	71°.06	63°.40	53°.69	43°.10	32°.75
120. Westtown	39 57	75 34	550	33.87	29.33	40.64	48.47	56.41	73.61	74.31	71.07	63.52	56.05	39.71	35.97
121. Whitehall	40 40	75 32	450	27.42	29.69	36.33	48.35	59.15	68.19	73.62	71.20	63.68	52.05	41.28	31.13
122. Worthington	40 52	79 37	1050	29.27	30.95	39.41	47.70	59.86	65.93	69.21	68.88	61.07	50.88	40.13	29.84
123. Williamsport	41 15	77 04	533	35.35	29.56	..	48.03	60.05	67.30	..	..	..	..	..	..
124. Youngsville	41 50	79 20	1185	23.15	25.42	32.50	41.63	..	..	..	..	..	..	..	..

RHODE ISLAND.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Acquidneset	41 40	71 26	30	18.61	14.78	30.66	51.01	..	..	..	..	..	..	..	..
2. Fort Adams	41 29	71 20	40	30.23	30.53	35.89	45.45	55.48	65.98	72.18	71.54	63.89	53.97	42.94	33.63
3. Fort Wolcott	41 30	71 20	20	29.49	30.48	37.24	46.02	55.54	64.52	70.41	69.59	63.22	54.30	43.03	34.29
4. Little Compton	41 31	71 11	..	..	..	..	..	61.44	..	67.96	..	..	..	..	..
5. Newport	41 30	71 19	25	29.93	29.40	36.14	44.51	53.88	64.70	70.14	69.52	63.43	53.55	43.27	34.16
6. Newport	41 30	71 19	25	28.59	30.50	33.58	44.44	53.25	63.80	68.61	67.79	63.39	51.27	41.26	31.00
7. North Scituate	41 50	71 34	300	24.33	25.71	34.07	42.20	56.95	66.38	68.70	63.42	60.09	47.02	39.31	26.01
8. Providence	41 50	71 24	155	25.84	27.01	34.43	45.64	55.75	63.85	70.93	69.08	61.73	50.85	40.45	29.37
9. Smithfield	41 57	71 28	..	24.2	..	30.0	44.9	52.9	63.3	67.9	68.9	61.0	50.9	38.8	29.1

SOUTH CAROLINA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Abbeville[3]	34 12	82 17	500	46.41	48.92	54.89	62.61	69.99	77.55	79.43	78.67	74.31	60.95	54.33	46.53
2. Aiken	33 32	81 33	565	44.15	47.83	53.22	61.49	69.25	76.08	78.80	77.19	72.23	61.80	51.84	45.48
3. All Saints	33 40	79 17	20	45.69	49.46	53.66	62.66	70.43	76.70	79.85	79.08	74.77	64.07	55.47	49.34
4. Beaufort	32 26	80 41	14	44.44	50.17	56.57	61.05	69.78	76.98	81.97	83.05	..	66.85	57.68	50.79
5. Black Oak	33 19	80 00	..	50.56	51.50	58.66	69.76	77.63	81.57	83.40	79.41	73.77	66.33	..	51.68
6. Bluffton	32 14	80 51	..	55.98	53.08	57.25	64.20	73.35	78.90	83.33	82.33	77.30	70.80	60.30	48.25
7. Camden	34 15	80 31	240	42.71	47.28	53.37	61.73	70.60	78.32	80.64	78.99	73.56	60.94	52.28	45.49
8. Charleston	32 47	79 56	20	49.33	53.71	58.43	65.16	72.87	78.94	80.22	79.48	74.19	65.34	57.35	51.35
9. Charleston	32 47	79 56	20	50.40	51.70	58.30	65.00	72.80	78.50	81.30	80.30	76.10	67.20	59.00	51.20
10. Columbia	34 02	80 57	315	43.71	44.61	53.99	62.02	69.85	76.75	78.78	78.14	73.48	60.55	54.35	48.12
11. Edgefield	33 47	81 51	..	22.99	..	..	..	..	..	..	..	..	..	..	..
12. Edisto Island	32 34	80 18	23	38.72	49.98	53.11	65.25	71.62	79.82	..	80.79	74.48	65.55	59.61	51.00
13. Evergreen	34 22	82 46	..	47.08	45.85	52.10	65.35	..	..	..	..	..	..	..	..
14. Fort Mill	35 02	80 52	..	..	..	47.28	60.80	69.78	74.45	..	..	70.73	..	..	..
15. Fort Moultrie	32 45	79 51	25	50.28	52.40	58.19	65.21	73.26	79.44	81.94	81.30	76.92	67.77	59.50	52.66
16. Gowdysville	34 55	81 30	600	47.20	44.35	51.11	63.07	70.07	76.67	82.43	82.24	73.15	59.60	49.94	42.66
17. Greenville	34 52	82 18	..	49.0	50.4	53.9	64.8	70.8	75.1	76.2	76.6	71.3	57.6	52.0	46.5
18. Hilton Head	32 14	80 43	15	45.43	52.24	58.58	67.12	73.14	79.16	83.75	83.58	78.17	67.57	57.02	52.45
19. Morris Island	32 42	79 52	15	..	51.40	55.65	61.56	72.00	..	..	..	..	..	..	49.96
20. Mount Pleasant	32 47	79 55	20	..	57.63	54.17	..	..	..	..	..	..	..	..	..
21. Nightingale Hall	..	..	..	43.33	47.00	60.17	69.33	74.83	79.50	78.00	80.17	76.50	..	..	..
22. Orangeburg	33 30	80 48	..	50.37	52.43	57.02	63.79	71.17	77.37	82.91	81.06	74.96	63.89	56.31	51.57
23. Richmond Hill	33 38	82 00	..	..	..	..	..	..	..	82.70	..	..	..	..	..
24. Robertville	32 36	81 12	50	50.0	47.0	46.0	60.5	70.0	75.0	79.3	76.3	76.5	62.5	54.5	42.5
25. St. Johns	33 10	79 50	50	46.19	51.34	55.84	62.17	69.89	75.36	78.28	77.48	72.41	64.48	54.26	49.47
26. Wilkinson	35 00	81 27	..	38.50	38.48	52.60	57.85	68.30	..	81.58	77.45	71.72	61.12	52.77	..

[1] Observations corrected for daily variation.
[2] Corrected for daily variation by means of the New Haven table.

PENNSYLVANIA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
119	48°.63	71°.46	53°.40	31°.63	51°.28	July, 1843; Dec. 1870	16 6	[1]	E. W. Beans, T. H. Aldrich, J. C. Green and others.	P. O. and S. I. Vol. I, MS. in S. Coll., and S. O.
120	48.51	73.00	53.09	33.06	51.91	July, 1857; Mar. 1859	1 9	$7_m\ 2_a\ 9_a$	S. Alsop.	P. O. and S. I. Vol. I.
121	47.94	71.00	52.34	29.41	50.17	Jan. 1856; Dec. 1870	14 10	$\odot_r$ N. $\odot_s$	E. Kohler.	P. O. and S. I. Vol. I, and S. O.
122	48.99	68.01	50.69	30.02	49.43	Jan. 1859; July, 1862	3 6	$7_m\ 2_a\ 9_{a\ bis}$	S. Scott.	" " " " " "
123	..	..	..	..	..	May, 1864; Feb. 1870	0 7	"	H. C. Moyer.	S. O.
124	..	..	..	..	..	1854	0 4	$7_m\ 2_a\ 9_a$	Dr. A. P. Blodget.	P. O. and S. I. Vol. I.

RHODE ISLAND.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1856	0 4	$7_m\ 2_a\ 9_a$	E. G. Arnold.	P. O. and S. I. Vol. I.
2	45.61	69.90	53.60	31.46	50.14	Jan. 1842; Dec. 1870	19 2	"	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
3	46.27	68.17	53.52	31.42	49.84	Jan. 1822; Dec. 1835	14 0	"	" "	Ar. Met. Reg. 1855.
4	..	..	..	..	..	1849; 1850	0 2	$\odot_r\ 9_m\ 3_a\ 9_a$	Bailey.	S. Coll.
5	44.84	68.12	53.42	31.16	49.39	1817; 1856	40 0	......	Taylor.	Printed Journal.
6	43.76	66.73	51.97	30.03	48.12	Sept. 1865; Dec. 1870	5 4	$7_m\ 2_a\ 9_{a\ bis}$	W. H. Crandall, W. A. Barber.	S. O.
7	44.41	66.17	48.81	25.35	46.18	Jan. 1853; June, 1854	1 6	$7_m\ 2_a\ 9_a$	H. C. Sheldon.	P. O. and S. I. Vol. I, & S. Coll.
8	45.27	67.95	51.01	27.41	47.91	Dec. 1831; Apr. 1867	34 8	[2]	A. Caswell, H. C. Sheldon.	Sm. Cont. to Knowl. 1860, and S. O.
9	42.60	66.70	50.23	..	..	July, 1806; Oct. 1807	1 2	$\odot_r\ 2_a$	....	Med. and Agr. Reg. Boston, 1806–7.

SOUTH CAROLINA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	62.50	78.55	63.20	47.29	62.88	July, 1838; 1851	2 10	[4]	Th. Parker, & Barratt.	Am. Alm. 1840 and S. Coll.
2	61.32	77.36	61.96	45.82	61.61	Jan. 1853; Dec. 1869	8 8	$7_m\ 2_a\ 9_{a\ bis}$	H. W. Ravenal, J. H. Cornish, & Newton.	P. O. and S. I. Vol. I, S. Coll., S. O. and MS. from S. G. O.
3	62.25	78.54	64.77	48.16	63.43	Oct. 1854; Apr. 1861	6 5	$7_m\ 2_a\ 9_a$	Rev. A. Glennie.	P. O. and S. I. Vol. I, and S. O.
4	62.47	80.67	..	48.47	..	July, 1863; Mar. 1865	1 5	$7_m\ 2_a\ 9_{a\ bis}$	Dr. M. M. Marsh.	S. O.
5	68.68	81.46	..	51.25	..	1844; 1845	1 8	7_m N. $4_a\ 6_a\ 9_a$	Ferguson.	Manuscript.
6	64.93	81.52	69.47	52.44	67.09	1870	1 0	$7_m\ 2_a\ 9_{a\ bis}$	J. S. J. Guerard.	S. O.
7	61.90	79.32	62.26	45.16	62.16	Jan. 1838; Apr. 1869	9 9	$7_m\ 2_a\ 9_a$	Dr. M. Holbrook, C. McRae, T. Carpenter, J. A. Young.	Am. Alm. 1840, S. O., P. O. and S. I. Vol. I, and S. Coll.
8	65.49	79.55	65.63	51.46	65.53	Jan. 1738; Oct. 1861	24 8	[4]	Drs. J. L. Dawson, Lining, Chalmers, and Johnson, and John Ryan.	Am. Alm. 1842 and foll., Print. slips, P. O. and S. I. Vol. I, Phil. Trans., 1748, MS. in Coll., and S. O.
9	65.37	80.03	67.43	51.10	65.98	....	20 0	......	....	Pat. Off. Rep.
10	61.95	77.89	62.79	45.48	62.03	Feb. 1836; Nov. 1859	4 11	$7_m\ 2_a\ 9_a$	Dr. E. H. Barton and others.	P. O. and S. I. Vol. I, Rep. Brit. Assoc. 1847, Printed Journ. Pat. Off. Rep.
11	..	..	..	..	..	1857	0 1	$\odot_r\ \odot_s$	....	P. O. and S. I. Vol. I.
12	63.33	..	66.55	46.57	..	Feb. 1856; Jan. 1857	0 11	$7_m\ 2_a\ 9_a$	E. A. and Dr. E. N. Fuller.	" " " "
13	..	..	..	..	..	1870	0 4	$7_m\ 2_a\ 9_{a\ bis}$	E. J. Earle.	S. O.
14	59.29	..	..	..	..	Sept. 1869; June, 1870	0 5	"	R. A. Spring, Jr.	" "
15	65.55	80.89	68.06	51.78	66.57	Jan. 1823; Dec. 1860	32 11	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860.
16	61.42	80.45	60.90	44.74	61.88	Mar. 1869; Dec. 1870	1 9	$7_m\ 2_a\ 9_{a\ bis}$	C. Petty.	S. O.
17	63.17	75.97	60.30	48.63	62.02	Mar. 1839; Nov. 1845	2 2	$\odot_r$ max. $\odot_s$	Major E. Earle.	MS. in S. Coll.
18	66.28	82.16	67.59	50.04	66.52	Apr. 1862; June, 1865	3 11	$7_m\ 2_a\ 9_a$	Capt. J. R. Suter, & Maj. J. W. Albert.	MS. from S. G. O., and S. O.
19	63.07	..	..	..	..	Dec. 1863; May, 1864	0 5	"	....	MS. from S. G. O.
20	..	..	..	..	..	1857	0 2	$8_m\ 2_a\ 9_a$	Dr. E. N. Fuller.	P. O. and S. I. Vol. I.
21	68.11	79.22	..	..	..	1849	0 9	$\odot_r\ 2_a\ \odot_s$	Kelly.	Pat. Off. Rep.
22	63.99	80.45	65.05	51.46	65.24	Aug. 1849; Mar. 1851	1 8	$\odot_r\ 9_m\ 3_a\ 9_a$	Elliott.	S. Coll.
23	..	..	..	..	..	1854	0 1	$7_m\ 2_a\ 9_a$	....	" "
24	58.83	76.87	64.50	46.50	61.68	1843	1 0	max. & min.	Smith.	Newspaper slip in S. Coll.
25	62.63	77.04	63.72	49.00	63.10	Mar. 1846; Mar. 1861	13 11	$\odot_r\ 2_a\ 9_a$	W. H. and T. P. Ravenal.	Black Oak Agr. Soc., Printed Journ., Pamph. in S. Coll., P. O. & S. I. Vol. I, and S. O.
26	59.58	..	61.87	..	..	Sept. 1867; Nov. 1868	1 1	$7_m\ 2_a\ 9_{a\ bis}$	C. Petty.	S. O.

[3] Observations after 1839 were made at Barratsville, about three miles southwest of Abbeville.

[4] Observations corrected for daily variation by means of the general table.

TENNESSEE.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Alexandria	36°06′	86°06′	..	29°.87	..	...	..	..	..	..	..	..	..	44°.72	35°.91
2. Austin[1]	36 12	86 20	2000	36.60	42°.82	49°.59	57°.23	67°.22	75°.04	78°.07	76°.52	69°.55	60°.09	44.73	39.69
3. Chattanooga	35 02	85 21	..	.	..	...	57.65	..	..	..	..	..	..	..	..
4. Clearmont	35 44	86 02	1000	..	..	..	..	..	70.43	75.78	75.03	68.23	58.30	47.15	36.28
5. Dixon's Springs	36 20	86 08	..	34.68	40.91	49.44	58.13	67.98	76.75	79.90	73.62	69.59	62.84	44.46	44.08
6. Dover	36 29	87 55	..	39.03	41.08	48.76	57.38	64.48	70.25	74.42	73.41	66.65	55.76	47.54	42.09
7. Elisabethton	36 18	82 12	1500	38.52	38.93	45.37	55.23	62.90	70.47	75.80	74.84	66.97	54.20	42.02	34.27
8. Fayetteville	35 12	86 38	..	44.40	45.24	56.59	61.19	68.64	76.76	78.51	79.45	70.21	57.96	50.74	42.66
9. Franklin	35 55	86 53	..	..	..	..	..	..	..	77.08	76.88	74.90	60.65	50.47	45.82
10. Fort Humboldt	35 51	88 56	..	..	..	..	60.99	73.87	77.52	83.66	81.77	77.63	62.92	50.30	37.16
11. Friendship	35 50	89 25	..	..	..	..	70.13	68.90	72.49	78.17	..	..	..	..	..
12. Gallatin	36 21	86 30	..	47.0	48.0	46.0	60.0	67.0	75.0	76.0	75.0	71.0	..	54.0	..
13. Glenwood Cottage	36 28	87 20	481	36.44	40.63	47.36	57.17	64.59	71.67	75.87	74.29	68.70	56.11	46.68	38.83
14. Greenville (Tusculum Coll.)	36 05	82 50	..	36.10	39.97	43.80	55.52	63.53	71.55	76.76	74.82	66.79	..	42.98	35.38
15. Knoxville East Tennessee University	35 56	83 56	1000	36.90	40.79	46.93	56.92	63.56	71.20	77.67	75.33	74.31	56.93	44.63	35.76
16. La Grange	35 08	89 15	480	40.92	48.20	54.97	60.69	71.10	76.28	82.44	79.40	74.39	63.77	50.33	37.50
17. Lookout Mountain	35 00	85 27	1626	40.69	43.76	47.95	58.24	66.53	74.41	79.46	78.00	70.81	59.15	49.23	38.86
18. Memphis	35 08	90 04	262	40.19	44.75	52.72	59.89	69.97	77.40	81.39	79.79	71.75	59.14	50.06	41.41
19. Nashville	36 09	86 49	533	37.66	42.22	49.77	61.81	67.96	73.18	79.26	76.53	69.61	57.31	45.35	39.12
20. Nashville	36 09	86 49	533	35.63	38.74	50.27	56.14	66.77	75.79	77.63	78.97	70.19	..	49.80	39.94
21. Pomona	36 00	85 00	2200	36.03	40.45	45.98	59.08	65.93	71.65	78.15	74.33	66.38	55.22	45.91	34.83
22. Trenton	35 57	89 02	..	43.95	45.23	47.65	60.63	68.49	74.09	79.65	79.31	71.69	58.29	46.27	41.88
23. University Place	35 12	86 00	2000	39.02	42.17	47.91	61.33	67.18	72.33	78.58	73.23	66.53	55.95	43.35	36.18
24. Walnut Grove	36 00	82 53	1350	..	..	..	..	..	..	80.66	72.86	..	..	43.40	..
25. Winchester	35 12	86 15	..	38.98	41.60	..	..	..	..	..	..	..	..	..	37.90

TEXAS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Anahuac	29 47	94 54	..	..	..	60.35	69.12	74.97	80.37	84.65	80.60	78.80	..	..	..
2. Aransas Canal	27 47	97 08	[2]	..	..	..	..	..	..	..	..	..	..	62.00	..
3. Austin	30 17	97 44	650	49.46	54.10	60.14	67.31	74.05	79.71	82.61	82.72	76.83	66.22	57.59	49.92
4. Blue Branch[3]	30 27	97 26	600	52.53	54.06	59.51	65.17	71.81	78.03	79.86	81.50	76.22	65.53	62.70	46.73
5. Bluff Settlement	30 00	97 00	180	..	..	..	..	..	80.68	82.17	82.49	80.31	71.52	61.87	48.98
6. Bonham	33 40	96 13	435	..	..	..	..	..	..	..	..	..	63.01	60.08	35.48
7. Buffalo Springs	33 30	98 14	1800	39.48	48.68	..	..	..	..	..	..	..	..	55.70	54.14
8. Burkeville	31 00	93 38	..	47.49	50.98	56.98	66.32	73.35	82.90	86.10	79.33	75.63	62.40	54.68	43.87
9. Camp Colorado	31 55	99 17	..	42.98	52.05	59.25	64.75	74.53	82.81	86.31	83.28	75.25	65.40	52.21	44.09
10. Camp Concordia	31 46	106 21	3600	47.04	50.95	61.92	67.45	71.97	86.81	83.09	80.30	78.67	69.26	57.04	49.96
11. Camp Cooper	31 01	99 00	..	..	51.14	56.11	55.59	74.74	83.39	87.10	81.53	74.27	62.77	..	..
12. Camp Hudson	29 42	101 10	..	49.34	56.75	64.36	71.34	79.30	83.98	87.23	84.36	78.51	71.18	57.32	49.39
13. Camp Moore	..	..	..	46.00	48.70	62.13	64.05	70.61	..	..	..	..	..	..	..
14. Camp Stockton	30 20	102 30	..	46.54	51.43	59.44	68.20	79.81	82.51	84.33	80.75	74.69	65.15	56.07	44.07
15. Camp Verde	30 00	99 10	1400	47.39	52.72	58.43	64.45	73.70	82.00	82.07	81.20	72.71	66.60	53.99	46.09
16. Cedar Grove Plantation	29 08	95 42	60	53.09	54.78	62.90	69.58	74.77	80.21	81.84	81.10	78.33	70.11	59.19	58.11
17. Chapel Hill	30 10	96 20	542	53.38	63.23	..	..	74.38	78.73	80.23	78.95	..	..	..	..
18. Clarkeville	33 35	95 02	..	..	..	..	..	..	78.74	83.98	82.24	78.97	69.67	59.74	45.40
19. Clinton	29 04	97 23	..	54.81	57.23	61.35	67.64	75.11	80 64	81.49	81.60	77.44	67.39	63.78	49.69
20. Corpus Christi	27 47	97 27	20	50.05	55.11	64.75	69.87	77.92	82.00	82.46	83.11	81.20	72.36	65.42	56.93
21. Cross Roads	30 33	97 46	672	..	53.45	62.03	70.55	75.53	85.55	89.60	..	78.63	70.33	57.11	41.61
22. Dallas[4]	32 44	96 45	..	42.02	53.34	60.24	62.22	72.72	75.01	80.55	81.03	79.04	67.46	58.37	43.78

[1] The observations previous to 1861 were made at Cumberland University at Lebanon, very near Austin.

[2] Altitude given as 15 feet above the Gulf.

TENNESSEE.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1851;	1852	0 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Sawyer.	S. Coll.
2	58°.01	76°.54	58°.12	39°.70	58°.09	1850;	Oct. 1870	6 0	$7_m\ 2_a\ 9_{a\ bis}$	Prof. A. P. Stewart and others.	P. O. and S. I. Vol. I, S. O., & S. Coll.
3	..	..	..	..	..	1864		0 1	"	G. H. Blaker.	S. O.
4	..	73.75	57.89	..	..	1870		0 7	"	T. P. Wright.	" "
5	58.52	76.76	58.96	39.89	58.53	Feb. 1852;	Jan. 1853	1 0	$\odot_r\ 9_m\ 3_a\ 9_a$	Sawyer.	S. Coll.
6	56.87	72.69	56.65	40.73	56.74	1846;	1850	4 5	"	Favel.	Manuscript.
7	54.50	73.70	54.40	37.24	54.96	Jan. 1868;	Dec. 1870	3 0	$7_m\ 2_a\ 9_{a\ bis}$	C. H. Lewis.	S. O.
8	62.14	78.24	59.64	44.10	61.03	Mar. 1849;	Feb. 1851	2 0	$\odot_r\ 9_m\ 3_a\ 9_a$	McWelly.	S. Coll.
9	..	..	62.01	..	..	1867		0 6	$7_m\ 2_a\ 9_{a\ bis}$	J. M. Parker.	S. O.
10	..	80.98	63.62	..	..	1870		0 9	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
11	..	..	..	..	..	1855		0 4	"	Dr. R. T. Turner.	P. O. and S. I. Vol. I.
12	57.67	75.33	..	..	..	1819		0 10	"	....	Rep. Brit. Asso. 1847.
13	56.37	73.94	57.16	38.63	56.53	Mar. 1851;	Dec. 1870	19 8	$7_m\ 2_a\ 9_{a\ bis}$	Prof. W. M. Stewart.	P. O. and S. I. Vol. I, S. O., and S. Coll.
14	54.28	74.38	..	37.15	..	July, 1843;	Dec. 1870	2 4	"	S. S. & W. S. Doak.	S. O. and Manuscript.
15	55.80	74.73	58.62	37.82	56.74	1843;	Dec. 1870	6 4	"	Prof. G. Cooke and others.	P. O. and S. I. Vol. I, S. O., S. Coll., and MS.
16	62.25	79.37	62.83	42.21	61.66	Apr. 1858;	Dec. 1870	1 1	"	J. R. Blake, and Dr. W. E. Franklin.	P. O. and S. I. Vol. I, and S. O.
17	57.57	77.29	59.73	41.10	58.92	June, 1866;	Dec. 1870	4 5	"	E. F. Williams & Rev. C. F. P. Bancroft.	S. O.
18	60.86	79.53	60.32	42.12	60.71	1849;	Mar. 1870	11 3	"	Various observers.	Met. Rep. Memphis, 1857, P. O. and S. I. Vol. I, S. O., and S. Coll.
19	59.85	76.32	57.42	39.67	58.32	Jan. 1834;	Dec. 1844	6 7	......	Prof. J. Hamilton.	Am. Alm. 1836 and foll.
20	57.73	77.46	..	38.10	..	1849;	Feb. 1868	2 2	$\odot_r\ 9_m\ 3_a\ 9_a$	Rothrock, F. H. French, and Dr. J. W. Parker.	S. O. and S. Coll.
21	57.00	74.71	55.84	37.10	56.16	Oct. 1859;	May, 1861	1 7	$7_m\ 2_a\ 9_{a\ bis}$	J. W. Dodge and son.	P. O. and S. I. Vol. I, and S. O.
22	58.92	77.68	58.75	43.69	59.76	Feb. 1869;	Oct. 1870	1 9	"	W. T. Grigsby.	S. O.
23	58.81	74.71	55.28	39.12	56.98	Dec. 1859;	Mar. 1861	1 4	"	C. R. Barney.	P. O. and S. I. Vol. I, and S. O.
24	..	..	..	..	..	1856		0 3	$7_m\ 2_a\ 9_a$	J. B. Bean.	P. O. and S. I. Vol. I.
25	..	..	..	39.49	..	Dec. 1859;	Feb. 1860	0 3	$7_m\ 2_a\ 9_{a\ bis}$	S. W. Houghton.	P. O. and S. I. Vol. I. and S. O.

TEXAS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	68.15	81.87	..	..	..	1831		0 7	......	....	Dove.
2	..	..	..	..	..	1860		0 1	$7_m\ 2_a\ 9_{a\ bis}$	F. Koler.	S. O.
3	67.17	81.68	66.88	51.16	66.72	1852;	Dec. 1870	19 0	"	J. Van Nostrand, Dr. S. V. Jennings, and S. Palm.	MS. from S. G. O., S. Coll., P. O. & S. I. Vol. I, & S. O.
4	65.50	79.80	68.15	51.11	66.14	Jan. 1869;	Dec. 1870	2 0	"	F. H. Wade, and W. H. Good.	S. O.
5	..	81.78	71.23	..	..	1870		0 7	"	J. Fietsam.	" "
6	..	..	..	..	..	1859		0 3	$7_m\ 2_a\ 9_a$	Prof. J. Sias.	P. O. and S. I. Vol. I.
7	..	..	..	47.43	..	Nov. 1867;	Feb. 1868	0 4	"	....	MS. from S. G. O.
8	65.55	82.78	64.24	47.45	65.00	Nov. 1859;	Apr. 1861	1 6	$7_m\ 2_a\ 9_{a\ bis}$	Dr. N. P. West.	P. O. and S. I. Vol. I, and S. O.
9	66.18	84.13	64.29	46.37	65.24	Nov. 1856;	Jan. 1861	4 2	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860, and MS. from S. G. O.
10	67.11	83.40	68.32	49.32	67.04	Apr. 1868;	Mar. 1869	1 0	"	....	MS. from S. G. O.
11	62.15	84.01	..	..	..	Feb. 1857;	Oct. 1859	1 2	"	Assistant Surgeon.	Ar. Met. Reg. 1860.
12	71.67	85.19	69.00	51.83	69.42	May, 1858;	Dec. 1861	2 10	"	" "	Ar. Met. Reg. 1860, and MS. from S. G. O.
13	65.60	..	..	..	..	1857		0 5	"	" "	Ar. Met. Reg. 1860.
14	69.15	82.53	65.30	47.35	66.08	Jan. 1860;	Dec. 1870	2 3	"	" "	Ar. Met. Reg. 1860 and MS. from S. G. O.
15	65.53	81.76	64.43	48.73	65.11	Nov. 1856;	Feb. 1869	4 4	"	" "	" " " "
16	69.08	81.05	69.21	55.33	68.67	Mar. 1867;	May, 1869	2 2	$7_m\ 2_a\ 9_{a\ bis}$	H. Stevens, and J. B. Boshwick.	S. O.
17	..	79.30	..	..	..	May, 1866;	Feb. 1867	0 6	"	Dr. W. Gantt.	" "
18	..	81.65	69.46	..	..	1870		0 7	"	J. Anderson.	" "
19	68.03	81.24	69.54	53.91	68.18	Jan. 1869;	Dec. 1870	1 10	"	Dr. A. C. White.	" "
20	70.85	82.52	72.99	54.03	70.10	Nov. 1845;	Mar. 1856	3 5	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860.
21	69.37	..	68.69	..	..	Nov. 1859;	Nov. 1860	0 11	$7_m\ 2_a\ 9_{a\ bis}$	F. S. Wade.	P. O. and S. I. Vol. I, and S. O.
22	65.06	78.86	68.29	46.38	64.65	July, 1851;	Dec. 1859	1 5	$\odot_r$ N. $\odot_s$	J. M. Crockett, W. A. Ferris.	P. O. and S. I. Vol. I, and MS. in S. Coll.

[3] Also called Mine Creek and Sandy Fly.

[4] The observations, except for October, November, and December, 1859, were made at Ferris Plantation, about five miles east of Dallas.

TEXAS.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
23. Fort Belknap	33°08′	98°46′	1600	40°.29	47°.79	56°.13	65°.67	72°.45	80°.27	85°.18	84°.42	78°.45	66°.64	50°.78	43°.73
24. Fort Bliss[1]	31 47	106 30	3830	44.22	49.52	57.64	64.75	74.48	81.46	83.03	80.49	74.93	65.09	54.55	52.10
25. Fort Brown	25 50	97 37	50	60.08	63.89	68.66	74.62	79.99	83.17	84.74	84.53	80.83	74.43	68.79	61.98
26. Fort Chadbourne	31 58	100 15	2120	41.94	48.57	57.05	64.56	71.86	78.62	82.83	81.23	73.78	63.52	51.86	43.95
27. Fort Clark	29 17	100 25	1000	49.56	54.94	62.82	70.53	77.51	81.73	83.89	83.70	78.32	69.51	60.43	51.33
28. Fort Croghan	30 40	98 25	1000	49.29	52.21	60.38	65.66	71.54	78.34	81.06	82.56	77.53	67.30	56.10	46.89
29. Fort Davis	30 40	104 07	4700	43.99	49.63	56.87	65.64	73.69	76.25	75.71	75.01	69.69	61.34	53.40	44.50
30. Fort Duncan	28 39	100 30	1460	51.96	58.65	66.08	75.78	81.36	85.76	86.66	87.02	81.68	73.05	61.60	53.47
31. Fort Ewell	28 10	99 00	200	52.92	57.56	67.10	74.06	78.42	82.70	84.37	83.84	80.57	72.44	64.77	56.89
32. Fort Gates	31 26	97 52	1000	48.80	50.90	59.18	63.67	71.53	78.94	82.92	85.10	79.18	67.25	56.97	45.81
33. Fort Graham	32 00	97 21	900	47.95	52.14	58.09	64.06	72.59	79.45	83.14	84.70	77.46	67.64	55.49	46.48
34. Fort Griffin	..	..	..	42.27	48.09	50.33	64.58	73.32	77.23	82.89	83.72	76.10	..	58.03	38.19
35. Fort Houston	31 42	95 44	..	65.20	60.50	68.70	72.70	85.50	80.10	84.20	81.40	83.50	72.30	62.30	60.00
36. Fort Inge	29 10	99 50	845	50.41	57.93	63.32	69.49	77.61	82.09	84.32	84.33	79.75	68.93	59.15	51.42
37. Fort Lancaster	30 46	101 48	2350	44.84	53.57	60.99	66.54	75.77	82.64	85.12	83.61	76.28	66.17	52.52	44.94
38. Fort Lincoln	29 22	99 35	900	51.77	59.02	63.32	66.81	73.23	78.33	82.27	82.52	79.76	70.00	55.64	53.79
39. Fort McIntosh	27 35	99 48	806	54.82	61.33	69.18	76.46	82.50	84.99	86.97	87.50	82.73	73.82	64.74	55.61
40. Fort McKavett	30 48	100 08	2060	44.63	50.31	57.68	66.09	73.23	77.24	80.34	80.16	73.78	65.41	53.26	47.11
41. Fort Martin Scott	30 10	99 05	1300	46.18	52.45	57.61	62.48	68.50	75.48	77.26	78.14	72.95	62.04	52.41	43.10
42. Fort Mason	30 40	99 15	1200	48.05	54.65	59.06	68.62	75.20	80.47	83.61	82.75	75.97	67.74	55.67	49.89
43. Fort Merrill	28 10	98 00	150	55.02	57.31	68.96	73.65	80.39	82.78	83.39	84.52	80.68	73.26	63.67	57.18
44. Fort Polk	26 00	97 30	15	66.74	..	..	..	..	..	81.25	81.11	81.01	74.36	72.24	62.21
45. Fort Quitmann	30 45	105 00	3710	40.20	47.75	56.23	61.03	73.93	83.35	82.02	80.88	74.75	63.96	52.69	38.58
46. Fort Richardson	33 15	98 01	..	46.44	51.12	56.03	66.24	73.70	81.73	84.53	81.17	75.33	63.14	54.68	42.49
47. Fort Terrett	30 20	100 11	1320	44.43	45.98	56.91	66.35	72.83	75.96	78.21	78.77	73.35	65.09	56.23	49.59
48. Fort Worth	32 42	97 18	1100	45.58	48.78	56.30	62.56	70.48	77.44	80.99	82.87	76.54	66.22	53.36	43.38
49. Galveston	29 18	94 47	30	51.55	56.36	63.93	68.55	75.56	81.92	84.42	84.86	79.94	70.72	62.11	52.62
50. Gilmer (3 miles west of)	32 40	94 59	950	45.84	50.97	59.34	65.97	72.37	80.01	83.30	82.34	75.73	63.56	56.26	46.95
51. Goliad	28 35	97 30	50	58.64	58.83	63.57	69.82	77.66	79.96	83.33	84.42	79.76	68.97	60.49	58.58
52. Gonzales	29 32	97 32	150	59.2	58.0	67.8	68.8	78.1	80.6	84.4	84.0	82.4	75.1	65.6	56.7
53. Helena	28 58	97 56	600	48.94	63.47	65.78	..	..	..	..	..	..	..	..	..
54. Houston	29 44	95 28	..	53.69	55.19	63.74	68.64	73.62	78.61	79.58	76.18	73.35	69.98	64.34	50.23
55. Huntsville	30 41	95 40	..	54.64	58.76	65.06	65.67	73.34	82.85	82.23	84.38	79.04	69.03	60.64	54.11
56. Indianola	28 32	96 31	..	..	..	...	..	..	..	85.26	85.75	82.46	..	..	..
57. Jefferson	32 44	94 20	..	62.28	56.65	55.27	66.91	76.42	79.71	84.12	82.56	76.96	63.65	53.49	44.32
58. Larissa	32 01	95 19	755	51.07	52.92	60.15	65.28	73.84	80.39	83.06	84.21	76.56	67.35	56.01	45.38
59. Lavaca	28 37	96 37	17	53.08	56.55	60.93	66.53	74.79	80.25	82.39	83.34	77.08	65.54	66.23	51.38
60. Lockhart	29 55	97 44	..	51.78	55.80	59.58	67.98	75.58	82.10	82.03	81.82	..	..	..	..
61. New Braunfels[3]	29 42	98 15	720	48.50	55.24	63.02	69.34	78.06	82.78	84.90	86.24	79.53	69.38	58.96	50.86
62. Northern tier of counties	..	..	..	..	51.45	58.27	59.27	72.50	78.24	80.92	..	..	..	..	..
63. Oakland	29 35	97 00	..	..	..	..	69.96	76.07	79.85	82.59	81.69	80.37	71.39	63.12	49.58
64. Palestine	31 45	95 40	480	50.73	54.20	57.73	67.55	75.25	..	..	..	..	67.50	63.38	47.42
65. Pine Oak	30 00	97 09	..	38.59	49.46	57.13	70.01	71.83	79.28	81.57	84.22	75.39	66.59	55.66	49.32
66. Plantation Hill[4]	32 20	99 45	1100	42.93	49.31	58.02	66.39	71.93	76.47	80.73	81.50	74.43	63.59	53.26	46.26
67. Ringgold Barracks	26 25	99 00	521	57.25	63.59	70.04	76.56	82.07	85.95	86.42	86.35	82.01	75.00	66.04	58.94
68. Round Top	30 03	96 44	..	52.68	58.13	63.04	69.13	76.97	83.81	86.74	85.05	78.91	68.41	60.91	47.70
69. San Antonio	29 25	98 25	600	49.76	57.39	63.51	70.03	77.90	82.07	84.47	84.64	80.19	73.06	61.44	51.07
70. Sisterdale	29 59	98 43	1000	45.07	57.25	59.86	66.69	77.65	83.52	84.91	86.05	76.32	63.06	58.95	39.00
71. Turner's Point	32 30	96 08	..	..	53.33	..	..	..	..	..	..	..	..	..	..
72. Union Hill[5]	30 14	96 31	540	49.99	56.41	59.77	65.27	71.93	77.11	81.20	80.61	77.43	69.49	56.71	47.86
73. Waco	31 35	97 08	..	45.86	50.01	60.79	65.55	73.63	82.58	84.87	83.24	77.89	63.30	54.35	52.58
74. Washington	30 19	96 15	..	49.62	57.50	62.26	64.36	75.64	80.20	82.72	84.02	77.90	69.23	60.71	48.27
75. Webberville (Parson's Sem.)	30 14	97 34	394	..	59.56	64.88	69.89	79.60	83.18	84.58	85.81	78.65	66.44	..	..

[1] The observations in 1865, except for December, were made at Franklin, about two miles northwest of Fort Bliss.

[2] Observations corrected for daily variation by means of the general table.

TEXAS.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
23	64°.75	83°.29	65°.29	43°.94	64°.32	July, 1851;	Dec. 1858	7 1	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860.
24	65.62	81.66	64.86	48.61	65.19	July, 1854;	Dec. 1870	10 4	“	“ “	Ar. Met. Reg. 1860, MS. from S. G. O.
25	74.42	84.15	74.68	61.98	73.81	Nov. 1846;	Dec. 1870	13 5	“	“ “	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
26	64.49	80.89	63.05	44.82	63.31	May, 1852;	Mar. 1861	8 10	“	“ “	“ “ “ “
27	70.29	83.11	69.42	51.94	68.69	Aug. 1852;	Dec. 1870	10 1	“	“ “	“ “ “ “
28	65.86	80.65	66.98	49.46	65.74	June, 1849;	Aug. 1853	4 3	$\odot_r\ 9_m\ 3_a\ 9_a$	“ “	Ar. Met. Reg. 1855.
29	65.40	75.66	61.48	46.04	62.14	Nov. 1854;	Dec. 1870	7 10	$7_m\ 2_a\ 9_a$	“ “	Ar. Met. Reg. 1860 & MS. from S. G. O.
30	74.41	86.48	72.11	54.69	71.92	Oct. 1849;	Mar. 1861	10 5	“	“ “	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
31	73.19	83.64	72.59	55.79	71.30	Sept. 1852;	Sept. 1854	2 1	$\odot_r\ 9_m\ 3_a\ 9_a$	“ “	Ar. Met. Reg. 1855.
32	64.79	82.32	67.80	48.50	65.85	Oct. 1849;	Jan. 1852	2 4	“	“ “	“ “ “
33	64.91	82.43	66.86	48.86	65.77	Mar. 1850;	Aug. 1853	3 6	“	“ “	“ “ “
34	62.74	81.28	..	42.85	..	Aug. 1869;	Dec. 1870	1 2	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
35	75.63	81.90	72.70	61.90	73.03	1842		1 0	......	....	Rep. Brit. Assoc. 1847.
36	70.14	83.58	69.28	53.25	69.06	Sept. 1849;	Jan. 1868	7 9	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
37	67.77	83.79	64.99	47.78	66.08	May, 1856;	Feb. 1861	4 10	“	“ “	Ar. Met. Reg. 1860, and MS. from S. G. O.
38	67.79	81.04	68.47	54.86	68.04	Aug. 1849;	July, 1852	2 3	“	“ “	Ar. Met. Reg. 1855.
39	76.05	86.49	73.76	57.25	73.39	July, 1849;	Dec. 1870	10 10	“	“ “	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
40	65.67	79.25	64.15	47.35	64.10	Apr. 1852;	Aug. 1870	7 5	“	“ “	“ “ “ “
41	62.86	76.96	62.47	47.24	62.38	Aug. 1849;	Mar. 1852	2 7	$\odot_r\ 9_m\ 3_a\ 9_a$	“ “	Ar. Met. Reg. 1855.
42	67.63	82.28	66.46	50.86	66.81	Apr. 1852;	Feb. 1861	5 9	$7_m\ 2_a\ 9_a$	“ “	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
43	74.33	83.56	72.54	56.50	71.73	Apr. 1851;	Nov. 1855	3 5	“	“ “	Ar. Met. Reg. 1855 and 1860.
44	..	..	..	75.87	..	July, 1849;	Jan. 1850	0 7	$\odot_r\ 9_m\ 3_a\ 9_a$	“ “	Ar. Met. Reg. 1855.
45	63.73	82.08	63.80	42.18	62.95	Jan. 1859;	Dec. 1870	3 1	$7_m\ 2_a\ 9_a$	“ “	Ar. Met. Reg. 1860, and MS. from S. G. O.
46	65.32	82.48	64.38	46.68	64.72	Apr. 1868;	June, 1870	2 3	“	....	MS. from S. G. O.
47	65.36	77.65	64.89	46.67	63.64	Apr. 1852;	Dec. 1853	1 8	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
48	63.11	80.43	65.37	45.91	63.71	Nov. 1849;	Aug. 1853	3 10	“	“ “	“ “ “
49	69.35	83.73	70.92	53.51	69.38	Sept. 1851;	Apr. 1870	3 1	2	U. S. Coast Survey.	MS. from S. G. O. & MS. in S. Coll.
50	65.89	81.88	65.18	47.92	65.22	July, 1859;	Dec. 1870	5 0	$7_m\ 2_a\ 9_a$ bis	J. M. Glasco.	P. O. and S. I. Vol. I, and S. O.
51	70.35	82.57	69.74	58.68	70.34	Dec. 1832;	Dec. 1858	2 2	$7_m\ 2_a\ 9_a$	J. C. Brightman.	P. O. and S. I. Vol. I, & MS.
52	71.57	83.00	74.37	57.97	71.73	Feb. 1848;	June, 1850	2 4	max. & min.	C. D. Bennett.	MS. in S. Coll.
53	..	..	..	..	..	1857		0 3	$7_m\ 2_a\ 9_a$	J. C. Brightman.	P. O. and S. I. Vol. I.
54	68.67	78.12	69.22	53.04	67.26	May, 1867;	Dec. 1870	2 2	$7_m\ 2_a\ 9_a$ bis	Miss E. Baxter.	S. O.
55	68.02	83.15	69.57	55.84	69.15	1849;	Mar. 1854	2 5	$\odot_r$ N. $\odot_s$	T. Gibbs and Browne.	P. O. and S. I. Vol. I, & S. Coll.
56	..	..	..	..	..	1868		0 3	$7_m\ 2_a\ 9_a$	....	MS. from S. G. O.
57	66.20	82.13	64.70	54.42	66.86	July, 1869;	Dec. 1870	1 6	“	....	“ “ “
58	66.42	82.55	66.64	49.79	66.35	Jan. 1858;	Dec. 1859	2 0	“	F. L. Yoakum.	P. O. and S. I. Vol. I.
59	67.42	81.99	69.62	53.67	68.17	Feb. 1869;	Aug. 1870	1 7	$7_m\ 2_a\ 9_a$ bis	L. D. Heaton.	S. O.
60	67.71	81.98	..	..	..	July, 1869;	Aug. 1870	0 10	“	L. Woodruff.	“ “
61	70.14	84.64	69.29	51.53	68.90	July, 1850;	Dec. 1859	9 1	$7_m\ 2_a\ 9_a$	Prof. L. C. Ervendburg.	P. O. & S. I. Vol. I, and S. Coll.
62	63.35	..	..	..	..	1859		0 6	$\odot_r\ 7_m\ 2_a\ 7_a\ 9_a$	....	P. O. and S. I. Vol. I.
63	..	81.38	71.63	..	..	1870		0 9	$7_m\ 2_a\ 9_a$ bis	F. Simpson.	S. O.
64	66.84	..	..	50.78	..	Oct. 1869;	Dec. 1870	0 10	“	N. S. Brooks.	“ “
65	66.32	81.69	65.88	45.79	64.92	1856		1 0	$\odot_r$ N. $\odot_s$	Dr. W. H. Gantt.	P. O. and S. I. Vol. I.
66	65.45	79.57	63.76	46.16	63.73	Dec. 1851;	Mar. 1854	2 4	$\odot_r\ 9_m\ 3_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
67	76.22	86.24	74.35	59.93	74.19	Oct. 1849;	Dec. 1870	10 5	$7_m\ 2_a\ 9_a$	“ “	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
68	69.71	85.20	69.41	52.84	69.29	Jan. 1859;	Apr. 1861	2 4	$7_m\ 2_a\ 9_a$ bis	B. Schumann.	P. O. and S. I. Vol. I, and S. O.
69	70.48	83.73	71.56	52.74	69.63	Jan. 1846;	Dec. 1870	8 7	$7_m\ 2_a\ 9_a$	Assistant Surgeon and F. Peterson.	Ar. Met. Regs. 1855 and 1860, MS. from S. G. O., & S. O.
70	68.07	84.83	66.11	47.11	66.53	1859		1 0	“	E. Kapp.	P. O. and S. I. Vol. I.
71	..	..	..	..	..	1861		0 1	“	J. T. Rayel.	S. O.
72	65.66	79.64	67.88	51.42	66.15	Jan. 1857;	Aug. 1867	3 6	$7_m\ 2_a\ 9_a$ bis	Dr. W. H. Gantt, and W. Rutherford.	P. O. and S. I. Vol. I, and S. O.
73	66.66	83.56	65.18	49.48	66.22	Apr. 1867;	Apr. 1869	2 0	“	Dr. E. Merrill.	S. O.
74	67.42	82.31	69.28	51.80	67.70	Dec. 1856;	Dec. 1859	2 8	$7_m\ 2_a\ 9_a$	B. H. Rucker.	P. O. and S. I. Vol. I.
75	71.46	84.52	..	..	..	Feb. 1859;	Apr. 1861	1 0	“	E. W. Yellowby.	P. O. and S. I. Vol. I, and S. O.

[3] Formerly called New Wied.

[4] Also called Phantom Hill.

[5] The observations in July and August, 1867, were made at Long Point, about two miles northeast of Union Hill.

UTAH.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Camp Douglas . .	40°47′	111°52′	4800	28°.71	31°.99	38°.82	48°.78	60°.32	69°.06	75°.90	75°.49	64°.67	54°.34	42.°77	31°.92
2. Coalville	41 00	111 00	5630	..	27.75	32.15	..	54.83	64.26	70.99	68.39	59.69	45.52	38.11	19.59
3. Fort Crittenden[1] .	40 12	112 06	4860	19.42	28.61	37.79	48.47	59.38	72.96	76.33	72.71	61.01	48.30	36.80	24.54
4. Great Salt Lake City[2]	40 46	111 54	4260	25.86	32.98	40.70	48.73	60.35	69.21	76.56	74.94	64.10	55.05	41.54	32.30
5. Heberville[3] . . .	40 32	111 16	..	34.41	39.67	48.55	56.53	75.43	82.58	84.83	84.29	74.12	62.65	54.95	38.42
6. St. Mary's . . .	40 42	111 00	6200	..	26.05	28.00	36.70	54.70	61.00	70.70	70.67	59.25	46.75	38.85	19.45
7. Wanship	40 40	111 20	6200	19.69	25.61	30.33	37.10	51.83	59.91	70.18	69.97	61.44	50.32	38.35	31.07

VERMONT.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Barnet	44 18	72 05	952	10.91	25.87	25.54	45.42	52.75	66.43	72.78	64.70	..	..	36.63	8.70
2. Bradford	44 01	72 10	..	22.95	13.70	26.06	..	..	..	..	..	..	..	..	..
3. Brandon	43 49	73 03	460	19.29	21.95	28.57	41.91	54.75	64.01	68.67	65.87	58.43	46.27	36.28	23.45
4. Brattleboro . . .	42 50	72 31	359	24.78	26.05	33.89	41.29	52.51	67.58	71.49	66.77	60.85	47.79	43.51	21.25
5. Brookfield . . .	44 02	72 36	1000	..	15.95	17.60	37.65	52.63	..	..	..	..	..	..	..
6. Burlington . . .	44 28	73 12	346	14.4	18.9	28.5	39.5	56.3	66.6	68.2	67.6	57.1	45.2	33.5	24.7
7. Burlington . . .	44 28	73 12	346	20.02	20.04	28.39	41.76	54.68	64.21	68.52	67.24	58.76	47.16	35.85	22.84
8. Calais	44 22	72 25	..	17.23	18.81	24.77	36.12	48.51	..	63.59	..	53.60	..	..	..
9. Castleton . . .	43 38	73 09	490	22.65	19.48	29.03	42.60	53.34	67.76	73.44	70.25	60.10	48.38	37.45	24.67
10. Craftsbury . . .	44 40	72 23	1100	13.51	16.62	24.57	37.60	50.72	60.97	65.27	62.15	54.70	42.49	31.71	18.35
11. Fairfax	44 39	73 00	..	..	..	..	..	..	66.77	..	..	..	..	..	..
12. Fayetteville . . .	42 57	72 36	350	18.4	19.9	31.0	44.0	56.2	63.5	67.5	66.1	57.4	46.7	34.9	24.1
13. Ferrisburg . . .	44 11	73 14	..	26.08	18.83	24.70	46.33	56.28	68.45	72.88	78.50	62.69	46.48	33.84	24.74
14. Grafton	43 12	72 34	..	..	..	..	40.60	51.66	..	..	..	..	..	..	..
15. Luxenburg . . .	44 28	71 44	1124	15.68	17.52	26.32	37.77	51.84	63.96	67.52	64.55	55.64	44.55	32.24	19.36
16. Middlebury . . .	44 02	73 10	398	18.51	21.30	29.84	42.82	54.52	65.78	69.80	66.01	58.91	46.93	37.15	23.23
17. Montpelier[4] . . .	44 17	72 36	540	22.85	17.86	24.77	38.86	50.66	60.67	67.40	63.98	57.49	46.40	38.94	23.26
18. Newbury . . .	44 06	72 07	420	17.58	19.04	29.08	41.81	53.87	64.70	69.15	67.06	57.60	45.68	35.38	21.17
19. New Fane . . .	42 58	72 35	..	18.88	19.29	30.67	43.27	54.45	64.49	67.28	66.53	56.90	46.89	35.58	24.46
20. Newport . . .	43 57	72 18	750	15.54	22.29	25.73	42.38	53.22	64.95	71.11	65.55	57.85	47.44	34.67	25.62
21. Norwich[5] . . .	43 45	72 21	..	6.61	27.17	24.43	42.05	51.59	65.50	69.71	68.12	65.40	44.63	32.28	20.73
22. Randolph . . .	43 55	72 36	700	17.19	19.65	25.64	40.37	52.79	65.07	69.59	64.98	57.45	44.32	34.08	20.22
23. Rupert	43 15	73 11	750	21.55	25.45	31.73	43.20	58.51	67.96	72.74	70.79	62.63	50.13	38.79	25.76
24. Rutland	43 37	72 57	500	18.0	18.5	32.0	41.0	50.0	64.0	67.5	67.5	57.0	41.0	37.0	30.0
25. Rutland	43 37	72 57	500	27.75	30.13	34.65	43.38	..	..	..	67.30	55.00	47.33	39.70	26.98
26. St. Johnsbury . .	44 27	72 02	540	15.61	16.82	27.16	37.64	52.99	62.16	64.15	63.62	55.16	43.61	33.05	17.43
27. Shelburn	44 23	73 11	150	9.51	21.06	24.97	41.63	53.22	64.71	71.62	65.04	58.09	45.05	35.11	22.25
28. Springfield . . .	43 18	72 25	300	16.19	21.19	29.24	39.38	53.33	62.00	66.08	66.37	58.67	48.37	37.56	22.87
29. West Charlotte . .	44 20	73 15	90	25.69	22.80	26.56	44.54	55.71	68.48	75.02	71.04	63.43	47.77	35.40	25.23
30. Williamstown . .	44 08	72 34	1000	15.34	15.72	25.45	37.93	50.12	59.45	64.04	61.36	52.98	41.79	30.08	18.06
31. Wilmington . . .	42 53	72 50	1200	11.95	26.43	..	..	52.28	64.97	70.33	60.03	56.60	45.50	36.75	21.72
32. Windsor	43 29	72 25	..	22.7	25.7	29.6	37.7	57.2	66.7	68.3	63.7	61.1	47.8	35.0	23.6
33. Woodstock . .	43 36	72 31	650	16.44	14.95	23.52	38.78	52.13	62.59	68.07	62.91	55.81	41.85	31.08	19.64

1 Observations previous to March, 1861, were made at old Camp Floyd.

2 Observations prior to 1861 at various hours; they have been referred to $7_m\ 2_a\ 9_{a\ bis}$, by means of the general table.

3 Also known as St. George. The series is unreliable; when compared with other stations the results are shown to be much too high; probably due to improper exposure of the instrument, or defective scale.

UTAH.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	49°.31	73°.48	53°.93	30°.87	51°.90	Dec. 1862;	Dec. 1870	7 9	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	MS. from S. G. O.
2	..	67.88	47.77	..	..	May, 1869;	Dec. 1870	1 5	$7_m\ 2_a\ 9_{a\ bis}$	T. Bullock.	S. O.
3	48.55	74.00	48.70	24.19	48.86	July, 1858;	July, 1861	3 0	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860, and MS. from S. G. O.
4	49.93	73.57	53.56	30.38	51.86	Jan. 1850;	Aug. 1870	9 0	$7_m\ 2_a\ 9_{a\ bis}$	H. E. & W. W. Phelps, and others.	Ar. Met. Reg. 1855, P. O. and S. I. Vol. 1, and S. O.
5	60.17	83.90	63.91	37.50	61.37	Jan. 1861;	June, 1870	2 2	"	H. Pearce and C. Johnson.	S. O.
6	39.80	67.46	48.28	..	..	June, 1865;	Aug. 1867	2 0	$7_m\ 2_a\ 9_a$	T. Bullock.	S. Coll.
7	39.75	66.69	50.04	25.46	45.48	June, 1866;	Mar. 1869	2 4	$7_m\ 2_a\ 9_{a\ bis}$	" "	S. O.

VERMONT.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	41.24	67.97	..	15.16	..	Apr. 1866;	Mar. 1869	1 3	$7_m\ 2_a\ 9_{a\ bis}$	Dr. B. F. Eaton.	S. O.
2	..	..	..	..	..	1858		0 3	$7_m\ 2_a\ 9_a$	L. W. Bliss.	P. O. and S. I. Vol. 1.
3	41.74	66.18	46.99	21.56	44.12	Oct. 1852;	June, 1869	13 10	$7_m\ 2_a\ 9_{a\ bis}$	D. and H. Buckland.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
4	42.56	68.61	50.72	24.03	46.48	Mar. 1849;	Sept. 1851	1 6	$\odot_r\ 9_m\ 3_a\ 9_a$	Frost.	S. Coll.
5	35.96	..	..	..	..	1863		0 4	$7_m\ 2_a\ 9_{a\ bis}$	T. F. Pollard.	S. O.
6	41.43	67.47	45.27	19.33	43.37	1803;	1808	6 0	......	Sanders.	Tompson's Hist. Vermont.
7	41.61	66.66	47.26	20.97	44.12	Jan. 1828;	Nov. 1864	29 6	$\odot_r\ 1_a\ 9_a$	Prof. Z. Thompson, and M. K. Petty.	MS. in S. Coll., S. O., P. O. and S. I. Vol. 1.
8	36.47	..	..	..	..	Feb. 1861;	Sept. 1864	1 2	$7_m\ 2_a\ 9_{a\ bis}$	J. K. Toby.	S. O.
9	41.66	70.48	48.64	22.27	45.76	1851;	Dec. 1870	4 3	"	D. Underwood and R. G. Williams.	P. O. and S. I. Vol. 1, S. O., & S. Coll.
10	37.63	62.80	42.97	16.16	39.89	Jan. 1854;	Dec. 1870	16 4	"	C A. J. Marsh, J. A. Paddock, and E. P. Wild.	P. O. and S. I. Vol. 1, and S. O.
11	..	..	..	..	..	1854		0 1	$7_m\ 2_a\ 9_a$	Prof. S. H. Peabody.	P. O. and S. I. Vol. 1.
12	43.73	65.70	46.33	20.80	44.14	May, 1826;	Dec. 1834	8 8	$\odot_r\ 2_a\ 9_a$	Gen. M. Field.	Am. Journ. Sci. and MS. in S. Coll.
13	42.44	73.28	47.67	23.22	46.65	May, 1869;	Dec. 1870	1 8	$7_m\ 2_a\ 9_{a\ bis}$	D. C. & M. E. Barto.	S. O.
14	..	..	..	..	..	1843		0 2	$\odot_r\ 9_m\ 3_a\ 9_a$	Peabody.	S. Coll.
15	38.64	65.34	44.15	17.52	41.41	1848;	Dec. 1870	19 0	$7_m\ 2_a\ 9_{a\ bis}$	H. A. Cutting.	S. O. and S. Coll.
16	42.39	67.20	47.66	21.01	44.57	1849;	Dec. 1870	10 1	"	H. A. Shelden and Parker.	" " "
17	38.10	64.02	47.61	21.32	42.76	May, 1849;	May, 1863	2 5	$\odot_r$ N. $\odot_s$	B. J. Wheeler, Dr. M. M. Marsh, and Thompson.	P. O. and S. I. Vol. 1, S. O., and S. Coll.
18	41.59	66.97	46.22	19.26	43.51	May, 1835;	Dec. 1854	18 5	6_m N. 6_a	D. Johnson.	Dove, Regents' Report.
19	42.80	66.10	46.46	20.88	44.06	....		6 0	$\odot_r\ 2_a\ 9_a$	....	Dove, 1857.
20	40.44	67.20	46.65	21.15	43.86	Nov. 1856;	Nov. 1870	2 1	$7_m\ 2_a\ 9_{a\ bis}$	L. W. Bliss, and J. M. Currier.	P. O. and S. I. Vol. 1, and S. O.
21	39.36	67.78	47.44	18.17	43.19	Mar. 1856;	Sept. 1869	1 8	$7_m\ 2_a\ 9_a$	Prof. A. Jackmann, and Dr. B. F. Eaton.	" " " " " "
22	39.60	66.55	45.28	19.02	42.61	1850;	Dec. 1870	5 8	$7_m\ 2_a\ 9_{a\ bis}$	C. S. Paine, E. Bethel, and Manly.	S. O. and S. Coll.
23	44.48	70.50	50.52	24.25	47.44	Jan. 1857;	Mar. 1863	5 6	"	J. Parker.	P. O. and S. I. Vol. 1, and S. O.
24	41.00	66.33	45.00	22.17	43.62	1789		1 0	......	Williams.	Williams's Hist. of Vermont.
25	..	..	47.34	28.29	..	Aug. 1863;	Apr. 1864	0 9	$7_m\ 2_a\ 9_{a\ bis}$	S. O. Mead.	S. O.
26	39.26	63.31	43.94	16.62	40.78	Jan. 1853;	Jan. 1861	5 2	$7_m\ 2_a\ 9_a$	J. K. Colby and F. Fairbanks.	P. O. & S. I. Vol. 1, & S. Coll.
27	39.94	67.12	46.08	17.61	42.69	Mar. 1856;	Dec. 1857	1 10	"	G. Bliss.	P. O. and S. I. Vol. 1.
28	40.65	64.82	48.20	20.08	43.44	Dec. 1860;	Nov. 1863	2 4	$7_m\ 2_a\ 9_{a\ bis}$	J. W. Chickering.	S. O.
29	42.27	71.51	48.87	24.57	46.81	May, 1868;	Dec. 1870	2 8	"	M. E. Wing.	" "
30	37.83	61.62	41.62	16.37	39.36	Feb. 1829;	Dec. 1841	12 9	$\odot_r\ 1_a\ 9_a$	Paine.	MS. in S. Coll.
31	..	65.11	46.28	20.03	..	May, 1866;	Feb. 1867	0 10	$7_m\ 2_a\ 9_{a\ bis}$	J. B. Perry.	S. O.
32	41.50	66.23	47.97	24.00	44.92	1806		1 0	$\odot_r\ 2_a$ [6]	B. Towler.	Med. and Agr. Reg. Bost. Vol. 1, 1806–7.
33	38.14	64.52	42.91	17.01	40.65	Mar. 1857;	Dec. 1870	3 0	$7_m\ 2_a\ 9_{a\ bis}$	C. Marsh, H. Doton, and L. A. Miller.	P. O. and S. I. Vol. 1, & S. O.

[4] The observations previous to 1863 were made at East Montpelier, about three miles east of Montpelier.

[5] Observations in Sept. 1869 at Hartford, about one and a half miles southeast of Norwich.

[6] Observations corrected for daily variation.

VIRGINIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Alexandria . . .	38°48′	77°02′	56	32°.65	34°.05	41°.26	52°.53	63°.47	74°.94	78°.59	76°.19	67°.76	54°.50	46°.35	35°.98
2. Ashland (Randolph Macon Coll.) . .	37 45	77 30	221	42.85	..	..	..	..	..	..	..	..	..	..	..
3. Bellona Arsenal .	37 33	77 32	120	38.73	41.97	50.31	58.36	67.79	76.58	79.19	77.90	70.57	60.08	50.59	43.43
4. Berryville . . .	39 08	77 58	575	21.86	32.22	35.24	43.59	57.81	72.78	75.41	72.05	65.99	54.45	42.78	36.14
5. Cape Charles Light.	37 07	75 54	20	36.05	33.20	39.70	52.85	60.48	70.05	76.00	76.75	74.00	63.28	51.83	38.03
6. Charlottesville . .	38 01	78 26	150	38.87	39.01	48.05	53.26	63.71	73.11	77.87	76.77	66.33	57.34	48.11	36.60
7. Christiansburgh .	37 05	80 23	2000	37.73	43.68	..	52.55	63.78	67.55	..	..	..	..	47.26	38.56
8. Cottage Home . .	37 10	76 50	..	43.05	40.88	48.76	57.52	66.53	76.74	82.04	79.31	72.49	58.49	47.72	39.42
9. Crichton's Store[1] .	36 40	77 46	500	39.31	42.29	49.39	59.25	68.03	75.35	80.45	77.89	71.48	59.52	49.61	41.32
10. Fredericksburg . .	38 18	77 27	600	42.02	53.80	56.14	53.05	64.10	75.30	75.07	74.28	66.11	55.39	49.52	36.84
11. Fortress Monroe .	37 00	76 19	8	42.41	41.81	49.90	55.99	66.13	74.62	78.73	77.86	72.44	61.90	51.41	41.10
12. Garysville . . .	37 18	77 16	..	21.92	32.10	43.84	58.33	65.33	76.50	80.50	70.33	61.00	53.00	47.00	37.00
13. Glasgow Station (near)	37 36	78 57	..	30.06	37.92	44.15	53.81	62.07	71.18	78.49	75.14	69.03	57.95	48.08	35.68
14. Hampton . . .	37 02	76 21	5	44.24	42.51	43.60	54.92	64.35	75.94	80.24	77.69	70.50	58.42	46.72	40.72
15. Harper's Ferry (heights, near) .	39 20	77 44	..	..	..	..	..	..	..	..	..	..	54.73	42.48	..
16. Heathville . . .	37 52	76 26	..	..	..	44.77	52.41	61.72	..	..	..	..	..	..	..
17. Hewlett's Station (near)	37 52	77 45	..	..	..	..	59.13	60.98	74.38	74.58	70.18	..	..	..	..
18. Lewinsville . . .	38 56	77 12	180	38.62	40.97	50.38	52.67	65.35	72.85	76.76	73.76	66.82	56.69	42.41	41.67
19. Lexington[3] . . .	37 44	79 24	1000	38.41	39.31	44.19	54.22	63.74	72.51	78.71	76.04	66.52	53.29	42.05	34.85
20. Longwood . . .	37 30	79 31	800	24.22	46.43	41.72	..	..	..	..	..	..	..	..	..
21. Lynchburg . . .	37 22	79 07	575	..	42.94	51.09	57.30	68.63	75.43	83.80	80.37	..	..	..	..
22. Lynchburg (six miles west of) . . .	37 22	79 12	800	39.57	40.42	46.30	55.88	63.18	71.63	78.28	76.09	68.77	57.88	48.76	39.35
23. Madison C. H. . .	38 22	78 17	500	..	..	..	..	66.13	..	..	..	..	..	..	..
24. Meadow Dale . .	38 23	79 35	..	28.52	34.36	34.59	42.43	54.80	65.05	67.02	66.05	59.93	50.19	37.17	37.64
25. Mechanicsville . .	38 50	78 00	..	36.68	33.73	38.50	51.98	62.63	70.83	76.10	74.10	65.35	55.63	39.80	33.88
26. Montross	38 07	76 46	200	34.02	38.91	44.49	50.98	62.99	72.83	76.08	73.85	67.51	52.46	44.59	37.88
27. Mossy Creek . .	38 25	79 02	..	28.78	34.35	37.73	49.59	59.99	72.34	..	..	63.70	44.59	39.29	33.13
28. Mount Solon . .	38 17	79 02	..	38.05	37.49	46.33	54.19	61.39	71.24	76.73	73.85	69.85	55.93	..	33.86
29. Mount View . .	38 00	78 30	521	36.21	40.12	48.77	54.82	66.29	70.61	74.26	73.22	64.57	53.49	46.63	34.54
30. Mulberry Hill . .	36 50	76 50	100	45.13	43.25	45.26	56.74	65.21	76.58	81.49	..	68.30	54.28	42.20	43.80
31. Newark (near) . .	38 00	78 10	..	..	..	..	..	..	..	..	..	..	..	..	..
32. Norfolk	36 51	76 17	20	43.73	48.44	55.72	62.01	71.00	76.73	80.21	77.09	74.09	65.54	59.58	47.35
33. Norfolk	36 51	76 17	20	40.50	41.00	47.50	56.10	65.90	74.20	78.30	77.10	71.40	61.70	51.20	43.20
34. Paddystown . . .	39 28	78 55	..	30.42	..	..	..	..	..	..	..	..	..	35.01	36.95
35. Peachlawn[4] . . .	38 19	77 27	350	37.18	37.33	46.23	52.67	64.46	72.42	76.48	76.05	68.16	57.90	47.10	36.95
36. Piedmont . . .	38 40	78 00	900	38.43	33.43	38.23	52.53	62.08	71.08	76.75	73.13	66.08	56.70	41.12	34.55
37. Portsmouth[5] . . .	36 50	76 18	25	40.10	43.91	48.79	56.65	64.83	75.32	79.08	77.11	71.36	60.14	50.42	43.23
38. Powhatan Hill . .	38 13	77 12	100	41.69	37.18	43.75	53.89	63.92	74.25	79.60	76.85	70.53	56.26	45.50	35.92
39. Prince Edward C. H.	37 10	78 21	..	37.21	41.63	47.09	53.42	63.46	70.48	75.46	72.61	65.10	56.71	49.26	39.63
40. Prospect Hill Farm	37 25	75 52	40	43.18	40.64	42.05	52.63	61.98	72.16	78.03	75.72	70.03	57.53	47.07	38.88
41. Richmond . . .	37 32	77 26	172	37.21	42.79	48.68	54.87	65.97	74.10	77.50	75.08	67.85	58.98	47.27	40.10
42. Rose Hill . . .	38 00	76 57	250	34.71	35.17	45.51	52.24	62.87	75.37	76.77	76.90	..	57.74	50.10	45.42
43. Rougemont . . .	38 05	78 21	450	29.72	39.19	44.82	53.35	63.34	74.11	79.18	76.05	69.43	58.58	45.44	40.89
44. Ruthven[6] . . .	37 21	77 33	..	36.07	38.18	50.41	52.85	63.63	74.86	76.49	74.78	69.77	55.60	44.31	38.64
45. Smithfield . . .	36 57	76 38	100	35.89	39.28	45.53	55.94	64.09	73.85	77.26	75.03	68.72	58.07	47.74	39.43
46. Snowville . . .	37 00	80 00	1800	34.30	36.45	41.06	49.35	58.15	66.45	71.77	69.30	62.55	48.30	38.91	32.34
47. Staunton	38 09	79 04	1387	41.04	37.68	39.98	52.04	61.22	71.39	74.83	74.58	64.66	51.65	42.49	33.95
48. Stribling Springs .	38 17	79 12	1639	28.43	32.08	41.17	45.16	..	..	..	..	59.05	49.71	33.70	34.59
49. The Plains (near) .	38 50	77 51	..	..	..	46.60	50.71	..	..	..	..	..	..	..	..
50. The Shades . . .	39 00	78 00	..	..	..	..	..	..	..	..	..	63.55	..	..	..
51. Vienna[7]	38 57	77 19	400	37.40	32.08	40.00	54.73	65.33	75.35	77.05	72.50	65.33	..	41.35	31.48

1 This series is of very little value on account of great irregularity in the hours of observation.

2 Observations corrected for daily variation by means of the general table.

3 The observations, except the first three months of 1861, were made at Tribrook Farm, about three miles northeast of Lexington, by W. H. Ruffner.

4 Also called Hartwood or Falmouth.

VIRGINIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs.	Extent mos.	Observing hours.	Observer.	References.
1	52°.42	76°.57	56°.20	34°.23	54°.86	Oct. 1849;	Feb. 1864	6	8	$7_m\ 2_a\ 9_a$	B. Hallowell and others.	P. O. and S. I. Vol. 1, MS. from S. G. O., and S. Coll.
2	..	..	..	..	..	1865		0	1	$7_m\ 2_a\ 9_a$ bis	Prof. R. M. Smith.	S. O.
3	58.82	77.89	60.41	41.38	59.62	Jan. 1824;	Sept. 1833	7	10	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
4	45.55	73.41	54.41	30.07	50.86	Jan. 1856;	Dec. 1857	1	11	"	Dr. R. and Miss E. Kownslar.	P. O. and S. I. Vol. 1.
5	51.01	74.27	63.04	35.76	56.02	Mar. 1867;	Feb. 1868	1	0	$7_m\ 2_a\ 9_a$ bis	J. G. Potts (Prison Keeper).	S. O.
6	55.01	75.92	57.26	38.16	56.59	July, 1837;	Dec. 1852	2	11	$7_m\ 2_a\ 9_a$	Meriwether.	Am. Alm. 1839 and S. Coll.
7	..	..	..	39.99	..	1850;	1853	0	9	$\odot_r\ 9_m\ 3_a\ 9_a$	Chevalier and Hogan.	S. Coll.
8	57.60	79.36	59.57	41.12	59.41	May, 1867;	Dec. 1870	3	7	$7_m\ 2_a\ 9_a$ bis 2	B. W. Jones.	S. O.
9	58.89	77.90	60.20	40.97	59.49	Jan. 1854;	Jan. 1861	7	1		R. F. Astrop.	Rec. in S. Coll. and S. O.
10	57.76	74.88	57.01	44.22	58.47	Mar. 1849;	Apr. 1860	1	3	$\odot_r\ 9_m\ 3_a\ 9_a$	C. H. Robey and Wellford.	S. O. and S. Coll.
11	57.34	77.07	61.92	41.77	59.52	Jan. 1825;	Dec. 1870	45	5	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
12	55.83	75.78	53.67	30.34	53.91	1856		1	0	$\odot_r\ 2_a\ \odot_s$	Dr. T. F. Beckwith.	P. O. and S. I. Vol. 1.
13	53.34	74.94	58.35	34.55	55.30	Oct. 1866;	Sept. 1868	2	0	......	R. J. Davis.	S. O.
14	54.29	77.96	58.55	42.49	58.32	Jan. 1869;	Dec. 1870	2	0	$7_m\ 2_a\ 9_a$ bis	J. M. Sherman.	" "
15	..	..	..	..	..	1860		0	2	"	L. J. Bell and wife.	" "
16	52.97	..	..	..	..	1849		0	3	$\odot_r\ 9_m\ 3_a\ 9_a$	Miller.	S. Coll.
17	..	73.05	..	..	..	1867		0	5	$7_m\ 2_a\ 9_a$ bis	J. F. Adams.	S. O.
18	56.13	74.46	55.31	40.42	56.58	June, 1858;	Oct. 1859	1	5	$7_m\ 2_a\ 9_a$	Rev. C. B. Mackee.	P. O. and S. I. Vol. 1.
19	54.05	75.75	53.95	37.52	55.32	Jan. 1861;	Dec. 1870	2	8	$7_m\ 2_a\ 9_a$ bis	W. K. Park and W. H. Ruffner.	S. O.
20	..	..	..	..	..	1857		0	3	$7_m\ 2_a\ 9_a$	T. J. Wickline.	P. O. and S. I. Vol. 1.
21	59.01	79.87	..	..	..	1854		0	7	"	A. Nettleton.	" " " "
22	55.12	75.33	58.47	39.78	57.18	Oct. 1866;	Dec. 1870	3	9	$7_m\ 2_a\ 9_a$ bis	C. J. Merriwether.	S. O.
23	..	..	..	..	..	1851		0	1	$\odot_r\ 9_m\ 3_a\ 9_a$	Grinnan.	S. Coll.
24	43.94	66.04	49.10	33.51	48.15	Jan. 1857;	Feb. 1859	2	2	$7_m\ 2_a\ 9_a$	J. and J. B. Slaven.	P. O. and S. I. Vol. 1.
25	51.04	73.68	53.59	34.76	53.27	Nov. 1869;	Dec. 1870	1	2	$7_m\ 2_a\ 9_a$ bis	W. A. Martin.	S. O.
26	52.82	74.25	54.85	36.94	54.72	Dec. 1856;	Oct. 1859	2	6	$7_m\ 2_a\ 9_a$	H. H. Fountleroy and E. E. Spence.	P. O. and S. I. Vol. 1.
27	49.10	..	49.19	32.09	..	Apr. 1853;	May, 1858	1	8	"	J. Hotchkiss.	P. O. and S. I. Vol. 1, & S. Coll.
28	53.97	73.94	..	36.47	..	Apr. 1856;	Apr. 1869	1	10	$7_m\ 2_a\ 9_a$ bis	Dr. J. T. Clarke.	P. O. and S. I. Vol. 1, and S. O.
29	56.63	72.70	54.89	36.96	55.29	Feb. 1859;	Apr. 1861	2	2	"	J. R. Abell.	" " " " "
30	55.74	..	54.93	44.06	..	Jan. 1869;	July, 1870	1	6	"	R. Binford.	S. O.
31	..	..	..	..	59.75	1823;	1828	6	0	......	Watson.	Am. Alm.
32	62.91	78.01	66.40	46.51	63.46	1822		1	0	$7_m\ 2_a\ 9_a$	....	Long's Expedition to St. Peter's River, Vol. 2.
33	56.50	76.53	61.43	41.57	59.01	....		25	0	......	....	Pat. Off. Rep.
34	..	..	..	..	..	1852;	1853	0	3	$\odot_r\ 9_m\ 3_a\ 9_a$	Webster.	S. Coll.
35	54.45	74.98	57.72	37.15	56.08	Jan. 1858;	Mar. 1861	3	3	$7_m\ 2_a\ 9_a$ bis	A. Van Doren.	P. O. and S. I. Vol. 1, and S. O.
36	50.95	73.65	54.63	35.47	53.68	Nov. 1869;	Dec. 1870	1	2	"	F. Williams.	S. O.
37	56.76	77.17	60.64	42.41	59.24	Apr. 1843;	Sept. 1870	12	1	"	Various observers.	S Coll., P. O. and S. I. Vol. 1, and S. O.
38	53.85	76.90	57.43	38.26	56.61	Feb. 1868;	Dec. 1870	2	10	"	C. T. Taylor.	S. O.
39	54.66	72.85	57.02	39.49	56.01	1849;	1852	2	8	$\odot_r\ 9_m\ 3_a\ 9_a$	Metteaur.	S. Coll.
40	52.22	75.30	58.21	40.90	56.66	Apr. 1868;	Dec. 1870	2	9	$7_m\ 2_a\ 9_a$ bis	C. R. Moore.	S. O.
41	56.51	75.56	58.03	40.03	57.53	Jan. 1824;	Feb. 1860	7	2	$\odot_r$ N. $\odot_s$	Chevalier, D. Turner, and J. Applyard.	Darby's View of the U. S. pp. 4 and 11, S. O., and S. Coll.
42	53.54	76.35	..	38.43	..	Jan. 1857;	Aug. 1858	1	1	$7_m\ 2_a\ 9_a$	G. U. Upshaw.	P. O. and S. I. Vol. 1.
43	53.84	76.45	57.82	36.60	56.18	Feb. 1853;	Mar. 1861	5	6	$7_m\ 2_a\ 9_a$ bis	A. Nettleton and G. C. Dickinson.	P. O. & S. I. Vol. 1, S. Coll., & S. O.
44	55.63	75.38	56.56	37.63	56.30	Aug. 1856;	May, 1859	2	4	$7_m\ 2_a\ 9_a$	J. C. Ruffin.	P. O. and S. I. Vol. 1.
45	55.19	75.38	58.18	38.20	56.74	July, 1854;	Mar. 1861	6	8	"	Dr. J. R. Purdie.	P.O. and S. I. Vol. 1, and S. O.
46	49.52	69.17	49.92	34.36	50.74	Sept. 1867;	June, 1870	2	10	$7_m\ 2_a\ 9_a$ bis	Dr. J. W. Stalnacker.	S. O.
47	51.08	73.60	52.93	37.56	53.79	Sept. 1868;	Dec. 1870	2	3	"	J. C. Covell.	" "
48	..	..	47.49	31.70	..	Sept. 1858;	Apr. 1859	0	8	$7_m\ 2_a\ 9_a$	J. Hotchkiss.	P. O. and S. I. Vol. 1.
49	..	..	..	..	..	Apr. 1859;	Apr. 1860	0	3	$7_m\ 2_a\ 9_a$ bis	J. Rickett.	P. O. and S. I. Vol. 1, and S. O.
50	..	..	..	..	..	1870		0	1	"	L. E. Payne.	S. O.
51	53.35	74.97	..	33.65	..	1870		0	11	"	J. B. Bowman and Lilly Thrift.	" "

[5] This series is composed of observations made at Gosport Navy Yard, the United States Naval Hospital, and Portsmouth proper.

[6] This series is not at all reliable.

[7] The observations in Jan., Feb., June, July, Nov., and Dec. were made at Fairfax Co. Ho., about three miles southeast of Vienna.

VIRGINIA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
52. Vienna (near)	38°55′	77°15′	400	40°.58	35°.90	40°.18	54°.75	64°.35	72°.85	76°.83	75°.27	68°.29	54°.07	44°.08	36°.61
53. Washington and Lee University	37 44	79 24	1075	..	..	..	..	..	..	..	..	66.00	53.88	40.20	31.25
54. Westwood	37 33	77 27	..	38.20	42.17	50.00	56.29	65.83	73.30	76.69	74.83	69.11	57.05	50.14	36.86
55. Wytheville[1]	36 55	81 03	2257	36.31	35.29	42.10	52.26	59.70	66.88	72.98	71.14	63.47	51.78	40.20	33.18
56. Williamsburg[2]	37 18	76 40	100	41.43	43.68	47.88	57.59	64.00	72.48	76.49	75.26	68.72	59.41	47.28	42.65
57. Winchester	39 10	78 09	..	31.37	34.37	42.44	51.85	64.38	72.99	..	..	67.99	54.62	43.68	34.68
58. Woodlawn (near Mt. Vernon)	38 40	77 10	150	..	..	..	..	..	..	..	..	..	..	44.45	32.95

WASHINGTON TERRITORY.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Camp Simiahmoo	49 01	122 47	11	36.63	37.56	42.86	47.34	53.76	60.80	62.27	60.84	56.17	48.47	40.20	35.70
2. Camp Steele[5]	48 28	123 01	150	37.96	40.38	43.12	49.07	54.95	59.74	61.85	61.03	57.07	50.74	45.51	40.90
3. Cape Disappointment	46 17	124 03	30	41.24	42.65	44.96	51.32	56.33	60.52	62.43	61.23	59.12	54.70	51.43	47.16
4. Cathlamet, near	46 15	123 12	40	..	..	40.05	48.44	52.95	59.18	64.95	64.45	..	..	..	35.36
5. Fort Bellingham	48 45	122 30	88	37.78	39.60	44.68	50.27	55.91	61.13	62.11	62.21	58.03	50.16	44.50	39.81
6. Fort Cascades	45 39	121 50	..	36.81	41.51	45.12	50.38	55.31	63.48	65.52	66.91	61.37	53.22	43.54	34.73
7. Fort Chehalis	46 54	124 07	..	43.25	45.19	46.16	48.26	51.26	..	..	65.68	62.28	56.17	48.24	44.21
8. Fort Colville[6]	48 42	118 02	1963	19.12	26.79	33.20	46.44	55.77	64.75	69.87	66.49	55.37	42.81	32.81	26.10
9. Fort George	46 18	123 00	..	36.13	42.42	44.79	48.67	53.92	59.59	61.42	62.67	59.54	56.13	47.59	39.67
10. Fort Simcoe	46 30	120 40	..	30.31	31.81	40.71	52.99	60.99	67.85	71.99	72.70	64.49	50.18	38.99	32.71
11. Fort Steilacoom[7]	47 11	122 34	250	37.36	39.92	42.94	48.85	55.81	61.14	64.57	64.54	59.09	51.88	44.51	39.06
12. Fort Townshend[8]	48 07	122 45	135	39.14	41.36	43.12	42.56	53.58	59.63	..	..	..	..	..	41.41
13. Fort Vancouver	45 40	122 30	50	37.48	43.67	44.58	46.00	48.98	62.77	66.03	66.08	61.13	55.14	43.08	42.94
14. Fort Vancouver	45 40	122 30	50	36.34	37.17	45.76	50.22	58.43	58.72	61.76	63.05	61.10	50.44	39.03	36.54
15. Fort Vancouver[9]	45 40	122 30	50	36.96	40.41	44.87	51.92	58.63	63.04	67.68	66.93	61.21	52.86	44.89	37.54
16. Fort Walla-Walla	46 03	118 20	..	31.35	37.18	42.54	52.38	62.28	70.50	77.01	75.01	65.25	54.54	41.80	33.76
17. Koos-Koos-Kee	46 30	122 37	..	31.59	37.58	44.84	52.85	57.80	69.40	70.47	72.72	68.47	48.96	42.40	41.52
18. Lake Washington	47 36	122 20	..	..	..	41.25	50.88	55.53	62.80	68.95	66.10	..	..	..	..
19. Nee-ah Bay	48 22	124 37	40	38.81	38.84	39.81	44.33	50.43	55.11	57.00	57.33	52.97	51.25	45.39	40.39
20. Port Townshend	48 07	122 45	8	29.63	40.78	..	48.95	53.28	58.48	61.20	59.85	55.68	47.88	45.55	39.80
21. Sinyakwateen Depot	48 25	117 18	1894	..	..	..	46.9	55.3	62.7	70.7	68.8	..	..	..	..
22. Tatoosh Island Light-house	48 23	124 44	90	41.94	41.86	44.13	50.12	53.49	57.72	61.39	59.58	56.50	52.82	49.31	44.75
23. Walla-Walla	46 05	118 54	930	34.85	..	..	..	..	..	..	..	..	..	42.33	37.20

WEST VIRGINIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Ashland[10]	38 34	82 10	600	33.25	45.87	51.00	56.75	65.81	73.43	76.91	75.01	69.97	56.45	44.72	36.98
2. Ashland	38 34	82 10	600	30.96	37.15	40.83	53.89	63.10	70.57	76.31	74.58	70.25	53.97	43.56	35.71
3. Ashland	38 30	82 15	600	35.14	37.43	42.54	53.89	61.05	71.49	74.72	72.36	68.79	52.18	42.98	37.60
4. Buffalo	38 36	81 56	500	27.97	38.09	47.61	51.25	65.13	69.72	75.75	71.70	66.15	59.30	41.93	35.63
5. Buffalo	38 36	81 56	..	..	..	..	..	66.85	81.58	81.82	80.14	..	..	..	..
6. Burning Springs	38 56	81 21	..	31.94	31.36	51.83	..	..	..	..	..	..	..	..	..
7. Capon Bridge[11]	39 16	78 29	..	..	38.96	38.87	43.39	59.94	..	..	..	..	..	..	..
8. Crack Whip	39 02	78 33	1720	23.31	31.48	34.63	45.41	55.87	68.47	70.54	66.27	60.00	50.38	40.27	28.31
9. Cross Creek[12]	40 16	80 33	..	27.58	31.59	41.77	48.85	65.47	66.49	71.38	70.01	61.15	46.73	36.63	31.19

[1] The observations from Feb. 1868, to Dec. 1870, were made by J. A. Brown, near Wytheville, the position being Lat. 36°57′, Long. 81°06′, Alt. 2400.

[2] The observations from July, 1777, to Aug. 1778, both inclusive, were made at William and Mary College, and are the means of daily extremes between 8 A. M. and 4 P. M., the hours of observation were assumed to be 8_m 3_a, and the corresponding correction applied.

[3] Observations corrected for daily variation by means of the general table.

[4] Bihourly, 6_m to 10_a, from July, 1857, to Oct. 1858; hourly in Jan. Feb. March, 1859; hourly, 6_m to 10_a in April, 1859, and at 7_m 2_a 9_a for remaining 16 months of series. A small correction has been applied to the results for 7_m 2_a 9_a, the rest are assumed to represent very nearly the true mean of the day.

VIRGINIA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.	mos.	Observing hours.	Observer.	References
52	53°.09	74°.98	55°.48	37°.70	55°.31	Aug. 1869;	Dec. 1870	1	5	$7_m\ 2_a\ 9_a$ bis	H. C. Williams.	S. O.
53	..	..	53.36	..	..	1870		0	4	"	Prof. J. L. Campbell.	" "
54	57.37	74.94	58.77	39.08	57.54	Jan. 1859;	Feb. 1852	2	2	"	C. J. Merriwether.	P. O. and S. I. Vol. I, and S. O.
55	51.35	70.33	51.82	34.93	52.11	May, 1860;	Dec. 1870	4	8	"	H. Shriver, W. D. Roedel, and J. A. Brown.	S. O.
56	56.49	74.74	58.47	42.59	58.07	Jan. 1760;	Aug. 1778	9	2	3	Farquier & Madison.	Jefferson's Notes on Va., Cotté, and Phil. Soc. Trans.
57	52.89	..	55.43	33.47	..	Sept. 1851;	Dec. 1859	6	7	$7_m\ 2_a\ 9_a$	Prof. J. W. Marvin.	P. O. & S. I. Vol. I, and S. Coll.
58	..	..	..	..	..	1870		0	2	$7_m\ 2_a\ 9_a$ bis	C. Gillingham.	S. O.

WASHINGTON TERRITORY.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.	mos.	Observing hours.	Observer.	References
1	47.99	61.30	48.28	36.63	48.55	July, 1857;	June, 1860	3	0	4	Assistant Surgeon.	Rep. of N. W. Bound. Com. and MS. from S. G. O.
2	49.05	60.87	51.11	39.75	50.19	Feb. 1860;	Dec. 1870	10	0	$7_m\ 2_a\ 9_a$	" "	MS. from S. G. O.
3	50.87	61.39	55.08	43.68	52.76	July, 1864;	Apr. 1869	4	4	"	" "	Med. and Surg. Reporter, Feb. 13, 1869, & MS. from S. G. O.
4	47.15	62.86	..	..	..	1870		0	7	$7_m\ 2_a\ 9_a$ bis	C. McCall.	S. O.
5	50.29	60.82	50.90	39.06	50.52	Mar. 1857;	July, 1859	2	5	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860.
6	50.27	65.30	52.71	37.68	51.49	May, 1858;	May, 1861	3	1	"	" "	Ar. Met. Reg. 1860 and MS. from S. G. O.
7	48.56	..	55.56	44.22	..	Aug. 1860;	May, 1861	0	10	"	" "	MS. from S. G. O.
8	45.14	67.04	43.66	24.00	44.96	Nov. 1859;	Dec. 1870	9	1	"	" "	Rep. of N. W. Bound. Com. and MS. from S. G. O.
9	49.13	61.23	54.42	39.41	51.05	June, 1821;	Mar. 1824	2	0	6_m N. 6_a	Scouler.	Edinburgh Journ. of Sci. Vol. VI.
10	51.56	70.85	51.22	31.61	51.31	Apr. 1857;	Apr. 1859	2	1	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860.
11	49.20	63.42	51.83	38.78	50.81	Nov. 1849;	Mar. 1868	17	7	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
12	46.42	..	..	40.64	..	Jan. 1859;	May, 1861	1	2	"	" "	Ar. Met. Reg. 1860, and MS. from S. G. O.
13	46.52	64.96	53.12	41.36	51.49	Nov. 1832;	Oct. 1833	1	0	M. N.	....	Sill. Journal.
14	51.47	61.18	50.19	36.68	49.88	Oct.;	Mar.	1	6	$7_m\ 1_a$	Parker.	Dove.
15	51.81	65.88	52.99	38.30	52.24	June, 1841;	July, 1868	17	5	$7_m\ 2_a\ 9_a$	McLaughlin, Assistant Surgeon.	Wilkes, Ar. Met. Regs. 1855 & 1860, and MS. from S. G. O.
16	52.40	74.17	53.86	34.10	53.63	Jan. 1857;	May, 1867	8	10	"	Assistant Surgeon.	Ar. Met. Reg. 1860, and MS. from S. G. O.
17	51.83	70.86	53.28	36.90	53.22	....		2	0	$\odot_r\ 2_a\ \odot_s\ 9_a$	....	Dove, 1857.
18	49.22	65.95	..	..	..	1870		0	6	$7_m\ 2_a\ 9_a$ bis	J. E. Whilworth.	S. O.
19	44.86	56.48	49.87	39.35	47.64	June, 1862;	Mar. 1867	3	11	"	J. G. Swan.	" "
20	..	59.84	49.70	36.74	..	Sept. 1867;	Aug. 1868	0	11	"	S. S. Bentley.	" "
21	..	67.40	..	..	..	1860		0	5	$7_m\ 2_a\ 9_a$	....	Rep. of N. W. Bound Com.
22	49.25	59.56	52.88	42.85	51.13	Apr. 1869;	Dec. 1870	1	9	$7_m\ 2_a\ 9_a$ bis	A. Sampson.	S. O.
23	..	..	..	..	..	Nov. 1869;	Jan. 1870	0	3	"	A. H. Simmons.	" "

WEST VIRGINIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs.	mos.	Observing hours.	Observer.	References
1	57.85	75.12	57.05	38.70	57.18	1851—1854		2	8	$\odot_r\ 9_m\ 3_a\ 9_a$	Prof. G. R. Rossiter, S. Couch.	MS. in S. Coll.
2	52.61	73.82	55.93	34.61	54.24	Jan. 1854;	Jan. 1858	3	2	$7_m\ 2_a\ 9_a$	" " "	P. O. and S. I. Vol. I.
3	52.49	72.86	54.65	36.72	54.18	Feb. 1865;	July, 1870	4	6	$7_m\ 2_a\ 9_a$ bis	C. L. Roffe.	S. O.
4	54.66	72.39	55.79	33.90	54.19	1852		1	0	$\odot_r\ 9_m\ 3_a\ 9_a$	Prof. G. R. Rossiter.	MS. in S. Coll.
5	..	81.18	..	..	..	1858		0	4	$7_m\ 2_a\ 9_a$	W. R. Boyers.	P. O. and S. I. Vol. I.
6	..	..	..	..	..	1868		0	3	$7_m\ 2_a\ 9_a$ bis	R. H. Boliven.	S. O.
7	47.40	..	..	..	..	1857		0	4	$7_m\ 2_a\ 9_a$	Dr. J. J. T. Offutt.	P. O. and S. I. Vol. I.
8	45.30	68.43	50.22	27.70	47.91	Jan. 1856;	May, 1861	2	6	"	D. H. Ellis.	P. O. and S. I, Vol. I, & S. O.
9	52.03	69.29	48.17	30.12	49.90	Nov. 1858;	June, 1860	1	8	"	B. D. Sanders.	" " " " "

5 Also known as "Camp Pickett" and "San Juan Island."

6 The earlier observations were made at Colville Depot, some miles to the southeast, and for five months of 1860 at Harney Depot.

7 Observations previous to 1855 at $\odot_r\ 9_m\ 3_a\ 9_a$; they were referred to $7_m\ 2_a\ 9_a$.

8 For additional observation in this vicinity, see "Port Townshend."

9 Observations for four months, in 1841, at $6_m\ 2_a\ 6_a$, and for four years and one month, from Dec. 1849, to Dec. 1854, at $\odot_r\ 9_m\ 3_a\ 9_a$; they were referred to $7_m\ 2_a\ 9_a$.

10 Observations at $7_m\ 2_a\ 9_a$ after Jan. 1853.

11 Observations in March and May imperfect.

12 Also known as "Trout Run Valley" and Wardenville.

WEST VIRGINIA.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
10. Grafton	39°21′	79°56′	..	28°.77	37°.03	40°.33	54°.45	61°.20	..	76°.89	76°.40	70°.49	56°.86	46°.91	35°.18
11. Holiday's Cove	40 22	80 37	..	..	..	..	..	..	..	..	76.98	63.76	54.36	..	..
12. Kanawah[1]	38 53	81 25	..	33.83	40.66	44.90	55.39	62.84	69°.79	72.79	71.62	64.19	56.27	43.49	35.48
13. Kanawah	38 53	81 25	..	22.00	38.05	42.34	52.42	63.39	71.57	76.87	72.80	65.55	56.61	42.05	31.31
14. Lewisburgh	37 49	80 28	2000	29.03	37.21	44.07	48.00	62.37	66.48	71.51	68.60	61.42	51.63	39.73	33.16
15. Lewisburgh[2]	37 49	80 28	2000	33.18	39.48	47.18	53.37	66.76	72.62	78.47	74.24	68.62	57.08	44.48	36.45
16. Lewisburgh	37 49	80 28	2000	30.64	34.12	40.79	51.59	62.98	69.35	74.05	71.95	64.03	52.01	41.68	33.49
17. New Creek Depot	39 25	79 00	..	..	38.99	40.87	..	..	..	..	74.20	..	..	..	..
18. N. R. Mills	39 20	78 29	..	33.5	34.7	53.5	57.3	..	..	..	..	..	..	..	..
19. Peach Grove Lodge	39 15	81 00	1100	20.19	26.08	31.76	53.86	61.24	71.60	76.88	70.69	..	..	..	..
20. Point Pleasant	38 51	82 09	480	32.32	37.79	48.79	44.64	73.50	72.13	..	..	..	..	38.36	39.83
21. Poplar Grove[3]	38 20	81 30	720	34.92	38.98	44.28	52.88	64.15	70.35	75.76	72.70	65.82	55.05	43.75	37.97
22. Romney	39 20	78 42	573	29.26	30.68	44.03	50.42	58.69	70.54	76.61	72.74	65.82	52.73	42.81	29.01
23. Salem	39 20	80 01	1100	..	36.93	47.72	..	..	..	74.81	..	69.51	54.39	..	..
24. Sistersville	39 34	80 56	540	..	..	..	..	57.13	69.16	73.08	..	65.45	50.51	38.78	38.37
25. Weston	39 00	80 22	..	28.87	33.63	35.95	..	..	69.85	..	..	..	..	42.98	40.12
26. White Day	39 30	79 55	..	38.27	36.94	39.94	..	63.81	72.67	81.65	77.71	67.73	54.35	45.19	33.21
27. Wheeling	40 05	80 43	600	31.43	32.90	42.37	51.40	..	..	..	..	..	..	42.15	28.69
28. Wirt Court House[4]	39 05	81 26	..	28.29	33.69	37.67	47.49	60.25	72.58	75.62	72.41	63.84	53.88	38.76	35.02

WISCONSIN.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Appleton (Lawrence University)	44 18	88 31	800	17.99	20.79	30.67	42.34	54.58	65.77	70.73	65.94	59.32	47.07	33.52	21.68
2. Aztalan	43 04	88 55	808	26.82	29.60	35.97	43.28	56.40	68.06	71.29	69.56	62.63	48.37	35.84	20.38
3. Baraboo	43 29	89 54	920	18.87	23.03	29.94	44.51	57.58	69.62	73.17	69.15	62.50	49.27	34.58	22.14
4. Bay City (or Ashland)	46 36	91 00	610	13.94	12.27	23.45	33.02	45.20	56.58	65.08	60.90	53.48	39.38	26.40	15.90
5. Bayfield	46 50	90 57	..	13.44	15.08	23.68	38.59	49.65	60.15	67.84	63.59	54.70	41.59	30.25	18.21
6. Bellefontaine	43 30	89 15	750	18.47	22.21	33.24	45.42	57.97	68.79	72.58	70.75	61.74	48.71	34.08	21.32
7. Beloit College	42 30	89 11	750	19.77	23.64	32.05	45.37	57.44	68.39	72.38	69.33	61.76	48.50	34.99	23.06
8. Bloomfield	42 35	88 32	600	18.38	23.54	30.79	43.90	55.66	66.22	71.30	67.83	60.45	46.12	35.53	22.20
9. Ceresco	43 50	88 57	917	17.15	8.71	30.78	48.87	59.90	..	73.20	70.80	60.80	51.39	31.60	..
10. Dartford	43 45	89 16	850	17.05	20.32	30.69	44.24	52.55	67.25	68.45	69.13	61.37	49.15	34.25	28.55
11. Delafield (or Summit)	43 04	88 34	900	22.59	24.51	33.43	44.28	56.03	64.14	69.41	68.30	60.82	48.94	35.74	22.50
12. Delavan	42 39	88 42	957	15.69	23.01	27.57	44.65	52.33	67.29	68.84	66.34	60.54	47.06	36.37	19.96
13. Edgerton	42 38	89 00	1700	18.94	22.54	30.94	46.41	61.15	68.22	74.24	70.06	61.76	47.65	37.05	22.43
14. Embarrass[5]	44 25	89 00	..	15.19	20.78	26.71	40.58	54.41	65.19	69.95	65.32	58.09	44.56	32.54	18.77
15. Emerald Grove	42 39	88 54	1005	23.92	26.48	34.60	42.50	55.43	67.39	70.51	68.57	61.05	48.07	34.48	19.19
16. Fort Crawford	43 03	91 14	642	19.47	21.72	34.59	51.02	59.78	69.89	75.58	72.19	61.64	48.98	35.18	22.68
17. Fort Howard	44 33	88 09	620	18.83	20.10	31.19	43.20	55.87	66.27	71.57	67.93	57.28	46.75	34.24	21.15
18. Fort Winnebago	43 33	89 35	770	19.56	18.53	32.64	47.33	57.07	65.97	71.26	67.48	57.92	47.25	32.12	21.34
19. Galesville (Univ.)	44 07	91 29	775	21.00	..	..		..	69.48	..	69.68	..	..	..	..
20. Green Bay	44 29	88 00	732	15.19	23.00	27.14	39.77	54.46	66.36	69.85	68.09	60.46	45.85	35.98	17.66
21. Greenfield	44 00	90 45	750	..	..	..	..	63.28	68.28	70.55	66.30	63.78	49.08	37.18	19.45
22. Green Lake	43 45	89 00	670	24.57	27.22	32.13	40.37	50.42	67.48	69.35	67.33	60.90	49.16	37.11	20.35
23. Holland	43 36	87 58	670	15.01	23.49	27.17	43.58	56.20	63.93	69.91	67.67	60.58	44.61	35.22	23.05
24. Janesville	42 41	89 00	780	18.30	20.60	31.26	45.57	57.42	68.82	72.36	70.11	62.23	48.11	34.43	23.61
25. Kenosha	42 35	87 56	600	23.86	26.07	33.06	40.96	52.40	63.43	70.51	68.50	60.94	49.71	36.46	26.70
26. Lake Mills	43 06	89 02	..	12.50	21.50	26.81	..	..	..	..	..	..	..	..	..
27. Lebanon	44 28	88 54	900	..	..	..	..	..	67.85	72.20	..	..	..	..	..
28. Lowell	43 20	88 54	..	5.95	25.84	27.05	33.86	53.03	63.04	69.72	66.81	62.54	47.80	29.83	29.67
29. Madison (Wisconsin University)	43 05	89 24	1088	17.65	21.19	30.00	43.88	56.54	66.81	71.82	68.70	62.46	48.46	33.67	23.67
30. Manitowoc	44 07	87 46	658	21.76	23.92	31.31	41.72	51.91	62.04	67.91	65.95	58.64	46.95	36.21	25.48
31. Menasha	44 13	88 34	..	26.77	14.50	35.00	..	..	..	..	..	..	47.09	29.91	28.06
32. Milwaukee	43 04	88 00	604	21.39	25.22	32.81	43.36	52.95	63.60	69.86	67.61	60.99	48.78	37.10	25.38

[1] The morning and evening observations were probably taken at $\odot_r$ and $\odot_s$.

[2] Observations at $7_m\ 2_a\ 9_a$ after Jan. 1853, except for March, May, June, July, and Oct. 1853, at $7_m\ 2_a$.

WEST VIRGINIA.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
10	51°.99	..	58°.09	33°.66	..	Jan. 1867;	Feb. 1868	1 1	$7_m\ 2_a\ 9_a$ bis	Dr. W. H. Sharp.	S. O.
11	..	..	..	..	..	1858		0 3	$7_m\ 2_a\ 9_a$	R. B. Sanders.	P. O. and S. I. Vol. I.
12	54.38	71°.40	54.65	36.66	54°.27	Jan. 1829;	Jan. 1843	7 10	M. N. E.	D. Ruffner.	MS. in S. Coll.
13	52.72	73.75	54.74	30.45	52.91	Jan. 1856;	July, 1859	2 8	$7_m\ 2_a\ 9_a$	D. L. Ruffner, W. C. Reynolds.	P. O. and S. I. Vol. I.
14	51.48	68.86	50.93	33.13	51.10	Apr. 1851;	Mar. 1853	2 0	9_m	Patton.	MS. in S. Coll.
15	55.77	75.11	56.73	36.37	55.99	1851—1854		3 9	$9_m\ 3_a$	" "	" " "
16	51.79	71.78	52.57	32.75	52.22	Jan. 1854;	Mar. 1861	7 1	$7_m\ 2_a\ 9_a$	Dr. T. Patton, Dr. J. W. Stalnaker.	P. O. and S. I. Vol. I, and S. O.
17	..	..	..	..	..	1854		0 3	"	M. McDonald.	P. O. and S. I. Vol. I.
18	..	..	..	..	..	1868		0 4	2_a	S. J. Stump.	S. O.
19	48.95	73.06	..	..	..	1856		0 8	$7_m\ 2_a\ 9_a$	W. C. Quincy.	P. O. and S. I. Vol. I.
20	55.64	..	..	36.65	..	Nov. 1858;	June, 1859	0 8	"	W. R. Boyers.	" " " "
21	53.77	72.94	54.87	37.29	54.72	June, 1856;	Jan. 1861	4 4	"	J. E. Kendall.	P. O. and S. I. Vol. I, and S. O.
22	51.05	73.30	53.79	29.65	51.95	May, 1866;	Sept. 1870	3 1	$7_m\ 2_a\ 9_a$ bis	W. H. McDowell.	S. O.
23	..	..	..	..	..	July, 1857;	Mar. 1858	0 5	$7_m\ 2_a\ 9_a$	J. C. Wells.	P. O. and S. I. Vol. I.
24	..	..	51.58	..	..	1857		0 7	"	E. D. Johnson.	" " " "
25	..	..	..	34.21	..	Nov. 1865;	Mar. 1870	0 6	$7_m\ 2_a\ 9_a$ bis	B. Owen.	S. O.
26	..	77.34	55.76	36.14	..	May, 1868;	Mar. 1869	0 11	"	Dr. W. A. Sharp.	" "
27	..	..	..	31.01	..	Nov. 1859;	Apr. 1860	0 6	$7_m\ 2_a\ 9_a$	G. P. Lockwood.	P. O. and S. I. Vol. I, and S. O.
28	48.47	73.54	52.16	32.33	51.62	May, 1856;	Dec. 1858	2 8	"	Dr. J. W. Hoff.	P. O. and S. I. Vol. I.

WISCONSIN.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	42.53	67.48	46.64	20.15	44.20	Jan. 1856;	May, 1870	8 4	$7_m\ 2_a\ 9_a$ bis	Prof. R. Z. Mason & others.	P. O. and S. I. Vol. I. and S. O.
2	45.22	69.64	48.95	25.60	47.35	1850;	1851	1 11	$\odot_r\ 9_m\ 3_a\ 9_a$	Brayton.	S. Coll.
3	44.01	70.65	48.78	21.35	46.20	1850;	Dec. 1870	7 6	$7_m\ 2_a\ 9_a$ bis	M. C. Waite, & Mills.	S. O. and S. Coll.
4	33.89	60.85	39.75	14.04	37.13	July, 1856;	Apr. 1866	6 11	"	Dr. E. Ellis.	P. O. and S. I. Vol. I, and S. O.
5	37.31	63.86	42.18	15.58	39.73	Sept. 1858;	Dec. 1870	3 6	"	J. H. Nourse and A. Tate.	" " " " "
6	45.54	70.71	48.18	20.67	46.27	1850;	1853	3 0	$\odot_r\ 9_m\ 3_a\ 9_a$	Gay.	S. Coll.
7	44.95	70.03	48.42	22.16	46.39	Jan. 1850;	July, 1867	17 5	$7_m\ 2_a\ 9_a$ bis	Prof. W. Porter and others.	P. O. and S. I. Vol. I, S. O., & S. Coll.
8	43.45	68 45	47.37	21.37	45.16	May, 1863;	Dec. 1870	6 4	"	W. H. Whiting.	S. O.
9	46.52	..	47.93	..	..	Mar. 1854;	May, 1855	0 11	$7_m\ 2_a\ 9_a$	Miss M. E. Baker.	P. O. and S. I. Vol. I.
10	42.49	68.28	48.26	21.97	45.25	Mar. 1861;	Apr. 1862	1 1	$7_m\ 2_a\ 9_a$ bis	M. H. Powers.	S. O.
11	44.58	67.28	48.50	23.20	45.89	Jan. 1845;	June, 1863	10 2	$\odot_r$ N. $\odot_s$	E. W. Spencer and others.	MS. in S. Coll., S. O., P. O. and S. I. Vol. I.
12	41.52	67.49	47.99	19.55	44.14	Sept. 1864;	Dec. 1867	3 3	$7_m\ 2_a\ 9_a$ bis	L. Eddy.	S. O.
13	46.17	70.84	48.82	21.30	46.78	July, 1867;	Dec. 1870	3 6	"	W. J. Shintz.	" "
14	40.57	66.82	45.06	18.25	42.67	Oct. 1856;	Dec. 1870	8 10	"	J. E. & E. E. Breed.	P. O. and S. I. Vol. I, and S. O.
15	44.18	68.82	47.87	23.20	46.02	Mar. 1849;	1853	4 3	$\odot_r\ 9_m\ 3_a\ 9_a$	Densmore.	S. Coll.
16	48.46	72.55	48.60	21.29	47.73	Jan. 1822;	Aug. 1845	18 5	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1855.
17	43.42	68.59	46.09	20.03	44.53	Jan. 1822;	May, 1852	21 5	"	" "	" " "
18	45.68	68.24	45.76	19.81	44.87	Jan. 1829;	Aug. 1845	15 3	"	" "	" " "
19	..	..	..	..	..	June, 1867;	Jan. 1868	0 3	$7_m\ 2_a\ 9_a$ bis	W. Gale.	S. O.
20	40.46	68.10	47.43	18.62	43.65	May, 1858;	Sept. 1865	3 0	"	D. Underwood and F. Deckner.	P. O. and S. I. Vol. I, and S. O.
21	..	68.38	50.01	..	..	1870		0 8	"	G. Pegler.	S. O.
22	40.97	68.05	49.06	24.05	45.53	Jan. 1850;	Mar. 1852	2 2	$\odot_r\ 2_a$	F. C. Pomeroy.	Am. Alm. 1852 and S. Coll.
23	42.32	67.17	46.80	20.52	44.20	Oct. 1868;	Dec. 1870	2 2	$7_m\ 2_a\ 9_a$ bis	J. DeLyser.	S. O.
24	44.75	70.43	48.25	20.84	46.07	Jan. 1853;	July, 1862	8 6	$7_m\ 2_a\ 9_a$	J. F. Willard and others.	P. O. and S. I. Vol. I, S. O., and S. Coll.
25	42.14	67.48	49.04	25.54	46.05	1850;	June, 1863	9 9	"	Rev. J. and Dr. G. Gridley.	" " " "
26	..	..	..	..	..	1861		0 3	7_m	J. Atwood.	S. O.
27	..	..	..	..	..	1864		0 2	$7_m\ 2_a\ 9_a$ bis	J. C. Hicks.	" "
28	37.98	66.52	46.72	20.49	42.93	1857		1 0	......	N. C. Daniels.	Am. Alm. 1859.
29	43.47	69.11	48.20	20.84	45.40	Jan. 1853;	Dec. 1870	9 3	$7_m\ 2_a\ 9_a$ bis	Various observers.	P. O. and S. I. Vol. I, S. O., and S. Coll.
30	41.65	65.30	47.27	23.72	44.48	Oct. 1851;	Dec. 1870	19 3	"	J. Lüps.	P. O. and S. I. Vol. I, and S. O.
31	..	..	..	23.11	..	Oct. 1859;	Mar. 1858	0 6	$7_m\ 2_a\ 9_a$	Col. D. Underwood.	P. O. and S. I. Vol. I.
32	43.04	67.02	48.96	24.00	45.75	Jan. 1837;	Dec. 1870	26 7	$7_m\ 2_a\ 9_a$ bis	Dr. I. A. Lapham and others.	S. Coll., Am. Alm. 1852 and foll., P. O. and S. I. Vol. I, and S. O.

[3] Also known as "Kanawah Salines." [4] Also known as "Elizabethtown."

[5] The observations previous to 1864 were made by J. E. Breed at New London, about four miles south of Embarrass.

WISCONSIN.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
33. Mosinee	44°48′	89°46′	750	13°.24	17°.67	25°.38	45°.33	58°.60	66°.20	67°.80	62°.08	59°.13	44°.00	31°.75	16°.75
34. Mt. Morris	44 06	89 20	..	..	..	34.91	42.02	..	..		..	..	..	..	..
35. New Danemore	44 17	90 38	..	20.60	17.80	36.41	41.09	55.68	67.55	71.16	66.43	58.04	46.04	30.00	18.50
36. New Holstein	43 58	88 12	..	16.38	..	..	..	..	..	..	..	...	..	..	31.90
37. New Lisbon	43 52	90 17	..	16.51	20.56	28.21	45.12	57.70	68.03	72.93	67.48	60.50	45.46	34.92	20.74
38. New Richmond	45 06	92 42	..	..	..	..	40.17	..	..	..	..	..	..	..	..
39. Norway[1]	42 50	88 10	753	9.75	20.54	27.37	47.11	56.96	71.14	74.56	68.58	60.21	50.01	34.48	16.22
40. Pardeeville	43 29	89 14	..	..	..	..	..	..	..	..	..	..	46.59	35.92	15.10
41. Parfreyville (or Rural)	44 15	89 05	910	13.83	21.57	26.75	44.61	57.27	69.70	70.23	67.80	61.30	50.76	36.22	30.90
42. Platteville	42 45	90 37	800	17.22	21.21	33.25	46.43	60.58	70.74	76.51	73.03	63.42	49.96	33.61	20.68
43. Plymouth	43 45	88 06	870	16.54	19.94	25.75	40.54	51.39	64.67	69.95	65.72	58.34	44.08	34.82	20.77
44. Prescott	44 46	92 55	800	4.23	14.50	35.00	..	..	..	..	..	..	47.09	29.91	28.06
45. Racine	42 43	87 54	660	19.33	20.74	29.56	39.39	50.44	66.73	69.89	63.35	58.00	50.52	36.91	26.00
46. Ripon College	43 48	88 33	..	17.33	17.75	25.90	46.07	54.50	67.44	74.55	64.35	..	..	39.68	22.10
47. Rocky Run	43 26	89 19	..	16.90	21.60	29.33	45.01	57.40	67.49	71.00	68.33	60.06	46.55	34.64	21.17
48. St. Croix Falls	45 27	92 47	660	21.60	11.01	33.10	..	..	..	..	..	..	..	..	25.30
49. Southport	42 30	87 30	..	28.27	29.06	..	41.52	50.71	64.78	69.48	77.61	62.89	50.59	47.37	21.47
50. Springdale	43 31	89 16	..	19.63	23.53	38.80	46.45	58.65	65.45	69.53	..	..	..	..	..
51. Sturgeon Bay	44 52	87 30	35	14.91	17.80	26.30	44.46	57.91	67.85	70.18	66.63	62.80	50.59	38.30	24.70
52. Superior	46 44	92 13	680	11.56	14.17	22.22	36.76	47.03	57.53	64.52	63.70	53.01	43.15	30.38	13.74
53. Waterford	42 48	88 18	..	17.50	26.04	30.32	46.30	53.62	66.75	..	..	..	..	32.13	21.13
54. Watertown	43 13	88 45	840	26.59	..	..	..	..	71.60	74.11	70.86	58.82	52.36	31.08	24.79
55. Waukesha	43 00	88 20	812	18.47	19.48	32.58	45.88	53.89	68.38	72.78	68.18	62.05	49.31	33.01	24.30
56. Waupaca	44 21	89 10	900	17.24	22.06	28.73	43.98	56.53	69.27	72.57	68.68	60.05	46.45	36.06	22.15
57. Wausau	44 58	89 43	..	14.97	22.42	25.42	40.03	58.29	65.03	76.62	67.39	57.52	43.82	33.26	14.99
58. Weyauwega	44 20	89 02	870	15.72	18.83	27.54	44.25	56.82	67.70	70.33	66.51	62.75	44.78	32.56	23.42

WYOMING.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Camp Scott	41 18	110 32	..	18.38	26.98	34.52	42.24	46.50	53.54	..	..	..	..	..	21.20
2. Camp Stanbaugh	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13.73
3. Deer Creek Agency	42 49	106 00	5000	..	..	..	..	..	..	..	..	..	..	32.14	18.32
4. Fort Bridger	41 20	110 23	6656	18.88	22.89	27.73	38.44	50.09	59.12	65.44	64.37	53.86	42.26	31.56	20.66
5. Fort D. A. Russell	41 12	104 50	..	28.57	30.60	24.54	36.14	48.60	58.86	68.70	63.64	55.50	42.98	38.69	23.32
6. Fort Fetterman	42 45	105 37	..	28.11	..	27.08	41.92	54.41	62.35	71.23	66.32	55.29	41.46	35.05	23.32
7. Fort F. Steele	41 45	107 10	..	23.24	24.16	28.58	40.84	53.54	63.47	69.45	66.16	56.87	44.00	36.78	20.05
8. Fort Halleck	41 34	106 50	7800	21.16	23.72	29.12	37.09	51.76	62.11	65.79	68.90	54.95	41.78	33.45	21.50
9. Fort Laramie	42 12	104 31	4472	28.43	31.83	37.26	46.94	56.60	68.34	75.93	73.49	62.07	49.68	36.42	27.68
10. Fort P. Kearney	44 30	106 50	6000	14.88	25.44	23.57	42.75	53.60	69.24	76.33	74.66	62.60	47.11	36.64	29.09
11. Fort Sanders	41 13	105 38	7161	20.60	25.26	28.85	38.61	47.15	57.26	66.20	62.07	53.04	44.16	35.49	23.93
12. Fort Thompson	42 48	108 56	..	10.67	..	..	..	..	..	..	..	..	..	..	..
13. Gilbert's Trading P'st	42 28	108 40	7400	7.57	..	..	..	..	..	..	..	..	..	..	9.23
14. Sweetwater Bridge	42 30	107 25	7000	..	..	29.80	41.88	53.93	..	..	..	..	..	..	..

MEXICO.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Bar of Tabasco	18 34	92 40	10	..	..	77.83	..	80.80	..	..	81.93	81.20	77.90	..	72.48
2. Cordova	18 45	96 51	860	65.03	67.13	70.51	73.12	74.86	73.37	72.31	73.05	71.83	70.29	66.74	65.65
3. Frontera	18 32	92 40	12	72.28	76.00	77.72	79.84	81.28	81.84	80.62	81.30	81.58	..	..	71.65
4. Gulf of Mexico	..	..	..	74.66	71.06	75.74	80.24	82.58	84.01	84.01	79.34	80.78	80.60	75.01	74.66
5. Matamoras	25 49	97 38	55	64.95	65.89	70.48	76.00	81.33	83.47	85.72	85.73	82.55	77.06	71.32	62.02
6. Mazatlan	23 15	106 29	..	71.15	72.25	69.85	75.20	81.60	87.60	83.00	85.25	84.40	84.65	79.90	75.05
7. Mexico City	19 27	99 05	7665	58.39	57.30	61.84	64.00	67.07	64.72	62.79	63.02	62.06	60.83	56.82	54.36

[1] This series includes observations in Sept. Oct. and Nov. 1861, at Caldwell's Prairie, about four miles southwest of Norway.

WISCONSIN.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
33	43°.10	65°.36	44°.96	15°.89	42°.33	Jan. 1859; Dec. 1870	1 2	$7_m\ 2_a\ 9_a$ bis	Dr. J. S. Pashley and J. O. Donoghue.	P. O. and S. I. Vol. 1, and S. O.
34	..	..	..	..	..	1858	0 2	$7_m\ 2_a\ 9_a$	....	P. O. and S. I. Vol. 1.
35	44.39	68.38	44.69	18.97	44.11	Jan. 1858; June, 1859	1 3	6_m N. 6_a	E. Haeuser.	" " " "
36	..	..	..	..	..	Dec. 1864; Jan. 1865	0 2	$7_m\ 2_a\ 9_a$ bis	F. Hatchez.	S. O.
37	43.68	69.48	46.96	19.27	44.85	Mar. 1867; June, 1870	2 10	"	J. L. Dungen.	" "
38	..	..	..	..	..	1866	0 1	"	C. Scribner.	" "
39	43.81	71.43	48.23	15.50	44.74	Mar. 1856; Nov. 1861	1 4	$7_m\ 2_a\ 9_a$	J. E. Himoe and S. Armstrong.	P. O. and S. I. Vol. 1, and S. O.
40	..	..	..	..	..	1859	0 1	"	S. Armstrong.	P. O. and S. I. Vol. 1.
41	42.88	69.24	49.43	22.10	45.91	May, 1860; Apr. 1865	1 1	$7_m\ 2_a\ 9_a$ bis	R. H. Struthers, and J. C. Hicks.	S. O.
42	46.75	73.43	49.00	19.70	47.22	Sept. 1851; Dec. 1859	9 4	$7_m\ 2_a\ 9_a$	Dr. J. L. Pickard.	P. O. and S. I. Vol. 1, & S. Coll.
43	39.23	66.78	45.75	19.08	42.71	Jan. 1865; Feb. 1870	4 10	$7_m\ 2_a\ 9_a$ bis	G. Moeller.	S. O.
44	..	..	..	15.60	..	Oct. 1857; Mar. 1858	0 6	$7_m\ 2_a\ 9_a$	Rev. S. L. Hillier.	P. O. and S. I. Vol. 1.
45	39.80	66.66	48.48	22.02	44.24	Nov. 1855; Jan. 1861	1 11	"	E. Seymour, J. W. Durham, and H. W. Phelps.	P. O. and S. I. Vol. 1, and S. O.
46	42.16	68.78	..	19.06	..	Nov. 1865; Aug. 1866	0 10	$7_m\ 2_a\ 9_a$ bis	Prof. W. H. Ward.	S. O.
47	43.91	68.94	47.08	19.89	44.96	Aug. 1859; Dec. 1870	10 11	"	W. W. Curtis.	P. O. and S. I. Vol. 1, & S. O.
48	..	..	..	19.30	..	Dec. 1857; Mar. 1858	0 4	$7_m\ 2_a\ 9_a$	M. T. W. Chandler & W. M. Blanding.	P. O. and S. I. Vol. 1.
49	..	70.62	53.62	26.27	..	1849; 1850	0 11	$\odot_r\ 9_m\ 3_a\ 9_a$	Gridley.	S. Coll.
50	47.97	..	..	..	..	1860	0 7	$7_m\ 2_a\ 9_a$ bis	S. Armstrong.	S. O.
51	42.89	68.22	50.56	19.14	45.20	1870	0 11	"	R. M. Wright.	" "
52	35.34	61.92	42.18	13.16	38.15	June, 1855; Dec. 1867	10 0	$7_m\ 2_a\ 9_a$	G. R. Stuntz, E. H. Bly, W. H. Newton, W. Mann.	U. S. Lake Survey, Rep. of 1867–68, P. O. & S. I. Vol. 1, and S. O.
53	43.41	..	..	21.56	..	Nov. 1860; Apr. 1863	0 10	$7_m\ 2_a\ 9_a$ bis	S. Armstrong.	S. O.
54	..	72.19	47.42	..	..	1852; 1853	0 8	$\odot_r\ 9_m\ 3_a\ 9_a$	Ayres.	S. Coll.
55	44.12	69.78	48.12	20.75	45.69	Mar. 1856; Mar. 1859	2 9	$7_m\ 2_a\ 9_a$	Prof. S. A. Bean, Dr. L. C. Lyle.	P. O. and S. I. Vol. 1.
56	43.08	70.17	47.52	20.48	45.31	Dec. 1863; Dec. 1870	7 5	$7_m\ 2_a\ 9_a$ bis	H. C. Mead, C. D. Webster.	S. O.
57	41.25	69.68	44.87	17.46	43.31	Nov. 1858; Dec. 1859	1 2	$7_m\ 2_a\ 9_a$	Dr. W. A. Gordon.	P. O. and S. I. Vol. 1.
58	42.87	68.18	46.70	19.32	44.27	June, 1860; May, 1867	4 7	$7_m\ 2_a\ 9_a$ bis	Various observers.	S. O.

WYOMING.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	41.09	..	..	22.19	..	Dec. 1857; June, 1858	0 7	$7_m\ 2_a\ 9_a$	Assistant Surgeon.	Ar. Met. Reg. 1860.
2	..	..	..	..	..	1870	0 1	"	" "	MS. from S. G. O.
3	..	..	..	..	..	1859	0 2	"	Maj. T. S. Twiss.	P. O. and S. I. Vol. 1.
4	38.75	62.98	42.56	20.81	41.27	July, 1858; Dec. 1870	10 6	"	Assistant Surgeon.	Ar. Met. Reg. 1860, and MS. from S. G. O.
5	36.43	63.73	45.72	27.50	43.35	Dec. 1869; Dec. 1870	1 1	"	" "	MS. from S. G. O.
6	41.14	66.63	43.93	..	...	Nov. 1868; Dec. 1870	1 9	"	" "	" " "
7	40.99	66.36	45.88	22.48	43.93	Jan. 1869; Dec. 1870	2 0	"	" "	" " "
8	39.32	65.60	43.39	22.13	42.61	Sept. 1862; Nov. 1866	3 3	"	" "	" " "
9	46.93	72.59	49.39	29.31	49.56	Sept. 1849; Dec. 1870	17 9	"	" "	Ar. Met. Regs. 1855 and 1860, and MS. from S. G. O.
10	39.97	73.41	48.78	23.14	46.33	Jan. 1867; July, 1868	1 7	"	" "	MS. from S. G. O.
11	38.20	61.84	44.23	23.26	41.88	Sept. 1866; Dec. 1870	3 8	"	" "	" " "
12	..	..	..	..	..	1858	0 1	"	W. H. Wagner.	P. O. and S. I. Vol. 1.
13	..	..	..	..	..	Dec. 1858; Jan. 1859	0 2	"	C. H. Miller.	" " " " "
14	41.87	..	..	..	..	1864	0 3	$7_m\ 2_a\ 9_a$ bis	A. F. Ziegler.	S. O.

MEXICO.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	Dec. 1862; Oct. 1863	0 6	$7_m\ 2_a\ 9_a$ bis	C. Lazlo.	S. O.
2	72.83	72.91	69.62	65.94	70.32	Jan. 1858; Dec. 1864	6 0	9_m N. $3_a\ 6_a\ 9_a$	J. A. Hieto.	P. O. and S. I. Vol. 1, and S. O.
3	79.61	81.25	..	73.31	..	Dec. 1863; July, 1865	1 3	$7_m\ 2_a\ 9_a$ bis	C. Lazlo.	S. O.
4	79.52	82.45	78.80	73.46	78.56	Aug. 1838; July, 1839	1 0	......	Bevard.	Dove.
5	75.94	84.97	76.98	64.29	75.54	1830; 1851	9 2	[2]	Dr. J. L. Berlandier.	Manuscript.
6	75.55	85.28	82.98	72.82	79.16	1868	1 0	$\odot_r$ N.[3]	....	S. O.
7	64.30	63.51	59.90	56.68	61.10	Apr. 1769; Nov. 1856	3 11		Alzate, Burkhardt, Berard, L. C. Ervendberg.	Cotté, Blodget's Climatology, Rep. Brit. Assoc. 1847, P. O. and S. I. Vol. 1.

[2] The observations were made at $6_m\ 8_m\ 9_m\ 10_m\ 1_a\ 2_a\ 3_a\ 4_a\ 6_a\ 8_a$.

[3] Corrected for daily variation by the Gulf table.

MEXICO.—Continued.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
8. Mexico City . . .	19°27′	99°05′	7665	..	..	..	65°.50	65°.70	66°.10	62°.60	60°.40	61°.50	57°.90	56°.70	..
9. Minatitlan . . .	17 59	94 30	45	..	..	78°.29	81.58	82.72	80.31	78.59	78.25	77.35	77.91	72.15	72°.73
10. Mirador	19 15	96 40	3600	61°.78	64°.08	67.85	70.46	73.51	72.27	70.96	71.55	70.59	68.67	64.68	62.54
11. San Juan Bautista .	17 47	92 46	40	..	73.67	..	..	..	..	80.77	..	..	..	72.85	..
12. Tuxpan	20 45	97 17	12	..	..	..	..	..	..	..	..	78.93	75.93	73.38	69.90
13. Veta Grand . . .	22 50	102 25	8030	49.06	51.35	57.65	60.13	63.37	63.52	60.31	59.49	58.62	58.37	55.44	52.00
14. Vera Cruz . . .	19 12	96 09	26	69.98	71.60	73.40	77.18	80.42	81.86	81.50	82.40	80.96	78.44	75.38	71.06
15. Vera Cruz . . .	19 12	96 09	26	..	..	..	..	..	..	..	..	..	..	..	..
16. Vera Cruz . . .	19 12	96 09	26	73.10	73.31	76.90	77.43	81.79	80.33	81.17	81.61	80.66	79.93	74.58	71.77

COSTA RICA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Heredia	10 00	84 00	3837	69.98	69.75	71.11	71.73	71.78	69.80	69.13	70.57	68.54	67.69	69.44	70.39
2. Port of Limon . .	10 00	83 03	..	77.4	77.2	76.5	..	81.9	80.6	79.7	79.8	..	80.1	78.1	78.8
3. San José	9 54	84 06	3772	68.34	69.25	70.45	72.10	72.49	71.90	68.21	67.40	68.15	68.19	67.57	67.36

GUATEMALA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Guatemala . . .	14 35	90 30	4961	62.74	64.39	66.49	68.96	68.55	68.14	66.83	66.86	66.73	66.64	64.72	64.02

HONDURAS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Belize	17 29	88 12	..	75.	78.	78.	80.	81.	82.	82.	82.	82.	81.	79.75	75.
2. Belize	17 29	88 12	..	75.15	77.94	79.55	79.49	81.90	83.67	82.74	83.12	82.55	80.81	78.13	74.91
3. Truxillo	15 54	86 00	80	..	..	..	..	..	..	82.75	81.85	..	80.27	77.24	74.08

NICARAGUA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Leon	12 20	86 30	180	..	..	..	..	..	..	80.46	..	..	..	..	..
2. Nicaragua (Virgin Bay)	11 24	85 39	..	..	..	77.25	..	..	..	..	..	..	..	..	..

BAHAMA ISLANDS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Nassau (New Providence)	25 05	77 21	80	74.31	73.81	77.21	78.46	80.18	82.74	85.23	85.53	84.32	80.94	76.39	75.98
2. Nassau (New Providence)	25 05	77 21	80	69.	73.	76.	78.	79.	83.	87.	88.	87.	80.	74.	70.
3. Salt Cay	21 00	71 15	20	74.55	..	..	..	..	..	..	..	..	..	..	..
4. Turk's Island . .	21 29	71 05	15	76.94	75.12	75.05	76.02	79.40	80.31	82.34	83.44	83.40	82.42	80.14	77.53

BERMUDA ISLANDS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Bermuda (R. N. Hospital, Centre Signal Station)	32 23	64 40	..	61.88	61.04	61.83	64.09	69.65	73.99	78.24	80.05	78.09	73.10	67.21	64.33
2. St. George . . .	32 23	64 43	123	61.5	62.7	62.2	60.7	70.7	75.1	74.2	80.0	77.0	72.4	69.7	64.8

MEXICO.—Continued.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
8	..	63°.03	58°.70	..	..	1769	0 8	......	Alzate.	Blodget's Climatology.
9	80°.86	79.05	75.80	..	..	May, 1858; May, 1859	0 11	$7_m\ 3_a$	C. Lazlo.	P. O. and S. I. Vol. I.
10	70.61	71.59	67.98	62°.80	68°.25	Jan. 1854; Dec. 1870	16 0	$7_m\ 2_a\ 9_{a\ bis}$	C. Sartorius.	P.O. and S. I. Vol. I, and S. O.
11	..	..	..	..	..	Feb. 1861; Nov. 1862	0 3	"	C. Lazlo.	S. O.
12	..	..	76.08	..	..	1867	0 4	"	B. Crowther.	" "
13	60.38	61.11	57.48	50.80	57.44	1839; 1840	2 0	$8\frac{1}{2}_m\ 4\frac{1}{2}_a$	Burkhardt.	Rep. Brit. Assoc. 1847.
14	77.00	81.92	78.26	70.88	77.02	1791; 1803	13 0	......	Orta.	" " " "
15	77.90	81.50	78.62	71.96	77.72	....	....	......	....	Bridgewater Treatise.
16	78.71	81.04	78.39	72.73	77.72	June, 1847; Aug. 1859	3 7	[1]	Assist. Surg., Dr. G. Berendt.	Army Reg., P. O. and S. I. Vol. I.

COSTA RICA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	71.54	69.83	68.56	70.04	69.99	1868	1 0	$7_m\ 2_a\ 7_a$	Señor Rohrmoser.	S. O.
2	..	80.03	..	77.80	..	Oct. 1865; Aug. 1866	0 10	"	Philip Valentin.	MS. in S. Coll.
3	71.68	69.17	67.97	68.32	69.28	Jan. 1861; June, 1861	4 1	$7_m\ 2_a\ 9_{a\ bis}$	C. M. Raotte, Dr. A. Frantzius.	S. O.

GUATEMALA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	68.00	67.28	66.03	63.72	66.26	Jan. 1845; Dec. 1859	4 0	[1]	Bailly & A. Canndas.	Rep. Brit. Assoc. 1847, P. O. and S. I. Vol. I.

HONDURAS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	79.67	82.00	80.92	76.00	79.65	....	1 0	......	....	Martin's Brit. Colonies p. 138.
2	80.31	83.18	80.50	76.00	80.00	1863	1 0	max. & min.	S. Cockburn.	S. Coll.
3	..	..	..	..	..	1854	0 5	$9_m\ 3_a$	E. Purdot.	P. O. and S. I. Vol. I.

NICARAGUA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1849	0 1	$\odot_r\ 9_a\ 3_a$	Squier.	S. Coll.
2	..	..	..	..	..	1865	0 1	$7_m\ 2_a\ 6_a$	F. M. Rogers.	S. O.

BAHAMA ISLANDS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	78.62	84.50	80.55	74.70	79.59	Jan. 1841; Aug. 1859	3 11	[1]	J. C. Lees, Chief Justice, and A. M. Smith.	Printed Journ. in S. Coll., P. O. and S. I. Vol. I.
2	77.67	86.00	80.33	70.67	78.67	....	1 0	......	....	Martin's Brit. Colonies p. 105.
3	..	..	..	..	..	1861	0 1	$7_m\ 2_a\ 9_{a\ bis}$	S. S. Garland.	S. O.
4	76.82	82.03	81.99	76.53	79.34	Feb. 1844; Dec. 1868	2 9	[1]	J. Arthur, J. B. Hayne, J. C. Crisson, A. G. Carothers (U. S. Consul).	MS. in S. Coll., P. O. and S. I. Vol. I, and S. O.

BERMUDA ISLANDS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	65.19	77.43	72.80	62.42	69.46	Jan. 1836; Dec. 1859	12 9	[1]	Capt. Page, R. E., S. L. D. Wells, Assist. Surg. R. N., Serg't 56th, Reg. Signal Director, and Hartshorn.	Pamphlet by Sir W. Reid, Gov., MS. in S. Coll., Bermuda Royal Gazette, and Board of Trade.
2	64.53	76.43	73.03	63.00	69.25	Jan. 1856; Dec. 1859	2 5	$\{3\frac{1}{2}_m\ 9\frac{1}{2}_m$; $3\frac{1}{2}_a\ 9\frac{1}{2}_a$	R. E. Met. Obs'y.	Bermuda Royal Gazette.

[1] Corrected for daily variation by the Gulf table.

CARIBBEAN ISLANDS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Antigua	17°08′	61°48′	..	76°.80	75°.90	76°.40	77°.50	79°.40	80°.10	80°.10	81°.70	80°.60	80°.30	84°.30	79°.40
2. Antigua	17 08	61 48	..	..	..	..	..	..	..	..	..	..	..	..	..
3. Barbadoes	13 04	59 37	..	76.11	..	..	..	79.77	80.40	80.05	80.63	79.58	79.72	79.86	76.79
4. Barbadoes	13 04	59 37	..	78.04	78.04	79.16	78.23	79.64	78.10	79.01	78.49	82.11	82.25	81.87	79.35
5. Guadeloupe	15 59	61 25	..	76.14	75.33	76.53	78.30	79.79	81.07	80.98	81.72	81.64	80.37	79.27	77.50
6. Roseau (Dominica Island)	15 18	61 22	..	76.0	74.0	77.0	77.0	79.0	81.0	81.0	80.0	80.0	80.0	75.0	..
7. St. Bartholomew	17 53	63 00	..	79.05	78.69	79.99	80.06	79.86	79.59	83.30	81.01	79.18	80.17	79.48	79.32
8. St. Christopher	17 30	62 45	..	78.02	78.13	80.09	80.32	81.46	83.28	84.19	83.89	83.48	82.40	81.27	78.73
9. St. Thomas	18 21	64 56	..	80.78	79.43	81.55	81.32	82.85	83.57	82.22	82.58	82.22	83.48	82.94	81.32
10. St. Thomas	18 21	64 56	..	79.30	79.02	78.21	80.67	80.67	82.65	82.76	82.87	83.69	82.06	81.54	81.30
11. St. Vincent	13 10	61 15	..	79.80	79.12	79.51	80.92	81.99	81.94	81.95	82.60	82.87	82.48	81.85	80.18
12. Santa Cruz	17 45	64 40	..	76.0	77.5	74.0	76.0	..	..	.	..	..	..	..	75.7
13. Sombrero Island	18 37	63 27	45	75.55	74.92	75.50	77.41	79.37	80.16	81.05	81.62	81.53	81.68	79.35	76.77
14. Tortola	18 27	64 40	860	77.35	77.00	76.09	78.39	78.56	80.79	80.44	81.96	81.00	80.95	80.02	79.85
15. Trinidad (Port of Spain)	10 39	61 38	16	76.82	76.95	78.14	78.28	78.66	78.75	..	..	..	..	..	..
16. Trinidad	10 39	61 38	16	78.13	78.14	..	..	..	..	..	..	..	80.13	79.57	75.94
17. Trinidad	10 38	61 34	..	76.50	76.50	77.50	78.50	77.50	78.00	79.00	79.50	79.00	78.50	79.00	76.50

CUBA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Havana	23 09	82 23	..	74.60	75.51	78.80	80.69	82.62	84.96	87.57	86.90	86.67	83.07	80.91	73.26
2. Havana	23 09	82 23	..	65.34	70.04	72.05	75.43	79.66	83.68	85.23	83.62	80.60	78.44	72.79	69.94
3. Havana	23 09	82 23	50	69.98	71.96	75.74	78.98	82.58	83.12	83.30	83.84	82.04	79.52	75.56	71.78
4. Havana	23 09	82 23	..	71.38	74.03	74.08	76.62	77.97	81.01	81.46	81.57	80.38	78.85	75.13	73.54
5. Havana	23 09	82 23	..	73.33	75.39	77.97	79.12	82.02	84.02	85.89	85.37	83.13	80.47	79.54	72.46
6. Havana	23 09	82 23	..	..	..	..	..	..	..	..	..	..	..	..	..
7. Havana (College of Belen)	23 09	82 23	..	72.90	74.19	76.46	78.94	81.23	83.57	84.26	83.99	83.02	80.40	75.77	73.89
8. Matanzas	23 02	81 40	50	73.53	72.10	75.76	80.23	80.75	82.09	81.58	82.12	82.15	78.79	77.71	74.67
9. San Fernando	22 22	80 09	554	69.90	71.40	73.20	74.60	77.90	78.90	80.50	79.60	78.60	75.90	72.90	67.90
10. Ubajay	23 00	82 00	290	64.50	67.50	66.88	70.00	76.13	82.25	83.63	83.25	79.63	76.50	69.25	62.38

JAMAICA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. San Antonio	18 10	76 30	..	75.60	74.60	74.75	75.10	77.25	79.45	79.75	79.40	80.40	79.45	78.70	75.40
2. Up Park Camp	17 59	76 56	225	78.95	79.65	81.15	..	..	..	..	..	..	82.38	82.26	82.93
3. Up Park Camp	17 59	76 56	225	78.	78.	82.	83.	81.	82.	83.	82.	82.	80.	79.	78.
4. Kingston	18 00	76 47	50	75.73	76.00	75.87	78.08	80.27	80.60	81.67	81.00	80.73	79.80	78.73	76.74

SAN DOMINGO.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. San Domingo	18 29	70 00	..	85.17	84.04	85.17	86.00	85.50	82.06	78.69	77.00	78.69	78.69	77.83	78.69
2. Tivoli (Hayti)	18 35	70 00	..	69.08	68.90	71.60	73.40	72.50	78.08	77.90	77.00	77.00	74.71	73.58	70.88

PORTO RICO.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Estate San Isidro	18 25	66 12	..	76.43	75.14	75.40	76.90	..	..	..	..	..	..	..	..
2. Ponce	17 56	66 35	23	..	78.5	..	..	..	..	..	..	..	..	..	..
3. Porto Rico	18 29	66 13	..	77.33	78.83	75.33	80.33	81.33	84.00	87.33	89.33	83.67	81.33	79.67	78.00

GUIANA (BRITISH).

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Demerara	6 45	58 02	36	..	..	..	..	..	..	81.8	..	..	..	..	..
2. Demerara	6 45	58 02	..	79.5	81.0	81.0	80.5	82.0	79.0	82.0	83.0	82.0	81.0	81.0	76.5
3. Georgetown	6 49	58 12	..	77.5	77.8	79.1	79.5	79.7	79.4	..	..	..	..	..	..

CARIBBEAN ISLANDS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	77°.77	80°.63	81°.73	77°.37	79°.38	Dec. 1833; Nov. 1834	1 0	......	....	Martin's Brit. Colonies, p. 80.
2	..	..	..	..	79.68	1836	1 0	......	....	" " " "
3	..	80.36	79.72	..	..	May, 1841; Jan. 1842	0 9	[1]	Lawson.	Rep. Brit. Assoc. 1847.
4	79.01	78.53	82.08	78.48	79.52	1844	1 0	$\odot_r$ 9_a	R. Young.	Dove.
5	78.21	81.26	80.43	76.32	79.05	1849; 1851	3 0	max. & min.	....	Rep. Brit. Assoc. 1847.
6	77.67	80.67	78.33	..	..	....	0 11	......	....	Martin's Brit. Colonies, p. 75.
7	79.97	81.30	79.61	79.02	79.97	May, 1786; Apr. 1787	1 0	6_m N. 2_a 6_a	Fahlberg.	Rep. Brit. Assoc. 1847.
8	80.62	83.79	82.38	78.29	81.27	....	1 3	max. & min.	....	" " " "
9	81.91	82.79	82.88	80.51	82.02	1840; 1846	1 11	......	Knox.	Dove, 1853.
10	79.85	82.76	82.43	79.87	81.23	1833	1 0	6_m 7_m 4_a 8_a	Schonburgh.	Rep. Brit. Assoc. 1847.
11	80.81	82.16	82.40	79.70	81.27	1824; 1832	8 0	......	....	" " " "
12	..	..	..	76.40	..	Dec. 1836; Apr. 1837	0 5	$6\frac{1}{2}_m$ 9_m N. 3_a 6_a 9_a	Rev. Dr. Tuckerman.	Am. Alm. 1839.
13	77.43	80.94	80.85	75.75	78.74	Feb. 1863; Oct. 1865	1 10	7_m 2_a 9_a bis	A. A. Julien.	S. O.
14	77.68	81.06	80.66	78.07	79.37	1831; 1833	3 0	6_m 2_a 6_a	Schonburgh.	Rep. Brit. Assoc. 1847.
15	78.36	..	..	..	..	....	.....	......	Deville.	Dove, 1853.
16	..	..	..	77.40	..	Oct. 1856; Feb. 1857	0 5	7_m 2_a 9_a	Geological surveyors.	P. O. and S. I. Vol. I.
17	77.83	78.83	78.83	76.50	78.00	....	1 0	max. & min.	....	Martin's Brit. Colonies, p. 26.

CUBA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	80.70	86.48	83.55	74.46	81.30	1794	1 0	......	....	Dove, 1853.
2	75.71	84.18	77.28	68.44	76.40	1800; 1807	4 0	......	....	" "
3	79.10	83.42	79.04	71.24	78.20	1810; 1812	3 0	......	Humboldt.	" "
4	76.22	81.35	78.12	72.98	77.17	1825; 1831	7 0	......	....	Rep. Brit. Assoc. 1847.
5	79.70	85.09	81.05	73.73	79.89	Jan. 1842; Oct. 1849	1 3	8_m 2_a 8_a	Gibbs and Poey.	MS. in S. Coll. & Print. Journ.
6	78.98	83.30	78.98	71.24	78.08	....	.....	......	....	Bridgewater Treatise.
7	78.88	83.94	79.73	73.66	79.05	Jan. 1859; Nov. 1870	11 3	[2]	Various observers.	Printed Records of Observa.
8	78.91	81.93	79.55	73.43	78.46	1832; 1835	2 0	$\odot_r$ 2_a $\odot_s$	Mallory.	Sill. Journ.
9	75.23	79.67	75.80	69.73	75.11	Jan. 1839; June, 1840	1 0	8_m N. $\odot_s$	Blake.	" "
10	71.00	83.04	75.13	64.79	73.49	1831; 1833	3 0	6_m 2_a 6_a	Schonburgh.	Rep. Brit. Assoc. 1847.

JAMAICA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	75.70	79.53	79.52	75.20	77.49	1819; 1820	2 0	$\odot_r$ N.	Arnold.	Rep. Brit. Assoc. 1847.
2	..	..	..	80.51	..	Oct. 1855; Mar. 1856	0 6	$9\frac{1}{2}_m$ $3\frac{1}{2}_a$	Col. W. B. Marlow, and J. G. Lawkins.	P. O. and S. I. Vol. I.
3	82.00	82.33	80.33	78.00	80.67	....	.....	......	From Sir J. McGregor's Office, Military Medical Dep.	Martin's Brit. Colonies, p. 5.
4	78.07	81.09	79.75	76.16	78.77	1832	1 0	......	....	Martin's Brit. Colonies, p. 57.

SAN DOMINGO.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	85.56	79.25	78.40	82.63	81.46	May, 1782; Apr. 1783	1 0	......	....	Rep. Brit. Assoc. 1847.
2	72.50	77.66	75.10	69.62	73.72	1779	1 0	......	....	" " " "

PORTO RICO.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1868	0 4	7_m 2_a 8_a	G. Latimer.	S. O.
2	..	..	..	..	..	1844	0 1	$\odot_r$ 9_m 3_a 9_a	W. A. Mitchell.	MS. in S. Coll.
3	79.00	86.89	81.56	78.05	81.37	....	5 0	7_m N. 5_a	Vertez.	Rep. Brit. Assoc. 1847.

GUIANA (BRITISH).

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins. Ends.	Extent yrs.mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	1843	0 1	3_m 9_m 3_a 9_a	D. Blair.	MS. in S. Coll.
2	81.17	81.33	81.33	79.00	80.71	....	1 6	......	....	Rep. Brit. Assoc. 1847.
3	79.43	..	..	..	..	1854	0 6	max. & min.	J. P. Dawes.	MS. in S. Coll.

[1] Means of 18 daily observations.

[2] The observing hours were 6_m 8_m 10_m N. 2_a 4_a 6_a 8_a 10_a.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
GUIANA (DUTCH).															
1. Catharina Sophia	5°48′	56°47′	..	79°.18	79°.99	80°.42	80°.40	80°.22	79°.75	80°.14	81°.45	81°.42	82°.19	80°.60	79°.39
2. Commervine	5 38	54 42	..	78.26	77.18	77.00	78.08	78.26	78.08	77.90	78.08	78.26	79.16	78.80	78.80
3. Guanabacoa	5 05	..	..	71.00	72.76	78.33	76.00	78.67	79.33	81.33	82.00	80.67	79.33	72.00	70.33
4. Paramaribo	5 44	55 13	..	78.24	78.01	78.94	79.16	79.88	79.52	80.02	82.00	83.44	83.28	81.46	79.66
5. Rio Berbice	6 29	57 30	..	78.44	78.62	79.88	80.24	80.78	82.22	83.12	84.38	83.84	84.20	82.76	80.24
6. Rustenburg	6 00	55 00	..	77.24	77.56	78.19	78.24	77.93	77.40	77.81	79.61	80.17	80.76	79.06	78.04
NEW GRANADA.															
1. Aspinwall	9 21	79 54	6	78.82	78.85	79.13	79.98	79.98	79.43	78.96	79.26	78.91	78.64	78.57	78.98
2. Barbacoas	8 30	79 00	65	..	..	..	..	..	78.74	..	..	..	..	..	..
3. Bogota	4 36	74 14	8863	..	..	..	..	..	60.07	..	..	..	..	..	..
4. Bogota	4 36	74 14	8863	..	..	..	..	..	..	..	..	..	..	..	..
5. Chagres	9 21	79 59	..	..	79.7	80.6	..	..	..	..	..	..	..	..	..
6. Manzanilla Island	9 21	79 57	..	..	..	..	..	78.53	77.22	78.66	77.82	77.84	79.82	..	..
7. Panama	8 57	79 30	..	..	..	..	81.9	..	..	..	..	..	..	..	..
8. Rio Hacha	11 28	73 00	..	81.32	81.83	84.25	81.50	84.30	84.38	..	..	..	..	..	81.70
VENEZUELA.															
1. Caracas	10 31	66 55	2900	69.72	69.98	70.25	71.66	73.04	72.30	73.63	73.07	72.73	73.00	72.39	69.44
2. Cumana	10 30	64 15	..	80.35	80.51	81.95	83.84	84.54	83.10	83.28	81.50	..	..	83.21	80.83
3. Cumana	10 30	64 15	..	..	..	..	..	..	..	..	..	..	..	..	..
4. Curaçoa	12 06	69 20	..	77.90	78.62	78.62	80.24	80.96	81.86	..	..	..	..	81.14	72.68
5. Colonia Tovar	10 26	67 20	6500	60.65	62.85	62.76	63.36	63.92	61.05	60.50	61.57	61.49	61.51	60.77	61.26
6. Colonia Tovar	10 26	67 20	6500	61.51	62.64	64.06	64.89	64.89	65.34	65.75	65.75	66.01	64.62	64.62	63.05
7. La Guayra	10 37	67 00	..	76.59	76.51	77.42	78.45	79.42	79.78	79.30	80.70	81.12	80.69	79.64	76.81
8. Maracaybo	10 43	71 52	..	81.20	83.36	82.83	86.35	85.93	86.60	86.66	86.91	86.42	84.99	83.91	81.87
9. Puerto Cabello	10 28	68 17	..	..	79.2	..	..	..	81.4	..	82.2	82.2	81.3	..	79.3
BRAZIL.															
1. Gongo Soco	—19 59	43 30	3360	71.07	71.25	70.20	68.65	65.75	60.20	59.52	63.81	61.67	70.60	72.19	72.20
2. Para	— 1 28	48 29	20	80.00	78.90	78.90	79.30	80.60	81.10	81.60	81.50	81.10	81.20	81.90	81.50
3. Parnambuco	— 8 10	34 57	..	79.59	81.19	81.80	78.30	78.22	76.44	75.38	75.03	76.33	81.06	82.93	81.09
4. Rio de Janeiro	—22 54	43 09	..	80.13	80.04	77.95	75.47	70.68	68.68	67.15	69.96	70.48	72.82	74.39	77.27
5. Rio de Janeiro	—22 54	43 09	..	82.83	83.95	81.18	77.77	74.48	71.73	71.99	73.38	74.63	76.49	77.16	80.56
6. Rio de Janeiro	—22 54	43 09	..	..	..	..	..	..	71.86	71.49	68.92	69.72	69.99	..	..
BUENOS AYRES.															
1. Buenos Ayres	—34 37	58 24	..	73.57	75.71	73.31	64.77	55.41	53.41	52.55	51.83	54.64	58.91	68.43	70.91
2. Buenos Ayres	—34 37	58 24	..	..	..	..	..	..	..	..	..	..	..	..	..
CHILI.															
1. Chanarcillo	—27 28	70 28	3860	66.49	66.94	65.93	..	..	..	..	..	..	..	62.44	65.13
2. Rio de Condon	..	..	..	..	..	..	63.74	61.34	56.48	52.70	52.51	55.75	58.10	..	..
3. Talcahuana	—36 34	72 57	..	..	..	..	64.72	59.90	56.84	52.15	51.44	51.62	55.04	..	..
4. Valdivia	—39 50	73 10	..	61.47	60.80	55.17	51.57	50.67	48.87	43.47	48.20	45.11	48.26	49.95	57.42
5. Valparaiso	—33 02	71 40	..	..	65.50	62.75	62.45	59.05	54.98	57.72	57.77	59.50	61.50	63.62	64.75
6. Valparaiso	—33 02	71 40	..	..	..	..	..	..	54.09	54.34	53.26	..	..	..	..

GUIANA (DUTCH).

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	80°.35	80°.45	81°.40	79°.52	80°.43	Feb. 1856;	Dec. 1859	3 9	$6_m\ 2_a\ 6_a$	C. T. Hering.	P. O. and S. I. Vol. I.
2	77.78	78.02	78.74	78.08	78.15	1843;	1844	2 0	......	....	Rep. Brit. Assoc. 1847.
3	77.67	80.89	77.33	71.36	76.81	July, 1819;	June, 1820	1 0	6_m N. 9_a	....	" " " "
4	79.33	80.51	82.73	78.64	80.30	Jan. 1833;	Feb. 1835	2 0	$7_m\ 2_a\ 7_a$	Dieperink.	" " " "
5	80.30	83.24	83.60	79.10	81.56	1772		1 0	$7_m\ 3_a\ 7_a$	Massé.	" " " "
6	78.12	78.27	80.00	77.61	78.50	May, 1861;	Dec. 1865	3 7	$7_m\ 2_a\ 6_a$	C. T. Hering.	S. O.

NEW GRANADA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	79.70	79.22	78.71	78.88	79.13	Oct. 1862;	Dec. 1868	5 10	$7_m\ 2_a\ 9_a$ bis	Drs. W. T. White, & J. P. Kluge.	S. O.
2	..	..	..	..	..	1852		0 1	......	Bertherd.	Manuscript.
3	..	..	..	..	..	1857		0 1	$10_m\ 4_a\ 10_a$	Dr. E. Wricoschea.	P. O. and S. I. Vol. I.
4	59.54	59.54	58.10	59.18	59.09	....		1 4	......	....	Kaemptz.
5	..	..	..	..	..	1850		0 2	$6_m\ 9_m$ N. $3_a\ 6_a$	A. Fendler.	MS. in S. Coll.
6	..	77.90	..	..	..	1851		0 6	$\odot_r\ 9_m\ 3_a\ 9_a$	....	S. Coll.
7	..	..	..	..	..	1849		0 1	$9_m\ 3_a$	Major Emory.	Am. Acad. Trans.
8	83.35	..	..	81.62	..	Dec. 1822;	June, 1823	0 7	$7_m\ 3_a$	Wright.	Rep. Brit. Assoc. 1847.

VENEZUELA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	71.65	73.00	72.71	69.71	71.77	July, 1841;	Aug. 1848	1 2	max. & min.	Graham & A. Fendler.	Dove, 1853, P. O. & S. I. Vol. I.
2	83.44	82.63	..	80.56	..	Nov. 1799;	Aug. 1800	0 10	......	Don Rubio.	Rep. Brit. Assoc. 1847.
3	83.66	82.04	80.24	80.24	81.86	....		.....	......	....	Bridgewater Treatise.
4	79.94	..	..	76.40	..	....		0 8	5_m N. 9_a	Dorfel.	Rep. Brit. Assoc. 1847.
5	63.35	61.04	61.26	61.59	61.81	Apr. 1854;	Nov. 1856	1 6	$\odot_r 9_m$ N. $3_a \odot_s$	A. Fendler	MS. in S. Coll., P. O. and S. I. Vol. I.
6	64.61	65.61	65.08	62.40	64.43	....		1 0	min. & max.	Karston.	Dove, 1853.
7	78.43	79.93	80.48	76.64	78.87	Sept. 1834;	Aug. 1837	3 0	$6_m\ 11_m\ 4_a\ 9_a$	Halle.	" "
8	85.04	86.72	85.11	82.14	84.75	Sept. 1823;	Aug. 1824	1 0	$7_m\ 3_a$	Wright.	Rep. Brit. Assoc. 1847.
9	..	..	..	..	..	June, 1843;	Feb. 1844	0 6	$\odot_r\ 9_m\ 3_a\ 9_a$	F. Litchfield, U. S. Consul.	MS. in S. Coll.

BRAZIL.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	68.20	61.18	68.15	71.51	67.26	....		.....	$\{6_m\ 9_m$ N. 4_a / $6_a\ 8_a\ 12_a\}$	....	Rep. Brit. Assoc. 1847.
2	79.60	81.40	81.40	80.13	80.63	Dec. 1844;	May, 1849	4 6	......	Deweg.	Blodget's Climatology.
3	79.44	75.62	80.11	80.62	78.95	1842		1 0	......	Loudon.	Dove, 1853.
4	74.70	68.60	72.56	79.15	73.75	1782;	1788	7 0	trihourly.	Dorta.	Rep. Brit. Assoc. 1847
5	77.81	72.37	76.09	82.45	77.18	Jan. 1832;	Dec. 1843	12 0	N.	Gardner.	Sill. Journ.
6	..	70.76	..	..	..	....		0 5	bihourly.	King.	Dove, 1853.

BUENOS AYRES.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	64.50	52.60	60.66	73.40	62.79	Jan. 1822;	June, 1823	1 6	......	....	Dove, 1853.
2	64.58	52.52	59.36	73.04	63.12	....		1 4	......	....	Kaemptz.

CHILI.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	66.19	..	Nov. 1858;	Mar. 1859	0 5	$\{6_m\ 9_m$ N. $3_a\ 6_a\ 9_a\}$	E. B. Dorsey.	P. O. and S. I. Vol. I.
2	..	53.90	..	..	..	1827		0 7	......	....	Dove, 1853.
3	..	53.48	..	..	..	1828		0 7	......	....	" "
4	52.47	46.85	47.77	59.90	51.75	Apr. 1851;	Mar. 1852	1 0	$6_m\ 7_a$	....	Dove.
5	61.42	56.82	61.54	..	..	1853;	1854	1 6	$9\frac{1}{2}_m\ 3\frac{1}{2}_a$	MacKey.	Board of Trade.
6	..	53.90	..	..	..	....		0 3	bihourly.	King.	Dove.

NOTE.—The heading of the seasons corresponds to those existing at the time in the *northern* hemisphere; for stations in south latitude they would be the opposite ones.

ECUADOR.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Antisana	—0°27′	78°28′	13455	43°.11	41°.11	41°.99	42°.60	41°.92	40°.08	37°.31	37°.41	39°.27	41°.02	41°.95	42°.42
2. Quito	—0 14	78 45	8970	58.24	60.98	60.04	59.86	60.62	59.00	59.18	60.94	61.34	59.95	60.53	..
3. Quito	—0 14	78 45	8970	..	..	..	..	..	..	..	..	..	..	..	..

FALKLAND ISLANDS.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Falkland Islands (Cape Oxford)	—52 00	61 00	...	56.00	54.00	51.61	48.65	46.64	43.50	37.41	38.64	45.75	47.51	47.20	49.87
2. Falkland Islands (Byron Sound)	—51 25	59 59	...	..	..	..	..	..	..	..	..	..	..	..	..
3. Port Egmont	—51 20	60 00	...	54.10	54.21	51.60	48.63	46.63	43.48	37.47	38.62	45.73	47.50	47.19	49.87

PATAGONIA.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Cape Horn	—56 08	67 00	...	..	..	40.01	35.69	..	35.42	..	..	36.68	..	..	43.34
2. Port Famine (Tierra del Fuego)	—53 38	70 58	...	..	47.80	45.09	38.94	37.55	33.75	33.40	35.13	..	..	..	..
3. Port Famine (Tierra del Fuego)	—53 38	70 58	...	51.10	49.37	41.22	35.47	32.97	33.03	33.25	..	..	..	..	..

PARAGUAY.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Asuncion	—25 16	57 45	...	82.35	81.73	79.43	75.34	71.24	..	66.69	67.67	..	..	..	84.54

PERU.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Callao	—12 03	77 13	...	73.94	..	69.80	..	66.56	64.76	..	61.70	..	..	68.36	71.96
2. Jauja	—12 00	75 15	10000	59.37	..	..	..	..	..	..	..	..	..	..	..
3. Lima	—12 03	77 08	530	78.08	79.88	80.06	77.36	77.90	68.36	68.54	67.28	66.20	69.26	71.96	74.84

URUGUAY.

Name of Station.	Lat.	Long.	Height.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.
1. Montevideo	—34 54	56 13	...	80.	77.	74.	72.	58.	56.	57.	59.	58.	66.	70.	75.

ECUADOR.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	42.17	38.27	40.75	42.21	40.85	Dec. 1845;	Dec. 1846	1 1	......	Anguire.	Dove, 1853.
2	60.17	59.71	60.61	..	..	1825;	1828	2 6	......	Hallarn.	Rep. Brit. Assoc. 1847.
3	60.26	60.08	63.50	59.72	60.89	....		2 3	......	....	Kaemptz.

FALKLAND ISLANDS.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	48.97	39.85	46.82	53.29	47.23	....		1 0	......	....	Rep. Brit. Assoc. 1847.
2	48.46	39.56	46.58	53.06	46.94	....		.....	......	....	Bridgewater Treatise.
3	48.95	39.86	46.81	52.73	47.09	....		1 0	N.	Friquinet.	Rep. Brit. Assoc. 1847.

PATAGONIA.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	....		.....	......	....	Rep. Brit. Assoc. 1847.
2	40.53	34.09	..	..	..	1828		0 7	bihourly.	King.	Dove, 1853.
3	36.55	..	..	..	..	....		.....	6_m 9_m N. 3_a 6_a	....	Rep. Brit. Assoc. 1847.

PARAGUAY.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	75.34	..	..	82.87	..	Dec. 1853;	1854	0 8	8_m N. 4_a 9_a	Hopkins.	S. Coll.

PERU.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	..	..	..	..	..	....		.....	......	....	Rep. Brit. Assoc. 1847.
2	..	..	..	..	..	1861		0 1	9_m 2_a 9_a	G. H. Brown.	S. O.
3	78.44	68.06	69.14	77.60	73.31	1799;	1800	2 0	N.	Uranne.	Rep. Brit. Assoc. 1847.

URUGUAY.

	Spring.	Summer.	Autumn.	Winter.	Year.	Series. Begins.	Series. Ends.	Extent yrs. mos.	Observing hours.	Observer.	References.
1	68.00	57.33	64.67	77.33	66.83	....		1 0	......	Friquinet.	Rep. Brit. Assoc. 1847.

NOTE.—The heading of the seasons corresponds to those existing at the time in the *northern* hemisphere; for stations in south latitude they would be the opposite ones.

GRAPHICAL REPRESENTATION

OF THE PRECEDING

TABULAR RESULTS BY ISOTHERMAL CHARTS.

EXPLANATION

OF

THE ISOTHERMAL CHARTS ACCOMPANYING THIS PAPER.

THE three accompanying charts have been constructed to show the distribution of the atmospheric temperature within the limits of the United States, on the average during the year, and for the winter and summer seasons.

The great value of the graphical method consists in its capacity of bringing into a connected view the result of a large mass of apparently disconnected figures, and thus presenting their relations to the eye. In the present case, these relations depend on the geographical and hypsometrical features of the country.

The results brought out in these tables form the basis of the charts. They are laid down by means of curves connecting places of equal temperature. These curves may be conceived as forming the intersections of the earth's surface by a series of thermal surfaces of equal temperature one above the other and for equal differences of temperature. The difference, here adopted, is 4° Fah., and is the same for all the charts. During the winter season the decrease of temperature between the southern and northern limits of the United States is greater than during the summer season, hence a greater number of curves appear on the chart showing the distribution of temperature in the winter than on that for the year, and the chart for the distribution in summer has the least number of curves. The limiting curves are as follows: For the cold season 4° to 72° Fah., for the yearly average 36° to 76° Fah., and for the warm season 56° to 88° Fah.

From the above designation of the isothermals it follows that each curve must be continuous no matter how tortuous its course may be, that is, it cannot abruptly come to an end; of this instructive examples are presented on the chart for the year by the curve of 48° Fah., and on the chart for the summer by the curve of 68° Fah. The construction of the curves for the yearly distribution was found slightly more troublesome than those for either of the other charts, owing to the way in which the mean temperature results, from the monthly means, are influenced by the annual variation. Some difficulty was experienced in tracing out the summer curves for the western part of California, owing to the well-known exceptional and remarkable distribution of its temperature, of which more will be said further on.

The want of a reliable hypsometric chart of the United States was seriously felt, not one only on which the existence of hills and mountains should be *correctly* indicated as regards position, but one, on which the actual elevations are indicated by contour lines. A rough hypsometric chart of the latter description was constructed by me to aid in the tracing out of the thermal curves, but the latter are not what they might be, respecting accuracy in detail, were we in possession of an elaborate hypsometric chart.

On each chart was plotted the mean temperature for the respective period, corrected for daily variation, if necessary, for all the available stations within the area of the chart. On the east of the Mississippi all series extending over five years or more were given to the nearest tenth of a degree of Fahrenheit, those of less than five years' duration were set down to the nearest whole degree.

The decimal point marked the position of the place. For stations west of the Mississippi the limit of 3° was adopted instead of 5°. The curves were constructed with due regard to the elevations of the ground, producing a resemblance, for short distances, of the thermal curves to contour lines of equal elevation. The isothermals thus constructed are *not reduced* to the *sea level* for the following reasons. In the first place, we desire a knowledge of the true distribution of the temperature near the surface to which we are actually exposed and which affects agricultural and other pursuits, and not of any artificial distribution under special, qualified conditions such as the reduction to the sea level; in fact we might as well correct also for propinquity to the sea, for prevailing wind, for proximity of table-land or large lakes, nature of the soil, and a variety of other disturbing causes, which process would finally bring about a close conformity of the isothermals with parallels of latitude, and would represent what has been called the solar climate. Moreover, we do not possess the precise data for such a reduction; thus to experience a diminution of 1° Fah. in the atmospheric temperature, near the surface, the average values vary between 250 and 500 feet of rise, and at elevations beyond a mile, the change in altitude must be greater for the same difference in temperature. Besides, the law is different in the different seasons. It is proper to connect the decrease of temperature in altitude with the decrease of pressure to which it is supposed proportional (when starting from the absolute zero of temperature), a fall of 1° of temperature corresponds approximately to a decrease in pressure of nearly 0.25 inch, the barometric column indicating about 29 inches, and to 0.35 inch nearly for pressure at and below 27 inches.

On the other hand, if the meteorological stations were sufficiently numerous and equally distributed in area, the isothermal curves drawn among them would themselves furnish the best means of ascertaining the separate effects on the climate (temperature) of the various modifying elements of elevation, slope, surface condition (wooded or barren), and many other circumstances.

If we review the indications presented by each chart separately and notice only the leading characteristic features of the distribution of temperature, we may conveniently divide the area of the United States into two parts, viz.: that east of the 100th meridian, of comparatively small elevation, generally below 1000 feet and only exceptionally rising to 4000, and that west of this meridian, with an elevation generally above 4000 feet, and not unfrequently attaining the altitude of 10,000 feet and above.

When referring to the isothermal curves in the description of the charts, those referring to the yearly period will simply be designated as "isothermals," those referring to the winter as "isocheimals," and those referring to the summer as "isotherals."

As already pointed out, the position of the isothermal curves is intimately connected with the hypsometric features of the country, and this direct dependence has consequently been made the basis of the above division, greater or less elevation constituting the principal cause of their deflections. This appears, for instance, conspicuously in the isothermal of 52°, depending on the direction of the Apalachian range, and in the isothermal of 44°, depending on the directions of the Rocky Mountains, the Cascade range, and the Sierra Nevada.

In the *eastern* part of the United States, the distribution of heat appears normal, as indicated by the isothermals between 44° and 68° which follow, with no great departures, parallels of latitude; in the *western* part, on the contrary, it is altogether more irregular, and the pure solar climate is apparently subverted, the distribution of temperature on the Pacific shore being governed by a system almost at right angles to that in the eastern part, and possessing an *intermediate* system of distribution at the head of the Gulf of California.

In the *winter* months, the proximity of the Gulf stream to the Atlantic sea-board has the effect of *elevating* the temperature in the vicinity of the ocean, the amount being 0° in Florida, about 4° in North Carolina, and about 8° or 10° in Massachusetts; in the *summer* months, the effect is reversed, as shown by the isotherals curving southwards; this is due to the cold current running southwards between the coast and the gulf stream, and the depression produced would be still greater but for the circumstance of the prevalence of *westerly* winds which carry the heated air to seaward. The depressing effect, however, in amount, is less than one-half that given for the opposite season. It would appear that in summer nearly the whole of Florida enjoys an almost equal temperature, barely rising above 80° Fah.; with this we connect the fact that in Florida summer constitutes the rainy season.

On the yearly average the vicinity of the Atlantic is apparently without any direct effect on the temperature of the coast.

Passing now to the influence of the great lakes we shall find it similar, viz.: a *warming* effect in *winter*, rising to about 10°, and a *cooling* effect in *summer*, depressing about 5°, whereas, during the year the presence or absence of this body of water would seem to be of no particular consequence as regards mean temperature.

The coldest region is in northern Minnesota and northeastern Dakota, the isocheimal of 4° appearing along the low elevations near Red Lake in Minnesota. It is near these regions that the extremely cold waves, which occasionally sweep over the eastern and southern states during the winter appear to enter the United States.

In the western part of the country we recognize as the most remarkable feature, the great uniformity of the distribution of temperature along the Pacific coast as exhibited in the isothermal of 52°, skirting the coast for about 650 miles between San Francisco and the northwestern part of Washington Territory; the same feature is indicated by the direction of the isocheimals, approximating to parallelism with that of the coast and again in the isotheral of 60°. The direct influence of the Pacific Ocean on the climate of the western states (west of 100° longitude) is heightened by the presence of a cool current running southward close along the coast. The presence of the cool ocean, together with the prevailing westerly winds, sweeping the air which had been resting over the ocean across a great portion of the country, thus impresses the chief character on the climate, viz.: a comparatively high and uniformly distributed *winter* temperature, which is even felt beyond the Rocky Mountains in central Montana, to which latent heat is carried by the moist winds, as clearly exhibited in my Rain Chart[1] for the winter season. With the high winter temperature, we associate the fact of comparatively great precipitation. Secondly, we are impressed with the comparatively low *summer* temperature over the Pacific States; in fact the coldest place in the whole United States, at this season, excepting only the high mountain ranges and peaks, is just outside the Golden Gate, Bay of San Francisco, where we encounter the isotheral of 56°, which appears nowhere else during this season. To exhibit the contrast more forcibly, we have in the corresponding season and latitude on the Atlantic side (near the mouth of Chesapeake Bay, a temperature higher by as much as 18°. With this low summer temperature we connect the fact of but little precipitation.

In *winter* this contrast between the two (opposite) coasts is of the opposite kind, the isocheimal of 52°, off the Golden Gate, corresponding to the isocheimal of 42°, off the mouth of the Chesapeake, a temperature *lower* by 10°. Finally, we notice the extraordinary difference in the range of the mean temperature at the extreme seasons, this being nearly 4° on the Pacific, and nearly 33° on the Atlantic.

We next notice the greater accumulation of heat in valleys than in the plains, the most remarkable instance being that of the Joaquin Valley and its northern prolongation, the Sacramento Valley. This feature is most apparent in the *summer* season, when these valleys seem to become reservoirs of heat, and when their sloping sides are most exposed to insolation. The mean summer temperature in the central part of San Joaquin Valley rises above 84°, when on the sea-coast, close by, it is below 60°. Other instances of this kind are presented on the chart for the summer temperature, by the heated plains of the Columbia River, by the region along the Colorado and Gila Rivers, and, to return to the eastern portion of the country, by the lower valley of the Rio Grande, where the temperature reaches 84°, by the Hudson Valley, and lastly by that of the St. Lawrence.

The hottest region in the United States is along the lower course of the Colorado and Gila Rivers, where we meet with the isotheral of 88°.

It is needless to follow out, in further detail, the various features presented by the charts, since they address themselves sufficiently to the eye, nor has it been deemed necessary to construct isothermal charts for the intermediate seasons of spring and autumn, which, being periods of transition, cannot present features as striking as those exhibited by the extreme seasons.

The total number of results from series plotted on the charts and from which the isothermal curves were constructed are 1300 nearly for the year, 1450 nearly for the winter, and 1500 nearly for the summer. For the base chart, the Smithsonian Institution is indebted to Prof. Francis A. Walker, Superintendent U. S. Census.

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[1] Tables and Results of the Precipitation, in Rain and Snow, in the United States. Smithsonian Contributions to Knowledge, No. 222; Washington, May, 1872.

DISCUSSION

OF THE

DAILY FLUCTUATION OF THE ATMOSPHERIC TEMPERATURE,

WITH

TABLES OF HOURLY VALUES AND OF HOURLY DIFFERENCES FROM THE DAILY MEAN,

FOR

EACH MONTH AND THE YEAR,

AT VARIOUS PLACES IN NORTH AMERICA.

SECTION II.

DISCUSSION OF THE DAILY FLUCTUATION OF THE ATMOSPHERIC TEMPERATURE,

WITH

TABLES OF HOURLY VALUES AND OF HOURLY DIFFERENCES FROM THE DAILY MEAN, FOR EACH MONTH AND THE YEAR,

AT VARIOUS PLACES IN NORTH AMERICA.

The Daily Fluctuation of the Temperature.—The daily variation of the temperature, due to the change in the sun's altitude, and dependent upon the length of the day or time of insolation, is principally affected by the amount of aqueous vapor suspended in the atmosphere, by the serenity or cloudiness of the sky, and by the elevation of the ground. As an accumulative effect, the greatest heat will occur some time after the sun has reached its greatest altitude, and the greatest cold some time after its greatest depression. Even in midwinter, in the high latitudes of the Arctic Regions and in the continued absence of the sun, this periodic fluctuation is still perceptible, which may be accounted for by the progress of waves of heat and by its transfer from more southern and still partly insolated regions. In midsummer, when the sun remains above the horizon, the range of the daily fluctuation in the Arctic Regions is very small owing to the small variation in the sun's altitude. As an instance of a small daily fluctuation in a low latitude, Key West near the northern tropic may be cited; here the great humidity of the air tends to confine the daily amplitude within narrow limits. As an example of the opposite effect or of an excessive daily variation, Albuquerque in the valley of the Rio Grande may be cited; it is due to the dryness of the air and the great altitude of the place.

For the investigation of the daily fluctuation hourly observations are quite sufficient, but they should be continued for several years, whenever it is desirable to bring out reliable values of the average daily amplitude for each month. It is in these investigations that the want of self-registering instruments or thermographs is most felt. Our records of temperatures, continued regularly during day and night, even for a single year, are very scanty, and there are but three stations where the observations continue over a sufficiently long period; these are Toronto, Canada, and Mohawk, New York, with full hourly records extending over six years at each place, and Sitka, Alaska, with records over more than twice this period. To Dr.

James Lewis, of Mohawk, is due the merit of having early brought into operation a thermograph of his own invention.

The collection of monthly values for daily fluctuation comprises the results from bihourly, hourly, and semi-hourly observations at 18 stations, see first table accompanying this section of the paper. They are arranged according to latitude. From these the second series of tables is derived as follows: For each month separately, the daily mean temperature t is subtracted from the observed temperature at any hour, and the difference is set down; a positive sign thus indicates a higher, and a negative sign a lower temperature than that of the day. These tables of differences would furnish the true diurnal fluctuation, if the effect of the annual fluctuation was fully eliminated, and if the daily mean was accurately known. The amount of the annual fluctuation in one day is generally small when compared with the daily fluctuation, and corrections for it need only be applied in extreme cases, as for instance in the Arctic Regions, where the daily range is small in comparison with the annual range; at Van Rensselaer harbor and Port Kennedy the maximum effect for 24 hours amounts to a little more than half a degree (Fah.), on account of which the maximum correction for midnight and the hour preceding it would be one-fourth of a degree, and proportionally less for the intermediate hours. This correction is greatest in April and October, and insensible in July and January.

These tables of hourly differences furnish at once the means of correcting any irregularly observed series, and the mean temperature thus corrected will be the same as that found from an unbroken and regular series of hourly observations. The chief value of these tables lies in this application, and in any special case we have only to select the table for that locality where the thermal conditions may be supposed the same, or at least most nearly resembling those at the locality for which the interpolation or reduction is to be made. For the purpose of facilitating this application, a series of mean values for certain selected combinations of hours is added to each table—these require some further explanation.

These combinations refer to those observing hours from which most probably the nearest approximation to the mean temperature of the day may readily be deduced, not only for the entire year, but also for each month and for any locality, and apply to the cases of record limited to two, three, and four entries a day. The tabular corrections to the selected four hour combination specially, become serviceable for self-registering instruments, when with the least labor (reading off the trace or punctures at those four hours) we wish to obtain a reliable daily mean short of the tedious process of operating on 24 equidistant records.

About the year 1815, Prof. C. Dewey examined[1] the hours 7 A. M., 2 and 9 P. M., adopted by the Manheim[2] Meteorological Society, with reference to their applicability to our climate, and in 1816 and 1817 instituted a short series of hourly observations at Williamstown which proved the fitness of these hours for observation in the United States. These results he communicated to Secretary Calhoun,

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[1] Annual Report of the Board of Regents of the Smithsonian Institution for the year 1857, p. 310; also annual report for 1860, p. 413.

[2] In Baden, Germany.

and the hours 7, 2, 9 were, in consequence, adopted for the system of meteorological observations at the military posts of the United States, organized in 1819 under the direction of the surgeon-general of the United States Army. Although these hours were at one time abandoned (between 1841 and 1854, when the epochs a little before sunrise, 3 and 9 P. M. were substituted), they were re-established in 1855, mainly through the exertions of Dr. Coolidge, U. S. A. The convenience and satisfactory character of the results of these hours, also led to their adoption in the meteorological observations undertaken conjointly by the United States Patent Office and the Smithsonian Institution in 1854, and they have since been adhered to by the latter Institution. The recognition of the fact that the results by the three hours 7, 2, 9 can be greatly improved by taking one-fourth of the ordinates at 7, 2, and twice 9 in the place of one-third of the ordinates at 7, 2, 9, appears also to be due to Dr. Dewey.

From the present collection of results it appears that the homonymous hours, 10, 10, give differences of less than $\pm 0^\circ.5$ in the annual mean, that the triplets, 6, 2, 9, and equidistant hours, 6, 2, 10, are of nearly equal value, and but slightly superior to the preceding pair of hours, the former combination producing a higher, the latter a lower mean than the true value of twenty-four equidistant observations, but deviating less than $0^\circ.4$. The combination 7, 2, 9, produces a result nearly $0^\circ.5$ in excess, whereas the modification 7, 2, 9 (*bis*) diminishes this difference to nearly $0^\circ.1$ with a change of signs for different stations. The four-hour combination 3, 9, 3, 9, adopted by the Royal Society, is the best of all, being generally less than $0^\circ.1$ above the true daily mean. In the following table of differences from the daily mean, of the average temperature observed at 7, 2, 9, the sign + indicates an excess, the sign — a defect of the latter average. The *first* line for each station answers to the combination $\frac{1}{3}$ (7, 2, 9), the *second* to the modification $\frac{1}{4}$ [7, 2, 9 (*bis*)].

Station.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Van Rensselaer harb. $\phi=78°.6$	0.0	+0.5	+0.5	+0.8	+0.8	+0.7	0.0	+0.4	+0.4	—0.1	—0.2	+0.1	+0.3
	0.0	+0.5	+0.1	+0.5	+0.5	+0.5	—0.2	+0.2	0.0	—0.3	—0.3	—0.1	+0.1
Fort Kennedy. $\phi=72°.0$	0.0	+0.3	+0.4	+0.4	+0.7	+0.7	+0.4	+0.3	+0.2	+0.1	0.0	—0.1	+0.3
	+0.1	+0.2	—0.1	—0.2	0.0	0.0	+0.2	+0.2	+0.2	0.0	—0.2	—0.1	0.0
Sitka (13 yrs.). $\phi=57°.1$	+0.23	+0.14	+0.11	+0.44	+0.72	+0.69	+0.69	+0.40	+0.27	+0.27	+0.21	+0.12	+0.36
	+0.06	—0.13	—0.33	—0.12	+0.07	+0.12	+0.12	—0.13	—0.16	—0.04	+0.03	—0.01	—0.04
Thunder Bay Isl. $\phi=45°.0$	+0.5	+0.6	+0.5	+0.6	+0.6	+0.9	+0.9	+0.7	+0.3	+0.4	+0.3	+0.3	+0.52
	+0.4	+0.3	+0.1	+0.2	+0.1	+0.2	+0.3	+0.1	—0.1	0.0	+0.2	+0.2	+0.15
Toronto. $\phi=43°.6$	+0.42	+0.03	+0.12	+0.38	+0.81	+0.72	+1.01	+0.48	+0.37	+0.32	+0.29	+0.19	+0.44
	+0.28	—0.13	—0.19	—0.17	+0.04	—0.07	—0.02	—0.35	—0.12	—0.08	+0.10	+0.10	—0.05
Mohawk. $\phi=43°.0$	+0.28	+0.33	+0.14	+0.13	+0.28	+0.50	+0.29	+0.19	+0.15	+0.21	+0.09	+0.29	+0.24
	+0.14	+0.29	+0.16	+0.09	+0.14	+0.24	—0.05	—0.07	—0.10	+0.05	—0.05	+0.18	+0.08
Amherst. $\phi=42°.4$	+0.52	+0.33	+0.62	+0.89	+0.96	+0.93	+0.87	+0.59	+0.78	+0.52	+0.31	+0.55	+0.65
	+0.01	+0.18	0.00	+0.23	+0.30	+0.20	—0.11	+0.04	+0.07	+0.12	+0.03	+0.24	+0.11
New Haven. $\phi=41°.3$	+0.28	+0.21	+0.30	+0.36	+0.88	+1.11	+0.83	+0.64	+0.53	+0.45	+0.34	+0.37	+0.53
	—0.06	—0.15	—0.19	—0.23	+0.10	+0.38	+0.21	+0.07	—0.02	—0.03	+0.01	+0.02	+0.01
Frankford Arsen'l $\phi=40°.0$	+0.29	+0.39	+0.37	+0.30	+0.79	+1.00	+1.02	+0.78	+0.65	+0.75	+0.34	+0.52	+0.59
	—0.21	—0.08	—0.07	—0.25	+0.14	+0.09	+0.11	—0.14	—0.35	—0.09	—0.32	—0.01	—0.11
Philadelphia. $\phi=40°.0$	+0.28	+0.22	+0.03	+0.59	+0.67	+0.85	+0.68	+0.53	+0.40	+0.39	+0.28	+0.37	+0.44
	+0.17	+0.09	—0.24	+0.23	+0.20	+0.25	+0.15	+0.04	—0.19	—0.03	+0.02	+0.27	+0.08
Fort Morgan. $\phi=30°.2$	0.0	0.0	—0.1	+0.6	+0.5	+0.3	+0.5	+0.2	+0.2	+0.3	+0.1	+0.1	+0.3
	0.0	—0.1	0.0	+0.4	+0.4	0.0	+0.2	—0.2	+0.1	+0.3	+0.1	+0.1	+0.1
Key West. $\phi=24°.6$	—0.02	—0.21	—0.02	+0.09	+0.24	—0.05	+0.21	+0.09	+0.09	+0.10	—0.09	—0.28	+0.01
	—0.16	—0.28	—0.29	—0.17	—0.15	—0.40	—0.11	—0.08	—0.07	—0.06	—0.17	—0.29	—0.19

With the exception of Key West, where the proximity of the gulf stream produces an anomaly, the combination $\frac{1}{4}$ (7, 2, 9 (*bis*)) is superior to the simple mean for the three hours, and, in general, the results at the different stations are sufficiently accordant to permit monthly average values of differences to be taken; omitting, therefore, the first three stations and the last station, we find the following mean values applicable to most localities in the United States between latitudes 30° and 45° and east of the Mississippi.

Table of average differences, in temperature, of the mean derived from the observations at 7, 2, 9, also as deduced from 7, 2, 9 (*bis*), from the true daily mean; + in excess, — in defect of the true value. Expressed in degrees of the Fahrenheit scale.

Combination.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Hours: 7, 2, 9	+0.32	+0.26	+0.25	+0.48	+0.69	+0.79	+0.76	+0.68	+0.42	+0.42	+0.26	+0.34	+0.47
7, 2, 9 (bis)	+0.09	+0.06	—0.05	+0.06	+0.18	+0.16	+0.10	—0.06	—0.09	+0.03	+0.01	+0.14	+0.05

In order to make use of the values of this table, *as corrections* to means derived from observations at these hours, the *sign is to be reversed.*

The above tabular values are derived from more than 22 years of hourly observations made at eight stations. The assumption that the average of *hourly* observations equals the daily average, is so nearly correct as to require no further consideration; thus at Thunder Bay Island, Mich., the mean of 24 observations taken at the full hours is 42°.84, the mean of 24 observations taken at the intermediate half hours is 42°.83, which is also the mean of the 48 semi-hourly observations.

Times of Sunrise and Sunset in different Latitudes and for every tenth day in each month.—We meet frequently, particularly in the older meteorological observations, with records taken at the times of sunrise and sunset; this practice, now generally superseded by better selected fixed epochs, still obliges us to resort to tables of times of sunrise and sunset, with the day of the month and the latitude as arguments, whenever we aim at a careful reduction of the recorded temperatures.

In computing such a table for various latitudes and to answer for any year, the deduced times can only be more or less close approximations on account of the small variations, in different years, in the sun's declination, in its distance, and in the equation of time, on the same nominal day. Fortunately a few minutes of error with a tendency to cancel itself for long series, are of little moment in the meteorological record. The tabular quantities will generally be found correct within 2 or 3 minutes, excepting in the higher latitudes, where this limit may occasionally be slightly exceeded.

The times were computed by the formulæ

$$\cos t = \frac{\cos \zeta - \sin \phi \sin \delta}{\cos \phi \cos \delta} \quad \text{and} \quad \zeta = 90° + r - \pi + s + d = 90°51' \text{nearly.}$$

where ϕ = latitude,	r = refraction in horizon,
δ = sun's declination,	s = sun's semidiameter,
ζ = sun's zenith distance,	π = sun's horizontal parallax,
t = hour angle,	d = dip of horizon.

The apparent time was changed to mean time by application of the equation of time (E).

The value of δ may vary in different years, for the same nominal day, by $\pm 9'$ nearly, from its average amount; the value of s hardly varies as much as $\pm 0'.5$; the variations in E for the same nominal day amount to less than $\pm \frac{1}{4}$ of a minute, and the maximum half-daily change is of the same amount. The use of the value of δ for the meridian of Washington instead of any other meridian within the limits of the United States, cannot occasion an error as great as that previously noted for δ. The changes in the horizontal refraction due to extremes of temperature (and atmospheric pressure) may amount, at most, to about $\pm 8'$ from the mean state, assumed at 35′ (temp. 50° Fah.; pressure 30 inch.). The value of ζ was taken as constant, δ was taken from the ephemeris for the times of sunrise and set for those parts of the year where the use of the meridional value would introduce a notable defect. Both, δ and E, refer to average years.

15 February, 1875.

Time of Sunrise.

Latitude.

Date.	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°
Jan. 1	$6^h 42^m$	$6^h 44^m$	$6^h 46^m$	$6^h 48^m$	$6^h 50^m$	$6^h 52^m$	$6^h 54^m$	$6^h 56^m$	$6^h 58^m$	$7^h 00^m$	$7^h 03^m$	$7^h 05^m$	$7^h 08^m$
11	6 43	6 45	6 47	6 49	6 51	6 53	6 55	6 57	6 59	7 01	7 04	7 09	7 08
21	6 44	6 45	6 47	6 49	6 50	6 52	6 54	6 56	6 58	7 00	7 01	7 03	7 05
Feb. 1	6 40	6 41	6 43	6 44	6 46	6 47	6 48	6 50	6 52	6 54	6 56	6 57	6 59
11	6 35	6 36	6 38	6 39	6 40	6 41	6 42	6 44	6 45	6 47	6 49	6 50	6 51
21	6 28	6 29	6 30	6 31	6 32	6 33	6 33	6 34	6 35	6 36	6 37	6 39	6 40
Mar. 1	6 22	6 22	6 23	6 24	6 25	6 25	6 26	6 27	6 28	6 28	6 29	6 29	6 30
11	6 12	6 12	6 12	6 13	6 13	6 13	6 13	6 14	6 14	6 15	6 15	6 16	6 16
21	6 02	6 02	6 02	6 02	6 02	6 02	6 02	6 02	6 02	6 02	6 01	6 01	6 01
Apr. 1	5 53	5 53	5 52	5 52	5 51	5 51	5 50	5 49	5 49	5 48	5 48	5 47	5 47
11	5 44	5 43	5 42	5 41	5 40	5 39	5 38	5 37	5 36	5 35	5 35	5 34	5 33
21	5 35	5 34	5 33	5 32	5 30	5 29	5 28	5 27	5 26	5 24	5 23	5 22	5 21
May 1	5 27	5 25	5 24	5 23	5 21	5 20	5 19	5 17	5 15	5 13	5 12	5 11	5 09
11	5 21	5 19	5 17	5 15	5 14	5 12	5 10	5 09	5 07	5 05	5 03	5 01	4 59
21	5 16	5 14	5 12	5 10	5 08	5 07	5 05	5 03	5 00	4 58	4 55	4 53	4 52
June 1	5 13	5 11	5 09	5 07	5 05	5 03	5 01	4 58	4 55	4 53	4 50	4 48	4 46
11	5 13	5 11	5 09	5 07	5 05	5 03	5 01	4 58	4 55	4 52	4 49	4 47	4 44
21	5 14	5 12	5 10	5 07	5 05	5 03	5 01	4 59	4 56	4 54	4 51	4 48	4 45
July 1	5 17	5 15	5 13	5 11	5 09	5 07	5 05	5 02	4 59	4 56	4 54	4 51	4 48
11	5 21	5 19	5 17	5 15	5 13	5 11	5 09	5 06	5 04	5 02	4 59	4 57	4 54
21	5 25	5 23	5 21	5 19	5 18	5 16	5 14	5 12	5 10	5 07	5 05	5 02	5 00
Aug. 1	5 30	5 28	5 26	5 25	5 24	5 22	5 20	5 18	5 16	5 14	5 12	5 11	5 09
11	5 34	5 32	5 31	5 30	5 29	5 27	5 26	5 25	5 23	5 21	5 19	5 17	5 16
21	5 38	5 37	5 36	5 35	5 34	5 32	5 31	5 30	5 29	5 28	5 27	5 25	5 24
Sept. 1	5 42	5 42	5 41	5 40	5 39	5 38	5 37	5 36	5 35	5 34	5 33	5 32	5 32
11	5 46	5 45	5 45	5 44	5 44	5 43	5 42	5 42	5 42	5 41	5 41	5 40	5 40
21	5 48	5 48	5 48	5 48	5 48	5 48	5 47	5 47	5 47	5 47	5 47	5 47	5 47
Oct. 1	5 52	5 52	5 52	5 53	5 53	5 53	5 53	5 54	5 54	5 54	5 55	5 55	5 55
11	5 55	5 55	5 56	5 57	5 58	5 58	5 59	6 00	6 01	6 01	6 02	6 02	6 03
21	6 00	6 01	6 02	6 03	6 03	6 04	6 05	6 06	6 08	6 09	6 10	6 11	6 12
Nov. 1	6 05	6 06	6 08	6 09	6 10	6 11	6 12	6 14	6 16	6 17	6 19	6 21	6 22
11	6 11	6 12	6 14	6 15	6 17	6 18	6 20	6 22	6 23	6 25	6 27	6 29	6 31
21	6 17	6 19	6 21	6 23	6 24	6 26	6 28	6 30	6 32	6 34	6 36	6 38	6 40
Dec. 1	6 24	6 26	6 28	6 30	6 32	6 34	6 36	6 38	6 40	6 43	6 45	6 47	6 50
11	6 32	6 34	6 36	6 38	6 40	6 42	6 44	6 46	6 49	6 51	6 53	6 56	6 59
21	6 37	6 39	6 41	6 43	6 46	6 48	6 50	6 53	6 55	6 58	7 01	7 03	7 05

Time of Sunrise.—Continued.

Latitude.

Date.	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°
Jan. 1..........	7^h 10^m	7^h 13^m	7^h 16^m	7^h 19^m	7^h 22^m	7^h 25^m	7^h 29^m	7^h 32^m	7^h 35^m	7^h 39^m	7^h 43^m	7^h 47^m	7^h 51^m
11..........	7 10	7 13	7 16	7 18	7 21	7 24	7 27	7 30	7 33	7 36	7 40	7 43	7 47
21..........	7 07	7 10	7 12	7 15	7 18	7 20	7 23	7 25	7 28	7 31	7 34	7 37	7 41
Feb. 1..........	7 01	7 03	7 05	7 07	7 09	7 11	7 13	7 15	7 18	7 20	7 23	7 25	7 28
11..........	6 52	6 54	6 55	6 57	6 58	7 00	7 01	7 03	7 05	7 07	7 09	7 12	7 14
21..........	6 41	6 43	6 44	6 45	6 46	6 47	6 49	6 50	6 51	6 52	6 53	6 55	6 57
Mar. 1..........	6 31	6 32	6 33	6 33	6 34	6 35	6 36	6 37	6 38	6 39	6 40	6 41	6 42
11..........	6 16	6 16	6 17	6 17	6 17	6 17	6 18	6 18	6 19	6 19	6 20	6 20	6 21
21..........	6 01	6 01	6 01	6 01	6 01	6 01	6 01	6 00	6 00	6 00	6 00	6 00	6 00
Apr. 1..........	5 46	5 46	5 45	5 45	5 44	5 44	5 43	5 43	5 42	5 41	5 41	5 40	5 39
11..........	5 33	5 32	5 31	5 30	5 29	5 28	5 26	5 25	5 24	5 23	5 22	5 21	5 19
21..........	5 20	5 19	5 17	5 16	5 14	5 13	5 11	5 10	5 08	5 06	5 04	5 02	5 00
May 1..........	5 07	5 05	5 03	5 01	5 00	4 58	4 56	4 54	4 51	4 49	4 46	4 44	4 41
11..........	4 57	4 55	4 52	4 50	4 48	4 45	4 43	4 41	4 38	4 36	4 33	4 30	4 27
21..........	4 49	4 47	4 44	4 42	4 39	4 36	4 33	4 30	4 27	4 24	4 20	4 17	4 13
June 1..........	4 43	4 40	4 38	4 35	4 32	4 29	4 25	4 22	4 18	4 15	4 11	4 07	4 03
11..........	4 41	4 38	4 35	4 33	4 30	4 27	4 23	4 19	4 15	4 12	4 08	4 03	3 59
21..........	4 42	4 39	4 36	4 33	4 30	4 27	4 23	4 19	4 15	4 12	4 08	4 03	3 58
July 1..........	4 45	4 42	4 39	4 36	4 34	4 31	4 27	4 23	4 19	4 16	4 12	4 08	4 04
11..........	4 51	4 48	4 45	4 42	4 40	4 37	4 34	4 30	4 27	4 23	4 19	4 15	4 11
21..........	4 58	4 55	4 53	4 50	4 48	4 45	4 42	4 39	4 36	4 33	4 29	4 25	4 22
Aug. 1..........	5 06	5 04	5 02	5 00	4 58	4 55	4 52	4 50	4 47	4 45	4 42	4 39	4 36
11..........	5 14	5 12	5 10	5 09	5 07	5 04	5 02	5 00	4 57	4 55	4 53	4 50	4 47
21..........	5 23	5 22	5 20	5 19	5 17	5 15	5 13	5 12	5 10	5 08	5 06	5 04	5 02
Sept. 1..........	5 31	5 30	5 29	5 28	5 27	5 26	5 25	5 24	5 23	5 22	5 21	5 20	5 18
11..........	5 39	5 39	5 38	5 37	5 37	5 36	5 35	5 35	5 34	5 34	5 33	5 32	5 31
21..........	5 47	5 47	5 46	5 46	5 46	5 46	5 45	5 45	5 45	5 45	5 45	5 44	5 44
Oct. 1..........	5 55	5 56	5 56	5 57	5 57	5 57	5 58	5 58	5 59	5 59	5 59	5 59	6 00
11..........	6 03	6 04	6 05	6 06	6 07	6 07	6 08	6 09	6 10	6 11	6 12	6 13	6 14
21..........	6 13	6 15	6 16	6 17	6 18	6 20	6 21	6 22	6 23	6 24	6 25	6 27	6 28
Nov. 1..........	6 24	6 25	6 26	6 28	6 29	6 31	6 33	6 35	6 37	6 39	6 41	6 43	6 45
11..........	6 33	6 35	6 37	6 39	6 41	6 43	6 45	6 48	6 50	6 52	6 55	6 58	7 01
21..........	6 42	6 45	6 47	6 50	6 52	6 55	6 57	7 00	7 03	7 06	7 10	7 13	7 17
Dec. 1..........	6 52	6 55	6 57	7 00	7 02	7 05	7 08	7 12	7 15	7 18	7 22	7 25	7 29
11..........	7 01	7 04	7 07	7 09	7 12	7 15	7 18	7 22	7 25	7 29	7 33	7 37	7 41
21..........	7 08	7 1[illegible]	7 13	7 16	7 19	7 23	7 26	7 30	7 33	7 36	7 40	7 44	7 48

Time of Sunrise.—Continued.

Latitude.

Date.	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
Jan. 1	$7^h 55^m$	$8^h 00^m$	$8^h 05^m$	$8^h 10^m$	$8^h 15^m$	$8^h 20^m$	$8^h 25^m$	$8^h 31^m$	$8^h 38^m$	$8^h 46^m$	$8^h 54^m$	$9^h 03^m$
11	7 51	7 55	8 00	8 04	8 09	8 14	8 19	8 25	8 31	8 38	8 45	8 53
21	7 44	7 48	7 52	7 56	8 00	8 04	8 09	8 14	8 20	8 26	8 32	8 38
Feb. 1	7 31	7 34	7 38	7 41	7 45	7 48	7 51	7 55	7 59	8 04	8 09	8 14
11	7 16	7 19	7 21	7 24	7 26	7 29	7 32	7 35	7 39	7 42	7 45	7 49
21	6 58	7 00	7 01	7 03	7 04	7 06	7 08	7 10	7 13	7 16	7 19	7 22
Mar. 1	6 43	6 44	6 45	6 46	6 47	6 49	6 50	6 51	6 53	6 55	6 57	6 59
11	6 21	6 22	6 22	6 23	6 24	6 25	6 25	6 26	6 26	6 27	6 27	6 28
21	6 00	6 00	6 00	6 00	5 59	5 59	5 59	5 59	5 59	5 59	5 59	5 59
Apr. 1	5 38	5 37	5 36	5 35	5 34	5 33	5 32	5 31	5 29	5 28	5 27	5 25
11	5 18	5 16	5 15	5 13	5 11	5 09	5 07	5 05	5 03	5 01	4 58	4 55
21	4 57	4 55	4 53	4 50	4 48	4 46	4 43	4 40	4 36	4 33	4 30	4 26
May 1	4 39	4 36	4 33	4 30	4 27	4 23	4 20	4 16	4 12	4 07	4 03	3 58
11	4 24	4 20	4 16	4 12	4 08	4 04	3 59	3 54	3 48	3 43	3 38	3 32
21	4 10	4 06	4 01	3 56	3 52	3 47	3 42	3 36	3 30	3 23	3 16	3 08
June 1	3 59	3 55	3 50	3 45	3 40	3 34	3 28	3 21	3 14	3 06	2 57	2 47
11	3 55	3 50	3 44	3 38	3 32	3 26	3 20	3 13	3 05	2 56	2 47	2 37
21	3 54	3 49	3 43	3 37	3 31	3 25	3 19	3 12	3 04	2 55	2 45	2 34
July 1	3 59	3 54	3 48	3 42	3 36	3 30	3 24	3 17	3 09	3 00	2 50	2 40
11	4 07	4 03	3 58	3 53	3 47	3 42	3 36	3 29	3 22	3 14	3 05	2 55
21	4 18	4 14	4 09	4 04	3 59	3 54	3 49	3 43	3 37	3 30	3 23	3 15
Aug. 1	4 32	4 28	4 24	4 20	4 16	4 12	4 08	4 03	3 58	3 52	3 46	3 40
11	4 45	4 43	4 40	4 36	4 33	4 29	4 25	4 21	4 17	4 12	4 08	4 03
21	5 00	4 58	4 55	4 53	4 50	4 48	4 45	4 42	4 39	4 35	4 32	4 28
Sept. 1	5 17	5 15	5 13	5 11	5 09	5 08	5 06	5 04	5 02	4 59	4 57	4 54
11	5 31	5 30	5 29	5 28	5 26	5 25	5 24	5 23	5 22	5 20	5 19	5 17
21	5 44	5 44	5 44	5 44	5 43	5 43	5 43	5 43	5 43	5 43	5 42	5 42
Oct. 1	6 00	6 00	6 01	6 01	6 02	6 02	6 02	6 03	6 03	6 04	6 04	6 05
11	6 15	6 16	6 17	6 18	6 19	6 20	6 22	6 23	6 25	6 26	6 28	6 30
21	6 30	6 32	6 34	6 36	6 38	6 40	6 42	6 44	6 46	6 49	6 52	6 55
Nov. 1	6 47	6 50	6 53	6 55	6 58	7 01	7 04	7 07	7 11	7 15	7 19	7 23
11	7 04	7 07	7 10	7 14	7 17	7 20	7 24	7 28	7 33	7 38	7 43	7 48
21	7 20	7 24	7 28	7 32	7 36	7 40	7 45	7 50	7 56	8 02	8 08	8 14
Dec. 1	7 32	7 36	7 41	7 46	7 51	7 56	8 01	8 07	8 13	8 20	8 27	8 35
11	7 45	7 49	7 54	7 59	8 04	8 09	8 15	8 22	8 29	8 37	8 45	8 53
21	7 52	7 57	8 02	8 08	8 13	8 19	8 24	8 30	8 37	8 45	8 54	9 03

Time of Sunset.

Latitude.

Date.	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°
Jan. 1	5h 26m	5h 24m	5h 22m	5h 20m	5h 18m	5h 16m	5h 14m	5h 12m	5h 09m	5h 07m	5h 05m	5h 02m	5h 00m
11	5 34	5 32	5 30	5 28	5 26	5 24	5 22	5 20	5 18	5 16	5 14	5 11	5 09
21	5 40	5 39	5 37	5 35	5 34	5 32	5 30	5 28	5 26	5 24	5 22	5 20	5 19
Feb. 1	5 48	5 47	5 45	5 43	5 42	5 40	5 39	5 38	5 36	5 34	5 32	5 30	5 29
11	5 55	5 54	5 52	5 51	5 50	5 48	5 47	5 46	5 45	5 43	5 42	5 40	5 39
21	6 00	5 59	5 58	5 57	5 56	5 55	5 54	5 54	5 53	5 52	5 51	5 49	5 48
Mar. 1	6 04	6 03	6 03	6 02	6 02	6 02	6 01	6 00	6 00	5 59	5 58	5 57	5 56
11	6 08	6 08	6 08	6 07	6 07	6 07	6 06	6 06	6 05	6 05	6 04	6 04	6 04
21	6 12	6 12	6 12	6 12	6 12	6 12	6 12	6 12	6 12	6 12	6 13	6 13	6 13
Apr. 1	6 15	6 16	6 17	6 18	6 18	6 18	6 19	6 19	6 20	6 21	6 21	6 22	6 22
11	6 19	6 20	6 21	6 21	6 22	6 23	6 24	6 25	6 25	6 26	6 27	6 28	6 29
21	6 24	6 25	6 26	6 27	6 28	6 29	6 30	6 31	6 33	6 34	6 35	6 37	6 38
May 1	6 28	6 30	6 31	6 32	6 33	6 35	6 36	6 38	6 39	6 41	6 43	6 44	6 46
11	6 32	6 34	6 35	6 36	6 38	6 40	6 42	6 44	6 46	6 48	6 50	6 52	6 53
21	6 36	6 38	6 40	6 42	6 44	6 46	6 48	6 50	6 52	6 55	6 57	6 59	7 01
June 1	6 41	6 43	6 45	6 47	6 49	6 51	6 54	6 56	6 58	7 01	7 03	7 06	7 08
11	6 45	6 47	6 49	6 51	6 53	6 55	6 58	7 00	7 02	7 05	7 08	7 11	7 14
21	6 48	6 50	6 52	6 54	6 57	6 59	7 01	7 03	7 05	7 08	7 11	7 14	7 17
July 1	6 49	6 51	6 53	6 55	6 57	6 59	7 02	7 04	7 06	7 09	7 12	7 15	7 18
11	6 49	6 51	6 53	6 55	6 57	6 59	7 02	7 04	7 07	7 09	7 12	7 14	7 16
21	6 47	6 48	6 50	6 52	6 54	6 56	6 58	7 00	7 03	7 05	7 08	7 10	7 12
Aug. 1	6 41	6 43	6 45	6 46	6 48	6 50	6 51	6 53	6 55	6 57	6 59	7 01	7 03
11	6 36	6 37	6 38	6 39	6 41	6 42	6 43	6 45	6 47	6 48	6 50	6 52	6 54
21	6 28	6 29	6 30	6 31	6 32	6 33	6 34	6 36	6 37	6 39	6 40	6 41	6 42
Sept. 1	6 18	6 19	6 20	6 20	6 21	6 22	6 23	6 24	6 24	6 25	6 26	6 27	6 28
11	6 08	6 09	6 09	6 10	6 10	6 10	6 11	6 12	6 12	6 13	6 13	6 14	6 14
21	5 58	5 58	5 58	5 58	5 58	5 58	5 59	5 59	5 59	5 59	5 59	5 59	5 59
Oct. 1	5 48	5 48	5 48	5 47	5 47	5 47	5 46	5 46	5 46	5 46	5 45	5 45	5 45
11	5 39	5 38	5 37	5 37	5 36	5 35	5 35	5 34	5 34	5 33	5 32	5 32	5 31
21	5 30	5 29	5 28	5 28	5 27	5 26	5 25	5 24	5 22	5 21	5 20	5 19	5 18
Nov. 1	5 23	5 22	5 20	5 19	5 18	5 16	5 15	5 14	5 12	5 11	5 09	5 08	5 06
11	5 17	5 16	5 14	5 12	5 11	5 09	5 08	5 06	5 04	5 02	5 00	4 58	4 57
21	5 15	5 14	5 12	5 10	5 08	5 06	5 04	5 02	5 00	4 58	4 56	4 54	4 52
Dec. 1	5 14	5 12	5 10	5 08	5 06	5 04	5 02	5 00	4 58	4 55	4 53	4 50	4 48
11	5 16	5 14	5 12	5 10	5 08	5 06	5 04	5 02	5 00	4 57	4 54	4 51	4 49
21	5 21	5 19	5 16	5 14	5 12	5 10	5 07	5 05	5 03	5 00	4 58	4 55	4 53

Time of Sunset.—Continued.

Latitude.

Date.	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°
Jan. 1	4h 57m	4h 54m	4h 51m	4h 48m	4h 46m	4h 43m	4h 40m	4h 36m	4h 33m	4h 29m	4h 25m	4h 21m	4h 17m
11	5 06	5 04	5 01	4 59	4 56	4 53	4 50	4 47	4 44	4 41	4 37	4 34	4 30
21	5 16	5 14	5 11	5 08	5 06	5 03	5 01	4 58	4 56	4 53	4 50	4 47	4 43
Feb. 1	5 27	5 25	5 23	5 21	5 19	5 16	5 14	5 12	5 10	5 08	5 05	5 03	5 00
11	5 39	5 37	5 35	5 33	5 32	5 31	5 29	5 27	5 25	5 23	5 21	5 18	5 16
21	5 47	5 46	5 45	5 44	5 43	5 41	5 40	5 39	5 37	5 36	5 35	5 34	5 33
Mar. 1	5 56	5 55	5 55	5 54	5 53	5 52	5 51	5 50	5 49	5 48	5 47	5 46	5 45
11	6 04	6 03	6 03	6 03	6 03	6 02	6 02	6 02	6 01	6 01	6 01	6 00	6 00
21	6 13	6 13	6 13	6 13	6 13	6 13	6 13	6 14	6 14	6 14	6 14	6 14	6 15
Apr. 1	6 22	6 23	6 23	6 24	6 24	6 25	6 26	6 26	6 27	6 28	6 29	6 29	6 30
11	6 30	6 31	6 32	6 33	6 34	6 35	6 36	6 37	6 38	6 40	6 42	6 43	6 45
21	6 40	6 41	6 43	6 44	6 45	6 47	6 48	6 50	6 52	6 54	6 56	6 58	7 00
May 1	6 47	6 49	6 51	6 53	6 55	6 57	6 59	7 01	7 03	7 06	7 08	7 11	7 14
11	6 55	6 57	6 59	7 01	7 04	7 06	7 09	7 12	7 14	7 17	7 20	7 23	7 27
21	7 04	7 06	7 09	7 11	7 14	7 16	7 19	7 22	7 25	7 28	7 32	7 36	7 40
June 1	7 10	7 13	7 16	7 19	7 22	7 25	7 29	7 32	7 35	7 39	7 43	7 47	7 51
11	7 16	7 19	7 22	7 25	7 28	7 31	7 35	7 38	7 42	7 46	7 50	7 55	7 59
21	7 20	7 23	7 26	7 29	7 32	7 35	7 39	7 43	7 46	7 50	7 55	7 59	8 04
July 1	7 20	7 23	7 26	7 29	7 32	7 36	7 39	7 43	7 47	7 50	7 55	7 59	8 03
11	7 18	7 21	7 24	7 27	7 30	7 33	7 37	7 40	7 43	7 47	7 51	7 55	7 59
21	7 14	7 17	7 19	7 21	7 24	7 27	7 30	7 33	7 36	7 39	7 42	7 46	7 50
Aug. 1	7 05	7 07	7 09	7 12	7 14	7 17	7 19	7 22	7 24	7 27	7 30	7 33	7 36
11	6 55	6 57	6 58	7 00	7 02	7 04	7 07	7 09	7 12	7 14	7 16	7 19	7 21
21	6 43	6 44	6 46	6 47	6 49	6 50	6 52	6 54	6 55	6 57	6 59	7 01	7 03
Sept. 1	6 29	6 30	6 31	6 32	6 33	6 34	6 35	6 36	6 37	6 38	6 39	6 41	6 42
11	6 14	6 15	6 15	6 16	6 16	6 17	6 17	6 18	6 19	6 20	6 20	6 21	6 22
21	5 59	5 59	5 59	5 59	5 59	5 59	5 59	6 00	6 00	6 00	6 00	6 00	6 01
Oct. 1	5 44	5 44	5 44	5 43	5 43	5 43	5 42	5 42	5 41	5 41	5 41	5 40	5 40
11	5 30	5 29	5 29	5 28	5 27	5 27	5 26	5 25	5 24	5 23	5 22	5 21	5 20
21	5 17	5 16	5 15	5 14	5 12	5 11	5 09	5 08	5 07	5 06	5 04	5 02	5 01
Nov. 1	5 04	5 03	5 01	5 00	4 59	4 57	4 55	4 53	4 51	4 49	4 47	4 45	4 43
11	4 55	4 53	4 51	4 49	4 47	4 45	4 43	4 40	4 38	4 36	4 33	4 30	4 27
21	4 50	4 47	4 45	4 42	4 40	4 37	4 34	4 32	4 29	4 26	4 23	4 19	4 16
Dec. 1	4 45	4 43	4 41	4 38	4 36	4 33	4 30	4 27	4 24	4 20	4 16	4 13	4 09
11	4 46	4 43	4 41	4 38	4 36	4 33	4 29	4 26	4 23	4 19	4 15	4 11	4 07
21	4 50	4 47	4 44	4 42	4 39	4 36	4 32	4 29	4 26	4 22	4 18	4 14	4 10

Time of Sunset.—Continued.

Latitude.

Date.	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°
Jan. 1	4h 13m	4h 08m	4h 03m	3h 58m	3h 53m	3h 48m	3h 43m	3h 37m	3h 30m	3h 22m	3h 14m	3h 05m
11	4 26	4 22	4 17	4 12	4 08	4 03	3 58	3 52	3 46	3 39	3 32	3 24
21	4 40	4 36	4 32	4 28	4 24	4 20	4 15	4 10	4 04	3 59	3 53	3 46
Feb. 1	4 58	4 55	4 51	4 48	4 45	4 41	4 38	4 34	4 29	4 25	4 20	4 15
11	5 14	5 12	5 10	5 07	5 04	5 02	4 59	4 56	4 53	4 50	4 46	4 42
21	5 31	5 30	5 28	5 26	5 24	5 22	5 20	5 18	5 16	5 13	5 10	5 07
Mar. 1	5 44	5 43	5 41	5 39	5 38	5 37	5 36	5 35	5 34	5 32	5 30	5 28
11	5 59	5 59	5 58	5 58	5 57	5 56	5 56	5 55	5 55	5 54	5 53	5 52
21	6 15	6 15	6 15	6 15	6 15	6 16	6 16	6 16	6 16	6 17	6 17	6 17
Apr. 1	6 31	6 32	6 33	6 34	6 35	6 36	6 37	6 38	6 39	6 40	6 42	6 44
11	6 46	6 47	6 48	6 50	6 52	6 54	6 56	6 58	7 00	7 02	7 04	7 07
21	7 02	7 04	7 06	7 09	7 11	7 14	7 17	7 20	7 23	7 26	7 30	7 34
May 1	7 16	7 18	7 21	7 24	7 28	7 31	7 35	7 39	7 43	7 48	7 53	7 58
11	7 30	7 34	7 38	7 42	7 46	7 50	7 54	7 59	8 04	8 10	8 16	8 22
21	7 43	7 47	7 52	7 57	8 02	8 06	8 11	8 17	8 23	8 30	8 38	8 46
June 1	7 55	7 59	8 04	8 09	8 14	8 20	8 26	8 32	8 39	8 48	8 57	9 07
11	8 03	8 08	8 14	8 20	8 26	8 32	8 38	8 45	8 53	9 01	9 10	9 21
21	8 08	8 13	8 19	8 25	8 31	8 37	8 43	8 50	8 58	9 07	9 17	9 28
July 1	8 07	8 12	8 18	8 24	8 30	8 36	8 42	8 49	8 57	9 05	9 15	9 26
11	8 03	8 07	8 12	8 17	8 23	8 28	8 34	8 40	8 47	8 55	9 04	9 14
21	7 54	7 58	8 02	8 07	8 12	8 17	8 22	8 28	8 34	8 41	8 48	8 56
Aug. 1	7 39	7 43	7 47	7 51	7 55	7 59	8 03	8 08	8 13	8 19	8 25	8 31
11	7 24	7 26	7 29	7 33	7 36	7 40	7 43	7 47	7 51	7 55	7 59	8 04
21	7 05	7 07	7 09	7 12	7 14	7 17	7 20	7 23	7 27	7 30	7 33	7 37
Sept. 1	6 44	6 45	6 46	6 48	6 49	6 51	6 53	6 55	6 57	7 00	7 02	7 05
11	6 22	6 23	6 23	6 24	6 25	6 26	6 27	6 28	6 29	6 31	6 33	6 35
21	6 01	6 01	6 01	6 01	6 01	6 02	6 02	6 02	6 02	6 03	6 03	6 03
Oct. 1	5 39	5 39	5 38	5 38	5 37	5 37	5 37	5 37	5 36	5 36	5 35	5 34
11	5 19	5 18	5 16	5 15	5 14	5 12	5 11	5 10	5 08	5 06	5 05	5 03
21	4 59	4 58	4 56	4 54	4 52	4 50	4 48	4 46	4 43	4 41	4 38	4 35
Nov. 1	4 40	4 38	4 35	4 32	4 30	4 27	4 24	4 21	4 17	4 13	4 09	4 05
11	4 24	4 21	4 18	4 14	4 10	4 07	4 04	4 00	3 56	3 51	3 46	3 40
21	4 12	4 09	4 05	4 01	3 57	3 53	3 48	3 43	3 38	3 32	3 26	3 19
Dec. 1	4 06	4 02	3 57	3 52	3 47	3 42	3 37	3 32	3 26	3 19	3 11	3 03
11	4 03	3 59	3 54	3 49	3 44	3 39	3 33	3 27	3 20	3 12	3 04	2 55
21	4 06	4 01	3 56	3 50	3 45	3 39	3 34	3 28	3 21	3 13	3 04	2 55

TABLES

OF

BI-HOURLY, HOURLY, AND SEMI-HOURLY MEAN TEMPERATURES,

FOR

EACH MONTH AND THE YEAR,

AT VARIOUS PLACES IN NORTH AMERICA.

TABLES OF MEAN TEMPERATURES AT DIFFERENT HOURS OF THE DAY, FOR EACH MONTH AND THE YEAR.

INDEX TO STATIONS.

[Arranged according to latitudes.]

HOURLY MEANS OF TEMPERATURE (Fah. scale).

Van Rensselaer Harbor, North Greenland.[1] Lat. 78° 37′. Long. 70° 53′ W. of G.

Near sea level. Dr. E. K. Kane. Sept. 1853, to Jan. 1855, inclusive.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	—28°.3	—33°.6	—38°.4	—11°.4	+10°.2	+28°.2	+36°.9	+29°.8	+10°.7	—4°.7	—22°.6	—31.°4	—4°.5
1	28.3	34.3	38.8	12.2	9.0	27.0	36.6	29.2	11.2	3.5	21.3	31.5	—4.7
2	28.5	34.3	38.6	12·2	9.3	27.1	36.7	29.5	11.3	3.5	21.3	31.3	—4.6
3	28.6	34.1	38.8	12.6	10.0	27.2	36.8	29.5	11.5	3.5	21.3	31.6	—4.6
4	28.7	33.5	39.0	12.1	10.6	27.6	36.8	29.8	11.4	3.4	21.3	31.8	—4.4
5	28.7	34.2	38.9	11.2	11.8	28.8	36.9	29.7	11.4	3.3	22.0	30.9	—4.2
6	28.7	33.6	38.7	10.6	12.7	29.5	37.6	30.3	12.0	3.3	22.2	30.8	—3.8
7	29.0	33.2	38.0	9.5	13.5	30.4	37.8	31.0	13.0	3.2	22.0	31.0	—3.3
8	28.5	32.9	37.6	8.4	14.4	31.6	38.4	31.9	14.4	3.2	22.2	31.0	—2.7
9	28.6	32.6	36.3	6.8	14.4	30.8	39.4	33.0	15.2	2.9	22.0	30.7	—2.2
10	28.3	32.1	35.7	6.1	15.1	31.0	39.6	33.9	15.8	2.7	22.1	30.6	—1.8
11	27.8	32.4	34.5	5.1	15.3	31.4	40.0	34.0	16.2	2.8	21.6	30.5	—1.5
Noon	27.3	31.8	34.0	4.5	15.9	32.2	40.0	34.2	16.4	3.0	21.4	30.0	—1.1
1	27.5	31.3	33.6	4.0	16.1	32.3	39.8	34.2	16.5	3.0	21.7	30.1	—1.0
2	27.6	31.3	33.2	3.2	16.4	32.2	39.7	34.2	16.1	3.2	21.8	30.4	—1.0
3	28.1	31.4	33.8	3.1	16.5	31.9	39.7	33.8	15.6	3.1	21.8	30.8	—1.2
4	28.3	31.5	34.9	3.4	16.7	31.6	39.6	33.3	15.0	3.3	21.9	31.1	—1.5
5	28.0	31.8	35.6	3.5	16.2	31.4	38.9	33.0	14.4	3.5	21.8	31.2	—1.8
6	28.0	31.7	36.2	4.4	15.3	31.2	38.5	32.5	13.9	3.9	22.0	31.3	—2.1
7	27.9	31.6	36.7	5.8	14.5	30.8	38.2	32.1	13.1	4.5	22.2	31.9	—2.6
8	28.1	31.8	37.6	6.7	13.6	30.6	37.7	31.7	12.6	4.6	22.3	31.8	—3.0
9	28.1	32.2	37.7	8.1	12.8	29.9	37.2	31.5	12.2	4.6	22.8	31.7	—3.4
10	28.0	33.3	38.0	9.6	11.7	29.5	36.7	30.8	11.8	4.6	22.5	31.7	—3.9
11	—28.6	—33.3	—38.2	—10.3	+10.7	+28.6	+36.8	+30.4	+11.1	—4.6	—22.7	—31.6	—4.3
Mean	—28.2	—32.7	—36.8	— 7.7	+13.4	+30.1	+38.2	+31.8	+13.4	—3.6	—22.0	—31.1	—2.9

BI-HOURLY MEANS OF TEMPERATURE.

Port Foulke, North Greenland.[2] Lat. 78° 18′. Long. 73° 00′ W. of G.

Near sea level. Dr. I. I. Hayes. Sept. 1860, to July, 1861, inclusive.

Mdn't	—26.2	—25.8	—24.8	—13.5	+21.1	+33.0	+39.4	[3] +30.4	+21.5	+6.9	+2.5	—12.1	+4.37
2	—26.6	—27.0	—25.3	—14.0	+20.0	+32.2	+39.5	+30.7	+22.0	+6.7	+2.1	—11.4	+4.08
4	—26.2	—27.2	—26.0	—14.4	+21.9	+33.7	+39.8	+31.0	+22.3	+6.8	+2.0	—12.7	+4.24
6	—26.7	—26.0	—25.4	—13.1	+23.1	+34.6	+40.2	+31.3	+22.4	+6.6	+2.9	—12.9	+4.75
8	—25.7	—24.2	—23.1	—11.5	+25.4	+35.1	+41.7	+32.2	+22.6	+7.1	+2.8	—13.3	+5.73
10	—25.4	—24.2	—22.4	—10.9	+26.2	+36.3	+42.5	+32.6	+22.7	+7.8	+3.0	—12.7	+6.29
Noon	—25.2	—24.0	—20.7	— 9.6	+26.7	+36.8	+42.3	+32.7	+23.2	+8.5	+3.2	—12.6	+6.78
2	—25.9	—23.0	—17.0	— 8.7	+26.4	+37.4	+43.7	+33.6	+23.5	+8.8	+3.3	—12.5	+7.46
4	—26.2	—24.1	—18.5	— 9.7	+26.1	+36.9	+43.4	+33.4	+23.4	+8.7	+3.6	—11.6	+7.12
6	—26.2	—24.5	—20.8	—10.8	+25.8	+36.3	+42.4	+32.6	+22.8	+8.3	+3.9	—12.8	+6.42
8	—25.9	—24.7	—21.9	—11.4	+23.9	+35.3	+41.6	+32.1	+22.6	+8.1	+3.5	—12.7	+5.88
10	—26.3	—24.6	—23.3	—13.0	+22.3	+33.9	+41.3	+31.8	+22.3	+7.2	+3.4	—13.4	+5.13
Mean	—26.05	—24.95	—22.44	—11.72	+24.08	+35.13	+41.49	+32.04	+22.59	+7.62	+3.01	—12.56	+5.69

N. B. The above numbers are corrected for error of scale of thermometers, but are not changed for the effect of the annual fluctuation, which in Feb. is zero and in May 0.4 (its maximum amount) at midnight; see table on p. 183 of Sm. Cont's, No. 196.

[1] Smithsonian Contributions to Knowledge; Washington, 1859.

[2] Smithsonian Contributions to Knowledge, No. 196; Washington, 1867.

[3] The August values are interpolated, means of July and Sept. values.

BI-HOURLY MEANS OF TEMPERATURE.

Port Kennedy, North Somerset.[1] Lat. 72° 01′. Long. 94° 14′ W. of G.

Near sea level. Sir F. L. McClintock. Aug. 1858, to Aug. 1859, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	—34°.6	—37°.6	—21°.1	—6°.1	+11°.4	+31°.1	+37°.0	+35°.9	+24°.7	+6°.4	—13°.0	—34°.0	0°.00
2	—34.6	—37.7	—21.5	—5.7	11.0	30.2	36.5	35.6	24.5	6.9	—12.0	—33.2	0.00
4	—35.1	—37.3	—21.5	—4.7	13.3	33.3	37.2	35.6	24.2	7.4	—11.6	—33.1	+0.64
6	—34.8	—37.3	—22.0	—4.1	14.3	35.0	39.2	36.0	24.1	7.0	—11.0	—33.3	+1.09
8	—34.8	—37.0	—19.9	—2.6	16.5	38.1	41.3	36.8	24.7	7.2	—10.8	—34.0	+2.12
10	—34.4	—36.9	—15.2	—0.6	17.6	39.8	42.9	37.6	25.5	8.1	—10.5	—33.4	+3.37
Noon	—34.1	—36.3	—12.4	+1.0	18.8	39.8	43.5	38.1	26.5	8.9	—10.7	—33.5	+4.13
2	—34.4	—36.3	—12.5	+1.4	19.0	38.5	42.3	38.2	27.0	8.4	—11.5	—33.4	+3.89
4	—34.1	—36.8	—14.2	+0.3	18.2	36.9	42.0	38.0	26.8	7.4	—12.0	—33.8	+3.22
6	—33.7	—37.3	—18.9	—2.2	16.5	35.4	41.1	37.7	26.4	7.2	—12.3	—33.9	+2.18
8	—33.9	—37.1	—19.7	—4.4	14.3	33.9	40.0	37.2	25.6	7.1	—12.6	—34.0	+1.37
10	—33.9	—37.0	—20.0	—5.8	+12.6	+32.0	+38.6	+36.7	+25.4	+7.0	—12.7	—34.1	+0.73
Mean	—34.4	—37.1	—18.2	—2.8	+15.3	+35.3	+40.1	+36.9	+25.4	+7.4	—11.7	—33.6	+1.89

Means corrected for error of scale.

HOURLY MEANS BETWEEN 4 A. M. AND 10 P. M.

Sitka, Alaska Ter'y. Lat. 57° 03′. Long. 135° 20′ W. of G.

Alt. 20 ft. 1857 to 1864, inclusive. Magnetical and meteorological observatory at Japonski Island.

(Annales de l'observatoire, physique central de Russie.)

Mdn't	..	..	..	..	..	..	..	..	..	..	..	..	[39.80]
1	..	..	..	..	..	..	..	..	..	..	..	..	[39.57]
2	..	..	..	..	..	..	..	..	..	..	..	..	[39.40]
3	..	..	..	..	..	..	..	..	..	..	..	..	[39.30]
4	29.89	28.76	32.61	35.41	40.45	45.97	50.24	50.71	47.41	41.99	36.95	31.46	39.32
5	29.93	28.69	32.35	35.67	41.04	47.03	50.97	50.97	47.54	42.08	36.88	31.30	39.54
6	29.95	28.58	32.35	36.31	42.61	48.69	52.15	51.51	47.75	42.12	36.63	31.32	40.00
7	29.89	28.38	33.12	38.03	44.46	49.86	53.69	53.08	48.76	42.28	36.68	31.25	40.79
8	29.84	28.76	34.67	39.89	46.13	52.04	55.17	54.59	50.24	42.96	36.74	31.28	41.86
9	30.16	29.93	36.59	41.52	47.84	53.71	56.88	56.20	51.82	44.03	37.42	31.44	43.13
10	30.89	31.59	38.11	42.98	49.23	55.06	58.07	57.58	53.33	45.07	38.27	31.98	44.35
11	31.82	33.23	39.33	44.12	50.38	56.16	59.00	58.77	54.68	45.99	39.06	32.69	45.42
Noon	32.63	33.71	39.83	44.60	50.83	57.22	59.76	59.56	55.60	46.75	39.94	33.44	46.16
1	32.71	34.00	40.17	45.23	51.06	57.22	60.03	59.54	55.87	46.75	40.05	33.57	46.35
2	32.67	33.93	39.98	44.53	50.83	56.84	59.80	59.33	55.56	46.66	39.85	33.37	46.11
3	32.13	33.45	39.51	44.19	50.22	56.39	59.52	58.81	55.13	46.21	39.29	32.87	45.66
4	31.39	32.71	38.91	43.32	49.57	55.75	58.39	58.10	54.38	45.50	38.70	32.42	44.93
5	30.85	31.66	37.69	42.32	48.55	54.95	57.42	57.06	53.41	44.67	38.11	32.02	44.06
6	30.56	30.92	36.31	41.02	47.27	53.67	56.25	55.78	52.11	43.92	37.80	31.77	43.11
7	30.22	30.34	35.10	39.51	45.83	52.25	55.06	54.59	50.94	43.34	37.51	31.73	42.20
8	30.20	29.97	34.38	38.27	44.24	50.58	53.80	53.44	50.09	43.00	37.44	31.64	41.42
9	30.02	29.67	33.96	37.75	43.02	49.26	52.70	52.81	49.55	42.66	37.28	31.51	40.85
10	29.84	29.66	33.61	36.95	42.14	48.24	51.98	52.29	49.17	42.51	37.11	31.53	40.42
11	..	..	..	..	..	..	..	..	..	..	..	..	[40.08]
Means[2]	30.61	30.58	35.59	39.59	45.38	51.37	54.76	54.60	50.99	43.73	37.78	31.94	42.24

[1] Smithsonian Contributions to Knowledge, No. 146; Washington, 1862.

[2] The temperatures for the 5 hours, 11 to 3, were obtained by a graphical process, and the above means were taken from 24 values. The reckoning being in old style and easterly, *our* months begin and end 11 days earlier than those to which the above numbers correspond. The original record is given in Reaumur's scale, it is here converted in Fahrenheit's scale. Interpolated values for 4 and 5 A. M., January, 1861, —0°.63 and —0°.53 (Reaumur).

Hourly Means of Temperature.

Island of St. Helen, opposite Montreal. Lat. 45° 30′. Long. 73° 33′ W. of G.

Alt. 60 ft. J. S. McCord. Printed Report, Montreal, 1842.
Observations at the *even* hours from Aug. 1839, to July, inclusive, 1840.
" " " " *odd* " " " 1840, " " " 1841.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	7°.00	19°.56	26°.00	39°.75	52°.06	59°.13	66°.00	62°.40	53°.81	45°.48	29°.03	21°.74	40°.16
1	17.53	12.91	18.12	31.35	46.48	60.53	62.35	64.66	52.61	42.17	31.60	15.03	37.94
2	5.74	18.15	24.22	37.90	49.66	56.96	63.22	61.01	53.36	44.30	28.80	22.42	38.81
3	17.66	11.80	17.32	29.33	44.82	59.98	60.62	63.70	52.33	41.09	31.18	14.12	36.99
4	5.22	17.48	22.75	35.18	49.66	57.20	62.82	60.06	52.10	43.47	28.58	22.04	38.05
5	17.09	10.57	15.66	27.93	44.77	58.78	59.66	63.25	52.10	40.25	30.68	13.62	36.19
6	4.56	16.94	22.09	36.71	50.00	58.83	64.93	60.41	53.11	43.48	29.03	22.10	38.51
7	16.98	9.30	15.43	30.63	47.77	60.36	64.38	67.59	54.06	41.09	30.75	13.85	37.68
8	5.00	17.62	24.01	38.83	53.55	63.50	69.79	63.61	55.51	45.79	29.61	22.50	40.78
9	17.80	10.53	19.54	33.76	50.83	65.10	67.20	70.27	56.80	43.93	32.13	14.77	40.22
10	8.31	21.65	27.34	43.06	57.58	66.13	73.24	68.14	59.18	49.30	30.80	23.21	43.94
11	20.04	14.69	25.01	36.95	54.12	68.50	70.63	73.30	59.73	47.43	34.11	16.40	43.41
Noon	10.92	24.34	31.54	47.28	63.71	69.55	75.85	72.03	63.13	52.53	32.26	24.64	47.32
1	20.45	19.32	29.91	39.40	57.11	71.05	73.50	76.30	62.65	50.11	36.25	18.29	46.19
2	12.17	26.27	33.80	48.26	65.37	72.10	77.75	74.33	64.30	55.27	32.76	25.96	49.03
3	21.32	20.60	31.53	40.80	57.79	72.01	75.43	77.03	64.18	50.50	35.98	18.69	47.15
4	11.98	24.44	33.27	48.06	64.96	71.38	77.90	74.12	64.40	53.93	32.91	26.64	48.66
5	19.59	18.64	28.98	40.10	57.95	71.26	73.95	75.16	63.36	47.85	33.95	17.35	45.67
6	9.87	22.34	30.74	46.15	60.48	69.40	75.79	72.03	60.50	51.10	31.43	24.72	46.21
7	19.56	15.75	24.90	37.40	54.83	68.25	70.30	71.14	58.15	45.70	33.20	16.61	42.98
8	9.00	21.43	28.54	43.08	58.22	65.48	71.06	67.10	57.60	48.56	30.36	23.40	43.65
9	19.62	15.48	23.25	34.03	50.72	63.50	66.25	68.11	56.21	44.38	32.63	16.62	40.90
10	7.93	20.62	27.61	41.63	54.74	61.91	67.75	64.41	55.31	46.89	29.21	22.53	41.71
11	18.35	14.28	20.82	32.41	48.91	61.53	64.03	66.59	54.51	42.33	31.28	15.69	39.22
Ev. h. 1839–40	8.14	20.90	27.65	42.15	56.66	64.29	70.50	66.63	57.69	48.34	30.39	23.49	43.07
Odd h. 1849–41	18.83	14.48	22.54	34.50	51.34	65.07	67.35	69.75	57.22	44.73	32.81	15.92	41.21

Semi-hourly Means of Temperature.

Thunder Bay Island, Lake Huron, Mich. Lat. 45° 2′. Long. 83° 17′ W. of G.

Alt. 610 ft. [and 40 above Lake Huron]. Observer: J. J. Malden. Dec. 1863, to Dec. 1865. Report, N. and N. W. Lake Survey, for 1867.

Mdn't	19.4	21.4	25.3	34.5	43.1	54.3	60.8	62.9	57.7	43.0	36.8	24.6	40.3
0 30	19.0	21.5	24.6	34.0	42.4	53.9	60.1	62.6	58.0	43.2	36.6	24.4	40.0
1	18.7	21.1	24.3	33.6	42.1	53.7	59.7	62.4	57.8	43.0	36.4	24.3	39.8
1 30	18.3	20.8	24.1	33.4	41.8	53.3	59.2	62.1	57.7	42.8	36.3	24.2	39.5
2	18.0	20.7	23.8	33.0	41.5	53.0	58.8	61.8	57.5	42.6	36.2	24.1	39.2
2 30	17.8	20.5	23.6	32.8	41.4	52.7	58.5	61.7	57.3	42.5	36.1	24.0	39.1
3	17.7	20.4	23.5	32.7	41.3	52.5	58.2	61.5	57.2	42.5	36.0	23.8	38.9
3 30	17.7	20.4	23.6	32.8	41.2	52.7	58.2	61.5	57.1	42.4	36.0	23.9	38.9
4	17.8	20.5	23.7	32.9	41.3	52.8	58.3	61.4	57.0	42.4	35.9	24.0	39.0
4 30	17.9	20.5	23.8	33.0	41.4	52.8	58.4	61.4	56.8	42.3	35.9	24.0	39.0
5	18.0	20.7	23.9	33.1	41.6	53.2	58.6	61.4	56.8	42.3	35.9	24.1	39.1
5 30	18.1	20.8	24.0	33.4	42.3	53.7	59.1	61.6	56.9	42.4	36.0	24.2	39.3
6	18.2	20.9	24.2	33.8	43.2	54.6	59.9	61.9	56.9	42.5	36.0	24.3	39.7
6 30	18.3	21.0	24.6	34.5	43.9	55.9	61.1	62.7	57.3	42.6	36.0	24.3	40.1
7	18.3	21.2	25.0	35.4	45.0	56.9	62.7	63.7	57.8	42.9	36.0	24.3	40.8
7 30	18.4	21.4	25.5	36.3	46.0	58.1	63.4	65.0	58.6	43.3	36.1	24.5	41.4
8	18.8	21.7	26.5	37.2	46.9	59.2	64.5	66.2	59.5	43.7	36.3	24.7	42.1
8 30	19.1	22.1	27.4	38.0	47.6	60.1	65.6	67.3	60.1	44.3	36.6	24.8	42.7
9	19.4	22.7	28.0	38.7	48.2	60.7	66.5	68.2	61.0	45.0	37.0	25.0	43.4
9 30	20.0	23.2	28.9	39.2	48.5	61.5	67.2	68.8	61.6	45.7	37.4	25.3	43.9
10	20.4	23.7	29.6	39.8	49.0	62.0	67.9	69.6	62.3	46.4	37.9	25.6	44.5
10 30	21.0	24.4	30.3	40.3	49.5	62.5	68.4	70.5	63.0	47.1	38.3	25.9	45.1
11	21.6	25.1	31.3	40.8	49.8	62.8	68.9	71.3	63.6	47.8	38.7	26.3	45.7
11 30	22.2	25.7	31.3	41.2	50.1	63.1	69.3	72.0	64.2	48.4	39.2	26.7	46.1

Thunder Bay Island.—Continued.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Noon	22°.8	26°.2	31°.5	41°.4	50°.5	63°.5	69°.7	72°.6	64°.8	49°.1	39°.6	26°.9	46°.5
0 30	23.3	26.7	31.9	41.7	50.7	64.2	69.9	73.1	65.1	49.6	40.0	27.1	46.9
1	23.5	27.0	32.1	41.9	50.9	64.0	69.8	73.6	65.4	49.9	40.4	27.3	47.1
1 30	23.7	27.4	32.3	42.0	51.0	64.0	70.3	73.8	65.7	50.3	40.6	27.4	47.4
2	23.9	27.5	32.5	42.1	51.2	64.6	70.5	73.9	65.9	50.5	40.8	27.3	47.6
2 30	23.8	27.5	32.3	42.1	51.2	64.6	70.6	73.8	65.9	50.5	40.9	27.3	47.5
3	23.6	27.4	32.0	42.0	51.5	64.5	70.7	73.4	65.7	50.2	40.8	27.1	47.4
3 30	23.2	27.0	31.7	41.7	51.6	64.2	70.5	73.0	65.2	49.9	40.4	26.9	47.1
4	22.5	26.4	31.3	41.5	51.5	63.7	70.3	72.5	64.7	49.4	39.8	26.6	46.7
4 30	22.3	25.7	30.8	41.1	51.1	63.4	69.7	72.0	64.2	48.7	39.5	26.4	46.2
5	21.9	25.2	30.1	40.6	50.6	63.0	69.1	71.2	63.6	48.1	39.0	26.2	45.7
5 30	21.6	24.8	29.5	40.1	49.9	62.4	68.4	70.3	62.8	47.5	38.7	26.1	45.2
6	21.2	24.2	29.0	39.5	49.2	61.8	67.6	69.5	62.1	46.8	38.5	26.0	44.6
6 30	21.0	23.9	28.3	38.8	48.5	60.7	66.8	68.4	61.5	46.2	38.3	25.9	44.0
7	20.7	23.7	27.7	38.2	47.7	59.6	66.0	67.8	60.8	45.8	38.1	25.7	43.5
7 30	20.6	23.4	27.2	37.6	46.9	58.9	65.1	67.1	60.3	45.4	38.0	25.5	43.0
8	20.5	23.3	27.0	37.2	46.3	58.1	64.3	66.5	59.8	45.0	37.9	25.7	42.6
8 30	20.4	22.8	26.7	36.8	45.6	57.4	63.8	65.8	59.5	44.9	37.7	25.6	42.2
9	20.3	22.9	26.5	36.4	45.1	56.9	63.2	65.2	59.1	44.4	37.6	25.4	41.9
9 30	20.1	22.6	26.3	36.1	44.6	56.4	62.8	64.7	58.8	44.2	37.5	25.3	41.6
10	20.0	22.5	26.2	35.8	44.2	56.0	62.2	64.2	58.7	44.0	37.4	25.3	41.3
10 30	19.8	22.0	26.0	35.4	43.9	55.4	62.0	63.8	58.4	43.8	37.2	25.0	41.0
11	19.6	22.0	25.7	35.1	43.6	55.1	61.6	63.4	58.1	43.5	37.1	25.2	40.8
11 30	19.5	21.8	25.5	34.9	43.3	54.7	61.2	62.8	57.9	43.2	36.9	24.8	40.6
Mean	20.3	23.3	27.5	37.4	46.5	58.6	64.6	66.9	60.6	45.5	37.7	25.4	42.8

HOURLY MEANS OF TEMPERATURE.

Toronto, Canada West.[1] Lat. 43° 39′. Long. 79° 23′ W. of G.

Alt. 342 feet. Captains Riddell, Younghusband, and Lefroy, R. A. July, 1842, to July, 1848.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't[2]	+23.80	21.45	27.33	39.37	47.88	55.37	59.45	60.30	53.63	40.95	34.42	26.53	40.87
1	23.33	21.07	26.85	38.62	47.02	54.68	58.58	59.65	53.02	40.35	34.13	25.95	40.27
2	23.25	20.73	26.47	37.95	46.18	53.98	58.02	58.97	52.43	40.03	33.85	25.58	39.79
3	23.10	20.30	26.18	37.75	45.47	53.20	57.30	58.30	51.97	39.87	33.53	25.45	39.37
4	23.00	20.00	25.80	37.32	45.00	52.63	56.67	57.92	51.38	39.57	33.37	25.42	39.01
5	22.82	19.65	25.28	36.95	45.05	52.82	56.62	57.73	50.75	39.40	33.48	25.40	38.83
6	23.55	19.08	25.00	37.08	47.50	55.47	59.83	59.18	51.43	39.62	33 75	24.98	39.71
7	23.45	18.95	25.87	39.37	50.48	58.28	63.50	62.15	53.98	40.37	33.75	24.82	41.25
8	23.68	19.97	27.85	41.62	52.70	60.62	66.10	65.42	56.73	42.62	34.80	25.25	43.11
9	24.65	22.27	30.02	43.60	55.02	62.50	68.30	67.92	59.15	45.30	36.33	26.43	45.12
10	25.88	24.28	31.75	45.12	56.72	64.17	70.00	69.90	61.12	47.23	37.77	27.88	46.82
11	27.05	25.87	32.98	46.50	57.85	65.45	71.55	71.35	62.55	48.60	38.78	29.12	48.14
Noon	27.83	27.07	34.00	47.53	58.80	66.55	72.85	72.30	63.52	49.50	39.57	29.93	49.12
1	28.33	27.93	34.65	48.47	59.72	67.28	73.77	73.07	64.12	49.93	39.97	30.65	49.82
2	28.60	28.33	35.22	48.85	60.07	67.70	74.62	73.65	64.52	50.28	40.05	30.80	50.22
3	28.57	28.32	35.02	48.92	60.13	68.08	74.82	74.00	64.55	50.05	39.88	30.55	50.24
4	28.05	27.77	34.55	48.53	60.08	68.32	74.83	73.85	64.33	49.32	38.98	29.90	49.88
5	27.05	26.57	33.80	47.80	59.70	67.72	74.37	73.30	63.37	47.57	37.77	28.95	49.00
6	26.23	25.12	32.12	46.00	57.95	66.42	72.93	71.40	60.70	45.52	36.95	28.25	47.47
7	25.70	24.13	30.65	43.47	55.08	63.68	69.45	67.42	58.00	44.42	36.38	27.92	45.52
8	25.38	23.28	29.68	41.88	52.37	60.38	65.25	64.50	56.72	43.68	36.07	27.53	43.89
9	25.18	22.63	28.68	40.80	50.62	58.22	62.88	62.92	55.68	42.92	35.78	27.28	42.80
10	24.80	22.08	28.03	40.03	49.65	56.88	61.65	61.90	54.62	42.17	35.43	26.98	42.02
11	24.48	21.57	27.38	39.53	48.73	55.92	60.47	61.10	53.98	41.50	35.08	26.87	41.38
Mean	25.32	23.27	29.80	42.63	52.91	60.68	65.99	65.76	57.59	44.20	36.24	27.44	44.32

[1] Phil. Trans., Roy. Soc., Vol. 143, 1853.

[2] The table given by Gen. Sabine commences with noon, it was changed to commence with midnight, for the sake of uniformity with the other tables.

Hourly Means of Temperature.

From self-registering instrument (Lewis's thermograph).

Mohawk, N. Y. Lat. 43° 00′. Long. 75° 02′ W. of G.

Alt. 435 ft. By Dr. James Lewis.

Hour.	January. 1861	1862	1863	1864	1867	1868	1869	Mean of 7 years.	February. 1861	1862	1863	1864	1867	1868	Mean of 6 years.
Mdn't	16.06°	20.08°	26.76°	23.18°	12.91°	15.98°	22.79°	19.68°	24.03°	18.81°	19.63°	25.46°	26.87°	11.21°	21.00°
1	16.93	19.99	26.65	22.69	12.43	15.63	22.39	19.53	22.85	18.18	18.98	25.21	26.07	10.74	20.34
2	17.11	19.49	26.35	22.44	12.17	15.11	21.92	19.23	22.57	17.49	18.75	24.98	25.91	10.03	19.96
3	16.93	18.75	26.06	22.29	11.57	14.72	21.43	18.82	22.31	16.90	18.67	24.66	25.71	9.40	19.61
4	16.76	18.16	25.84	22.11	11.06	14.69	20.88	18.50	22.08	16.20	18.61	24.43	25.84	8.68	19.31
5	16.61	17.81	25.69	21.96	10.74	14.49	20.36	18.24	22.03	16.66	18.21	24.20	25.60	8.01	19.12
6	16.58	17.52	25.54	21.85	10.43	14.46	20.08	18.07	21.64	16.45	17.97	23.89	25.74	7.27	18.83
7	16.50	16.92	25.39	21.70	10.34	14.46	29.85	17.88	21.08	16.28	17.53	23.56	25.22	6.74	18.40
8	16.57	16.77	25.44	21.45	10.68	14.42	20.09	17.92	21.26	16.88	18.03	23.29	25.58	6.69	18.62
9	17.36	17.68	26.62	21.68	11.55	15.24	20.56	18.67	22.87	18.80	19.59	23.47	26.77	7.70	19.87
10	19.05	19.58	28.62	22.51	13.04	16.71	21.67	20.17	26.30	21.29	21.52	24.36	27.94	9.88	21.88
11	21.16	21.85	30.30	23.72	14.63	18.38	23.47	21.93	27.81	23.29	23.46	25.68	29.55	12.55	23.72
Noon	22.40	23.15	31.68	25.14	16.14	20.00	25.46	23.42	29.41	25.50	25.24	26.73	30.98	15.14	25.50
1	22.67	24.04	32.36	25.90	17.28	21.40	26.99	24.38	29.85	26.51	26.51	28.15	31.59	17.37	26.66
2	22.98	24.62	32.57	26.93	17.97	21.82	27.90	24.97	30.80	26.52	27.15	28.92	31.92	19.14	27.41
3	22.50	25.13	32.56	27.36	18.19	21.69	28.19	25.09	30.79	26.57	27.39	29.20	31.82	20.27	27.67
4	22.04	24.25	31.73	27.43	17.72	21.36	27.80	24.62	30.13	25.56	27.04	29.20	31.21	20.36	27.25
5	20.95	23.18	30.46	26.85	16.81	20.16	26.91	23.62	28.83	24.07	26.41	28.66	30.59	19.57	26 36
6	19.05	21.99	29.27	26.18	16.07	19.01	25.88	22.49	27.09	22.41	24.92	27.95	29.86	18.44	25.11
7	17.85	21.50	28.73	25.37	15.44	18.21	24.94	21.72	26.33	21.34	23.53	27.32	29.18	17.04	24.12
8	17.23	21.20	28.42	24.79	14.75	17.50	24.16	21.15	25.70	20.51	22.56	26.64	28.74	15.89	23.34
9	16.54	20.56	28.00	24.30	14.20	16.94	23.60	20.59	25.03	20.01	21.71	26.16	28.25	15.09	22.71
10	15.82	20.45	27.67	23.89	13.70	16.49	23.45	20.21	24.53	19.67	20.91	26.07	27.62	13.66	22.08
11	15.66	20.19	27.15	23.48	13.34	16.35	23.11	19.90	24.26	19.69	20.04	25.48	27.18	12.33	21.50
Mean	18.47	20.62	28.33	23.96	13.88	17.30	23.50	20.87	25.40	20.65	21.84	25.99	28.16	13.05	22.51

Hour.	March. 1861	1862	1863	1864	1867	1868	Mean of 6 years.	April. 1861	1862	1863	1864	1867	1868	Mean of 6 years.
Mdn't	25.73	27.53	22.13	30.59	26.82	27.85	26.77	38.63	38.08	43.36	41.56	39.04	35.61	39.38
1	25.39	26.46	21.18	29.60	26.05	26.11	25.80	37.51	36.85	41.83	40.48	37.99	34.45	38.18
2	24.90	26.28	20.50	29.14	25.71	25.51	25.34	36.92	36.52	40.93	39.81	37.63	33.89	37.62
3	24.24	25.75	20.09	28.55	25.07	25.06	24.79	36.43	36.08	40.36	39.22	37.16	33.39	37.11
4	23.77	25.40	19.38	28.03	24.71	24.67	24.33	35.96	35.50	39.85	38.70	36.74	32.68	36.57
5	23.60	24.78	18.81	27.59	24.33	24.35	23.91	35.96	34.95	39.22	38.18	36.82	32.09	36.20
6	23.33	24.18	18.17	27.30	23.93	24.10	23.50	35.97	34.71	38.50	37.65	36.96	31.63	35.90
7	23.55	24.70	17.97	26.97	23.79	24.26	23.54	37.22	35.30	38.28	37.51	37.89	32.42	36.44
8	24.95	26.54	20.10	27.11	25.22	25.42	24.89	40.50	37.86	39.50	38.09	39.43	34.04	38.23
9	27.25	28.32	22.65	28.52	27.07	27.20	26.83	43.50	40.87	41.46	39.76	41.01	36.16	40.46
10	28.93	30.52	25.13	30.54	28.63	29.39	28.86	45.89	43.52	43.75	41.54	42.61	38.43	42.62
11	29.89	32.43	27.46	32.21	29.93	31.65	30.59	47.75	45.16	45.91	43.27	44.37	40.42	44.48
Noon	31.07	33.98	29.06	33.69	31.41	33.73	32.16	49.11	46.78	47.98	44.66	46.14	42.42	46.18
1	31.99	34.59	30.24	35.05	32.34	35.61	33.30	49.71	47.85	49.72	46.11	47.43	44.21	47.51
2	32.68	35.83	30.90	35.99	32.97	36.98	34.22	50.26	49.04	51.22	47.52	48.44	45.28	48.63
3	32.68	35.45	31.30	36.70	33.14	38.10	34.56	49.88	49.15	52.62	48.75	49.54	45.78	49.29
4	32.64	34.58	31.31	36.80	33.19	38.82	34.56	49.45	48.76	53.23	49.26	50.21	46.80	49.62
5	32.16	33.56	30.61	36.37	32.62	38.95	34.05	49.23	48.12	53.19	48.74	49.97	46.62	49.31
6	30.73	32.34	29.23	35.36	31.31	37.07	32.67	48.19	47.18	52.32	48.28	48.38	44.85	48.20
7	28.91	30.94	27.69	34.17	29.96	34.82	31.08	46.09	44.63	50.74	47.05	45.85	42.80	46.19
8	27.90	30.20	26.59	33.31	29.01	32.95	29.99	43.55	41.79	48.70	45.41	43.65	40.62	43.95
9	27.49	29.40	25.53	32.60	28.29	31.29	29.10	41.82	40.08	47.18	44.20	41.83	38.74	42.31
10	27.44	28.78	24.27	31.99	27.69	29.86	28.34	40.37	39.46	45.75	43.21	40.82	37.45	41.18
11	26.83	28.39	23.07	31.32	27.24	28.88	27.62	39.39	38.83	44.41	42.28	39.97	36.42	40.22
Mean	27.84	29.62	24.72	31.65	28.36	30.53 *	28.78	42.90	41.56	45.42	42.97	42.50	38.63	42.33

Mohawk.—Continued.

Hour.	May.						Mean of 6 years.	June.						Mean of 6 years.
	1861	1862	1863	1864	1867	1868		1860	1861	1862	1863	1867	1868	
Mdn't	46.27°	48.65°	56.90°	58.23°	46.11°	51.89°	51.34°	59.83°	58.97°	56.63°	60.96°	62.35°	60.78°	60.25°
1	45.12	47.70	55.23	56.77	45.65	50.92	50.23	58.86	57.52	55.46	59.60	60.23	58.78	58.41
2	44.37	46.76	54.05	55.93	44.90	50.03	49.34	57.89	56.76	54.76	58.70	59.39	57.68	57.53
3	43.71	45.77	53.01	55.20	44.19	49.12	48.50	57.06	55.53	54.38	57.96	58.99	56.70	56.77
4	43.15	44.86	52.08	54.55	43.14	48.31	47.68	56.26	54.57	53.77	57.27	58.58	55.93	56.06
5	42.88	44.37	51.19	53.99	42.96	47.77	47.19	55.64	54.16	53.21	56.67	58.19	55.60	55.58
6	43.08	44.67	50.50	53.62	43.39	47.86	47.19	56.48	54.98	54.07	56.29	59.33	56.21	56.23
7	44.31	48.05	50.94	54.65	44.83	49.01	48.63	57.99	57.55	57.12	56.90	61.65	57.96	58.20
8	46.90	52.60	52.87	55.52	46.75	51.00	50.94	60.69	61.27	61.00	58.67	64.73	60.69	61.17
9	49.67	56.31	55.62	57.54	48.50	52.81	53.41	63.11	64.58	63.75	60.91	67.89	63.63	63.98
10	52.54	59.19	58.17	59.65	50.20	54.59	55.72	65.77	67.18	66.13	63.38	70.86	66.21	66.59
11	54.44	61.46	60.81	61.88	51.90	56.67	57.86	67.72	69.21	68.49	65.52	73.23	68.43	68.77
Noon	56.09	63.17	63.07	63.89	53.50	58.20	59.65	69.14	70.61	70.11	67.50	75.30	70.76	70.57
1	56.53	64.44	64.94	65.49	54.99	59.52	60.99	69.89	71.63	70.30	69.18	77.05	72.77	71.80
2	57.37	64.93	66.84	67.27	55.78	60.47	62.11	71.06	72.39	71.11	70.95	78.16	74.56	73.04
3	57.31	65.08	68.11	68.35	56.29	60.69	62.64	71.81	72.61	70.97	72.13	77.97	76.02	73.58
4	57.26	64.66	68.74	68.84	56.36	61.59	62.91	71.28	72.60	70.40	72.30	78.31	76.82	73.62
5	56.62	64.09	68.67	68.56	56.03	61.78	62.62	70.43	71.78	69.47	72.15	77.78	76.63	73.04
6	55.96	62.27	67.80	67.66	54.93	61.23	61.64	68.65	70.21	68.44	71.25	76.66	75.14	71.72
7	53.74	58.94	66.15	65.84	52.95	59.40	59.50	67.25	67.80	66.19	69.63	73.68	72.17	69.45
8	50.50	54.46	63.80	64.03	50.86	57.01	56.78	65.35	64.71	62.59	67.83	69.48	68.96	66.49
9	48.34	51.97	61.68	62.08	49.22	55.75	54.84	63.39	62.33	60.30	65.52	66.42	66.29	64.04
10	46.99	50.93	59.91	60.62	47.88	54.19	53.42	62.03	60.72	59.40	63.74	64.92	64.17	62.50
11	46.56	49.79	58.35	59.42	46.87	53.00	52.33	60.88	59.75	57.64	62.26	63.45	62.37	61.06
Mean	49.99	54.78	59.56	60.81	49.51	54.70 *	54.89	63.70	63.73	62.28	64.06	68.11	65.64	64.59

Hour.	July.						Mean of 6 years.	August.						Mean of 6 years.
	1860	1861	1862	1863	1867	1868		1860	1861	1862	1863	1867	1868	
Mdn't	61.21	63.16	62.41	70.48	63.01	71.38	65.27	62.23	61.64	61.62	67.96	63.23	64.48	63.53
1	60.40	62.31	61.54	69.56	62.08	69.89	64.30	61.67	61.93	60.62	67.53	62.56	63.45	62.96
2	59.50	61.68	60.54	68.90	60.93	68.64	63.36	61.07	61.66	59.86	66.67	61.59	62.60	62.24
3	58.75	61.06	59.80	68.40	60.00	67.56	62.59	60.58	60.71	59.14	65.94	60.99	61.97	61.55
4	58.12	60.46	59.13	67.89	59.12	66.66	61.90	59.97	59.87	58.44	65.44	60.45	61.51	60.95
5	57.46	60.04	58.68	67.44	58.53	66.05	61.37	59.64	59.16	58.01	65.05	59.81	61.02	60.45
6	57.95	60.41	59.21	67.20	58.83	66.12	61.62	59.70	58.90	57.98	64.67	59.69	60.70	60.27
7	59.84	61.92	61.74	67.52	61.18	67.47	63.28	60.70	60.02	59.99	64.78	61.29	61.45	61.37
8	62.42	64.14	64.81	68.79	64.41	69.61	65.70	62.84	62.24	62.65	65.87	64.49	63.20	63.55
9	65.24	66.95	67.40	70.36	67.50	72.19	68.27	65.34	65.00	65.96	67.56	67.25	65.13	66.04
10	68.10	69.63	69.63	71.90	71.58	75.11	70.99	68.27	67.75	69.07	69.61	70.18	67.38	68.71
11	70.23	71.61	71.51	73.63	72.91	78.01	72.98	70.70	69.95	71.67	71.44	72.77	69.63	71.03
Noon	71.81	73.06	72.93	74.98	74.88	80.77	74.74	72.82	71.23	73.93	72.96	74.94	71.70	72.93
1	72.37	73.79	74.26	76.47	77.13	82.63	76.11	73.97	71.93	75.55	74.69	76.88	73.27	74.38
2	72.30	73.96	74.89	77.98	79.05	84.95	77.19	74.34	71.98	75.76	76.53	78.24	74.80	75.27
3	72.14	74.35	75.20	79.31	80.74	86.63	78.06	74.50	72.11	76.02	78.23	79.04	75.86	75.96
4	71.83	74.07	74.60	79.98	81.32	88.43	78.37	74.09	72.10	75.82	78.78	79.13	76.78	76.12
5	71.61	73.40	74.47	80.10	81.59	88.83	78.33	73.20	71.69	75.02	78.36	78.55	76.97	75.63
6	70.56	72.27	73.12	79.29	79.27	87.68	77.03	71.75	70.69	73.64	77.59	76.63	76.10	74.40
7	68.70	70.75	70.99	77.77	75.42	84.69	74.72	69.10	68.58	71.03	76.01	73.07	73.40	71.86
8	66.14	68.20	68.20	75.92	71.85	80.60	71.82	66.49	65.98	68.00	73.77	69.53	70.83	69.10
9	64.27	66.00	65.99	74.10	68.34	77.63	69.39	65.21	64.41	65.42	71.83	67.16	68.47	67.08
10	63.22	64.75	64.15	72.56	66.31	75.15	67.69	64.13	63.20	63.77	70.19	65.58	66.82	65.61
11	62.08	63.99	63.25	71.38	64.60	73.06	66.39	63.26	62.45	62.59	69.01	64.17	65.51	64.50
Mean	65.26	67.16	67.02	72.99 *	69.20 *	76.24 *	69.64	66.48	65.63	66.73	70.85	68.63	68.04 *	67.73

Mohawk.—Continued.

Hour.	September. 1860	1861	1862	1863	1867	1868	Mean of 6 years.	October. 1860	1861	1862	1863	1867	1868	Mean of 6 years.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	53.35	56.87	55.99	56.51	54.63	53.84	55.20	48.30	48.45	46.74	47.57	44.94	40.65	46.11
1	53.49	56.09	55.89	55.86	54.52	53.98	54.97	47.08	48.09	46.55	47.22	43.54	39.96	45.41
2	52.90	55.39	55.19	55.12	53.79	53.40	54.30	46.85	47.34	46.26	46.75	42.71	39.49	44.90
3	52.15	54.96	54.70	54.33	53.10	52.99	53.71	46.65	46.82	46.03	46.24	42.02	39.12	44.48
4	51.24	54.46	54.16	53.65	52.66	52.51	53.11	45.95	46.50	45.49	45.80	41.57	38.68	44.00
5	50.36	54.12	53.86	53.06	52.04	52.06	52.58	45.29	46.34	45.25	45.42	41.02	38.46	43.63
6	49.92	53.84	53.57	52.54	51.48	51.81	52.19	44.77	46.09	44.99	45.12	40.61	38.30	43.31
7	50.25	54.39	54.51	52.22	51.76	52.01	52.52	44.55	45.86	44.85	44.86	40.65	38.19	43.16
8	51.80	56.04	57.08	52.99	53.58	53.14	54.10	44.92	46.52	45.81	45.05	41.75	38.86	43.82
9	54.40	58.40	60.16	54.90	56.10	54.72	56.45	46.18	48.60	47.05	46.19	44.13	40.21	45.39
10	57.03	61.03	63.09	57.16	59.14	56.71	59.03	48.25	50.98	49.24	47.98	47.13	42.05	47.60
11	59.53	63.01	66.05	59.48	61.64	58.54	61.38	50.22	53.17	51.33	49.69	50.27	43.76	49.74
Noon	61.58	64.55	68.37	61.66	64.05	60.11	63.39	52.02	54.94	53.15	51.19	52.53	45.53	51.56
1	63.38	65.49	70.18	63.62	66.63	61.65	65.16	53.18	56.05	54.04	52.50	54.76	46.82	52.89
2	64.42	65.86	70.70	65.52	68.97	62.50	66.33	53.84	56.96	54.26	53.75	56.20	47.71	53.79
3	64.11	66.23	71.19	67.12	70.56	63.26	67.08	54.16	57.20	53.87	54.57	56.97	48.37	54.19
4	63.78	65.87	70.73	67.56	71.11	63.41	67.08	53.79	56.48	53.38	54.58	56.50	48.19	53.82
5	62.85	65.25	69.49	67.22	68.96	62.48	66.04	52.70	55.01	52.25	53.77	54.97	47.13	52.64
6	61.20	63.60	67.15	65.79	65.79	61.09	64.10	51.31	53.11	50.81	52.69	52.20	45.71	50.97
7	58.62	60.88	64.08	63.75	62.54	59.29	61.53	49.48	51.39	49.37	51.53	50.20	44.47	49.41
8	56.32	59.38	61.15	61.65	60.05	57.69	59.37	48.45	50.46	48.34	50.49	48.69	43.43	48.31
9	55.11	58.51	59.36	59.96	58.16	56.41	57.92	47.68	50.00	47.78	49.58	47.41	42.53	47.50
10	54.54	57.92	57.94	58.59	56.73	55.49	56.87	48.04	50.40	47.53	48.84	46.51	41.82	47.19
11	53.82	57.33	56.83	57.43	55.75	54.66	55.97	48.38	49.37	46.85	48.17	45.74	41.20	46.62
Mean	56.51	59.57	61.31	59.07	59.32	56.82	58.77	48.83	50.67	48.80	49.15	47.63	42.53	47.94

Hour.	November. 1860	1861	1862	1863	1867	1868	Mean of 6 years.	December. 1860	1861	1862	1863	1867	1868	Mean of 6 years.
Mdn't	37.72	35.02	34.45	39.17	34.38	32.54	35.54	21.00	25.81	25.47	23.32	17.62	19.87	22.18
1	38.53	35.06	34.69	39.80	34.80	33.49	36.06	21.41	25.54	25.80	22.85	16.70	19.38	21.95
2	38.48	34.65	34.23	39.26	34.19	33.11	35.65	21.22	25.06	25.54	22.51	16.22	19.03	21.60
3	38.27	34.09	33.74	39.08	33.82	32.63	35.27	20.90	24.44	25.41	22.22	15.82	18.57	21.23
4	38.20	33.74	33.43	38.78	33.52	32.34	35.00	20.68	24.10	25.10	21.97	15.44	18.30	20.93
5	38.01	33.32	33.10	38.53	32.87	32.21	34.67	20.67	23.84	24.95	21.81	15.34	18.23	20.81
6	37.95	32.94	32.88	38.32	32.28	32.04	34.40	20.61	23.57	24.85	21.69	14.97	18.07	20.63
7	37.59	32.42	32.24	38.04	32.15	32.01	34.07	20.41	23.77	24.68	21.59	14.47	17.96	20.48
8	37.47	32.52	33.09	37.92	32.40	32.12	34.25	19.93	23.99	24.93	21.54	14.34	18.17	20.50
9	37.89	33.74	34.55	38.11	33.73	32.63	35.11	20.90	25.02	26.08	21.88	15.38	18.73	21.33
10	38.96	35.74	36.38	39.10	35.27	33.66	36.52	22.38	27.00	27.09	22.56	16.61	20.13	22.63
11	40.51	37.52	38.16	40.18	37.07	34.66	38.02	23.97	28.89	28.42	23.75	18.50	21.16	24.11
Noon	41.70	39.05	39.42	41.31	38.33	35.74	39.26	24.98	30.65	29.42	25.08	20.17	22.59	25.48
1	42.40	40.11	40.01	42.20	39.00	36.54	40.04	25.52	31.54	30.31	26.18	21.44	23.52	26.42
2	42.69	40.46	40.41	42.70	39.38	26.93	40.43	25.36	31.62	30.35	26.87	22.19	24.18	26.76
3	42.72	40.66	40.54	42.96	39.31	37.17	40.56	24.96	31.05	30.30	27.21	22.35	24.00	26.65
4	42.07	39.65	40.24	42.69	38.72	36.94	40.05	24.49	29.66	29.97	26.87	22.06	23.51	26.09
5	41.14	38.14	39.15	42.24	37.71	36.31	39.11	23.42	27.98	29.02	26.44	21.36	22.69	25.15
6	40.11	37.02	37.93	41.48	37.02	35.46	38.17	22.63	27.10	28.27	25.87	20.79	21.81	24.41
7	39.17	36.20	37.05	40.83	36.20	34.76	37.37	22.28	26.20	27.62	25.35	20.44	21.18	23.84
8	38.31	35.77	36.95	40.46	35.75	34.20	36.91	21.93	25.73	27.11	24.86	19.69	20.93	23.38
9	37.91	35.19	36.25	39.96	35.45	33.71	36.41	21.57	25.76	26.42	24.36	19.22	20.63	22.99
10	37.76	35.01	35.68	39.58	35.21	33.40	36.11	21.19	26.28	26.00	24.10	18.87	20.26	22.78
11	37.76	34.98	35.01	39.35	35.03	32.91	35.84	21.14	25.97	25.71	23.79	18.48	20.04	22.52
Mean	39.31	35.96	36.24	40.08	35.57	34.06	36.88	22.24	26.69	27.03	23.94	18.27	20.54	23.12

Mohawk.—Continued.

N. B. In the following means the preceding months marked thus *, are omitted.

Hour.	Mar. 5 years.	May. 5 years.	July. 5 years.	Aug. 5 years.	Hour.	Mar. 5 years.	May. 5 years.	July. 5 years.	Aug. 5 years.
Mdn't	26°.56	51°.23	62°.26	63°.34	Noon	31°.84	59°.94	72°.60	73°.18
1	25.74	50.09	61.42	62.86	1	32.84	61.28	73.47	74.60
2	25.31	49.20	60.57	62.17	2	33.67	62.43	73.72	75.37
3	24.74	48.38	59.87	61.47	3	33.85	63.03	73.90	75.98
4	24.26	47.56	59.24	60.83	4	33.70	63.17	73.50	75.98
5	23.82	47.08	58.73	60.33	5	33.06	62.79	73.16	75.36
6	23.38	47.05	59.19	60.19	6	31.79	61.72	71.98	74.06
7	23.40	48.56	61.17	61.36	7	30.33	59.52	70.15	71.56
8	24.78	50.93	63.79	63.62	8	29.40	56.73	67.51	68.75
9	26.76	53.53	66.53	66.22	9	28.66	54.65	65.42	66.81
10	28.75	55.95	69.12	68.98	10	28.03	53.27	64.04	65.37
11	30.38	58.10	71.12	71.31	11	27.37	52.20	63.11	64.30
					Mean	28.44	54.93	66.48	67.66

N. B. The observer remarks that the indications of the instrument are absolutely correct, but that its exposure was not unexceptionable; the locality, though in the shade and on the north side of the house, being accessible to the influence of the sun between 2½ or 3 P. M., and sunset or to within half an hour previous to sunset. In 1865 the station was movable to avoid this influence, in 1866–7 it was tolerably free from disturbance, in the winter 1868–9 a screen was erected to the westward. I have omitted the results in all months marked *, considering the indications affected from the above cause. [S.]

Bi-hourly means of Temperature.

Cambridge,[1] Mass. Lat. 42° 23′. Long. 71° 07′ W. of G.

Alt. about 71 ft. Observer . . . . . Oct. 1841, to Dec. 1842, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
0.6_m	27°.92	34°.21	33°.02	39°.41	46°.93	54°.65	66°.00	61°.20	49°.90	39°.66	33°.13	29°.22	42°.94
2.6	27.31	32.94	31.79	39.76	45.67	52.68	64.79	60.35	48.49	38.40	32.77	28.75	41.97
4.6	26.97	32.01	31.48	38.24	45.06	52.60	64.93	59.50	48.17	37.90	32.41	28.66	41.49
6.6	25.71	32.15	30.59	38.93	49.61	59.74	68.24	62.11	47.81	37.75	32.27	28.24	42.76
8.6	23.90	32.54	37.09	43.31	57.04	65.09	73.56	68.00	56.44	43.15	35.37	29.48	47.08
10.6	29.30	36.42	42.41	46.55	60.52	68.95	78.48	71.95	63.45	51.33	41.51	33.85	52.06
0.6_a	33.24	40.40	45.04	48.22	63.08	71.18	79.03	72.72	66.10	55.07	43.66	36.57	54.53
2.6	33.27	40.99	44.51	48.52	63.98	71.49	78.49	73.01	66.04	55.91	43.69	36.33	54.69
4.6	31.76	38.87	42.11	47.01	62.51	69.33	76.64	71.79	63.28	52.28	40.58	33.33	52.46
6.6	29.55	35.13	37.77	44.31	58.13	66.54	72.45	68.39	58.09	45.59	37.62	31.64	48.77
8.6	28.82	34.58	35.24	41.07	52.40	59.60	68.80	64.40	53.82	42.52	35.67	30.58	45.62
10.6	28.13	34.57	33.85	40.21	49.40	56.08	67.00	62.86	51.30	40.82	34.57	29.61	44.03
Mean	28.82	35.40	37.07	42.96	54.53	62.33	71.53	66.36	56.07	45.03	35.94	31.35	47.37
No. of days	13	10	14	15	14	11	10	11	11	15	30	23	

It is apparent that the small number of observations is the principal cause of certain anomalies presented in the above means.

[1] Memoirs Am. Acad., vol. ii, new series; also Trans. Conn. Acad. of Arts and Sci., vol. i, part 1, 1866.

HOURLY MEANS OF TEMPERATURE.

Amherst, Mass. Lat. 42° 22′. Long. 72° 34′ W. of G.

Alt. 267 feet. Prof. E. S. Snell. 1839.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	+20°.44	26°.87	29°.96	43°.62	52°.17	56°.12	66°.30	62°.92	54°.46	46°.37	32°.40	27.°30	43°.24
1	19.04	25.79	30.08	42.31	51.41	54.96	65.22	62.30	54.44	45.59	32.46	27.65	42.61
2	18.70	25.54	30.00	41.85	50.44	54.32	64.78	61.78	53.68	44.81	31.81	27.08	42.07
3	18.81	25.37	29.46	41.12	49.51	53.68	64.33	61.41	52.88	44.00	31.31	26.73	41.55
4	18.44	24.63	29.12	40.69	49.04	53.56	64.19	61.15	52.24	43.37	31.08	26.58	41.17
5	18.22	24.37	28.77	40.42	48.74	53.80	64.07	60.78	51.92	42.74	30.77	25.96	40.88
6	18.26	23.79	28.69	40.77	50.15	55.64	65.59	61.63	52.36	42.81	30.46	25.50	41.30
7	18.19	23.79	30.19	42.57	52.70	57.40	67.81	62.96	54.48	43.59	30.52	25.31	42.47
8	19.11	24.79	32.73	45.50	55.30	60.20	70.52	65.48	57.28	46.15	32.12	25.15	44.53
9	21.48	27.12	35.27	48.46	57.52	62.48	72.48	68.37	60.36	49.63	34.46	26.88	47.04
10	24.26	29.42	37.38	51.23	60.04	64.72	75.41	70.48	63.12	52.70	36.23	29.83	49.57
11	27.04	31.29	39.58	54.19	62.04	67.28	78.04	72.89	65.84	55.48	37.81	32.04	51.96
Noon	29.26	32.83	41.19	56.46	63.67	69.68	80.11	74.30	67.96	57.52	39.81	33.58	53.86
1	30.40	33.92	42.46	58.00	65.07	70.96	80.44	75.67	68.92	58.70	40.92	35.42	55.07
2	30.74	34.63	43.15	58.96	65.67	70.60	81.11	75.30	69.60	59.74	40.77	35.58	55.49
3	30.26	34.37	42.92	58.35	65.19	70.20	79.11	75.11	69.00	59.70	40.08	34.88	54.93
4	28.74	33.46	42.04	57.15	64.78	69.44	78.78	73.67	68.20	58.70	38.65	33.04	53.89
5	26.26	31.67	40.46	55.58	62.89	67.60	77.44	72.70	66.24	56.11	37.08	31.31	52.11
6	25.00	29.75	38.27	53.04	61.00	65.80	75.78	70.26	63.32	53.96	35.65	29.96	50.15
7	22.70	29.62	34.64	50.23	59.30	63.52	73.15	68.88	61.27	51.70	35.44	29.59	48.34
8	22.30	29.00	33.88	48.27	57.11	61.56	70.63	67.11	59.69	50.33	34.72	29.08	46.97
9	21.44	28.29	32.92	46.77	55.26	59.64	68.56	65.85	57.81	49.30	34.00	28.59	45.70
10	20.93	28.00	31.52	45.23	54.19	58.40	67.82	64.42	56.27	48.56	33.64	28.08	44.75
11	20.52	27.38	30.52	44.31	52.93	57.40	67.37	63.65	55.19	47.22	32.84	27.70	43.92
Mean	22.94	28.57	34.80	48.54	56.92	61.62	71.62	67.45	59.85	50.36	34.79	29.28	47.23

DERIVED HOURLY MEANS OF TEMPERATURE.

New Haven,[1] Conn. Lat. 41° 18′. Long. 72° 56′ W. of G.

Approx. Alt. 45 feet. Various observers. 1778 to 1865 inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	24.26	25.24	32.28	42.19	51.88	61.15	66.46	65.57	57.71	47.02	37.68	28.25	44.98
1	23.91	24.77	31.77	41.41	51.01	60.03	65.49	64.75	56.87	46.26	37.14	27.93	44.28
2	23.53	24.31	31.24	40.74	50.12	58.91	64.69	64.03	56.18	45.62	36.64	27.60	43.63
3	23.19	23.80	30.72	40.10	49.31	58.25	64.11	63.56	55.70	45.05	36.22	27.25	43.10
4	22.83	23.32	30.28	39.52	48.78	58.10	63.97	63.16	55.27	44.59	35.82	26.93	42.71
5	22.46	22.95	29.91	39.31	48.90	58.79	64.27	63.22	55.15	44.29	35.52	26.64	42.62
6	22.19	22.81	30.00	39.69	50.68	60.83	65.51	63.96	55.66	44.45	35.52	26 45	43.15
7	22.15	23.01	31.18	41.57	53.65	63.79	67.98	66.21	57.75	45.83	35.84	26.46	44.62
8	22.71	24.42	33.79	44.80	56.77	66.99	70.80	68.98	50.78	48.81	37.34	27.21	46.95
9	25.20	27.60	36.55	47.96	59.42	69.64	73.30	71.54	63.75	51.68	39.86	29.41	49.66
10	28.12	30.59	39.33	50.71	61.49	71.69	75.45	73.71	66.28	54.62	42.56	32.05	52.22
11	30.16	32.34	40.95	52.33	63.05	73.04	77.23	75.60	68.15	56.75	44.51	33.91	54.00

[1] Transactions of the Connecticut Academy of Arts and Sciences. Vol. I, Part. 1. New Haven, 1866. Art. v. By E. Loomis and H. A. Newton.

The numbers of the tables are derived in part from 3 observations a day, during 86 years, and in part from 5 observations a day, during 9 years, with the assistance of the law of the diurnal fluctuation as found at Philadelphia, Amherst, and Cambridge.

New Haven.—Continued.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Noon	31°.72	33°.67	42°.23	53°.62	64°.26	74°.08	78°.37	76°.82	69°.39	58°.05	45°.95	35°.47	55°.30
1	32.60	34.70	43.12	54.58	65.21	74.89	79.12	77.62	70.17	58.85	46.69	36.27	56.15
2	32.87	35.06	43.56	55.16	65.79	75.28	79.47	78.01	70.54	59.18	46.89	36.54	56.53
3	32.41	34.87	43.43	55.19	65.81	75.21	79.37	77.94	70.39	58.81	46.51	35.95	56.32
4	31.26	33.89	42.69	54.67	65.30	74.59	78.85	77.38	69.65	57.70	44.95	34.44	55.45
5	29.37	31.92	40.83	53.44	64.07	73.44	77.79	76.21	68.30	55.57	43.20	32.51	53.89
6	27.92	30.12	38.63	50.89	62.00	71.27	75.84	74.26	66.47	53.86	41.88	31.42	52.05
7	26.84	28.73	36.97	48.31	58.93	69.12	73.69	72.24	64.38	52.28	40.82	30.63	50.24
8	26.04	27.67	35.52	46.23	56.66	66.88	71.77	70.31	62.42	50.88	39.95	29.93	48.69
9	25.42	26.88	34.43	44.86	55.05	65.14	70.01	68.67	60.81	49.64	39.25	29.38	47.46
10	24.98	26.27	33.69	43.87	53.81	63.68	68.78	67.53	59.65	48.68	38.73	28.96	46.55
11	24.58	25.73	33.04	43.04	52.83	62.36	67.55	66.46	58.63	47.82	38.20	28.60	45.74
Mean	26.53	28.11	36.09	46.84	57.28	66.96	71.66	70.32	62.50	51.10	40.32	30.42	49.01

HOURLY MEANS BETWEEN 4 A. M. AND 10 P. M.

Brooklyn Heights,[1] N. Y. Lat. 40° 41′. Long. 73° 59′ W. of G.

Alt. . . E. Merriam. Dec. 1847, to May, 1849, inclusive.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	..	..	..	..	..	..	..	..	..	..	..	..	..
1	..	..	..	..	..	..	..	..	..	..	..	..	..
2	..	..	..	..	..	..	..	..	..	..	..	..	..
3	..	..	..	..	..	..	..	..	..	..	..	..	..
4	27.7	24.5	31.9	42.9	53.8	62.8	67.6	67.2	56.9	48.5	36.6	36.8	46.4
5	27.5	24.4	32.4	43.2	53.8	63.3	67.6	67.2	56.8	50.0	36.6	36.8	46.6
6	27.5	24.5	32.4	43.3	54.5	64.4	67.6	67.6	57.1	51.3	37.2	37.0	47.0
7	27.5	24.5	33.1	44.9	56.7	67.7	68.3	68.5	58.0	51.3	37.0	37.2	47.9
8	27.8	25.5	34.9	48.5	58.8	70.7	69.6	69.9	59.3	52.8	38.4	37.3	49.4
9	28.8	27.5	36.8	50.4	60.3	72.9	71.0	71.8	61.3	54.6	40.2	38.2	51.1
10	30.3	29.5	39.1	52.1	62.2	73.9	72.1	74.0	63.8	56.2	42.2	39.5	52.9
11	32.0	30.8	41.1	54.2	64.3	75.7	73.8	75.5	66.5	57.8	43.8	40.8	54.7
Noon	33.1	32.0	42.0	55.8	65.7	77.1	74.7	77.1	67.3	58.9	44.6	41.8	55.8
1	33.7	32.9	42.7	56.9	65.9	77.7	75.6	78.0	67.3	59.4	45.4	42.3	56.5
2	34.0	33.0	43.5	57.2	65.9	78.0	75.6	76.7	67.2	59.9	45.6	42.6	56.6
3	33.5	32.9	43.6	56.9	65.2	77.9	75.7	76.6	67.0	59.6	45.4	42.3	56.4
4	33.0	32.4	42.6	55.3	64.7	77.0	75.6	75.7	66.2	58.5	44.1	41.5	55.5
5	31.9	31.6	41.3	53.7	63.5	75.3	74.8	74.8	65.1	57.1	41.8	40.6	54.3
6	31.2	30.3	39.7	51.8	61.9	73.4	73.5	73.5	63.8	56.3	41.0	39.8	53.0
7	30.7	29.6	38.6	50.0	60.3	71.5	72.3	72.7	62.8	55.0	40.2	39.2	51.9
8	30.1	29.1	37.8	48.7	59.2	69.6	71.5	71.6	61.9	53.9	39.9	38.9	51.0
9	29.8	28.5	37.3	47.7	58.2	68.5	70.6	70.8	61.1	53.5	39.6	38.3	50.3
10	29.5	28.1	35.9	46.0	57.5	66.0	70.0	70.0	60.3	53.1	39.6	37.8	49.5
11	..	..	..	..	..	..	..	..	..	..	..	..	..

Some of these observations do not appear to me altogether trustworthy. [S.]

By graphical interpolation the following quite reliable numbers were found to supply the missing observations:—

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
11	29.1	27.5	34.2	45.0	56.6	64.6	69.2	69.4	59.5	52.0	38.9	37.5	48.6
Mdn't	28.8	26.8	33.3	44.2	55.8	63.6	68.8	68.7	58.8	51.0	38.4	37.2	47.9
1	28.5	26.2	32.7	43.6	55.1	63.0	68.4	68.1	58.2	50.1	37.8	37.0	47.4
2	28.2	25.5	32.3	43.2	54.5	62.8	68.0	67.6	57.6	49.3	37.3	36.9	46.9
3	27.9	24.9	32.1	43.0	54.1	62.7	67.8	67.3	57.2	48.9	36.8	36.8	46.6
Mean	30.1	28.4	37.1	49.1	59.5	70.0	71.2	71.7	61.7	54.1	40.4	38.9	51.0

[1] MS. in Smithsonian Coll.

HOURLY MEANS OF TEMPERATURE.

Philadelphia, Girard College,[1] Penn. Lat. 39° 58′. Long. 75° 10′ W. of G.

Alt. 114 feet. A. D. Bache. June, 1840, to June, 1845, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	30°.90	30°.10	39°.25	46°.60	54°.16	63°.53	68°.06	67°.68	59°.76	47°.74	38°.46	31°.14	48°.11
1	30.35	29.67	38.60	45.76	53.54	62.82	67.32	67.08	59.50	47.36	38.32	30.72	47.59
2	30.20	29.28	38.05	44.96	52.82	62.25	66.76	66.60	59.10	46.78	37.94	30.36	47.09
3	29.92	28.73	37.75	44.60	52.14	61.60	66.26	66.44	58.64	46.36	37.66	30.06	46.68
4	29.72	28.45	37.58	44.18	51.48	61.13	65.82	65.88	58.32	45.88	37.18	29.78	46.28
5	29.50	28.22	36.78	44.08	51.60	61.60	66.04	65.78	58.10	45.46	36.90	29.46	46.12
6	29.22	27.95	36.77	44.54	53.04	63.03	67.10	66.36	58.08	45.12	36.64	29.22	46.42
7	29.10	28.08	37.42	46.08	55.16	65.45	69.40	68.20	59.94	46.50	36.96	29.52	47.65
8	29.52	29.63	39.40	48.12	57.44	67.85	71.66	70.48	62.40	48.96	38.20	30.02	49.47
9	30.80	31.55	41.40	50.10	59.64	69.78	73.62	72.40	64.54	51.38	40.10	31.40	51.39
10	32.32	33.60	43.25	52.08	61.22	71.45	75.24	74.22	66.62	53.54	41.82	32.94	53.19
11	33.65	35.32	45.27	53.86	62.70	72.95	76.74	75.86	68.30	55.20	43.28	34.46	54.80
Noon	34.88	36.70	46.75	55.46	63.86	74.35	77.96	77.16	69.64	56.70	44.48	35.54	56.12
1	35.87	37.83	47.80	56.70	64.90	75.37	78.80	77.94	70.56	57.76	45.46	36.28	57.10
2	36.53	38.47	48.55	57.68	65.80	76.25	79.54	78.84	71.38	58.54	46.14	36.88	57.88
3	36.60	38.73	49.10	57.94	66.26	76.54	79.82	79.08	71.48	58.46	45.88	36.66	58.04
4	36.37	38.50	49.00	58.00	66.46	76.67	79.76	78.98	71.40	58.20	45.40	36.28	57.92
5	35.05	37.35	47.85	57.14	66.00	75.77	79.10	77.94	70.00	56.34	43.88	35.06	56.79
6	34.23	35.70	45.98	55.74	64.44	74.43	77.76	76.52	67.80	54.14	42.54	34.36	55.30
7	33.42	34.50	44.85	53.10	61.86	71.93	75.62	74.44	65.60	52.48	41.50	33.62	53.57
8	32.75	33.23	43.80	51.08	59.22	68.93	73.04	71.98	63.36	51.00	40.66	33.00	51.83
9	32.17	32.47	41.35	49.70	57.64	67.28	71.32	70.60	62.12	49.98	40.00	32.60	50.60
10	31.58	31.68	41.00	48.46	56.28	65.93	70.04	69.46	60.92	48.82	39.50	32.16	49.65
11	31.12	31.10	40.28	47.40	55.06	64.63	69.08	68.64	60.34	48.06	39.02	31.70	48.86
Mean	32.32	32.79	42.41	50.56	58.86	68.81	72.74	72.02	64.08	51.28	40.75	32.63	51.60
No of years	4	4	4	5	5	6	5	5	5	5	5	5	

HOURLY MEANS BETWEEN 3 A. M. AND 9 P. M.

Jackson, Jackson Co., Ohio.[2] Lat. 39° 02′. Long. 82° 32′ W. of G.

Alt. 700 feet. G. L. Crookham. May, 1851, to June, 1852, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	..	..	..	..	..	..	..	..	..	..	..	..	45.1
1	..	..	..	..	..	..	..	..	..	..	..	..	44.4
2	..	..	..	..	..	..	..	..	..	..	..	..	43.9
3	20.9	31.5	37.6	40.9	52.2	57.8	64.5	61.1	54.9	41.0	36.1	23.2	43.5
4	20.5	31.2	37.3	40.6	51.8	56.5	61.5	60.5	54.2	40.0	35.7	23.0	42.7
5	20.4	30.8	36.9	40.4	52.3	56.8	61.7	60.5	53.7	39.4	35.1	22.5	42.5
6	20.3	30.3	37.3	41.1	54.3	59.3	63.7	62.0	54.2	39.3	34.4	22.4	43.2
7	20.1	30.9	38.7	44.0	58.4	63.9	68.0	65.6	57.2	40.0	34.3	23.0	45.3
8	21.6	33.1	42.4	47.2	63.3	68.5	73.9	70.1	63.5	45.9	35.3	23.8	49.0
9	24.7	35.3	46.0	50.2	66.9	72.1	77.0	73.6	68.9	52.5	38.8	26.9	52.7
10	28.3	37.9	48.1	53.1	70.0	74.9	80.0	76.2	72.9	56.9	41.8	29.7	55.8
11	30.7	40.3	50.2	55.0	71.8	77.1	83.0	79.1	75.9	60.5	44.2	31.7	58.3

[1] The observations between June, 1840, and Dec. 1841, inclusive, were taken bi-hourly, and those between June, 1840, and Feb. 1841, inclusive, 25 minutes after the full hours; those between March, 1841, and Dec. 1841, inclusive, 15 minutes after the full hours. By *interpolation* the results were *changed* to refer to the full hours and for every hour. The means for each hour for the whole period of observations were then combined separately for each month. There is no record for Jan., Feb., and March, 1843. For record see "Observations at the magnetical and meteorological Observatory." Washington, D. C., 1847, four volumes.

[2] MS. in Sm. Coll.

The record begins with Jan. 1851, but is not sufficiently regular for use till May, 1851. Numbers interpolated at the following hours: 3 A. M. May, 1851; 9 A. M., 3 P. M., and 9 P. M. May, June, July, 1851. The annual means for 10, 11 P. M., 0, 1, and 2 A. M. are graphically interpolated.

There are many omissions in the record. Some scattering observations between the hours 10 P. M. and 3 A. M. cannot be utilized.

Jackson.—Continued.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Noon	32°.4	42°.0	51°.7	56°.4	74°.0	78°.3	85°.0	80°.8	78°.6	62°.6	45°.9	33°.6	60°.1
1	32.9	43.1	52.9	57.7	74.9	79.2	85.4	81.9	80.0	63.9	46.6	34.4	61.1
2	32.9	43.4	53.8	59.2	75.5	78.9	84.1	82.6	79.8	64.2	47.4	35.2	61.4
3	32.4	42.9	53.6	58.9	75.2	78.0	83.2	82.6	80.1	63.7	47.0	35.2	61.1
4	31.2	42.0	52.9	58.3	73.6	76.2	82.3	80.7	79.0	62.3	46.0	34.3	59.9
5	29.0	39.5	51.2	56.4	72.1	75.4	81.1	78.7	76.4	58.8	43.1	31.9	57.8
6	27.0	35.8	47.1	53.8	68.9	72 8	78.1	75.0	70.3	52.9	40.4	29.9	54.3
7	25.6	34.1	43.6	49.7	64.4	68.8	73.1	69.6	64.3	49.6	39.8	28.8	51.0
8	24.9	33.2	41.7	46.9	60.9	64.1	69.4	66.3	61.3	47.3	38.9	27.1	48.5
9	23.7	32.6	40.6	45.7	57.9	62.2	67.8	65.1	59.6	46.0	38.1	27.0	47.2
10	..	..	..	..	..	..	..	..	..	..	..	..	46.4
11	..	..	..	..	..	..	..	..	..	..	..	..	45.8
Mean													50.9

Bi-hourly Means of Temperature.

Washington City, Capitol Hill, D. C.[1] Lat. 38° 53′. Long. 77° 01′ W. of G.

Alt. 80 feet. Lieut. J. M. Gilliss, U. S. N. Jan. 1841, to June, 1842, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
0.2_m	32.37	32.58	42.48	47.91	55.20	66.83	68.78	66.82	62.70	44.90	41.80	33.50	49.66
2.2	32.10	31.22	41.26	46.92	53.34	66.04	68.09	65.12	61.90	43.70	40.70	33.16	48.63
4.2	31.71	30.51	40.06	46.12	52.42	65.07	66.78	64.17	61.00	42.30	39.40	32.20	47.64
6.2	30.74	30.18	39.88	46.49	55.50	68.26	70.64	65.69	61.29	41.70	38.80	31.60	48.40
8.2	33.13	31.44	42.28	49.93	59.72	73.63	75.19	71.39	65.73	45.00	39.50	31.88	51.57
10.2	35.38	36.72	48.06	54.02	63.23	77.37	78.38	76.09	71.02	51.61	44.10	36.00	55.99
0.2_a	38.28	40.04	51.39	57.68	66.38	79.33	81.13	78.70	74.66	55.30	48.00	39.20	59.17
2.2	40.83	42.51	53.61	59.98	68.48	81.93	83.25	80.73	76.50	57.00	49.20	41.30	61.27
4.2	40.18	42.28	53.28	60.20	68.69	83.43	84.76	80.09	76.30	56.20	48.50	40.60	61.21
6.2	36.68	38.22	49.97	57.22	65.93	76.89	81.33	75.93	72.30	52.94	47.30	37.95	57.72
8.2	35.48	35.38	46.20	52.18	59.83	72.29	74.93	71.48	68.59	48.40	44.20	36.26	53.77
10.2	34.25	33.86	44.37	49.12	56.70	68.70	71.56	68.00	64.90	46.60	43.20	34.70	51.33
Mean	35.10	35.41	46.08	52.31	60.45	73.32	75.40	72.02	68.07	48.80	43.73	35.70	53.87

Tri-hourly Means of Temperature.

Washington City, U. S. Naval Observatory. Lat. 38° 54′. Long. 77° 03′ W. of G.

Alt. 110 feet. Sup't U. S. N. O. Astro. and Met. Obs. for 1866–7–8–9. Jan. 1862, to Dec. 1869, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	29.55	31.75	37.76	47.71	56.80	65.72	70.64	69.16	62.94	50.35	41.35	32.57	49.69
3	28.45	30.45	36.31	45.45	54.54	63.77	68.96	67.58	61.34	48.54	39.76	31.49	48.05
6	27.56	29.58	35.20	44.62	54.41	63.67	68.53	66.66	60.35	47.35	38.82	30.64	47.28
9	29.46	32.63	39.54	51.66	62.37	71.56	76.38	74.25	69.23	53.99	42.82	32.67	53.05
Noon	35.89	39.02	45.35	57.46	68.28	77.40	82.68	81.46	75.37	62.25	51.00	38.51	59.56
3	37.43	41.13	47.56	59.50	70.51	78.88	84.10	83.67	77.11	63.76	51.94	39.51	61.26
6	33.70	37.20	44.40	56.26	66.51	75.35	80.64	78.13	70.08	56.47	46.21	35.62	56.71
9	31.29	34.04	40.07	51.03	60.24	68.91	73.56	72.31	65.14	52.36	43.16	33.41	52.13
Mean	31.67	34.47	40.77	51.71	61.71	70.66	75.69	74.15	67.70	54.38	44.38	34.30	53.47

[1] Pub. Doc., 2d Session, 28th Congress, vol. x, No. 172. Washington, 1845.

HOURLY MEANS OF TEMPERATURE.

Fort Morgan, Mobile Point, Alabama.[1] Lat. 30° 14′. Long. 88° 01′ W. of G.

Alt. 20 feet. Observed by U. S. Coast Survey. June, 1848 and 1850.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	..	..	63°.55	66°.98	..	79°.10	83°.53	84°.44	81°.45	70°.93	60°.21	54°.95	68°.8
1	..	..	62.25	65.93	..	78.42	83.14	84.55	81.21	70.70	59.98	54.95	68.4
2	..	..	62.16	66.27	..	78.21	82.78	84.34	80.57	70.11	59.60	54.69	68.1
3	..	..	61.69	65.22	..	78.05	82.51	83.98	80.13	69.55	59.23	54.16	67.7
4	..	..	60.95	66.24	..	78.17	82.12	83.82	79.59	68.87	58.74	53.75	67.4
5	..	..	60.52	66.04	67°.39	77.97	82.00	83.68	79.10	68.47	58.35	53.42	67.1
6	56°.38	52°.28	60.05	65.98	67.45	78.30	82.49	84.01	78.80	68.18	57.76	53.27	67.0
7	55.89	51.88	60.30	67.24	68.42	79.34	83.53	84.68	79.50	68.74	57.51	52.99	67.5
8	57.05	53.03	61.46	68.25	69.58	80.62	84.46	85.87	80.86	69.18	58.30	53.65	68.5
9	58.12	54.79	62.84	69.43	70.75	81.76	85.53	86.99	82.25	70.52	59.28	54.48	69.7
10	59.45	55.77	63.80	70.73	71.76	82.86	86.66	88.33	83.73	71.78	60.32	55.74	70.9
11	60.55	57.03	64.96	71.82	72.56	83.40	88.16	89.49	84.96	72.85	61.44	56.72	71.9
Noon	61.28	58.01	65.91	72.98	73.43	83.75	88.55	90.15	85.75	73.95	62.56	57.38	72.8
1	61.73	58.74	66.34	73.44	74.56	84.08	89.38	90.85	86.56	74.74	63.43	58.14	73.5
2	62.04	59.19	66.70	73.61	75.18	84.21	89.65	90.77	86.97	75.56	64.35	58.89	73.9
3	62.13	58.95	67.06	73.68	75.37	84.17	88.96	90.09	87.31	75.73	64.74	59.14	73.9
4	61.71	58.54	66.96	73.56	74.93	83.76	88.35	89.75	86.99	75.54	64.44	58.67	73.5
5	60.70	57.87	66.27	72.18	73.70	82.79	87.27	88.89	86.27	74.56	63.46	57.74	72.6
6	60.06	56.86	65.04	70.85	72.61	81.94	86.34	87.74	84.78	73.25	62.41	57.04	71.5
7	59.63	56.12	64.22	69.83	71.76	80.89	85.38	86.45	83.74	72.68	62.08	56.61	70.7
8	59.21	55.79	63.87	69.39	71.31	80.27	84.76	85.67	83.19	72.39	61.58	56.33	70.3
9	59.07	55.27	63.61	68.98	71.00	79.93	84.45	85.16	82.92	72.13	61.17	56.08	70.0
10	58.61	55.09	63.28	68.58	..	79.35	84.20	84.91	82.26	71.91	60.83	55.95	69.6
11	..	..	62.93	66.74	..	79.29	83.94	84.67	81.89	71.54	60.50	55.54	69.1
Mean	58.96*	55.50*	63.61	69.33	71.04*	80.86	85.34	86.64	82.95	71.83	60.93	55.84	70.24

N. B. Some of the results are not altogether reliable, as the series is too short and broken.

* These values were found by means of graphical interpolation for the hours of no record, viz:—

Hour.	Jan.	Feb.	Mar.	Apr.	May.
10 P. M.	..	..	..	..	70.6
11	58.0	54.8	..	..	70.1
Mdn't	57.7	54.5	..	..	69.5
1	57.6	54.2	..	..	69.1
2	57.4	53.9	..	..	68.5
3	57.2	53.5	..	..	68.0
4	56.9	53.2	..	..	67.6
5 A. M.	56.6	52.7	..	..	

HOURLY MEANS OF TEMPERATURE.

Galveston, Texas.[1] Lat. 29° 18′. Long. 94° 47′ W. of G.

Alt. 20 ft. Obs'd by U. S. Coast Survey. June, Sept. Oct. Nov. Dec. 1851; Jan. Feb. Mar. 1852; Jan. Feb. 1853.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	48.2	56.5	65.3	..	..	..	..	..	78.5	70.4	58.0	52.2	..
1	47.9	55.9	64.9	..	..	..	..	..	78.7	70.0	58.7	52.3	..
2	47.7	55.8	64.5	..	..	..	..	..	78.7	69.6	58.2	51.8	..
3	47.5	55.6	64.2	..	..	..	..	..	78.3	69.2	57.8	51.6	..
4	47.1	53.3	63.8	..	..	..	..	..	77.8	68.8	57.4	51.2	..
5	46.7	55.2	63.6	..	..	75.7	..	..	77.7	69.0	57.1	50.7	..
6	46.6	55.5	64.0	..	..	77.1	..	..	77.7	70.7	57.2	50.4	..
7	46.7	55.5	65.1	..	..	79.7	..	..	79.7	74.1	58.2	50.3	..
8	47.7	57.0	68.0	..	..	81.3	..	..	82.2	76.2	61.3	51.1	..
9	48.6	59.1	71.1	..	..	82.4	..	..	83.9	77.2	62.7	53.4	..
10	51.2	60.5	73.1	..	..	81.8	..	..	84.8	77.2	63.3	54.7	..
11	51.8	61.3	73.6	..	..	83.3	..	..	84.7	76.9	62.5	54.7	..

[1] MS. in Sm. Coll.

Galveston.—Continued.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Noon	51°.8	61°.1	72°.8	..	..	83°.0	..	..	84°.2	76°.9	61°.9	54°.8	..
1	51.8	61.0	71.8	..	..	83.3	..	..	84.1	76.8	61.7	54.9	..
2	51.6	60.8	71.7	..	..	83.8	..	..	83.6	76.3	61.7	54.9	..
3	51.5	60.4	70.9	..	..	84.8	..	..	83.2	75.6	61.6	54.9	..
4	51.5	60.0	70.5	..	..	86.0	..	..	82.8	74.4	61.4	54.6	..
5	50.8	59.0	69.5	..	..	84.3	..	..	82.0	73.6	60.7	54.1	..
6	50.1	58.4	68.3	..	..	81.0	..	..	81.4	72.6	60.2	53.7	..
7	49.6	58.0	67.4	..	..	79.1	..	..	80.4	72.1	59.5	53.3	..
8	49.2	57.5	66.8	..	..	..	..	..	79.6	71.7	58.9	52.9	..
9	48.7	57.1	66.3	..	..	..	..	..	79.3	71.1	58.6	52.7	..
10	48.6	56.9	65.8	..	..	..	..	..	79.1	70.9	58.2	52.3	..
11	48.4	56.7	65.7	..	..	..	..	..	78.7	70.8	58.1	52.2	..
Mean	49.2	57.8	67.9	..	..	80.4[1]	..	..	80.9	73.0	59.8	52.9	..

Hourly Means of Temperature.

Key West, Florida.[2] Lat. 24° 33′. Long. 81° 48′ W. of G.

Alt. 20 feet. Observed by the U. S. Coast Survey. June, 1851, to May, 1852, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	63.32	69.64	74.06	75.67	79.79	81.70	82.87	83.54	..	79.03	..	70.74	..
1	63.34	69.09	74.02	75.40	79.45	81.68	83.02	83.35	..	78.74	..	70.81	..
2	63.27	69.12	74.06	75.38	79.50	81.35	82.77	83.09	..	78.79	..	70.85	..
3	63.16	68.74	73.89	75.32	79.34	81.26	82.58	82.84	..	78.79	..	70.66	..
4	63.00	68.62	73.74	75.30	79.16	81.00	82.29	82.71	..	78.71	..	70.48	..
5	62.56	68.12	73.31	74.92	78.60	80.93	82.00	82.35	..	78.39	..	69.97	..
6	62.55	68.10	73.19	74.98	78.97	81.23	82.19	82.48	..	78.34	..	69.32	..
7	62.48	68.17	73.85	75.97	81.18	82.18	83.76	83.42	..	78.90	..	69.15	..
8	63.02	69.33	75.53	77.48	83.26	83.38	85.43	85.00	..	80.08	..	69.63	..
9	64.66	71.17	77.11	78.58	84.53	84.68	86.47	85.77	..	80.97	..	70.61	..
10	65.74	72.52	78.18	79.28	85.02	85.71	87.23	86.39	..	81.60	..	71.26	..
11	66.63	73.34	78.76	79.57	85.27	85.81	87.53	86.81	..	81.98	..	71.82	..
Noon	67.08	73.84	78.97	79.78	85.16	86.16	87.76	86.84	..	82.10	..	72.10	..
1	67.71	73.93	79.21	80.30	85.27	86.36	88.32	87.35	..	82.48	..	72.08	..
2	67.89	74.05	79.39	80.50	85.37	86.18	88.15	87.42	..	82.52	..	72.21	..
3	68.16	74.48	79.29	80.57	85.19	86.30	88.11	87.39	..	82.44	..	72.37	..
4	68.23	74.84	79.15	80.28	85.08	86.28	87.70	87.29	..	82.29	..	72.39	..
5	67.71	74.50	78.53	80.17	84.69	85.83	87.65	87.03	..	81.79	..	71.89	..
6	66.26	73.14	77.32	79.85	84.53	85.11	86.43	86.42	..	80.77	..	70.97	..
7	65.06	71.76	75.79	77.92	82.18	83.68	85.15	85.42	..	80.16	..	70.44	..
8	64.58	71.03	75.11	76.98	81.34	82.64	84.47	84.84	..	79.97	..	70.40	..
9	64.34	70.69	74.98	76.67	80.92	82.10	84.00	84.39	..	79.77	..	70.60	..
10	63.94	70.28	74.52	76.22	80.42	81.76	83.38	83.97	..	79.47	..	70.79	..
11	63.53	69.93	74.23	75.92	79.97	81.76	83.03	83.81	..	79.26	..	70.84	..
Mean	64.92	71.18	76.09	77.62	82.25	83.54	85.09	84.99	..	80.30	..	70.93	..

N. B. No observations in Sept. and Nov. 1851.

[1] Obtained by interpolation for 3 A. M. and 9 P. M., by the hours 3, 9, 3, 9. The observations extend over too short a time to be relied on.

[2] MS. in Sm. Coll.; Gustavus Wurdemann, observer.

TABLES OF DIFFERENCES

OF

BI-HOURLY, HOURLY AND SEMI-HOURLY MEAN TEMPERATURES FROM THE MEAN OF THE DAY,

FOR

EACH MONTH AND THE YEAR.

AT VARIOUS PLACES IN AMERICA.

18 February, 1875.

TABLES OF DIFFERENCES OF MEAN TEMPERATURES AT DIFFERENT HOURS OF THE DAY FROM THE DAILY MEAN, FOR EACH MONTH AND THE YEAR.

INDEX TO STATIONS.

[Arranged according to latitudes.]

DIURNAL FLUCTUATION OF TEMPERATURE (Fah. scale).

Van Rensselaer Harbor, North Greenland. Lat. 78° 37′. Long. 70° 53′ W. of G.

Kane. Near sea level. Sept. 1853, to Jan. 1855, inclusive.

(Uncorrected for effect of annual fluctuation.)

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	—0.1	—0.9	—1.6	—3.7	—3.2	—1.9	—1.3	—2.0	—2.7	—1.1	—0.6	—0.3	—1.6
1	—0.1	—1.6	—2.0	—4.5	—4.4	—3.1	—1.6	—2.6	—2.2	+0.1	+0.7	—0.4	—1.8
2	—0.3	—1.6	—1.8	—4.5	—4.1	—3.0	—1.5	—2.3	—2.1	+0.1	+0.7	—0.2	—1.7
3	—0.4	—1.4	—2.0	—4.9	—3.4	—2.9	—1.4	—2.3	—1.9	+0.1	+0.7	—0.5	—1.7
4	—0.5	—0.8	—2.2	—4.4	—2.8	—2.5	—1.4	—2.0	—2.0	+0.2	+0.7	—0.7	—1.5
5	—0.5	—1.5	—2.1	—3.5	—1.6	—1.3	—1.3	—2.1	—2.0	+0.3	0.0	+0.2	—1.3
6	—0.5	—0.9	—1.9	—2.9	—0.7	—0.6	—0.6	—1.5	—1.4	+0.3	—0.2	+0.3	—0.9
7	—0.8	—0.5	—1.2	—1.8	+0.1	+0.3	—0.4	—0.8	—0.4	+0.4	0.0	+0.1	—0.4
8	—0.3	—0.2	—0.8	—0.7	+1.0	+1.5	+0.2	+0.1	+1.0	+0.4	—0.2	+0.1	+0.2
9	—0.4	+0.1	+0.5	+0.9	+1.0	+0.7	+1.2	+1.2	+1.8	+0.7	0.0	+0.4	+0.7
10	—0.1	+0.6	+1.1	+1.6	+1.7	+0.9	+1.4	+2.1	+2.4	+0.9	—0.1	+0.5	+1.1
11	+0.4	+0.3	+2.3	+2.6	+1.9	+1.3	+1.8	+2.2	+2.8	+0.8	+0.4	+0.6	+1.4
Noon	+0.9	+0.9	+2.8	+3.2	+2.5	+2.1	+1.8	+2.4	+3.0	+0.6	+0.6	+1.1	+1.8
1	+0.7	+1.4	+3.2	+3.7	+2.7	+2.2	+1.6	+2.4	+3.1	+0.6	+0.3	+1.0	+1.9
2	+0.6	+1.4	+3.6	+4.5	+3.0	+2.1	+1.5	+2.4	+2.7	+0.4	+0.2	+0.7	+1.9
3	+0.1	+1.3	+3.0	+4.6	+3.1	+1.8	+1.5	+2.0	+2.2	+0.5	+0.2	+0.3	+1.7
4	—0.1	+1.2	+1.9	+4.3	+3.3	+1.5	+1.4	+1.5	+1.6	+0.3	+0.1	0.0	+1.4
5	+0.2	+0.9	+1.2	+4.2	+2.8	+1.3	+0.7	+1.2	+1.0	+0.1	+0.2	—0.1	+1.1
6	+0.2	+1.0	+0.6	+3.3	+1.9	+1.1	+0.3	+0.7	+0.5	—0.3	0.0	—0.2	+0.8
7	+0.3	+1.1	+0.1	+1.9	+1.1	+0.7	0.0	+0.3	—0.3	—0.9	—0.2	—0.8	+0.3
8	+0.1	+0.9	—0.8	+1.0	+0.2	+0.5	—0.5	—0.1	—0.8	—1.0	—0.3	—0.7	—0.1
9	+0.1	+0.5	—0.9	—0.4	—0.6	—0.2	—1.0	—0.3	—1.2	—1.0	—0.8	—0.6	—0.5
10	+0.2	—0.6	—1.2	—1.9	—1.7	—0.6	—1.5	—1.0	—1.6	—1.0	—0.5	—0.6	—1.0
11	—0.4	—0.6	—1.4	—2.6	—2.7	—1.5	—1.4	—1.4	—2.3	—1.0	—0.7	—0.5	—1.4
Comb's													
10, 10	0.0	0.0	0.0	—0.1	0.0	+0.1	0.0	+0.5	+0.4	0.0	—0.3	0.0	0.0
6, 2, 9	+0.1	+0.3	+0.3	+0.4	+0.6	+0.4	0.0	+0.2	0.0	—0.3	—0.3	—0.1	+0.2
6, 2, 10	+0.1	0.0	+0.2	—0.1	+0.2	+0.3	—0.2	0.0	—0.1	—0.1	—0.2	+0.1	0.0
7, 2, 9	0.0	+0.5	+0.5	+0.8	+0.8	+0.7	0.0	+0.4	+0.4	—0.1	—0.2	+0.1	+0.3
7, 2, 9 bis	0.0	+0.5	+0.1	+0.5	+0.5	+0.5	—0.2	+0.2	0.0	—0.3	—0.3	—0.1	+0.1
3, 9, 3, 9	—0.1	+0.1	+0.1	0.0	0.0	—0.1	+0.1	+0.1	+0.2	+0.1	0.0	—0.1	+0.0

Port Foulke, North Greenland. Lat. 78° 18′. Long. 73° 00′ W. of G.

Hayes. Near sea level. Sept. 1860, to July, 1861, inclusive.

(Uncorrected for effect of annual fluctuation.)

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	—0.2	—0.9	—2.4	—1.8	—3.0	—2.1	—2.1	—1.6	—1.1	—0.7	—0.5	+0.5	—1.32
2	—0.5	—2.0	—2.9	—2.3	—4.1	—2.9	—2.0	—1.3	—0.6	—0.9	—0.9	+1.2	—1.61
4	—0.2	—2.3	—3.6	—2.7	—2.2	—1.4	—1.7	—1.0	—0.3	—0.8	—1.0	—0.1	—1.45
6	—0.6	—1.0	—3.0	—1.4	—1.0	—0.5	—1.3	—0.7	—0.2	—1.0	—0.1	—0.3	—0.94
8	+0.3	+0.7	—0.7	+0.2	+1.3	0.0	+0.2	+0.2	0.0	—0.5	—0.2	—0.7	+0.06
10	+0.7	+0.8	0.0	+0.8	+2.1	+1.2	+1.0	+0.6	+0.1	+0.2	0.0	—0.1	+0.60
Noon	+0.8	+0.9	+1.7	+2.1	+2.6	+1.7	+0.8	+0.7	+0.6	+0.9	+0.2	0.0	+1.09
2	+0.2	+2.0	+5.4	+3.0	+2.3	+2.3	+2.2	+1.6	+0.9	+1.2	+0.3	+0.1	+1.77
4	—0.2	+0.8	+3.9	+2.0	+2.0	+1.8	+1.9	+1.4	+0.8	+1.1	+0.6	+1.0	+1.43
6	—0.1	+0.5	+1.6	+0.9	+1.7	+1.2	+0.9	+0.6	+0.2	+0.7	+0.9	—0.2	+0.73
8	+0.1	+0.2	+0.5	+0.3	—0.2	+0.2	+0.1	+0.1	0.0	+0.5	+0.5	—0.1	+0.19
10	—0.2	+0.4	—0.9	—1.3	—1.8	—1.2	—0.2	—0.2	—0.3	—0.4	+0.4	—0.8	—0.56
Comb's													
10, 10	+0.2	+0.6	—0.4	—0.2	+0.1	0.0	+0.4	+0.2	—0.1	—0.1	+0.2	—0.4	+0.02
6, 2, 10	—0.2	+0.5	+0.5	+0.1	—0.2	+0.2	+0.2	+0.2	+0.1	—0.1	+0.2	—0.3	+0.09

The values for August are interpolated.

Melville Island, Arctic America.[1] Lat. 74° 47′. Long. 110° 48′ W. of

Parry. At sea level. 1819 to 1820.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	..
Mdn't	..	..	..	..	..	..	..	..	..	..	—0.56	0.00	..
1	—0.26	—0.22	—2.34	..	..	..	..	..	..	—0.09	..	..	..
2	..	..	..	..	..	..	..	..	..	..	+0.26	+0.20	..
3	—0.40	—0.11	—2.74	..	..	..	..	..	..	—0.26	..	..	..
4	..	..	..	..	..	..	..	..	..	..	+0.04	+0.13	..
5	—0.16	—0.56	—2.02	..	..	..	..	..	..	—0.54	..	..	..
6	..	..	..	..	..	..	..	..	..	..	0.00	—0 24	..
7	—0.24	—0.65	—1.28	..	..	..	..	..	..	—0.45	..	..	..
8	..	..	..	..	..	..	..	..	..	..	+0.49	—0.16	..
9	+0.29	+0.54	+0.65	..	..	..	..	..	..	+0.33	..	..	..
10	..	..	..	..	..	..	..	..	..	..	+0.85	—0.24	..
11	+0.78	+0.97	+2.99	..	..	..	..	..	..	+1.03	..	..	..
Noon	..	..	..	..	..	..	..	..	..	..	+0.92	—0.54	..
1	+0.49	+1.46	+3.86	..	..	..	..	..	..	+0.97	..	..	..
2	..	..	..	..	..	..	..	..	..	..	+0.61	—0.32	..
3	+0.56	+1.16	+2.25	..	..	..	..	..	..	—0.49	..	..	..
4	..	..	..	..	..	..	..	..	..	..	—0.36	0.00	..
5	—0.09	—0.09	+0.97	..	..	..	..	..	..	+0.54	..	..	..
6	..	..	..	..	..	..	..	..	..	..	—0.61	+0.26	..
7	—0.09	—0.54	—0.13	..	..	..	..	..	..	+0.22	..	..	..
8	..	..	..	..	..	..	..	..	..	..	—0.85	+0.58	..
9	—0.24	—0.78	—0.74	..	..	..	..	..	..	—0.24	..	..	..
10	..	..	..	..	..	..	..	..	..	..	—0.80	+0.26	..
11	—0.90	—1.10	—1.48	..	..	..	..	..	..	—0.97	..	..	..

Port Kennedy, North Somerset. Lat. 72° 01′. Long. 94° 14′ W. of G.

McClintock. Near sea level. Aug. 1858, to Aug. 1859, inclusive.

(Uncorrected for effect of annual fluctuation.)

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	—0.2	—0.5	—2.9	—3.3	—3.9	—4.2	—3.1	—1.0	—0.7	—1.0	—1.3	—0.4	—1.9
2	—0.2	—0.6	—3.3	—2.9	—4.3	—5.1	—3.6	—1.3	—0.9	—0.5	—0.3	+0.4	—1.9
4	—0.7	—0.2	—3.3	—1.9	—2.0	—2.0	—2.9	—1.3	—1.2	0.0	+0.1	+0.5	—1.2
6	—0.4	—0.2	—3.8	—1.3	—1.0	—0.3	—0.9	—0.9	—1.3	—0.4	+0.7	+0.3	—0.8
8	—0.4	+0.1	—1.7	+0.2	+1.2	+2.8	+1.2	—0.1	—0.7	—0.2	+0.9	—0.4	+0.2
10	0.0	+0.2	+3.0	+2.2	+2.3	+4.5	+2.8	+0.7	+0.1	+0.7	+1.2	+0.2	+1.5
Noon	+0.3	+0.8	+5.8	+3.8	+3.5	+4.5	+3.4	+1.2	+1.1	+1.5	+1.0	+0.1	+2.2
2	0.0	+0.8	+5.7	+4.2	+3.7	+3.2	+2.2	+1.3	+1.6	+1.0	+0.2	+0.2	+2.0
4	+0.3	+0.3	+4.0	+3.1	+2.9	+1.6	+1.9	+1.1	+1.4	0.0	—0.3	—0.2	+1.3
6	+0.7	—0.2	—0.7	+0.6	+1.2	+0.1	+1.0	+0.8	+1.0	—0.2	—0.6	—0.3	+0.3
8	+0.5	0.0	—1.5	—1.6	—1.0	—1.4	—0.1	+0.3	+0.2	—0.3	—0.9	—0.4	—0.5
10	+0.5	+0.1	—1.8	—3.0	—2.7	—3.3	—1.5	—0.2	0.0	—0.4	—1.0	—0.5	—1.2
Comb's 10, 10	+0.2	+0.1	+0.6	—0.4	—0.2	+0.6	+0.6	+0.2	0.0	+0.1	+0.1	—0.1	+0.1
6, 2, 9[2]	0.0	+0.2	0.0	+0.2	+0.3	+0.2	+0.2	+0.1	+0.1	+0.1	0.0	0.0	+0.1
6, 2, 10	0.0	+0.2	0.0	0.0	0.0	—0.1	—0.1	+0.1	+0.1	+0.1	0.0	0.0	0.0
7, 2, 9[2]	0.0	+0.3	+0.4	+0.4	+0.7	+0.7	+0.4	+0.3	+0.2	+0.1	0.0	—0.1	+0.3
7, 2, 9 bis[2]	+0.1	+0.2	—0.1	—0.2	0.0	0.0	+0.2	+0.2	+0.2	0.0	—0.2	—0.1	0.0
3, 9, 3, 9[2]	0.0	0.0	+0.1	0.0	0.0	+0.1	0.0	0.0	+0.1	0.0	0.0	0.0	0.0

[1] From Prof. Guyot's Meteorological and Physical Tables, Smithsonian Misc. Coll.; Washington, 1858. Reaumur's changed into Fahrenheit's scale. Table by Dove.

[2] By interpolation.

Boothia Felix, Arctic America.[1] Lat. 69° 59′. Long. 92° 01′ W. of G.

At sea level. Ross. [Table by Dove]. 1829 to 1830.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	−0.11	−1.10	−3.10	−4.68	−5.17	−4.59	−3.57	−2.81	−1.14	−0.63	−0.33	−0.26	−2.29
1	−0.18	−0.94	−3.62	−4.88	−5.94	−5.35	−4.00	−3.01	−1.25	−0.67	−0.04	−0.26	−2.51
2	−0.22	−0.63	−4.16	−5.06	−6.18	−5.73	−4.00	−2.92	−1.39	−0.71	+0.40	−0.29	−2.58
3	−0.24	−0.56	−4.72	−5.17	−5.87	−5.51	−3.71	−2.63	−1.48	−0.74	+0.65	−0.22	−2.51
4	−0.24	−0.47	−5.17	−5.08	−5.02	−4.61	−3.03	−2.29	−1.48	−0.76	+0.69	−0.13	−2.29
5	−0.22	−0.49	−5.35	−4.54	−3.95	−3.12	−2.22	−1.93	−1.25	−0.71	+0.54	−0.04	−1.96
6	−0.22	−0.58	−5.02	−3.44	−2.29	−1.46	−1.37	−1.57	−1.03	−0.61	+0.29	+0.09	−1.44
7	−0.20	−0.65	−3.98	−1.82	−0.78	+0.09	−0.58	−1.12	−0.61	−0.38	+0.04	+0.16	−0.83
8	−0.18	−0.49	−2.20	+0.13	+0.71	+1.30	+0.07	−0.54	−0.11	−0.02	+0.02	+0.22	−0.09
9	−0.13	−0.11	+0.13	+2.20	+2.13	+2.22	+0.83	+0.22	+0.26	+0.45	+0.09	+0.22	+0.71
10	−0.04	+0.58	+2.75	+4.07	+3.46	+2.99	+1.57	+1.10	+0.97	+0.92	+0.32	+0.22	+1.57
11	+0.04	+1.30	+5.13	+5.51	+4.63	+3.73	+2.36	+1.93	+1.46	+1.32	+0.58	+0.24	+2.36
Noon	+0.11	+1.96	+6.86	+6.43	+5.53	+4.54	+3.22	+2.60	+1.84	+1.55	+0.71	+0.26	+2.96
1	+0.24	+2.29	+7.60	+6.82	+5.99	+5.24	+3.82	+3.01	+2.09	+1.53	+0.67	+0.32	+3.31
2	+0.32	+2.20	+7.33	+6.65	+5.97	+5.58	+4.18	+3.10	+2.11	+1.28	+0.42	+0.29	+3.28
3	+0.33	+1.75	+6.25	+6.01	+5.40	+5.26	+4.00	+2.96	+2.09	+0.85	+0.09	+0.22	+2.94
4	+0.32	+1.03	+4.63	+4.90	+4.45	+4.45	+3.50	+2.65	+1.53	+0.40	−0.13	+0.11	+2.32
5	+0.24	+0.32	+2.90	+3.37	+3.26	+3.05	+2.65	+2.27	+0.99	−0.02	−0.54	−0.02	+1.55
6	+0.20	−0.29	+1.28	+1.66	+1.98	+1.48	+1.75	+1.75	+0.38	−0.32	−0.69	−0.16	+0.76
7	+0.13	−0.71	−0.02	−1.13	+0.76	+0.02	+0.76	+1.12	−0.18	−0.49	−0.80	−0.22	+0.02
8	+0.11	−0.97	−0.99	−1.75	−0.45	−1.14	−0.16	+0.36	−0.58	−0.56	−0.85	−0.24	−0.61
9	+0.07	−1.12	−1.70	−3.03	−1.66	−2.06	−1.12	−0.54	−0.85	−0.58	−0.85	−0.22	−1.14
10	+0.04	−1.14	−2.22	−3.91	−2.88	−2.83	−2.02	−1.48	−0.99	−0.58	−0.78	−0.22	−1.59
11	−0.04	−1.16	−2.67	−4.38	−4.09	−3.67	−2.70	−2.27	−1.08	−0.58	−0.63	−0.20	−1.96
Comb's													
10, 10	0.00	−0.28	+0.26	+0.08	+0.29	+0.08	−0.22	−0.19	−0.01	+0.17	−0.23	0.00	0.00
6, 2, 9	+0.06	+0.17	+0.20	+0.06	+0.67	+0.69	+0.56	+0.33	+0.08	+0.03	−0.05	+0.05	+0.23
6, 2, 10	+0.05	+0.16	+0.03	−0.23	+0.27	+0.43	+0.26	+0.02	+0.03	+0.03	−0.02	+0.05	+0.08
7, 2, 9	+0.06	+0.14	+0.55	+0.60	+1.18	+1.20	+0.83	+0.48	+0.22	+0.11	−0.13	+0.08	+0.44
7, 2, 9 bis	+0.06	−0.17	−0.01	−0.31	+0.47	+0.39	+0.34	+0.22	−0.05	−0.06	−0.31	0.00	+0.04
3, 9, 3, 9	These four hours appear to have been used for the daily means, the results of the combination being zero.												

Sitka, Alaska Ter'y.[1] Lat. 57° 03′. Long. 135° 20′ W. of G.

Alt. 20 feet. [Table by Dove.] From a 5 year series.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	−0.74	−1.30	−2.18	−3.39	−4.05	−4.07	−3.78	−3.01	−2.41	−2.67	−0.92	−0.63	−2.43
1	−0.76	−1.48	−2.45	−3.78	−4.59	−4.63	−4.23	−3.44	−2.65	−2.49	−1.03	−0.74	−2.70
2	−0.78	−1.61	−2.63	−4.07	−4.95	−5.06	−4.59	−3.73	−2.99	−2.65	−1.10	−0.74	−2.90
3	−1.14	−1.75	−3.05	−4.25	−5.47	−5.60	−4.85	−3.98	−2.79	−1.44	−1.08	−0.40	−2.99
4	−1.01	−1.93	−3.31	−4.54	−5.73	−5.78	−4.95	−4.09	−2.90	−1.53	−1.10	−0.40	−3.10
5	−1.01	−1.87	−3.53	−4.66	−5.37	−5.56	−6.63	−4.25	−2.99	−1.57	−1.10	−0.32	−3.24
6	−1.01	−1.89	−3.51	−4.25	−3.95	−3.98	−3.76	−3.64	−2.99	−1.75	−1.03	−0.40	−2.67
7	−1.16	−1.84	−3.08	−2.54	−2.15	−2.43	−2.15	−2.45	−2.36	−1.30	−0.90	−0.38	−1.91
8	−1.08	−1.70	−1.68	−0.69	0.00	−0.58	−0.58	−0.90	−1.06	−1.19	−0.74	−0.26	−0.87
9	−0.87	−1.10	+0.18	+1.42	+1.84	+1.16	+1.30	+0.58	+0.38	−0.26	−0.52	−0.22	+0.33
10	−0.35	+0.07	+1.55	+2.58	+3.03	+2.88	+2.86	+2.13	+1.64	+0.63	0.00	+0.24	+1.44
11	+0.42	+1.35	+2.90	+3.78	+3.93	+3.82	+4.43	+3.53	+2.88	+1.68	+0.78	+0.24	+2.49

[1] From Prof. Guyot's Meteorological and Physical Tables, Smithsonian Misc. Coll.; Washington, 1858. Reaumur's changed into Fahrenheit's scale.

Sitka.—Continued.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Noon	+1.28	+2.36	+3.84	+4.79	+4.88	+4.74	+4.74	+4.59	+3.71	+2.56	+1.61	+0.71	+3.33
1	+1.87	+3.05	+3.91	+5.24	+5.33	+5.28	+5.06	+5.24	+3.50	+3.10	+1.89	+1.03	+3.71
2	+2.13	+3.24	+4.47	+5.13	+5.40	+5.44	+5.19	+4.85	+4.18	+3.19	+2.25	+1.12	+3.89
3	+2.13	+3.31	+4.36	+4.72	+5.13	+5.19	+4.79	+4.50	+3.86	+3.08	+2.11	+0.99	+3.69
4	+1.75	+2.70	+3.76	+4.29	+4.59	+4.70	+4.36	+3.95	+3.50	+2.54	+1.68	+0.71	+3.22
5	+1.12	+1.91	+2.58	+3.67	+3.89	+3.95	+3.71	+3.22	+2.79	+1.98	+1.01	+0.45	+2.54
6	+0.56	+1.01	+1.84	+2.54	+3.08	+3.33	+2.83	+2.29	+1.44	+1.12	+0.47	+0.22	+1.73
7	+0.33	+0.22	+0.65	+1.08	+1.70	+2.25	+1.82	+1.10	+0.63	+0.35	+0.09	+0.07	+0.85
8	+0.02	—0.24	—0.29	—0.33	+0.52	+0.92	+0.49	—0.26	—0.42	—0.13	—0.16	—0.02	0.00
9	—0.33	—0.67	—0.99	—1.57	—1.08	—0.61	—0.74	—1.49	—1.16	—0.47	—0.49	—0.26	—0.83
10	—0.52	—0.83	—1.44	—2.41	—2.29	—2.18	—2.22	—2.15	—1.70	—0.67	—0.65	—0.43	—0.46
11	—0.69	—1.08	—1.89	—2.88	—3.53	—3.28	—3.10	—2.67	—2.02	—2.13	—0.97	—0.49	—2.09
Comb's													
10, 10	—0.43	—0.38	+0.05	+0.08	+0.37	+0.35	+0.32	—0.01	—0.03	—0.02	—0.32	—0.33	—0.01
6, 2, 9	+0.26	+0.23	—0.01	—0.23	+0.12	+0.28	+0.23	—0.09	+0.01	+0.32	+0.24	+0.15	+0.13
6, 2, 10	+0.20	+0.17	—0.16	—0.91	—0.28	—0.24	—0.26	—0.31	—0.17	+0.26	+0.19	+0.10	—0.08
7, 2, 9	+0.21	+0.24	+0.13	+0.34	+0.72	+0.80	+0.77	+0.30	+0.22	+0.47	+0.29	+0.16	+0.38
7, 2, 9 bis	+0.08	+0.01	—0.15	—0.14	+0.27	+0.45	+0.39	—0.14	—0.12	+0.24	+0.09	+0.05	+0.08
3, 9, 3, 9	—0.05	—0.05	+0.12	+0.08	+0.10	+0.03	+0.12	—0.10	+0.07	+0.23	0.00	+0.03	+0.05

Sitka, Alaska Ter'y. Lat. 57° 03'. Long. 135° 20' W. of G.

Alt. 20 feet. Months of old style. From an 8 year series, 1857 to 1864.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	—0.85	—1.22	—2.34	—3.69	—4.45	—4.67	—3.86	—3.20	—2.49	—1.39	—0.83	—0.35	—2.44
1	—0.84	—1.39	—2.48	—4.01	—4.88	—5.12	—4.16	—3.50	—2.99	—1.49	—0.83	—0.36	—2.67
2	—0.82	—1.57	—2.59	—4.21	—5.08	—5.44	—4.46	—3.80	—3.35	—1.63	—0.80	—0.38	—2.84
3	—0.77	—1.71	—2.75	—4.23	—5.12	—5.60	—4.66	—3.94	—3.55	—1.73	—0.80	—0.40	—2.94
4	—0.72	—1.82	—2.98	—4.18	—4.93	—5.40	—4.52	—3.89	—3.58	—1.74	—0.83	—0.48	—2.92
5	—0.68	—1.89	—3.24	—3.92	—4.34	—4.34	—3.79	—3.63	—3.45	—1.65	—0.90	—0.64	—2.70
6	—0.66	—2.00	—3.24	—3.28	—2.77	—2.68	—2.61	—3.09	—3.24	—1.61	—1.15	—0.62	—2.24
7	—0.72	—2.20	—2.47	—1.56	—0.92	—1.51	—1.07	—1.52	—2.23	—1.45	—1.10	—0.69	—1.45
8	—0.77	—1.82	—0.92	+0.30	+0.75	+0.67	+0.41	—0.01	—0.75	—0.77	—1.04	—0.66	—0.38
9	—0.45	—0.65	+1.00	+1.93	+2.46	+2.34	+2.12	+1.60	+0.83	+0.30	—0.36	—0.50	+0.89
10	+0.28	+1.01	+2.52	+3.39	+3.85	+3.69	+3.31	+2.98	+2.34	+1.34	+0.49	+0.04	+2.11
11	+1.21	+2.65	+3.74	+4.53	+5.00	+4.79	+4.24	+4.17	+3.69	+2.26	+1.28	+0.75	+3.18
Noon	+2.02	+3.13	+4.24	+5.01	+5.45	+5.85	+5.00	+4.96	+4.61	+3.02	+2.16	+1.50	+3.92
1	+2.10	+3.42	+4.58	+5.64	+5.68	+5.85	+5.27	+4.94	+4.88	+3.02	+2.27	+1.63	+4.11
2	+2.06	+3.35	+4.39	+4.94	+5.45	+5.47	+5.04	+4.73	+4.57	+2.93	+2.07	+1.43	+3.87
3	+1.52	+2.87	+3.92	+4.60	+4.84	+5.02	+4.76	+4.21	+4.14	+2.48	+1.51	+0.93	+3.42
4	+0.78	+2.13	+3.32	+3.73	+4.19	+4.38	+3.63	+3.50	+3.39	+1.77	+0.92	+0.48	+2.69
5	+0.24	+1.08	+2.10	+2.73	+3.17	+3.58	+2.66	+2.46	+2.42	+0.94	+0.33	+0.08	+1.82
6	—0.05	+0.34	+0.72	+1.43	+1.89	+2.30	+1.49	+1.18	+1.12	+0.19	+0.02	—0.17	+0.87
7	—0.39	—0.24	—0.49	—0.08	+0.45	+0.88	+0.30	—0.01	—0.05	—0.39	—0.27	—0.21	—0.04
8	—0.41	—0.61	—1.21	—1.32	—1.14	—0.79	—0.96	—1.16	—0.90	—0.73	—0.34	—0.30	—0.82
9	—0.59	—0.91	—1.63	—1.84	—2.36	—2.11	—2.06	—1.79	—1.44	—1.07	—0.50	—0.43	—1.39
10	—0.77	—0.92	—1.98	—2.64	—3.24	—3.13	—2.78	—2.31	—1.82	—1.22	—0.67	—0.41	—1.82
11	—0.83	—1.07	—2.19	—3.19	—3.98	—3.97	—3.36	—2.80	—2.09	—1.30	—0.76	—0.38	—2.16
Comb's													
10, 10	—0.24	+0.04	+0.27	+0.37	+0.32	+0.28	+0.26	+0.34	+0.26	+0.06	—0.09	—0.18	+0.14
6, 2, 9	+0.27	+0.15	—0.16	—0.06	+0.11	+0.23	+0.12	—0.05	—0.04	+0.08	+0.14	+0.13	+0.08
6, 2, 10	+0.21	+0.14	—0.28	—0.33	—0.19	—0.11	—0.12	—0.22	—0.16	+0.09	+0.08	+0.13	—0.06
7, 2, 9	+0.25	+0.08	+0.10	+0.51	+0.72	+0.62	+0.64	+0.47	+0.30	+0.14	+0.16	+0.10	+0.34
7, 2, 9 bis	+0.05	—0.22	—0.45	—0.10	—0.06	—0.09	—0.05	—0.12	—0.18	—0.22	—0.01	—0.04	—0.12
3, 9, 3, 9	—0.07	—0.10	+0.13	+0.11	—0.04	—0.09	+0.04	+0.02	0.00	0.00	—0.04	—0.10	0.00

Montreal, Canada East.[1] Lat. 45° 30′. Long. 73° 33′ W. of G.

J. S. McCord. Alt. 57 feet. Aug. 1839, to July, 1841, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	—1.1	—1.3	—1.3	—2.5	—4.5	—5.2	—4.4	—4.0	—3.9	—2.8	—1.4	—1.7	—2.85
1	—1.4	—1.6	—4.4	—3.1	—4.8	—4.5	—5.1	—5.0	—4.9	—2.5	—1.2	—0.9	—3.30
2	—2.4	—2.7	—2.9	—4.4	—6.9	—7.4	—7.2	—5.4	—4.3	—4.0	—1.6	—1.0	—4.20
3	—1.3	—2.7	—5.2	—5.1	—6.5	—5.1	—6.8	—6.0	—5.2	—3.6	—1.6	—1.8	—4.25
4	—2.9	—3.4	—5.6	—7.1	—7.0	—7.2	—7.6	—6.3	—5.6	—4.8	—1.8	—1.4	—4.96
5	—1.9	—4.0	—6.8	—6.5	—6.6	—6.3	—7.7	—6.4	—5.4	—4.5	—2.1	—2.2	—5.05
6	—3.5	—3.9	—5.2	—5.6	—6.6	—5.5	—5.5	—6.0	—4.6	—4.8	—1.4	—1.3	—4.50
7	—2.0	—5.2	—7.1	—3.8	—3.6	—4.7	—3.0	—2.1	—3.5	—3.6	—2.0	—2.1	—3.56
8	—3.1	—3.2	—3.3	—3.4	—3.1	—0.9	—0.6	—2.8	—2.2	—2.5	—0.8	—0.9	—2.24
9	—1.2	—4.0	—3.0	—0.7	—0.5	0.0	—0.2	+0.6	—0.7	—0.8	—0.6	—1.1	—1.02
0	+0.2	+0.8	0.0	+0.8	+1.0	+1.7	+2.9	+1.7	+1.5	+1.0	+0.4	—0.2	+0.93
11	+1.1	+0.2	+2.5	+2.5	+2.8	+3.4	+3.2	+3.6	+2.2	+2.7	+1.4	+0.5	+2.17
Noon	+2.8	+3.5	+4.2	+5.0	+7.1	+5.2	+5.5	+5.6	+5.4	+4.2	+1.9	+1.2	+4.30
1	+1.5	+4.8	+7.4	+4.9	+5.8	+6.0	+6.1	+6.6	+5.1	+5.4	+3.5	+2.4	+4.95
2	+4.1	+5.4	+6.5	+6.0	+8.8	+7.7	+7.4	+7.9	+6.6	+7.0	+2.4	+2.5	+6.02
3	+2.4	+6.1	+9.0	+6.3	+6.5	+6.9	+8.0	+7.3	+6.7	+5.8	+3.2	+2.8	+5.91
4	+3.9	+3.6	+6.0	+5.8	+8.4	+7.0	+7.5	+7.7	+6.7	+5.6	+2.5	+3.2	+5.65
5	+0.6	+4.1	+6.5	+5.6	+6.6	+6.2	+6.5	+5.5	+5.8	+3.2	+1.2	+1.4	+4.43
6	+1.8	+1.5	+3.4	+3.9	+3.9	+5.0	+5.4	+5.6	+2.8	+2.8	+1.0	+1.3	+3.20
7	+0.6	+1.2	+2.4	+2.9	+3.5	+3.2	+2.9	+1.4	+0.6	+1.0	+0.4	+0.7	+1.74
8	+0.9	+0.6	+1.2	+0.8	+1.6	+1.1	+0.7	+0.7	—0.1	+0.2	0.0	0.0	+0.65
9	+0.7	+1.0	+0.7	—0.4	—0.6	—1.6	—1.2	—1.6	—1.3	—0.3	—0.1	+0.7	—0.34
10	—0.2	—0.2	+0.3	—0.6	—1.9	—2.5	—2.6	—2.0	—2.4	—1.4	—1.2	—0.9	—1.30
11	—0.6	—0.2	—1.8	—2.1	—2.5	—3.5	—3.4	—3.1	—3.0	—2.5	—1.5	—0.2	—2.02
Comb's													
10, 10	0.0	+0.3	+0.1	+0.1	—0.4	—0.4	+0.1	—0.1	—0.4	—0.2	—0.4	—0.5	—0.18
6, 2, 9	+0.4	+0.8	+0.7	0.0	+0.5	+0.2	+0.2	+0.1	+0.2	+0.4	+0.3	+0.6	+0.39
6, 2, 10	+0.1	+0.4	+0.5	—0.1	+0.1	—0.1	—0.2	0.0	—0.1	+0.3	—0.1	+0.1	+0.07
7, 2, 9	+0.9	+0.4	0.0	+0.6	+1.5	+0.5	+1.1	+1.4	+0.6	+1.0	+0.1	+0.4	+0.71
7, 2, 9 bis	+0.9	+0.5	+0.2	+0.3	+1.0	0.0	+0.5	+0.6	+0.1	+0.7	0.0	+0.4	+0.44
3, 9, 3, 9	+0.1	+0.1	+0.4	0.0	—0.3	0.0	0.0	+0.1	—0.1	+0.3	+0.2	+0.1	+0.07

Thunder Bay Island, Lake Huron, Mich. Lat. 45° 2′. Long. 83° 17′ W. of G.

Alt. 610 feet. Dec. 1863, to Dec. 1865.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	—0.9	—1.9	—2.2	—2.9	—3.4	—4.3	—3.8	—4.0	—2.9	—2.5	—0.8	—0.8	—2.52
0 30	—1.3	—1.8	—2.9	—3.4	—4.1	—4.7	—4.5	—4.3	—2.6	—2.3	—1.1	—1.0	—2.82
1	—1.6	—2.2	—3.2	—3.8	—4.4	—4.9	—4.9	—4.5	—2.8	—2.5	—1.4	—1.1	—3.10
1 30	—2.0	—2.5	—3.4	—4.0	—4.7	—5.3	—5.4	—4.8	—2.9	—2.7	—1.5	—1.2	—3.36
2	—2.3	—2.6	—3.7	—4.4	—5.0	—5.6	—5.8	—5.1	—3.1	—2.9	—1.6	—1.3	—3.60
2 30	—2.5	—2.8	—3.9	—4.6	—5.1	—5.9	—6.1	—5.2	—3.3	—3.0	—1.6	—1.4	—3.77
3	—2.6	—2.9	—4.0	—4.7	—5.2	—6.1	—6.4	—5.4	—3.4	—3.0	—1.8	—1.6	—3.91
3 30	—2.6	—2.9	—3.9	—4.6	—5.3	—5.9	—6.4	—5.4	—3.5	—3.1	—1.8	—1.5	—3.90
4	—2.5	—2.8	—3.8	—4.5	—5.2	—5.8	—6.3	—5.5	—3.6	—3.1	—1.9	—1.4	—3.86
4 30	—2.4	—2.8	—3.7	—4.4	—5.1	—5.8	—6.2	—5.5	—3.8	—3.2	—1.8	—1.4	—3.83
5	—2.3	—2.6	—3.6	—4.3	—4.9	—5.4	—6.0	—5.5	—3.8	—3.2	—1.9	—1.3	—3.72
5 30	—2.2	—2.5	—3.5	—4.0	—4.2	—4.9	—5.5	—5.3	—3.7	—3.1	—1.8	—1.2	—3.48
6	—2.1	—2.4	—3.3	—3.6	—3.3	—4.0	—4.7	—5.0	—3.7	—3.0	—1.8	—1.1	—3.16
6 30	—2.0	—2.3	—2.9	—2.9	—2.6	—2.7	—3.5	—4.2	—3.3	—2.9	—1.7	—1.1	—2.66
7	—2.0	—2.1	—2.5	—2.0	—1.5	—1.7	—1.9	—3.2	—2.8	—2.6	—1.8	—1.1	—2.09
7 30	—1.9	—1.9	—2.0	—1.1	—0.5	—0.5	—1.2	—1.9	—2.0	—2.2	—1.6	—0.9	—1.46
8	—1.5	—1.6	—1.0	—0.2	+0.4	+0.6	—0.1	—0.7	—1.1	—1.8	—1.5	—0.7	—0.76
8 30	—1.2	—1.2	—0.1	+0.6	+1.1	+1.5	+1.0	+0.4	—0.5	—1.2	—1.1	—0.6	—0.10
9	—0.9	—0.6	+0.5	+1.3	+1.7	+2.1	+1.9	+1.3	+0.4	—0.5	—0.8	—0.4	+0.51
9 30	—0.3	—0.1	+1.4	+1.8	+2.0	+2.9	+2.6	+1.9	+1.0	+0.2	—0.3	—0.1	+1.09
10	+0.1	+0.4	+2.1	+2.4	+2.5	+3.4	+3.3	+2.7	+1.7	+0.9	+0.1	+0.2	+1.66
10 30	+0.7	+1.1	+2.8	+2.9	+3.0	+3.9	+3.8	+3.6	+2.4	+1.6	+0.6	+0.5	+2.25
11	+1.3	+1.8	+3.8	+3.4	+3.3	+4.2	+4.3	+4.4	+3.0	+2.3	+0.9	+0.9	+2.81
11 30	+1.9	+2.4	+3.8	+3.8	+3.6	+4.5	+4.7	+5.1	+3.6	+2.9	+1.5	+1.3	+3.27

[1] From Prof. Guyot's Met. and Phys. Tables, Sm. Misc. Coll.; Wash., 1858. From Aug. 1839, to July, 1840, inclu. the observations were taken at the *even* hours; from Aug. 1840, to July, 1841, at the *odd* hours. [Sch.]

Thunder Bay Island.—Continued.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Noon	+2.5	+2.9	+4.0	+4.0	+4.0	+4.9	+5.1	+5.7	+4.2	+3.6	+1.8	+1.5	+3.69
0 30	+3.0	+3.4	+4.4	+4.3	+4.2	+5.6	+5.3	+6.2	+4.5	+4.1	+2.3	+1.7	+4.09
1	+3.2	+3.7	+4.6	+4.5	+4.4	+5.4	+5.2	+6.7	+4.8	+4.4	+2.6	+1.9	+4.29
1 30	+3.4	+4.1	+4.8	+4.6	+4.5	+5.4	+5.7	+6.9	+5.1	+4.8	+2.9	+2.0	+4.52
2	+3.6	+4.2	+5.0	+4.7	+4.7	+6.0	+5.9	+7.0	+5.3	+5.0	+3.0	+1.9	+4.62
2 30	+3.5	+4.2	+4.8	+4.7	+4.7	+6.0	+6.0	+6.9	+5.3	+5.0	+3.2	+1.9	+4.69
3	+3.3	+4.1	+4.5	+4.6	+5.0	+5.9	+6.1	+6.5	+5.1	+4.7	+3.0	+1.7	+4.55
3 30	+2.9	+3.7	+4.2	+4.3	+5.1	+5.6	+5.9	+6.1	+4.6	+4.4	+2.7	+1.5	+4.26
4	+2.2	+3.1	+3.8	+4.1	+5.0	+5.1	+5.7	+5.6	+4.1	+3.9	+2.0	+1.2	+3.83
4 30	+2.0	+2.4	+3.3	+3.7	+4.6	+4.8	+5.1	+5.1	+3.6	+3.2	+1.8	+1.0	+3.39
5	+1.6	+1.9	+2.6	+3.2	+4.1	+4.4	+4.5	+4.3	+3.0	+2.6	+1.2	+0.8	+2.86
5 30	+1.3	+1.5	+2.0	+2.7	+3.4	+3.8	+3.8	+3.4	+2.2	+2.0	+1.0	+0.7	+2.33
6	+0.9	+0.9	+1.5	+2.1	+2.7	+3.2	+3.0	+2.6	+1.5	+1.3	+0.7	+0.6	+1.76
6 30	+0.7	+0.6	+0.8	+1.4	+2.0	+2.1	+2.2	+1.5	+0.9	+0.7	+0.6	+0.5	+1.17
7	+0.4	+0.4	+0.2	+0.8	+1.2	+1.0	+1.4	+0.9	+0.2	+0.3	+0.3	+0.3	+0.62
7 30	+0.3	+0.1	−0.3	+0.2	+0.4	+0.3	+0.5	+0.2	−0.3	−0.1	+0.3	+0.1	+0.15
8	+0.2	0.0	−0.5	−0.2	−0.2	−0.5	−0.3	−0.4	−0.8	−0.5	+0.1	+0.3	−0.22
8 30	+0.1	−0.5	−0.8	−0.6	−0.9	−1.2	−0.8	−1.1	−1.1	−0.6	0.0	+0.2	−0.60
9	0.0	−0.4	−1.0	−1.0	−1.4	−1.7	−1.4	−1.7	−1.5	−1.1	−0.2	0.0	−0.94
9 30	−0.2	−0.7	−1.2	−1.3	−1.9	−2.2	−1.8	−2.2	−1.8	−1.3	−0.2	−0.1	−1.23
10	−0.3	−0.8	−1.3	−1.6	−2.3	−2.6	−2.4	−2.7	−1.9	−1.5	−0.4	−0.1	−1.48
10 30	−0.5	−1.3	−1.5	−2.0	−2.6	−3.2	−2.6	−3.1	−2.2	−1.7	−0.5	−0.4	−1.79
11	−0.7	−1.3	−1.8	−2.3	−2.9	−3.5	−3.0	−3.5	−2.5	−2.0	−0.7	−0.2	−2.02
11 30	−0.8	−1.5	−2.0	−2.5	−3.2	−3.9	−3.4	−4.1	−2.7	−2.3	−0.8	−0.6	−2.31
Comb's													
10, 10	−0.1	−0.2	+0.4	+0.4	+0.1	+0.4	+0.4	0.0	−0.1	−0.3	−0.1	0.0	+0.08
6, 2, 9	+0.5	+0.5	+0.2	0.0	0.0	+0.1	−0.1	+0.1	0.0	+0.3	+0.3	+0.3	+0.16
6, 2, 10	+0.4	+0.3	+0.1	−0.2	−0.3	−0.2	−0.4	−0.2	−0.1	+0.2	+0.3	+0.2	−0.02
7, 2, 9	+0.5	+0.6	+0.5	+0.6	+0.6	+0.9	+0.9	+0.7	+0.3	+0.4	+0.3	+0.3	+0.52
7, 2, 9 bis	+0.4	+0.3	+0.1	+0.2	+0.1	+0.2	+0.3	+0.1	−0.1	0.0	+0.2	+0.2	+0.15
3, 9, 3, 9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	+0.2	+0.1	0.0	0.0	−0.1	+0.04

N. B. The hours 6_m, 9_m, 3_a, 6_a were employed in the U. S. Lake Survey, prior to June, 1860, the differences for the means at these hours are as follows:—

6, 9, 3, 6	+0.3	+0.5	+0.8	+1.1	+1.5	+1.5	+1.6	+1.3	+0.8	+0.6	+0.3	+0.2	+0.90

The mean of 6_m, 9_m, 3_a, is about the same as 7_a.

Toronto, Canada West. Lat. 43° 39′. Long. 79° 23′ W. of G.

Alt. 342 feet. July, 1842, to July, 1848.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	−1.52	−1.82	−2.47	−3.26	−5.03	−5.31	−6.54	−5.46	−3.96	−3.25	−1.82	−0.91	−3.45
1	−1.99	−2.20	−2.95	−4.01	−5.89	−6.00	−7.41	−6.11	−4.57	−3.85	−2.11	−1.49	−4.05
2	−2.07	−2.54	−3.33	−4.68	−6.73	−6.70	−7.97	−6.79	−5.16	−4.17	−2.39	−1.86	−4.53
3	−2.22	−2.97	−3.62	−4.88	−7.44	−7.48	−8.69	−7.46	−5.62	−4.33	−2.71	−1.99	−4.95
4	−2.32	−3.27	−4.00	−5.31	−7.91	−8.05	−9.32	−7.84	−6.21	−4.63	−2.87	−2.02	−5.31
5	−2.50	−3.62	−4.52	−5.68	−7.86	−7.86	−9.37	−8.03	−6.84	−4.80	−2.76	−2.04	−5.49
6	−1.77	−4.19	−4.80	−5.55	−5.41	−5.21	−6.16	−6.58	−6.16	−4.58	−2.49	−2.46	−4.61
7	−1.87	−4.32	−3.93	−3.26	−2.43	−2.40	−2.49	−3.61	−3.61	−3.83	−2.49	−2.62	−3.07
8	−1.64	−3.30	−1.95	−1.01	−0.21	−0.06	+0.11	−0.34	−0.86	−1.58	−1.44	−2.19	−1.21
9	−0.67	−1.00	+0.22	+0.97	+2.11	+1.82	+2.31	+2.16	+1.56	+1.10	+0.09	−1.01	+0.80
10	+0.56	+1.01	+1.95	+2.49	+3.81	+3.49	+4.01	+4.14	+3.53	+3.03	+1.53	+0.44	+2.50
11	+1.73	+2.60	+3.18	+3.87	+4.94	+4.77	+5.56	+5.59	+4.96	+4.40	+2.54	+1.68	+3.82

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Toronto.—Continued.													
Noon	+2.51°	+3.80°	+4.20°	+4.90°	+5.89°	+5.87°	+6.86°	+6.54°	+5.93°	+5.30°	+3.33°	+2.49°	+4.80°
1	+3.01	+4.66	+4.85	+5.84	+6.81	+6.60	+7.78	+7.31	+6.53	+5.73	+3.73	+3.21	+5.50
2	+3.28	+5.06	+5.42	+6.22	+7.16	+7.02	+8.63	+7.89	+6.93	+6.08	+3.81	+3.36	+5.90
3	+3.25	+5.05	+5.22	+6.29	+7.22	+7.40	+8.83	+8.24	+6.96	+5.85	+3.64	+3.11	+5.92
4	+2.73	+4.50	+4.75	+5.90	+7.17	+7.64	+8.84	+8.09	+6.74	+5.12	+2.74	+2.46	+5.56
5	+1.73	+3.30	+4.00	+5.17	+6.79	+7.04	+8.38	+7.54	+5.78	+3.37	+1.53	+1.51	+4.68
6	+0.91	+1.85	+2.32	+3.37	+5.04	+5.74	+6.94	+5.64	+3.11	+1.32	+0.71	+0.81	+3.15
7	+0.38	+0.86	+0.85	+0.84	+2.17	+3.00	+3.46	+1.66	+0.41	+0.22	+0.14	+0.48	+1.20
8	+0.06	+0.01	−0.12	−0.75	−0.54	−0.30	−0.74	−1.26	−0.87	−0.52	−0.17	+0.09	−0.43
9	−0.14	−0.64	−1.12	−1.83	−2.29	−2.46	−3.11	−2.84	−1.91	−1.28	−0.46	−0.16	−1.52
10	−0.52	−1.19	−1.77	−2.60	−3.26	−3.80	−4.34	−3.86	−2.97	−2.03	−0.81	−0.46	−2.30
11	−0.84	−1.70	−2.42	−3.10	−4.18	−4.76	−5.52	−4.66	−3.61	−2.70	−1.16	−0.57	−2.94
Comb's													
10, 10	+0.02	−0.09	+0.09	−0.05	+0.27	−0.15	−0.16	+0.14	+0.28	+0.50	+0.36	−0.01	+0.10
6, 2, 9	+0.46	+0.08	−0.17	−0.39	−0.18	−0.22	−0.21	−0.51	−0.38	+0.07	+0.29	+0.25	−0.08
6, 2, 10	+0.33	−0.11	−0.38	−0.64	−0.50	−0.66	−0.62	−0.85	−0.73	−0.18	+0.17	+0.15	−0.34
7, 2, 9	+0.42	+0.03	+0.12	+0.38	+0.81	+0.72	+1.01	+0.48	+0.37	+0.32	+0.29	+0.19	+0.44
7, 2, 9 bis	+0.28	−0.13	−0.19	−0.17	+0.04	−0.07	−0.02	−0.35	−0.12	−0.08	+0.10	+0.10	−0.05
3, 9, 3, 9	+0.05	+0.11	+0.17	+0.14	−0.10	−0.18	−0.16	+0.02	+0.25	+0.33	+0.14	−0.01	+0.06

Mohawk, N. Y. Lat. 43° 00′. Long. 75° 02′ W. of G.

Alt. 435 feet. June, 1860, to May, 1864, inclusive; and Jan. 1867, to Jan. 1869, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	−1.19	−1.51	−1.88	−2.95	−3.70	−4.34	−4.22	−4.32	−3.57	−1.83	−1.34	−0.94	−2.65
1	−1.34	−2.17	−2.70	−4.15	−4.84	−6.18	−5.06	−4.80	−3.80	−2.53	−0.82	−1.17	−3.30
2	−1.64	−2.55	−3.13	−4.71	−5.73	−7.06	−5.91	−5.49	−4.47	−3.04	−1.23	−1.52	−3.88
3	−2.05	−2.90	−3.70	−5.22	−6.55	−7.82	−6.61	−6.19	−5.06	−3.46	−1.61	−1.89	−4.42
4	−2.37	−3.20	−4.18	−5.76	−7.37	−8.53	−7.24	−6.83	−5.66	−3.94	−1.88	−2.19	−4.93
5	−2.63	−3.39	−4.62	−6.13	−7.85	−9.01	−7.75	−7.33	−6.19	−4.31	−2.21	−2.31	−5.31
6	−2.80	−3.68	−5.06	−6.43	−7.88	−8.36	−7.29	−7.47	−6.58	−4.63	−2.48	−2.49	−5.43
7	−2.99	−4.11	−5.04	−5.89	−6.37	−6.39	−5.31	−6.30	−6.25	−4.78	−2.81	−2.64	−4.91
8	−2.95	−3.89	−3.66	−4.10	−4.00	−3.42	−2.69	−4.04	−4.67	−4.12	−2.63	−2.62	−3.56
9	−2.20	−2.64	−1.68	−1.87	−1.40	−0.61	+0.05	−1.44	−2.32	−2.55	−1.77	−1.79	−1.69
10	−0.70	−0.63	+0.31	+0.29	+1.02	+2.00	+2.64	+1.32	+0.26	−0.34	−0.36	−0.49	+0.44
11	+1.06	+1.21	+1.94	+2.15	+3.17	+4.18	+4.64	+3.65	+2.61	+1.80	+1.14	+0.99	+2.38
Noon	+2.55	+2.99	+3.40	+3.85	+5.01	+5.98	+6.12	+5.52	+4.62	+3.62	+2.38	+2.36	+4.03
1	+3.51	+4.15	+4.40	+5.18	+6.35	+7.21	+6.99	+6.94	+6.39	+4.95	+3.16	+3.30	+5.21
2	+4.10	+4.90	+5.23	+6.30	+7.50	+8.45	+7.24	+7.71	+7.56	+5.85	+3.55	+3.64	+6.00
3	+4.22	+5.16	+5.41	+6.96	+8.10	+8.99	+7.42	+8.32	+8.31	+6.25	+3.68	+3.53	+6.36
4	+3.75	+4.74	+5.26	+7.29	+8.24	+9.03	+7.02	+8.32	+8.31	+5.88	+3.17	+2.97	+6.17
5	+2.75	+3.85	+4.62	+6.98	+7.86	+8.45	+6.68	+7.70	+7.27	+4.70	+2.23	+2.03	+5.42
6	+1.62	+2.60	+3.35	+5.87	+6.79	+7.13	+5.50	+6.40	+5.33	+3.03	+1.29	+1.29	+4.19
7	+0.85	+1.61	+1.89	+3.86	+4.59	+4.86	+3.67	+3.90	+2.76	+1.47	+0.49	+0.72	+2.55
8	+0.28	+0.83	+0.96	+1.62	+1.80	+1.90	+1.03	+1.09	+0.60	+0.37	+0.03	+0.26	+0.90
9	−0.28	+0.20	+0.22	−0.02	−0.28	−0.55	−1.06	−0.85	−0.85	−0.44	−0.47	−0.13	−0.38
10	−0.66	−0.43	−0.41	−1.15	−1.66	−2.09	−2.44	−2.29	−1.90	−0.75	−0.77	−0.34	−1.24
11	−0.97	−1.01	−1.07	−2.11	−2.73	−3.53	−3.37	−3.36	−2.80	−1.32	−1.04	−0.60	−1.99
Comb's													
10, 10	−0.68	−0.53	−0.05	−0.43	−0.32	−0.04	+0.10	−0.48	−0.82	−0.54	−0.57	−0.42	−0.40
6, 2, 9	+0.34	+0.47	+0.13	−0.05	−0.22	−0.15	−0.37	−0.20	+0.04	+0.26	+0.20	+0.34	+0.06
6, 2, 10	+0.21	+0.26	−0.08	−0.43	−0.68	−0.67	−0.80	−0.68	−0.31	+0.16	+0.10	+0.27	−0.22
7, 2, 9	+0.28	+0.33	+0.14	+0.13	+0.28	+0.50	+0.29	+0.19	+0.15	+0.21	+0.09	+0.29	+0.24
7, 2, 9 bis	+0.14	+0.29	+0.16	+0.09	+0.14	+0.24	−0.05	−0.07	−0.10	+0.05	−0.05	+0.18	+0.08
3, 9, 3, 9	−0.08	−0.04	+0.06	−0.04	−0.03	0.00	−0.05	−0.04	+0.02	−0.05	−0.04	−0.06	−0.03

Cambridge, Mass. Lat. 42° 23′. Long. 71° 07′ W. of G.

Alt. about 71 feet. Oct. 1841, to Dec. 1842, inclusive.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
0.6 A.M.	−0.90	−1.19	−4.05	−3.55	−7.60	−7.68	−5.53	−5.16	− 6.17	− 5.37	−3.81	−2.13	−4.43
2.6	−1.51	−2.46	−5.28	−3.20	−8.86	−9.65	−6.74	−6.01	− 7.58	− 6.63	−4.17	−2.60	−5.40
4.6	−1.85	−3.39	−5.59	−4.72	−9.47	−9.73	−6.60	−6.86	− 7.90	− 7.13	−4.53	−2.69	−5.88
6.6	−3.11	−3.25	−6.48	−4.03	−4.92	−2.59	−3.29	−4.25	− 8.26	− 7.28	−4.67	−3.11	−4.61
8.6	−4.92	−2.86	+0.02	+0.35	+2.51	+2.76	+2.03	+1.64	+ 0.37	− 1.88	−1.57	−1.87	−0.29
10.6	+0.48	+1.02	+5.34	+3.59	+5.99	+6.62	+6.95	+5.59	+ 7.38	+ 6.30	+4.57	+2.50	+4.69
0.6 P.M.	+4.42	+5.00	+7.97	+5.26	+8.55	+8.85	+7.50	+6.36	+10.03	+10.04	+6.72	+5.22	+7.16
2.6	+4.45	+5.59	+7.44	+5.56	+9.45	+9.16	+6.96	+6.65	+ 9.97	+10.88	+6.75	+4.98	+7.32
4.6	+2.94	+3.47	+5.04	+4.05	+7.98	+7.00	+5.11	+5.43	+ 7.21	+ 7.25	+3.64	+1.98	+5.09
6.6	+0.73	−0.27	+0.70	+1.35	+3.60	+4.21	+0.92	+2.03	+ 2.02	+ 0.56	+0.68	+0.29	+1.40
8.6	0.00	−0.82	−1.83	−1.89	−2.13	−2.73	−2.73	−1.96	− 2.25	− 2.51	−1.27	−0.77	−1.75
10.6	−0.69	−0.83	−3.22	−2.75	−5.13	−6.25	−4.53	−3.50	− 4.77	− 4.21	−2.37	−1.74	−3.34

The following values for certain combinations of hours were obtained by a process of graphical interpolation, the above monthly results having been plotted on a suitable scale for that purpose:—

Comb's	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
7, 2, 9	+0.3	+0.5	−0.2	+0.1	+0.9	+1.4	+0.5	+0.3	− 0.1	+ 0.4	+0.2	+0.3	+0.4
7, 2, 9 bis	+0.2	+0.1	−0.7	−0.4	−0.1	+0.2	−0.4	−0.3	− 0.7	− 0.4	−0.2	0.0	−0.2
3, 9, 3, 9	−0.5	−0.1	+0.2	+0.4	+0.2	−0.2	+0.1	+0.4	+ 0.5	+ 0.2	+0.4	0.0	+0.1

The above results are of comparatively little value on account of the small number of observations.

Amherst, Mass. Lat. 42° 22′. Long. 72° 34′ W. of G.

Alt. 267 feet. 1839.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	−2.50	−1.70	−4.84	− 4.92	−4.75	−5.50	−5.32	−4.53	−5.39	−3.99	−2.39	−1.98	−3.98
1	−3.90	−2.78	−4.72	− 6.23	−5.51	−6.66	−6.40	−5.15	−5.41	−4.77	−2.33	−1.63	−4.62
2	−4.24	−3.03	−4.80	− 6.69	−6.48	−7.30	−6.84	−5.67	−6.17	−5.55	−2.98	−2.20	−5.16
3	−4.13	−3.20	−5.34	− 7.42	−7.41	−7.94	−7.29	−6.04	−6.97	−6.36	−3.48	−2.55	−5.68
4	−4.50	−3.94	−5.68	− 7.85	−7.88	−8.06	−7.43	−6.30	−7.61	−6.99	−3.71	−2.70	−6.05
5	−4.72	−4.20	−6.03	− 8.12	−8.18	−7.82	−7.55	−6.67	−7.93	−7.62	−4.02	−3.32	−6.36
6	−4.68	−4.78	−6.11	− 7.77	−6.77	−5.98	−6.03	−5.82	−7.49	−7.55	−4.33	−3.78	−5.92
7	−4.75	−4.78	−4.61	− 5.97	−4.22	−4.22	−3.81	−4.49	−5.37	−6.77	−4.27	−3.97	−4.77
8	−3.83	−3.78	−2.07	− 3.04	−1.62	−1.42	−1.10	−1.97	−2.57	−4.21	−2.67	−4.13	−2.70
9	−1.46	−1.45	+0.47	− 0.08	+0.60	+0.86	+0.86	+0.92	+0.51	−0.73	−0.33	−2.40	−0.19
10	+1.32	+0.85	+2.58	+ 2.69	+3.12	+3.10	+3.79	+3.03	+3.27	+2.34	+1.44	+0.55	+2.34
11	+4.10	+2.72	+4.78	+ 5.65	+5.12	+5.66	+6.42	+5.44	+5.99	+5.12	+3.02	+2.76	+4.73
Noon	+6.32	+4.26	+6.39	+ 7.92	+6.75	+8.06	+8.49	+6.85	+8.11	+7.16	+5.02	+4.30	+6.64
1	+7.46	+5.35	+7.66	+ 9.46	+8.15	+9.34	+8.82	+8.22	+9.07	+8.34	+6.13	+6.14	+7.85
2	+7.80	+6.06	+8.35	+10.42	+8.75	+8.98	+9.49	+7.85	+9.75	+9.38	+5.98	+6.30	+8.26
3	+7.32	+5.80	+8.12	+ 9.81	+8.27	+8.58	+7.49	+7.66	+9.15	+9.34	+5.29	+5.60	+7.70
4	+5.80	+4.89	+7.24	+ 8.61	+7.86	+7.82	+7.16	+6.22	+8.35	+8.34	+3.86	+3.76	+6.66
5	+3.32	+3.10	+5.66	+ 7.04	+5.97	+5.98	+5.82	+5.25	+6.39	+5.75	+2.29	+2.03	+4.89
6	+2.06	+1.18	+3.47	+ 4.50	+4.08	+4.18	+4.16	+2.81	+3.47	+3.60	+0.86	+0.68	+2.93
7	−0.24	+1.05	−0.16	+ 1.69	+2.38	+1.90	+1.53	+1.43	+1.42	+1.34	+0.65	+0.31	+1.11
8	−0.64	+0.43	−0.92	− 0.27	+0.19	−0.06	−0.99	−0.34	−0.16	−0.03	−0.07	−0.20	−0.25
9	−1.50	−0.28	−1.88	− 1.77	−1.66	−1.98	−3.06	−1.60	−2.04	−1.06	−0.79	−0.69	−1.53
10	−2.01	−0.57	−3.28	− 3.31	−2.73	−3.22	−3.80	−3.02	−3.58	−1.80	−1.15	−1.20	−2.47
11	−2.42	−1.19	−4.28	− 4.23	−3.99	−4.22	−4.25	−3.80	−4.66	−3.14	−1.95	−1.58	−3.31
Comb's													
10, 10	−0.34	+0.14	−0.35	− 0.31	+0.19	−0.06	0.00	0.00	−0.19	+0.27	+0.24	−0.32	−0.06
6, 2, 9	+0.54	+0.33	+0.12	+ 0.29	+0.11	+0.34	+0.13	+0.14	+0.07	+0.26	+0.29	+0.61	+0.27
6, 2, 10	+0.37	+0.24	−0.35	− 0.22	−0.25	−0.07	−0.11	−0.33	−0.44	+0.01	+0.17	+0.44	−0.04
7, 2, 9	+0.52	+0.33	+0.62	+ 0.89	+0.96	+0.93	+0.87	+0.59	+0.78	+0.52	+0.31	+0.55	+0.65
7, 2, 9 bis	+0.01	+0.18	0.00	+ 0.23	+0.30	+0.20	−0.11	+0.04	+0.07	+0.12	+0.03	+0.24	+0.11
3, 9, 3, 9	+0.06	+0.22	+0.34	+ 0.13	−0.05	−0.12	−0.50	+0.23	+0.16	+0.30	+0.17	−0.01	+0.08

New Haven, Conn. Lat. 41° 18′. Long. 72° 56′ W. of G.

Alt. about 45 feet. Partly 1779 to 1865, partly 1838 to 1852, constructed from various hours of observation.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	—2.27	—2.87	—3.71	—4.65	—5.40	—5.81	—5.20	—4.75	—4.79	—4.08	—2.64	—2.17	—4.03
1	—2.62	—3.34	—4.32	—5.43	—6.27	—6.93	—6.17	—5.57	—5.63	—4.84	—3.18	—2.49	—4.73
2	—3.00	—3.80	—4.85	—6.10	—7.16	—8.05	—6.97	—6.29	—6.32	—5.48	—3.68	—2.82	—5.38
3	—3.34	—4.31	—5.37	—6.74	—7.97	—8.71	—7.55	—6.76	—6.80	—6.05	—4.10	—3.17	—5.91
4	—3.70	—4.79	—5.81	—7.32	—8.50	—8.86	—7.69	—7.16	—7.23	—6.51	—4.50	—3.49	—6.30
5	—4.07	—5.16	—6.18	—7.53	—8.38	—8.17	—7.39	—7.10	—7.35	—6.81	—4.80	—3.78	—6.39
6	—4.34	—5.30	—6.09	—7.15	—6.60	—6.13	—6.15	—6.36	—6.84	—6.65	—4.80	—3.97	—5.86
7	—4.38	—5.10	—4.91	—5.27	—3.63	—3.17	—3.68	—4.11	—4.75	—5.27	—4.48	—3.96	—4.39
8	—3.82	—3.69	—2.30	—2.04	—0.51	+0.03	—0.86	—1.34	—1.72	—2.29	—2.98	—3.21	—2.06
9	—1.33	—0.51	+0.46	+1.12	+2.14	+2.68	+1.64	+1.22	+1.25	+0.58	—0.46	—1.01	+0.65
10	+1.59	+2.48	+3.24	+3.87	+4.21	+4.73	+3.79	+3.39	+3.78	+3.52	+2.24	+1.63	+3.21
11	+3.63	+4.23	+4.86	+5.49	+5.77	+6.08	+5.57	+5.28	+5.65	+5.65	+4.19	+3.49	+4.99
Noon	+5.19	+5.56	+6.14	+6.78	+6.98	+7.12	+6.71	+6.50	+6.89	+6.95	+5.63	+5.05	+6.29
1	+6.07	+6.59	+7.03	+7.74	+7.93	+7.93	+7.46	+7.30	+7.67	+7.75	+6.37	+5.85	+7.14
2	+6.34	+6.95	+7.47	+8.32	+8.51	+8.32	+7.81	+7.69	+8.04	+8.08	+6.57	+6.12	+7.52
3	+5.88	+6.76	+7.34	+8.35	+8.53	+8.25	+7.71	+7.62	+7.89	+7.71	+6.19	+5.53	+7.31
4	+4.73	+5.78	+6.60	+7.83	+8.02	+7.63	+7.19	+7.06	+7.15	+6.60	+4.63	+4.02	+6.44
5	+2.84	+3.81	+4.74	+6.60	+6.79	+6.48	+6.13	+5.89	+5.80	+4.47	+2.88	+2.09	+4.88
6	+1.39	+2.01	+2.54	+4.05	+4.72	+4.31	+4.18	+3.94	+3.97	+2.76	+1.56	+1.00	+3.04
7	+0.31	+0.62	+0.88	+1.47	+1.65	+2.16	+2.03	+1.92	+1.88	+1.18	+0.50	+0.21	+1.23
8	—0.49	—0.44	—0.57	—0.61	—0.62	—0.08	+0.11	—0.01	—0.08	—0.22	—0.37	—0.49	—0.32
9	—1.11	—1.23	—1.66	—1.98	—2.23	—1.82	—1.65	—1.65	—1.69	—1.46	—1.07	—1.04	—1.55
10	—1.55	—1.84	—2.40	—2.97	—3.47	—3.28	—2.88	—2.79	—2.85	—2.42	—1.59	—1.46	—2.46
11	—1.95	—2.38	—3.05	—3.80	—4.45	—4.60	—4.11	—3.86	—3.87	—3.28	—2.12	—1.82	—3.27
Comb's													
10, 10	+0.02	+0.32	+0.42	+0.45	+0.37	+0.72	+0.45	+0.30	+0.46	+0.55	+0.32	+0.08	+0.37
6, 2, 9	+0.30	+0.14	—0.09	—0.27	—0.11	+0.12	0.00	—0.11	—0.16	—0.01	+0.23	+0.37	+0.04
6, 2, 10	+0.15	—0.06	—0.34	—0.60	—0.52	—0.36	—0.41	—0.49	—0.55	—0.33	+0.06	+0.23	—0.27
7, 2, 9	+0.28	+0.21	+0.30	+0.36	+0.88	+1.11	+0.83	+0.64	+0.53	+0.45	+0.34	+0.37	+0.53
7, 2, 9 bis	—0.06	—0.15	—0.19	—0.23	+0.10	+0.38	+0.21	+0.07	—0.02	—0.03	—0.01	+0.02	+0.01
3, 9, 3, 9	+0.02	+0.18	+0.19	+0.19	+0.12	+0.10	+0.04	+0.11	+0.16	+0.19	+0.14	+0.08	+0.13

Brooklyn Heights, N. Y. Lat. 40° 41′. Long. 73° 59′ W. of G.

Alt. . . Dec. 1847, to May, 1849, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	—1.3	—1.6	—3.8	—4.9	—3.7	—6.4	—2.4	—3.0	—2.9	—3.1	—2.0	—1.7	—3.1
1	—1.6	—2.2	—4.4	—5.5	—4.4	—7.0	—2.8	—3.6	—3.5	—4.0	—2.5	—1.9	—3.6
2	—1.9	—2.9	—4.8	—5.9	—5.0	—7.2	—3.2	—4.1	—4.1	—4.8	—3.1	—2.0	—4.1
3	—2.2	—3.5	—5.0	—6.1	—5.4	—7.3	—3.4	—4.4	—4.5	—5.2	—3.5	—2.1	—4.4
4	—2.4	—3.9	—5.2	—6.2	—5.7	—7.2	—3.6	—4.5	—4.8	—5.6	—3.8	—2.1	—4.6
5	—2.6	—4.0	—4.7	—5.9	—5.7	—6.7	—3.6	—4.5	—4.9	—4.1	—3.7	—2.1	—4.4
6	—2.6	—3.9	—4.7	—5.8	—5.0	—5.6	—3.6	—4.1	—4.6	—2.8	—3.2	—1.9	—4.0
7	—2.6	—3.9	—4.0	—4.2	—2.8	—2.3	—2.9	—3.2	—3.7	—2.8	—3.3	—1.7	—3.1
8	—2.3	—2.9	—2.2	—0.6	—0.7	+0.7	—1.6	—1.8	—2.4	—1.3	—2.0	—1.6	—1.6
9	—1.3	—0.9	—0.3	+1.3	+0.8	+2.9	—0.2	+0.1	—0.4	+0.5	—0.1	—0.7	+0.1
10	+0.2	+1.1	+2.0	+3.0	+2.7	+3.9	+0.9	+2.3	+2.1	+2.1	+1.8	+0.6	+1.9
11	+1.9	+2.4	+4.0	+5.1	+4.8	+5.7	+2.6	+3.8	+4.8	+3.7	+3.5	+1.9	+3.7

Brooklyn Heights.—Continued.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Noon	+3.0°	+3.6°	+4.9°	+6.7°	+6.2°	+7.1°	+3.5°	+5.4°	+5.6°	+4.8°	+4.2°	+2.9°	+4.8°
1	+3.6	+4.5	+5.6	+7.8	+6.4	+7.7	+4.4	+6.3	+5.6	+5.3	+5.1	+3.4	+5.5
2	+3.9	+4.6	+6.4	+8.1	+6.4	+8.0	+4.4	+5.0	+5.5	+5.8	+5.2	+3.7	+5.6
3	+3.4	+4.5	+6.5	+7.8	+5.7	+7.9	+4.5	+4.9	+5.3	+5.5	+5.1	+3.4	+5.4
4	+2.9	+4.0	+5.5	+6.2	+5.2	+7.0	+4.4	+4.0	+4.5	+4.4	+3.7	+2.6	+4.5
5	+1.8	+3.2	+4.2	+4.6	+4.0	+5.3	+3.6	+3.1	+3.4	+3.0	+1.5	+1.7	+3.3
6	+1.1	+1.9	+2.6	+2.7	+2.4	+3.4	+2.3	+1.8	+2.1	+2.2	+0.6	+0.9	+2.0
7	+0.6	+1.2	+1.5	+0.9	+0.8	+1.5	+1.1	+1.0	+1.1	+0.9	−0.1	+0.3	+0.9
8	0.0	+0.7	+0.7	−0.4	−0.3	−0.4	+0.3	−0.1	+0.2	−0.2	−0.5	0.0	0.0
9	−0.3	+0.1	+0.2	−1.4	−1.3	−1.5	−0.6	−0.9	−0.6	−0.6	−0.7	−0.6	−0.7
10	−0.6	−0.3	−1.2	−3.1	−2.0	−4.0	−1.2	−1.7	−1.4	−1.0	−0.8	−1.1	−1.5
11	−1.0	−0.9	−2.9	−4.1	−2.9	−5.4	−2.0	−2.3	−2.2	−2.1	−1.4	−1.4	−2.4
Comb's													
10, 10	−0.2	+0.4	+0.4	0.0	+0.3	0.0	−0.1	+0.3	+0.3	+0.5	+0.5	−0.2	+0.2
6, 2, 9	+0.3	+0.3	+0.6	+0.3	0.0	+0.3	+0.1	0.0	+0.1	+0.8	+0.4	+0.4	+0.3
6, 2, 10	+0.2	+0.1	+0.2	−0.3	−0.2	−0.5	−0.1	−0.3	−0.2	+0.7	+0.4	+0.2	0.0
7, 2, 9	+0.3	+0.3	+0.9	+0.8	+0.8	+1.4	+0.3	+0.3	+0.4	+0.8	+0.4	+0.5	+0.6
7, 2, 9 bis	+0.2	+0.2	+0.7	+0.3	+0.2	+0.7	+0.1	0.0	+0.1	+0.4	+0.1	+0.2	+0.3
3, 9, 3, 9	−0.1	0.0	+0.3	+0.4	0.0	+0.5	+0.1	−0.1	0.0	0.0	+0.2	0.0	+0.1

The above results are not entitled to full confidence, either from insufficiency or irregularity of observation.

Frankford Arsenal, near Philadelphia,[1] Penn. Lat. 40° 00′. Long. 75° 04′ W. of G.

Alt. 24 feet. Captain Mordecay, U. S. A. 1836 and 1837.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	−2.68	−3.06	−3.33	−3.65	−4.52	−6.84	−5.92	−5.40	−5.29	−4.91	−2.59	−2.10	−4.23
1	−3.02	−3.29	−3.94	−4.21	−5.85	−7.67	−6.91	−6.05	−5.92	−5.40	−2.66	−3.02	−4.84
2	−3.40	−3.89	−4.79	−5.24	−6.86	−8.39	−7.90	−6.84	−6.86	−6.01	−2.86	−3.38	−5.54
3	−4.10	−4.46	−5.76	−6.48	−7.72	−8.82	−8.62	−7.47	−7.85	−6.62	−3.17	−3.74	−6.23
4	−4.79	−5.02	−6.53	−7.40	−8.03	−8.64	−8.64	−7.56	−8.39	−7.04	−3.40	−4.05	−6.62
5	−5.20	−5.54	−6.64	−7.45	−7.74	−7.56	−7.65	−6.73	−7.97	−7.02	−3.89	−4.21	−6.44
6	−5.06	−5.29	−5.90	−6.37	−5.96	−5.54	−5.67	−4.97	−6.39	−6.35	−3.11	−4.05	−5.38
7	−4.23	−4.52	−4.30	−4.37	−3.74	−2.84	−3.02	−2.59	−3.85	−4.93	−2.39	−3.42	−3.69
8	−2.75	−2.99	−2.12	−1.91	−1.28	+0.07	−0.18	−0.02	−0.81	−2.84	−1.31	−2.18	−1.53
9	−0.77	−0.68	+0.16	+0.45	+1.01	+2.70	+2.39	+2.25	+2.16	−0.27	+0.05	−0.41	+0.77
10	+1.40	+1.62	+2.25	+2.36	+2.90	+4.75	+4.41	+4.01	+4.64	+2.54	+1.58	+1.71	+2.86
11	+3.47	+3.98	+3.96	+3.80	+4.43	+6.17	+5.94	+5.27	+6.50	+5.24	+2.52	+3.83	+4.59
Noon	+5.18	+5.85	+5.22	+5.00	+5.29	+7.13	+7.11	+6.26	+7.81	+7.54	+4.41	+5.51	+6.03
1	+6.41	+6.77	+6.17	+6.12	+6.91	+7.90	+8.06	+7.11	+8.69	+9.11	+5.36	+6.46	+7.09
2	+6.80	+7.16	+6.77	+7.18	+7.92	+8.48	+8.71	+7.83	+9.16	+9.81	+5.72	+6.58	+7.67
3	+6.57	+6.59	+6.98	+7.94	+8.51	+8.75	+8.87	+8.12	+9.05	+9.50	+5.40	+5.72	+7.67
4	+5.69	+5.49	+6.64	+7.99	+8.33	+8.44	+8.26	+7.70	+8.17	+8.24	+4.41	+4.37	+6.98
5	+4.28	+4.21	+5.63	+7.00	+7.20	+7.27	+6.75	+6.32	+6.39	+6.19	+3.42	+2.77	+5.63
6	+2.57	+2.50	+4.01	+5.02	+5.20	+5.24	+4.50	+4.12	+3.87	+3.71	+1.26	+1.24	+3.60
7	+0.83	+1.04	+2.07	+2.45	+2.68	+2.61	+1.87	+1.51	+1.08	+1.22	−0.32	−0.02	+1.42
8	−0.65	−0.27	+0.14	−0.05	+0.23	−0.16	−0.63	−0.97	−1.49	−0.97	−1.55	−0.95	−0.61
9	−1.71	−1.48	−1.37	−1.91	−1.80	−2.63	−2.63	−2.90	−3.35	−2.63	−2.30	−1.60	−2.21
10	−2.30	−2.09	−2.36	−2.97	−3.22	−4.55	−4.03	−4.14	−4.41	−3.74	−2.59	−2.03	−3.20
11	−2.54	−2.66	−2.95	−3.38	−4.16	−5.87	−5.04	−4.84	−4.91	−4.41	−2.05	−2.39	−3.76
Comb's													
10, 10	−0.45	−0.25	−0.07	−0.29	−0.16	+0.11	+0.18	−0.07	+0.11	−0.59	−0.52	−0.16	−0.18
6, 2, 9	+0.01	+0.13	−0.17	−0.37	+0.05	+0.10	+0.14	−0.01	−0.19	+0.28	+0.10	+0.31	+0.03
6, 2, 10	−0.18	−0.07	−0.50	−0.72	−0.42	−0.54	−0.33	−0.43	−0.55	−0.09	+0.01	+0.17	−0.30
7, 2, 9	+0.29	+0.39	+0.37	+0.30	+0.79	+1.00	+1.02	+0.78	+0.65	+0.75	+0.34	+0.52	+0.59
7, 2, 9 bis	−0.21	−0.08	−0.07	−0.25	+0.14	+0.09	+0.11	−0.14	−0.35	−0.09	−0.32	−0.01	−0.11
3, 9, 3, 9	These four hours appear to have been employed for the daily means, the results of the combination being zero.												

[1] From Prof. A. Guyot's Meteorological and Physical Tables, Smithsonian Misc. Coll.; Washington, 1858. Table by Dove.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Philadelphia, Girard College, Penn. Lat. 39° 58′. Long. 75° 10′ W. of G. Alt. 114 feet. June, 1840, to June, 1845, inclusive.													
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	−1.42	−2.69	−3.16	−3.96	−4.70	−5.28	−4.68	−4.34	−4.32	−3.54	−2.29	−1.49	−3.49
1	−1.97	−3.11	−3.81	−4.80	−5.32	−5.99	−5.42	−4.94	−4.58	−3.92	−2.43	−1.91	−4.01
2	−2.12	−3.51	−4.36	−5.60	−6.04	−6.56	−5.98	−5.42	−4.98	−4.50	−2.81	−2.27	−4.51
3	−2.40	−4.05	−4.66	−5.96	−6.72	−7.21	−6.48	−5.58	−5.44	−4.92	−3.09	−2.57	−4.92
4	−2.60	−4.34	−4.83	−6.38	−7.38	−7.68	−6.92	−6.14	−5.76	−5.40	−3.57	−2.85	−5.32
5	−2.82	−4.56	−5.63	−6.48	−7.26	−7.21	−6.70	−6.24	−5.98	−5.82	−3.85	−3.17	−5.48
6	−3.10	−4.84	−5.64	−6.02	−5.82	−5.78	−5.64	−5.66	−6.00	−6.16	−4.11	−3.41	−5.18
7	−3.22	−4.70	−4.99	−4.48	−3.70	−3.36	−3.34	−3.82	−4.14	−4.78	−3.79	−3.11	−3.95
8	−2.80	−3.16	−3.01	−2.44	−1.42	−0.96	−1.08	−1.54	−1.68	−2.32	−2.55	−2.61	−2.13
9	−1.52	−1.23	−1.01	−0.46	+0.78	+0.97	+0.88	+0.38	+0.46	+0.10	−0.65	−1.23	−0.21
10	0.00	+0.81	+0.84	+1.52	+2.36	+2.64	+2.50	+2.20	+2.54	+2.26	+1.07	+0.31	+1.59
11	+1.33	+2.54	+2.86	+3.30	+3.84	+4.14	+4.00	+3.84	+4.22	+3.92	+2.53	+1.83	+3.20
Noon	+2.56	+3.91	+4.34	+4.90	+5.00	+5.54	+5.22	+5.14	+5.56	+5.42	+3.73	+2.91	+4.52
1	+3.55	+5.05	+5.39	+6.14	+6.04	+6.56	+6.06	+5.92	+6.48	+6.48	+4.71	+3.65	+5.50
2	+4.21	+5.68	+6.14	+7.12	+6.94	+7.44	+6.80	+6.82	+7.30	+7.26	+5.39	+4.25	+6.28
3	+4.28	+5.95	+6.69	+7.38	+7.40	+7.73	+7.08	+7.06	+7.40	+7.18	+5.13	+4.03	+6.44
4	+4.05	+5.71	+6.59	+7.44	+7.60	+7.86	+7.02	+6.96	+7.32	+6.92	+4.65	+3.65	+6.32
5	+2.73	+4.57	+5.44	+6.58	+7.14	+6.96	+6.36	+5.92	+5.92	+5.06	+3.13	+2.43	+5.19
6	+1.91	+2.91	+3.57	+5.18	+5.58	+5.62	+5.02	+4.50	+3.72	+2.86	+1.79	+1.73	+3.70
7	+1.10	+1.72	+2.44	+2.54	+3.00	+3.12	+2.88	+2.42	+1.52	+1.20	+0.75	+0.99	+1.97
8	+0.43	+0.44	+1.39	+0.52	+0.36	+0.12	+0.30	−0.04	−0.72	−0.28	−0.09	+0.37	+0.23
9	−0.15	−0.31	−1.06	−0.86	−1.22	−1.53	−1.42	−1.42	−1.96	−1.30	−0.75	−0.03	−1.00
10	−0.74	−1.11	−1.41	−2.10	−2.58	−2.88	−2.70	−2.56	−3.16	−2.46	−1.25	−0.47	−1.95
11	−1.20	−1.68	−2.13	−3.16	−3.80	−4.18	−3.66	−3.38	−3.74	−3.22	−1.73	−0.93	−2.74
Comb's													
10, 10	−0.37	−0.15	−0.28	−0.29	−0.11	−0.12	−0.10	−0.18	−0.31	−0.10	−0.09	−0.08	−0.18
6, 2, 9	+0.32	+0.18	−0.19	+0.08	−0.03	+0.04	−0.09	−0.09	−0.22	−0.07	+0.18	+0.27	+0.03
6, 2, 10	+0.12	−0.09	−0.30	−0.33	−0.49	−0.41	−0.51	−0.47	−0.62	−0.45	+0.01	+0.12	−0.28
7, 2, 9	+0.28	+0.22	+0.03	+0.59	+0.67	+0.85	+0.68	+0.53	+0.40	+0.39	+0.28	+0.37	+0.44
7, 2, 9 bis	+0.17	+0.09	−0.24	+0.23	+0.20	+0.25	+0.15	+0.04	−0.19	−0.03	+0.02	+0.27	+0.08
3, 9, 3, 9	+0.05	+0.09	−0.01	+0.02	+0.06	−0.01	+0.01	+0.11	+0.11	+0.26	+0.16	+0.05	+0.08
Washington City, Capitol Hill, D. C. Lat. 38° 53′. Long. 77° 01′ W. of G. Alt. 80 feet. Lieut. J. M. Gilliss, U. S. N. Jan. 1841, to June, 1842, inclusive.													
0.2 A.M.	−2.73	−2.83	−3.60	−4.40	−5.25	− 6.49	−6.62	−5.20	−5.37	−3.90	−1.93	−2.20	−4.21
2.2	−3.00	−4.19	−4.82	−5.39	−7.11	− 7.28	−7.31	−6.90	−6.17	−5.10	−3.03	−2.54	−5.24
4.2	−3.39	−4.90	−6.02	−6.19	−8.03	− 8.25	−8.62	−7.85	−7.07	−6.50	−4.33	−3.50	−6.22
6.2	−4.36	−5.23	−6.20	−5.82	−4.95	− 5.06	−4.76	−6.33	−6.78	−7.10	−4.93	−4.10	−5.47
8.2	−1.97	−3.97	−3.80	−2.38	−0.73	+ 0.31	−0.21	−0.63	−2.34	−3.80	−4.23	−3.82	−2.30
10.2	+0.28	+1.31	+1.98	+1.71	+2.78	+ 4.05	+2.98	+4.07	+2.95	+2.81	+0.37	+0.30	+2.13
0.2 P.M.	+3.18	+4.63	+5.31	+5.37	+5.93	+ 6.01	+5.73	+6.68	+6.59	+6.50	+4.27	+3.50	+5.31
2.2	+5.73	+7.10	+7.53	+7.67	+8.03	+ 8.61	+7.85	+8.71	+8.43	+8.20	+5.47	+5.60	+7.41
4.2	+5.08	+6.87	+7.20	+7.89	+8.24	+10.11	+9.36	+8.07	+8.23	+7.40	+4.77	+4.90	+7.34
6.2	+1.58	+2.81	+3.89	+4.91	+5.48	+ 3.57	+5.93	+3.91	+4.23	+4.14	+3.57	+2.25	+3.86
8.2	+0.38	−0.03	+0.12	−0.13	−0.62	− 1.03	−0.47	−0.54	+0.52	−0.40	+0.47	+0.56	−0.10
10.2	−0.85	−1.55	−1.71	−3.19	−3.75	− 4.62	−3.84	−4.02	−3.17	−2.20	−0.51	−1.00	−2.53

By means of interpolation we find the diurnal ordinates for the full hours of combination, as follows:—

Comb's	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
10, 10	−0.4	−0.3	−0.1	−0.8	−0.5	− 0.3	−0.4	0.0	−0.2	+0.1	−0.2	−0.5	−0.3
6, 2, 9	+0.4	+0.4	+0.2	+0.1	+0.3	+ 0.2	+0.3	0.0	+0.2	0.0	+0.2	+0.4	+0.2
6, 2, 10	+0.2	+0.1	−0.1	−0.4	−0.3	− 0.4	−0.3	−0.5	−0.5	−0.3	0.0	+0.2	−0.2
7, 2, 9	+0.7	+0.5	+0.6	+0.6	+1.0	+ 1.0	+1.0	+0.9	+0.8	+0.5	+0.3	+0.5	+0.7
7, 2, 9 bis	+0.5	+0.3	+0.3	+0.2	+0.3	+ 0.2	+0.3	+0.2	+0.4	+0.1	+0.3	+0.3	+0.3
3, 9, 3, 9	+0.2	0.0	0.0	0.0	−0.1	+ 0.2	0.0	+0.1	+0.1	0.0	−0.1	+0.1	0.0

Washington City, U. S. Naval Observatory.[1] Lat. 38° 54′. Long. 77° 03′ W. of G.

Alt. 110 feet. Jan. 1862, to Dec. 1869, inclusive.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	-2.12	-2.72	-3.01	-4.00	-4.91	-4.94	-5.02	-4.99	-4.76	-4.03	-3.03	-1.73	-3.77
3	-3.22	-4.02	-4.46	-6.26	-7.17	-6.89	-6.73	-6.57	-6.36	-5.84	-4.62	-2.81	-5.41
6	-4.11	-4.89	-5.57	-7.09	-7.30	-6.99	-7.16	-7.49	-7.35	-7.03	-5.56	-3.66	-6.18
9	-2.21	-1.84	-1.23	-0.05	+0.66	+0.90	+0.69	+0.10	+1.53	-0.39	-1.56	-1.63	-0.42
Noon	+4.22	+4.55	+4.58	+5.75	+6.57	+6.74	+6.99	+7.31	+7.67	+7.87	+6.62	+4.21	+6.09
3	+5.76	+6.66	+6.79	+7.79	+8.80	+8.22	+8.41	+9.52	+9.41	+9.38	+7.56	+5.21	+7.79
6	+2.03	+2.73	+3.63	+4.55	+4.80	+4.69	+4.95	+3.98	+2.38	+2.09	+1.83	+1.32	+3.25
9	-0.38	-0.43	-0.70	-0.68	-1.47	-1.75	-2.13	-1.84	-2.56	-2.02	-1.22	-0.89	-1.34
Comb's 3, 9, 3, 9	-0.01	+0.09	+0.10	+0.20	+0.20	+0.12	+0.06	+0.30	+0.50	+0.28	+0.04	-0.03	+0.15

Fort Morgan, Mobile Point, Alabama. Lat. 30° 14′. Long. 88° 01′ W. of G.

Alt. 20 feet. 1851 to Feb. 1853, inclusive, June, 1848 to 1850.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	-1.3	-1.0	-0.1	-2.4	-1.7	-1.8	-1.8	-2.2	-1.5	-0.9	-0.7	-0.9	-1.4
1	-1.4	-1.3	-1.4	-3.4	-2.1	-2.4	-2.2	-2.1	-1.7	-1.1	-1.0	-0.9	-1.8
2	-1.6	-1.6	-1.5	-3.1	-2.7	-2.6	-2.6	-2.3	-2.4	-1.7	-1.3	-1.2	-2.1
3	-1.8	-2.0	-1.9	-4.1	-3.2	-2.8	-2.8	-2.7	-2.8	-2.3	-1.7	-1.7	-2.5
4	-2.1	-2.3	-2.7	-3.1	-3.5	-2.6	-3.2	-2.8	-3.4	-3.0	-2.2	-2.1	-2.8
5	-2.4	-2.8	-3.1	-3.3	-3.7	-2.9	-3.3	-3.0	-3.8	-3.4	-2.6	-2.4	-3.1
6	-2.6	-3.2	-3.6	-3.4	-3.6	-2.6	-2.8	-2.6	-4.1	-3.6	-3.2	-2.6	-3.2
7	-3.1	-3.6	-3.3	-2.1	-2.6	-1.5	-1.8	-2.0	-3.4	-3.1	-3.4	-2.9	-2.7
8	-1.9	-2.5	-2.2	-1.1	-1.5	-0.2	-0.9	-0.8	-2.1	-2.6	-2.6	-2.2	-1.7
9	-0.8	-0.7	-0.8	+0.1	-0.3	+0.9	+0.2	+0.3	-0.7	-1.3	-1.7	-1.4	-0.5
10	+0.5	+0.3	+0.2	+1.4	+0.7	+2.0	+1.3	+1.7	+0.8	0.0	-0.6	-0.1	+0.7
11	+1.6	+1.5	+1.3	+2.5	+1.5	+2.5	+2.8	+2.8	+2.0	+1.0	+0.5	+0.9	+1.7
Noon	+2.3	+2.5	+2.3	+3.6	+2.4	+2.9	+3.2	+3.5	+2.8	+2.1	+1.6	+1.5	+2.6
1	+2.8	+3.2	+2.7	+4.1	+3.5	+3.2	+4.0	+4.2	+3.6	+2.9	+2.5	+2.3	+3.3
2	+3.1	+3.7	+3.1	+4.3	+4.1	+3.4	+4.3	+4.1	+4.0	+3.7	+3.4	+3.0	+3.7
3	+3.1	+3.5	+3.4	+4.3	+4.3	+3.3	+3.6	+3.4	+4.4	+3.9	+3.8	+3.3	+3.7
4	+2.8	+3.0	+3.3	+4.2	+3.9	+2.9	+3.0	+3.1	+4.0	+3.7	+3.5	+2.8	+3.3
5	+1.7	+2.4	+2.7	+2.8	+2.7	+1.9	+1.9	+2.2	+3.3	+2.7	+2.5	+1.9	+2.4
6	+1.1	+1.4	+1.4	+1.5	+1.6	+1.1	+1.0	+1.1	+1.8	+1.4	+1.5	+1.2	+1.3
7	+0.7	+0.6	+0.6	+0.5	+0.7	0.0	0.0	-0.2	+0.8	+0.8	+1.1	+0.8	+0.5
8	+0.2	+0.3	+0.3	+0.1	+0.3	-0.6	-0.6	-1.0	+0.2	+0.6	+0.6	+0.5	+0.1
9	+0.1	-0.2	0.0	-0.3	0.0	-0.9	-0.9	-1.5	0.0	+0.3	+0.2	+0.2	-0.2
10	-0.3	-0.4	-0.3	-0.8	-0.6	-1.5	-1.1	-1.7	-0.7	+0.1	-0.1	+0.1	-0.6
11	-1.0	-0.7	-0.7	-2.6	-1.1	-1.6	-1.4	-2.0	-1.1	-0.3	-0.4	-0.3	-1.1
Comb's													
10, 10	+0.1	0.0	0.0	+0.3	0.0	+0.2	+0.1	0.0	0.0	0.0	-0.3	0.0	0.0
6, 2, 9	+0.2	+0.1	-0.2	+0.2	+0.2	0.0	+0.2	0.0	0.0	+0.1	+0.1	+0.2	+0.1
6, 2, 10	+0.1	0.0	-0.3	0.0	0.0	-0.2	+0.1	-0.1	-0.3	+0.1	0.0	+0.2	0.0
7, 2, 9	0.0	0.0	-0.1	+0.6	+0.5	+0.3	+0.5	+0.2	+0.2	+0.3	+0.1	+0.1	+0.3
7, 2, 9 bis	0.0	-0.1	0.0	+0.4	+0.4	0.0	+0.2	-0.2	+0.1	+0.3	+0.1	+0.1	+0.1
3, 9, 3, 9	+0.1	+0.1	+0.2	0.0	+0.2	+0.1	0.0	-0.1	+0.2	+0.1	+0.1	+0.1	+0.1

[1] The differences in this table depend on the assumption that the mean of 8 equidistant observations represents the daily mean, which is only an approximation to the truth.

Galveston, Texas. Lat. 29° 18′. Long. 94° 47′ W. of G.

Alt. 20 feet. June, 1851, to Feb. 1853, inclusive.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Mdn't	−1.0	−1.3	−2.6	..	..	..	..	..	−2.4	−2.6	−1.8	−0.7	..
1	−1.3	−1.9	−3.0	..	..	..	..	..	−2.2	−3.0	−1.1	−0.6	..
2	−1.5	−2.0	−3.4	..	..	..	..	..	−2.2	−3.4	−1.6	−1.1	..
3	−1.7	−2.2	−3.7	..	..	..	..	..	−2.6	−3.8	−2.0	−1.3	..
4	−2.1	−4.5	−4.1	..	..	..	..	..	−3.1	−4.2	−2.4	−1.7	..
5	−2.5	−2.6	−4.3	..	..	−5.1	..	..	−3.2	−4.0	−2.7	−2.2	..
6	−2.6	−2.3	−3.9	..	..	−3.7	..	..	−3.2	−2.3	−2.6	−2.5	..
7	−2.5	−2.3	−2.8	..	..	−1.1	..	..	−1.2	+1.1	−1.6	−2.6	..
8	−1.5	−0.8	+0.1	..	..	+0.5	..	..	+1.3	+3.2	+1.5	−1.8	..
9	−0.6	+1.3	+3.2	..	..	+1.6	..	..	+3.0	+4.2	+2.9	+0.5	..
10	+2.0	+2.7	+5.2	..	..	+1.0	..	..	+3.9	+4.2	+3.5	+1.8	..
11	+2.6	+3.5	+5.7	..	..	+2.5	..	..	+3.8	+3.9	+2.7	+1.8	..
Noon	+2.6	+3.3	+4.9	..	..	+2.2	..	..	+3.3	+3.9	+2.1	+1.9	..
1	+2.6	+3.2	+3.9	..	..	+2.5	..	..	+3.2	+3.8	+1.9	+2.0	..
2	+2.4	+3.0	+3.8	..	..	+3.0	..	..	+2.7	+3.3	+1.9	+2.0	..
3	+2.3	+2.6	+3.0	..	..	+4.0	..	..	+2.3	+2.6	+1.8	+2.0	..
4	+2.3	+2.2	+2.6	..	..	+5.2	..	..	+1.9	+1.4	+1.6	+1.7	..
5	+1.6	+1.2	+1.6	..	..	+3.5	..	..	+1.1	+0.6	+0.9	+1.2	..
6	+0.9	+0.6	+0.4	..	..	+0.2	..	..	+0.5	−0.4	+0.4	+0.8	..
7	+0.4	+0.2	−0.5	..	..	−1.7	..	..	−0.5	−0.9	−0.3	+0.4	..
8	0.0	−0.3	−1.1	..	..	..	..	..	−1.3	−1.3	−0.9	0.0	..
9	−0.5	−0.7	−1.6	..	..	..	..	..	−1.6	−1.9	−1.2	−0.2	..
10	−0.6	−0.9	−2.1	..	..	..	..	..	−1.8	−2.1	−1.6	−0.6	..
11	−0.8	−1.1	−2.2	..	..	..	..	..	−2.2	−2.2	−1.7	−0.7	..
Comb's													
7, 2, 9	−0.2	0.0	−0.2	..	..	..	..	..	0.0	+0.8	−0.3	−0.3	..
7, 2, 9 bis	−0.3	−0.2	−0.5	..	..	..	..	..	−0.4	+0.1	−0.5	−0.2	..
3, 9, 3, 9	−0.1	+0.2	+0.2	..	..	..	..	..	+0.3	+0.3	+0.4	+0.2	..

Key West, Florida. Lat. 24° 33′. Long. 81° 48′ W. of G.

Alt. 20 feet. June, July, Aug. Oct. Dec. 1851, Jan. to May, inclusive, 1852.

Hour.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
									[1]		[1]		
Mdn't	−1.60	−1.54	−2.03	−1.95	−2.46	−1.84	−2.22	−1.45	−1.36	−1.27	−0.73	−0.19	−1.55
1	−1.58	−2.09	−2.07	−2.23	−2.80	−1.86	−2.07	−1.64	−1.60	−1.56	−0.84	−0.12	−1.70
2	−1.65	−2.06	−2.03	−2.24	−2.75	−2.19	−2.32	−1.90	−1.70	−1.51	−0.80	−0.08	−1.77
3	−1.76	−2.44	−2.20	−2.31	−2.91	−2.28	−2.51	−2.15	−1.83	−1.51	−0.89	−0.27	−1.92
4	−1.92	−2.56	−2.35	−2.32	−3.09	−2.54	−2.80	−2.28	−1.93	−1.59	−1.02	−0.45	−2.07
5	−2.36	−3.06	−2.78	−2.71	−3.65	−2.61	−3.09	−2.64	−2.27	−1.91	−1.44	−0.96	−2.46
6	−2.37	−3.08	−2.90	−2.64	−3.28	−2.31	−2.90	−2.51	−2.23	−1.96	−1.78	−1.61	−2.47
7	−2.44	−3.01	−2.24	−1.66	−1.07	−1.36	−1.33	−1.57	−1.48	−1.40	−1.59	−1.78	−1.74
8	−1.90	−1.85	−0.56	−0.14	+1.01	−0.16	+0.34	+0.01	−0.11	−0.22	−0.76	−1.30	−0.47
9	−0.26	−0.01	+1.02	+0.95	+2.28	+1.14	+1.38	+0.78	+0.72	+0.67	+0.18	−0.32	+0.71
10	+0.82	+1.34	+2.09	+1.66	+2.77	+2.17	+2.14	+1.40	+1.35	+1.30	+0.81	+0.33	+1.51
11	+1.71	+2.16	+2.67	+1.94	+3.02	+2.27	+2.44	+1.82	+1.75	+1.68	+1.28	+0.89	+1.97

[1] Interpolated values, the mean of Aug. and Oct. for Sept. and the mean of Oct. and Dec. for Nov.

Key West.—Continued.

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Noon	+2.16	+2.66	+2.88	+2.16	+2.91	+2.62	+2.67	+1.85	+1.82	+1.80	+1.49	+1.17	+2.18
1	+2.79	+2.75	+3.12	+2.67	+3.02	+2.82	+3.23	+2.36	+2.27	+2.18	+1.67	+1.15	+2.50
2	+2.97	+2.87	+3.30	+2.88	+3.12	+2.64	+3.06	+2.43	+2.32	+2.22	+1.75	+1.28	+2.57
3	+3.24	+3.30	+3.20	+2.94	+2.94	+2.76	+3.02	+2.40	+2.27	+2.14	+1.79	+1.44	+2.62
4	+3.31	+3.66	+3.06	+2.66	+2.83	+2.74	+2.61	+2.30	+2.15	+1.99	+1.73	+1.46	+2.54
5	+2.79	+3.32	+2.44	+2.55	+2.44	+2.29	+2.56	+2.04	+1.76	+1.49	+1.23	+0.96	+2.16
6	+1.34	+1.96	+1.23	+2.22	+2.28	+1.57	+1.34	+1.43	+0.95	+0.47	+0.25	+0.04	+1.26
7	+0.14	+0.58	−0.30	+0.30	−0.07	+0.14	+0.06	+0.43	+0.15	−0.14	−0.32	−0.49	+0.04
8	−0.34	−0.15	−0.98	−0.65	−0.91	−0.90	−0.62	−0.15	−0.24	−0.33	−0.43	−0.53	−0.52
9	−0.58	−0.49	−1.11	−0.95	−1.33	−1.44	−1.09	−0.60	−0.57	−0.53	−0.43	−0.33	−0.79
10	−0.98	−0.90	−1.57	−1.41	−1.83	−1.78	−1.71	−1.02	−0.92	−0.83	−0.48	−0.14	−1.13
11	−1.39	−1.25	−1.86	−1.70	−2.28	−1.78	−2.06	−1.18	−1.11	−1.04	−0.56	−0.09	−1.36
Comb's													
10, 10	−0.08	+0.22	+0.26	+0.12	+0.47	+0.19	+0.21	+0.19	+0.21	+0.23	+0.16	+0.09	+0.19
6, 2, 9	+0.01	−0.23	−0.24	−0.24	−0.50	−0.37	−0.31	−0.23	−0.16	−0.09	−0.15	−0.22	−0.23
6, 2, 10	−0.13	−0.37	−0.39	−0.39	−0.66	−0.48	−0.52	−0.37	−0.28	−0.19	−0.17	−0.16	−0.34
7, 2, 9	−0.02	−0.21	−0.02	+0.09	+0.24	−0.05	+0.21	+0.09	+0.09	+0.10	−0.09	−0.28	+0.01
7, 2, 9 bis	−0.16	−0.28	−0.29	−0.17	−0.15	−0.40	−0.11	−0.08	−0.07	−0.06	−0.17	−0.29	−0.19
3, 9, 3, 9	+0.16	+0.09	+0.23	+0.16	+0.24	+0.04	+0.20	+0.11	+0.15	+0.19	+0.16	+0.13	+0.15

Rio Janeiro, Brazil, S. Am.[1] Lat. —22° 54′. Long. 43° 09′ W. of G.

Fort Villegagnon (Con. des Temps, 1870).

Hour.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Mdn't	0.00	−0.59	−1.06	−0.23	−0.14	+0.29	−0.92	−0.61	−0.38	−0.32	−1.15	−0.65	−0.47
1	−0.74	−1.51	−1.80	−0.90	−1.13	−0.56	−1.85	−1.31	−1.04	−0.97	−1.76	−1.31	−1.24
2	−1.64	−2.41	−2.48	−1.64	−2.12	−1.53	−2.75	−2.00	−1.69	−1.64	−2.32	−2.05	−2.03
3	−2.50	−3.11	−3.02	−2.32	−2.93	−2.43	−3.47	−2.66	−2.27	−2.21	−2.75	−2.66	−2.70
4	−3.08	−3.90	−3.24	−2.79	−3.38	−3.04	−3.87	−3.04	−2.59	−2.50	−2.93	−2.99	−3.06
5	−3.22	−3.29	−3.15	−2.90	−3.40	−3.29	−3.83	−3.08	−2.66	−2.52	−2.79	−2.99	−3.08
6	−2.93	−2.84	−2.75	−2.75	−3.06	−3.20	−3.47	−2.79	−2.41	−2.27	−2.32	−2.68	−2.79
7	−2.30	−2.21	−2.14	−2.30	−2.48	−2.84	−2.70	−2.25	−2.00	−1.82	−1.67	−2.12	−2.23
8	−1.49	−1.49	−1.40	−1.71	−1.85	−2.39	−1.96	−1.60	−1.46	−1.28	−0.90	−1.40	−1.58
9	−0.68	−0.72	−0.59	−1.04	−1.15	−1.82	−1.15	−0.90	−0.86	−0.68	−0.14	−0.59	−0.86
10	+0.07	+0.05	+0.23	−0.32	−0.50	−1.13	−0.32	−0.23	−0.18	−0.05	+0.56	+0.23	−0.14
11	+0.77	+0.86	+1.01	+0.45	+0.23	−0.32	+0.50	+0.50	+0.54	+0.59	+1.22	+1.04	+0.61
Noon	+1.40	+1.64	+1.71	+1.22	+0.99	+0.65	+1.31	+1.19	+1.26	+1.22	+1.80	+1.82	+1.35
1	+2.00	+2.30	+2.30	+1.94	+1.71	+1.67	+2.16	+1.91	+1.89	+1.78	+2.32	+2.43	+2.03
2	+2.41	+2.75	+2.66	+2.41	+2.30	+2.48	+2.88	+2.48	+2.34	+2.16	+2.66	+2.81	+2.52
3	+2.59	+2.88	+2.84	+2.66	+2.66	+2.99	+3.40	+2.84	+2.50	+2.27	+2.79	+2.86	+2.77
4	+2.45	+2.70	+2.77	+2.57	+2.75	+3.04	+3.60	+2.93	+2.36	+2.12	+2.66	+2.59	+2.70
5	+2.05	+2.30	+2.50	+2.21	+2.54	+2.75	+3.47	+2.68	+2.00	+1.78	+2.25	+2.09	+2.39
6	+1.51	+1.82	+2.12	+1.76	+2.21	+2.23	+3.04	+2.23	+1.55	+1.37	+1.67	+1.49	+1.91
7	+1.04	+1.40	+1.67	+1.28	+1.89	+1.76	+2.39	+1.67	+1.13	+1.04	+1.08	+0.99	+1.44
8	+0.72	+1.13	+1.22	+0.95	+1.67	+1.42	+1.85	+1.13	+0.83	+0.77	+0.59	+0.61	+1.08
9	+0.59	+0.92	+0.77	+0.72	+1.44	+1.26	+1.22	+0.70	+0.61	+0.61	+0.14	+0.38	+0.79
10	+0.56	+0.63	+0.25	+0.52	+1.13	+1.13	+0.59	+0.32	+0.41	+0.45	−0.23	+0.16	+0.50
11	+0.41	+0.14	−0.36	+0.25	+0.63	+0.86	−0.09	−0.09	+0.09	+0.16	−0.65	−0.14	−0.09
Comb's													
10, 10	+0.31	+0.34	+0.24	+0.10	+0.31	0.00	+0.13	+0.04	+0.11	+0.20	+0.16	+0.14	+0.18
6, 2, 9	+0.02	+0.28	+0.23	+0.13	+0.23	+0.18	+0.21	+0.13	+0.18	+0.17	+0.16	+0.17	+0.17
6, 2, 10	+0.01	+0.18	+0.05	+0.06	+0.12	+0.14	0.00	0.00	+0.11	+0.11	+0.04	+0.10	+0.08
7, 2, 9	+0.23	+0.49	+0.43	+0.28	+0.42	+0.30	+0.47	+0.31	+0.32	+0.32	+0.38	+0.36	+0.36
7, 2, 9 bis	+0.32	+0.59	+0.51	+0.39	+0.67	+0.54	+0.65	+0.41	+0.39	+0.39	+0.32	+0.36	+0.47
3, 9, 3, 9	These four hours appear to have been employed for the daily means, the result of the combination being zero.												

[1] From Prof. Guyot's Meteorological and Physical Tables, Smithsonian Misc. Coll.; Washington, 1858. Table by Dove.

For systematic comparison of the law of the diurnal fluctuation we present the resulting hourly numbers, on the yearly average as contained in the table of differences, in an analytical form, making use of Bessel's periodic function—[1]

$$t = A + B_1 \sin(\theta + C_1) + B_2 \sin(2\,\theta + C_2) + B_3 \sin(3\,\theta + C_3) + \text{etc.}$$

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[1] See Bessel's paper in the Astronomische Nachrichten, No. 136 (May, 1828). His first publication on the subject is contained in the Literary Gazette of Jena, in 1814.

See also a memoir by M. A. Bravais in "Voyages en Scandinavie, en Laponie, au Spitzberg et aux Feroe, pendant les années 1838, 1839, et 1840, Météorologie." An extract is given by M. J. Haeghens in the "Annuaire Météorologique de la France pour 1850, p. 93.

See also Sir J. Herschel's Article, "Meteorology" in the Encyclopædia Britannica. Reprint, p. 144. The general formulæ given in this article, when applied to the case of 24 equidistant observations in a cycle, change into the following expressions, which were employed for the numerical computations:

$$A = \tfrac{1}{24}(y_1 + y_2 + y_3 + \ldots + y_{24})$$

$$12\,a_1 = 0.966\,(y_1 - y_{11} - y_{13} + y_{23}) + 0.866\,(y_2 - y_{10} - y_{14} + y_{22}) + 0.707\,(y_3 - y_9 - y_{15} + y_{21})$$
$$+ 0.500\,(y_4 - y_8 - y_{16} + y_{20}) + 0.259\,(y_5 - y_7 - y_{17} + y_{19}) - y_{12} + y_{24}$$

$$12\,b_1 = 0.259\,(y_1 + y_{11} - y_{13} - y_{23}) + 0.500\,(y_2 + y_{10} - y_{14} - y_{22}) + 0.707\,(y_3 + y_9 - y_{15} - y_{21})$$
$$+ 0.866\,(y_4 + y_8 - y_{16} - y_{20}) + 0.966\,(y_5 + y_7 - y_{17} - y_{19}) + y_6 - y_{18}$$

$$B_1 = \sqrt{a_1^2 + b_1^2} \quad \text{and} \quad \tan C_1 = \frac{a_1}{b_1}$$

$$12\,a_2 = 0.866\,(y_1 - y_5 - y_7 + y_{11} + y_{13} - y_{17} - y_{19} + y_{23}) + 0.500\,(y_2 - y_4 - y_8 + y_{10} + y_{14} - y_{16} - y_{20} + y_{22})$$
$$- y_6 + y_{12} - y_{18} + y_{24}$$

$$12\,b_2 = 0.500(y_1 + y_5 - y_7 - y_{11} + y_{13} + y_{17} - y_{19} - y_{23}) + 0.866\,(y_2 + y_4 - y_8 - y_{10} + y_{14} + y_{16} - y_{20} - y_{22})$$
$$+ y_3 - y_9 + y_{15} - y_{21}$$

$$12\,a_3 = 0.707\,(y_1 - y_3 - y_5 + y_7 + y_9 - y_{11} - y_{13} + y_{15} + y_{17} - y_{19} - y_{21} + y_{23})$$
$$- y_4 + y_8 - y_{12} + y_{16} - y_{20} + y_{24}$$

$$12\,b_3 = 0.707\,(y_1 + y_3 - y_5 - y_7 + y_9 + y_{11} - y_{13} - y_{15} + y_{17} + y_{19} - y_{21} - y_{23})$$
$$+ y_2 - y_6 + y_{10} - y_{14} + y_{18} - y_{22}$$

$$12\,a_4 = 0.500\,(y_1 - y_2 - y_4 + y_5 + y_7 - y_8 - y_{10} + y_{11} + y_{13} - y_{14} - y_{16} + y_{17} + y_{19} - y_{20} - y_{22} + y_{23})$$
$$- y_3 + y_6 - y_9 + y_{12} - y_{15} + y_{18} - y_{21} + y_{24}$$

$$12\,b_4 = 0.866\,(y_1 + y_2 - y_4 - y_5 + y_7 + y_8 - y_{10} - y_{11} + y_{13} + y_{14} - y_{16} - y_{17} + y_{19} + y_{20} - y_{22} - y_{23})$$

etc.

The values $B_2\ B_3\ B_4$ . . and $C_2\ C_3\ C_4$ . . are found in a similar manner as B_1 and C_1.

For 12 equidistant observations in a cycle, as in our bi-hourly series, we use the formulæ:

$$A = \tfrac{1}{12}(y_1 + y_2 + y_3 + \ldots + y_{12})$$

$$6\,a_1 = 0.866\,(y_1 - y_5 - y_7 + y_{11}) + 0.500\,(y_2 - y_4 - y_8 + y_{10}) - y_6 + y_{12}$$
$$6\,b_1 = 0.500\,(y_1 + y_5 - y_7 - y_{11}) + 0.866\,(y_2 + y_4 - y_8 - y_{10}) + y_3 - y_9$$

$$6\,a_2 = 0.500\,(y_1 - y_2 - y_4 + y_5 + y_7 - y_8 - y_{10} + y_{11}) - y_3 + y_6 - y_9 + y_{12}$$
$$6\,b_2 = 0.866\,(y_1 + y_2 - y_4 - y_5 + y_7 + y_8 - y_{10} - y_{11})$$

$$6\,a_3 = - y_2 + y_4 - y_6 + y_8 - y_{10} + y_{12}$$
$$6\,b_3 = y_1 - y_3 + y_5 - y_7 + y_9 - y_{11}$$

$$6\,a_4 = 0.500\,(- y_1 - y_2 - y_4 - y_5 - y_7 - y_8 - y_{10} - y_{11}) + y_3 + y_6 + y_9 + y_{12}$$
$$6\,b_4 = 0.866\,(y_1 - y_2 + y_4 - y_5 + y_7 - y_8 + y_{10} - y_{11})$$

etc.

The values $B_1\ B_2\ B_3\ B_4$ . . and $C_1\ C_2\ C_3\ C_4$ . . are found as stated.

The above expressions, together with others, are given in Coast Survey Report of 1862, Appendix, No. 22 (with erratum in 1866 report).

20 February, 1875.

We retain three periodic terms as generally sufficient for our purpose. The angle θ counts from midnight at the rate of 15° an hour; at those stations where the observations were not made at the full hours, the angles C_1, C_2, C_3 were changed in the expression for t in order to refer them to the same epoch. The table also contains the latitude (ϕ), the longitude (λ), the elevation (h) of the station, and the number of years (n) of observation. The column headed T contains the annual mean temperature or the mean of the twelve monthly averages.

Numerical quantities in Bessel's function for the DAILY *fluctuation of temperature, on the yearly average.*

	STATION.	ϕ	λ	h feet	n	T	B_1	C_1	B_2	C_2	B_3	C_3
1	Van Rensselaer Harbor	78°37′	70°53′	6	1	− 2°.47	1.86	243°19′	0.18	158°.6	0.03	301°
2	Port Foulke	78 18	73 00	6	1	+ 5.86	1.57	235 08	0.02	195.3	0.11	148
3	Port Kennedy	72 01	94 14	4	1	+ 1.89	1.98	254 04	0.19	81.0	0.15	264
4	Boothia Felix	69 59	92 01	4	..	+ 3.68	2.82	247 24	0.40	58.5	0.09	194
5	Sitka	57 03	135 20	20	13	43.03	3.46	239 59	0.66	66.6	0.09	330
6	Montreal	45 31	73 34	57	2	44.73	5.19	221 54	0.94	42.8	0.12	104
7	Thunder Bay Island	45 02	83 17	610	2	42.83	4.06	233 19	0.67	66.4	0.17	101
8	Toronto	43 39	79 23	342	6	44.18	5.61	232 04	0.84	59.2	0.48	41
9	Mohawk	43 00	75 02	435	6	44.84	5.63	216 20	1.19	33.7	0.24	357
10	Cambridge	42 23	71 07	71	1	47.37	6.57	236 07	1.52	62.1	0.26	5
11	Amherst	42 22	72 34	267	1	47.23	6.84	230 16	1.49	65.7	0.08	317
12	New Haven	41 18	72 57	45	..	49.01	6.75	231 50	1.39	65.8	0.29	22
13	Brooklyn	40 41	73 58	125	1	51.00	4.94	231 30	1.01	67.1	0.10	243
14	Frankford Arsenal	40 00	75 04	24	1	52.66	6.96	232 54	1.14	51.1	0.51	53
15	Philadelphia	39 58	75 10	114	5	51.35	5.77	224 50	0.93	40.9	0.34	34
16	Jackson	39 02	82 32	700	1	50.90	9.28	237 41	2.24	57.4	0.68	39
17	Washington, D. C.	38 53	77 03	110	9½	53.52	6.72	227 21	1.61	49.6	0.21	13
18	Fort Morgan	30 14	88 01	20	1	70.24	3.06	222 16	0.90	54.9	0.07	95
19	Key West	24 33	81 48	20	1	76.63	2.48	234 58	0.55	60.4	0.35	26
20	Rio Janeiro	−22 54	43 09	..	..	73.75	2.68	205 20	0.42	83.6	0.22	110

A better insight into the systematic character of the co-efficients and epochal angles, as far as they depend upon the latitude and local conditions, can be had by a combination of the results into groups. The hourly values for the stations forming a group were combined into mean values, and then submitted to the numerical process, which produced the following results:—

Types of the daily fluctuation of the temperature on the yearly average.

Group I. The four Arctic stations. $\phi_m = 74°.7$ $\lambda_m = 82°.5$. 4 years.

$$t = + \ 2°.23 + 2°.11 \sin(\theta + 243°.6) + 0°.14 \sin(2\,\theta + 66°.3) + 0.04 \sin(3\,\theta + 216°).$$

Group II. The Alaska station. $\phi = 57°.1$ $\lambda = 135°.3$. 13 years.

$$t = + 43°.03 + 3°.46 \sin(\theta + 240°.0) + 0°.66 \sin(2\,\theta + 66°.6) + 0.09 \sin(3\,\theta + 330°).$$

Group III. Four stations in Canada and Northern New York. $\phi_m = 44°.3$ $\lambda_m = 77°.8$. 16 years.

$$t = + 44°.14 + 5°.08 \sin(\theta + 225°.5) + 0°.89 \sin(2\,\theta + 48°.2) + 0.21 \sin(3\,\theta + 50°).$$

Group IV. Four stations in Mass., Conn., and N. Y. $\phi_m = 41°.7$ $\lambda_m = 72°.6$. More than 4 years.

$$t = +48°.65 + 6°.27 \sin(\theta + 232°.7) + 1°.38 \sin(2\theta + 61°.1) + 0.10 \sin(3\theta + 359°).$$

Group V. Three stations in Penn. and Dist. of Col. $\phi_m = 39°.6$ $\lambda_m = 75°.8$. 15 years.

$$t = +53°.38 + 6°.55 \sin(\theta + 228°.7) + 1°.27 \sin(2\theta + 48°.1) + 0.35 \sin(3\theta + 36°).$$

Group VI. Two Gulf stations. $\phi_m = 27°.4$ $\lambda_m = 84°.9$. 2 years.

$$t = +73°.44 + 2°.75 \sin(\theta + 227°.8) + 0°.70 \sin(2\theta + 57°.5) + 0.17 \sin(3\theta + 31°).$$

The hourly means from which these expressions were derived are contained in the following table:—

Observed Daily fluctuation of temperature, on the yearly average, for groups of stations.

Hour.	I. Van Rensselaer Har. Port Foulke. Port Kennedy. Boothia Felix.	II. Sitka.	III. Montreal. Thunder Bay Island. Toronto. Mohawk.	IV. Cambridge. Amherst. New Haven. Brooklyn.	V. Frankford Arsenal. Philadelphia. Washington.	VI. Fort Morgan. Key West.	Hour.	I. Van Rensselaer Har. Port Foulke. Port Kennedy. Boothia Felix.	II. Sitka.	III. Montreal. Thunder Bay Island. Toronto. Mohawk.	IV. Cambridge. Amherst. New Haven. Brooklyn.	V. Frankford Arsenal. Philadelphia. Washington.	VI. Fort Morgan. Key West.
	°	°	°	°	°	°		°		°	°	°	°
Midn't	—1.8	—2.4	—2.9	—3.9	—3.8	—1.5	Noon	+2.0	+3.7	+4.2	+6.1	+5.6	+2.4
1	—1.9	—2.7	—3.4	—4.4	—4.4	—1.8	1	+2.2	+4.0	+5.0	+7.0	+6.7	+2.9
2	—2.0	—2.9	—4.0	—5.0	—4.9	—2.0	2	+2.3	+3.9	+5.6	+7.3	+7.4	+3.1
3	—1.8	—2.9	—4.4	—5.4	—5.5	—2.2	3	+2.0	+3.5	+5.7	+6.9	+7.4	+3.1
4	—1.6	—3.0	—4.8	—5.7	—6.0	—2.4	4	+1.6	+2.9	+5.3	+5.8	+6.8	+2.9
5	—1.4	—2.9	—4.9	—5.8	—6.2	—2.8	5	+1.2	+2.1	+4.3	+4.3	+5.4	+2.3
6	—1.0	—2.4	—4.4	—5.3	—5.7	—2.8	6	+0.7	+1.2	+3.1	+2.5	+3.5	+1.3
7	—0.5	—1.7	—3.4	—4.0	—4.3	—2.2	7	+0.2	+0.3	+1.5	+0.9	+1.7	+0.3
8	+0.1	—0.6	—1.9	—2.0	—2.2	—1.1	8	—0.3	—0.5	+0.2	—0.4	—0.2	—0.2
9	+0.7	+0.7	—0.4	+0.4	0.0	+0.1	9	—0.7	—1.2	—0.8	—1.5	—1.5	—0.5
10	+1.2	+1.8	+1.4	+2.5	+2.2	+1.1	10	—1.1	—1.7	—1.6	—2.4	—2.5	—0.8
11	+1.6	+2.9	+2.8	+4.7	+4.1	+1.8	11	—1.5	—2.1	—2.2	—3.2	—3.3	—1.2

At several stations, interpolation, graphical or analytical, was required to complete the hourly values before they could be combined into groups. Frankford Arsenal and Philadelphia values were united into a mean and then combined with the Washington values.

By means of the equations we readily find the following times of greatest, least, and average heat of the day and of the daily range, on the yearly average.

	Max. at P. M.	Min. at A. M.	Mean at A. M.	Mean at P. M.	Range.
Group I . . .	1h 31m	1h 56m	8h 0m	7h 32m	4°.3
II . . .	1 20	3 43	8 28	7 24	7.2
III . . .	2 38	4 31	9 12	8 11	10.6
IV . . .	1 46	4 24	8 53	7 42	13.1
V . . .	2 28	4 28	9 01	7 54	13.6
VI . . .	2 12	4 54	9 04	7 49	5.9
Mean III, IV, V	2 17	4 28	9 02	7 56	12.4

The results of the daily fluctuation, as given above, may be summed up as follows:—

The daily range diminishes from about latitude 40° in either direction north or south. The precise latitude of maximum range cannot yet be given. Diagram A shows the extremely small ranges in latitude 75° and in latitude 27°, the former produced by the small range in the sun's altitude during the Arctic day, the latter by the equalizing effect of the aqueous vapor near the Gulf coast notwithstanding the sun's great daily range in altitude near the tropic of cancer. Diagram B shows the large daily range for the stations comprising groups IV and V, and the somewhat smaller one for group III.

Diagram A.

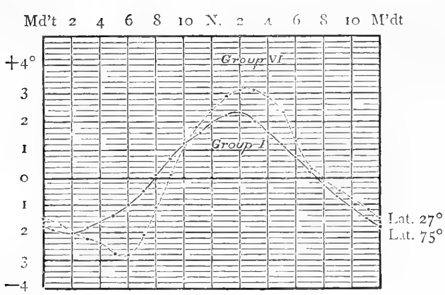
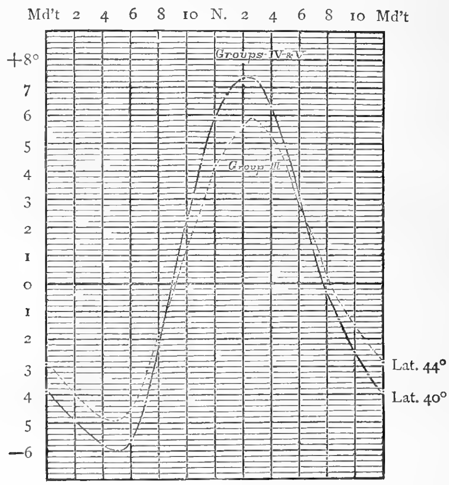


Diagram B.



The greatest heat of the day is reached earlier in the high than in the low latitudes; with the mean annual temperature near or below the freezing point, the warmest time of the day is about $1\frac{1}{2}$ P. M., in the middle and lower latitudes this epoch changes to $2\frac{1}{4}$ P. M. The greatest depression in the daily fluctuation occurs in the Arctic regions about two hours after midnight, in the temperate zone about

4½ A. M. or about one hour and a half *before* sunrise. The epochs of mean daily temperature are subject to less variations with respect to latitude than the epochs of the daily extremes. In the Arctic regions the mean temperature of the day is reached about 8 A. M., in the temperate regions about 9 A. M., and again about 7½ P. M. and about 8 P. M. respectively.

The material for the discussion of the daily fluctuation for stations in the Mississippi valley and in the western states and territories is yet wanting.

The annual variation in the range of the daily fluctuation is shown in the following table. From want of completeness in the records the tabular numbers, in many instances, are the result of interpolation, and they can only be considered as close approximations.

Monthly means of the RANGE *of the daily fluctuation.*

	Group I. Arctic Regions. 4 Stations.	Group II. Alaska. 1 Station.	Group III. Canada and N. New York. 4 Stations.	Groups IV & V.[1] Mass., Conn., Penn., D. of C. 6 Stations.	Group VI. Gulf Coast. 2 Stations.
	°	°	°	°	°
January	1.2	3.1	6.3	10.4	6.0
February	3.0	5.4	8.9	11.2	7.0
March	9.2	7.9	10.9	13.6	6.6
April	8.6	9.8	12.0	14.8	7.1
May	8.6	10.9	14.0	17.0	7.4
June	7.8	11.3	14.9	17.2	5.8
July	5.7	10.6	15.4	15.8	6.9
August	4.2	9.2	14.6	14.9	6.1
September	3.5	8.4	12.5	16.6	6.5
October	2.2	4.8	10.3	16.2	5.8
November	1.7	3.4	5.9	11.1	5.4
December	1.0	2.1	5.3	9.8	4.7

[1] Omitting Brooklyn as too irregular.

Diagram C.

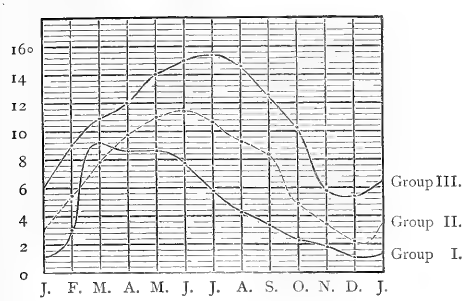
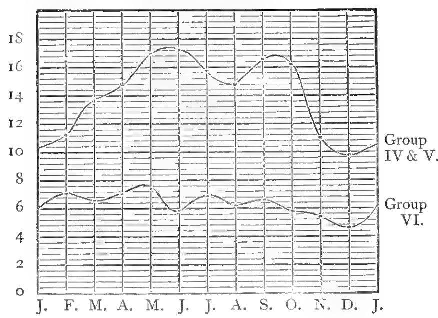


Diagram D.



At all stations, of the above table, between the Gulf of Mexico and the Arctic Sea, the daily range is a minimum in December; this, however, is the only feature they have in common, as shown in diagrams C and D. In the first diagram the curves for the northern stations appear single-crested, in the second the curve of the middle latitude stations is double-crested and that of the Gulf stations exhibits three or more elevations and depressions, all ill-defined. The marked feature of the low latitude range is its great uniformity throughout the year. In the Arctic regions, with the returning day, the range suddenly rises to its maximum in March; in Canada and northern New York the range is greatest in July or about the time of greatest heat; along the coast from Massachusetts to the District of Columbia the range attains two maxima, one early in June the other late in September, with an intermediate depression of range during the hottest season. As our observations become more extended, other features in the march of the daily temperature will undoubtedly make their appearance, and those already recognized will become better defined. At San Francisco especially, it would be interesting to have a series of hourly observations, extending at least over one year, this locality being otherwise noted for anomalous temperature relations. According to Dr. Gibbons the coldest and warmest periods of the day are not far from sunrise and noon, and by taking the differences of the mean monthly temperatures at these times, as given in the Smithsonian report for 1854, p. 231 and foll. For the years 1851 to 1854, I obtain the following table of daily range of temperature at San Francisco.

January	12°.1	July	15°.7
February	14.0	August	12.8
March	15.3	September	14.9
April	16.5	October	16.1
May	14.9	November	13.7
June	16.2	December	11.5

These numbers are approximations only, yet they indicate a comparatively large range, a minimum range in December and two maxima—one in spring, the other in autumn.

The modification which the daily fluctuation undergoes in the course of a year can be advantageously brought out by a comparison of its value in December when near the least, with its value in June when not far from its greatest development.

The fluctuations observed at Van Rensselaer, Port Foulke, Port Kennedy, and Boothia Felix were united into a mean, those at Thunder Bay Island, Toronto, Mohawk, Amherst, and Philadelphia into another, and those at Fort Morgan, Key West, and Galveston into a third; these localities are designated, Arctic stations, Temperate stations, and Gulf stations respectively.

Before taking means, the record for Galveston, Texas, was made complete by interpolation.

Extremes of daily fluctuation in December and June.

	Arctic Stations (4).		Temperate Stations (5).		Gulf Stations (3).	
	Dec.	June.	Dec.	June.	Dec.	June.
	°	°	°	°	°	°
Md'nt	−0.2	−3.2	−1.5	−4.9	−1.3	−2.0
1	−0.2	−3.9	−2.2	−6.0	−1.4	−2.3
2	−0.3	−4.2	−2.5	−6.7	−1.6	−2.5
3	−0.3	−3.5	−2.7	−7.3	−1.8	−2.8
4	−0.4	−2.6	−2.9	−7.6	−2.0	−3.0
5	−0.4	−1.6	−3.0	−7.5	−2.4	−3.4
6	−0.4	−0.7	−2.9	−5.9	−2.5	−2.7
7	−0.4	+0.3	−2.9	−3.6	−2.7	−1.2
8	−0.2	+1.4	−2.5	−1.1	−1.8	+0.2
9	0.0	+1.8	−1.4	+1.0	−0.6	+1.3
10	+0.1	+2.4	+0.3	+2.9	+1.1	+1.9
11	+0.3	+2.8	+1.9	+4.6	+2.0	+2.6
Noon	+0.5	+3.2	+3.3	+6.1	+2.4	+2.7
1	+0.4	+3.3	+4.1	+7.0	+2.7	+3.0
2	+0.3	+3.3	+4.6	+7.6	+2.8	+3.1
3	+0.2	+2.9	+4.5	+7.7	+2.9	+3.5
4	+0.1	+2.4	+3.7	+7.5	+2.8	+3.7
5	+0.2	+1.7	+2.4	+6.6	+2.0	+2.7
6	+0.2	+1.0	+1.5	+5.2	+1.1	+1.1
7	+0.2	+0.2	+0.5	+2.8	+0.4	−0.4
8	+0.2	−0.5	+0.1	+0.2	0.0	−1.1
9	+0.1	−1.3	−0.4	−1.7	−0.3	−1.4
10	+0.1	−2.0	−0.8	−2.9	−0.6	−1.8
11	−0.1	−2.6	−1.2	−4.0	−1.1	−1.9

The above numbers are plotted on diagrams E, F, and G. These diagrams show plainly, in December the morning minimum later and the afternoon maximum earlier than in June; also the morning and afternoon epochs of mean daily temperature later in December (nearly two hours) than in June, but in the temperate latitudes the afternoon hour (8 o'clock) answers for the time of the winter as well as for the time of the summer solstice.

DIAGRAM E.

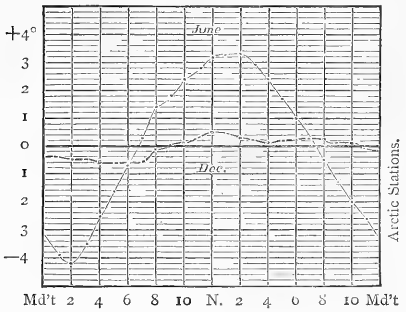


DIAGRAM F.

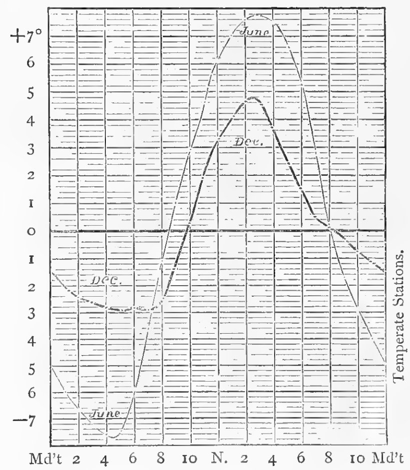
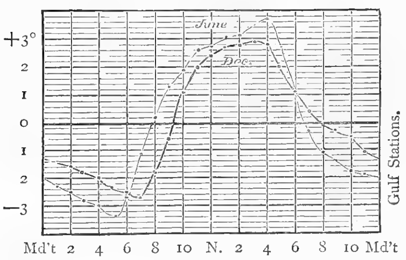


DIAGRAM G.



The vicinity of San Francisco, Cal., probably presents the greatest anomaly yet noticed. Dr. H. Gibbons remarks[1] that at San Francisco the warmest period of the day in winter is from 1 to 2 P. M., but in summer (May to August) it is an hour or two earlier owing to the sea breeze, which springs up about noon or soon after, instantly depressing the temperature. In the season of the westerly breezes the temperature is rapidly reduced and the change is effected long before sunset, after which time the thermometer shows but little variation till the following morning. Under the influence of this brisk sea breeze, the rays of a high sun fail to impart any appreciable heat to the air. These conditions are quite local and the attending phenomena respecting the daily and annual fluctuations are confined to the vicinity of the Bay of San Francisco, though traces of it appear at all stations along the western coast exposed to the immediate influence of the westerly winds from the Pacific ocean. Observations of the daily march of the temperature in these localities are specially desirable. For the study of the effect of height on the daily fluctuation no material is at present available, but our records show that under this condition it may become quite excessive; at elevated regions the air is comparatively dry and the sun's rays reach the ground but little impeded, while at night radiation is going on with great energy from the comparative absence of an absorbing medium. The great interior basin bounded on the east by the Rocky Mountains and the

[1] The climate of San Francisco; Smithsonian Annual Report for 1854, p. 231 and foll.

Sierra Madre, on the west by the Sierra Nevada and including the regions of the Colorado River, also the northern portion of the Rio Grande, furnishes many interesting examples of an excessively large daily range, the magnitude of which may, in a measure, be inferred from the following comparisons of the difference of temperature at the observing hours 7 A. M. and 2 P. M., or at the time of sunrise and 3 P. M., for a few selected places, located in New Mexico, Texas, Arizona, and California. With the exception of Fort Yuma, which is but 200 feet above the sea level, these stations are all at considerable elevations.

Average difference in the temperature, between sunrise and 3 P. M., or between 7 A. M. and 2 P. M., taken from the monthly means at these hours of observation. [Army Met. Regs. for 1855 and 1860.]

Name of Station, State, or Territo	Fort Thorn, N. M.	Albuquerque, N. M.	Fort Quitman, Tex.	Fort Defiance, Ariz.	Fort Buchanan, Ariz.	Fort Craig, N. M.	Fort Yuma, Cal.	Fort Chadburne, Tex.	Fort Crook, Cal.	Weighted Mean
Latitude . . .	32°40′	35°06′	30°45′	35°43′	31°40′	33°36′	32°46′	31°58′	41°07′	
Longitude . . .	107 09	106 38	105 00	109 10	110 55	107 00	114 44	100 15	121 29	
Altitude (feet) .	4500	5032	3710	6500	5330	4576	200	2120	3390	
No. of years of record . .	4	7	1	7	2	4	7	7	2	
January . . .	26°	27°	37°	24°	27°	26°	22°	23°	15°	24°
February . . .	31	26	35	23	28	28	25	24	13	25
March	30	31	41	25	32	27	24	26	16	27
April	34	31	30	25	29	29	24	26	24	28
May	36	34	29	24	25	22	22	19	20	25
June	34	29	21	27	23	22	22	20	21	25
July	27	25	13	19	13	20	20	20	25	21
August	25	26	17	19	15	17	20	20	29	21
September . . .	25	28	14	25	17	17	20	18	29	22
October . . .	32	27	17	28	22	21	21	21	31	25
November . . .	33	26	29	24	23	22	20	24	17	24
December . . .	25	22	30	22	21	23	18	23	12	21
Year	30	28	26	24	23	23	22	22	21	24

The mean daily range, for any month or for the year, at any of the above stations is necessarily several degrees higher than the corresponding tabular difference since the morning and afternoon extremes do not take place at the hours of observation; even the tabular numbers, when contrasted with the observed daily range in other parts of the United States, appear excessive, and imperfect as they must be owing to the short number of years and the great variability of the quantities themselves, the annual fluctuation of the differences given in the last column presents quite a regular double crested curve. The maximum daily range occurs in March and April, a second smaller maximum in October with minima in July and August, and again in December, the latter minimum being apparently a common feature within the boundaries of the United States. The great development of the daily fluctuation at Albuquerque, N. M., would recommend this station as a suitable locality for an extended hourly series (to be recorded with a self-registering instrument). Such observations would greatly assist in establishing corrections to the mean temperature derived from the ordinary hours of observation (7 A. M. and 2 and 9 P. M.) in order to refer them to the true daily mean.

A table of the daily fluctuation for this place would answer for most stations situated within the elevated and arid region generally known as the great interior basin, as well as for the regions of the upper Rio Grande and of western Texas.

In some instances the recorded mean monthly difference between the morning and afternoon temperatures rises to 40°, and if the observations are to be trusted to 45°; the corresponding daily incidental range is equally great and for the regions described above it is not uncommon to meet, in the morning, with a temperature below the freezing point and to experience in the afternoon of the same day a heat rising to 70 or 80° Fah.

Variability of the temperature at any hour of the day from the normal value of that hour.

To complete the investigation of the general laws of the daily fluctuation we have yet to inquire into the amount of digression of the monthly mean of any observed hourly temperature when compared with its normal value.

These irregular variations are most readily ascertained by a comparison of the *monthly means* for each hour of the day, given separately for a *series* of years, with the mean of the combined years for each hour. By this method we completely free our results from the effects of the annual fluctuation, and have the advantage of presenting the probable error to the hourly temperatures, as given in the first set of tables for each month, provided the particular table was derived from a *single year* of observations; if the tables are constructed from n years, the probable errors require a division by $\sqrt{n}$ in order to represent the probable uncertainties of their tabular numbers.

With a special view to this investigation the Mohawk table of hourly temperatures is given in full, from 1860 to 1868, only six years of hourly observations, however, could be utilized for the present purpose. At Philadelphia, the Girard College series furnished hourly means for nearly 5 years from 1840 to 1845. At Sitka a series of hourly observations (with omissions of 5 readings in each day) was taken from the records of the observatory, for 5 years, selecting 1847–8–9 and 1862–3–4. For Toronto, Can., the results are copied from Table VII[1] of the

[1] The following is, in part, a copy of the Toronto table.

Hour.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Oct. to March inclusive.	Apr. to Sept. inclusive.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
2 P. M.	3.49	2.47	2.43	1.94	2.38	2.20	2.36	1.66	1.95	1.69	1.45	3.12	2.44	2.08
4 "	3.31	2.54	2.59	1.76	2.36	2.13	2.09	1.37	1.71	1.46	1.30	3.10	2.38	1.90
10 "	3.53	3.52	2.69	1.56	1.82	1.76	1.36	1.10	1.21	1.54	1.26	3.02	2.59	1.47
Mdn't	3.67	3.85	2.76	1.52	1.76	1.88	1.33	1.14	1.07	1.56	1.30	3.04	2.70	1.45
6 A. M.	3.90	3.65	2.98	1.32	1.72	1.85	1.59	1.09	1.25	1.48	1.24	3.20	2.74	1.47
8 "	3.89	3.57	2.85	1.38	1.95	1.99	1.67	1.01	1.26	1.59	1.23	3.12	2.71	1.54
All hours	3.63	3.27	2.72	1.58	2.00	1.97	1.73	1.23	1.41	1.55	1.30	3.10	2.59	1.65

"Results of meteorological observations made at the magnetical observatory, during the years 1860–1–2." G. T. Kingston, Director. This table is headed "Probable variability of the monthly means of temperature at each of the 6 observation hours, in a single year, together with their half-yearly and yearly averages, from the years 1854 to 1862 inclusive," and the deduction from the results is stated as follows: The *warm* hours are most liable to disturbances of temperature in the *warm* months, and the *cold* hours in the *cold* months, and altogether the abnormal digressions are greater in the colder half year than in the warmer.

A series of hourly observations continued for 6 years is barely sufficient for the investigation and the results for the three winter months (Dec., Jan., Feb.) were contracted into a mean, also the results of the three summer months (June, July, Aug.); it was not deemed necessary to investigate the six remaining months, since the law is seen to change gradually from season to season, the variability of the temperature of any hour being nearly the same about or after the epochs of the equinoxes.

Probable error of the monthly mean temperature for any hour of the day, derived from a series of years.

Hours of day.	Winter.					Summer.				
	Toronto.	Mohawk.	Phila.	Sitka.		Toronto.	Mohawk.	Phila.	Sitka.	
	°	°	°	°		°	°	°	°	
Md't	±3.5	±3.2	±2.4	±..		±1.4	±1.2	±0.8	±..	
1	..	3.2	2.4	..		..	1.2	0.8	..	
2	..	3.2	2.4	..		..	1.2	0.9	..	
3	..	3.3	2.4	..		..	1.2	0.8	..	
4	..	3.3	2.4	2.4		..	1.2	0.8	0.8	
5	..	3.3	2.4	2.5		..	1.2	0.8	0.8	
6	3.6	3.3	2.4	2.5		1.5	1.2	0.8	1.0	
7	..	3.3	2.3	2.6		..	1.0	0.7	1.2	
8	3.5	3.4	2.3	2.5		1.5	1.0	0.7	1.3	
9	..	3.2	2.2	2.4		..	1.0	0.8	1.5	
10	..	3.1	2.3	2.2		..	1.0	0.9	1.4	
11	..	3.0	2.2	2.2		..	1.0	0.8	1.4	
Noon	..	2.9	2.1	2.0		..	1.1	0.9	1.4	
1	..	2.8	2.3	1.9		..	1.3	0.8	1.3	
2	3.0	2.8	2.4	1.9		2.1	1.6	1.0	1.1	
3	..	2.7	2.5	2.0		..	1.8	1.0	1.1	
4	3.0	2.8	2.5	2.1		1.9	2.0	1.0	1.0	
5	..	2.8	2.5	2.2		..	2.0	1.0	0.8	
6	..	2.9	2.4	2.3		..	2.0	1.1	0.9	
7	..	2.9	2.4	2.3		..	1.9	1.0	0.8	
8	..	3.0	2.4	2.4		..	1.8	1.1	0.9	
9	..	3.0	2.4	2.4		..	1.6	1.0	0.8	
10	3.3	3.1	2.5	2.3		1.4	1.4	1.1	0.8	
11	..	3.2	2.5	..		..	1.3	1.0	..	
Mean	±3.3	±3.1	±2.4	±2.3	±2.8°	±1.6	±1.4	±0.9	±1.0	±1.2°

The Toronto results are in the main confirmed by those at the other stations, and there is no doubt a much closer accordance would be obtained from longer series of records. In winter the maximum variability occurs a few hours after midnight, or about the period of the maximum cold of the day; in summer the reverse of this happens, the maximum variability then occurs about 3 P. M., or about the period of maximum heat. In winter the greatest constancy is noted about 2 P. M., but in summer the temperature is most steady some hours after midnight.

The progression of the tabular numbers from hour to hour is quite regular, particularly for Mohawk. The amount of variation is nearly the same at Toronto and Mohawk, but less at Philadelphia and Sitka. In general the variability in winter is more than double that of summer; this latter variation will be found further investigated under the head of the annual fluctuation.

In winter the maximum variability at any hour is to the minimum variability as 5 to 4, and in summer as 8 to 5.

Multiplying the above average probable errors $\pm 2°.8$ in winter, and $\pm 1°.2$ in summer by $\sqrt{30.4}$ or by 5.5 nearly, we have an approximation to the probable error of an observed temperature at any hour of the day at these seasons, with reference to the normal values of that hour, month, and season. These quantities are $\pm 15°$ and $\pm 7°$ respectively.

Any attempt to deduce, for any given time and place at the earth's surface, even approximately, the daily fluctuation of the temperature, as far as it depends upon the variations of the sun's altitude[1] and with consideration of the loss of heat by absorption while passing through various depths of atmosphere,[2] must lead to

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[1] Let $\zeta =$ the sun's zenith distance, δ its declination, t the hour angle, then for the latitude φ

$$\cos\zeta = \sin\varphi\sin\delta + \cos\varphi\cos\delta\cos t,$$

from which expression the altitude or depression of the sun for any hour of the day may be computed.

[2] If we treat the *length* of the oblique path of a ray of heat passing through the atmosphere simply as a geometrical problem, it is given by

$$l = \sqrt{r^2\cos^2\zeta + 2rh + h^2} - r\cos\zeta,$$

hence for the case of a horizontal ray (irrespective of refraction),

$$L = \sqrt{2rh + h^2},$$

where $r =$ the earth's radius and $h =$ the height of the atmosphere. Taking for instance $h = 45$ st. miles, at which elevation twilight yet indicates the presence of air capable of reflection, and $r = 3956$ miles, we find that horizontal ray must traverse nearly 600 miles of atmosphere or 13.3 times the vertical thickness, if $h = 74$ miles, which is the average height at which shooting stars become incandescent when coming in contact with the atmosphere, the length of path is about 770 miles or 10.4 times the vertical thickness. The decrease of heat of inclined rays is greater than that resulting from the inverse proportion of the length of tract, and is due to the density of the air increasing geometrically, while the depth increases arithmetically. The following measures of atmospheric tract and of calorific effect on a surface vertically exposed to the ray, is extracted from a table given in the Encyclopædia Britannica (8th edition), article, climate; it supposes that of one thousand rays, vertically incident on the outer boundary of the atmosphere, only 750 will be transmitted through it and received on the ground. The numbers in the column headed "H" are computed by the formula $(\frac{2}{3})^{\sec\zeta}$, given in the article meteorology, according to which only 667 rays reach the ground. The last two columns contain the number of rays incident on a horizontal surface, obtained by multiplying the numbers in the preceding columns by $\cos\zeta$.

Zenith distance. ζ	Length of atmospheric tract.	Rays transmitted. (L)	$(\frac{2}{3})^{\sec\zeta}$ (H)	$L\cos\zeta$	$H\cos\zeta$
0°	1.000	750	667	750	667
10	1.015	747	663	735	653
20	1.064	736	650	691	611
30	1.154	718	626	619	542
40	1.305	687	589	526	451
50	1.554	640	531	411	341
60	1.995	563	444	282	222
70	2.905	434	306	148	105
80	5.610	199	97	35	17
90	37.850	0	0	0	0

unsatisfactory results, for the reason that the distribution of heat passing into the atmosphere directly and indirectly through surface radiation, evection, and conduction, and the amount parted with by radiation during the night, as well as the modifying influence of the aqueous vapor, present far too complex phenomena to be accounted for numerically. We have already seen that the absolute amount of vapor and the relative humidity are among the causes sufficient to impress a totally different character upon the range of the daily fluctuation, from that we might otherwise have expected from the meridian altitude of the sun and the length of its diurnal arc.

DISCUSSION

OF THE

ANNUAL FLUCTUATION, OF THE MONTHLY AND ANNUAL EXTREMES AND OF THE SECULAR VARIATION OF THE ATMOSPHERIC TEMPERATURE,

WITH

TABLES OF RESULTING TEMPERATURES FOR EACH DAY IN THE YEAR, OF MONTHLY EXTREMES AND OF ANNUAL MEANS FOR A SUCCESSION OF YEARS.

SECTION III.

DISCUSSION OF THE ANNUAL FLUCTUATION, OF THE MONTHLY AND ANNUAL EXTREMES AND OF THE SECULAR VARIATION OF THE ATMOSPHERIC TEMPERATURE

WITH

TABLES OF RESULTING TEMPERATURES FOR EACH DAY OF THE YEAR, OF OBSERVED MONTHLY EXTREMES AND OF ANNUAL MEANS FOR A SUCCESSION OF YEARS.

The annual fluctuation of the temperature.—The annual fluctuation in the temperature of the lower atmosphere is exhibited in the progression of the successive monthly means, for a great number of stations in the General Temperature—Tables of Section I, but it may also be shown by the tabulation of the mean temperature, derived from a series of years, of every day of the year. The latter method, while more advantageous, is also more laborious than the first, but is indispensable in inquiries respecting certain suspected irregularities in the annual fluctuation.

In the application of Bessel's periodic function to the case of the annual fluctuation of the temperature as derived from the *monthly means*, corrections are required for the inequality in the *length* of the calendar months, and for *curvature* or difference in the *mean* monthly temperature, and the temperature for the *middle* of the month. The first correction, for unequal length, affects principally the mean annual temperature, and but slightly the periodic terms in the epochs; the second correction, for curvature, affects only the amplitude of the fluctuations. These corrections may be applied separately and for each month before the application of the periodic function, especially in the case where the temperature for each day is known. When we have to make many applications of the formula, it becomes desirable to reduce this labor as far as is possible, without sacrifice of accuracy There is no need for introducing these small corrections to results from short series, and it suffices to state the rules for complete quadriennia, in which, consequently, the mean length of February equals 28.25 days, and the year 365.24 days nearly; the average or normal month comprises 30.44 days nearly.

The mean temperature for the months of normal length may readily be computed by means of the following epochs of the ending of each month—

Normal months:	January	ends with	0.44	of the	31st	of	Calendar month.
	February	" "	0.62	" "	2d	"	March.
	March	" "	0.06	" "	2d	"	April.
	April	" "	0.50	" "	2d	"	May.
	May	" "	0.94	" "	1st	"	June.
	June	" "	0.37	" "	2d	"	July.
	July	" "	0.81	" "	1st	"	August.
	August	" "	0.25	" "	1st	"	September.
	September	" "	0.69	" "	1st	"	October.
	October	" "	0.13	" "	1st	"	November.
	November	" "	0.56	" "	1st	"	December.
	December	" "	with midnight of the 31st.				

To make use of these expressions we require to know the mean temperature of certain days near the beginning of each month; this may either be taken directly from the observations or may be computed from the monthly means. In Silliman's Journal of Science and Arts, May numbers of 1866 and of 1867, Mr. E. L. De Forest has presented the case in a different and very convenient form[1] by using the monthly means already computed and finding corrections thereto, employing the means of the months preceding and following. Practically the results by the two methods are identical. The general effect of the correction for inequality is to increase the annual means by a small fraction of a degree.

To exhibit the magnitude of the monthly corrections, the results for the New Haven series, extending over nearly 86 years, may serve as a sample. The second column contains the uncorrected or calendar means, the third and fourth the correction to reduce to months of mean length, according to first and second methods, the last column gives the corrected means.

---

[1] On page 316 of Sill. Journ., No. 129 (May, 1867), we find the expressions for the normal months, M, by means of the calendar months, m, as follows :—

$$
\begin{aligned}
M_1 &= m_1 + .0037\, m_1 + .0030\, m_{12} - .0067\, m_2 \\
M_2 &= m_2 - .0127\, m_2 - .0031\, m_1 + .0158\, m_3 \\
M_3 &= m_3 + .0028\, m_3 - .0249\, m_2 + .0221\, m_4 \\
M_4 &= m_4 - .0042\, m_4 - .0200\, m_3 + .0242\, m_5 \\
M_5 &= m_5 + .0016\, m_5 - .0218\, m_4 + .0202\, m_6 \\
M_6 &= m_6 - .0039\, m_6 - .0180\, m_5 + .0219\, m_7 \\
M_7 &= m_7 + .0026\, m_7 - .0200\, m_6 + .0174\, m_8 \\
M_8 &= m_8 + .0025\, m_8 - .0103\, m_7 + .0078\, m_9 \\
M_9 &= m_9 - .0027\, m_9 - .0067\, m_8 + .0094\, m_{10} \\
M_{10} &= m_{10} + .0030\, m_{10} - .0085\, m_9 + .0055\, m_{11} \\
M_{11} &= m_{11} - .0026\, m_{11} - .0046\, m_{10} + .0072\, m_{12} \\
M_{12} &= m_{12} + .0032\, m_{12} - .0064\, m_{11} + .0032\, m_1
\end{aligned}
$$

Mr. De Forest also remarks that the term $T = A + B_1 \sin(\theta + C_1)$ obtained on the supposition of calendar months will be very nearly corrected, for temperate climates, for the inequality of months by taking $T = A + .0041\, B_1 + B_1 \sin(\theta + C_1 + 46')$. The effect on the periodical terms involving multiples of θ is small and variable. They are preferred in the form $\pm A_n \sin n(\theta - e_n)$, as determined by $\sin(n\theta \pm E_n) = \sin n\left(\theta - \frac{1}{n}(360° - E_n)\right)$ or $-\sin n\left(\theta - \frac{1}{n}(180 - E_n)\right)$ according to $E_n >$ or $<$ than 180°, the arc e_n indicates the position of the first intersection, and the ascending or descending wave is shown by the sign of the term. In the usual form the signs are all positive.

	Calendar Month. Mean.	Correction. I.	Correction. II.	Corr'd Mean.		Calendar Month. Mean.	Correction. I.	Correction. II.	Corr'd Mean.
January	26°.46	0°.00	0°.00	26°.46	July	71°.69	+0°.06	+0°.07	71°.76
February	28.08	+0.12	+0.12	28.20	August	70.24	—0.07	—0.07	70.17
March	36.03	+0.46	+0.43	36.47	September	62.49	—0.18	—0.16	62.32
April	46.96	+0.44	+0.47	47.42	October	51.06	—0.15	—0.16	50.90
May	57.28	+0.41	+0.42	57.70	November	40.28	—0.14	—0.11	40.16
June	66.96	+0.27	+0.28	67.24	December	30.42	—0.08	—0.08	30.34

Uncorrected annual mean	48°.996
Correction	+ 0.099
Corrected mean	49.095

The monthly corrections, beginning with January and continuing in regular progression, for two extreme cases are given below, viz., for Key West, Flo., with an annual range of about 14°.7, for New Haven, Conn., with about 46°.7 and for Fort Snelling, Minn., with about 61°.8.

	°	°	°	°	°	°	°	°	°	°	°	°
Key West	.00	+.04	+.11	+.14	+.13	+.09	+.02	—.01	—.04	—.05	—.04	—.03
New Haven	.00	+.12	+.44	+.46	+.42	+.28	+.07	—.07	—.17	—.16	—.12	—.08
Fort Snelling	.00	+.21	+.67	+.63	+.47	+.28	+.04	—.12	—.19	—.19	—.18	—.11

Expressed in parts of the half of the annual range or nearly as a multiplier of B_1, the correction to the mean temperature of the year derived from the mean temperature of the calendar months, in order to obtain the true mean derived from the daily means, has been determined for a number of stations as follows:—

Locality.	Approx. Value of Half Range.	Factor.
Fort Snelling, Min.	30°.9 Fah.	0.0043
Brunswick, Me.	24.2	41
St. Louis, Mo.	24.1	38
Fort Laramie, Wyo.	23.7	37
Albion Mines, Nov. Sco.	23.6	50
New Haven, Conn.	23.3	44
Toronto, Can.	22.8	45
Providence, R. I.	22.6	44
Marietta, Ohio	21.4	43
Austin, Tex.	16.0	34
Charleston, S. C.	15.9	34
Sitka, Alas.	12.3	39
San Diego, Cal.	9.5	36
Key West, Flo.	7.3	38
San Francisco, Cal.	4.9	23

The factor seems to diminish with a diminishing range, but is sufficiently constant and equal to 0.0043 for half ranges above 20°, and equal to 0.0036 for half ranges below 20°. The San Francisco value is known to be exceptional.

The effect or correction to the epochal angles, C_1 C_2 C_3, may be seen from the following selected expressions of typical stations:—

Station.	Extent of Series in Years.	Calendar or Mean Mo.	A	B_1	B_2	B_3	C_1	C_2	C_3
Fort Snelling, Min.	42	Cal.	44°.52	30°.03	1°.60	0°.65	238°58′	208°.8	184°.4 [1]
		Mean	44.65	30.03	1.71	0.69	239 46	209.4	182.7
New Haven, Conn.	86	Cal.	49.00	22.66	0.27	0.39	233 37	298.0	139.4
		Mean	49.10	22.66	0.26	0.41	234 25	283.2	140.2
Marietta, Ohio	49	Cal.	52.24	21.16	0.79	0.41	238 38	284.1	72.6
		Mean	52.33	21.16	0.80	0.42	239 25	279.7	77.6
San Diego, Cal.	20	Cal.	62.11	8.78	1.59	0.17	224 07	285.7	156.7
		Mean	62.14	8.78	1.58	0.19	224 50	285.8	161.7
Key West, Flo.	26	Cal.	77.05	7.23	0.29	0.20	228 49	235.7	243.6
		Mean	77.08	7.23	0.31	0.19	229 34	233.0	243.2

[1] Uncorrected for daily fluctuation.

The terms in B_4 and B_5 are of no practical consequence in the present inquiry. The difference in the angle C_1 for calendar and mean months is for Fort Snelling, Min., $+ 48'$; for New Haven, Conn., $+ 48'$; for Marietta, Ohio, $+ 47'$; also (Sill. Journ., May, 1866, p. 377–378) for St. Paul, Min.; New York; and Charleston, S. C., $+ 46'$, and for San Diego, Cal. $+ 43'$; for Key West, Flo., $+ 45'$. We can therefore correct our expressions derived from the calendar months, for their inequality in length, by *substituting* for stations having a range between the hottest and coldest months exceeding 40°,

$$A + 0.0043\ B_1 \text{ for } A \text{ and } C_1 + 47' \text{ for } C_1,$$

and for stations having a less range,

$$A + 0.0036\ B_1 \text{ for } A \text{ and } C_1 + 45' \text{ for } C_1.$$

The effect on C_2 and C_3 appears irregular, and may therefore be omitted as of little importance; the values of B_2 and B_3 are not sensibly affected.

The preceding five expressions for the annual fluctuation refer to the middle of December for their epoch; hence, in order to count the angle θ from the *first day of January*, we must increase C_1 by 15°, C_2 by twice 15°, and C_3 by thrice 15°.

The second correction is nearly zero in April and May, and again in Oct. and Nov., and reaches a maximum (a few tenths of a degree) in July or August, and again in January or February, the monthly amounts changing gradually, with opposite sign for the half year when the temperature is above, and the half year when it is below the mean. Since the mean monthly temperature is numerically less than the temperature corresponding to the middle of the month, the parameters of the fluctuations must be increased, and the correction for curvature is effected[1] by multiplying the parameters or values, $B_1\ B_2\ B_3$ . . . , as found without regard to this, by the factors,

$$\frac{\frac{\pi}{12}}{\sin\frac{\pi}{12}},\quad \frac{\frac{2\pi}{12}}{\sin\frac{2\pi}{12}},\quad \frac{\frac{3\pi}{12}}{\sin\frac{3\pi}{12}}\quad \ldots\ldots$$

respectively. To allow, therefore, for curvature, we increase the co-efficients $B_1\ B_2\ B_3$ . . . as ordinarily obtained

[1] A. Bravais in "Voyages en Scandinavie, etc." Pendant les années 1838, 1839, 1840. Météorologie, Vol 2, pp. 291 and 325. Paris, 18 . .

by their $\frac{1}{88}$, $\frac{1}{21}$, $\frac{1}{9}$ . . . . part respectively. Inversely, if we wish to compare computed monthly means with observed means, the respective multipliers are

$$\frac{\sin\frac{\pi}{12}}{\frac{\pi}{12}}, \quad \frac{\sin\frac{2\pi}{12}}{\frac{2\pi}{12}}, \quad \frac{\sin\frac{3\pi}{12}}{\frac{3\pi}{12}} \quad . \; . \; . \; .$$

In the case of incomplete monthly means, one or more being wanting, the function may still be employed by first finding, by interpolation, graphical or analytical, values for the terms omitted, and obtaining first an approximate, and by a second or third (if necessary) application an exact expression for T. For the supposition of one month being omitted in the observations or y_0 in the values, $y_1\, y_2\, y_3 \ldots y_{11}$, wanting, Mr. Bravais gives the formula—

$$y_0 = \tfrac{2}{7}(y_1 + y_5 + y_7 + y_{11}) + \tfrac{1}{7}(y_2 - y_3 - y_4 + y_6 - y_8 - y_9 + y_{10}) + \tfrac{1}{7}\sqrt{3}\,(y_1 - y_5 - y_7 + y_{11})$$

The expressions for two or more adjacent ordinates are too complicated, and of too little use to be inserted here.

In connection with the use of the periodic function, a table giving the value of θ for each day (noon) is herewith appended.[1]

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[1] Table, as given by Mr. De Forest—

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0°30′	31° 3′	58°53′	89°26′	119° 1′	149°34′	179° 8′	209°41′	240°15′	269°49′	300°22′	329°56′
2	1 29	32 2	59 52	90 26	120 0	150 33	180 7	210 40	241 14	270 48	301 21	330 55
3	2 28	33 1	60 51	91 25	120 59	151 32	181 6	211 40	242 13	271 47	302 20	331 55
4	3 27	34 0	61 51	92 24	121 58	152 31	182 5	212 39	243 12	272 46	303 20	332 54
5	4 26	34 59	62 50	93 23	122 57	153 30	183 5	213 38	244 11	273 45	304 19	333 53
6	5 25	35 59	63 49	94 22	123 56	154 30	184 4	214 37	245 10	274 44	305 18	334 52
7	6 24	36 58	64 48	95 21	124 55	155 29	185 3	215 36	246 9	275 44	306 17	335 51
8	7 24	37 57	65 47	96 20	125 55	156 28	186 2	216 35	247 9	276 43	307 16	336 50
9	8 23	38 56	66 46	97 19	126 54	157 27	187 1	217 34	248 8	277 42	308 15	337 49
10	9 22	39 55	67 45	98 19	127 53	158 26	188 0	218 34	249 7	278 41	309 14	338 49
11	10 21	40 54	68 44	99 18	128 52	159 25	188 59	219 33	250 6	279 40	310 13	339 48
12	11 20	41 53	69 44	100 17	129 51	160 24	189 59	220 32	251 5	280 39	311 13	340 47
13	12 19	42 53	70 43	101 16	130 50	161 24	190 58	221 31	252 4	281 38	312 12	341 46
14	13 18	43 52	71 42	102 15	131 49	162 23	191 57	222 30	253 3	282 38	313 11	342 45
15	14 18	44 51	72 41	103 14	132 48	163 22	192 56	223 29	254 3	283 37	314 10	343 44
16	15 17	45 50	73 40	104 13	133 48	164 21	193 55	224 28	255 2	284 36	315 9	344 43
17	16 16	46 49	74 39	105 13	134 47	165 20	194 54	225 28	256 1	285 35	316 8	345 42
18	17 15	47 48	75 38	106 12	135 46	166 19	195 53	226 27	257 0	286 34	317 7	346 42
19	18 14	48 47	76 38	107 11	136 45	167 18	196 53	227 26	257 59	287 33	318 7	347 41
20	19 13	49 47	77 37	108 10	137 44	168 17	197 52	228 25	258 58	288 32	319 6	348 40
21	20 12	50 46	78 36	109 9	138 43	169 17	198 51	229 24	259 57	289 32	320 5	349 39
22	21 11	51 45	79 35	110 8	139 42	170 16	199 50	230 23	260 57	290 31	321 4	350 38
23	22 11	52 44	80 34	111 7	140 42	171 15	200 49	231 22	261 56	291 30	322 3	351 37
24	23 10	53 43	81 33	112 7	141 41	172 14	201 48	232 22	262 55	292 29	323 2	352 36
25	24 9	54 42	82 32	113 6	142 40	173 13	202 47	233 21	263 54	293 28	324 1	353 36
26	25 8	55 41	83 32	114 5	143 39	174 12	203 46	234 20	264 53	294 27	325 1	354 35
27	26 7	56 40	84 31	115 4	144 38	175 11	204 46	235 19	265 52	295 26	326 0	355 34
28	27 6	57 40	85 30	116 3	145 37	176 11	205 45	236 18	266 51	296 26	326 59	356 33
29	28 5	58 16	86 29	117 2	146 36	177 10	206 44	237 17	267 51	297 25	327 58	357 32
30	29 5		87 28	118 1	147 36	178 9	207 43	238 16	268 50	298 24	328 57	358 31
31	30 4		88 27		148 35		208 42	239 15		299 23		359 30

The arc from the beginning of the year to the middle of each calendar month is found in the above table opposite the 16th for months of 31 days, and by subtracting 30′, for months of 30 days; the arc to the middle of February is 44° 28′.

To exhibit the annual fluctuation in a concise form, suitable for comparisons and further deductions, a number of characteristic stations have been selected, representing various climatological features, and for which the numerical values of the several quantities entering in the expression—

$$T = A + B_1 \sin(\theta + C_1) + B_2 \sin(2\theta + C_2) + B_3 \sin(3\theta + C_3)$$

have been computed and tabulated. In preference, stations having long and reliable series of observations have been selected, and they comprise with some rough approximation to uniformity of distribution, the area of the United States, with a few representative stations in Arctic and British North America. The results are based on the monthly means presented in the general table of temperatures (Section I), they were first corrected for *daily* fluctuation[1] according to the hours of observation, whenever needed, those depending on $7_m\ 2_a\ 9_{a\ bis}$ receiving no correction. They were next corrected for *inequality* in length of months and for *curvature*, as explained. It was deemed sufficient for the present purpose to stop at the term involving $B_3\ C_3$, considering that this and any subsequent term represent rather local peculiarities and, moreover, are subject to considerable changes with the use of additional observations. The days of average epochs of maxima and minima were computed by the formula—

$$0 = B_1 \cos(\theta + C_1) + 2B_2 \cos(2\theta + C_2) + 3B_3 \cos(3\theta + C_3)$$

resulting from putting $\dfrac{dT}{d\theta} = 0$

The 46 stations are given in five groups, each arranged according to latitude.

---

[1] Excepting the results for Fort Franklin, to which no corrections whatever have been applied, it is a series of less than two years. The expressions for the Arctic stations, Van Rensselaer Harbor, Port Foulke, and Port Kennedy, were taken from my discussion of the Physical Observations in the Arctic Seas by Dr. I. I. Hayes; Smithsonian Contributions to Knowledge, No. 196, Washington, June, 1867, p. 180. To these a fourth term has now been added, and the parameters have been corrected for curvature. [On p. 180 B_1 for Van Rensselaer Harbor should have been 35.39.]

TABLE OF COMPUTED ANNUAL FLUCTUATION

OF THE

TEMPERATURE OF 46 STATIONS.

ANNUAL FLUCTUATION

[The angle θ counts from January 1,

No.	Locality.	Lat.	Long. W. of Gr.	Height.	Extent of Series.	A	B_1	C_1
	ARCTIC REGIONS.							
				feet.	yrs. mos.			
1	Polaris Bay, Hall Land	81°38′	61°14′	34	1 0	+4°.19	33.09	247°52′
2	Van Rensselaer Harbor, N. Greenland	78 37	70 53	6	1 8	— 2.20	35.79	251 43
3	Port Foulke, North Greenland	78 18	73 00	6	0 11	+ 6.06	33.49	242 14
4	Port Kennedy, North Somerset	72 01	94 14	4	1 1	+ 2.02	39.46	249 05
	BRITISH NORTH AMERICA AND CANADA.							
5	Fort Franklin, Great Bear Lake	65 12	122 45	230	1 9	+17.18	37.64	248 55
6	Fort Chipewayan, Athabasca Lake	58 43	111 15	700	3 6	+28.69	34.36	246 55
7	Nain, Labrador	57 10	61 50	...	9 6	+23.46	25.09	241 18
8	Toronto, Canada West	43 39	79 23	342	31 0	+44.26	22.37	246 11
	ALASKA.							
9	Sitka	57 03	135 20	20	16 11	+42.09	12.38	234 47
10	Illoolook, Unalaska Island	53 54	166 24	20	7 1	+37.56	10.08	235 51

1 Through the courtesy of Dr. E. Bessels, who had charge of the scientific observations in the Hall Polar expedition, I have received in advance of the publication, the monthly mean temperatures as observed at Polaris Bay, between Sept. 1871, and Aug. 1872, together with some other information bearing on the same.

These results are given in the table below, to which I have added a reduction to refer them to months of average length, also the results computed by the formula—

$$T = +4^\circ.19 + 33.09 \sin(\theta + 247^\circ\ 52') + 7.15 \sin(2\theta + 81^\circ.9) + 1.83 \sin(3\theta + 51^\circ) + 2.59 \sin(4\theta + 211^\circ).$$

For the fourth term the correction for curvature $\dfrac{\frac{4\pi}{12}}{\sin\frac{4\pi}{12}}$ amounts to nearly $\frac{1}{5}$ of B_4.

Polaris Bay, Hall Land.

	Observed Temp. Calendar Month.	Red'n.	Temp. for Average Month.	Comp'd.	Obs'd.—Com'd.
1872 January	—22°.42	—°.01	—22°.43	—22°.78	+°.35
February	—23.52	+.01	—23.51	—24.15	+ .64
March	—22.65	+.17	—22.48	—21.98	— .50
April	— 7.66	+.56	— 7.10	— 8.95	+1.85
May	+17.59	+.20	+17.79	+19.19	—1.40
June	+36.94	+.05	+36.99	+37.27	— .28
July	+39.28	—.01	+39.27	+39.24	+ .03
August	+35.88	+.05	+35.93	+37.21	—1.28
1871 September	+23.07	—.76	+22.31	+21.62	+ .69
October	— 1.59	—.03	— 1.62	— 1.11	— .51
November	— 8.76	—.22	— 8.98	—10.17	+1.19
December	—15.79	—.09	—15.88	—15.11	— .77

OF THE TEMPERATURE.

and T is expressed in degrees of Fahrenheit.

No.	B_2	C_2	B_3	C_3	B_4	C_4	Warmest Day. Average date.	Warmest Day. Temp.	Coldest Day. Average date.	Coldest Day. Temp.	Annual Range.	Yearly Means reached.	Notes.
							ARCTIC REGIONS.						
1	7.15	81°.9	1.83	51°	2.59	211°	July 10	+39°.4	Jan. 30	—24°.3	63°.7	May 2; Oct. 8	1
2	7.02	69.8	3.56	17	3.79	328	July 8	+39.3	Mar. 1	—28.6	67.9	Apr. 25; Oct. 12	2
3	6.62	119.0	0.82	318	4.80	250	July 15	+41.6	Feb. 16	—28.0	69.6	May 1; Oct. 31	2
4	0.84	256.9	1.18	275	1.16	79	July 15	+42.0	Jan. 22	—38.3	80.3	Apr. 23; Oct. 25	
						Mean:	July 12		Feb. 9			Apr. 28; Oct. 19	
							BRITISH NORTH AMERICA AND CANADA.						
5	0.91	213.0	1.24	32	..	..	July 22	+52.7	Jan. 23	—21.0	73.7	Apr. 22; Oct. 24	
6	3.06	147.1	1.10	259	..	..	July 13	+63.9	Jan. 28	— 7.1	71.0	Apr. 26; Oct. 28	*a*
7	2.81	245.2	1.91	200	..	..	Aug. 3	+48.1	Jan. 24	— 6.0	54.1	May 1; Oct. 26	*a*
8	0.70	48.4	0.53	151	..	..	July 28	+67.7	Jan. 28	+22.1	45.6	Apr. 26; Oct. 24	
							ALASKA.						
9	0.88	324.9	0.20	351	..	..	Aug. 13	+54.9	Jan. 30	+30.3	24.6	May 9; Nov. 4	*
10	2.73	8.4	0.44	103	..	..	Aug. 12	+50.6	Feb. 9	+30.0	20.6	May 21(?); Oct. 26	*b* *

2 At Van Rensselaer Harbor and Port Foulke the epochs and amount of maxima and minima are those resulting from 3 variable terms, as preferable to those resulting from 4 terms. The dates are quite uncertain on account of the shortness of the series.

a Monthly means corrected for daily variation by the general table p. xiv.

* Expressions referred to new style, by subtracting 10° 51′ from C_1, 21°.7 from C_2, and 33° from C_3.

b Monthly means corrected for daily variation by the Sitka table; for Astoria allowance was made for change of style.

ANNUAL FLUCTUATION

No.	Locality.	Lat.	Long. W. of Gr.	Height.	Extent of Series.		A	B_1	C_1
	UNITED STATES EAST OF THE 98th MERIDIAN.								
				feet.	yrs.	mos.			
11	Fort Brady, Michigan	46°30′	84°28′	600	32	1	40°.22	24.70	247°18
12	Fort Snelling (St. Paul), Minnesota	44 53	93 10	820	42	2	44.23	30.14	254 37
13	Dennysville, Maine	44 53	67 14	..	40	0	42.25	23.72	247 16
14	Burlington, Vermont	44 28	73 12	346	29	6	44.52	25.95	249 33
15	Brunswick, Maine	43 54	69 57	74	51	3	44.50	23.31	248 45
16	Milwaukee, Wisconsin	43 04	88 00	604	26	7	45.84	23.84	248 24
17	Penn Yan, New York	42 42	77 04	740	31	0	45.51	22.79	250 33
18	Detroit, Michigan	42 20	83 03	597	30	3	47.33	22.79	250 36
19	New Bedford, Massachusetts	41 39	70 56	90	58	1	48.30	21.16	245 20
20	Muscatine, Iowa	41 26	91 05	586	27	6	47.08	25.60	253 53
21	New Haven, Connecticut	41 18	72 57	45	86	0	49.10	22.90	249 25
22	Marietta, Ohio	39 28	81 26	670	49	10	52.33	21.40	254 25
23	Fort Leavenworth, Kansas	39 21	94 54	896	39	11	52.84	25.21	254 52
24	Fort McHenry, Baltimore, Maryland	39 16	76 35	36	36	0	54.59	22.39	249 57
25	Cincinnati, Ohio	39 06	84 30	540	36	8	54.80	22.79	254 12
26	St. Louis, Missouri	38 37	90 12	481	41	0	55.09	23.94	254 56
27	Chapel Hill, North Carolina	35 58	78 54	..	20	0	59.83	18.87	253 52
28	Fort Gibson, Indian Territory	35 48	95 20	560	29	10	60.56	21.48	254 55
29	Columbus, Mississippi	33 31	88 28	227	15	9	62.25	18.57	256 01
30	Fort Moultrie, Charleston, S. C.	32 45	79 51	25	32	11	66.43	16.15	250 54
31	Fort Barrancas, Pensacola, Florida	30 21	87 18	20	20	2	68.44	15.10	253 16
32	Austin, Texas	30 17	97 44	650	19	0	66.78	16.91	256 36
33	New Orleans, Louisiana	29 56	90 03 [a]	25	32	9	69.12	14.11	255 53
34	Fort Marion, St. Augustine, Florida	29 54	81 19	25	25	4	69.73	12.33	248 38
35	Fort Brown, Texas	25 50	97 37	50	13	5	73.74	12.04	255 22
36	Key West, Florida	24 33	81 48	10	26	6	77.08	7.31	244 34
	UNITED STATES WEST OF THE 98th MERIDIAN.								
37	Fort Stevenson, Dakota	47 36	101 10	..	2	11	41.84	33.82	253 33
38	Fort Shaw, Montana	47 30	111 42	6000	3	4	46.13	23.03	253 44
39	Astoria, Oregon	46 11	123 48	52	18	3	49.22	10.87	242 44
40	Fort Laramie, Wyoming	42 12	104 31	4472	17	9	49.22	23.63	252 37
41	Salt Lake City, Utah	40 46	111 54	4260	9	0	51.95	23.72	250 32
42	Presidio, San Francisco, California	37 47	122 28	150	19	0	54.80	4.22	234 55
43	Fort Garland, Colorado	37 32	105 40	8365	15	3	42.53	23.65	255 09
44	Fort Mojavé, Arizona	35 06	114 35	604	6	5	73.20	20.95	254 31
45	Fort Craig, New Mexico	33 36	107 00	4576	13	10	60.03	22.17	259 31
46	San Diego, California	32 42	117 14	150	20	10	62.14	8.88	239 50

a Monthly means corrected for daily variation by the general table p. xiv.

b Monthly means corrected for daily variation by the Sitka table; for Astoria allowance was made for change of style.

c Monthly means corrected for daily variation by the tables for Key West and Fort Morgan.

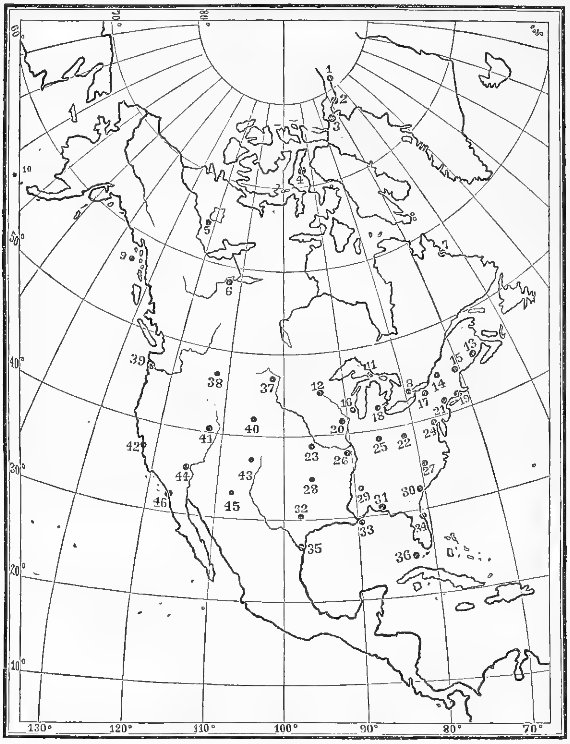
OF THE TEMPERATURE.—Continued.

No.	B_2	C_2	B_3	C_3	B_4	C_4	Warmest Day. Average date.	Warmest Day. Temp.	Coldest Day. Average date.	Coldest Day. Temp.	Annual Range.	Yearly Means reached.	Notes.
UNITED STATES EAST OF THE 98th MERIDIAN.													
11	0.64	171°.8	0.80	163°	..	..	July 26	+65°.2	Jan. 28	+14.4	50°.8	Apr. 22; Oct. 24	*a*
12	1.75	243.2	0.78	226	..	..	July 18	+73.4	Jan. 16	+11.6	61.8	Apr. 14; Oct. 20	*a*
13	0.62	238.6	0.86	225	..	..	July 23	+66.2	Jan. 21	+17.1	49.1	Apr. 24; Oct. 27	*a*
14	0.59	191.9	0.19	56	..	..	July 21	+69.8	Jan. 24	+18.3	51.5	Apr. 21; Oct. 23	*a*
15	0.92	258.0	0.88	225	..	..	July 24	+67.9	Jan. 18	+19.5	48.4	Apr. 20; Oct. 24	*d*
16	1.19	313.8	0.86	241	..	..	July 25	+70.3	Jan. 15	+21.0	49.3	Apr. 23; Oct. 24	
17	0.68	90.7	0.36	163	..	..	July 22	+69.1	Jan. 24	+22.9	46.2	Apr. 22; Oct. 20	*a*
18	0.34	36.5	0.49	168	..	..	July 24	+70.8	Jan. 23	+24.5	46.3	Apr. 22; Oct. 20	
19	0.40	13.3	0.42	222	..	..	July 27	+70.2	Jan. 23	+27.1	43.1	Apr. 28; Oct. 27	*a*
20	1.75	273.3	0.04	325	..	..	July 23	+71.3	Jan. 13	+19.9	51.4	Apr. 15; Oct. 15	
21	0.27	313.2	0.46	185	..	..	July 25	+72.4	Jan. 21	+25.7	46.7	Apr. 21; Oct. 22	
22	0.84	309.7	0.47	123	..	..	July 24	+73.6	Jan. 15	+30.7	42.9	Apr. 15; Oct. 16	
23	1.90	284.7	0.22	190	..	..	July 26	+77.0	Jan. 12	+26.1	50.9	Apr. 14; Oct. 20	*a*
24	0.62	317.0	0.15	170	..	..	July 26	+77.0	Jan. 19	+32.0	45.0	Apr. 21; Oct. 22	*a*
25	0.98	341.2	0.48	120	..	..	July 26	+77.9	Jan. 14	+32.3	45.6	Apr. 17; Oct. 16	
26	1.14	291.2	0.29	147	..	..	July 24	+78.5	Jan. 13	+30.3	48.2	Apr. 15; Oct. 19	
27	0.68	337.5	0.29	299	..	..	July 19	+78.9	Jan. 10	+40.9	38.0	Apr. 19; Oct. 18	
28	2.14	296.2	0.64	143	..	..	July 31	+81.7	Jan. 12	+37.7	44.0	Apr. 13; Oct. 18	
29	1.38	330.9	0.32	97	..	..	July 26	+81.0	Jan. 9	+43.7	37.3	Apr. 15; Oct. 15	
30	0.73	302.4	0.15	22	..	..	July 26	+82.2	Jan. 15	+50.1	32.1	Apr. 21; Oct. 21	*e*
31	1.08	287.0	0.39	45	..	..	July 28	+82.6	Jan. 12	+52.9	29.7	Apr. 16; Oct. 21	*c*
32	1.95	316.8	0.01	315	..	..	July 29	+81.7	Jan. 12	+37.7	44.0	Apr. 13; Oct. 17	
33	1.37	301.5	0.81	349	..	..	July 18	+82.8	Dec. 31	+54.1	28.7	Apr. 16; Oct. 20	
34	1.36	296.2	0.82	335	..	..	July 30	+81.0	Jan. 4	+56.7	24.3	Apr. 23; Oct. 27	*c*
35	1.24	270.0	0.30	247	..	..	July 22	+85.0	Jan. 12	+60.3	24.7	Apr. 11; Oct. 21	*c*
36	0.32	263.0	0.21	288	..	..	July 27	+84.2	Jan. 21	+69.5	14.7	Apr. 27; Oct. 29	
UNITED STATES WEST OF THE 98th MERIDIAN.													
37	2.30	198.0	2.21	211	..	..	July 16	+76.1	Jan. 21	+ 4.0	72.1	Apr. 14; Oct. 22	*a*
38	0.70	205.7	1.98	242	..	..	July 14	+70.6	Jan. 15	+20.8	49.8	Apr. 19; Oct. 21	*a*
39	1.25	280.9	0.38	168	..	..	Aug. 2	+59.2	Jan. 23	+37.4	21.8	Apr. 26; Oct. 31	*b*
40	3.24	9.7	0.58	252	..	..	July 25	+75.8	Jan. 4	+26.7	49.1	Apr. 26; Oct. 16	*a*
41	1.42	330.1	1.59	234	..	..	July 23	+77.4	Jan. 14	+25.8	51.6	Apr. 24; Oct. 22	
42	1.46	258.7	0.61	307	..	..	Sept. 23	+59.1	Jan. 9	+49.3	9.8	May 1; Nov. 13	
43	1.91	313.3	1.00	249	..	..	July 21	+66.6	Jan. 8	+17.1	49.5	Apr. 14; Oct. 19	*a*
44	1.91	330.0	0.71	239	..	..	July 22	+95.0	Jan. 8	+51.2	43.8	Apr. 18; Oct. 17	*c*
45	2.39	312.1	1.15	304	..	..	July 15	+81.6	Dec. 31	+35.5	46.1	Apr. 12; Oct. 16	*a*
46	1.66	315.8	0.21	207	..	..	Aug. 15	+72.0	Jan. 13	+52.9	19.1	May 6; Oct. 31	

d See Smithsonian Contributions to Knowledge, No. 204; Washington, June, 1867, p. 32. The expression is here corrected for curvature.

e Monthly means corrected for daily variation by one-half of the value given by the general table p. xiv.

The positions of the meteorological stations, embraced in the preceding table, are shown on the accompanying chart by dots, to which the tabular number has been attached.



If we examine the variability of the respective dates, given in the columns of "warmest day," "coldest day," and "days of mean temperature," we shall find the latter confined to the narrowest limit; near these epochs the expression for T reaches its greatest daily change and consequently fixes them with comparative accuracy, whereas near the epochs of maxima and minima the daily change is least, in consequence of which greater uncertainty must attach to these dates.

The results for the 4 Arctic stations have been united into a mean for each epoch; even these means have less weight than corresponding values at any other station, since they are based upon less than 5 years of observation. The epoch when the mean of the year is reached, with a falling temperature, is the most constant for all the stations; its dates are comprised between October 8, at Polaris Bay, and November 13, at San Francisco, both stations being of an exceptional character; all the rest cluster closely around the 22d of October, which follows 30 days after the autumnal equinox. The average deviation from this date is 4 days, earlier or later.

The epochs of the mean value of the year, reached with rising temperature, are comprised, with the exception of Illoolook which is doubtful, between April 11, at Fort Brown, Texas, and May 9, at Sitka; the average date for all other stations being April 21, which is 32 days after the vernal equinox. The average deviation from this date is 5 days, earlier or later.

The dates for the maximum temperature, with the exception of that for San Francisco which is anomalous and delayed to Sept. 23, are comprised between the limits of July 8, at Van Rensselaer Harbor, and August 15, at San Diego; all the other stations cluster about July 24, which is 33 days after the summer solstice. The average deviation from this date is $4\frac{1}{2}$ days, earlier or later.

The dates for the minimum temperature vary between the limits of December 31, at New Orleans and at Fort Craig, and February 16, at Port Foulke; we have to except, however, the date for Van Rensselaer Harbor, which has the highly uncertain date March 1; the remainder of the stations cluster about January 18, which is 28 days after the winter solstice. The average deviation from this date is 6 days, earlier or later.

We thus see that the daily balance between the decreasing radiation and the increasing insolation at the midwinter extreme is struck earlier by 5 days than the opposite balance between the decreasing insolation and the increasing radiation at the midsummer extreme, as compared with the corresponding astronomical epochs.

Altogether, then, the curve expressive of the annual distribution of heat, for our stations, follows in epoch, on the average 31 days, or very nearly $\frac{1}{12}$ of a year, the corresponding astronomical epochs depending on the revolution of the earth around the sun.

Examining the dates of the four epochs with respect to geographical distribution of stations within the area of the United States, we find for the 9 Atlantic coast stations, Nos. 13, 15, 19, 21, 24, 27, 30, 34, 36, the average dates: July 25, January 17, for maximum and minimum, and April 23, October 24, for an average of the year in spring and autumn. Compared with the normal epochs, viz.:—

July 24, January 18, April 21, and October 22, they appear about 1 day later than the normals. No dependence on the latitude is indicated.

The 10 centrally located stations in the valley of the Mississippi and east of the foot of the Rocky Mountains, also including two Texas stations, viz.: Nos. 37, 12, 20, 23, 26, 28, 29, 32, 33, and 35, give the respective dates:—

July 23, January 12, April 14, and October 19, which are on the average 4 days earlier than the normal values. The latitude of the stations is apparently of no consequence in this inquiry. Similarly we find for the three Pacific coast stations, Nos. 9, 39, and 46 the respective dates: August 10, January 22, May 4, and November 1, which are on the average 15 days *later* than the respective normal values, while at San Francisco the dates for the maximum and for the autumnal mean are still later. With respect to the annual thermal epochs we thus notice the apparent effect on the coast stations by the Atlantic is to retard them by about

1 day and by the Pacific for about 15 days, the later effect being necessarily the greater, owing to the prevalence of westerly winds over the whole area under consideration. In the interior, on the contrary, the epochs appear about 4 days earlier than the average values. Our data are yet too scanty to allow of any precise estimate respecting the effect of elevation on these epochs, but they appear to occur earlier for greater elevation.

The result arrived at respecting the shifting of the epochs in different longitudes may also be stated as follows: The seasons occur 5 days earlier in the valley of the Mississippi and the western plains than on the Atlantic seacoast, and 19 days earlier than on the Pacific coast.

We may arrive at a tolerably fair estimate of the annual mean temperature at any place by observing for a few days the temperature about the two epochs when the mean is reached, and still better by observing in addition about the epochs of maximum and minimum. The least labor will be spent by observing only at 8 P. M. ($8^h\ 05^m$ may still improve the result), an hour which has the advantage of convenience for the observer and which produces equally good results in *all months* of the year, the values will probably keep within a half degree, during any month, and within one-tenth of a degree, for the year, of the true value.

If we now turn our attention to the annual range, we find it to vary between the limits of 80°, nearly, at Port Kennedy (in approximate latitude 72°) and of 10°, nearly, at San Francisco. The next smallest annual range is attained at Key West, of about 15°, next follows San Diego with 19°, and Illoolook (approximate latitude 54°) with 20½°. The smaller ranges are due almost entirely to the proximity and equalizing effect of the sea.

The magnitude of the annual range depends principally on the latitude and the distance from the ocean, apparently less on the altitude of the station; it is greater in the higher latitudes and appears to reach its maximum value in the region about the Great Bear and the Great Slave Lakes; from the vicinity of Lake Athabasca high values extend towards Lake Winnipeg and even within the northern boundary of the United States. Our four Arctic stations in the average latitude of 77½° show an average amplitude of 70½°, at Peel River in latitude 67° 32′ the amplitude probably exceeds[1] 83°, Fort Simpson in latitude 62° 10′ has an annual amplitude probably greater than 75°, our stations Nos. 5 and 6 in the average latitude of 62° have an amplitude of nearly 72½°, Norway House in latitude 53° 50′ shows nearly 71°, while at Fort Stevenson, Dakota, in latitude 47° 36′ the observed amplitude is as high as 72°, and at Fort Pierre, Dakota, in latitude 44° 23′ a range above 70° is indicated; these last two stations exhibit a range of a truly arctic character.

The rigor of a climate may be supposed measurable by two factors, viz.: the mean annual temperature and its range, which latter is approximated by the value $2\ B_1$ (provided $B_2\ B_3$ . . . are small in comparison). The values of A in our table fluctuate between the extreme limits of —2°.2 at Van Rensselaer Harbor, and of

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[1] A still greater range of about 90° probably occurs at Fort Yukon, Alaska, in latitude 66° 34′, but our observations are too limited to give an exact value.

+ 77°.1 at Key West, Florida; their geographical distribution and relations within the limits of the United States are sufficiently shown on the chart of the mean annual isothermals.

Apparent interruptions in the regularity of the annual fluctuation.

While, for all general purposes of comparison, monthly means will be found quite sufficient for the elucidation of the character of the annual fluctuation, they will not be adequate in the case of a special and detailed examination, having for its object to ascertain the reality of certain anomalies in the otherwise regular progression.

It has been noticed, elsewhere, that at certain stations and at certain periods of the year, the regularity of the annual march of the temperature appears interrupted for a few days by interfering with the ordinary rising or falling of the temperature, as we should expect it, at these periods of the year. The phenomenon has been attributed to local as well as to cosmical influences; it would seem to be referable to the setting in of a particular wind at these times, causing the mean temperature to be more or less influenced.

Of such periods of apparent irregularities, pointed out by different meteorologists,[1] the following may be mentioned: About the beginning of December and the middle of May; about the 12th of February and between the first and second week in March; it cannot be said, however, that any such periods have been fully tested or confirmed for stations in the United States, but the subject demands further research. From observations at Geneva, N. Y., Dr. Wilson[2] suspects an arrest of the increasing warmth during about 16 days, commencing with May 25, and a retrocession of the increasing cold in autumn from October 28th to about November 10th.

To meet the requirements of such investigations the observed temperatures have, by some, been united into 5 day means or penthemers, while others have gone through the extremely laborious process of determining the mean temperature of every day, resulting from a long series of years. Owing to the great labor of preparation but few of such tables exist, and they extend yet over too limited a period to be conclusive in their results. In places where the annual range is small, a 15 year series is quite valuable, but in our temperate and higher latitudes a combination of observations embracing at least double this time is requisite to eliminate the greater irregularities in the daily means.

There is another use of tables of daily average temperatures; by their means we can ascertain for any given day (and in combination with the known daily fluctuation, for any given hour) how much the observed temperature will be in excess or defect of the normal (or tabular) temperature belonging to that day, a

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[1] See report of British Association for Advancement of Science; Birmingham meeting, 1865; also Silliman's Journal, May, 1867, p. 290.

[2] Local Climatology, in the 20th annual report of the Regents of the University of the State of New York. Albany, 1868.

question to which an answer is often demanded in the study of the progress of certain unusually hot or cold terms or waves spreading themselves over large surfaces.

In the following series of tables of the average temperature of each day of the year, the observing hours as well as the corrections applied (if possible or necessary) to reduce to daily mean are added to each station.

Albion Mines, Nova Scotia. Lat. 45° 34′. Long. 62° 42′ W. of G.

Alt. 120 feet. 10 years of observation, between 1843 and 1852, inclusive. H. Poole.

MS. in Smithsonian Coll.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	21°.8	13°.0	22°.0	33°.9	41°.8	50°.9	59°.3	70°.0	59°.9	50°.6	42°.8	26°.8
2	17.4	15.7	20.5	31.0	46.2	52.3	60.5	69.6	60.9	48.0	44.5	28.1
3	22.6	20.4	20.1	32.9	43.6	55.5	61.9	67.9	63.2	49.5	44.5	27.1
4	20.5	20.7	18.0	34.4	43.7	57.5	63.0	67.3	63.5	48.7	43.9	31.0
5	19.8	22.9	20.2	34.5	43.8	57.4	64.2	67.9	62.0	49.5	41.5	35.0
6	20.6	22.8	19.3	33.0	46.5	55.3	65.1	66.7	61.1	49.3	41.8	27.8
7	19.8	21.7	21.2	36.3	48.3	54.5	63.7	65.7	63.4	47.8	38.2	26.0
8	23.7	19.6	24.8	38.7	50.0	55.4	64.6	66.5	62.3	48.4	38.5	27.6
9	18.9	18.5	29.9	38.9	49.0	56.7	65.4	67.8	58.4	44.6	36.1	27.2
10	23.4	21.5	24.8	34.7	47.2	57.1	66.1	68.9	55.9	47.2	36.8	27.9
11	19.7	21.1	24.6	36.0	47.5	57.2	68.8	68.3	58.0	47.1	36.7	26.3
12	19.5	20.2	23.5	33.9	47.0	53.8	67.9	67.6	58.2	48.0	33.8	24.8
13	20.4	15.1	25.9	35.0	42.7	53.2	67.4	64.7	56.9	51.7	33.3	23.4
14	23.9	15.0	28.8	37.6	49.0	56.2	66.7	68.4	55.4	49.6	30.2	19.8
15	19.9	19.9	25.1	37.8	50.9	57.2	66.9	67.1	54.8	46.3	31.8	25.1
16	20.0	19.2	24.1	37.3	52.6	55.8	66.3	62.4	54.2	44.0	33.1	25.8
17	18.7	19.0	28.5	36.6	52.2	55.6	68.1	65.1	53.5	44.5	34.7	25.4
18	17.5	18.5	26.5	35.4	50.3	58.8	69.5	63.9	54.5	47.2	36.8	24.0
19	11.3	16.5	28.9	37.7	47.3	63.6	66.6	64.1	55.6	50.8	36.2	20.2
20	10.3	17.3	28.5	38.0	50.1	64.5	69.3	62.8	53.8	47.7	35.9	23.6
21	16.7	20.6	32.2	42.3	49.5	62.0	71.0	62.2	58.8	43.4	35.9	22.4
22	14.6	20.8	29.9	41.1	48.9	62.8	73.5	63.3	53.8	44.7	35.4	14.7
23	12.9	22.4	27.2	40.5	53.6	63.3	71.8	64.5	52.3	47.1	34.8	18.9
24	18.2	20.3	31.2	40.9	50.1	61.2	67.1	62.7	52.3	43.5	36.4	21.1
25	23.0	19.3	30.2	38.6	50.1	63.3	65.0	64.3	50.3	43.7	34.7	20.6
26	23.7	21.2	31.9	40.3	50.4	60.2	64.8	63.1	50.1	44.2	37.3	21.6
27	18.9	21.9	34.7	40.1	51.1	61.4	64.6	63.5	51.9	43.7	31.3	17.3
28	13.4	16.7	33.9	40.2	49.7	61.6	64.6	63.7	50.1	41.7	30.6	19.8
29	18.7	20.5	35.0	41.0	51.2	62.0	64.3	64.1	51.0	40.4	26.3	26.5
30	21.3		34.7	40.5	50.5	63.5	64.7	65.0	51.9	45.3	26.8	24.2
31	12.8		34.2		49.8		67.3	64.1		42.6		24.0

Observations at ⊙ rise, 9 A. M., 3 and 9 P. M. To the mean at these hours the correction for daily fluctuation is very small, throughout the year, and judging from the Montreal table probably does not exceed 0°.1; no correction was therefore applied.

Toronto, Canada West. Lat. 43° 39′. Long. 79° 23′ W. of G.

Alt. 342 feet. Observed temperature at Toronto, in groups of 10 and 30 years.
Communicated to the Smithsonian Institution by G. T. Kingston, Director of the Toronto observatory.

Day of Month.	January.				February.				March.			
	1840–9[1]	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69
1	25°.9	25°.2	23°.7	25°.0	20°.1	26°.7	22°.8	23°.0	28°.1	25°.2	29°.3	27°.2
2	21.4	24.2	20.3	21.8	27.8	18.9	21.7	22.6	24.9	24.2	28.5	24.9
3	21.5	25.6	21.3	22.9	25.2	20.7	17.3	21.4	26.9	25.6	27.1	25.7
4	21.1	27.0	18.3	21.9	23.7	21.9	21.3	22.2	28.2	25.1	20.2	24.6
5	23.6	23.7	23.7	23.6	25.1	18.1	23.9	22.3	29.7	27.3	22.6	26.4
6	26.7	23.8	21.5	24.2	24.5	16.9	24.9	22.3	28.6	22.5	25.7	25.7
7	29.3	20.2	18.2	22.1	22.9	22.3	17.8	21.0	31.0	26.6	28.6	28.7
8	23.4	18.1	20.4	20.6	23.0	20.9	20.9	21.6	32.3	25.3	29.2	28.8
9	23.7	23.8	23.7	23.7	19.9	22.3	22.9	21.7	29.9	27.6	29.4	29.1
10	20.5	21.5	23.4	21.8	23.8	18.6	18.4	20.6	28.8	24.2	26.6	26.5
11	20.3	26.1	18.0	21.7	18.7	19.1	23.9	20.7	27.3	29.8	26.3	27.9
12	25.6	25.4	19.5	23.6	19.2	17.5	28.5	21.5	29.8	28.4	26.3	28.1
13	26.3	25.6	21.7	24.7	19.0	23.5	25.7	22.9	30.7	32.1	26.1	29.5
14	28.6	25.8	22.0	25.3	21.6	24.2	21.3	22.4	28.7	32.4	28.3	29.7
15	29.6	22.8	21.7	24.8	20.3	26.1	22.0	22.7	23.4	33.4	28.4	28.6
16	23.2	26.4	19.6	22.8	19.8	25.2	21.0	22.1	27.4	34.1	29.3	31.3
17	21.2	19.9	15.3	18.8	21.4	23.1	20.4	21.7	29.2	35.4	30.6	31.8
18	20.8	23.8	19.8	21.4	25.3	21.3	22.5	22.9	29.5	33.1	22.9	28.4
19	19.5	20.6	22.4	20.8	28.2	20.2	25.4	24.6	33.5	28.9	23.7	28.5
20	25.9	25.2	25.1	25.5	28.6	24.8	25.2	26.1	34.5	26.2	28.6	29.9
21	27.1	23.0	23.3	24.4	29.8	26.4	22.1	26.1	30.7	31.9	27.3	29.8
22	20.2	17.8	20.2	19.4	28.9	25.6	27.3	27.3	31.1	32.4	28.2	30.6
23	27.2	16.9	28.2	24.4	21.5	22.5	28.8	24.2	33.1	33.4	32.7	33.0
24	24.6	21.1	28.1	24.1	23.7	25.8	21.3	24.3	33.8	31.8	30.2	32.0
25	23.5	23.6	22.0	23.0	24.2	26.5	22.9	24.6	35.5	30.8	31.1	32.4
26	22.4	23.0	21.6	23.3	27.0	25.4	26.0	26.1	36.6	32.4	29.0	32.7
27	23.8	22.0	20.0	22.1	26.9	24.4	26.6	26.0	34.3	30.3	33.4	32.7
28	28.3	23.7	22.5	24.7	29.4	25.2	27.3	27.3	37.5	29.4	32.7	33.2
29	28.2	23.1	24.7	25.4	36.3	25.9	23.9	28.4	36.0	34.2	30.5	33.6
30	23.3	19.5	23.2	22.1					33.6	36.1	38.3	36.0
31	19.3	25.5	21.3	22.2					34.6	35.9	38.4	36.2

Day of Month.	April.				May.				June.			
	1840–9	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69
1	32.7	35.1	34.2	34.0	48.0	45.3	40.7	44.5	54.6	56.8	57.2	56.2
2	38.7	29.3	34.4	33.7	47.5	45.1	41.4	44.5	56.9	59.3	56.8	57.7
3	39.7	36.2	35.9	37.4	46.5	46.5	42.4	45.1	58.0	59.0	58.2	58.4
4	40.7	36.6	36.9	38.0	47.3	49.2	47.3	47.9	59.5	53.6	57.2	56.8
5	35.6	37.0	40.0	37.6	46.1	49.1	49.1	48.0	56.5	57.3	57.4	57.1
6	39.2	25.2	38.4	37.7	49.2	48.7	48.2	48.7	53.4	58.9	57.9	56.8
7	38.8	34.5	34.8	36.1	48.1	50.2	48.4	49.0	57.0	59.3	59.5	58.6
8	38.5	37.2	34.2	36.7	49.4	49.0	50.6	49.7	58.2	57.2	59.3	58.3
9	39.6	39.1	36.2	38.2	47.6	48.1	52.7	49.6	62.0	56.3	57.9	58.8
10	43.0	36.7	38.3	39.5	50.1	48.7	49.8	49.5	58.5	57.0	59.5	58.3
11	42.5	36.0	41.0	39.9	50.5	46.1	49.7	48.9	58.8	55.9	59.4	58.0
12	42.0	39.5	42.6	41.3	52.6	50.9	53.0	52.1	58.0	58.0	63.2	59.8
13	40.1	36.8	38.1	38.4	51.8	53.1	49.2	51.5	58.8	61.9	61.7	60.8
14	37.6	40.5	38.7	39.0	52.2	51.3	51.6	51.7	56.7	63.4	61.2	60.6
15	41.5	38.4	44.0	41.2	52.1	53.7	51.4	52.4	60.8	64.9	63.7	63.0
16	40.0	40.0	45.0	41.7	52.4	53.8	53.7	53.3	59.7	61.8	61.7	61.0
17	41.0	40.1	43.7	41.7	53.2	52.0	52.6	52.6	60.3	61.4	63.9	61.8
18	40.1	41.8	41.6	41.1	55.3	49.4	50.8	51.9	63.3	63.2	62.4	62.9
19	39.6	43.5	43.8	42.3	54.3	50.4	52.6	52.4	63.5	64.9	62.2	63.5
20	42.7	43.1	44.6	43.5	53.1	48.9	52.6	51.5	63.4	64.7	62.9	63.6
21	46.2	45.1	46.3	45.8	50.8	52.5	52.6	52.0	63.9	65.3	63.0	64.2
22	48.3	45.7	43.5	45.9	52.9	52.6	53.2	52.9	64.3	64.1	64.2	64.2
23	48.5	40.3	40.0	42.9	54.7	54.0	52.2	53.6	65.4	63.1	63.8	64.1
24	47.8	44.2	42.1	44.6	54.8	54.5	54.2	54.5	66.1	62.4	64.3	64.3
25	46.4	45.6	41.0	44.2	57.9	56.7	58.0	57.6	65.2	64.3	67.2	65.6
26	45.7	44.9	44.0	44.9	56.4	56.0	56.6	56.3	67.1	69.1	67.0	67.7
27	42.0	41.8	43.5	42.4	58.6	56.4	55.9	57.0	66.1	65.7	64.8	65.5
28	46.2	44.3	46.3	45.6	59.4	56.7	52.9	56.2	65.1	69.8	62.9	66.1
29	44.6	45.0	45.0	44.8	56.5	54.2	55.5	55.4	67.2	70.0	64.9	67.3
30	49.1	47.1	47.4	47.8	53.5	52.1	56.7	54.2	66.6	66.9	66.6	66.7
31					51.0	53.2	57.8	54.0				

[1] Observations made 6 times each day, excluding Sundays, at the hours 6, 8 A. M. and 2, 4, 10, and 12 P. M.; their mean is sufficiently near the true daily mean.

Toronto.—Continued.

Day of Month.	July.				August.				September.			
	1840–9	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69
1	64°.0	62°.2	66°.0	63°.9	63°.0	69°.3	69°.9	67°.5	65°.1	63°.7	60°.9	63°.3
2	62.8	63.3	66.1	64.1	63.4	67.9	68.2	66.5	66.5	64.3	60.5	63.9
3	60.7	67.3	70.1	66.0	66.2	68.4	68.0	67.9	63.5	62.8	60.8	62.4
4	62.1	67.0	69.7	66.4	67.0	68.4	69.9	67.6	66.1	64.2	63.2	64.4
5	63.4	65.3	66.5	65.1	67.8	68.3	70.2	68.7	63.0	65.2	64.3	64.2
6	65.5	65.6	68.5	66.6	66.8	68.6	67.6	67.7	61.3	65.2	64.5	63.7
7	66.1	66.4	69.7	67.2	66.7	67.8	67.6	67.3	63.3	61.0	61.5	61.9
8	66.1	68.7	70.6	68.4	66.6	67.6	71.5	68.7	60.0	63.7	60.2	61.4
9	68.1	66.7	68.2	67.7	68.3	68.4	69.6	68.7	58.7	63.9	60.5	61.1
10	69.1	68.7	66.6	68.1	65.0	69.9	69.3	67.7	60.2	65.7	58.1	61.4
11	68.4	69.0	67.2	68.2	65.8	68.3	66.3	66.8	57.9	64.7	61.9	61.4
12	70.7	66.9	65.2	67.6	66.8	69.8	64.6	67.1	56.8	62.6	60.6	60 0
13	69.7	67.4	66.4	67.9	65.6	69.4	64.8	66.6	56.6	55.2	59.4	56.9
14	67.6	69.9	67.8	68.5	66.9	65.8	64.9	65.9	58.8	55.8	59.9	58.3
15	66.8	70.2	67.4	68.2	66.2	64.9	65.4	65.5	57.5	55.3	60.9	57.7
16	67.5	71.2	68.9	69.3	69.7	65.4	63.6	66.2	57.7	55.0	59.8	57.4
17	67.4	74.6	65.6	69.0	67.0	64.7	64.3	65.4	59.9	58.7	59.8	59.5
18	68.9	70.3	68.0	69.0	65.8	62.5	64.8	64.3	56.7	57.2	57.9	57.2
19	69.6	68.3	67.4	68.4	65.2	62.6	67.1	64.1	56.9	56.9	56.3	56.7
20	66.4	68.7	67.6	67.5	65.2	65.8	66.1	65.0	57.5	55.5	57.9	56.9
21	68.0	67.8	65.5	67.2	66.3	66.3	66.2	66.2	53.0	55.2	53.1	53.7
22	68.2	69.8	66.8	68.3	66.5	67.3	64.0	65.9	51.0	51.8	55.2	52.6
23	67.0	67.5	67.0	67.2	64.9	65.5	62.7	64.4	55.5	55.0	57.9	56.0
24	66.9	69.0	69.0	68.3	63.4	67.8	64.0	64.8	52.5	54.6	55.7	54.3
25	65.3	70.6	67.5	67.8	65.9	63.2	64.0	64.4	53.2	55.3	54.6	54.4
26	66.1	67.8	69.0	67.6	65.9	64.6	66.0	65.5	47.8	57.2	50.6	51.8
27	64.5	67.2	69.1	66.9	63.9	60.2	64.2	62.7	49.6	52.3	51.8	51.3
28	66.1	68.1	67.8	67.3	65.2	61.8	65.3	64.2	49.9	51.6	52.2	51.2
29	66.3	68.8	66.4	67.3	66.9	61.4	61.2	63.1	53.8	50.2	53.2	52.4
30	63.8	67.5	68.4	66.6	66.2	63.6	59.3	63.1	52.6	49.8	51.0	51.1
31	64.3	65.9	67.4	65.9	65.6	63.1	60.3	63.0				

Day of Month.	October.				November.				December.			
	1840–9	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69	1840–9	1850–9	1860–9	1840–69
1	48.6	51.1	51.3	50.4	43.2	45.2	45.8	44.7	27.5	32.3	29.3	29.7
2	50.2	51.0	54.4	51.9	42.5	42.3	42.0	42.3	29.8	28.6	28.5	29.4
3	50.0	50.4	50.8	50.4	41.9	39.3	40.0	40.4	29.5	28.8	29.2	29.2
4	48.9	53.1	50.9	51.1	40.0	40.4	40.5	40.3	31.1	28.7	31.9	30.6
5	50.6	52.0	49.2	50.6	42.6	40.9	39.2	40.8	26.5	28.6	28.7	28.0
6	50.2	50.4	48.2	49.7	38.7	42.2	35.1	38.5	28.2	33.0	28.9	30.1
7	51.0	48.8	53.2	50.9	41.0	40.2	35.9	38.9	30.7	28.5	31.0	30.1
8	51.7	48.7	50.4	50.2	38.0	39.3	38.8	38.8	33.9	26.7	26.6	29.2
9	50.1	53.3	52.7	51.2	39.1	38.5	40.5	39.4	33.0	28.1	25.8	29.1
10	47.8	49.7	51.2	49.7	39.3	35.9	35.9	37.1	30.4	27.0	26.7	27.9
11	47.3	50.7	48.6	48.9	38.2	35.6	36.8	36.9	27.5	27.0	26.6	27.0
12	47.1	47.2	44.2	46.1	41.4	40.3	36.6	39.4	24.6	24.8	23.4	24.2
13	43.6	48.6	43.2	45.2	38.2	35.7	38.3	37.5	30.2	26.1	21.4	25.9
14	44.0	44.9	46.2	45.0	36.6	35.4	38.6	35.5	31.9	31.1	20.1	27.6
15	43.0	42.6	45.6	43.8	35.7	36.2	34.0	35.3	29.1	28.7	23.3	27.2
16	45.4	42.5	47.8	45.3	37.7	35.1	36.9	36.6	26.3	26.8	27.5	26.8
17	41.2	45.8	48.2	45.2	38.7	35.2	41.5	38.4	23.7	21.8	28.0	24.5
18	42.2	47.4	49.2	46.3	35.5	36.5	34.7	35.6	23.4	16.8	26.0	22.5
19	41.6	44.5	47.6	44.6	34.2	35.3	37.4	35.7	26.3	19.0	25.9	23.8
20	41.1	45.0	45.3	43.7	36.2	32.3	36.7	35.1	22.9	24.7	20.3	22.7
21	39.5	44.6	44.1	42.7	34.4	34.7	34.4	34.6	23.8	25.7	23.2	24.2
22	40.0	45.4	44.9	43.6	37.6	35.3	32.8	35.2	19.6	22.1	21.9	21.2
23	40.7	43.2	40.3	41.3	37.3	34.7	33.6	35.2	23.2	19.7	19.8	20.9
24	42.7	40.6	40.4	41.2	36.0	29.1	30.8	32.0	24.1	18.4	23.1	21.8
25	40.8	40.3	40.6	40.6	29.7	31.4	26.6	32.4	[1]	[1]	[1]	[1]
26	38.6	39.8	40.3	39.6	27.5	33.6	34.6	32.3	25.2	20.6	29.9	25.7
27	38.1	41.4	38.7	39.4	25.1	34.8	35.4	31.7	26.0	24.0	31.4	27.0
28	38.9	43.4	40.0	40.8	27.6	34.3	35.9	32.8	27.8	20.5	27.1	25.3
29	42.4	42.1	43.4	42.6	26.2	33.5	37.8	32.6	30.2	18.5	28.4	25.6
30	41.3	45.8	43.8	43.6	28.4	33.7	31.7	31.2	28.4	23.7	24.7	25.6
31	38.2	42.2	44.6	41.8					26.7	22.0	24.5	28.2

[1] No observations made on this day.

Portland, Maine. Lat. 43° 39′. Long. 70° 15′ W. of G.
Alt. 87 feet. 37 years of observation; from 1816 to 1852, inclusive. Moody.
MS. in Smithsonian Coll.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	21.0	16.4	24.7	36.0	46.7	55.0	64.8	64.7	61.1	51.2	41.9	28.2
2	20.1	16.1	23.8	36.1	46.9	56.4	65.7	66.2	61.6	51.9	42.1	29.3
3	18.4	19.2	23.3	36.1	46.8	57.0	63.8	66.3	61.8	52.0	40.1	28.9
4	18.5	18.3	24.5	36.5	46.4	57.6	64.5	66.6	62.7	50.3	40.5	29.3
5	18.0	14.7	26.8	36.4	45.7	58.5	65.0	66.2	62.6	50.3	40.6	29.0
6	18.8	17.7	28.1	37.6	46.4	58.7	66.3	65.0	62.8	51.8	39.3	26.0
7	20.3	19.2	28.1	38.8	48.2	58.4	66.9	65.9	60.5	49.6	39.4	27.1
8	20.0	19.2	28.1	38.7	48.6	59.8	66.0	66.4	60.0	49.3	39.8	28.5
9	21.1	17.2	29.2	38.9	48.8	59.8	66.8	65.6	60.1	50.7	38.6	28.8
10	22.0	20.0	28.7	38.9	47.7	60.3	67.0	66.4	60.2	49.5	37.9	27.1
11	18.0	21.2	28.6	37.8	48.8	59.9	67.1	65.7	59.3	48.2	37.3	24.1
12	20.4	18.5	29.4	37.9	50.1	59.4	67.5	66.2	58.0	47.8	37.4	24.1
13	18.3	17.9	31.1	38.7	49.3	59.1	67.8	66.5	57.5	47.6	35.2	23.1
14	17.9	17.8	29.1	38.4	49.4	60.0	66.6	65.8	57.1	46.1	36.1	25.3
15	19.3	18.3	28.6	39.0	50.2	59.6	67.5	65.1	57.4	45.2	35.7	24.8
16	21.1	19.8	28.3	38.2	51.2	60.5	66.7	64.0	55.7	46.4	35.7	22.4
17	20.6	19.0	29.2	40.2	52.7	60.6	67.6	64.1	55.8	46.4	36.2	22.5
18	19.8	20.9	28.9	39.6	52.6	60.3	66.8	64.2	58.0	47.3	36.3	22.1
19	17.5	21.5	29.7	40.6	51.6	62.7	67.4	63.9	58.2	48.5	34.5	21.6
20	18.8	24.9	30.9	41.3	51.5	61.7	67.5	64.2	59.1	45.3	33.7	22.2
21	19.9	26.6	30.8	41.3	54.2	62.0	68.0	63.6	56.1	43.5	33.6	21.6
22	17.8	27.3	29.7	43.9	51.9	61.8	68.3	63.8	53.7	43.3	33.4	16.1
23	17.1	25.3	32.0	43.0	53.5	61.3	67.4	64.3	53.9	43.7	33.4	16.2
24	16.9	22.0	34.0	42.7	52.9	62.5	66.1	63.9	53.5	44.9	31.2	21.5
25	18.8	22.4	33.7	41.3	53.4	61.7	65.8	64.2	53.5	41.9	30.2	23.9
26	21.1	24.3	33.1	44.4	53.2	62.7	64.7	63.4	53.2	41.5	30.2	20.1
27	20.8	24.8	33.2	44.5	53.0	62.8	65.4	62.8	52.8	41.2	29.2	19.6
28	20.1	24.4	33.9	43.6	55.1	63.3	65.6	62.0	53.1	41.3	27.3	22.1
29	19.3	26.0	33.6	45.5	53.7	63.2	66.2	62.0	51.9	41.8	28.9	21.6
30	18.6		33.2	45.6	52.8	61.3	66.0	63.1	52.3	42.0	29.9	20.8
31	16.7		34.9		54.5		65.7	62.9		39.8		21.8

Observations at ⨀ rise, noon, and 8 P. M. Means uncorrected.

Using the tables for Montreal and Amherst, the correction to mean deduced from observations at ⨀ rise, noon, and 8 P. M., to refer to mean of day is very small, for 6 months it is nearly 0, and probably does not rise to 0.2 or 0.3 in any one month.

Salem, Mass. Lat. 42° 31′. Long. 70° 53′ W. of G.
Alt. 30 feet.[1] 43 years of observation; from 1786 to 1828, inclusive. Dr Holyoke.
MS. in Smithsonian Coll.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	28.0	23.5	31.9	41.3	54.8	62.7	73.5	73.1	67.2	55.4	41.5	35.0
2	28.2	24.9	30.6	41.7	53.5	63.2	73.1	72.6	68.8	56.7	41.6	34.2
3	24.9	26.5	31.3	41.2	52.2	65.1	72.8	71.5	68.4	56.6	42.8	32.3
4	26.9	27.1	30.7	42.8	54.5	64.1	72.0	72.1	68.0	56.5	42.9	33.7
5	24.6	22.8	30.2	44.2	53.7	64.9	72.7	73.7	66.2	56.1	43.9	31.6
6	25.2	24.2	32.5	43.2	52.6	65.7	72.9	71.4	65.4	57.2	43.4	33.0
7	25.6	28.2	31.1	43.8	52.7	65.3	72.9	72.2	63.6	52.1	42.4	33.3
8	26.3	28.3	31.3	43.9	52.7	65.8	72.9	73.6	64.9	52.2	41.5	33.0
9	25.6	27.2	30.9	43.2	53.7	65.0	72.8	73.4	64.7	52.5	41.5	32.1
10	26.3	25.1	32.0	41.8	54.7	66.7	73.6	73.4	65.0	54.4	43.2	30.4
11	25.1	26.4	34.5	43.0	54.4	66.6	73.0	72.9	65.3	52.6	41.3	30.0
12	26.5	28.6	35.7	43.1	54.4	66.6	73.9	72.6	65.1	53.6	39.3	29.0
13	24.6	27.2	35.2	44.5	55.4	68.1	73.3	72.3	64.5	53.2	38.6	30.8
14	23.9	27.8	34.1	45.7	56.3	66.8	72.0	71.0	64.9	52.2	38.8	31.6
15	26.5	26.4	34.8	45.6	55.9	67.4	73.6	70.7	65.0	53.4	39.1	30.1
16	26.0	25.0	35.8	45.8	55.9	66.8	72.9	71.1	63.6	51.1	39.3	28.7
17	26.7	26.5	36.3	47.1	55.3	68.9	73.1	71.1	62.7	50.4	38.4	28.6
18	24.8	29.7	36.2	47.8	56.7	67.7	73.5	71.0	62.6	47.4	38.1	28.7
19	23.0	27.1	36.9	48.1	56.7	69.6	72.1	70.6	62.5	47.4	36.4	30.3
20	25.2	30.2	36.4	48.9	57.9	68.7	73.0	71.1	60.3	46.0	35.7	29.0

[1] Given as 75 feet in the general table.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Salem.—Continued.												
	°	°	°	°	°	°	°	°	°	°	°	°
21	25.3	31.0	37.3	47.7	58.8	68.4	71.9	69.6	60.8	48.6	37.5	27.9
22	23.8	30.4	36.5	46.3	60.4	68.6	72.6	69.5	58.1	47.7	36.3	26.3
23	23.4	27.7	38.3	48.1	61.1	70.6	74.0	68.8	58.7	44.9	35.7	26.6
24	24.6	29.8	38.4	47.8	62.4	71.7	74.2	68.4	58.5	45.2	35.8	28.5
25	23.1	28.8	38.9	48.4	61.1	71.5	73.5	69.3	58.7	43.7	34.3	26.3
26	24.4	29.1	38.1	50.4	61.4	69.2	72.2	68.9	57.5	46.8	33.2	26.8
27	25.4	30.0	38.0	50.2	60.2	70.3	72.4	68.6	57.2	44.1	35.7	28.4
28	27.5	30.9	39.1	49.6	61.6	71.8	72.5	68.3	56.8	45.6	35.0	29.5
29	26.0	30.5	38.4	50.5	62.9	72.6	73.1	69.3	56.4	44.9	35.7	31.0
30	24.7		38.5	52.3	63.1	72.4	72.9	68.7	56.5	43.5	36.0	28.5
31	24.1		39.9		61.5		74.0	67.4		41.7		29.9

Observations at 8 A. M. Tabular numbers corrected for daily fluctuation.

To correct the table of temperatures observed at 8 A. M., for daily fluctuation, two sets of corrections were applied; first, the observed means were referred to the means from observations at 8 A. M., Noon, sunset, and 10 P. M., taken at Salem from a 10 year series between 1819 and 1828, inclusive; secondly, the means so corrected were referred to the daily mean by means of the Amherst table. The two sets of corrections and their sum are as follows:—

	I.	II.	I & II.		I.	II.	I & II.
	°	°	°		°	°	°
January	+4.52	—0.89	+3.63	July	+2.26	—0.96	+1.30
February	+4.48	—0.47	+4.01	August	+2.51	—0.82	+1.69
March	+3.52	—0.91	+2.61	September	+3.49	—1.25	+2.24
April	+2.49	—1.03	+1.46	October	+4.54	—1.62	+2.92
May	+1.94	—0.98	+0.96	November	+3.57	—1.03	+2.54
June	+1.70	—0.99	+0.71	December	+4.16	—0.46	+3.70

The above corrections refer to the middle of each month, and by interpolation they were found for each day.

Williamstown, Mass. Lat. 42° 43′. Long. 73° 13′ W. of G.

Alt. 721 feet. 23 years of observation; from 1816 to 1838, inclusive. Prof. C. Dewey and Prof. E. Kellogg. MS. in Smithsonian Coll.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	25.8	16.1	26.2	38.6	54.9	63.9	70.4	69.9	62.5	53.5	40.7	31.6
2	22.8	18.9	24.8	38.6	53.9	64.5	70.4	69.3	62.8	54.8	40.5	30.8
3	22.0	20.7	23.9	39.8	54.4	63.3	68.8	69.5	63.6	52.9	39.7	29.3
4	22.1	19.5	25.5	39.2	52.9	65.1	69.7	68.4	64.6	50.4	41.4	28.5
5	23.2	14.8	29.6	40.3	51.6	65.4	70.3	67.7	64.4	52.9	41.3	28.0
6	22.9	17.6	30.8	40.6	54.1	63.4	70.7	67.4	63.6	52.0	37.9	28.5
7	21.5	21.7	28.6	42.0	52.3	67.4	72.0	69.3	61.7	50.7	40.1	29.8
8	22.7	21.2	28.3	42.8	51.6	65.7	71.1	69.6	61.4	50.0	40.1	30.0
9	23.9	21.3	29.2	41.5	49.3	66.0	70.3	68.0	62.0	52.0	39.1	29.0
10	23.1	24.5	31.0	41.4	51.7	64.7	70.0	69.0	61.2	50.5	40.0	25.9
11	19.4	22.5	31.9	41.3	53.3	66.6	70.9	70.0	61.5	49.5	39.3	27.3
12	22.4	21.7	33.1	41.0	56.0	66.8	70.5	70.9	59.8	47.9	39.0	27.1
13	24.0	21.2	33.6	41.6	55.0	66.0	69.0	69.1	59.5	47.8	34.3	25.4
14	18.8	20.3	30.3	43.9	54.3	65.9	69.1	68.5	59.7	46.7	35.8	26.7
15	21.4	21.7	29.8	43.5	55.6	65.9	69.2	67.4	58.6	46.4	35.2	25.5
16	22.5	22.4	30.1	44.6	56.2	66.8	69.1	66.6	57.7	48.2	36.4	19.4
17	24.3	22.9	29.0	43.9	57.4	66.7	68.6	66.7	58.4	47.0	38.2	22.8
18	24.9	23.9	29.7	43.5	59.3	66.3	69.2	67.1	59.2	48.0	36.3	26.9
19	23.2	23.3	30.1	44.7	58.6	65.9	70.3	66.9	58.1	46.7	35.3	26.7
20	20.5	27.9	33.8	46.8	59.0	63.9	70.8	66.9	57.9	46.9	35.4	26.0
21	20.3	30.6	31.8	47.1	61.0	66.2	69.5	66.7	56.7	44.9	35.0	22.7
22	20.7	29.0	32.2	44.1	61.2	66.2	69.6	66.2	55.3	43.4	35.0	17.8
23	18.7	26.5	35.4	46.2	59.3	66.4	70.8	69.7	55.0	46.3	33.7	17.5
24	17.9	23.7	37.9	43.3	59.7	67.1	70.3	63.8	55.2	45.0	29.9	24.4
25	18.1	24.8	37.7	46.2	59.6	66.4	69.2	63.6	55.4	40.3	29.1	26.7
26	23.0	24.6	35.3	48.9	58.1	67.0	68.0	64.7	54.0	40.9	30.0	24.0
27	23.3	27.5	35.5	46.8	60.1	67.1	68.9	63.8	55.6	41.9	29.3	22.2
28	24.0	24.4	36.7	47.5	62.7	67.3	69.6	62.7	54.2	40.3	30.0	23.0
29	20.6	26.7	34.5	51.6	60.7	67.3	70.5	62.6	63.0	39.9	31.4	25.2
30	19.8		35.5	51.5	60.5	70.0	71.3	69.3	51.8	39.9	32.0	22.1
31	20.8		37.7		62.5		70.5	64.9		39.7		28.0

Observing hours 7_m, 2_a, 9_a. Tabular quantities uncorrected for daily fluctuation.

Day of Month.	Jan. (29)	Feb. (29)	Mar. (29)	April. (29)	May. (29)	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec. (29)
Providence, Rhode Island. Lat. 41° 50′. Long. 71° 24′ W. of G. Alt. 155 feet. 28½ years of observation; Dec. 1831, to May, 1860, inclusive. Prof. A. Caswell, observer. Smithsonian Cont. to Knowl. Washington, 1860.												
	°	°	°	°	°	°	°	°	°	°	°	°
1	28.3	24.6	29.8	41.0	51.7	59.5	69.7	70.4	65.4	56.5	44.7	33.5
2	25.9	24.6	29.0	39.5	51.6	62.4	69.7	70.4	65.6	57.6	46.6	33.1
3	25.3	24.8	27.5	41.6	52.1	63.9	69.0	70.0	67.2	54.5	45.8	34.1
4	26.2	23.8	29.2	42.6	52.0	63.2	69.9	69.9	67.7	53.7	45.8	33.3
5	26.4	24.7	30.4	42.4	51.3	62.3	70.4	71.1	67.8	53.6	45.2	32.2
6	26.4	24.7	32.5	43.4	53.4	62.2	67.6	71.0	67.2	54.6	43.3	31.2
7	28.1	25.8	32.1	43.6	53.5	61.9	67.5	70.7	65.9	52.9	42.8	32.4
8	27.1	26.0	34.0	44.5	53.1	63.1	71.3	70.8	64.5	54.0	44.1	32.7
9	27.3	26.0	34.8	45.5	53.7	64.3	71.2	71.2	65.6	54.2	44.3	32.3
10	27.7	25.4	33.6	44.6	52.9	65.2	71.3	69.7	63.7	52.7	41.6	33.0
11	27.5	25.9	32.7	44.3	53.7	63.9	71.2	69.7	65.0	52.2	40.6	31.3
12	27.5	23.9	33.3	45.9	56.3	63.2	71.2	71.2	63.0	54.0	42.4	29.4
13	27.4	24.0	36.4	44.9	55.8	64.5	71.9	72.1	60.7	53.5	42.4	28.6
14	28.2	26.4	34.3	42.4	55.5	65.8	72.1	71.8	59.4	50.1	40.3	30.7
15	29.4	27.1	34.5	42.7	55.7	65.6	71.9	69.5	61.3	48.7	38.3	30.9
16	29.5	28.0	34.4	43.0	57.5	65.6	70.0	68.5	60.3	50.7	39.7	28.3
17	29.6	25.5	36.1	43.8	58.2	65.6	71.6	68.3	60.5	52.0	40.2	28.9
18	25.5	25.5	36.2	44.2	58.1	65.8	72.7	68.3	63.4	53.9	42.1	26.4
19	23.3	27.4	35.5	45.5	58.5	67.1	72.8	68.1	62.7	52.8	40.2	26.4
20	26.3	30.2	37.0	45.8	57.0	67.0	72.2	67.4	63.2	49.5	37.3	27.6
21	29.6	31.1	38.1	47.3	57.1	67.9	72.3	67.9	61.6	47.5	37.2	26.9
22	25.2	32.5	34.8	49.0	56.4	67.0	72.3	68.8	57.6	48.9	39.4	25.4
23	23.9	32.3	35.0	48.4	58.2	67.8	71.9	68.4	57.0	49.1	39.5	25.5
24	26.2	28.7	37.0	48.5	58.2	68.0	72.2	68.8	57.6	49.3	36.6	26.7
25	28.5	27.8	37.2	47.5	57.4	68.3	72.1	67.9	58.0	46.9	34.2	27.7
26	29.6	28.4	37.7	50.1	58.4	68.5	72.1	66.7	57.4	44.3	34.2	26.8
27	26.8	29.6	39.7	49.9	58.3	69.0	70.8	67.4	57.4	45.8	32.7	24.9
28	26.5	29.6	39.7	49.1	60.8	69.7	70.3	66.4	57.4	45.3	32.6	27.5
29	27.7	32.4	39.1	50.7	59.0	70.4	70.7	66.1	55.4	46.6	33.0	27.4
30	29.1		39.7	51.1	56.8	70.3	71.0	66.7	55.4	47.5	34.8	26.4
31	26.5		40.9		56.4		71.0	67.3		44.8		27.7

Observing hours various, generally $\odot_r$, 1_a or 2_a, 10_a, from Oct. to March, inclusive, and 6_m, 1_a or 2_a, 10_a, in the remaining months. The tabular quantities are corrected for daily fluctuation.

To correct the observed daily means resulting from three observations a day, taken at various hours, the following table was prepared and used:—

		°		°		°		°
January	7, 1, 9	—0.2	⊙, 1, 10	—0.1	⊙, 2, 10	—0.2		
February	7, 1, 10	+0.1	⊙, 1, 10	+0.1	⊙, 2, 10	0.0		
March	6, 1, 10	+0.5	⊙, 1, 10	+0.4	6, 2, 10	+0.3	⊙, 2, 10	+0.2
April	⊙, 1, 9	+0.5	⊙, 1, 10	+0.8	6, 1, 10	+0.8	6, 2, 10 ⊙, 2, 10	+0.6 +0.6
May	⊙, 1, 10	+1.2	6, 1, 10	+0.7	6, 2, 10	+0.5		
June	6, 1, 10	+0.5	5, 1, 10 ⊙, 1, 10	+1.2 +1.3	6, 2, 10	+0.3		
July	⊙, 1, 10	+1.0	5, 1, 10	+0.9	6, 1, 10	+0.5	6, 2, 10	+0.4
August	⊙, 1, 10	+0.9	6, 1, 10	+0.6	5, 1, 10	+0.5	6, 2, 10	+0.5
September	⊙, 1, 10	+0.7	6, 1, 10	+0.7	6, 2, 10	+0.5		
October	⊙, 1, 10	+0.4	6, 1, 10	+0.4	⊙, 2, 10	+0.3		
November	⊙, 1, 10	—0.1			⊙, 2, 10	—0.1		
December	⊙, 1, 10	—0.2	7, 1, 9	—0.3	⊙, 2, 10	—0.3		

The above corrections apply to the middle of each month, and were interpolated for every day.

Albany, New York. Lat. 42° 39′. Long. 73° 44′ W. of G.

Alt. 130 feet. 21 years of observation; including the years 1820 to 1829, inclusive.

MS. in Smithsonian Coll.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	25.4	18.4	27.2	42.6	53.3	64.5	73.3	71.6	64.3	55.7	43.6	35.8
2	23.4	22.7	29.5	43.1	54.7	66.6	71.2	71.4	67.2	57.0	43.3	34.2
3	22.8	23.4	28.0	43.4	57.0	66.6	70.8	73.4	65.2	56.3	43.4	32.8
4	19.8	19.9	29.3	43.3	55.9	68.6	71.4	71.4	66.7	56.0	44.0	31.7
5	22.1	20.1	33.3	43.9	55.1	68.8	72.0	71.6	65.0	56.3	42.9	31.0
6	23.0	22.7	31.6	45.7	57.4	68.7	72.5	72.8	64.9	53.8	41.1	32.3
7	24.3	24.4	30.6	45.9	55.2	70.0	73.5	74.2	62.2	53.8	42.8	34.7
8	23.3	24.1	32.2	45.7	55.6	68.6	73.1	73.0	61.9	53.7	42.4	32.9
9	24.3	23.6	33.9	45.7	54.6	67.5	72.0	71.3	62.5	55.1	42.0	31.4
10	22.8	27.2	35.1	48.6	54.9	66.3	72.3	72.0	62.6	53.6	42.0	29.8
11	21.4	25.9	35.8	46.6	57.1	68.9	70.6	73.2	63.3	51.0	40.8	30.5
12	24.8	23.3	36.9	47.1	59.4	69.5	70.3	72.2	61.2	50.5	38.7	28.1
13	24.3	25.2	33.7	46.6	58.5	69.4	69.4	71.3	62.2	52.3	37.6	29.2
14	23.7	23.8	31.5	49.8	59.8	68.2	72.2	71.3	61.9	49.6	38.0	30.3
15	23.7	26.2	34.0	50.4	58.7	70.0	72.3	69.8	61.3	50.0	36.0	28.9
16	24.4	28.2	32.3	48.7	58.6	70.4	72.3	70.1	62.3	49.5	38.4	28.9
17	24.9	30.0	32.8	48.6	62.3	68.8	72.1	71.6	60.5	50.6	39.0	25.9
18	24.7	29.1	33.5	49.9	63.7	68.8	71.9	68.5	60.0	51.5	37.1	27.6
19	25.6	28.5	35.3	51.9	62.5	69.1	73.1	68.5	60.7	48.5	37.0	28.0
20	23.0	30.1	37.4	53.5	63.8	67.7	71.3	69.7	61.0	47.5	36.6	29.9
21	20.6	30.7	33.5	50.9	61.7	68.3	73.6	68.7	60.2	45.7	36.7	28.9
22	22.8	29.5	35.7	50.5	61.7	67.9	73.3	69.1	57.3	44.6	36.7	26.0
23	21.1	27.9	37.5	50.7	64.3	68.2	72.6	68.9	57.9	48.9	37.0	21.7
24	17.9	26.3	40.0	47.5	62.9	69.0	72.9	69.1	57.6	46.6	34.4	28.9
25	21.3	26.6	38.5	48.9	63.2	69.5	72.4	68.5	57.9	46.6	35.7	26.7
26	25.0	30.4	39.1	51.8	63.1	70.7	71.6	67.6	55.9	45.3	34.8	24.2
27	25.6	28.1	42.4	52.7	65.1	73.4	72.3	66.6	56.9	45.7	34.1	25.9
28	25.9	27.4	40.9	51.0	67.0	70.4	71.7	66.3	55.3	44.7	34.3	27.5
29	22.6	24.7	40.3	53.9	64.2	71.3	72.2	67.3	54.9	45.3	33.8	27.6
30	21.0		40.4	53.5	64.2	73.3	73.1	68.9	55.5	44.2	34.3	27.7
31	20.8		41.8		64.3		73.6	69.6		42.6		28.3

Observations at 3 P. M. for 2 years, at 9 P. M. for 10 years, and at 7 A. M., 2 and 9 P. M. for 9 years. Tabular numbers corrected for daily fluctuation.

In computing the original table, the observations at 3 P. M. were used for two of the years, those at 9 P. M. for ten, and the daily means at 7 A. M., 2 and 9 P. M. for the remaining nine. When combined they afford a tolerable approximation to the true mean, as may be seen from the following statement, which shows the correction for daily fluctuation at 2 and 9 P. M. deduced from the observations of ten years of this series, from 1820 to 1829, inclusive, and the reduction from 2 P. M. to 3 P. M. from the Mohawk table of daily fluctuation:—

	Corr'n at 2 P. M.	Refer'd to 3 P. M.	Corr'n at 3 P. M.	Corr'n at 9 P. M.	Corr'n to $7_m, 2_a, 9_a$		Corr'n at 2 P. M.	Refer'd to 3 P. M.	Corr'n at 3 P. M.	Corr'n at 9 P. M.	Corr'n to $7_m, 2_a, 9_a$
	°		°	°	°		°		°	°	°
January	—4.4	—.1	—4.5	+0.7	—0.3	July	—7.7	—.3	—8.0	+1.9	—0.3
February	—5.4	—.2	—5.6	+0.6	—0.3	August	—8.3	—.6	—8.9	+1.7	—0.2
March	—6.6	—.3	—6.9	+1.0	—0.1	September	—7.3	—.6	—7.9	+1.4	—0.2
April	—8.3	—.6	—8.9	+2.2	—0.1	October	—6.8	—.3	—7.1	+1.3	—0.2
May	—8.4	—.5	—8.9	+1.7	—0.3	November	—4.3	—.1	—4.4	+0.9	—0.1
June	—7.9	—.5	—8.4	+1.8	—0.5	December	—3.8	+.1	—3.7	+0.7	—0.3

The correction to mean of 7, 2, 9 is from the Mohawk table; now twice the correction 3 P. M. + ten times that at 9 P. M. + nine times that at 7, 2, 9, divided by 21, gives the following table of corrections:—

	°		°		°		°
January	—0.2	April	+0.1	July	0.0	October	—0.1
February	—0.4	May	—0.1	August	—0.1	November	0.0
March	—0.2	June	—0.1	September	—0.1	December	—0.1

These small corrections were applied, they answer to the middle of each month, and were interpolated for any other day.

Geneva, New York. Lat. 42° 53′. Long. 77° 01′ W. of G.

Alt. 567 feet. From 12 years of observation; from 1854 to 1865, inclusive. Dr. W. D. Wilson.
In the 20th Annual Report of the Regents of the University of the State of New York, Albany, 1868.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1	24.73	27.81	29.29	33.32	49.19	62.00	68.19	73.29	63.93	54.13	48.25	34.98
2	23.31	21.45	28.72	38.45	48.98	62.92	68.21	73.12	62.72	55.45	47.92	32.01
3	26.19	19.09	31.81	41.44	48.14	62.40	69.68	71.64	63.76	58.94	44.75	30.26
4	27.22	19.41	30.84	41.42	50.38	60.15	64.54	70.93	63.65	58.54	44.23	29.84
5	24.82	23.10	29.26	41.29	53.12	60.49	68.67	71.34	65.38	56.87	43.42	31.30
6	25.34	23.34	28.26	37.80	52.17	60.89	70.62	71.15	65.17	54.51	41.32	32.17
7	24.74	26.11	27.82	41.98	51.63	61.55	71.98	70.78	65.01	54.60	43.38	32.03
8	19.09	24.19	29.78	34.92	55.31	60.34	71.47	71.44	65.12	52.82	43.13	28.35
9	22.54	24.43	29.66	41.81	55.18	61.68	71.36	71.94	64.45	50.12	41.69	30.43
10	25.00	19.93	26.30	40.23	53.66	61.10	71.43	72.40	66.94	50.59	40.58	30.70
11	23.57	21.28	30.62	42.63	51.63	60.81	70.09	71.53	66.56	52.41	40.85	29.84
12	28.11	23.68	29.53	44.63	54.31	63.13	69.35	70.03	63.03	50.65	42.37	28.25
13	27.32	25.05	29.50	42.17	51.71	61.94	69.02	70.59	59.39	49.48	39.98	33.63
14	27.52	25.00	35.16	42.79	56.27	63.72	70.52	63.35	61.38	48.48	36.82	35.69
15	28.29	27.54	35.31	41.92	58.22	66.04	72.35	67.88	62.71	45.73	34.87	31.06
16	26.10	27.15	36.71	43.64	58.17	61.53	71.57	67.99	60.37	48.62	38.84	33.08
17	24.21	25.16	35.67	43.72	55.92	64.49	72.24	67.87	63.69	48.74	38.61	27.96
18	22.42	29.12	33.06	46.54	56.23	67.75	72.41	68.23	61.03	51.74	39.70	25.01
19	25.57	22.78	30.24	45.46	55.76	66.45	74.32	66.90	58.21	49.06	38.87	27.31
20	27.10	26.59	30.76	44.02	55.82	66.00	71.38	68.45	58.89	46.37	35.03	26.22
21	25.89	26.93	32.52	47.07	58.29	67.12	67.79	69.29	59.20	47.30	35.30	25.96
22	24.19	30.51	32.82	49.16	56.71	69.89	68.26	68.53	55.54	47.62	35.51	23.48
23	26.49	29.71	35.65	45.88	59.91	65.48	68.32	65.88	56.94	45.14	36.32	24.25
24	26.28	27.86	32.96	45.25	63.29	66.61	70.12	68.00	57.90	45.07	31.40	21.87
25	27.62	27.04	33.62	45.94	60.84	70.17	71.79	66.86	55.84	43.09	34.05	24.26
26	25.55	27.72	33.00	47.70	60.65	72.25	72.53	67.55	57.18	41.29	34.27	30.61
27	24.34	31.02	33.10	47.68	60.25	69.88	71.66	65.39	57.64	41.54	36.13	28.73
28	27.32	29.92	32.70	46.76	57.32	72.35	72.12	65.38	56.53	45.17	35.75	27.38
29	26.08	33.37	37.22	49.30	57.57	72.88	71.37	63.77	55.37	47.85	34.62	25.22
30	25.22		37.82	49.70	57.65	69.48	70.96	61.55	52.88	49.68	36.22	27.82
31	22.18		40.00		62.31		71.46	62.41		48.66		22.85

Value of April 8 doubtful. Observing hours, 7_m, 2_a, 9_a. Tabular quantities uncorrected for daily fluctuation.

Marietta, Ohio. Lat. 39° 28′. Long. 81° 26′ W. of G.

Alt. 580 feet.[1] 32 years; between 1818–1823 and 1829–1859. J. Wood and Dr. S. P. Hildreth.
Smithsonian Cont. to Knowl. No. 120. Washington, June, 1867.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
				(31 yr's)	(31 yr's)							[2]
1	33.2	30.2	38.6	47.3	60.8	65.0	72.6	71.4	68.9	59.6	47.1	37.2
2	31.1	31.5	35.7	47.2	59.8	66.8	72.3	71.5	68.6	59.0	48.0	36.9
3	30.0	31.4	34.8	49.4	60.0	67.3	70.8	73.0	68.7	57.4	47.9	36.3
4	31.1	30.1	37.2	50.4	60.6	67.1	68.9	72.5	69.0	55.8	47.7	36.0
5	30.4	29.2	37.5	49.3	61.1	67.2	71.6	71.9	69.6	54.9	46.3	35.6
6	32.7	30.2	38.4	49.1	59.2	67.0	72.5	72.7	68.7	54.8	46.0	35.7
7	33.9	30.0	42.0	53.1	60.2	68.4	73.6	72.5	68.7	54.4	46.3	35.7
8	30.9	30.7	41.6	51.2	59.5	68.4	73.8	72.6	69.0	56.2	45.6	35.4
9	30.9	31.6	41.4	50.7	59.4	69.2	73.3	72.4	68.6	56.4	44.6	34.7
10	30.4	31.6	41.3	52.5	58.9	68.9	73.0	72.7	68.3	55.1	44.1	33.4
11	31.4	31.9	41.8	53.0	61.1	68.5	72.4	72.9	65.7	54.5	45.6	33.8
12	30.6	33.0	43.3	53.0	60.5	69.1	72.5	72.7	63.5	53.4	45.5	32.4
13	31.0	32.4	42.7	53.2	60.7	69.4	73.5	73.7	63.3	51.6	41.3	33.8
14	33.6	33.6	41.6	51.5	62.0	70.0	73.2	74.3	64.3	50.3	41.0	35.1
15	34.7	33.7	40.9	50.6	60.6	70.0	72.0	73.3	64.2	49.8	40.2	32.9
16	32.6	32.7	41.5	51.6	62.3	70.3	71.8	72.8	63.3	52.7	40.8	32.4
17	32.8	30.9	41.8	52.6	62.8	70.7	72.9	72.3	63.4	52.8	43.0	31.6
18	31.9	33.6	40.9	50.6	61.9	70.6	73.2	71.9	63.8	52.6	42.2	31.4
19	29.8	36.1	40.1	52.1	60.8	70.0	74.3	71.8	64.1	50.5	39.4	33.4
20	33.4	36.5	41.1	54.5	60.7	70.0	73.6	70.5	64.5	49.6	40.0	32.3

[1] Stated to be 670 feet in the general table.

[2] After 16th 30 years.

Marrietta.—Continued.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
21	33.1	37.3	42.9	56.5	62.0	69.3	74.0	70.9	62.2	48.5	41.7	30.8
22	30.3	37.9	42.0	58.6	63.6	70.3	73.6	70.6	60.5	48.9	42.5	29.9
23	28.7	36.6	43.5	57.9	64.3	70.1	74.5	68.6	59.7	51.4	40.9	29.4
24	30.1	35.4	45.0	57.8	63.1	70.2	74.3	69.7	61.5	48.1	38.1	32.0
25	31.3	35.7	44.7	58.2	62.8	70.5	74.1	69.8	61.5	47.8	36.4	33.3
26	32.1	36.8	47.1	57.6	63.8	72.0	74.0	69.7	60.1	47.5	35.9	32.3
27	31.1	36.4	46.1	56.0	64.7	73.0	73.4	69.5	60.2	47.4	33.8	30.8
28	31.9	36.4	46.6	58.1	65.5	72.5	74.1	69.0	58.3	46.2	36.6	32.2
29	33.4	39.0	47.1	59.1	66.5	72.7	75.0	68.9	58.5	45.8	37.9	32.4
30	33.7		45.9	61.3	65.6	72.4	74.7	69.3	58.1	46.3	37.6	33.0
31	32.2		48.6		64.3		72.7	69.6		46.9		31.6

Hours of observations various: During 5 years $\odot_r$, 2_a, $\odot_s$, during the remaining years generally 6_m, 2_a, 9_a in summer, and 7_m, 2_a, 9_a in winter; the tabular numbers are corrected for daily fluctuation; see table on p. 16 of the Smithsonian Cont. to Knowl., No. 120. Washington, 1867.

MEAN TEMPERATURE OF EACH DAY OF THE YEAR.

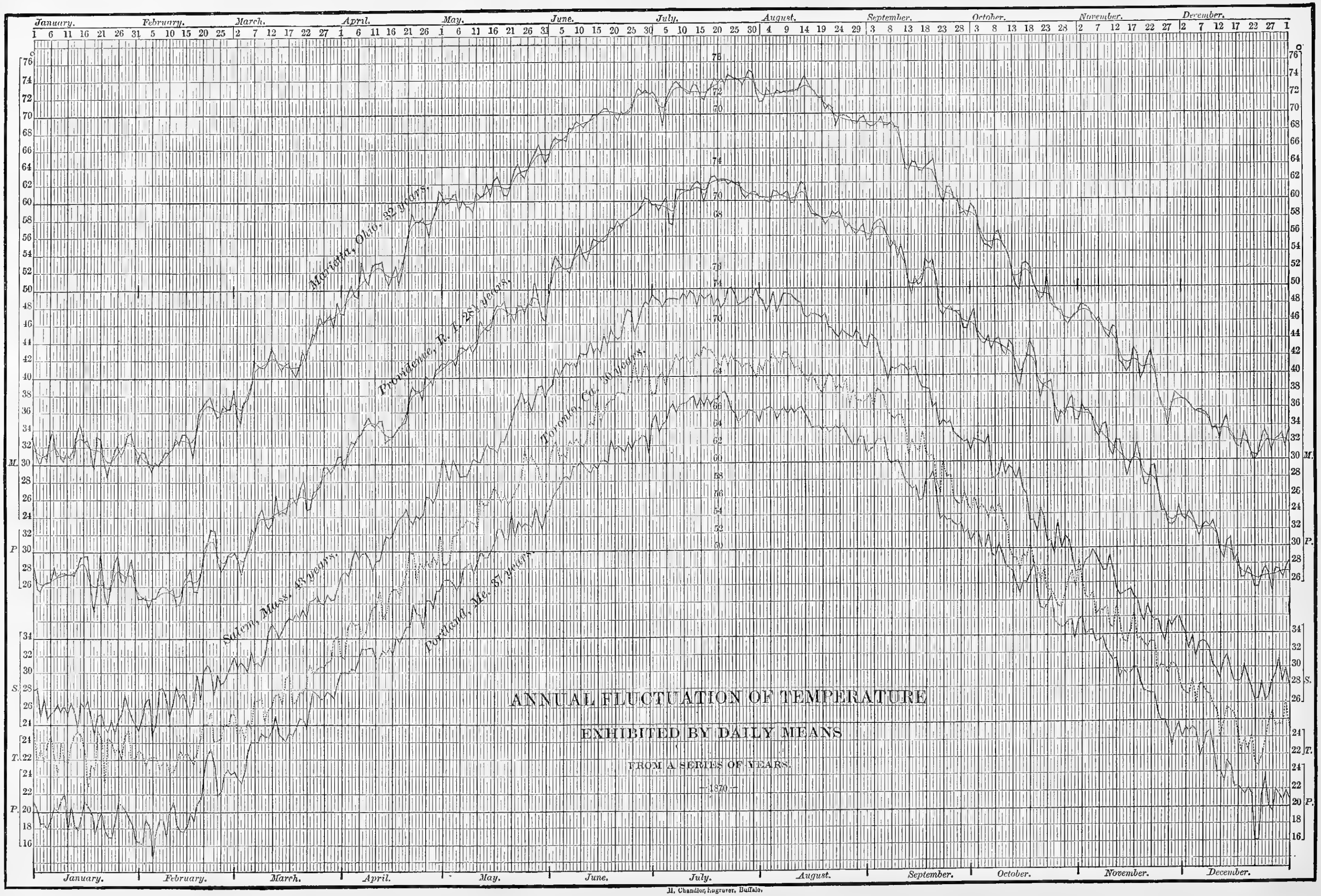
Washington, Arkansas. Lat. 33° 44′. Long. 93° 41′ W. of G.

Alt. 660 feet. From 20 years of observations; from 1840 to 1859, inclusive. Dr. N. D. Smith.

Smithsonian Cont. to Knowl. Washington, 1860.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	40.57	46.02	50.60	57.50	66.52	73.40	77.82	77.48	75.97	66.37	58.60	48.27
2	42.97	45.57	50.17	60.70	67.65	74.58	77.57	77.80	75.80	65.62	59.00	47.42
3	42.25	42.22	47.80	62.00	66.97	75.11	77.37	77.83	76.27	65.12	59.67	43.87
4	41.90	43.37	50.85	62.77	66.27	74.82	78.30	78.80	76.80	66.27	58.05	44.57
5	46.65	44.60	53.50	59.35	66.00	74.98	78.20	78.60	76.10	66.32	57.55	45.47
6	46.62	46.27	54.90	58.95	66.58	74.47	79.32	78.90	75.90	65.17	53.92	43.42
7	41.30	45.90	53.65	61.22	66.98	75.53	79.75	79.50	76.67	66.05	54.17	44.35
8	42.00	44.90	55.47	61.82	66.79	75.66	80.12	79.10	76.10	64.37	52.32	44.17
9	40.12	44.32	54.45	63.50	66.63	75.56	79.85	79.55	75.72	63.82	52.47	44.50
10	40.00	43.42	52.17	64.70	67.90	73.92	79.97	78.68	74.57	65.72	52.35	43.65
11	41.85	45.25	51.87	62.97	68.21	73.63	78.90	79.28	74.72	66.27	54.40	42.10
12	42.75	48.20	50.85	61.87	69.50	74.28	79.57	79.00	74.50	64.00	49.90	43.77
13	43.87	50.17	50.95	62.85	70.61	75.53	79.95	79.98	74.07	61.70	47.85	44.63
14	44.25	46.55	55.00	61.45	69.95	75.92	80.37	79.92	74.67	62.45	49.30	44.85
15	47.37	45.77	53.22	61.32	70.00	75.40	81.17	79.58	74.37	60.32	51.12	45.12
16	45.77	46.87	54.72	62.92	70.29	77.27	81.10	79.23	73.57	61.22	54.07	45.30
17	40.42	47.95	55.77	62.55	69.61	78.34	80.85	80.00	74.82	59.92	51.17	40.00
18	37.72	50.22	54.95	62.35	68.79	77.24	79.87	79.65	73.82	58.95	46.65	40.52
19	39.07	51.60	54.55	62.95	69.92	77.42	79.92	79.43	71.80	58.32	44.70	45.00
20	43.90	50.00	54.77	63.12	70.82	77.50	79.37	78.83	70.32	58.75	48.15	42.82
21	40.20	49.67	56.57	65.20	70.84	76.16	79.52	79.30	67.55	60.37	51.57	40.67
22	40.07	50.82	55.30	66.70	72.24	76.61	79.47	79.30	67.90	58.20	47.85	41.70
23	41.45	49.72	54.70	65.71	72.19	75.85	79.82	77.95	68.35	58.97	49.37	41.42
24	46.70	50.27	57.87	66.72	72.82	75.37	79.97	77.50	69.62	59.77	47.20	42.07
25	48.27	49.13	56.87	65.55	72.19	75.77	80.00	78.18	69.60	55.45	47.50	44.75
26	48.82	51.89	57.79	67.08	72.37	76.87	79.92	77.43	69.60	56.27	46.82	44.52
27	48.57	52.65	57.17	62.95	73.13	78.37	79.82	77.38	67.80	55.97	48.60	47.47
28	46.42	54.50	58.05	63.27	73.74	79.32	80.45	76.58	67.85	55.70	47.32	47.10
29	45.80	56.20	58.22	64.70	72.65	78.85	80.27	76.03	67.47	55.10	47.67	46.50
30	44.45		59.60	67.65	73.13	79.67	79.27	76.73	65.69	55.90	48.32	43.16
31	43.80		57.62		73.12		78.78	76.50		56.55		42.06

Two observations a day; $\odot_r$ and 2_a, Nov. to April, inclusive; $\odot_r$ and 3_a, May to Oct. inclusive. Means uncorrected for daily fluctuation.



To face page 193.

The tabular numbers for five stations, having the longest series of observations, are graphically represented on the accompanying plate.

The greater irregularity for the shorter series is sufficiently well marked, and the zigzag lines of the Salem temperature, derived from a 43 year series, are yet inconveniently large for the purposes of comparison.

The Marietta and Providence daily temperatures show many coincidences in the zigzag lines or in the differences from their respective mean values and particularly so in the *winter season;* the Portland temperatures, also, frequently conform to the same fluctuations. From this we infer that changes from the normal temperatures extend, especially in the winter season, over large tracts of country, and there are also indications of the occurrence of the same phase about one day later in Rhode Island than in Ohio, showing that the normal state of the weather has a tendency (especially in the winter) to an easterly progression, the same as recognized in the case of storms or unusual thermal disturbances of the atmosphere. About the 20th of February, all stations indicate a rapid rise of temperature, this epoch, therefore, deserves further attention; there are also fainter indications of an unusual depression about May 31, of a constancy between September 13 and 18, and of a rapid decline about Nov. 26.

The temperatures recorded at the above stations refer nearly to the *same* period of time, and consequently exhibit many coincidences of departures from regularity which only belong to this period, but as soon as we compare with recorded temperatures covering *another* period, these coincidences disappear, and it is only by such comparisons of different epochs that we can assure ourselves of the reality or non-reality of any suspected deviation from the regular annual progression. The character of the Salem line is essentially different from that of any of the other lines, its period terminating about the time of the beginning of the others. This is the only station where the record extends, in part, to the past century.

Examining now, specially, the suspected periods of irregularity they will possess a strong probability of existence if exhibited alike for two independent epochs, for instance, those of the Salem and Providence series. About the beginning of December the march of temperature, at all the stations given, appears to be normal, though there is a remarkable depression about November 26, 27, 28, which latter feature seems to demand further attention. There is no thermal anomaly about the middle of May,[1] and the progression about February 12th and in the first and second week of March appears regular enough; at this season, however, the accidental irregularities are very great, and may hide any smaller fixed deviation. The suspected arrest of increasing temperature after May 25 is not supported by the Marietta and Salem observations, and the rise or constancy of temperature noted

[1] In an Article on the Variations of Temperature at Toronto, Canada (Phil. Trans. Roy. Soc., 1853, Vol. 143, part 1), Col. Sabine remarks: "On a reference to Table IV, it is seen that on the average of the twelve years from 1841 to 1852 the 11th of May was 0°.1 *below* and on the 12th and 13th of May respectively 3°.1 and 2°.4 *above* the general mean of the temperature. The meteorological observations at Toronto during these twelve years do not, therefore, support the supposition that the depression of temperature on the 11th, 12th, and 13th of May observed at Berlin (from a series of 86 years of observations) is a general and periodically recurring phenomenon over the whole globe."

25 March, 1875.

at Marietta and Providence between October 27, and November 2, is contradicted by the ordinary fall of temperature observed at Salem during this period, but appears supported by Toronto.

The smooth curves, given in the Marietta and Providence diagrams, which cut off the zigzags, equally, above and below, are obtained by the method of successive means, and in this instance represent the sixth order of means.[1] This process facilitates comparison and enables us to construct tables of daily temperature, the values of which have thus become more consistent by the removal of the greater accidental irregularities.

In the tables which follow, the annual fluctuation is given either directly by the daily ordinates or by those of smooth curves, obtained by the process just explained, or by means of Bessel's periodic function with constants supplied by observation, as stated at the top of each table.

The director of the Toronto observatory noticed the curious fact, that the daily means or normals of temperature made out by General Sabine for the epoch 1841 to 1852 had now become totally inapplicable, in consequence of which a new set of normals was prepared, employing the series of observations from 1859 to 1868, and calculating the table with the help of Bessel's periodic function as had been done before.

The two sets of tables given for Toronto will, therefore, represent the variability of the annual fluctuation for two epochs not very remote from those when the extreme values obtain, as has been found from a further study of this phenomenon of the shifting of the epoch of maximum cold and of apparent changes in the curve of the annual fluctuation.[2]

On account of this variability of the annual fluctuation, the years of observation from which the daily means were deduced, are stated at the head of each table.

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[1] Supposing $y_1\, y_2\, y_3\, y_4\, y_5\, y_6\, y_7$ to represent consecutive values of the daily temperature, the resulting mean of the sixth order and corresponding in point of time to the middle ordinate y_4 will be given by

$$\tfrac{1}{64}\,\{y_1 + 6y_2 + 15y_3 + 20y_4 + 15y_5 + 6y_6 + y_7\}$$

and in general for $n + 1$ ordinates, the co-efficients are those of the *nth* power of a binomial and the divisor equals their sum.

No precise rule can be given prescribing the limiting number of successive means, but as the values converge towards a constant, at first rapidly and afterwards more slowly, it will soon be found that after repeating the process a few times very little impression can be made on the results by continuing it, which sufficiently indicates that we have arrived at a practical limit. We may either compute directly by means of the formula, or we may set down *each* series of consecutive means; the latter process offers the advantage of a partial check in the regularity of progression of the numbers standing in the same horizontal line. It will also be convenient to stop at an order of an *even* number, in which case the resulting means refer, in point of time, to noon, whereas odd numbers (which may be written between the line) refer to midnight.

[2] Referring the reader to a subsequent part of this paper for the analyzation of the results connected with this inequality, it may be stated that it probably exists over the greater part of the United States east of the Mississippi River, and, perhaps with some modification, also in other parts of the country; allied with it, but not necessarily connected, there appears also an inequality in the amount of greatest cold and heat extending over a number of years, which, however, leaves the annual range almost undisturbed. These inequalities are necessarily of a periodic nature, and consequently our daily means, in order to become truly normals, must comprise at least one full period (or at least half a period if the curve be regular and just includes the maximum and minimum).

Toronto, Canada West.

[General Sabine, Phil. Trans. 1853, vol. 143, part i.]

Resulting annual fluctuation from a series of 12 years of observations between 1841 and 1852, or mean temperature of every day derived from computation by Bessel's periodic function,

$$T = 44^\circ.23 - 21^\circ.81 \sin(\theta + 81^\circ\, 27') + 1^\circ.06 \sin(2\theta + 71^\circ\, 32') - 0^\circ.80 \sin(3\theta + 347^\circ\, 42') + 0^\circ.22 \sin(4\theta + 37^\circ\, 27') + 0^\circ.88 \sin(5\theta + 50^\circ\, 41') + 0^\circ.325 \cos 6\,\theta,$$

the angle θ reckoning from Jan. 15.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	25°.2	23°.9	25°.4	36°.3	46°.4	56°.9	64°.7	66°.9	63°.1	50°.5	40°.5	30°.8
2	25.2	23.9	25.6	36.7	46.7	57.2	64.9	66.8	62.8	50.0	40.3	30.5
3	25.1	23.8	25.9	37.1	47.0	57.5	65.1	66.8	62.5	49.6	40.0	30.1
4	25.1	23.7	26.2	37.4	47.4	57.8	65.2	66.8	62.2	49.1	39.8	29.8
5	25.1	23.6	26.4	37.8	47.7	58.1	65.3	66.8	61.9	48.7	39.5	29.4
6	25.1	23.6	26.7	38.1	48.0	58.4	65.5	66.8	61.5	48.3	39.2	29.1
7	25.1	23.5	27.0	38.5	48.4	58.7	65.6	66.7	61.2	47.9	39.0	28.7
8	25.1	23.5	27.4	38.8	48.7	59.0	65.7	66.7	60.8	47.5	38.7	28.5
9	25.1	23.4	27.7	39.1	49.1	59.4	65.9	66.6	60.4	47.1	38.4	28.2
10	25.1	23.4	28.0	39.5	49.4	59.7	66.0	66.6	60.1	46.7	38.1	27.9
11	25.0	23.4	28.4	39.8	49.8	59.9	66.1	66.5	59.7	46.3	37.8	27.7
12	25.0	[23.4]	28.7	40.2	50.1	60.2	66.2	66.4	59.3	46.0	37.5	27.4
13	25.0	23.4	29.1	40.5	50.5	60.5	66.3	66.3	58.9	45.6	37.2	27.2
14	25.0	23.4	29.5	40.8	50.8	60.8	66.3	66.3	58.4	45.3	36.9	27.0
15	25.0	23.4	29.9	41.1	51.2	61.1	66.4	66.2	58.0	44.9	36.5	26.8
16	24.9	23.5	30.2	41.5	51.5	61.3	66.5	66.1	57.6	44.6	36.2	26.6
17	24.9	23.5	30.6	41.8	51.9	61.6	66.6	66.0	57.1	44.3	35.8	26.4
18	24.9	23.6	31.0	42.1	52.2	61.9	66.6	65.9	56.7	44.1	35.5	26.2
19	24.8	23.7	31.4	42.4	52.5	62.1	66.7	65.8	56.2	43.8	35.1	26.1
20	24.8	23.8	31.8	42.8	52.9	62.4	66.7	65.6	52.7	43.6	34.8	25.9
21	24.7	23.9	32.2	43.1	53.2	62.6	66.7	65.5	55.2	43.3	34.4	25.8
22	24.7	24.0	32.6	43.4	53.6	62.9	66.8	65.4	54.7	43.0	34.1	25.7
23	24.6	24.1	32.9	43.7	53.9	63.1	66.8	65.2	54.3	42.8	33.7	25.6
24	24.5	24.3	33.3	44.0	54.2	63.3	66.8	65.0	53.8	42.5	33.3	25.5
25	24.5	24.5	33.7	44.4	54.6	63.5	66.9	64.8	53.3	42.3	33.0	25.4
26	24.4	24.7	34.1	44.7	54.9	63.8	66.9	64.6	52.8	42.0	32.6	25.3
27	24.3	24.9	34.5	45.0	55.2	64.0	66.9	64.4	52.3	41.8	32.2	25.3
28	24.3	25.1	34.8	45.4	55.6	64.2	[66.9]	64.2	51.9	41.5	31.9	25.2
29	24.2		35.2	45.7	55.9	64.4	66.9	63.9	51.4	41.3	31.5	25.2
30	24.1		35.6	46.0	56.2	64.5	66.9	63.7	50.9	41.0	31.1	25.2
31	24.0		36.0		56.5		66.9	63.4		40.8		25.2

Toronto, Canada West.

[Received from G. T. Kingston, Director of the Toronto Mag. Observatory, May 23, 1870.]

Resulting annual fluctuation from a series of 10 years of observation between 1859 and 1868, or mean temperature of every day derived from computation by Bessel's periodic function.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	21.3	22.5	25.6	35.6	46.8	57.5	66.4	68.1	62.5	51.0	42.2	30.5
2	21.3	22.6	25.8	36.0	47.2	57.8	66.5	68.0	62.3	50.6	41.9	30.0
3	21.3	22.7	26.0	36.4	47.6	58.1	66.7	67.9	62.0	50.2	41.7	29.6
4	21.2	22.7	26.2	36.8	47.9	58.5	66.9	67.8	61.7	49.9	41.4	29.1
5	21.2	22.8	26.5	37.1	48.3	58.8	67.1	67.8	61.4	49.5	41.2	28.6
6	21.2	22.8	26.7	37.6	48.6	59.1	67.2	67.7	61.1	49.2	40.9	28.2
7	[21.2]	22.9	27.0	37.9	49.0	59.3	67.4	67.6	60.7	48.8	40.6	27.7
8	21.2	23.0	27.3	38.4	49.3	59.7	67.5	67.4	60.4	48.5	40.3	27.3
9	21.2	23.0	27.5	38.7	49.7	60.0	67.7	67.3	60.0	48.1	40.0	26.8
10	21.3	23.1	27.9	39.0	50.0	60.4	67.8	67.2	59.6	47.8	39.7	26.4
11	21.3	23.1	28.1	39.4	50.4	60.7	67.9	67.0	59.2	47.5	39.3	26.0
12	21.4	23.2	28.5	39.8	50.7	61.0	68.0	66.9	58.8	47.2	39.0	25.6
13	21.4	23.3	28.8	40.2	51.1	61.3	68.1	66.7	58.4	46.9	38.6	25.3
14	21.5	23.4	29.1	40.6	51.4	61.7	68.2	66.6	58.0	46.6	38.2	24.9
15	21.5	23.5	29.4	40.9	51.8	62.0	68.2	66.4	57.6	46.3	37.8	24.5
16	21.6	23.6	29.7	41.3	52.2	62.3	68.3	66.2	57.2	46.1	37.4	24.2
17	21.6	23.7	30.1	41.7	52.5	62.6	68.3	66.1	56.8	45.8	37.0	23.9
18	21.7	23.8	30.4	42.1	52.8	62.9	68.4	65.9	56.4	45.5	36.6	23.6
19	21.8	23.9	30.8	42.4	53.2	63.2	68.4	65.7	56.0	45.3	36.2	23.3
20	21.8	24.0	31.1	42.8	53.5	63.5	68.4	65.5	55.5	45.0	35.7	23.1
21	21.9	24.2	31.4	43.2	53.9	63.8	68.5	65.3	55.1	44.8	35.3	22.8
22	21.9	24.3	31.8	43.5	54.2	64.1	[68.5]	65.1	54.7	44.5	34.8	22.6
23	22.0	24.5	32.3	43.9	54.5	64.4	68.4	64.8	54.3	44.3	34.4	22.4
24	22.1	24.6	32.6	44.3	54.9	64.6	68.4	64.6	53.8	44.1	33.9	22.2
25	22.1	24.8	32.9	44.7	55.2	64.9	68.4	64.4	53.4	43.8	33.4	22.0
26	22.2	25.0	33.3	45.0	55.6	65.1	68.4	64.1	53.0	43.6	32.9	21.9
27	22.3	25.2	33.7	45.4	55.9	65.3	68.3	63.8	52.6	43.3	32.5	21.7
28	22.3	25.4	34.1	45.8	56.2	65.6	68.3	63.6	52.2	43.1	32.0	21.6
29	22.4	25.5	34.5	46.1	56.5	65.9	68.2	63.3	51.8	42.9	31.5	21.5
30	22.4		34.8	46.5	56.9	66.1	68.2	63.1	51.4	42.6	31.0	21.4
31	22.5		35.2		57.2		68.1	62.8		42.4		21.4

Providence, Rhode Island.

Resulting annual fluctuation from a series of 28½ years, 1831–1860, or mean temperature of every day, derived from the 6th order of successive means.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	27°.1	25°.6	30°.0	40°.5	51°.3	59°.5	69°.8	70°.6	66°.2	56°.1	45°.6	33°.6
2	26.6	24.8	29.3	40.8	51.6	61.3	69.8	70.5	66.2	55.9	45.7	33.5
3	26.2	24.6	29.0	41.3	51.8	62.5	69.7	70.4	66.7	55.1	45.7	33.4
4	26.2	24.5	29.4	42.0	52.0	62.8	69.6	70.4	67.2	54.3	45.4	33.0
5	26.4	24.6	30.4	42.2	52.2	62.7	69.3	70.5	67.2	54.0	44.7	32.6
6	26.8	24.9	31.6	43.2	52.6	62.5	69.0	70.7	66.7	53.9	44.0	32.2
7	27.1	25.3	32.6	43.8	53.0	62.6	68.9	70.8	66.0	53.8	43.6	32.2
8	27.3	25.6	33.4	44.3	53.2	63.2	69.9	70.7	65.3	53.7	43.4	32.3
9	27.4	25.6	33.8	44.6	53.3	63.8	70.7	70.5	64.7	53.6	43.0	32.3
10	27.4	25.5	33.7	44.7	53.6	64.1	71.1	70.3	64.3	53.2	42.4	32.0
11	27.5	25.2	33.7	44.7	54.2	64.1	71.2	70.4	63.7	53.1	41.9	31.1
12	27.6	24.9	34.0	44.5	55.0	64.2	71.3	70.8	62.6	52.8	41.6	30.2
13	27.7	25.1	34.5	44.0	55.5	64.5	71.5	71.1	61.4	52.0	41.2	29.8
14	28.3	25.9	34.7	43.4	55.7	65.0	71.6	70.7	60.7	50.8	40.4	29.8
15	28.8	26.6	34.7	43.1	56.1	65.4	71.5	69.8	60.6	50.2	39.8	29.7
16	28.8	26.7	35.0	43.2	56.9	65.5	71.4	69.0	60.8	50.7	39.8	29.0
17	27.7	26.5	35.5	43.6	57.7	65.7	71.6	68.5	61.3	51.7	40.1	28.1
18	26.5	26.8	35.9	44.1	58.0	66.2	72.1	68.3	61.9	52.2	40.3	27.3
19	25.8	27.8	36.2	44.9	57.8	66.6	72.3	68.0	62.3	51.7	39.7	27.0
20	26.1	29.4	36.5	45.8	57.5	67.1	72.4	67.9	61.9	50.3	38.7	26.8
21	26.4	30.7	36.4	47.0	57.3	67.2	72.4	68.0	60.6	49.1	38.3	26.6
22	26.1	31.3	36.1	47.9	57.2	67.4	72.3	68.2	58.9	48.7	38.3	26.3
23	25.9	30.8	36.0	48.2	57.5	67.6	72.2	68.2	57.9	48.6	37.9	26.3
24	26.5	29.7	36.5	48.3	57.8	67.9	72.1	68.2	57.6	48.0	36.7	26.5
25	27.4	28.9	37.3	48.6	58.0	68.2	71.9	67.8	57.6	47.4	35.1	26.7
26	27.9	28.8	38.1	49.1	58.3	68.6	71.6	67.3	57.5	45.9	34.0	26.6
27	27.7	29.3	38.8	49.5	58.8	69.1	71.2	67.0	57.2	45.5	33.3	26.6
28	27.5	30.0	39.2	49.8	59.0	69.5	70.9	66.7	56.7	45.8	33.2	26.7
29	27.5	30.3	39.5	50.3	58.6	69.9	70.7	66.6	56.2	46.1	33.3	26.9
30	27.3		39.9	50.9	58.0	69.9	70.7	66.6	56.1	46.1	33.6	27.1
31	26.6		40.3		58.1		70.7	66.5		45.8		27.3

New Haven, Conn.

[Conn. Acad. vol. i, part 1, 1866.]

Resulting annual fluctuation from a series of 86 years of observations between 1778 and 1865, or mean temperature of every day derived from computation by Bessel's periodic function,

$$T = 49°.11 + 22°.92 \sin(\theta + 263° 38') + 0°.29 \sin(2\theta + 345° 24') + 0°.45 \sin(3\theta + 229° 50')$$
$$+ 0°.02 \sin(4\theta + 150°) + 0°.38 \sin(5\theta + 54° 31') - 0.08 \cos 6\theta,$$ where θ counts from Jan. 15.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	27.4	26.4	31.1	41.8	52.1	62.8	70.5	71.9	67.4	56.5	45.5	34.6
2	27.3	26.5	31.4	42.1	52.5	63.1	70.6	71.9	67.1	56.1	45.2	34.3
3	27.2	26.5	31.7	42.5	52.8	63.4	70.8	71.8	66.8	55.7	44.8	33.9
4	27.1	26.6	32.0	42.9	53.1	63.8	70.9	71.7	66.5	55.3	44.5	33.6
5	27.0	26.7	32.3	43.2	53.4	64.1	71.0	71.7	66.2	55.0	44.1	33.3
6	26.9	26.8	32.6	43.6	53.8	64.4	71.1	71.6	65.9	54.6	43.8	32.9
7	26.8	26.9	32.9	43.9	54.1	64.7	71.2	71.5	65.6	54.3	43.4	32.6
8	26.7	27.0	33.2	44.3	54.5	65.1	71.3	71.5	65.3	53.9	43.1	32.3
9	26.6	27.1	33.6	44.6	54.8	65.4	71.4	71.4	65.0	53.5	42.7	32.0
10	26.6	27.2	33.9	45.0	55.2	65.7	71.5	71.3	64.6	53.2	42.3	31.7
11	26.5	27.3	34.2	45.3	55.5	66.0	71.6	71.2	64.3	52.8	42.0	31.4
12	26.5	27.4	34.6	45.7	55.9	66.2	71.7	71.1	64.0	52.5	41.6	31.1
13	26.4	27.6	34.9	46.0	56.2	66.5	71.7	71.0	63.6	52.1	41.3	30.9
14	26.4	27.7	35.3	46.4	56.6	66.8	71.8	70.9	63.3	51.8	40.9	30.6
15	26.3	27.9	35.6	46.7	56.9	67.1	71.8	70.8	62.9	51.4	40.5	30.3
16	26.3	28.0	36.0	47.1	57.3	67.3	71.9	70.6	62.5	51.1	40.2	30.1
17	26.3	28.2	36.3	47.4	57.6	67.6	71.9	70.5	62.1	50.7	39.8	29.8
18	26.3	28.4	36.7	47.8	58.0	67.8	72.0	70.3	61.8	50.4	39.4	29.6
19	26.3	28.6	37.1	48.1	58.3	68.1	72.0	70.2	61.4	50.0	39.1	29.4
20	26.2	28.8	37.4	48.4	58.7	68.3	72.0	70.0	61.0	49.7	38.7	29.2
21	26.2	29.0	37.8	48.7	59.0	68.5	72.1	69.8	60.6	49.3	38.3	29.0
22	26.2	29.2	38.2	49.1	59.4	68.8	72.1	69.6	60.2	49.0	38.0	28.8
23	26.3	29.5	38.5	49.4	59.8	69.0	72.1	69.5	59.8	48.6	37.6	28.6
24	26.3	29.7	38.9	49.7	60.1	69.2	72.1	69.3	59.4	48.3	37.2	28.4
25	26.3	29.9	39.3	50.1	60.4	69.4	72.1	69.1	59.0	47.9	36.8	28.2
26	26.3	30.2	39.6	50.4	60.8	69.6	72.1	68.9	58.6	47.6	36.5	28.1
27	26.3	30.5	40.0	50.7	61.1	69.8	72.1	68.6	58.1	47.2	36.1	27.9
28	26.3	30.8	40.4	51.1	61.4	70.0	72.0	68.4	57.7	46.9	35.8	27.8
29	26.4		40.7	51.4	61.8	70.1	72.0	68.2	57.3	46.6	35.4	27.7
30	26.4		41.1	51.8	62.1	70.3	72.0	67.9	56.9	46.2	35.0	27.6
31	26.4		41.4		62.5		71.9	67.7		45.9		27.5

Marietta, Ohio.

Resulting annual fluctuation from a series of 32 years, 1818–1859, or mean temperature of every day, derived from the 6th order of successive means.

Day of Month.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	31.8	31.3	37.3	47.7	60.3	65.6	72.3	72.3	69.0	58.6	47.1	37.1
2	31.4	31.0	36.6	48.1	60.3	66.3	71.8	72.1	69.0	58.3	47.4	36.8
3	31.0	30.7	36.4	48.8	60.3	66.8	71.1	72.2	68.9	57.4	47.4	36.4
4	30.9	30.3	36.8	49.4	60.3	67.0	70.8	72.3	68.9	56.3	47.2	36.1
5	31.1	30.0	37.9	49.8	60.2	67.2	71.4	72.4	68.9	55.3	46.7	35.8
6	31.5	30.0	39.2	50.3	60.1	67.5	72.2	72.4	68.9	55.0	46.3	35.6
7	31.9	30.3	40.4	50.9	60.0	68.0	72.9	72.4	68.8	55.2	45.9	35.5
8	31.7	30.7	41.2	51.3	59.8	68.4	73.2	72.5	68.7	55.4	45.4	35.2
9	31.1	31.2	41.4	51.5	59.7	68.7	73.2	72.6	68.2	55.5	45.0	34.6
10	30.9	31.6	41.6	52.0	59.9	68.8	73.0	72.7	67.3	55.0	44.8	33.9
11	31.0	32.0	42.0	52.5	60.2	68.9	72.9	72.8	65.9	54.2	44.5	33.5
12	31.2	32.5	42.2	52.6	60.6	69.1	72.8	73.0	64.6	53.1	43.8	33.5
13	31.9	32.8	42.1	52.4	60.9	69.4	72.8	73.3	64.0	52.0	42.5	33.6
14	32.7	33.0	41.8	51.9	61.1	69.6	72.7	73.5	63.8	51.2	41.4	33.6
15	33.2	33.0	41.5	51.6	61.5	69.9	72.5	73.3	63.7	51.2	41.1	33.3
16	33.0	32.7	41.4	51.6	61.8	70.2	72.5	72.9	63.6	51.7	41.3	32.6
17	32.4	32.8	41.3	51.7	61.9	70.3	72.8	72.4	63.6	52.0	41.5	32.2
18	31.9	33.7	41.1	52.0	61.7	70.3	73.2	71.9	63.7	51.7	41.3	32.2
19	31.9	35.1	41.1	52.8	61.4	70.2	73.6	71.5	63.7	50.7	40.8	32.2
20	31.9	36.2	41.4	54.3	61.5	70.1	73.7	71.1	63.2	49.7	40.7	31.8
21	31.6	36.9	42.0	56.1	62.1	70.0	73.8	70.6	62.3	49.4	41.0	31.0
22	30.8	36.9	42.8	57.3	62.9	70.1	73.9	70.1	61.3	49.3	41.0	30.4
23	30.3	36.6	43.6	57.8	63.3	70.1	74.0	69.8	60.8	49.2	40.0	30.6
24	30.3	36.2	44.4	57.9	63.4	70.4	74.1	69.7	60.8	48.7	38.4	31.3
25	30.9	36.1	45.3	57.8	63.5	70.9	74.0	69.6	60.7	48.0	36.8	32.0
26	31.4	36.2	46.0	57.6	63.9	71.6	74.0	69.5	60.3	47.5	35.8	32.0
27	31.8	36.5	46.4	57.5	64.5	72.2	74.0	69.5	59.7	47.0	35.7	31.9
28	32.2	37.1	46.5	58.1	65.2	72.5	74.1	69.4	59.0	46.6	36.2	32.0
29	32.6	37.6	46.7	59.2	65.5	72.5	74.2	69.3	58.6	46.3	36.9	32.2
30	32.6		46.9	60.0	65.4	72.4	73.8	69.2	58.6	46.3	37.2	32.3
31	32.0		47.3		65.3		73.0	69.1		46.8		32.2

Variability in the mean temperature of any one day, in a succession of years.

The fact that the amount of departure of the observed temperature of any day of the year from the normal value assigned to that day from a series of years, is variable at different periods of the year may be verified at a glance by an examination of the accompanying diagram of the annual fluctuation showing the progression of the temperature from day to day. The zigzag lines or irregularities are evidently much greater in winter than in summer.

To obtain a measure of this irregularity we deduce the probable error of each normal, and thus secure the advantage of comparative numbers of the amount of this irregularity, as well as a knowledge of the degree of reliability of our normal temperatures.

Let n = number of years from which the mean temperature of any one day is deduced.

Δ = difference from this mean and any observed temperature.

e = probable error of a single value observed, or the probable amount of ordinary departure from the mean or normal value.

ε = probable error of normal value; then, with sufficient accuracy for our purpose,

$$e = 0.845 \frac{\Sigma\Delta}{\sqrt{n(n-1)}} \qquad \text{and} \qquad \varepsilon = \frac{e}{\sqrt{n}}.$$

To shorten the labor, I shall here only present the values of e and ε for four epochs of the annual fluctuation, and for three days in each case, viz.: for January 20, 21, 22, for April 21, 22, 23, for July 22, 23, 24, for October 21, 22, 23; epochs which correspond respectively nearly to the times of maximum cold, of average temperature, of maximum heat, and again of average temperature.

Selecting a station near the Atlantic sea-board, one on the western slope of the Alleghanies, and one near the Red River, we have the following results:—

Probable error (e) of the mean temperature of any day about the periods of maximum cold and heat—

	January.				July.			
	20th.	21st.	22d.	Mean.	22d.	23d.	24th.	Mean.
Providence, R. I. . .	7°.0	6°.1	7°.9	±7°.0	3°.4	3°.9	3°.2	±3°.5
Marietta, Ohio . . .	7.0	6.9	7.2	±7.0	3.4	3.1	2.8	±3.1
Washington, Ark. . .	9.8	8.0	7.9	±8.6	1.6	1.9	1.4	±1.6

and about the periods of average temperature—

	April.				October.			
	21st.	22d.	23d.	Mean.	21st.	22d.	23d.	Mean.
Providence, R. I. . .	4°.4	4°.2	3°.9	±4°.2	5°.9	6°.3	4°.7	±5°.6
Marietta, Ohio . . .	5.7	5.8	6.6	±6.0	6.2	6.4	5.3	±6.0
Washington, Ark. . .	5.2	4.6	5.2	±5.0	5.2	5.5	7.0	±5.9

We have also the probable error (ε) of our daily normals as given in the preceding tables for Providence (from a series of $28\frac{1}{2}$ years), for Marietta (from a series of 32 years), and for Washington, Ark. (from a series of 20 years).

	Providence.	Marietta.	Washington, Ark.
January 20–22	±1°.3	±1°.2	±1°.9
April 21–23	±0.8	±1.0	±1.1
July 22–24	±0.6	±0.5	±0.4
October 21–23	±1.0	±1.0	±1.3

In midwinter the mean temperature of any day will, therefore, fluctuate, in different years, from 2 to 5 times as much as in midsummer, and the fluctuation for days in that part of the year where its mean temperature is reached, are intermediate between the maxima and minima values.

In our annual curve of the temperature at Providence, the daily means for any two adjacent days in midwinter, will, therefore, ordinarily differ by $\varepsilon \sqrt{2}$ or by $\pm$ 1°.8, and in midsummer by $\pm$ 0°.8, and at the intermediate times by $\pm$ 1°.3, and *may* differ by three times these amounts, or even more, before positively indicating any abnormal influence in the annual fluctuation. In a series of observations comprehending 100 years, the probable error of the resulting average temperature of any day, in the colder half of the year, would still be $\pm$ 0°.6, and in the warmer half $\pm$ 0°.4, and on the average, the normals for two consecutive days will differ $\pm$ 0°.7, thus showing the difficulty of clearly making out small deviations at certain suspected periods of the year. If a series of observations can be had long enough to be divided into two or more parts, and the same apparent deviations are noted in each, the probability of their being real and not accidental would be much strengthened.

At Providence, for any day in the winter, a deviation of 20° (or of three times the probable error [*e*] assigned), either in excess or defect of the normal temperature of that day, is a limit which is but rarely surpassed, and for any day in summer this limit becomes 10°. At Washington, Arkansas, these limits must be changed to 25° in winter, and to 6° in summer.

As a specimen of a table exhibiting the extreme heat and cold experienced, during a number of years, on the same calendar day, the following table is given from Dr. Wilson's paper, 20th Annual Report of the Regents of the University, State of New York (Albany), for 1868.

Geneva, New York. Lat. 42° 52′. Long. 77° 02′ W. of G.

Alt. 567 feet. From 12 years of observations; 1854 to 1865, inclusive.

Day of Month.	Jan.		Feb.		Mar.		Apr.		May.		June.		July.		Aug.		Sept.		Oct.		Nov.		Dec.	
1	51°	5°	50°	—2°	53°	13°	61°	11°	69°	39°	75°	46°	86°	55°	90°	56°	83°	50°	69°	40°	73°	34°	59°	12
2	41	—2	41	3	53	7	65	21	69	31	84	50	84	49	89	59	81	46	68	39	68	31	54	14
3	41	6	35	—5	57	5	65	25	68	36	80	50	88	49	86	57	82	46	80	44	62	34	59	12
4	52	7	36	—6	57	6	61	28	67	34	87	38	84	32	92	62	82	47	79	42	69	23	54	11
5	53	6	42	—1	57	—1	68	23	78	40	84	44	87	52	84	61	87	50	82	40	72	20	48	8
6	42	7	53	—19	41	10	54	22	80	33	86	48	88	54	84	62	81	49	74	36	62	24	53	12
7	46	5	55	—12	58	4	61	27	84	31	86	47	88	55	90	57	88	56	79	36	58	22	53	8
8	42	—1	39	—9	51	5	63	25	81	35	78	49	87	57	88	58	89	52	85	35	58	22	61	4
9	41	—8	46	11	48	—4	68	26	73	40	82	46	89	58	89	58	88	47	75	34	65	29	51	14
10	46	—16	44	4	49	—5	55	31	77	41	85	47	90	62	90	59	87	47	74	38	58	28	64	11
11	53	5	51	3	54	13	72	29	69	30	86	41	90	57	90	58	86	53	76	41	59	27	54	13
12	65	2	51	—2	53	10	66	32	78	36	83	46	91	56	86	60	87	44	68	37	58	26	47	9
13	43	6	42	—6	64	8	63	22	75	39	79	50	90	55	92	58	84	50	63	33	55	22	47	12
14	42	5	42	—1	54	15	62	27	74	39	79	54	89	59	90	55	77	46	65	34	57	20	58	7
15	44	6	56	5	56	4	62	26	82	46	87	54	88	60	82	56	86	37	70	29	50	22	54	5
16	46	0	46	8	60	16	67	32	84	39	80	46	90	58	84	55	82	52	66	30	48	27	58	15
17	40	1	56	—1	59	8	75	30	84	36	81	50	97	56	84	54	85	48	77	35	58	26	45	8
18	39	—15	47	2	60	8	74	31	82	37	89	48	91	58	86	52	90	48	73	37	56	29	49	—5
19	42	2	46	—1	54	6	64	35	68	44	87	53	91	63	85	50	78	41	74	31	63	28	46	6
20	54	0	44	12	63	11	67	32	75	41	88	54	92	61	88	54	86	37	70	30	45	20	45	5
21	51	10	48	9	72	10	64	34	82	43	87	55	89	56	85	57	76	48	70	29	48	23	40	14
22	43	—8	49	4	50	15	79	34	84	44	88	55	82	56	86	53	78	41	63	33	52	24	37	1
23	51	—1	52	7	52	15	66	32	85	45	86	54	84	58	79	50	78	40	57	36	50	23	44	7
24	48	6	59	8	49	12	77	32	85	42	85	57	85	54	06	52	75	45	65	32	57	19	40	9
25	50	1	45	7	56	16	70	31	85	43	91	55	90	60	82	53	74	42	65	32	47	10	52	12
26	52	5	49	10	51	19	72	32	84	44	88	62	91	62	86	52	74	41	63	28	44	20	50	10
27	54	3	60	10	52	19	76	30	80	48	86	60	87	57	75	51	79	41	69	28	47	20	44	0
28	40	6	51	11	61	13	78	30	82	44	89	54	88	61	80	53	76	45	66	30	46	23	44	—2
29	39	17	50	15	59	17	69	33	83	40	94	56	87	62	78	55	71	34	71	34	59	18	46	—5
30	41	7			68	18	68	37	80	39	90	52	86	56	80	48	74	34	72	33	60	20	38	10
31	38	—8			70	16			82	40			91	53	76	48			72	32			39	3

Inequality in the epoch of the annual fluctuation of the temperature.

A secular inequality in the law of the annual distribution of the temperature has lately been noticed by Mr. Kingston, director of the Toronto observatory, who stated that about the end of 1868, it was noticed that the normals given in General Sabine's paper (Phil. Trans. vol. 143, 1853), derived from 12 years of observations at Toronto, between 1841 and 1852, were wholly inapplicable to observations of recent years, and that a new set of normals had been prepared in consequence, using the records for ten years between 1859 and 1868 and Bessel's interpolation formula.

He further communicated two tables,[1] showing by five-year means that January was warmer than February in 1841–5, and has since become gradually colder, and that by forming two groups of years, whose centres were distant about 20 years, the temperature of winter and spring (1841–50) had now (1861–8) become lower, and the temperature of summer and autumn higher, and suggests an examination of the larger series of places in the United States with a view of learning whether the progressive change is general or confined to special localities.

In taking up the study of this subject the existence of such an inequality was confirmed for a number of places, and its geographical range and epochs were approximately determined. Selecting, from our general tables of monthly temperatures, such stations as appeared to me best suited for the purpose, on account of their location and length of record, the differences (J.—F.) of the monthly means of January and February, as well as the differences (J.—A.) of the monthly means of July and August, were formed for each year, and the results were united into means of five years:—

Table of differences (J.—F.): a + sign indicates February colder than January, a — sign the reverse.

Epochs.	Quebec, Can., and Windsor, N. S.	Brunswick, Me.	Montreal, Can.	Salem, Mass.	Cambridge, Mass.	New Haven, Conn.	Toronto, Can.	Philadelphia, Penn.	Charleston, S. C.	Savannah, Ga.	Marietta, Ohio.	Forts Snelling and Ridgeley, Minn.	Fort Leavenworth, Kan.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1781–85	..	..	..	..	..	—1.9	..	..	..	..	..	..	..
1786–90	..	..	..	+2.1	..	0.0	..	..	..	..	..	..	..
1791–95	..	..	..	—1.8	—0.8	—0.5	..	..	..	..	..	..	..
1796–1800	—1.8	..	..	—2.5	—1.6	—1.4	..	..	..	..	..	..	..
1801–05	—4.1	..	..	—2.3	—2.4	—2.2	..	..	..	..	..	..	..
1806–10	—2.3	—4.6	..	—3.4	—4.2	—4.5	..	—4.5	..	..	..	..	..
1811–15	—4.6	—4.0	..	—2.9	—5.4	—2.5	..	—2.0	..	..	..	..	..
1816–20	..	—2.9	..	—1.9	..	—1.2	..	—3.6	..	..	..	..	..
1821–25	..	—4.2	..	—2.7	..	—2.4	..	—2.7	..	..	—2.9	—3.3	..
1826–30	..	—3.5	..	—2.1	..	—2.8	..	—2.1	..	..	—4.0	—3.6	..
1831–35	..	—1.2	—3.2	..	..	—0.3	+1.6	—1.7	—3.1	—4.6	—3.0	—1.1	+0.3
1836–40	..	—2.8	—3.3	..	..	—1.3	+1.4	—0.1	..	—2.9	—1.1	—3.3	—3.2
1841–45	..	—0.1	+0.1	..	—0.7	+0.3	+2.6	[+2.1]	[+1.7]	[+0.3]	[+0.5]	[—1.7]	—0.2
1846–50	..	[+0.1]	[+1.2]	..	+[2.3]	[+1.6]	[+2.6]	+1.5	+0.5	+0.2	—0.1	—4.0	—3.3
1851–55	..	—4.9	..	..	..	—1.1	+0.8	—2.0	—4.2	—6.5	—3.8	—6.0	—6.6
1856–60	..	—5.8	..	..	..	—3.4	—0.4	—2.6	—5.1	..	—4.4	—3.9	—5.3
1861–65	..	..	..	..	..	—2.9	—1.6	—2.6	—3.7	..	..	—4.2	—5.6
1866–69	..	..	..	..	..	..	—2.1	—3.9	..	..	..	..	..

[1] Comparison of means of Jan. and Feb. in groups of five years, from observations at Toronto:—

1841–45	Jan. *warmer*	than	Feb.	2°.6		1856–60	Jan. *colder*	than	Feb.	0°.3
1846–50	"	"	"	2.6		1861–65	"	"	"	1.5
1851–55	"	"	"	0.9		1866–69	"	"	"	2.1

Comparison of seasons in two groups of years:—

	Winter.	Spring.	Summmer.	Autumn.
1841–50	25°.1	41°.0	64°.7	46°.4
1861–68	23.4	40.3	65.6	47.4
Difference	—1.7	—0.7	+0.9	+1.0

In General Sabine's paper, the coldest day is Feb. 14, the warmest July 28.
In 1849–68 " " " " Jan. 6, " " " 22.

(Letter to the Secretary of the Smithsonian Institution of Jan. 25, 1870.)

In a few instances the means are derived only from 3 or 4 years, and to complete the table means from a station adjacent to that heading the column were introduced; upon the whole, the table required the use of monthly records for an aggregate of 540 years. Notwithstanding the incidental irregularities in the successive values of this table, they appear to point conclusively to an epoch between 1841 and 1850 when the positive values reached a maximum, in other words, when the mean temperature of February was the lower (or when the lowest temperature of the year fell in that month). They also indicate, though with less certainty, a preceding epoch about the beginning of the century, when the coldest epoch of the year fell early in January, in which month it is again found at the present time. Such a shifting in the epoch of greatest annual cold can only be of a periodic nature, and we may, therefore, look forward in the course of a few years to a return motion.

To elucidate the point, whether the epoch of maximum annual heat was accompanied by a corresponding movement, a similar table was prepared containing the differences (J.—A.), a + sign indicating July warmer than August, a — sign would indicate the reverse. The successive annual values of which this table is made up were found to be much more irregular than the corresponding values for the cold period, though the individual differences are *smaller*, a fact which might have been anticipated from our knowledge of the greater variability of temperature in winter when compared with that of summer. The parallelism of the movement over large areas, also, is less distinctly pronounced in summer than in winter.

Table of differences (J.—A.) for supposed change in epoch of the greatest annual heat.

Epochs.	Quebec, Can., and Windsor, N. S.	Brunswick, Me.	Montreal, Can.	Salem, Mass.	Cambridge, Mass.	New Haven, Conn.	Toronto, Can.	Philadelphia, Penn.	Charleston, S. C.	Savannah, Ga.	Marietta, Ohio.	Forts Snelling and Ridgeley, Minn.	Fort Leavenworth, Kan.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1781–85	..	..	..	..	..	—0.2	..	..	..	..	..	..	..
1786–90	..	..	..	—1.7	..	+1.2	..	..	..	..	..	..	..
1791–95	..	..	..	0.0	+2.8	+0.6	..	..	..	..	..	..	.
1796–1800	+1.1	..	..	+1.9	+1.9	+1.3	..	..	..	..	..	..	.
1801–05	+0.1	..	..	+1.2	+1.8	+0.9	..	..	..	..	..	..	..
1806–10	+0.2	—0.5	..	+0.8	+1.2	+1.2	..	+0.6	..	..	..	..	..
1811–15	+1.8	+1.2	..	+2.5	—0.7	+1.4	..	+2.9	..	..	..	..	..
1816–20	+1.7	+1.8	..	+2.5	..	+2.5	..	+1.2	..	..	+1.7	..	..
1821–25	..	+2.8	..	+2.4	..	+2.2	..	+1.2	+0.9	..	..	+1.7	..
1826–30	..	+2.1	+1.2	+2.4	..	+0.6	..	+2.8	+0.7	..	+0.1	+4.0	..
1831–35	..	+1.7	+3.0	+2.2	..	+1.5	..	+2.3	+0.7	+0.6	+2.2	+4.0	+1.5
1836–40	..	+2.7	+4.3	..	..	+3.0	..	+2.9	..	+2.2	+2.0	+3.9	+2.0
1841–45	..	—0.4	—1.4	..	+1.5	+0.5	—0.5	+1.2	+1.8	+1.0	+2.0	+3.4	+3.5
1846–50	..	+1.4	+3.9	..	+2.8	+2.0	+0.6	+0.7	+0.8	—1.2	+1.2	+3.0	+2.0
1851–55	..	+4.1	..	..	..	+3.3	+1.4	+3.5	+0.6	+1.7	+2.3	+4.0	+1.1
1856–60	..	+2.9	..	..	..	+1.9	+1.6	+3.4	+0.5	..	+3.2	+5.7	+4.7
1861–65	..	..	..	..	..	+1.5	+0.1	0.0	+0.3	..	..	+3.1	+0.5
1866–69	..	..	..	..	..	..	+6.1	+4.6	..	..	..	..	..

There appears to be no regular progression in any of the figures of this table that could be ascribed as accompanying the singular anomaly of values between 1841–50, and even when means are taken for each five-year combination, the result remains inconclusive. If there is any variation in the epoch of maximum heat, it must be confined within much narrower limits than the variation in the epoch of maximum cold.

On the western coast the records of three stations were examined (San Diego, San Francisco, and Sitka), but, owing to the shortness of the record, only a glimpse of the existence of an inequality could be obtained with an indication of the occurrence of the extreme shift in winter later than in 1844.

Taking means of the values for the different stations, for winter and summer, we obtain the following results:—

Epochs.	Cold Season.		Warm Season.		Epochs.	Cold Season.		Warm Season.	
	No. of Stations.	Mean of Jan.—Feb.	No. of Stations.	Mean of July—Aug.		No. of Stations.	Mean of Jan.—Feb.	No. of Stations.	Mean of July—Aug.
		°		°			°		°
1786–90	2	+1.0	2	+1.5	1831–35	10	—1.6	10	+2.0
1791–95	3	—1.0	3	+1.1	1836–40	9	—1.8	8	+2.9
1796–1800	4	—1.8	4	+1.5	1841–45	10	[+0.6]	10	+1.1
1801–05	4	—2.7	4	+1.0	1846–50	10	0.0	10	+1.4
1806–10	6	[—3.9]	6	[+0.6]	1851–55	9	—3.4	9	+2.4
1811–15	6	—3.6	6	+1.5	1856–60	8	—3.9	8	+3.0
1816–20	4	—2.4	6	+1.9	1861–65	..	..	..	..
1821–25	6	—3.0	6	+1.9	1866–69	..	..	..	..
1826–30	6	—3.0	8	+1.8					

Extreme values are indicated by being contained within brackets, and they point approximately to the epochs 1809 and 1844, when the greatest cold fell on the average early in January and about the middle of February, respectively. Respecting the epoch of greatest heat, the figures leave us in no doubt, though the probability would seem to be in favor of a *corresponding* lateness about 1808 and an earlier occurrence in the position of the maximum at some rather undefined later epoch.

If the preceding result could be considered as well established, the cycle of the shifting of these dates of maximum cold (and heat) would be about twice 35 years.

Tables of observed extremes of temperature, for every month, for a series of years.

To complete our information respecting the annual fluctuation of the temperature, it is necessary to examine the extreme variations from the normal values; with this view the following table of monthly extremes has been prepared for a number of selected stations. They comprise nearly all the longer series, for which maxima and minima have been tabulated; the extreme values given are those found in the record, entered at the regular hours of observation, as adopted by the respective observers, the cases of maxima and minima thermometers being very restricted. They do not, therefore, exhibit the absolute extremes, but only approximations to them; besides, the intervals of time over which the series extend are far too restricted to entitle the extremes to be regarded as anything more than approximations. For the geographical position, and the actual duration of each series, after the deduction of breaks, the reader will have to consult the general tables of mean temperatures, given in Section I. Observations of a later date than 1870 are included in our table.

The tabular values are taken from a large manuscript collection, which embraces the observed monthly extremes for every year separately; in this form the table was found far too bulky to conform to the plan of this paper, and only an abstract of the manuscript is here presented.

The headings to the table give all the explanation needed. To render it easy to refer to the general tables for any further information, the table of extremes is arranged alphabetically, by States or Territories, and the stations in each are also given in alphabetical order.

TABLES OF OBSERVED EXTREMES OF TEMPERATURE

FOR EVERY MONTH, FROM A SERIES OF YEARS.

PRINCIPALLY FOR STATIONS WITHIN THE UNITED STATES.

ALL VALUES ARE EXPRESSED IN DEGREES OF THE FAHRENHEIT SCALE.

BRITISH NORTH AMERICA AND CANADA.

Name of Station.	Height.	Series. Begins.	Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
1. Caledonia Coal Mine, N. S.	60	Jan. 1867;	Dec. 1869	51	50	46	62	72	81
2. Chambly, C. E.	...	Jan. 1820;	Dec. 1826	49	51	61	75	91	89
3. Fort Simpson	300	June, 1848;	Apr. 1862	40	38	51	61	83	102
4. Halifax, N. S.	8	Jan. 1861;	Dec. 1869	54	53	56	70	79	92
5. Montreal, C. E.	60	Mar. 1845;	June, 1863	48	48	64	79	87	95
6. Peel River	...	Feb. 1863;	Dec. 1865	18	16	32	57	63	87
7. Rigolet, Lab.	...	July, 1860;	June, 1863	30	39	55	48	68	76
8. St. John, N. B.	135	Dec. 1863;	Dec. 1870	44	47	50	60	73	86
9. St. John's, N. F.	170	Jan. 1834;	Feb. 1869	49	51	55	61	66	80
10. Stanbridge, C. E.	222	Feb. 1860;	Dec. 1870	44	48	63	71	84	90
11. Toronto, C. W.	342	Jan. 1840;	Dec. 1870	55	52	67	90	82	93
12. Wolfville, N. S.	80	Jan. 1861;	Dec. 1870	55	54	57	79	83	92

ALABAMA.

1. Huntsville	600	Jan. 1831;	Dec. 1839	75	75	84	86	90	92
2. Mobile	15	Apr. 1840;	Sept. 1873	78	79	80	85	92	96
3. Mt. Vernon Arsenal	200	Jan. 1843;	June, 1874	80	84	90	95	102	100

ALASKA.

1. Fort Tongass	20	June, 1868;	Sept. 1870	47	45	59	60	70	75
2. Fort Wrangel	...	May, 1868;	Sept. 1870	42	54	54	69	78	86
3. Illoolook	...	July, 1829;	Mar. 1867	43	52	64	53	61	67
4. Sitka	20	Jan. 1833;	June, 1874	55	55	64	70	75	82

ARIZONA.

1. Camp Bowie	...	Aug. 1867;	June, 1874	68	74	87	87	100	105
2. Camp Colorado	...	Jan. 1869;	Dec. 1870	75	81	87	93	105	107
3. Camp Crittenden	...	Mar. 1866;	Dec. 1870	67	72	76	94	92	105
4. Camp Date Creek	3726	Aug. 1867;	Dec. 1870	73	84	86	92	101	108
5. Camp Goodwin	...	Jan. 1866;	May, 1870	74	83	86	96	100	106
6. Camp Grant	...	1861;	June, 1874	85	90	93	100	108	111
7. Camp Lowell Tucson	...	Nov. 1866;	Dec. 1870	76	82	93	98	102	111
8. Camp McDowell	...	Sept. 1866;	June, 1874	90	82	95	100	105	114
9. Camp Verde	...	Dec. 1868;	June, 1874	70	79	89	94	111	112
10. Camp Wallen	...	Nov. 1866;	Sept. 1869	68	73	79	87	89	102
11. Fort Buchanan	5330	Aug. 1857;	Dec. 1859	71	76	91	91	95	103
12. Fort Canby	6500	Dec. 1851;	Nov. 1863	63	61	76	80	89	98
13. Fort Mojavé	604	Jan. 1860;	June, 1864	78	83	92	100	110	117
14. Fort Whipple	5700	Jan. 1865;	June, 1874	82	78	76	94	98	110

ARKANSAS.

1. Fort Smith	460	Jan. 1840;	Mar. 1861	80	87	90	96	93	99
2. Little Rock	...	Jan. 1840;	Dec. 1867	71	78	80	84	87	95
3. Washington, near	660	Jan. 1840;	Sept. 1867	76	80	90	92	94	95

BRITISH NORTH AMERICA AND CANADA.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	°	°	°	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°	
1	89	85	78	75	63	55	1868	—10	—13	— 4	10	22	32	36	42	36	22	15	— 4	1868
2	92	90	90	80	63	54	1825	—36	—29	—12	13	30	58	62	55	30	23	— 5	—22	1822
3	104	80	70	68	30	46	1855	—53	—54	—46	—49	22	31	41	35	29	— 7	—54	—55	1851
4	87	89	82	75	67	54	1864	—15	—14	— 5	10	22	32	46	41	34	19	13	— 7	1866
5	101	94	93	81	64	51	1847	—20	—32	— 9	8	25	40	47	47	30	18	— 2	—18	1861
6	88	74	56	34	33	28	1864	—54	—55	—53	—20	— 3	28	35	30	19	—15	—51	—56	1865
7	88	86	72	56	50	28	1861	—31	—35	—21	—14	19	30	28	29	28	7	— 8	—24	1863
8	83	77	76	70	56	50	1866	—21	—11	— 3	10	29	39	45	46	36	22	10	—14	1866
9	86	81	77	71	61	47	1861[1]	—11	—14	—15	12	18	27	30	33	30	21	12	2	1863
10	95	90	85	83	69	52	1868	—33	—36	—34	11	25	38	52	45	32	16	2	—19	1865
11	98	99	94	76	64	55	1854	—27	—25	—16	6	13	28	39	40	28	16	— 4	—15	1859
12	88	82	82	82	67	63	1866	— 9	—13	— 3	12	26	41	55	49	39	26	17	— 7	1861

ALABAMA.

1	95	96	91	86	78	68	1838	— 9	— 7	11	31	40	50	51	54	39	29	13	— 7	1836[2]
2	98	96	96	94	85	76	1873	19	33	31	44	55	51	68	70	60	42	36	27	1873
3	100	104	98	96	88	84	1860	9	13	23	33	48	58	61	57	46	32	24	14	1852

ALASKA.

1	92	81	67	58	51	46	1870	6	23	— 2	33	38	43	52	47	38	37	32	24	1870
2	78	80	68	58	48	42	1868	0	16	—10	32	36	38	47	47	38	32	28	20	1870
3	76	77	59	55	55	47	1832[3]	3	— 1	0	16	27	34	39	38	26	21	6	5	1830
4	82	80	70	62	57	53	1833[4]	— 4	2	9	19	28	30	34	30	28	19	4	2	1874

ARIZONA.

1	103	97	99	96	85	80	1873	0	20	32	32	47	55	62	57	56	31	22	20	1873
2	106	108	104	101	90	68	1869	30	33	31	49	54	61	80	74	63	52	43	31	1869
3	105	94	92	89	76	69	1868	25	23	29	40	49	56	61	59	57	39	27	17	1869
4	111	105	106	97	86	84	1870	20	22	25	38	45	48	65	58	52	32	27	16	1869
5	111	102	98	98	83	72	1869	10	20	30	34	54	59	71	70	50	34	27	14	1866
6	116	106	106	100	98	88	1871	19	16	27	24	30	50	58	55	53	35	26	21	1874
7	112	102	101	96	98	78	1869	22	22	27	36	52	53	72	70	62	40	31	20	1869
8	114	108	110	108	99	89	1869[5]	16	18	30	29	43	49	62	65	51	20	17	21	1874
9	113	105	101	99	89	75	1873	5	12	19	27	34	43	48	50	36	16	6	6	1874
10	100	91	94	90	82	76	1867	23	3	30	36	49	50	64	61	52	35	17	16	1867
11	102	98	95	93	75	78	1858	14	24	13	28	42	57	60	56	55	28	24	15	1858
12	99	96	87	79	72	65	1855	—20	—12	— 1	12	19	30	36	43	30	17	0	—25	1855
13	118	116	109	105	90	81	1870[6]	21	14	36	40	47	39	47	52	45	27	20	23	1873
14	105	91	92	93	88	83	1865	—10	10	11	13	31	36	31	48	32	12	— 1	— 9	1866

ARKANSAS.

1	105	102	101	91	87	76	1860	2	— 4	— 3	24	37	47	54	49	32	26	6	0	1840
2	94	96	88	90	76	86	1840	16	17	12	40	50	58	64	65	51	36	19	23	1867
3	108	102	98	90	82	78	1860	3	6	6	24	38	48	54	52	36	24	15	— 6	1845

[1] Also in 1834. [2] Also in 1832. [3] Also in 1830.
[4] Also in 1870. [5] Also in 1874. [6] Also in 1873.

CALIFORNIA.

Name of Station.	Height.	Series. Begins.	Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
1. Alcatraz Island	...	Feb. 1860;	June, 1874	78°	70°	78°	82°	86°	88°
2. Angel Island	30	Dec. 1867;	June, 1874	72	75	76	83	93	88
3. Benicia Barracks	64	Nov. 1849;	June, 1874	70	78	82	98	95	103
4. Camp Bidwell	4680	Nov. 1863;	June, 1874	72	77	82	85	90	97
5. Camp Cady	3000	Jan. 1868;	Dec. 1870	71	76	90	98	104	114
6. Camp Gaston	...	Sept. 1861;	June, 1874	66	69	83	89	103	108
7. Camp Independence	4800	Nov. 1862;	June, 1874	73	78	86	95	95	105
8. Camp Lincoln	...	Sept. 1866;	May, 1869	62	70	70	77	86	75
9. Camp Wright	...	July, 1864;	June, 1874	77	81	89	91	102	108
10. Drum Barracks	32	May, 1864;	Nov. 1870	81	80	85	95	101	99
11. Fort Bragg	...	Dec. 1860;	Sept. 1864	64	65	70	75	72	72
12. Fort Crook	3390	Jan. 1858;	Apr. 1869	53	68	76	84	89	99
13. Fort Humboldt	50	Jan. 1854;	Dec. 1869	66	70	72	75	73	78
14. Fort Jones	2570	Jan. 1853;	June, 1858	60	70	82	92	98	99
15. Fort Miller	402	Aug. 1851;	Aug. 1864	70	74	88	101	113	121
16. Fort Point	27	Jan. 1860;	Dec. 1870	65	74	70	77	83	76
17. Fort Reading	674	Apr. 1852;	Mar. 1856	72	80	89	89	95	106
18. Fort Tijon	3240	Mar. 1855;	Aug. 1864	72	73	83	84	90	100
19. Fort Ter-Waw	...	Apr. 1859;	Oct. 1861	58	67	80	82	78	84
20. Fort Yuma	200	Dec. 1850;	June, 1874	83	86	94	106	108	117
21. Monterey	40	May, 1847;	Dec. 1869	76	74	86	85	85	92
22. Point San José	...	Mar. 1866;	June, 1874	65	75	78	90	81	87
23. Presidio	150	Oct. 1847;	June, 1874	72	74	82	82	86	89
24. Sacramento	52	July, 1849;	Dec. 1866	63	73	89	94	91	101
25. San Diego	150	July, 1849;	Apr. 1866	80	83	90	93	96	102
26. Union Ranche	...	Jan. 1861;	Dec. 1862	64	70	80	87	92	102
27. Yerba Buena Island	...	Feb. 1869;	Oct. 1873	70	74	83	80	88	90

COLORADO.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Garland	8365	Sept. 1852;	June, 1874	59	64	70	80	93	93
2. Fort Lyon	4000	Jan. 1861;	June, 1874	72	75	81	98	98	107

CONNECTICUT.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Colebrook	1210	Jan. 1861;	Nov. 1870	53	56	72	81	87	91
2. Columbia	...	Jan. 1861;	Dec. 1870	70	64	78	82	92	96
3. Fort Trumbull	23	Jan. 1827;	June, 1874	62	61	69	82	92	93
4. Middletown	175	Jan. 1860;	Dec. 1870	56	63	78	85	86	95
5. New Haven	45	July, 1778;	Oct. 1865	64	68	76	85	93	102
6. Pomfret	587	Jan. 1861;	Dec. 1868	56	57	69	80	87	89

DAKOTA.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Abercrombie	...	Feb. 1859;	June, 1874	43	44	58	83	102	99
2. Fort Buford	1900	Sept. 1866;	June, 1874	52	51	78	88	99	106
3. Fort Randall	1245	Jan. 1860;	June, 1874	65	68	79	95	101	105
4. Fort Ransom	..	Dec. 1868;	Dec. 1870	34	39	63	82	85	97
5. Fort Sully	...	Jan. 1866;	June, 1874	61	64	71	98	101	108
6. Fort Wadsworth	...	Sept. 1866;	June, 1874	40	42	54	84	93	96

DELAWARE.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Delaware	10	Jan. 1826;	Sept. 1870	62	65	80	85	91	97

[1] Also in 1874. [2] Also in 1870. [3] Also in 1873. [4] Also in 1857.

CALIFORNIA.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1	69°	75°	90°	89°	84°	87°	1872	37°	42°	39°	20°	43°	46°	46°	48°	48°	45°	43°	38°	1870
2	93	85	88	85	74	71	1870[1]	34	34	35	37	45	46	37	49	48	44	38	36	1873[1]
3	102	105	97	96	84	68	1857	19	21	26	36	40	47	47	46	46	44	27	25	1854
4	96	99	90	79	82	61	1870	—18	—18	0	9	22	31	39	38	24	12	9	—10	1868
5	118	112	109	101	80	77	1868	15	22	30	40	51	56	72	68	52	34	28	12	1869
6	110	114	100	92	77	70	1870	23	25	23	31	39	45	47	48	41	30	21	19	1872
7	107	107	100	90	80	73	1867[2]	13	1	14	21	29	38	48	31	37	21	12	— 2	1873
8	88	82	94	93	71	68	1867	27	30	30	35	38	44	48	49	42	39	35	33	1868
9	110	110	108	103	86	76	1870[3]	18	15	16	26	33	32	35	39	34	25	18	16	1867
10	98	102	97	100	103	86	1869	35	31	33	45	49	55	58	55	50	43	35	28	1869
11	78	78	75	72	70	66	1863	29	18	31	31	39	45	46	44	42	39	31	30	1861
12	103	100	96	85	71	60	1858	—20	4	2	18	31	40	48	46	30	20	10	0	1859
13	80	73	78	89	75	66	1862	16	29	30	29	32	40	41	46	42	33	30	20	1854
14	103	106	91	88	72	60	1856	—17	11	20	27	25	32	42	41	18	24	16	—17	1855[4]
15	118	113	114	98	88	72	1853	23	32	29	38	41	51	59	54	50	41	28	28	1854
16	80	74	82	82	72	68	1865	31	35	36	44	46	50	50	50	50	47	40	36	1862
17	110	107	108	98	87	71	1854	15	30	29	36	44	51	53	51	39	35	31	11	1855
18	97	98	98	89	76	68	1859	24	28	28	30	30	46	57	56	48	29	27	22	1855
19	73	88	91	80	68	62	1860	31	31	32	35	41	48	48	52	46	41	31	30	1359[5]
20	116	115	111	105	88	84	1859	26	19	32	46	46	59	70	60	59	35	34	15	1850
21	92	86	95	90	82	75	1867	30	29	32	38	40	45	46	44	43	36	33	27	1869
22	87	80	80	90	71	71	1871[6]	23	32	35	36	34	34	39	32	34	30	33	29	1871
23	95	84	91	92	78	70	1872	27	33	35	38	40	40	46	41	47	45	39	34	1854
24	102	102	100	94	74	68	1849[7]	29	31	35	43	41	55	52	50	45	44	34	28	1849
25	99	99	101	103	84	78	1859	27	27	31	40	39	48	56	56	62	38	34	26	1854
26	109	104	101	90	77	64	1861	20	30	32	37	44	54	63	60	58	41	34	30	1862
27	90	78	90	92	73	66	1870	38	40	40	40	42	46	48	50	50	44	41	34	1872

COLORADO.

1	97	96	89	80	76	70	1871	—40	—23	— 1	0	14	30	35	39	24	3	—35	—30	1873
2	108	108	99	92	82	73	1868[8]	—25	—22	— 7	11	22	34	41	40	29	13	— 3	—23	1870

CONNECTICUT.

1	94	92	87	84	71	59	1868	—25	—28	—10	15	25	46	52	47	31	20	9	—11	1861
2	100	96	94	88	80	78	1866	—20	—18	— 6	23	35	46	53	48	34	22	16	— 6	1866
3	98	94	90	77	67	60	1872	—15	— 8	— 3	15	25	33	44	44	32	24	11	— 7	1866
4	95	97	89	85	75	61	1870	—14	—17	— 4	19	32	46	51	48	33	23	14	—18	1860
5	101	98	92	83	74	68	1864	—24	—16	— 9	11	27	35	44	39	27	19	2	—11	1835
6	91	90	84	81	69	55	1866	—19	—20	— 3	10	30	45	51	50	37	21	14	— 5	1861

DAKOTA.

1	104	102	94	82	78	50	1871	—35	—40	—40	— 7	19	35	34	32	20	7	—22	—32	1861[8]
2	106	102	99	96	78	60	1868[2]	—38	—36	—40	5	15	32	37	29	8	4	—33	—35	1867
3	107	108	106	92	80	67	1863	—32	—30	—19	0	10	37	42	34	19	2	—14	—30	1873
4	103	102	87	81	70	54	1869	—25	—29	—24	11	37	42	45	39	32	2	— 7	—24	1870
5	114	107	101	93	80	64	1871	—30	—26	—12	0	19	37	42	36	24	— 3	—12	—27	1871
6	102	100	93	85	74	55	1871	—32	—32	—24	4	28	37	43	40	22	— 9	—24	—35	1872

DELAWARE.

1	101	101	90	88	75	65	1865	— 5	0	5	24	38	49	53	51	47	32	20	9	1866

[5] Also in 1860. [6] Also in 1872. [7] Also in 1863. [8] Also in 1869.

DISTRICT OF COLUMBIA.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Highest Temperature					
				Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
1. Washington	110	Jan. 1822;	Dec. 1870	74	72	84	91	96	99

FLORIDA.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Barrancas	20	Jan. 1822;	June, 1874	78	78	86	85	93	104
2. Fort Brooke	20	Jan. 1825;	July, 1869	88	89	88	91	92	96
3. Fort Dallas	20	Apr. 1850;	May, 1858	89	83	85	86	90	88
4. Fort Jefferson	11	Feb. 1861;	Nov. 1873	85	84	88	91	95	95
5. Fort King	50	Jan. 1833;	Feb. 1843	85	86	93	94	98	106
6. Fort Marion	25	Jan. 1825;	May, 1866	84	86	88	92	97	103
7. Fort Meade	80	May, 1851;	Nov. 1854	81	87	88	92	95	96
8. Fort Myers	50	Jan. 1851;	June, 1858	84	86	90	94	94	98
9. Fort Pierce	30	Oct. 1851;	May, 1858	83	87	89	90	98	96
10. Indian Key	...	Jan. 1836;	Dec. 1838	81	85	83	86	88	88
11. Key West	10	Jan. 1831;	June, 1874	88	88	90	91	95	97

GEORGIA.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Atlanta	1050	July, 1870;	June, 1874	72	75	79	89	94	95
2. Augusta Arsenal	350	Jan. 1826;	June, 1874	77	97	86	94	96	100
3. Oglethorpe Barracks	40	Jan. 1834;	Mar. 1870	80	87	86	93	96	102
4. Savannah	42	June, 1837;	June, 1874	78	85	88	94	97	102

IDAHO.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Boisé	...	Feb. 1864;	June, 1874	60	69	83	83	95	106
2. Fort Hall	...	Jan. 1871;	June, 1874	54	53	70	78	92	99
3. Fort Lapwai	...	Jan. 1864;	June, 1874	65	61	69	85	101	105

ILLINOIS.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Augusta	500	Jan. 1861;	Dec. 1870	66	69	79	83	87	99
2. Chicago	600	Jan. 1833;	Dec. 1870	64	64	84	84	98	102
3. Fort Armstrong	528	Jan. 1827;	Dec. 1835	64	60	74	87	96	96
4. Galesburg	795	Jan. 1862;	Dec. 1870	67	63	79	85	87	96
5. Highland	620	Jan. 1841;	Dec. 1852	68	74	82	88	94	100
6. Manchester	683	Jan. 1860;	Dec. 1870	68	70	80	86	92	99
7. Pleasant Ridge Nursery	550	Jan. 1864;	Dec. 1869	60	62	77	86	92	99
8. Rock Island Arsenal	528	Feb. 1866;	June, 1874	64	66	75	89	94	102
9. Sandwich	575	Jan. 1860;	Dec. 1869	65	68	74	86	90	96
10. Springfield	550	Jan. 1865;	Dec. 1869	52	70	75	88	92	94
11. Winnebago	900	Jan. 1860;	Dec. 1870	48	58	73	85	91	99

INDIANA.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. New Harmony	350	Jan. 1860;	Dec. 1870	68	66	78	86	91	96
2. Spiceland	1025	Jan. 1864;	Dec. 1870	64	66	74	84	94	97
3. Vevay	525	Jan. 1865;	Dec. 1870	69	70	82	97	98	100

DISTRICT OF COLUMBIA.

	DURING EACH MONTH.							LOWEST TEMPERATURE DURING EACH MONTH.												
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	103°	101°	95°	90°	75°	72°	1838	—14°	— 5°	— 5°	24°	33°	45°	50°	49°	33°	22°	12°	—10°	1835

FLORIDA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	100	102	98	92	86	87	1854	10	11	28	30	36	51	67	58	47	28	19	15	1852
2	94	98	94	90	88	86	1848	26	30	34	40	52	59	64	55	59	45	29	28	1857[1]
3	92	95	93	87	88	87	1850	30	35	42	50	63	68	71	73	72	55	50	35	1857
4	97	98	100	90	89	85	1871	48	55	50	58	59	72	70	72	71	65	56	42	1868
5	103	106	100	99	88	88	1833	23	11	27	44	44	60	64	55	54	31	28	27	1835
6	96	96	93	89	86	82	1837	21	26	32	30	48	58	70	65	57	43	33	23	1831
7	95	96	93	90	86	83	1851[2]	24	34	39	44	56	65	68	68	58	49	36	30	1852
8	95	95	99	93	89	85	1856	31	33	38	49	61	69	71	73	66	52	42	32	1852
9	97	95	95	89	86	88	1852	29	30	38	48	64	70	67	70	70	46	40	29	1851[3]
10	88	89	88	87	84	82	1836	49	47	56	62	64	71	73	72	73	62	58	54	1836
11	96	98	98	93	89	86	1861[4]	44	45	49	50	60	63	72	73	66	65	52	48	1857

GEORGIA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	96	97	96	92	81	78	1873	3	15	12	33	44	59	65	56	46	21	10	6	1873
2	103	100	98	92	80	79	1845	8	— 2	15	33	46	56	56	58	43	26	11	10	1835
3	99	96	99	89	82	78	1845	22	16	28	38	52	54	64	59	48	32	31	20	1835
4	100	98	97	88	81	80	1839[5]	18	32	27	41	53	60	68	69	49	36	27	15	1870[5]

IDAHO.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	113	121	97	95	75	67	1871	— 9	—10	5	27	35	41	50	47	31	20	7	—14	1865
2	102	101	97	90	68	60	1871	—12	—11	— 1	12	25	33	40	30	18	7	—12	— 6	1872[6]
3	110	103	95	86	72	64	1864	— 3	0	1	24	29	38	39	40	20	17	0	—15	1865

ILLINOIS.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	96	97	100	87	75	70	1864	—26	—17	— 5	23	35	49	55	50	34	16	—12	—19	1864
2	106	102	97	90	74	78	1868	—25	—22	—12	13	29	38	46	42	30	16	— 4	—20	1864
3	98	95	90	88	74	68	1830	—24	—24	—14	20	38	46	50	51	36	20	0	—16	183c[7]
4	96	95	94	86	69	69	1868[4]	—29	—22	— 7	20	32	38	41	39	33	14	— 6	—22	1864
5	100	99	100	87	80	68	1841[8]	—15	— 4	2	20	34	38	48	47	34	17	3	— 7	1852
6	101	101	102	90	78	69	1864	—24	—14	— 3	20	33	48	53	44	34	11	0	—15	1864
7	102	94	94	80	70	58	1868	—24	—19	— 7	18	34	42	50	48	33	17	3	—14	1864
8	100	102	94	87	68	66	1870[6]	—29	—21	—14	16	34	39	51	38	31	12	— 7	—26	1873
9	97	98	98	85	70	64	1860[9]	—26	—25	— 8	16	29	43	50	46	32	12	— 3	—22	1860[10]
10	103	98	95	84	80	64	1868	— 9	—12	— 2	26	34	46	56	51	40	20	2	—18	1868
11	97	95	90	85	68	60	1870	—28	—26	— 9	14	30	45	50	46	31	15	— 6	—20	1864

INDIANA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	99	99	93	86	75	70	1868	—15	— 2	7	28	34	48	56	48	38	20	10	— 2	1864
2	100	97	94	82	71	61	1864	—19	—21	0	25	34	49	55	48	39	15	4	—11	1866
3	100	98	99	96	78	76	1865[11]	— 4	—10	6	23	35	50	58	50	42	21	10	— 9	1867

1 Also in 1827. 2 Also in 1852. 3 Also in 1857. 4 Also in 1870.
5 Also in 1845. 6 Also in 1873. 7 Also in 1835. 8 Also in 1843.
9 Also in 1861. 10 Also in 1864. 11 Also in 1865 and 1866.

INDIAN TERRITORY.

Name of Station.	Height.	Series. Begins.	Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
1. Fort Arbuckle	1000	Oct. 1850;	Aug. 1870	75	84	94	92	100	100
2. Fort Gibson	560	Jan. 1828;	June, 1874	83	80	95	95	99	103
3. Fort Sill	...	July, 1870;	June, 1874	77	80	90	97	98	103
4. Fort Towson	300	Jan. 1833;	Apr. 1854	78	82	89	92	99	98
5. Fort Washita	645	Jan. 1843;	Mar. 1861	79	86	92	94	95	99

IOWA.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Algona	1500	Jan. 1862;	Dec. 1870	44	48	68	80	92	98
2. Brookside	...	Jan. 1864;	Dec. 1868	48	55	76	88	93	100
3. Davenport	737	Jan. 1862;	Dec. 1869	53	60	71	81	86	90
4. Bubuque	680	Jan. 1860;	Dec. 1870	51	71	74	84	91	102
5. Fort Atkinson	700	Jan. 1842;	May, 1846	53	53	82	88	84	90
6. Fort Dodge	944	Aug. 1851;	Dec. 1868	52	55	74	71	89	98
7. Fort Madison, near	600	Jan. 1860;	Dec. 1870	60	68	76	85	91	100
8. Guttenberg	690	Jan. 1867;	Dec. 1870	46	56	74	88	91	103
9. Independence	850	Jan. 1864;	Dec. 1870	49	53	63	87	91	102
10. Iowa City	621	Jan. 1861;	Dec. 1870	55	68	72	90	90	99
11. Monticello	880	Jan. 1866;	Dec. 1870	45	61	77	89	90	102
12. Mount Vernon	...	Jan. 1864;	Dec. 1870	45	60	75	90	93	98
13. Muscatine	586	Jan. 1839;	Dec. 1865	60	71	84	86	90	96
14. Spring Grove	...	Jan. 1864;	Dec. 1869	45	50	66	80	87	90
15. Vawter's Grove	1500	Jan. 1867;	Dec. 1870	48	58	82	87	91	97
16. Waterloo	666	Jan. 1865;	Dec. 1869	46	52	77	82	87	96

KANSAS.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Atchison	1000	Jan. 1867;	Dec. 1870	58	68	70	90	90	101
2. Baxter Springs	...	Jan. 1868;	Dec. 1870	68	78	84	86	96	103
3. Council Grove	1480	Jan. 1866;	Dec. 1870	62	75	92	89	91	100
4. Fort Atkinson	2330	Nov. 1850;	Sept. 1853	68	69	85	88	92	93
5. Fort Dodge	...	Nov. 1867;	Feb. 1871	71	82	86	91	90	101
6. Fort Hays	2107	Aug. 1867;	June, 1874	80	74	86	92	91	106
7. Fort Larned	1932	Sept. 1860;	June, 1874	67	81	86	96	99	105
8. Fort Leavenworth	896	Jan. 1831;	June, 1874	69	78	89	102	94	103
9. Fort Riley	1300	Nov. 1853;	June, 1874	69	77	88	95	99	104
10. Fort Scott	1000	Jan. 1843;	Mar. 1853	75	77	87	87	90	92
11. Holton	1172	Jan. 1868;	Dec. 1870	60	67	91	91	91	106
12. Lawrence	850	Jan. 1868;	Dec. 1870	64	72	93	89	91	101
13. Leavenworth City	896	Jan. 1861;	Dec. 1870	65	70	95	90	98	102
14. Manhattan	1000	Jan. 1861;	Dec. 1870	61	70	87	93	93	102
15. Olatha	...	Jan. 1866;	Dec. 1870	60	70	91	89	97	100

KENTUCKY.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Chilesburg	900	Jan. 1867;	Dec. 1870	62	66	76	82	90	92
2. Newport Barracks	500	July, 1847;	June, 1874	70	69	80	89	90	96

LOUISIANA.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Baton Rouge	41	Jan. 1822;	June, 1874	82	90	92	96	99	98
2. Fort Jesup	80	Jan. 1823;	Dec. 1845	84	86	90	98	98	98
3. Fort Wood	20	Jan. 1833;	Apr. 1846	81	78	84	88	95	98
4. Fort Pike	10	Jan. 1827;	Apr. 1870	80	86	87	94	93	96
5. New Orleans	25	Jan. 1820;	Dec. 1870	82	84	90	91	96	98

[1] Also in 1857. [2] Also in 1838, 1841, 1845. [3] Also in 1856. [4] Also in 1843. [5] Also in 1869.

INDIAN TERRITORY.

	… during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	°	°	°	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°	
1	109	107	99	94	83	75	1856	—4	—4	12	25	35	51	54	56	38	26	12	—1	1856[1]
2	106	116	103	95	86	91	1834	—20	—12	7	28	32	50	54	37	30	18	0	—8	1857
3	109	109	103	96	84	75	1871	—20	5	20	27	39	54	50	59	46	21	8	—11	1873
4	102	101	100	88	82	78	1845	0	0	10	30	38	52	54	56	35	24	10	0	1835[2]
5	106	106	100	92	84	78	1845[3]	—4	—1	10	28	38	52	61	58	42	29	17	1	1857

IOWA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	97	96	89	86	72	58	1864	—29	—26	—25	13	30	45	55	43	30	10	—6	—18	1862
2	105	98	97	86	68	51	1868	—26	—35	—11	10	33	47	50	44	29	10	—1	—27	1868
3	95	91	88	82	69	56	1868	—22	—24	—8	19	32	32	51	51	35	19	3	—17	1868
4	100	98	91	85	67	58	1870	—29	—20	—7	13	36	50	53	46	34	19	—6	—23	1864
5	99	92	92	84	78	46	1844	—19	—22	—16	4	29	40	44	44	22	2	—12	—22	1842[4]
6	99	93	90	82	70	58	1868	—28	—25	—19	16	31	51	57	50	34	18	—1	—18	1852
7	105	103	97	85	72	66	1870	—33	—20	—12	18	33	44	40	41	29	16	—2	—20	1864
8	99	99	87	82	68	52	1870	—30	—37	—20	16	27	41	50	42	26	8	—4	—22	1868
9	99	97	88	81	69	52	1870	—30	—21	—16	17	34	47	58	48	34	12	—5	—16	1864
10	100	99	92	86	72	62	1870	—26	—25	—13	20	31	42	46	43	33	16	0	—17	1864
11	101	98	90	82	68	55	1870	—22	—30	—10	22	33	35	59	48	34	16	3	—18	1868
12	99	95	90	80	76	53	1868	—24	—20	—15	11	30	43	52	49	30	16	—1	—18	1864
13	98	101	96	87	75	70	1861	—26	—25	—10	5	23	33	42	36	30	8	—11	—22	1860
14	92	94	86	78	68	47	1867[5]	—29	—14	—19	10	30	34	50	42	30	19	—5	—13	1864
15	103	97	89	81	71	58	1868	—18	—16	—12	17	36	49	33	47	33	13	—2	—21	1868
16	100	96	88	80	68	48	1868	—18	—28	—20	15	32	46	50	40	30	14	0	—19	1868

KANSAS.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	100	101	96	90	76	62	1870	—6	—6	—14	23	34	52	61	53	39	12	4	—7	1867
2	106	100	95	86	79	70	1868	—2	—7	6	32	46	54	70	62	46	24	22	—10	1870
3	106	102	96	93	78	67	1868	—12	—6	—17	24	36	50	58	48	33	24	6	—15	1867
4	96	102	94	86	68	60	1853	—6	2	9	22	43	45	64	56	40	30	10	—12	1850
5	103	102	93	90	82	69	1868	—5	—1	4	31	42	52	60	50	38	10	6	—10	1869[6]
6	110	104	102	97	96	82	1868	—15	—15	4	23	30	49	57	46	30	5	—7	—15	1872[7]
7	115	105	104	98	82	79	1871	—22	—9	4	11	31	49	54	47	34	11	1	—13	1861
8	105	105	104	93	78	71	1860[8]	—30	—26	—9	13	21	43	50	48	30	11	—14	—19	1834
9	111	108	108	97	81	71	1860	—29	—18	—20	10	34	45	50	48	28	9	—6	—16	1862
10	98	104	98	95	80	69	1850	—9	—12	—10	22	31	46	47	48	31	21	—10	—14	1848
11	111	102	93	83	77	66	1868	—11	—10	—2	22	40	52	61	52	32	11	14	—19	1868
12	101	98	93	82	73	64	1868[6]	—7	—5	—1	18	35	37	47	53	29	15	17	—16	1868
13	109	103	97	90	80	69	1868	—12	—16	—18	19	30	42	55	41	26	12	5	—19	1868
14	103	101	97	94	96	68	1862	—12	—9	—9	19	41	46	56	52	34	14	7	—16	1868
15	108	102	94	89	77	66	1868	—12	—14	—8	22	37	51	60	51	30	21	4	—20	1868

KENTUCKY.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	98	96	96	88	74	66	....	—2	—2	8	22	40	48	54	50	36	17	10	—6	1870
2	98	96	96	85	78	70	....	—15	—20	3	21	31	46	55	47	38	23	4	—8	....

LOUISIANA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	99	102	97	91	90	82	1860	8	10	26	34	49	57	63	63	47	32	26	18	1852
2	101	100	100	91	88	86	1824	11	7	16	34	44	54	50	58	36	23	17	14	1823[9]
3	98	100	97	90	86	76	1835[10]	30	14	28	46	62	62	68	69	51	43	31	30	1835
4	98	100	94	89	83	82	1870	21	23	26	42	54	64	70	66	48	38	30	22	1832
5	100	100	94	96	90	86	1840[11]	17	26	29	38	48	58	70	70	62	40	29	19	1852

[6] Also in 1870. [7] Also in 1873. [8] Also in 1834. [9] Also in 1838. [10] Also in 1845. [11] Also in 1841.

MAINE.

Name of Station.	Height.	Series. Begins.	Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
1. Brunswick	74	Jan. 1807;	Nov. 1859	56°	61°	76°	85°	98°	98°
2. Castine	50	Jan. 1810;	Dec. 1849	52	55	64	74	90	90
3. Fort Preble	31	Jan. 1822;	June, 1874	51	52	63	90	92	92
4. Fort Sullivan	70	Jan. 1822;	Sept. 1873	54	60	60	82	90	92
5. Gardiner	76	Jan. 1837;	Dec. 1870	52	55	65	86	90	94
6. Hancock Barracks	620	Jan. 1829;	Aug. 1845	57	58	86	85	91	98
7. Portland	50	Dec. 1815;	Dec. 1852	50	49	63	80	93	92

MARYLAND.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Annapolis	20	Jan. 1861;	Dec. 1870	69	67	79	84	90	100
2. Baltimore	80	Jan. 1817;	Oct. 1853	68	73	77	88	90	97
3. Fort Foote	...	July, 1871;	June, 1874	68	72	69	87	90	97
4. Fort McHenry	36	Jan. 1831;	June, 1874	66	74	76	89	93	100
5. Fort Severn	20	Jan. 1822;	July, 1845	68	72	76	88	90	96
6. Fort Washington	60	Jan. 1833;	Sept. 1870	68	70	79	93	97	105
7. Mount Saint Mary's College	498	Jan. 1867;	Dec. 1870	60	64	66	83	84	92

MASSACHUSETTS.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Amherst	267	Sept. 1837;	Dec. 1870	56	56	73	84	88	94
2. Fort Independence	50	Jan. 1831;	June, 1874	56	65	66	82	90	99
3. Fort Warren	...	Oct. 1862;	June, 1874	56	58	61	76	94	92
4. Lawrence	143	Jan. 1861;	Dec. 1869	48	58	69	82	87	91
5. Lunenburg	450	Jan. 1847;	Dec. 1870	59	60	70	82	88	97
6. Mendon	...	Jan. 1860;	Dec. 1870	58	56	74	80	90	94
7. Nantucket	30	Jan. 1847;	Dec. 1860	54	57	58	63	81	92
8. New Bedford	90	Oct. 1812;	Dec. 1870	64	63	73	80	90	95
9. North Billerica	135	Jan. 1867;	Dec. 1870	59	56	58	80	87	95
10. Topsfield	...	Jan. 1861;	Dec. 1869	51	66	72	81	87	93
11. Watertown Arsenal	100	Jan. 1837;	Nov. 1844	55	64	66	85	92	95
12. Williamstown	686	Jan. 1816;	Dec. 1870	61	61	71	87	95	95
13. Worcester	528	Jan. 1861;	Dec. 1870	55	58	71	79	85	92

MICHIGAN.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Detroit	597	Jan. 1840;	June, 1874	63	64	78	90	94	95
2. Fort Brady	600	Jan. 1823;	June, 1874	52	62	72	80	92	96
3. Fort Gratiot	598	Jan. 1831;	May, 1852	60	63	75	94	93	95
4. Fort Mackinac	728	Jan. 1826;	Apr. 1860	50	46	63	80	76	90
5. Grand Haven	588	Aug. 1859;	July, 1863	65	52	63	76	88	88
6. Lansing	895	Jan. 1864;	Dec. 1869	55	60	68	78	84	95
7. Marquette	710	July, 1859;	Dec. 1867	51	53	63	74	93	101
8. Monroe	551	July, 1859;	Dec. 1869	73	69	75	78	92	101
9. Ontonagon	620	Aug. 1859;	Dec. 1870	45	48	61	79	94	97
10. Tawas City	583	Jan. 1859;	Dec. 1867	50	57	56	61	81	90
11. Thunderbay Island	610	Jan. 1859;	Dec. 1870	47	47	51	62	76	90

MAINE.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	°	°	°	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°	
1	102	98	96	88	72	61	1808	—32	—28	—19	10	21	27	27	35	23	9	— 3	—22	1859
2	94	93	86	78	65	58	1849	—20	—21	—13	10	25	34	41	43	30	19	2	—16	1824
3	96	96	88	74	70	58	1822[1]	—16	—12	— 5	13	31	33	45	45	32	21	1	—10	1830
4	98	91	85	87	66	56	1826	—24	—20	—15	12	30	35	42	45	33	24	— 5	—20	1826
5	96	94	89	77	72	58	1841	—31	—25	—20	5	15	33	44	42	28	16	3	—24	1844
6	99	97	90	81	73	55	1836	—24	—23	—15	2	16	32	42	34	27	16	— 6	—23	1829[2]
7	96	90	94	77	70	56	1846[3]	—19	—24	—13	13	24	34	45	42	31	18	— 2	—13	1826

MARYLAND.

1	98	95	92	86	74	69	1864	— 5	— 1	6	26	39	56	58	54	42	31	21	6	1866[4]
2	98	98	98	85	76	76	1819[5]	— 9	— 4	9	18	35	41	52	48	36	26	12	4	1852
3	100	95	94	76	67	67	1872	— 5	— 2	4	23	38	44	55	55	37	26	15	— 2	1873
4	100	100	94	89	78	73	1834[6]	—15	— 4	0	20	31	45	54	50	38	25	11	— 1	1873
5	96	99	92	80	72	60	1834	1	8	9	27	42	46	62	58	45	34	19	2	1832
6	102	100	99	92	76	64	1853	— 4	11	10	32	34	48	58	52	42	31	22	5	1852
7	95	94	85	77	72	60	1868	4	2	2	22	37	50	54	48	44	27	19	3	1868

MASSACHUSETTS.

1	95	98	89	83	70	59	1864	—22	—20	— 9	5	27	34	40	38	26	15	3	—15	1844
2	99	92	89	83	69	60	1854[7]	—13	—10	— 6	18	31	35	35	40	34	24	5	—10	1857
3	100	95	100	73	65	58	1872	—10	— 8	— 2	16	35	39	50	50	41	30	9	— 8	1866[8]
4	95	97	85	75	66	55	1864	—15	—16	— 7	22	32	44	54	48	33	23	13	— 8	1861
5	98	96	89	83	71	66	1868	—29	—26	— 6	10	26	42	50	44	32	20	8	—16	1855
6	92	98	89	84	71	58	1864	—17	—17	— 6	19	30	46	50	49	30	22	11	— 5	1861[9]
7	89	88	83	76	70	60	1849	—12	— 5	3	17	40	46	53	44	36	25	15	— 2	1859
8	96	91	88	83	71	64	1818	—11	—16	0	18	26	38	55	44	33	23	6	—10	1861
9	97	90	88	78	70	51	1868	—14	—22	—11	22	32	48	50	43	34	16	12	— 9	1868
10	97	96	90	87	72	61	1861[10]	—16	—24	— 8	18	29	42	54	50	34	18	16	— 3	1861
11	97	94	91	82	72	49	1840	—12	—11	0	17	27	30	42	42	29	24	5	— 3	1839[11]
12	97	96	95	85	72	59	1820[12]	—30	—26	—12	17	28	35	43	39	25	13	— 3	—19	1835
13	94	89	85	85	70	60	1866	—15	—19	— 2	21	33	44	53	51	39	25	12	— 3	1861

MICHIGAN.

1	96	98	91	86	80	78	1861	—19	—14	— 5	11	24	32	41	37	31	15	2	—13	1864
2	96	96	98	82	72	60	1854	—42	—47	—29	—4	16	24	33	37	29	10	— 9	—41	1873
3	98	94	91	78	74	72	1834	—15	—18	— 7	2	22	33	40	39	30	19	1	—16	1836
4	88	86	82	70	62	51	1835	—27	—24	—19	6	21	32	41	41	30	17	— 4	—16	1851
5	90	91	81	75	62	57	1861	— 5	—16	1	8	27	28	33	48	28	17	9	0	1861
6	96	99	89	81	71	52	1864	—22	—15	— 2	20	30	44	52	38	22	18	4	—17	1864
7	103	100	93	85	69	61	1862	—31	—33	—19	3	16	30	33	38	23	15	— 4	—19	1861
8	103	99	98	89	71	59	1866	—17	—21	— 8	19	29	38	41	34	27	20	5	—13	1868
9	98	98	91	89	69	53	1864[4]	—34	—37	—22	—5	18	30	30	33	20	4	— 3	—16	1861
10	86	87	85	75	59	60	1864	—25	—25	—10	9	17	27	34	31	28	23	11	— 6	1861[9]
11	90	93	81	73	61	51	1864	—17	—25	—12	8	25	35	41	40	33	26	8	— 5	1861

[1] Also in 1834 and 1835.
[2] Also in 1833 and 1839.
[3] Also in 1849.
[4] Also in 1868.
[5] Also in 1820, 1850, and 1851.
[6] Also in 1849 and 1872.
[7] Also in 1872.
[8] Also in 1873.
[9] Also in 1866.
[10] Also in 1866 and 1868.
[11] Also in 1840.
[12] Also in 1825 and 1826.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
MINNESOTA.									
				°	°	°	°	°	°
1. Beaver Bay	1270	Jan. 1861;	Dec. 1870	46	49	65	74	84	96
2. Fort Ridgeley	1230	July, 1853;	Dec. 1864	53	54	78	90	91	95
3. Fort Ripley	1130	Jan. 1860;	June, 1874	53	53	70	83	101	96
4. Fort Snelling	820	Jan. 1820;	June, 1874	59	60	79	88	92	96
5. Minneapolis	856	Jan. 1865;	Dec. 1870	42	46	67	84	91	96
6. New Ulm	821	Jan. 1865;	Dec. 1870	41	43	71	85	92	98
7. Saint Paul	800	Jan. 1864;	Dec. 1870	49	50	70	83	89	99
8. Sibley	...	Jan. 1866;	Dec. 1870	41	47	67	82	88	93
MISSISSIPPI.									
1. Columbus	227	Jan. 1861;	Dec. 1870	78	79	84	86	93	98
2. Natchez	264	Jan. 1861;	June, 1870	80	83	80	85	89	92
3. Vicksburg	350	Sept. 1866;	May, 1870	80	81	83	85	95	97
MISSOURI.									
1. Allenton	...	Jan. 1867;	Dec. 1870	67	77	88	93	96	101
2. Harrisonville	...	Jan. 1865;	Dec. 1870	62	66	78	84	88	94
3. Jefferson Barracks	472	Jan. 1827;	July, 1862	72	81	98	94	92	100
4. Oregon	1100	Jan. 1867;	Dec. 1870	62	69	69	88	89	98
5. Rolla, near	950	Jan. 1868;	Dec. 1870	67	76	87	89	91	96
6. Saint Louis	481	Mar. 1833;	Dec. 1870	71	81	86	93	97	100
MONTANA.									
1. Camp Baker	...	Nov. 1870;	June, 1874	52	63	65	83	91	85
2. Deer Lodge City	4240	Jan. 1869;	Dec. 1870	51	55	62	76	85	98
3. Fort Benton	2730	Nov. 1869;	June, 1874	60	60	65	83	94	104
4. Fort Ellis	4800	Aug. 1868;	June, 1874	60	54	68	78	87	95
5. Fort Shaw	6000	Sept. 1867;	June, 1874	67	71	81	93	98	101
NEBRASKA.									
1. Bellevue	...	Jan. 1860;	Dec. 1870	58	65	76	88	92	96
2. De Soto	1100	Jan. 1868;	Dec. 1869	43	57	86	78	89	93
3. Fort Calhoun	1327	Jan. 1822;	Dec. 1826	67	68	80	90	98	102
4. Fort Learney	2360	Jan. 1849;	Jan. 1868	70	68	82	92	94	101
5. Fort McPherson	...	Nov. 1866;	June, 1874	78	82	86	96	96	104
6. Glendale	1010	Jan. 1867;	Dec. 1868	52	66	92	89	89	92
7. Omaha	1300	July, 1870;	Sept. 1873	58	60	69	96	91	96
8. Omaha Agency	...	Jan. 1869;	Dec. 1870	50	67	68	84	91	95
9. Richland	1350	Jan. 1861;	Dec. 1869	49	65	85	90	95	101
NEVADA.									
1. Camp Halleck	5600	Oct. 1867;	June, 1874	56	57	69	84	104.	111
2. Camp McDermit	4700	Dec. 1865;	Nov. 1873	56	65	72	85	90	100
3. Camp McGarry	6000	Nov. 1865;	Nov. 1868	48	54	57	75	77	85
4. Camp Winfield Scott	...	Dec. 1866;	July, 1870	49	54	64	86	91	94
5. Fort Churchill	4284	Oct. 1860;	May, 1869	59	68	68	83	89	98
6. Fort Ruby	5922	Jan. 1863;	Oct. 1868	72	82	80	80	88	95

MINNESOTA.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	°	°	°	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°	
1	94	89	84	80	64	45	1864	—35	—34	—26	3	25	37	45	41	30	15	—14	—21	1864
2	101	102	92	87	70	52	1861	—30	—31	—11	10	30	39	49	42	22	9	— 8	—26	1862
3	103	97	92	80	64	50	1871	—44	—43	—37	—5	21	28	26	28	12	8	—30	—40	1860
4	100	97	92	90	74	53	1838	—37	—35	—24	1	23	34	41	39	28	8	—23	—34	1840
5	101	91	88	86	67	53	1868	—40	—31	—27	8	28	47	52	46	25	12	— 6	—33	1868
6	100	100	91	87	71	55	1870	—30	—28	—20	10	29	46	55	46	31	16	— 8	—22	1868
7	97	99	87	83	65	52	1870	—39	—29	—26	8	30	46	51	45	23	16	— 6	—26	1868
8	98	94	87	86	68	53	1866[1]	—36	—37	—26	7	29	37	47	41	18	11	—11	—22	1866

MISSISSIPPI.

1	100	99	94	89	80	76	1862	10	14	20	37	47	59	72	56	47	29	22	15	1864
2	94	92	90	86	80	79	1860	16	20	22	37	45	63	60	60	46	36	22	16	1860[1]
3	96	96	95	90	85	91	1868	18	25	25	37	53	64	69	67	50	35	26	17	1868

MISSOURI.

1	109	103	100	100	84	73	1868	— 7	— 5	0	26	36	48	54	53	35	14	— 5	—16	1870
2	105	95	90	86	76	64	1868	— 8	— 8	—12	26	36	50	58	52	34	20	8	—14	1868
3	103	102	99	93	78	69	1860	—14	—18	0	17	32	44	52	35	37	22	— 2	—15	1835
4	105	96	93	91	78	72	1868	—12	—10	— 7	20	38	48	57	50	34	15	3	—16	1868
5	97	93	91	81	77	68	1870	0	— 3	10	23	39	44	61	58	39	18	15	—23	1870
6	103	108	98	95	81	74	1834	—19	—25	— 6	23	31	37	54	49	35	22	— 1	— 7	1835

MONTANA.

1	92	93	82	82	69	56	1873	—32	—43	—12	14	30	32	40	43	19	0	—42	—53	1871
2	92	95	85	81	68	56	1870	—36	—33	—28	16	32	35	45	32	26	0	8	—16	1870
3	105	101	92	85	70	62	1870	—38	—35	—23	11	27	29	40	28	9	—4	—36	—51	1871
4	102	100	93	75	71	60	1869	—53	—53	—36	10	25	28	30	28	18	—3	—19	—45	1872
5	112	102	94	91	80	74	1872	—43	—31	—25	10	24	30	34	24	17	—5	—37	—37	1870

NEBRASKA.

1	102	103	99	84	76	63	1861	—22	—13	—15	19	32	49	60	50	36	6	1	—14	1860
2	104	95	86	81	70	52	1868	—19	—17	— 9	19	41	42	56	53	33	10	9	—19	1868
3	108	104	94	96	87	63	1862	—21	—16	3	13	30	48	54	50	40	13	— 6	—17	1864
4	102	100	97	91	77	68	1857	—28	—22	— 4	10	26	39	45	37	27	8	1	—23	1852
5	115	110	102	102	81	76	1870	—20	—24	— 3	10	28	35	35	40	19	6	— 4	—18	1874
6	106	97	95	87	78	68	1868	—26	—22	—20	22	35	51	57	52	30	22	— 7	—30	1868
7	100	101	93	88	78	65	1873	—21	—16	— 1	16	28	24	54	46	34	24	— 7	—20	1873
8	102	98	91	78	72	70	1870	—10	—14	— 5	18	40	48	59	50	40	20	9	—15	1870
9	105	104	99	87	76	61	1862	—22	—20	—15	17	34	49	56	50	32	11	1	—21	1864

NEVADA.

1	107	100	88	93	68	60	1871	—22	—18	— 8	7	13	25	23	24	19	3	—12	—13	1868
2	100	104	95	88	73	58	1870	— 9	— 9	3	11	23	29	40	35	24	11	5	— 4	1868
3	90	88	86	76	71	47	1867[1]	—18	—10	— 6	15	20	32	40	48	32	16	9	—13	1868
4	98	99	93	80	64	59	1868	—15	—12	— 2	29	35	27	51	49	39	25	15	10	1868
5	100	97	92	85	71	65	1863	— 9	0	17	25	27	42	57	59	43	16	13	— 1	1866
6	100	99	94	101	88	78	1863	—23	—19	2	19	32	34	48	47	25	8	— 2	—15	1864

[1] Also in 1868.

NEW HAMPSHIRE.

Name of Station.	Height.	Series. Begins.	Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
1. Claremont	536	Jan. 1860;	Dec. 1867	52	54	60	79	90	94
2. Concord	374	Jan. 1828;	Dec. 1835	56	60	69	88	89	94
3. Dartmouth College	...	Jan. 1835;	Dec. 1852	52	68	71	86	90	93
4. Fort Constitution	40	Jan. 1820;	Sept. 1853	60	59	68	85	87	96
5. Portsmouth	38	Jan. 1839;	July, 1842	52	58	66	80	88	92
6. Stratford	1000	Jan. 1860;	Dec. 1870	42	51	62	72	86	95

NEW JERSEY.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Greenwich	30	Jan. 1864;	Dec. 1870	62	63	76	82	87	98
2. Haddonfield	50	Jan. 1864;	Dec. 1870	67	61	75	84	85	96
3. Newark	35	Jan. 1861;	Dec. 1870	57	62	75	84	88	95
4. Paterson	60	Jan. 1865;	Dec. 1870	55	58	72	85	90	95

NEW MEXICO.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Albuquerque	5032	Sept. 1849;	July, 1867	66	78	83	98	100	114
2. Cebolleta	6200	Dec. 1849;	Feb. 1852	60	70	73	83	87	96
3. Fort Bascom	...	Feb. 1864;	Oct. 1870	69	85	84	95	98	104
4. Fort Bayard	4450	Mar. 1867;	June, 1874	64	70	76	86	92	100
5. Fort Conrad	4576	Oct. 1851;	Mar. 1854	70	69	87	91	93	98
6. Fort Craig	4576	Apr. 1854;	June, 1874	77	84	94	104	108	110
7. Fort Cummings	...	Mar. 1869;	July, 1873	95	83	100	90	102	107
8. Fort Fillmore	3937	Sept. 1851;	Apr. 1861	95	85	92	99	102	107
9. Fort McRae	4500	Mar. 1864;	June, 1874	79	71	88	100	109	120
10. Fort Selden	...	Nov. 1865;	June, 1874	72	80	86	98	106	105
11. Fort Stanton	...	Aug. 1855;	Oct. 1872	65	68	76	83	93	100
12. Fort Sumner	...	Apr. 1864;	July, 1869	74	75	85	90	100	97
13. Fort Thorn	4500	Jan. 1854;	Jan. 1859	75	78	89	99	105	113
14. Fort Union	6670	Aug. 1851;	June, 1874	74	70	79	85	94	100
15. Fort Wingate	...	Nov. 1862;	June, 1874	62	66	75	82	95	96
16. Santa Fé	6846	Jan. 1849;	July, 1873	65	66	77	91	92	98

NEW YORK.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Albany	130	Jan. 1795;	Dec. 1849	60	60	73	88	93	94
2. Auburn	650	Jan. 1827;	Dec. 1865	62	64	78	83	92	96
3. Belleville	300	Jan. 1830;	Dec. 1844	59	58	72	80	88	95
4. Beverly	180	Jan. 1867;	Dec. 1870	58	57	61	79	86	92
5. Bridgewater	1286	Jan. 1833;	Dec. 1837	64	58	66	83	89	93
6. Buffalo	623	Jan. 1841;	Dec. 1870	56	59	74	82	87	96
7. Cambridge	500	Jan. 1827;	Dec. 1841	60	60	74	85	91	98
8. Canajoharie	284	Jan. 1830;	Dec. 1835	52	52	64	86	88	92
9. Canandaigua	590	Jan. 1829;	Dec. 1838	66	59	70	88	90	91
10. Cazenovia	1260	Jan. 1830;	Dec. 1870	61	59	76	90	95	93
11. Charlotte	273	July, 1859;	Dec. 1867	64	58	66	77	84	93
12. Cherry Valley Academy	1335	Jan. 1827;	Dec. 1845	62	57	78	85	90	96
13. East Hampton	16	Jan. 1827;	Dec. 1843	64	61	68	78	86	95
14. Fairfield	1185	Jan. 1827;	Dec. 1849	53	55	70	85	88	93
15. Flatbush	54	Jan. 1826;	Dec. 1869	64	64	74	85	92	96
16. Fort Columbus	23	Jan. 1822;	June, 1874	60	68	78	84	92	98
17. Fort Hamilton	25	Jan. 1843;	June, 1874	62	70	76	84	90	106
18. Fort Niagara	263	Jan. 1829;	June, 1874	62	60	84	94	94	94
19. Fort Ontario	295	Jan. 1843;	June, 1874	64	58	76	80	89	94

NEW HAMPSHIRE.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	°	°	°	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°	
1	92	92	90	80	73	57	1866	—22	—30	—18	16	30	41	50	42	30	21	4	—16	1861
2	98	93	91	80	68	57	1834	—32	—20	— 9	18	29	38	43	40	27	14	— 5	—16	1835
3	96	96	92	79	69	58	1843[1]	—34	—33	—23	0	22	26	40	27	20	12	— 9	—29	1848
4	96	94	90	76	68	59	1850[2]	—12	—10	— 7	16	30	36	47	48	32	26	9	—10	1821[3]
5	99	97	87	70	68	50	1840	—11	— 3	— 2	14	28	36	48	46	36	24	15	0	1839
6	100	90	86	79	70	50	1868	—33	—37	—22	2	20	36	43	40	28	10	2	—24	1861

NEW JERSEY.

1	95	93	86	79	73	67	1864	— 9	2	7	30	40	53	55	53	45	29	19	5	1866
2	102	94	90	78	72	62	1866	—12	3	16	30	32	45	46	51	42	31	19	1	1866
3	92	92	86	83	70	66	1864	— 5	— 7	2	21	31	44	52	49	39	28	19	— 1	1861
4	99	95	90	81	70	60	1866	—13	— 5	0	22	37	50	38	48	42	26	16	— 1	1866

NEW MEXICO.

1	110	105	98	96	86	66	1857	— 4	0	12	22	28	38	50	44	40	20	8	— 5	1850
2	100	99	90	86	68	65	1850	9	2	20	25	31	44	50	53	50	38	11	3	1851
3	109	108	99	93	78	76	1870	0	10	10	28	48	54	56	59	46	25	24	—18	1869
4	96	97	89	85	71	68	1871	— 8	— 1	12	9	29	35	50	50	40	12	3	8	1873
5	101	100	95	90	81	67	1852	4	11	17	27	31	45	55	60	41	25	14	11	1852
6	112	105	103	96	84	81	1857	— 3	8	16	20	36	45	57	54	42	25	10	— 2	1874
7	102	101	102	106	90	94	1871	— 5	13	23	10	36	45	56	54	47	23	3	20	1873
8	107	106	100	99	86	80	1852[4]	0	20	14	26	40	50	50	58	50	30	14	15	1859
9	116	107	103	90	78	81	1873	3	9	12	22	37	46	55	59	44	20	22	4	1874
10	104	105	99	94	79	74	1872	—12	11	15	27	33	52	49	52	39	18	4	9	1873
11	93	98	90	87	75	65	1867	— 2	1	9	21	32	44	50	50	29	22	2	0	1856
12	98	97	98	84	75	75	1865	1	6	8	28	40	57	60	58	46	26	2	1	1865[5]
13	110	107	95	95	79	76	1854	7	0	5	25	30	39	51	50	41	19	10	4	1854
14	101	96	90	89	87	72	1871	—13	— 7	— 4	15	20	25	40	32	28	9	5	—28	1855
15	99	102	97	95	89	68	1870	—16	3	4	18	30	38	51	50	30	18	— 3	— 8	1864
16	99	100	91	82	78	68	1850	— 9	— 2	8	19	28	39	50	49	34	3	3	—11	1850

NEW YORK.

1	97	96	89	80	70	62	1830[6]	—23	—16	—12	6	28	40	50	31	30	21	1	—13	1835[7]
2	98	110	90	85	70	63	1861	—14	—16	— 6	6	14	28	44	42	30	18	0	— 6	1861[8]
3	98	98	90	78	65	57	1834	—28	—34	—22	14	23	23	39	30	19	14	— 1	—36	1835
4	96	95	88	78	70	53	1868	0	—10	2	25	34	50	57	52	40	25	18	— 2	1868
5	94	93	88	76	68	52	1834	—31	—18	—16	15	17	30	38	33	21	17	— 4	—23	1835
6	98	97	91	80	73	60	1868	—11	—15	—11	13	22	36	44	41	32	23	10	— 6	1861
7	96	96	90	78	74	60	1831	—36	—32	—20	12	23	37	41	36	23	14	— 6	—29	1835
8	97	96	94	80	69	50	1830	—36	—16	— 6	22	28	43	48	38	26	22	4	—18	1835
9	94	93	84	79	70	61	1834	—10	—11	— 8	22	27	42	50	41	32	20	4	— 9	1832
10	97	92	93	83	70	59	1838	—28	—22	—19	11	17	27	37	32	25	10	— 6	—21	1840
11	98	96	92	84	73	66	1866	—15	—20	— 3	7	13	32	38	35	26	17	4	—22	1866
12	98	90	88	83	67	57	1834	—30	—30	—12	4	21	31	34	36	26	17	1	—19	1835[9]
13	93	92	88	78	68	60	1841	— 8	— 1	— 2	20	25	32	47	42	30	20	10	— 2	1835
14	94	96	90	78	69	60	1838	—21	—22	— 8	—1	23	26	32	30	22	14	—10	—26	1835
15	96	96	92	81	72	68	1827[10]	— 6	— 6	3	24	28	39	53	48	32	22	12	4	1835[11]
16	104	99	92	86	71	69	1825	—12	— 7	2	17	31	42	54	49	39	29	12	— 3	1866
17	99	96	90	84	76	65	1864	—10	— 7	0	18	34	40	47	50	37	29	13	— 2	1866
18	98	95	94	82	72	63	1830	— 9	15	1	14	18	37	48	46	33	25	12	— 8	1861
19	96	98	96	82	73	67	1870	—20	—16	—21	2	26	35	43	41	31	26	1	—20	1872

[1] Also in 1845. [2] Also in 1852. [3] Also in 1851. [4] Also in 1860.
[5] Also in 1867. [6] Also in 1845 and 1846. [7] Also in 1840. [8] Also in 1865.
[9] Also in 1836. [10] Also in 1849 and 1864. [11] Also in 1861.

28 April, 1875.

NEW YORK.—Continued.

Name of Station.	Height.	Series. Begins.	Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
20. Fort Porter	660	Dec. 1865;	Dec. 1870	50	45	58	68	80	85
21. Fredonia	715	Jan. 1830;	Dec. 1848	70	65	76	86	90	96
22. Gaines	427	Jan. 1839;	Dec. 1842	59	64	65	83	89	91
23. Goshen	425	Jan. 1835;	Dec. 1849	60	65	78	84	98	96
24. Gouverneur	400	Jan. 1831;	Dec. 1870	64	59	74	85	94	95
25. Hamilton	1127	Jan. 1826;	Dec. 1849	63	64	78	90	92	96
26. Hartwick	1100	Jan. 1826;	Dec. 1850	59	63	76	82	92	92
27. Homer	1096	Jan. 1832;	Dec. 1850	67	60	75	89	93	91
28. Hudson	150	Jan. 1827;	Dec. 1849	62	64	73	87	94	99
29. Ithaca	417	Jan. 1827;	Dec. 1848	71	60	76	98	89	96
30. Jamaica	30	Jan. 1826;	Dec. 1850	67	62	79	86	93	98
31. Johnstown	...	Jan. 1828;	Dec. 1845	52	60	75	93	92	96
32. Kinderhook	125	Jan. 1830;	Dec. 1846	65	68	76	88	91	96
33. Kingston	188	Jan. 1829;	Dec. 1849	69	64	78	86	96	97
34. Lansingburgh	30	Jan. 1826;	Dec. 1846	61	66	78	90	96	99
35. Ledyard	447	Jan. 1830;	Dec. 1850	62	65	76	85	89	96
36. Lewiston	280	Jan. 1831;	Dec. 1849	62	66	77	82	96	96
37. Lowville	847	Jan. 1827;	Dec. 1848	60	60	78	86	91	99
38. Madison Barracks	262	Jan. 1827;	June, 1874	65	58	70	79	88	90
39. Malone	703	Jan. 1839;	Dec. 1842	54	68	68	88	88	89
40. Mexico	331	Jan. 1837;	Dec. 1849	66	60	72	87	90	94
41. Middlebury	800	Jan. 1826;	Dec. 1848	65	70	84	88	96	97
42. Millville	600	Jan. 1840;	Dec. 1847	58	64	80	86	91	91
43. Mohawk	435	June, 1860;	Dec. 1868	50	52	60	75	85	94
44. Montgomery	300	Jan. 1828;	Dec. 1842	70	68	79	92	97	100
45. Moriches	13	Jan. 1865;	Dec. 1870	60	58	71	81	85	102
46. Mount Pleasant	125	Jan. 1831;	Dec. 1844	57	67	71	81	93	95
47. Newburg	74	Jan. 1828;	Dec. 1867	68	66	78	92	98	102
48. New York	25	Jan. 1844;	Dec. 1870	62	62	74	84	89	97
49. Nichols	800	Jan. 1860;	Dec. 1870	60	62	76	86	90	97
50. North Granville	250	Jan. 1835;	Dec. 1849	60	55	69	86	90	97
51. North Salem	361	Jan. 1829;	Dec. 1850	66	72	76	88	92	95
52. Oneida	500	Jan. 1861;	Dec. 1869	56	54	71	78	87	92
53. Onondaga	1260	Jan. 1826;	Dec. 1844	64	60	80	90	94	99
54. Oswego	232	Jan. 1861;	Dec. 1870	57	49	72	79	81	88*
55. Oxford	961	Jan. 1829;	Dec. 1845	64	60	74	84	94	98
56. Palermo	327	Jan. 1860;	Dec. 1870	56	52	68	84	86	95
57. Penn Yan	740	Jan. 1829;	Dec. 1844	66	65	74	88	93	95
58. Plattsburg	186	Jan. 1829;	Dec. 1870	56	60	72	83	96	95
59. Pompey	1300	Jan. 1826;	Dec. 1843	59	56	72	83	88	90
60. Potsdam	394	Jan. 1828;	Dec. 1848	57	67	76	84	94	95
61. Poughkeepsie	...	Jan. 1829;	Dec. 1849	65	65	78	88	94	102
62. Redhook	...	Jan. 1830;	Dec. 1842	65	65	72	90	92	97
63. Rochester	506	Jan. 1830;	Dec. 1869	64	62	76	88	89	97
64. Sackett's Harbor	266	July, 1859;	Dec. 1867	58	52	69	73	81	88
65. Salem	...	Jan. 1828;	Dec. 1847	57	60	73	85	97	96
66. Schenectady	300	Jan. 1829;	Dec. 1864	53	49	59	74	91	92
67. Springville	500	Jan. 1834;	Dec. 1850	58	64	70	80	88	91
68. Troy	58	Jan. 1861;	Dec. 1868	46	61	66	82	83	92
69. Utica	473	Jan. 1826;	Dec. 1848	75	68	79	90	90	97
70. Watervliet Arsenal	50	Jan. 1831;	Dec. 1854	59	64	73	83	94	99
71. West Point	167	Jan. 1827;	June, 1874	68	67	82	89	93	99
72. Whitestone	824	Jan. 1834;	Dec. 1840	53	56	61	81	90	95

NORTH CAROLINA.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Johnson	...	Jan. 1820;	June, 1874	76	72	80	88	92	99
2. Fort Macon	...	Jan. 1834;	Aug. 1849	68	72	78	86	93	96

NEW YORK.—Continued.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	°	°	°	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°	
20	92	89	83	73	67	54	1868	—7	—3	—10	20	24	37	51	44	33	22	11	—10	1866[1]
21	97	94	94	83	73	64	1830	—7	—12	—6	18	25	34	42	41	32	20	9	2	1832
22	94	92	90	78	62	56	1841[2]	—7	—7	—4	19	30	39	46	40	30	20	4	5	1839
23	96	91	88	82	78	62	1839	—30	—16	—5	10	26	36	42	36	32	14	4	—10	1835
24	100	99	93	81	73	58	1842	—38	—32	—30	10	22	33	37	32	22	10	—17	—40	1835
25	96	96	90	82	70	64	1831[3]	—34	—28	—15	4	20	28	38	33	19	11	—4	—20	1835
26	96	91	89	80	74	64	1826	—30	—24	—12	6	20	32	40	36	27	16	—2	—10	1831
27	95	93	88	82	70	63	1845	—28	—26	—19	0	16	28	40	34	28	17	—7	—14	1836
28	99	98	92	80	68	67	1827[4]	—24	—10	—2	12	28	33	48	44	30	18	7	—16	1835
29	99	98	94	86	75	66	1847	—18	—12	—10	15	20	37	43	37	28	19	1	—5	1836
30	100	95	93	85	76	70	1830	—7	—7	5	16	26	37	46	45	29	22	7	1	1836[4]
31	95	94	92	78	74	56	1828[5]	—30	—22	—8	6	24	30	42	38	25	15	—4	—25	1835[6]
32	102	97	95	89	73	57	1845	—30	—18	—10	9	24	33	41	38	26	16	0	—17	1840
33	100	93	91	88	83	64	1845	—30	—22	—5	10	27	40	47	41	30	16	6	—12	1835
34	101	104	98	82	75	57	1845	—28	—25	—13	4	25	34	42	42	25	17	4	—14	1835
35	96	96	90	86	72	57	1843[7]	—6	—10	—4	14	27	40	50	42	31	19	6	2	1841
36	97	93	95	82	76	70	1840	—6	—6	0	16	25	38	49	44	33	22	5	—1	1832[8]
37	100	96	88	80	75	60	1842	—35	—32	—17	10	20	30	37	33	16	10	—2	—40	1835
38	94	95	90	80	70	60	1872	—25	—30	—36	7	21	34	45	38	28	18	—6	—44	1871
39	94	94	84	74	64	45	1840	—24	—15	—12	11	25	30	38	40	23	20	6	—14	1840
40	99	92	92	92	72	58	1838	—24	—24	—15	2	18	31	40	42	28	20	8	—11	1837[4]
41	100	99	90	88	78	75	1826	—15	—20	—17	4	17	25	40	32	24	14	7	—17	1832
42	95	96	91	79	78	55	1845	—6	—5	—12	12	26	32	40	42	28	18	5	3	1841
43	102	92	96	82	70	56	1868	—22	—30	—12	11	23	34	44	41	29	18	11	—20	1861
44	104	99	98	87	79	62	1830	—33	—25	—6	4	20	40	38	38	25	17	—6	—10	1835
45	105	98	96	85	71	62	1868	—14	—15	0	28	37	51	58	51	44	30	16	—4	1868
46	100	97	85	78	70	57	1838	—8	—2	5	15	27	37	48	49	34	27	9	—4	1835[9]
47	105	98	97	80	76	69	1849	—27	—14	—2	16	27	32	48	43	30	20	8	—15	1835
48	99	96	90	85	72	69	1866	—13	—3	5	24	34	46	56	53	40	31	20	2	1866
49	101	99	92	86	72	64	1868	—18	—21	—11	17	28	43	49	44	30	21	6	—24	1866
50	102	94	92	81	80	64	1849	—31	—25	—14	—4	24	34	42	31	26	14	0	—22	1844
51	102	98	94	81	74	64	1841	—31	—15	—7	15	24	30	42	37	22	17	—1	—17	1835
52	97	98	88	84	70	61	1864	—16	—28	—9	12	27	38	50	44	35	24	8	—6	1865
53	99	95	93	81	70	69	1826[10]	—18	—22	—10	0	23	34	42	40	30	16	2	—18	1826
54	90	94	87	75	66	59	1863	—11	—14	0	16	28	43	51	44	37	26	15	—15	1866
55	96	93	91	81	68	62	1829	—36	—33	—19	9	20	28	40	32	17	14	2	—21	1836
56	99	97	93	87	73	58	1868	—23	—24	—8	15	30	39	40	45	29	20	5	—22	1861
57	96	94	90	84	75	63	1830[11]	—12	—13	—10	10	26	32	44	34	25	16	7	—7	1836
58	98	94	96	78	69	60	1840[4]	—19	—20	—14	12	25	35	42	34	26	12	4	—8	1849
59	91	89	84	76	70	60	1837	—18	—16	—8	10	20	29	45	40	28	16	—3	—18	1835[12]
60	96	95	89	86	71	59	1838	—34	—32	—28	—1	20	32	40	34	23	12	—10	—26	1840
61	105	98	100	95	76	68	1849	—30	—20	—4	2	32	30	46	36	28	16	4	—22	1835
62	98	93	91	82	78	60	1835[11]	—28	—16	—1	19	15	42	44	40	30	23	6	—8	1835
63	102	98	94	83	74	62	1844	—9	—13	—4	11	25	35	34	44	28	21	7	—9	1861
64	91	93	88	82	73	61	1863	—36	—46	—34	7	25	36	48	43	28	23	8	—30	1861
65	100	102	94	78	75	63	1840	—40	—26	—12	2	30	35	41	41	27	13	1	—23	1840
66	94	96	87	73	72	54	1864	—12	—16	—10	18	32	42	51	46	33	21	3	—10	1836
67	95	91	87	83	70	60	1834	—20	—11	—14	9	20	28	38	34	25	18	—8	—14	1849
68	100	94	85	87	67	56	1868	—22	—28	—1	19	32	43	55	50	39	26	19	—5	1861
69	95	96	89	79	71	57	1826	—26	—27	—16	9	20	32	41	37	30	0	2	—16	1836
70	98	99	92	79	70	66	1834[13]	—32	—28	—20	4	26	40	47	47	30	16	3	—18	1835
71	101	101	99	87	73	70	1827	—30	—10	—6	14	27	40	51	46	36	24	6	—11	1873
72	97	98	88	81	70	49	1840	—33	—32	—26	11	6	35	41	34	23	16	—2	—18	1835

NORTH CAROLINA.

1	102	100	98	90	84	74	1831	15	3	14	31	43	52	63	57	46	28	9	9	1835
2	95	95	92	85	74	68	1834	19	20	25	39	48	61	64	68	56	42	31	28	1844

[1] Also in 1868.
[2] Also in 1842.
[3] Also in 1843.
[4] Also in 1849.
[5] Also in 1831.
[6] Also in 1844.
[7] Also in 1846 and 1850.
[8] Also in 1837.
[9] Also in 1839.
[10] Also in 1828.
[11] Also in 1841.
[12] Also in 1840.
[13] Also in 1852.

OHIO.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Highest Temperature					
				Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
1. Bethel	555	Jan. 1864;	Dec. 1870	66	67	74	88	91	95
2. Cincinnati	540	Jan. 1835;	Dec. 1870	70	75	86	93	95	99
3. Cleveland	643	June, 1859;	Dec. 1870	65	71	76	84	89	95
4. College Hill	800	Jan. 1814;	Dec. 1870	67	77	82	89	93	98
5. Granville	995	Jan. 1837;	Apr. 1852	66	68	78	85	89	93
6. Hillsborough	1150	Jan. 1836;	Dec. 1870	66	68	79	83	88	94
7. Hudson	1137	Jan. 1838;	Dec. 1859	62	69	78	84	88	90
8. Kelly's Island	587	Jan. 1860;	Dec. 1870	54	56	63	75	84	93
9. Marietta	670	June, 1818;	Dec. 1871	70	76	85	90	94	99
10. Marion	1077	Jan. 1866;	Dec. 1870	59	65	69	80	87	93
11. New Lisbon	961	Jan. 1861;	Dec. 1868	62	68	76	86	90	98
12. Norwalk	...	Jan. 1861;	Dec. 1868	64	70	72	81	87	94
13. Toledo	604	Jan. 1860;	Dec. 1869	68	68	72	82	90	98
14. Urbana	1015	Jan. 1862;	Dec. 1870	64	66	74	84	89	05
15. Witchfield	1205	Jan. 1861;	Dec. 1865	58	67	70	79	87	95

OREGON.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Astoria	...	Aug. 1850;	Dec. 1870	56	69	64	82	80	84
2. Block House	...	Mar. 1858;	Dec. 1862	59	60	70	75	77	94
3. Camp Harney	...	Jan. 1868;	Dec. 1873	50	57	69	80	85	100
4. Camp Warner	...	Jan. 1868;	June, 1874	57	68	65	70	81	85
5. Fort Dalles	...	Sept. 1850;	Mar. 1866	62	83	86	90	96	104
6. Fort Haskins	...	Nov. 1856;	Mar. 1865	67	70	80	90	95	102
7. Fort Oxford	...	June, 1852;	July, 1856	71	70	75	68	80	77
8. Fort Stevens	...	Nov. 1865;	June, 1874	54	55	66	73	78	84
9. Fort Umpqua	...	Aug. 1856;	May, 1862	64	61	73	72	81	82
10. Fort Yamhill	...	Oct. 1856;	Apr. 1866	60	59	64	81	91	98

PENNSYLVANIA.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Allegheny Arsenal	704	Jan. 1836;	Apr. 1867	67	75	83	86	96	96
2. Carlisle Barracks	600	Jan. 1840;	June, 1874	66	68	76	88	92	100
3. Fallsington	30	Jan. 1860;	Dec. 1870	65	68	78	81	87	95
4. Fayette Tannery	...	Jan. 1865;	Dec. 1870	67	68	76	88	88	98
5. Fleming	780	Jan. 1861;	Dec. 1866	62	64	76	85	93	95
6. Fort Mifflin	20	Jan. 1823;	Oct. 1853	62	68	76	80	89	99
7. Frankford Arsenal	30	Jan. 1836;	Dec. 1843	66	70	77	84	94	95
8. Germantown	100	Jan. 1820;	Nov. 1870	68	64	78	85	93	99
9. Harrisburg	375	Jan. 1860;	Dec. 1868	58	64	76	85	89	96
10. Lewisburg	...	Jan. 1865;	Dec. 1870	54	53	74	82	88	93
11. Mooreland	250	Jan. 1865;	Dec. 1870	63	65	80	80	89	91
12. Mount Joy	...	Jan. 1860;	Dec. 1869	63	69	82	88	97	100
13. North Whitehall	...	Jan. 1860;	Dec. 1869	57	59	70	84	90	96
14. Pennsville, near	1400	Jan. 1865;	Dec. 1870	60	58	78	85	90	92
15. Philadelphia	36	Jan. 1758;	Dec. 1870	65	70	79	88	90	98
16. Pocopson	218	Jan. 1861;	Dec. 1870	65	65	76	86	88	97

RHODE ISLAND.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Adams	40	Jan. 1842;	June, 1874	51	54	60	69	81	92
2. Fort Wolcott	20	Jan. 1822;	Dec. 1835	58	58	61	74	83	87
3. Newport	25	Jan. 1866;	Dec. 1870	52	56	64	68	78	86
4. Providence	155	Dec. 1831;	Dec. 1866	63	68	75	82	91	97

OHIO.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1	98°	95°	93°	85°	72°	71°	1864	—8°	—8°	3°	20°	33°	37°	50°	42°	36°	20°	8°	—8°	1864[1]
2	101	100	99	90	80	73	1868	—12	—17	—4	20	27	38	48	46	31	19	2	—7	1835
3	96	93	88	85	75	68	1866	—11	—13	—5	17	29	42	48	43	35	24	5	—9	1866
4	99	97	97	89	78	70	1868	—12	—10	—10	14	27	39	37	38	26	16	—2	—10	1864
5	96	98	89	81	74	67	1838	—20	—14	—14	20	28	32	47	41	34	19	4	—12	1850
6	97	92	90	80	72	68	1864	—14	—22	—10	18	27	40	50	44	30	20	2	—12	1838
7	93	91	89	76	69	61	1841	—10	—8	—4	20	27	32	44	45	34	22	6	—6	1841
8	93	91	89	79	70	58	1866[2]	—12	—13	—5	17	35	50	56	52	42	29	10	0	1866
9	102	96	95	88	82	71	1859	—22	—18	—10	7	28	33	42	43	32	19	10	—11	1852
10	94	93	89	78	76	61	1868[2]	—17	—14	—11	19	37	44	56	40	36	19	12	—9	1867
11	100	100	95	88	90	68	1861[3]	—18	—14	—12	20	30	45	48	45	34	20	10	—13	1867
12	94	93	92	84	72	67	1864[4]	—12	—14	—6	16	32	48	52	50	37	26	14	—3	1868
13	100	96	90	88	70	67	1868	—10	—16	—6	13	34	42	48	48	36	19	6	—5	1866
14	96	95	92	86	74	64	1868	—16	—12	0	22	32	47	54	48	36	20	8	—12	1864
15	93	94	89	82	69	64	1864	—13	—12	5	17	30	43	52	47	37	27	12	2	1864

OREGON.

1	89	84	84	82	74	59	1870	15	19	19	32	38	45	44	47	43	36	25	15	1855[5]
2	80	98	88	81	68	59	1860	4	16	27	30	35	43	48	44	38	32	27	10	1862
3	100	100	93	83	70	53	1869[6]	—15	—16	—3	10	21	25	30	33	18	9	4	—6	1868
4	89	90	81	79	64	57	1869[2]	—14	—3	1	18	22	27	38	36	20	8	5	3	1868
5	105	104	94	100	79	64	1853	—23	1	3	32	31	41	42	47	40	25	4	—6	1862
6	101	103	98	89	75	67	1860	0	6	14	29	33	41	42	40	33	26	21	8	1857[7]
7	80	78	92	79	74	66	1852	32	31	30	31	38	45	45	45	40	39	33	30	1853[8]
8	82	86	84	72	62	59	1873	19	28	27	34	31	44	44	48	37	35	31	21	1868
9	74	81	84	77	67	59	1860[9]	16	28	34	36	42	50	50	49	49	38	35	20	1862
10	95	94	95	76	63	56	1859	9	13	13	29	37	35	46	42	39	28	22	7	1859

PENNSYLVANIA.

1	100	96	96	84	77	68	1854	—18	—22	—4	10	28	33	48	40	30	17	4	—6	1856
2	105	98	97	89	75	70	1868	—28	—11	—6	23	31	30	48	43	32	17	10	—14	1873
3	98	99	88	84	76	62	1865	—9	—6	0	25	37	50	55	55	43	30	17	4	1866
4	98	97	92	80	71	70	1868[2]	—10	—16	—7	20	32	44	50	48	35	20	10	—9	1865
5	99	100	92	87	72	65	1861	—26	—21	7	22	30	38	40	42	33	20	17	—19	1861
6	98	98	98	86	83	59	1849[10]	4	5	12	24	34	36	52	50	38	28	19	9	1849
7	98	92	88	86	72	63	1841	2	—7	7	25	32	42	56	49	35	29	18	10	1836
8	101	100	93	83	70	64	1866	—13	—4	8	21	33	46	55	53	33	26	18	0	1866
9	96	96	89	87	75	60	1861[11]	—2	1	6	25	39	55	61	55	45	30	16	4	1866
10	98	94	87	79	72	58	1866[4]	—13	—23	—11	22	35	48	51	46	38	20	17	—23	1865[12]
11	96	94	88	80	71	62	1866	—12	—4	2	26	38	45	58	53	43	27	18	0	1866
12	103	105	93	90	86	65	1869	—13	—12	14	13	36	48	58	52	39	21	13	7	1861
13	96	94	87	80	78	56	1864[4]	—13	—11	—2	17	30	42	46	43	33	23	12	—12	1866
14	102	90	87	77	66	60	1868	—14	—17	—14	10	28	38	44	42	30	12	4	—8	1865
15	101	97	93	88	80	72	1866	—9	—2	5	22	31	42	50	50	37	17	12	3	1866
16	101	99	93	85	70	65	1866	—10	—10	0	28	35	52	55	54	43	27	20	1	1866[4]

RHODE ISLAND.

1	102	92	89	76	64	61	1867	—13	—15	—6	18	33	44	53	47	37	22	8	0	1873
2	92	89	84	76	66	62	1834	—2	—1	3	21	33	45	52	50	36	30	18	—6	1835
3	90	86	88	79	66	55	1866	—6	4	4	26	35	48	53	52	40	24	15	2	1866
4	99	95	90	85	74	65	1866	—17	—16	—4	15	28	37	49	45	33	22	4	—12	1866

[1] Also in 1866 and 1870. [2] Also in 1870. [3] Also in 1867 and 1868. [4] Also in 1868.
[5] Also in 1859 and 1862. [6] Also in 1871. [7] Also in 1862. [8] Also in 1855.
[9] Also in 1856. [10] Also in 1852. [11] Also in 1862, 1866, and 1868. [12] Also in 1867.

SOUTH CAROLINA.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Highest Temperature Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
1. Charleston	20	Jan. 1750;	Dec. 1854	77	79	83	88	94	96
2. Fort Moultrie	25	Jan. 1823;	Dec. 1860	72	77	88	89	92	96

TENNESSEE.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Glenwood Cottage	481	Jan. 1860;	Dec. 1870	73	73	80	89	88	91
2. Humboldt	...	July, 1870;	June, 1874	70	77	82	89	98	104

TEXAS.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Austin	650	Apr. 1851;	June, 1874	87	87	96	102	103	104
2. Camp Colorado	...	Nov. 1856;	Jan. 1861	78	85	92	92	102	108
3. Camp Stockton	...	June, 1859;	June, 1874	88	88	98	105	111	112
4. Camp Verde	1400	Dec. 1856;	Feb. 1869	82	87	90	95	100	98
5. Fort Belknap	1600	July, 1851;	Jan. 1859	78	87	94	95	99	104
6. Fort Bliss	3830	July, 1854;	June, 1871	78	86	89	98	107	112
7. Fort Brown	50	Sept. 1849;	June, 1874	87	90	93	99	98	102
8. Fort Chadbourne	2120	May, 1852;	Mar. 1861	80	83	94	99	106	106
9. Fort Clarke	1000	Aug. 1852;	July, 1873	83	92	98	99	106	107
10. Fort Croghan	1000	June, 1849;	Aug. 1853	84	94	95	96	94	98
11. Fort Davis	4700	Nov. 1854;	Dec. 1873	81	83	90	96	100	107
12. Fort Duncan	1460	Oct. 1849;	June, 1874	91	94	100	104	106	112
13. Fort Graham	900	Mar. 1850;	Aug. 1853	80	80	96	92	98	100
14. Fort Griffin	...	July, 1870;	June, 1874	80	86	92	100	99	105
15. Fort Inge	845	Sept. 1849;	Jan. 1868	88	90	96	101	103	105
16. Fort Lancaster	2350	May, 1856;	Feb. 1860	73	85	95	98	107	110
17. Fort McIntosh	806	July, 1849;	June, 1874	90	101	105	108	110	106
18. Fort McKavett	2060	Apr. 1852;	June, 1874	80	89	92	100	102	103
19. Fort Mason	1200	Apr. 1852;	Feb. 1861	83	85	92	101	105	107
20. Fort Richardson	...	Apr. 1868;	June, 1874	78	86	84	94	97	101
21. Fort Worth	1100	Nov. 1849;	Aug. 1853	76	86	95	92	93	100
22. Gilmer, near	950	Jan. 1860;	Dec. 1870	86	82	87	94	98	98
23. Ringgold Barracks	521	Sept. 1849;	June, 1874	90	100	100	104	109	108
24. San Antonio	600	Jan. 1846;	July, 1873	82	93	94	98	107	108

UTAH.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Camp Douglas	4800	Dec. 1862;	June, 1874	62	64	70	82	91	98
2. Fort Crittenden	4860	July, 1858;	July, 1861	49	52	67	85	90	103
3. Great Salt Lake City	4260	Jan. 1864;	Dec. 1866	46	58	68	80	88	90

VERMONT.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Craftsbury	1100	Jan. 1862;	Dec. 1870	45	54	58	69	83	90
2. Lunenburg	1124	Jan. 1862;	Dec. 1870	42	65	78	78	88	98
3. Middlebury	398	Jan. 1865;	Dec. 1869	44	58	66	76	79	85
4. Randolph	700	Jan. 1866;	Dec. 1870	47	49	60	77	86	95

VIRGINIA.

Name of Station.	Height.	Series. Begins.	Series. Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Alexandria	56	Jan. 1853;	Feb. 1864	70	70	79	92	96	96
2. Fortress Monroe	8	Jan. 1826;	June, 1874	72	72	78	91	91	97

[1] Also in 1874. [2] Also in 1872. [3] Also in 1871. [4] Also in 1852.

	During Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
SOUTH CAROLINA.																				
1	° 101	° 96	° 92	° 89	° 85	° 78	1752	° 16	° 22	° 31	° 32	° 46	° 53	° 62	° 61	° 49	° 33	° 28	° 20	1852
2	99	96	93	88	82	79	1851	14	6	25	35	45	52	64	59	52	38	27	19	1835
TENNESSEE.																				
1	99	98	91	87	79	74	1860	— 8	— 4	11	30	40	52	57	51	33	24	13	0	1864
2	98	104	97	88	75	72	1871[1]	— 8	11	11	29	39	54	58	50	40	20	9	— 3	1873
TEXAS.																				
1	107	106	104	98	91	86	1860	6	19	21	28	44	61	66	65	49	29	18	10	1864
2	107	104	97	92	87	76	1857	7	17	22	28	46	58	70	64	55	41	21	9	1860
3	111	108	109	102	88	88	1873	— 3	15	24	22	32	54	49	58	44	24	14	— 9	1859
4	102	102	97	98	85	86	1857	10	9	16	29	45	57	61	63	43	37	14	12	1857
5	108	110	101	96	84	80	1855	2	11	23	31	42	52	62	57	46	32	10	1	1855
6	109	107	103	99	85	78	1871	11	12	18	28	41	54	58	56	51	25	11	11	1869[2]
7	102	100	96	98	91	89	1860[3]	20	28	36	44	48	63	63	67	51	44	31	22	1873
8	109	110	100	99	89	90	1855	— 1	9	20	28	36	55	48	61	44	26	15	3	1860
9	109	113	103	98	88	82	1871	1	20	29	30	51	59	68	68	50	40	10	12	1873
10	99	103	101	92	88	83	1851	8	15	25	32	40	50	62	60	50	40	28	9	1852
11	101	98	96	98	85	78	1873	—15	17	9	—2	38	45	56	45	30	21	10	7	1873
12	108	109	104	99	94	85	1860	12	19	24	36	43	62	63	67	54	38	27	12	1850[4]
13	112	112	105	96	87	82	1852	15	20	25	36	40	56	68	64	49	32	27	5	1850
14	106	108	101	96	88	82	1871	— 4	10	14	27	39	55	48	50	38	16	9	— 7	1870
15	106	106	101	92	93	84	1859	11	20	26	33	48	57	65	63	49	36	22	19	1868
16	109	106	97	94	85	79	1860	5	16	25	31	44	53	64	62	49	31	14	10	1857
17	108	109	106	104	97	93	1871	19	23	28	37	48	62	68	69	48	38	23	17	1850
18	105	104	100	91	85	81	1873	6	8	20	27	39	55	50	63	19	31	19	7	1873
19	114	103	96	91	86	83	1860	11	20	24	30	44	59	66	52	51	41	27	20	1860
20	109	107	102	94	85	74	1868	—10	10	23	9	40	45	55	50	48	30	8	2	1873
21	104	107	103	96	86	75	1850	5	16	25	34	44	60	62	61	44	30	26	7	1852
22	108	102	98	90	90	79	1860	10	16	22	38	40	62	71	63	47	31	21	17	1868
23	107	105	105	98	95	90	1871	20	26	32	30	49	63	69	70	56	40	22	18	1850
24	108	109	102	98	90	89	1871	14	25	29	32	46	62	60	60	55	36	27	14	1852[5]
UTAH.																				
1	103	105	89	99	71	68	1871	— 4	0	0	15	19	34	38	44	31	21	11	4	1864
2	96	95	90	86	69	60	1859	—15	— 6	— 2	20	21	43	58	56	30	12	8	—22	1859
3	95	95	85	83	72	52	1864[6]	— 8	— 3	4	22	38	45	56	60	35	30	22	6	1864
VERMONT.																				
1	101	92	85	80	64	64	1868	—25	—18	—17	13	28	36	47	42	28	11	3	—18	1866
2	97	100	90	83	70	48	1864	—25	—25	—23	4	25	32	38	43	25	15	5	—30	1868
3	90	82	82	70	65	49	1868	—21	—16	—20	13	31	43	54	48	34	23	7	—13	1866[7]
4	102	97	88	77	63	48	1868	—22	—31	—27	4	28	37	49	42	30	15	1	—24	1868
VIRGINIA.																				
1	100	104	96	80	72	65	1863	7	3	16	23	35	41	52	47	42	25	22	12	1855
2	102	96	97	89	82	69	1837	2	4	13	31	43	50	61	60	40	30	15	17	1857

5 Also in 1870. 6 Also in 1865. 7 Also in 1867 and 1868.

WASHINGTON.

Name of Station.	Height.	Series. Begins.	Ends.	Highest Temperature. Jan.	Feb.	Mar.	Apr.	May.	June.
				°	°	°	°	°	°
1. Camp Steele	150	Jan. 1860;	Dec. 1870	56	55	67	76	78	89
2. Cape Disappointment	30	Aug. 1864;	June, 1874	55	58	70	75	93	92
3. Fort Colville	1963	Jan. 1860;	June, 1874	48	51	68	78	91	90
4. Fort Steilacoom	250	Nov. 1849;	Mar. 1868	60	64	76	78	92	93
5. Fort Townshend	135	Jan. 1859;	June, 1874	57	55	63	72	79	85
6. Fort Vancouver	50	Dec. 1849;	July, 1868	61	64	82	82	98	98
7. Fort Walla-Walla	...	Jan. 1857;	May, 1867	68	61	76	96	99	104

WISCONSIN.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Beloit	750	Jan. 1860;	Dec. 1866	48	51	70	82	90	93
2. Embarrass	...	Jan. 1864;	Dec. 1870	53	56	66	82	98	98
3. Fort Crawford	642	Jan. 1820;	Aug. 1845	66	60	84	91	96	96
4. Fort Howard	620	Jan. 1822;	May, 1852	59	54	85	87	97	100
5. Fort Winnebago	770	Jan. 1831;	Aug. 1845	53	61	80	87	96	98
6. Manitowoc	658	Jan. 1860;	Dec. 1870	49	56	70	77	92	97
7. Milwaukee	604	Aug. 1859;	Dec. 1870	49	56	70	80	91	100
8. Superior City	680	Aug. 1859;	Dec. 1862	53	55	70	70	92	96
9. Waupaca	900	Jan. 1864;	Dec. 1869	54	50	71	77	95	98

WYOMING.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Fort Bridger	6656	July, 1858;	June, 1874	53	58	75	75	82	90
2. Fort D. A. Russell	...	Dec. 1869;	June, 1874	61	63	70	79	88	97
3. Fort Fetterman	...	Nov. 1868;	June, 1874	63	59	70	81	91	99
4. Fort Fred. Steele	...	Jan. 1860;	June, 1874	56	55	61	75	93	104
5. Fort Laramie	4472	Sept. 1849;	June, 1874	68	70	83	89	98	102
6. Fort Sanders	7161	Sept. 1866;	June, 1874	57	60	70	70	83	89

MEXICO.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Cordova	860	Jan. 1862;	Dec. 1864	76	78	84	86	82	81
2. Mirador	3600	Jan. 1861;	Dec. 1870	85	86	91	90	95	91

COSTA RICA.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. San José	3772	Jan. 1865;	Dec. 1866	81	85	85	85	82	81

CUBA.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Havana	50	Jan. 1859;	Nov. 1870	85	90	93	98	96	103

NEW GRANADA.

Name of Station.	Height.	Series. Begins.	Ends.	Jan.	Feb.	Mar.	Apr.	May.	June.
1. Aspinwall	6	Jan. 1865;	Dec. 1870	84	83	84	90	93	87

WASHINGTON.

	during Each Month.						Year of Extreme Heat.	Lowest Temperature during Each Month.												Year of Extreme Cold.
	July.	Aug.	Sept.	Oct.	Nov.	Dec.		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	°	°	°	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°	
1	95	88	85	67	59	56	1870	10	15	10	34	43	48	44	49	42	32	30	19	1862[1]
2	104	85	86	81	75	59	1865	20	26	20	33	38	38	49	46	40	36	30	17	1871
3	103	96	89	76	63	59	1872	—30	—20	—20	15	20	30	30	35	12	9	— 8	—22	1862
4	94	97	87	80	66	69	1860	— 8	2	12	25	35	41	44	13	28	28	17	0	1862
5	95	88	76	67	56	54	1870	18	19	26	32	35	38	41	40	35	32	19	—22	1872
6	96	98	94	82	68	59	1852[2]	—10	2	15	31	39	44	50	43	40	28	21	— 1	1862
7	107	107	98	88	78	63	1859[3]	—24	— 2	3	30	40	48	54	52	35	29	8	— 6	1862

WISCONSIN.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	94	96	86	82	61	50	1864	—29	—27	— 4	19	30	45	52	48	32	19	— 2	—20	1864
2	104	98	90	84	62	54	1866	—36	—25	—17	11	23	32	40	40	27	14	— 8	—18	1864
3	100	98	90	86	76	56	1839	—28	—32	—23	4	26	26	48	44	30	6	—12	—22	1832
4	100	100	98	84	76	54	1823[4]	—30	—38	—21	5	22	32	42	38	24	16	— 8	—25	1823
5	104	94	91	82	68	57	1838	—29	—33	—20	8	19	32	40	39	24	8	—13	—24	1832
6	96	94	86	80	63	56	1870	—26	—17	— 6	18	30	42	48	44	34	20	— 3	—16	1864
7	97	97	91	81	69	59	1870	—30	—18	— 7	16	27	39	44	43	33	20	— 3	—19	1864
8	99	97	88	84	66	49	1866	—37	—38	—24	—5	15	29	35	33	21	15	—19	—32	1863
9	97	98	90	83	64	49	1864	—30	—27	—17	10	30	45	52	45	35	18	— 6	—20	1864

WYOMING.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	91	92	85	79	69	57	1873	—33	—22	—29	0	17	24	32	26	15	—13	—27	—28	1873
2	103	97	99	85	71	62	1871	—23	—26	—21	1	14	25	38	30	20	0	—14	—29	1870
3	100	107	90	85	76	59	1869	—30	—40	—22	12	21	29	40	28	3	— 6	—22	—36	1873
4	102	100	97	80	64	57	1871	—38	—22	—20	5	13	20	34	33	16	— 8	—20	—22	1873
5	105	105	99	90	79	69	1861[5]	—40	—35	— 6	5	17	31	37	34	11	— 1	—18	—33	1864
6	96	97	87	90	73	60	1869	—50	—30	—21	—6	12	23	29	31	16	—25	—32	—36	1873

MEXICO.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	78	80	79	77	77	77	1862	53	53	58	60	67	68	68	68	68	60	57	58	1863
2	85	84	81	80	80	81	1868	41	43	48	50	59	63	63	64	61	52	49	46	1864

COSTA RICA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	79	79	79	79	79	80	1865	59	57	60	60	64	63	61	62	60	60	60	60	1866

CUBA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	100	99	99	95	89	86	1869	54	52	51	60	66	73	73	73	73	64	59	52	1869

NEW GRANADA.

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Heat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year of Extreme Cold.
1	86	86	86	86	86	86	1865	72	70	72	71	74	75	72	74	74	73	73	74	1865

[1] Also in 1870. [2] Also in 1857, 1858, and 1860. [3] Also in 1860.
[4] Also in 1824, 1825, 1826, and 1830. [5] Also in 1871.

Although the contents of the tables of observed extremes of temperature can readily be scanned by simple inspection, there are a few prominent features which deserve to be specially noticed.

With respect to extreme heat, perhaps the most remarkable contrast is presented in the case of Fort Simpson, in latitude 62° 10′, having a greater recorded maximum (104°) than even stations on the Gulf of Mexico; as for instance, New Orleans (100°) and Key West (98°). This arises on the one hand from the prolonged insolation and consequent accumulation of heat and from the dryness of the air at the northern station, and, on the other hand, mainly from the presence of a large amount of moisture at the southern stations. The difference of latitude is not less than 37½°. Of places showing high extremes in all months, Forts Fillmore and Cummings, New Mexico, are prominent examples; at these stations the heat in January rises to 95° but only to 107° in June. The former fort has an altitude of 3937 feet. Other stations of high January heat are Fort Duncan, Texas, with 91°, and Camp McDowell, Arizona, Fort McIntosh and Ringgold Barracks, Texas, with 90° each.

If we regard 110° Fah. as an exceptionally high temperature we shall find it exceeded in the following states or territories and stations, according to our limited table:—

Arizona	Fort Mojavé . .	118°
California . . .	Fort Miller . . .	121, also Camp Cady 118°, elevation 3000 feet.
Dakota	Fort Sully . . .	114
Idaho	Fort Boisé . . .	121
Indian Territory	Fort Gibson . .	116
Kansas	Fort Larned . .	115, elevation 1932 feet.
Montana	Fort Shaw . . .	112, elevation 6000 feet.
Nebraska	Fort McPherson .	115
Nevada	Camp Halleck . .	111, elevation 5600 feet.
New Mexico . . .	Fort McRae . .	120, elevation 4500 feet, also
	Albuquerque . .	114, elevation 5032 feet.
Texas	Fort Mason . . .	114.

These stations are all in the western part of the United States, and many of them at considerable elevations.

Exceptionally depressed heat, in *January*, we find noted at: Fort Ransom 34° and Fort Wadsworth 40° in Dakota; at New Ulm and Sibley, Minn., 41°, and at Lunenburg, Vt., Stratford, N. H., and Fort Wrangel, Alaska, of 42°.

With respect to extreme cold its geographical distribution depends mostly on the latitude, and not like the extreme heat, as we have seen, mostly on the longitude. Outside the boundaries of the United States, we have at Van Rensselaer Harbor the lowest temperature recorded —66°.4. At Peel River we find —56° recorded, at Fort Simpson —55°. The temperature sinks below that at which mercury congeals, which is —39° Fah. ±1°, in the following States and places, according to our limited table:—

Colorado	Fort Garland	—40°, elevation 8365 feet.	
Dakota	Fort Abercrombie	—40	The region in the vicinity of these stations is one frequently visited by the most excessive cold reached within the limits of the United States.
	Fort Buford	—40	
Michigan	Fort Brady	—47	
Minnesota	Fort Ripley	—44	
	Minneapolis	—40	
Montana	Camp Baker	—53	
	Fort Benton	—51	
	Fort Ellis	—53	
	Fort Shaw	—43	
New York	Gouverneur	—40	
	Lowville	—40	
	Madison Barracks	—44	
	Sackett's Harbor	—46	
	Salem	—40	
Wyoming	Fort Fetterman	—40	
	Fort Laramie	—40	
	Fort Sanders	—50, elevation 7160 feet.	

To the above would certainly have been added the States of Iowa, Maine, New Hampshire, Vermont, and Wisconsin, and most probably others bordering on these to the southward, but for our limited collection both in number of stations and in length of interval of time.

In the warmest month in the year, that is, for July, the temperature is recorded to have sunk to the freezing point of water (32°) or *below* it, in Arizona, Maine (at Brunswick, 27°), Michigan, Minnesota, Montana, Nevada, New York, Oregon, Washington Territory, and Wyoming.

Subtracting the lowest from the highest temperature recorded at any one station we obtain the *extreme range* of recorded variability, of which the following selected values may serve as examples: Extreme ranges at one or more stations equaling or exceeding 140°. British North America (Fort Simpson) 159°. Dakota 146°, Iowa 140°, Kansas 140°, Michigan 140°, Minnesota 147°, Montana 156°, New York 142°, Wisconsin 140°, and Wyoming 147°.

The least annual extreme range is recorded at Indian Key,[1] Florida, 42°, and very small ranges at Key West, Florida, 54°, at Fort Point, Golden Gate, California, 52°, and at Alcatraz Island, Harbor of San Francisco, of 53°. The ratio of the highest to the lowest range within the limits of the United States (excepting Alaska) is as 3.7 to 1.

If we investigate the extreme range for *each month separately* we find, for instance, from the 72 stations in our table for the State of New York, the average values:—

Averages.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
Highest temperature	61	61	73	85	91	95	98	96	91	82	72	61
Lowest temperature	—21	—19	—10	11	24	35	45	40	29	19	4	—14
Absolute monthly range	82	80	83	74	67	60	53	56	62	63	68	75
Ratio, the average being 69	1.2	1.2	1.2	1.1	1.0	0.9	0.8	0.8	0.9	0.9	1.0	1.1

[1] A very short series.

The monthly absolute range is least in summer and greatest in winter, a result which has already been reached in a different way in reference to variations in the monthly means, and the ratios indicate a regular progression in the yearly period; the January variability in the temperature is one and a half times as great as the July variability.

The 11 stations given in the table for Florida yield the following results:—

Averages.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
Highest temperature . . .	84.2	85.4	88.0	90.2	94.1	97.0	95.7	97.1	95.5	90.8	87.2	85.4
Lowest temperature . . .	30.4	32.4	39.3	45.9	55.1	64.1	68.8	66.7	63.0	49.1	40.2	33.0
Absolute monthly range . .	53.8	53.0	48.7	44.3	39.0	32.9	26.9	30.4	32.5	41.7	47.0	52.4
Ratio, the average being 41.9	1.3	1.3	1.2	1.1	0.9	0.8	0.6	0.7	0.8	1.0	1.1	1.2

We have the same regularity in the law of the annual progression, but the ratio of the variability in January to that of July is as 2 to 1. The average variability during the year in the latitude of New York is to the variability in the latitude of Florida as 69 to 42.

Tabulation of the Mean Annual Temperature in the United States, and at some places in British North America, for a succession of years, from the earliest records to the close of the year 1870.

The object of this tabulation was to furnish, in a convenient form, a basis for discussions relating to the study of the variations of our climate—as far as the same depends on temperature—during long intervals, involving questions of permanency, of periodic variations, of irregular fluctuations, and other relations. The tables will, therefore, be of permanent value, since they furnish the earliest material available, and they have consequently been made as complete as possible, at least within the area of the United States. The arrangement is that by States and Territories and by stations in each, the whole in alphabetical order.

In conformity with previous investigation the annual means have been corrected, as far as that could be done now, for daily variation, excepting those few cases where the hours of observation were unknown, as indicated by foot notes. To give to the tables the fullest extent compatible with accuracy, broken records (extending over less than one year) have been completed by interpolation, but only when observations were found recorded during at least 9 months of the calendar year. This interpolation for 1, 2, or 3 months (as the case may be) was effected as follows: comparison by differences was made with *records* complete during the period *at an adjacent station or at near places* for some months preceding and following the lacuna, and the average difference was applied to the record to furnish the interpolated value for the incomplete station. If no suitable adjacent station for comparison could be found, the general mean from the whole series for the particular months or month was substituted in the place of the blank record. The first method of interpolation is quite perfect, the second is less satisfactory, yet it is not apprehended that the annual mean could in the worst case be vitiated or in general rendered uncertain by more than $\pm 0^\circ.5$. In all cases where such limited interpolation had to be resorted to the *fact* is indicated in the tables by an asterisk affixed.

It should also be understood that all tabular annual means were found by dividing by 12, the sum of the monthly means belonging to the *calendar months;* the small correction for inequality of months (previously referred to) is nearly *constant*, and would not affect any conclusions we may deduce from the tables; of the same nature are index errors to the thermometers and reductions for difference of elevation or different exposures of stations at no great distance apart, as for instance within the limits of a city.

The bottom line of the tables contains the resulting mean temperatures for the respective stations; they are in general the mean of all the annual means in their respective columns, but they are made up from the *separate* monthly means, and include consequently all monthly means whether they belong to complete or incomplete years, in fact we might have a resulting annual mean from observations scattered over all the months but in different years and yet no single year complete. This explains the occasional differences of the resultant temperature from the simple mean of the individual complete years, and has nothing to do with interpolation.

In conformity with custom the mean temperatures are given to two places of decimals, but the hundredths of a degree have very little real value, and that only differentially.

TABLES OF THE MEAN ANNUAL TEMPERATURE IN THE UNITED STATES AND BRITISH NORTH AMERICA

FOR A SUCCESSION OF YEARS.

ALL NUMBERS ARE EXPRESSED IN DEGREES AND FRACTIONS OF THE FAHRENHEIT SCALE.

	GREENLAND.	BRITISH NORTH AMERICA.														
Year.	Van Rensselaer Harbor.	Peel River, Arctic Region.	Abbittibe.	Fort Churchill.	Fort Simpson.	Little Whale River.	Moose Factory.	Red River Settlement.	Rigolet, Labrador.	Winnipeg.	St. John's, New Foundland.	St. John's, New Foundland.	St. John's, New Foundland.	Albion Mines, Nova Scotia.	Caledonia Mine, Nova Scotia.	Halifax, Nova Scotia.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1769	...	...	...	19.75	...	...	...	...	...	...	...	...	...	...	...	...
1834	...	...	...	...	...	...	...	...	...	...	37.40	...	...	...	...	...
1835	...	...	...	...	...	...	...	...	...	...	38.90	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	37.81	...	...	...	...	...
1837	...	...	...	...	...	...	...	...	...	..	37.87	...	...	...	...	...
1838	...	...	...	...	...	...	...	...	...	...	37.65	...	...	...	...	...
1843	...	...	...	...	...	...	..	...	...	...	...	...	...	41.57	...	...
1844	...	...	...	...	...	...	...	33.8*	...	...	...	...	...	...	...	...
1854	—4.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.15
1855	...	...	...	...	...	...	...	...	...	...	...	40.9	...	...	...	44.77
1856	...	...	...	...	...	...	...	...	...	...	...	41.5	...	...	...	...
1857	...	...	...	...	...	...	...	...	...	...	...	...	41.82	...	...	...
1858	...	...	...	...	...	...	26.15	33.70*	...	...	...	40.0	39.91	...	...	...
1859	...	...	...	...	...	...	...	31.90	...	...	...	...	44.11	...	...	...
1860	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1861	...	...	...	...	24.0*	...	29.03	...	27.61	...	...	...	41.84	...	...	...
1862	...	...	...	...	...	21.7*	...	...	27.51*	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	12.5*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	13.1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	...	...	...	...	...	...	...	39.66	...
1868	...	...	31.88*	...	...	...	...	...	...	...	...	...	...	...	38.80	...
1869	...	...	...	...	...	...	...	...	...	37.1*	...	...	...	...	40.42	...
	—2.47	13.15	31.18	19.75[1]	...	22.36	...	...	26.75	37.17	37.93	40.80[1]	41.20	42.19	39.62	43.35

[1] Hours of observation unknown.

BRITISH NORTH AMERICA.—Continued.

Year.	Halifax, Nova Scotia.	Halifax, Nova Scotia.	Halifax, Nova Scotia.	Windsor, Nova Scotia.	Windsor, Nova Scotia.	Wolfville, Nova Scotia.	St. John, New Brunswick.	Year.	Fort Coulonge, Prov. of Quebec.	Is'd of St. Helen, Prov. of Quebec.	Montreal, Prov. of Quebec.	Montreal, Prov. of Quebec.	Montreal, Prov. of Quebec.	Montreal, Prov. of Quebec.	Year.	Montreal, Prov. of Quebec.
	°	°	°	°	°	°	°		°	°	°	°	°	°		°
1794	...	...	...	52.44	...	...	...	...	...	...	...	...	...	...	...	...
1795	...	...	...	51.76	...	...	...	...	...	...	...	...	...	...	...	...
1796	...	...	...	50.48	...	...	...	...	...	...	...	...	...	...	...	...
1797	...	...	...	48.72	...	...	...	...	...	...	...	...	...	...	...	...
1798	...	...	...	51.93	...	...	...	1824	41.0	...	...	...	...	...	...	...
1799	...	...	...	49.16	...	...	...	1825	42.5	...	...	...	...	...	...	...
1800	...	...	...	52.72	...	...	...	1826	40.3	...	45.9	...	...	...	...	...
1801	...	...	...	52.31	...	...	...	1827	40.0	...	43.5	...	...	...	...	...
1802	...	...	...	51.38*	...	...	...	1828	42.4	...	46.1	...	...	...	...	...
1803	...	...	...	50.95	...	...	...	1829	42.3	...	44.8	...	...	...	...	...
1804	...	...	...	49.10	...	...	...	1830	40.4	...	46.6	...	...	...	...	...
1805	...	...	...	51.80	...	...	...	1831	40.7	...	45.6	...	...	...	...	...
1806	...	...	...	50.61	...	...	...	1832	...	...	43.5	...	...	...	...	...
1807	...	...	...	52.09	...	...	...	1833	...	...	43.6	...	...	...	...	...
1808	...	...	...	...	...	...	...	1834	...	...	43.8	...	...	...	...	...
1809	...	...	...	52.54	...	...	...	1835	...	...	41.7	...	...	...	...	...
1810	...	...	...	52.50	...	...	...	1836	...	...	39.5	40.05	...	...	...	...
1811	...	...	...	53.20	...	...	...	1837	...	...	40.8	40.84	...	...	...	...
								1838	...	...	41.3	41.20	...	...	...	...
1856	...	...	...	...	...	43.32*	...	1839	...	...	43.8	43.69	...	...	...	...
1857	...	...	...	...	...	45.48	...	1840	...	42.54	42.8	43.91	...	...	...	...
1858	...	...	...	...	41.71	43.02*	...	1841	...	...	43.2	...	...	...	...	...
1859	...	...	...	...	43.15	44.04*	...	1842	...	...	42.7	...	...	...	...	...
1860	43.5	...	...	...	...	...	...	1843	...	...	42.5	...	...	...	...	...
1861	42.7	...	...	...	...	...	...	1844	...	...	42.2	...	...	...	...	...
1862	43.9	...	...	...	...	43.97*	...	1845	...	...	43.3	...	42.75	...	...	...
1863	44.5	43.4	...	...	...	...	...	1846	...	...	45.4	...	44.39	42.9	...	...
1864	...	42.7	...	...	...	43.97*	40.45	1847	...	...	43.1	...	42.07	41.0	1856	42.99
1865	...	42.8	...	...	...	43.65*	40.92	1848	...	...	44.0	...	42.88	44.0	1857	42.86
1866	...	42.4	...	...	...	43.54*	40.21	1849	...	...	43.1	...	42.45	42.1	1858	41.95
1867	...	...	41.98	...	...	42.80*	39.72	1850	...	...	43.4	...	42.56	43.8	1859	42.22*
1868	...	...	42.05	...	...	41.72*	38.60	1851	...	...	42.2	...	41.70	...	1860	...
1869	...	...	43.20	...	...	44.17*	41.31	1852	...	...	43.4	...	42.93	...	1861	44.41
1870	...	...	...	...	...	...	41.56*	1853	...	...	...	...	43.15	...	1862	43.99
	43.65[1]	42.83[2]	42.41	51.43[1]	42.95	43.75	40.39		41.18	42.12	43.44	44.48	42.75	42.77[1]		43.11

[1] Hours of observation unknown.

[2] Three observations daily; hours not stated.

BRITISH NORTH AMERICA.—Continued.

Year.	Montreal, Prov. of Quebec.	Nicolet, Prov. of Quebec.	Quebec, Prov. of Quebec.	St. Martin, Prov. of Quebec.	Year.	Stanbridge, Prov. of Quebec.	Ancaster, Prov. of Ontario.	Brantford, Prov. of Ontario.	Hamilton, Prov. of Ontario.	Kingston, Prov. of Ontario.	Kingston, Prov. of Ontario.	Michipicoten, Prov. of Ontario.	Michipicoten, Prov. of Ontario.	Toronto, Prov. of Ontario.
	°	°	°	°		°	°	°	°	°	°	°	°	°
...	...	...	...	...	1835	...	43.93	...	...	...	...	...	...	...
...	...	...	...	...	1836	...	44.01	...	...	...	...	...	...	...
...	...	...	...	...	1837	...	44.85	49.2	...	...	...	...	...	...
...	...	...	...	...	1838	...	45.81	49.0	...	...	...	...	...	...
1809	...	...	39.35	...	1839	...	48.23	51.7	...	...	...	...	...	...
1810	...	...	41.50	...	1840	...	48.42	51.7	...	...	...	...	...	43.62
1811	...	...	42.94	...	1841	...	48.03	50.7	...	...	...	...	...	43.92
1812	...	...	40.20	...	1842	...	48.01	49.7	...	...	...	...	...	43.96
1813	...	...	41.07	...	1843	...	49.42	49.7	...	...	...	...	...	42.35
1814	...	...	41.12	...	1844	...	48.67	52.5	...	...	...	...	...	44.48
1815	...	..	39.75	...	1845	...	48.65	...	...	...	...	...	...	44.58
1816	...	...	38.12	...	1846	...	...	...	50.82	...	...	...	...	46.36
1817	...	...	38.62	...	1847	...	...	...	48.77	...	...	38.59	...	43.70
1818	...	...	40.49	...	1848	...	...	...	49.91	...	...	...	...	45.08
———					1849	...	...	...	48.72	...	...	...	...	44.09
1838	...	40.3	...	...	1850	...	...	...	49.34	...	...	...	...	44.45
1839	...	41.4	...	...	1851	...	...	...	49.37	...	...	...	...	43.98
1840	...	41.5	...	...	1852	...	...	...	48.86	...	...	...	...	43.84
1841	...	41.2	...	...	1853	...	...	...	50.08	...	...	...	...	44.80
1842	...	40.2	...	...	1854	...	...	...	49.61	...	...	...	...	45.23
1843	...	40.3	...	...	1855	...	...	...	...	...	...	...	...	43.98
1844	...	39.8	...	...	1856	...	...	...	44.66	40.55	41.5	...	...	42.18
1845	...	40.8	...	...	1857	41.93	...	...	46.48	41.08	43.7	...	...	42.75
1846	...	42.3	...	...	1858	41.10	...	...	48.77	41.96	43.1	...	...	44.76
———					1859	41.43	...	...	47.49	40.75	...	...	...	44.21
1851	...	...	...	42.09	1860	42.68*	...	...	...	42.16	...	...	...	44.34
1852	...	...	...	42.82	1861	41.42	...	...	...	39.20	...	...	35.76*	44.24
1853	...	...	...	42.56	1862	41.23	...	...	...	...	...	...	...	44.37
1854	...	...	...	41.52	1863	41.35*	...	...	...	...	...	...	...	44.59
1855	...	...	...	41.63	1864	43.89	...	...	...	...	...	...	...	44.70
1856	...	...	...	39.91	1865	...	...	...	...	...	...	...	...	44.92
1857	40.58	...	...	40.93	1866	...	...	...	...	...	...	...	...	43.51
1858	40.06	...	...	40.35	1867	...	...	...	...	...	...	...	...	43.84
1859	...	...	...	41.58	1868	40.59	...	...	...	...	...	...	...	43.33
1860	43.42	...	...	...	1869	41.20	...	...	...	...	...	...	...	43.13
1861	41.72	...	...	42.96	1870	44.41	...	...	...	...	...	...	...	45.94
	41.45[1]	40.84	40.31[1]	41.62		41.89	47.09	50.54[1]	48.64	40.95	42.77[1]	38.59	35.01	44.17

[1] Hours of observation unknown.

ALABAMA.

Year.	Ashville.	Auburn.	Carlowville.	Coatopa.	Elyton (near).	Florence.	Fort Morgan.	Greene Springs.	Greensboro'.	Mobile.	Moulton.	Mt. Vernon Arsenal.	Opelika (near).	Prairie Bluff.	Selma.	Springhill.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1835	...	...	...	...	...	...	66.20*	...	...	...	...	...	...	...	...	...
1840	...	...	...	...	...	...	...	...	...	70.05*	...	...	...	...	...	...
1841	...	...	...	...	...	...	...	...	...	68.41	...	...	...	...	...	...
1842	...	...	...	...	...	...	66.56*	...	...	69.74	...	65.01*	...	...	...	70.01
1843	...	...	...	...	...	...	...	...	...	...	...	65.48	...	...	...	...
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	...	...	...	...	...	65.03	...	...	...	...
1846	...	...	...	...	...	...	...	...	...	...	...	65.85	...	...	...	...
1847	...	...	...	...	...	...	...	...	...	...	...	64.68	...	...	...	...
1848	...	...	...	...	...	...	...	...	...	...	...	65.68	...	...	...	...
1849	...	...	...	...	...	62.52	...	...	...	...	...	65.87	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	...	66.82	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	...	66.57	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	68.16	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	66.49	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...	...	66.67	...	...	...	...
1855	...	64.36*	...	...	...	...	...	65.24*	...	...	...	66.61	...	...	...	...
1856	...	62.48	...	...	...	...	...	62.99*	...	...	...	65.18	...	...	...	...
1857	56.45	61.96	62.89	...	...	...	...	60.80	60.64*	...	...	64.58	...	...	...	...
1858	...	...	63.95*	...	...	...	...	62.40	62.65*	...	...	66.32	...	...	63.81*	...
1859	...	...	65.62*	...	...	...	...	63.06	62.64*	...	...	66.22	...	...	64.29*	...
1860	...	...	...	...	...	...	...	...	...	...	...	69.25*	...	...	...	...
1861	...	...	...	...	...	...	...	...	64.56*	...	...	...	...	...	...	...
1867	...	...	66.35*	...	...	...	...	63.65	...	...	60.66*	...	64.36*	66.43*	...	...
1868	...	...	64.61	...	...	...	...	61.93	61.80	...	59.32	...	62.30	...	...	...
1869	...	...	64.51	...	...	...	...	61.14	61.85*	...	58.63	...	62.74*	...	...	...
1870	...	...	64.58	61.71*	61.28*	...	...	61.76	...	...	...	...	...	...	...	...
	56.45	63.18	64.72	...	61.28	62.52[1]	67.59	62.57	62.73	68.75	59.83	66.15	63.13	66.43	64.10	70.01

[1] Hours of observation unknown.

	ALASKA.						ARIZONA.									
Year.	Fort Kadiak.	Fort Tongass.	Fort Wrangel.	Illoolook.	Sitka.	Sitka.	Camp Bowie.	Camp Colorado.	Camp Crittenden.	Camp Date Creek.	Camp Goodwin.	Camp Grant.	Camp Lowell Tucson.	Camp McDowell.	Camp Reno.	Camp Verde.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1828	...	...	...	38.96	...	...	...	...	...	...	...	...	...	...	...	...
1829	...	...	...	37.43	...	...	...	...	...	...	...	...	...	...	...	...
1830	...	...	...	34.97	...	...	...	...	...	...	...	...	...	...	...	...
1831	...	...	...	35.20	...	...	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	38.37	...	...	...	...	...	...	...	...	...	...	...	...
1833	...	...	...	37.67	...	...	...	...	...	...	...	...	...	...	...	...
1848	...	...	...	...	41.77	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	40.37*	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	...	40.27	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	43.67	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	42.26	...	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	40.87	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	41.81	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	...	43.36	...	...	...	...	...	...	...	...	...	...	...
1857	...	...	...	...	43.05	...	...	...	...	...	...	...	...	...	...	...
1858	...	...	...	...	41.32	...	...	...	...	...	...	...	...	...	...	...
1859	...	...	...	...	40.84	...	...	...	...	...	...	...	...	...	...	...
1860	...	...	...	...	43.23	...	...	...	...	...	...	...	...	...	...	...
1861	...	...	...	...	42.55	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	...	...	41.28	...	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	42.34	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	43.31	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	...	...	...	66.33	68.00*	69.39*	72.12	...	...
1868	...	...	...	...	...	44.74	62.79	...	...	61.79	63.93	67.28	68.87	68.88*	...	...
1869	42.17*	47.37	43.30*	...	...	46.39	61.87	72.04	59.26	63.01	65.34	67.91	67.24	71.16	69.75	62.38
1870	...	45.38*	43.16*	...	...	44.58	63.81	72.13	60.35	64.04	...	66.84	67.15	70.92	...	62.89
	41.66	46.19	43.48	37.51[1]	42.05[1]	45.14	63.09	72.09	60.58	62.91	65.78	67.25	68.27	70.67	69.90	62.79

[1] Old style.

Year.	ARIZONA.—Continued.						ARKANSAS.					CALIFORNIA.				
	Camp Wallen.	Camp Willow Grove.	Fort Buchanan.	Fort Canby.	Fort Mojavé.	Fort Whipple.	Fort Smith.	Fort Wayne.	Helena (near).	Little Rock.	Washington (near).	Alcatraz Island.	Angel Island.	Benicia Barracks.	Cahto.	Camp Babbitt.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1840	...	...	...	...	...	...	60.03	59.67	...	62.28	60.29	...	...	...	...	...
1841	...	...	...	...	...	...	...	...	...	...	58.81	...	...	...	...	...
1842	...	...	...	...	...	...	59.35	...	...	...	59.88	...	...	...	...	...
1843	...	...	...	...	...	...	56.93	...	...	...	57.54	...	...	...	...	...
1844	...	...	...	...	...	...	59.71	...	...	...	61.15	...	...	...	...	...
1845	...	...	...	...	...	...	60.25	...	...	...	60.62	...	...	...	...	...
1846	...	...	...	...	...	...	61.16	...	...	...	60.57	...	...	...	...	...
1847	...	...	...	...	...	...	59.00	...	...	...	58.74	...	...	...	...	...
1848	...	...	...	...	...	...	59.93	...	...	...	61.06*	...	...	...	...	...
1849	...	...	...	...	...	...	61.00	...	...	...	63.10	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	62.00	...	...	58.63*	...	...
1851	...	...	...	...	...	...	...	...	...	...	63.06	...	...	59.58	...	...
1852	...	...	...	...	...	...	62.23	...	...	...	62.94	...	...	58.88	...	...
1853	...	...	...	47.60	...	...	60.05	...	...	...	62.76	...	...	58.24	...	...
1854	...	...	...	47.11	...	...	61.62	...	...	...	64.05	...	...	56.39	...	...
1855	...	...	...	46.99*	...	...	60.82	...	...	...	62.90	...	...	58.67*	...	...
1856	...	...	...	44.44	...	...	58.15	...	...	...	61.36	...	...	58.30	...	...
1857	...	...	...	48.84	...	...	58.20	...	...	...	61.50	...	...	60.05	...	...
1858	...	...	57.50	46.23	...	...	...	...	...	...	62.78	...	...	59.27	...	...
1859	...	...	57.85	46.64*	...	...	60.65*	...	...	...	63.42	...	...	56.54	...	...
1860	...	...	60.39	49.20*	72.74	...	62.21*	...	...	...	63.89	...	...	57.83*	...	...
1861	...	...	...	...	...	...	...	...	...	...	...	54.46	...	59.17	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	54.61	...	58.08*	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	55.09	...	58.43	...	...
1864	...	...	...	...	...	...	...	...	...	...	...	...	...	60.48	...	64.04*
1865	...	...	...	...	...	53.74*	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	62.10	...	...	...	...	...	...	...
1867	61.91*	...	...	...	...	57.00*	...	...	...	63.61*	...	56.33	...	...	...	...
1868	61.39	53.97*	...	...	72.91	51.38*	...	...	...	...	...	55.16	57.15	...	...	...
1869	61.50	55.67*	...	...	72.69	...	...	...	...	...	...	59.44	58.03	...	...	...
1870	...	...	...	...	72.54	53.60	...	...	61.26	...	...	57.83	58.41	...	58.16	...
	61.33	54.82	59.15	47.26	72.82	54.03	60.12	59.67	61.15	62.30	61.56	56.27	57.94	58.36	58.16	...

CALIFORNIA.—Continued.

Year.	Camp Bidwell.	Camp Cady.	Camp Far West.	Camp Gaston.	Camp Independence.	Camp Lincoln.	Camp Wright.	Chico.	Drum Barracks.	Fort Bragg.	Fort Crook.	Fort Humboldt.	Fort Jones.	Fort Miller.	Fort Point.	Fort Reading.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1851	...	...	60.72	...	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	67.17*	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	51.80*	66.64	...	62.72
1854	...	...	...	...	...	...	...	...	...	...	...	51.64	49.75	64.71*	...	61.55
1855	...	...	...	...	...	...	...	...	...	...	...	53.84*	50.76	66.85	...	63.18*
1856	...	...	...	...	...	...	...	...	...	...	...	53.66	52.63	65.58	...	...
1857	...	...	...	...	...	...	...	...	...	...	...	53.44*	52.98*	66.06	...	...
1858	...	. .	...	...	...	...	...	...	...	...	49.27	51.74	...	...	...	...
1859	...	...	...	...	...	...	...	...	...	...	47.98	51.91	...	...	...	...
1860	...	...	...	...	...	...	...	...	...	...	48.04	51.20	...	...	54.23	...
1861	...	...	...	...	...	...	...	...	...	51.97*	51.29*	51.77*	...	...	54.17	...
1862	...	...	...	59.33	...	...	...	...	...	51.50*	48.93	...	...	...	53.60	...
1863	...	...	...	61.86	...	...	...	...	...	53.36	50.64	52.44	...	...	53.89	...
1864	...	...	...	57.27	...	...	...	...	...	...	52.93	53.70*	...	...	55.86	...
1865	...	...	...	55.10	...	...	56.17	...	60.65	...	50.67*	51.87	...	...	54.26	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	54.94	...
1867	49.48	...	...	...	59.96*	52.47*	57.22*	...	64.28*	...	50.36*	...	...	...	55.16	...
1868	45.57	68.23	...	54.17	57.73	52.54	57.27	...	66.52*	...	51.30*	...	...	...	55.01	...
1869	50.87	67.71	...	56.85	58.42	...	58.85	...	62.10	...	...	...	...	...	56.50*	...
1870	49.56	65.70	...	56.73	57.81*	...	57.50	62.79	62.06*	...	...	...	...	...	57.41	...
	50.39	67.22	60.65	57.37	58.33	53.47	57.39	62.89	63.16	52.44	50.31	52.46	51.85	66.15	55.00	62.44

CALIFORNIA.—Continued.

Year.	Fort Ross.	Fort Tejon.	Fort Ter-Waw.	Fort Yuma.	Marysville.	Meadow Valley.	Montere.	Murphy's.	New San Diego.	Point San José.	Presidio.	Ranche de Jurupa.	Sacramento.	San Diego.	San Francisco.	Stockton.
1837	51.43	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1838	50.16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1839	51.18	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1840	50.79	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	54.40	...	...	...	...	...	...	60.72	...	...
1851	...	...	...	...	...	...	...	...	...	...	56.59	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	61.95	...	...
1853	...	...	...	75.41	...	...	...	...	...	...	55.28	64.64	62.41*	63.39	...	...
1854	...	...	...	73.85	...	...	...	...	...	...	54.76	...	59.51	61.97	56.00	60.14
1855	...	56.22*	...	74.96*	...	...	...	...	...	...	55.87	...	59.29	62.50	...	...
1856	...	58.12	...	73.84	...	...	...	...	...	...	54.42	...	59.62	60.97	...	...
1857	...	59.99	...	74.98*	...	...	...	...	...	...	54.75	...	59.60	61.85	57.02	...
1858	...	56.67	...	74.79	62.91	...	...	...	...	...	53.80	...	59.17	61.11	55.82	...
1859	...	57.38*	52.67*	73.60	...	...	...	...	...	...	52.98	...	58.33	61.09	54.94*	...
1860	...	56.48*	52.52*	74.74	...	...	54.27*	...	...	...	53.80	...	58.76	61.30	...	...
1861	...	...	...	76.44	...	49.54*	...	...	...	...	53.48*	...	60.00	63.32	55.92	...
1862	...	...	...	73.85*	59.91	...	...	...	...	...	...	...	60.03	62.46	55.02	...
1863	...	...	...	...	...	...	...	...	...	...	54.55*	...	60.64*	61.60	54.49*	...
1864	...	...	...	...	...	49.65	56.31	...	...	...	54.55	...	61.42*	63.41	55.66	...
1865	...	...	...	...	...	48.05	54.84	...	61.24	...	53.41	...	60.77	62.08	53.82	...
1866	...	..	...	...	...	...	56.42	...	...	55.83*	54.46*	...	61.59	62.98	54.10	...
1867	...	...	...	76.46	...	...	56.21	...	...	...	54.74*	...	...	63.77*	...	...
1868	...	...	...	74.46	...	...	54.70	55.51*	...	...	53.51	...	...	63.08	53.92*	...
1869	...	...	...	72.39	...	...	55.50	...	...	...	55.27	...	...	62.17	...	...
1870	...	...	...	72.18	...	...	55.71*	...	...	...	54.93	...	...	61.20	...	...
	50.89	57.62	52.71	74.36	61.55	48.72	55.45	...	62.08	...	54.38	63.81	60.00	62.11	55.23	60.35

	CALIFORNIA.—Continued.					COLORADO.						CONNECTICUT.				
Year.	Union Ranche.	Vacaville.	Visalia.	Watsonville.	Yerba Buena Island.	Denver.	Fort Garland.	Fort Lyon.	Fort Morgan.	Fort Reynolds.	Fort Sedgwick.	Brookfield.	Canton.	Colebrook.	Columbia.	Fort Trumbull.
	°	°	°		°	°	°	°	°	°	°	°	°	°	°	°
1827	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	52.69
1828	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	56.40
1831	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	53.60
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	54.34
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	52.59
1834	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.11
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48.76
1843	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.57
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47.64
1845	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	49.70
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.38
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.17
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.10
1853	...	...	...	...	...	...	40.39*	...	...	...	...	...	...	...	...	51.22*
1854	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	...	40.71*	...	...	...	...	...	...	...	...	...
1856	...	...	...	...	...	...	39.20	...	...	...	...	...	...	...	...	...
1857	...	...	...	...	...	...	40.38	...	...	...	...	...	...	...	46.28	...
1858	...	...	...	...	...	...	39.86*	...	...	...	...	...	...	...	46.92	...
1859	...	...	...	...	...	...	39.79	...	...	...	...	...	...	...	46.54	...
1860	60.54*	...	...	...	...	...	42.05	...	...	...	...	...	...	...	...	...
1861	63.28	...	...	...	. .	...	45.48	53.22	...	...	...	...	...	45.12	47.18	...
1862	60.98	...	...	...	...	...	44.24	...	...	...	...	...	44.58	44.97	49.96	49.36*
1863	...	...	...	...	...	...	43.24	...	...	...	...	...	...	45.96	48.96	50.81
1864	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.34	50.91
1865	...	...	...	...	...	...	...	...	...	...	...	...	...	45.83	51.13	52.14
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	44.57	49.43	49.09
1867	...	...	...	...	...	...	47.71	55.09	51.03*	...	...	...	...	44.12	47.52	49.25
1868	...	...	...	...	...	...	44.52	50.95	...	...	50.05	...	...	43.12	46.99	48.45
1869	...	63.85*	...	58.85*	56.37*	...	43.62	48.43*	...	51.16	47.43*	48.30*	...	44.06	48.45	49.39
1870	...	...	61.47	58.34*	56.53	48.23	44.94	51.07	...	53.26	50.01	51.45	...	46.92*	50.99	51.52
	61.71	62.91	61.47	58.60	56.45	48.13	42.45	51.61	...	52.29	49.51	49.57	45.63	44.91	48.26	50.64

CONNECTICUT.—Continued.

Year.	Georgetown.	Goshen.	Hartford.	Lynde Point Light-House.	Year.	Middletown.	Year.	New Haven.	Year.	New Haven.	Year.	New Haven.	New London.	Norwich.	Plymouth.	Pomfret.
	°	°	°	°		°		°		°		°	°	°	°	°
1807	...	...	47.71	...	...	...	...	...	...	...	...	...	...	...	...	...
					...	...	...	...	...	...	...	...	...	...	...	...
1829	...	48.74	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	...	50.85	...	...	...	...	...	...	...	...	1838	48.17	...	...	...	...
1831	...	49.40	...	...	...	...	...	...	...	...	1839	49.17	...	...	...	...
1832	...	47.61	...	...	...	...	1780	49.73*	1809	49.25	1840	49.04	...	...	...	...
1833	...	48.42	...	...	...	...	1781	50.36	1810	49.95	1841	49.54	...	...	...	...
1834	...	48.86	...	...	...	...	1782	49.06	1811	49.70	1842	49.86	...	...	...	...
1835	...	46.69	...	...	...	...	1783	48.39	1812	46.90	1843	47.38	...	...	...	...
1836	...	45.26	...	...	...	...	1784	47.27	1813	49.04	1844	50.24	...	...	...	...
1837	...	45.97	44.75	...	...	...	1785	47.70	1814	48.60	1845	50.16	...	...	...	...
1838	...	47.34	46.11	...	...	...	1786	48.51	1815	47.27	1846	50.10	...	...	...	...
1839	...	47.96	47.31	...	...	...	1787	48.47	1816	46.61	1847	49.44	...	...	...	...
1840	...	47.72	47.06	...	...	...	1788	49.72	1817	46.45	1848	49.22	...	...	...	...
1841	...	48.82	46.88	...	...	...	1789	49.50	1818	46.77	1849	48.29	...	...	...	...
1842	...	48.12	47.34	...	...	...	1790	49.46	1819	49.01	1850	48.75	...	...	...	...
1843	...	47.80	45.80	...	...	...	1791	49.50	1820	47.92	1851	49.00	...	...	...	...
1844	...	48.22	47.68	...	...	...	1792	48.15	1821	47.56	1852	48.78	...	...	...	...
1845	...	48.90	48.23	...	...	...	1793	50.35	1822	49.70	1853	49.60	...	...	...	...
1846	...	49.11	47.26	...	...	...	1794	50.17	1823	48.10	1854	49.30	49.97*	...	...	46.11
1847	...	48.41	45.68	...	...	...	1795	...	1824	49.86	1855	48.96	49.90*	...	...	45.71
1848	...	48.33	47.92	...	...	...	1796	48.36	1825	50.75	1856	46.98	47.00	47.21*	...	44.28
1849	...	47.89	45.92	...	1859	47.91	1797	48.11	1826	49.70	1857	47.53	47.79	47.96	...	44.63
1850	...	48.11	46.32	...	1860	47.11	1798	49.32	1827	48.87	1858	48.26	...	...	...	44.93
1851	...	...	45.53	...	1861	47.34	1799	48.41	1828	51.82	1859	48.01	...	...	...	44.99
1852	...	...	...	...	1862	47.25	1800	50.16	1829	48.67	1860	48.55	...	...	...	45.30*
1853	...	...	...	...	1863	48.03*	1801	50.96	1830	50.83	1861	50.10	...	...	...	45.43
1854	...	...	...	48.76*	1864	48.94*	1802	51.34	1831	49.24	1862	49.50	...	...	...	45.43
1855	...	...	...	48.36*	1865	49.88*	1803	50.77	1832	47.66	1863	50.00	...	...	45.50	46.01
1856	45.18*	...	...	47.47	1866	49.01*	1804	49.83	1833	48.29	1864	49.86	...	...	...	46.18
1857	...	...	...	47.03	1867	48.01	1805	51.72	1834	48.92	1865	49.97*	...	...	...	47.03
1858	...	...	...	48.27	1868	45.95	1806	49.71	1835	46.56	1866	...	...	...	...	45.73
1859	...	...	...	48.10	1869	47.42	1807	49.25	1836	45.18	1867	...	...	...	...	45.52
1860	...	...	...	49.00*	1870	50.01	1808	50.29	1837	46.41	1868	...	...	...	...	43.48
	...	48.16	46.61	48.07		48.09						49.00	49.14	48.18	45.74	46.01

CONNECTICUT.—Continued.

Year.	Salisbury.	Sharon.	Southington.	Wallingford.	Warren Center.	Waterbury.	West Cornwall.
	°	°	°	°	°	°	°
1816	...	45.82*	...	...	...	...	...
1817	...	45.51	...	...	...	...	...
1818	...	45.73	...	...	...	...	...
1819	...	48.68	...	...	...	...	...
1820	...	47.42	...	...	...	...	...
1821	...	45.20	...	...	...	...	...
1822	...	48.47	...	...	...	...	...
1823	...	45.31	...	...	...	...	...
1824	...	46.61	...	...	...	...	...
1825	...	48.00	...	...	...	...	...
1826	...	48.21	...	...	...	...	...
1827	...	46.47	...	...	...	...	...
1828	...	49.51	...	...	...	...	...
1829	...	45.85	...	...	...	...	...
1830	...	48.09	...	...	...	...	...
1831	...	46.83	...	...	...	...	...
1832	...	46.30	...	...	...	...	...
1833	...	46.31	...	...	...	...	...
1834	...	46.95	...	...	...	...	...
1835	...	44.75	...	...	...	...	...
1836	...	43.45	...	...	...	...	...
1849	...	...	...	...	45.84	...	...
1854	47.01	...	...	...	...	...	45.97
1856	...	...	...	45.85*	...	...	...
1857	...	...	...	46.04	...	...	...
1858	...	...	...	46.83	...	...	...
1859	...	...	...	46.92	...	...	...
1860	...	...	...	47.17	...	...	...
1861	...	...	...	47.65	...	...	...
1867	...	...	...	...	...	48.36*	...
1868	...	...	...	...	...	45.29*	...
1870	...	...	49.99*	...	...	...	...
	47.33	46.61	49.99	46.98	45.84[1]	46.49	45.97

DAKOTA.

Year.	Fort Abercrombie.	Fort Buford.	Fort Pierre.	Fort Randall.	Fort Ransom.	Fort Rice.	Fort Stevenson.	Fort Sully.
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...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
1856	...	...	45.56	...	...	...	...	...
1857	...	...	...	47.29	...	...	...	...
1858	...	...	...	46.92	...	...	...	...
1859	...	...	...	46.39	...	...	...	...
1860	...	...	...	48.68	...	...	...	...
1861	40.20	...	...	47.25	...	...	...	...
1862	39.23	...	...	46.33	...	...	...	...
1863	39.50	...	...	48.46	...	...	...	...
1864	41.50	...	...	48.85*	...	...	...	...
1865	41.73*	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...
1867	39.17	39.19*	...	45.66*	...	...	...	...
1868	38.51	41.23	...	46.80	...	...	40.73	...
1869	38.02	40.90	...	47.52*	38.20	42.14*	...	44.15
1870	41.58	40.78	...	49.56	40.46	42.91*	41.26*	48.34
	39.93	40.64	45.43	46.56	39.27	42.23	41.70	45.44

[1] Hours of observation unknown.

DAKOTA.—Cont'd.				DELAWARE.					DIST. OF COLUMBIA.					FLORIDA.		
Year.	Fort Totten.	Fort Wadsworth.	Yankton Indian Ag'y.	Fort Delaware.	Georgetown.	Milford.	Newark.	Wilmington.	Georgetown.	Year.	Washington.	Year.	Washington.	Belair.	Cedar Keys.	Fairview.
	°	°	°	°	°	°	°	°	°		°		°	°	°	°
...	...	...	...	...	...	...	...	...	...	1820	54.57	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1821	53.41	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1822	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1823	56.56	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1824	55.58	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1825	56.63	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1826	57.60	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1827	57.43	...	...	...	...	...
1825	...	...	...	55.56*	...	...	...	...	...	1828	57.29	...	...	...	...	...
1826	...	...	...	56.30	...	...	...	...	...	1829	54.25	...	...	...	...	...
1827	...	...	...	57.11*	...	...	...	...	...	1830	56.72	...	...	...	...	...
1828	...	...	...	58.54	...	...	...	...	...	1831	52.59	1841	...	...	69 99	...
1829	...	...	...	52.66	...	...	...	...	...	1832	...	1842	...	...	69.09	...
1830	...	...	...	54.38	...	...	...	...	...	1833	55.33					
										1834	55.34	1854	...	...	71.03	...
1855	...	...	...	52.97	...	...	...	...	...	1835	53.22	1855	...	...	69.73	...
1856	...	...	...	50.96	...	...	...	...	...			1856	...	...	68.87	...
1857	...	...	...	52.46	...	...	52.26	...	...	1839	53.63	1857	...	65.85	68.64	...
1858	...	...	...	53.52	55.66	...	...	...	...	1840	53.55	1858	...	69.03	70.51	...
1859	...	...	...	...	...	...	...	...	...	1841	52.87	1859	54.99	68.64	69.57*	...
1860	...	...	49.72	...	...	...	...	...	56.16			1860	...	...	...	...
1861	...	...	...	...	...	...	...	...	57.03*	1846	56.77	1861	...	...	...	...
1862	...	...	...	53.18*	...	...	...	...	54.92	1847	55.17	1862	54.09	...	...	...
1863	...	...	...	52.81*	...	...	...	...	...	1848	55.37	1863	53.65	...	...	...
1864	...	...	...	54.51	...	...	...	53.00	...	1849	55.82	1864	54.17	...	...	...
1865	...	...	...	56.06	...	...	...	52.82*	...			1865	55.00	...	...	...
1866	...	...	...	54.53*	...	...	...	...	...	1854	55.59*	1866	54.45	...	...	...
1867	...	37.44*	...	54.39*	...	...	...	...	...	1855	54.42	1867	53.03	...	...	...
1868	...	...	...	53.50	...	...	...	...	...	1856	51.67	1868	52.36	...	...	...
1869	...	38.16	...	52.54	...	...	...	...	...	1857	52.01*	1869	53.58	...	...	68.41*
1870	39.51	40.26	...	54.89*	...	54 95	...	...	...	1858	54.83	1870	55.13	...	...	69.55*
	38.40	38.73	48.22	54.28	55.52	55.06	51.82	52.91	56.00				54.91	68.10	70 05	68.98

FLORIDA.—Continued.

Year.	Fort Barrancas.	Fort Brooke.	Fort Dallas.	Fort Deynaud.	Fort Fanning.	Fort Gamble.	Fort Heiloman.	Fort Henderson.
	°	°	°	°	°	°	°	°
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
1822	68.56	...	...	...	...	...	...	...
1823	67.85	...	...	...	...	...	...	...
1824	68.70	...	...	...	...	...	...	...
1825	...	71.98	...	...	...	...	...	...
1826	69.51	72.91	...	...	...	...	...	...
1827	69.87	73.78	...	...	...	...	...	...
1828	69.86	73.47	...	...	...	...	...	...
1829	68.57	71.16*	...	...	...	...	...	...
1830	...	72.58	...	...	...	...	...	...
1831	...	71.01	...	...	...	...	...	...
1838	...	70.06	...	...	...	...	...	...
1839	...	71.64	74.71*	...	...	...	67.08	68.38*
1840	...	70.46	74.91	...	...	...	68.90*	...
1841	...	71.18	74.56*	...	71.15	...	...	...
1842	...	71.16	...	...	69.48	69.56	...	...
1843	68.54	70.33	...	...	...	...	...	...
1844	69.24	70.40	...	...	...	...	...	...
1845	67.57*	70.60	...	...	...	...	...	...
1846	68.26*	71.59	...	...	...	...	...	...
1847	...	71.66	...	...	...	...	...	...
1848	...	72.80*	...	...	...	...	...	...
1849	...	74.36	...	...	...	...	...	...
1850	...	73.47*	78.09*	...	...	...	...	...
1851	68.38*	71.33	...	...	...	...	...	...
1852	...	71.98	...	...	...	...	...	...
1853	67.73*	72.99	...	...	...	...	...	...
1854	68.73	71.54	...	...	...	...	...	...
1855	67.82	70.94*	74.38	72.91*	...	...	...	...
1856	65.95	70.70	75.59	...	...	...	...	...
1857	...	70.52*	75.87	...	...	...	...	...
1858	...	...	...	...	...	...	...	...
1859	67.75	...	...	...	...	...	...	...
1860	67.67	...	...	...	...	...	...	...
	68.08	71.51	74.90	72.44	69.80	69.16	68.29	68.39

Year.	Fort Jefferson.	Fort King.	Fort Marion.	Fort Meade.	Fort Micanopy.	Fort Myers.	Fort Pierce.
	°	°	°	°	°	°	°
1825	...	...	71.80	...	...	...	...
1826	...	...	72.12*	...	...	...	...
1827	...	...	71.27*	...	...	...	...
1828	...	...	72.91	...	...	...	...
1829	...	...	68.62*	...	...	...	...
1830	...	...	70.80	...	...	...	...
1831	...	...	68.32	...	...	...	...
1832	...	...	70.19	...	...	...	...
1833	...	72.00	70.16	...	...	...	...
1834	...	72.49	69.93*	...	...	...	...
1835	...	68.15	...	...	...	...	...
1837	...	...	67.29	...	...	...	...
1838	...	...	66.22	...	...	...	...
1839	...	...	66.58	...	70.55	...	...
1840	...	...	...	...	69.93	...	71.97
1841	...	67.90	66.74	...	68.48	...	...
1842	...	68.45	68.01	...	69.61	...	...
1843	...	...	68.68	...	...	...	...
1844	...	...	69.18	...	...	...	...
1845	...	...	69.51*	...	...	...	...
1851	...	...	70.39	...	...	74.90	...
1852	...	...	...	71.91	...	76.14	73.30
1853	...	...	...	71.06	...	75.28	75.07
1854	...	...	...	72.15*	...	74.37	74.64
1855	...	...	...	...	...	73.37	74.58*
1856	...	...	...	...	...	73.53	73.44
1857	...	...	69.04	...	...	72.53	73.33
1858	...	...	71.42*	...	...	...	...
1859	...	...	71.20	...	...	...	...
1861	78.01*	...	...	...	...	...	...
1862	78.12	...	...	...	...	...	...
1863	76.30*	...	...	...	...	...	...
1864	75.88	...	...	...	...	...	...
1865	78.42*	...	...	...	...	...	...
1867	79.53	...	...	...	...	...	...
1868	78.17	...	...	...	...	...	...
1870	77.02	...	...	...	...	...	...
	77.67	69.65	69.39	71.51	69.71	74.04	73.26

FLORIDA.—Continued.

Year.	Fort Russell.	Fort Shannon.	Fort Wacahootee.	Fort Waccassassa.	Gainesville.	Jacksonville.	Key West.	Knoxhill.	Lake City.	Manatec.	Micanopy.	New Smyrna.	Ocala.	Picolata.	Port Orange.	Seville.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1830	...	...	...	...	...	...	77.74	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	...	...	76.22	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	...	...	76.30	...	...	...	...	...	...	...	...	...
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1834	...	...	...	...	...	...	75.37	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	...	...	75.49*	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1837	...	...	...	...	...	...	75.64	...	...	...	...	...	...	...	...	...
1838	...	...	...	...	...	...	75.69	...	...	...	...	...	...	...	...	...
1840	...	71.47	...	...	...	...	...	...	...	...	...	71.61	...	...	...	...
1841	70.58	70.54*	67.95	69.40	...	...	...	...	...	...	...	71.43*	...	69.65*	...	...
1842	...	69.15	...	68.10	...	...	...	...	...	...	...	...	...	...	...	...
1843	...	...	...	...	...	...	77.60*	...	...	...	...	...	...	...	...	...
1844	...	...	...	...	...	...	77.04	...	...	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	69.33	78.22	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	77.45	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	76.32	...	...	...	...	71.10*	...	...	...	...
1854	...	...	...	...	...	69.21	76.69	67.13*	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	68.83	76.12	66.23*	...	...	...	...	...	...	...	...
1856	...	...	...	...	66.61*	68.08	76.23	...	...	...	...	...	...	...	...	...
1857	...	...	...	...	66.87	67.48*	75.98	...	66.83*	...	...	...	...	...	...	...
1858	...	...	...	...	68.29	69.36	77.71	...	68.83	...	...	...	...	...	...	...
1859	...	...	...	...	68.21*	69.85	77.08	...	68.77	...	69.15	...	...	...	...	66.97*
1860	...	...	...	...	68.19*	69.84	77.67*	...	...	...	...	...	...	...	...	...
1861	...	...	...	...	...	...	78.55	...	...	...	...	...	...	...	...	...
1862	...	...	...	...	...	...	78.29	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	77.69	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	77.14	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	78.10	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	69.73*	...	...	...	...	...	...	...	...	72.36	...
1868	...	...	...	...	...	69.44	...	...	...	...	...	...	...	...	...	...
1869	...	...	...	...	...	68.29	...	...	...	73.39	...	...	70.58*	...	69.12	...
1870	...	...	...	...	...	68.56	78.88	...	...	...	...	...	...	...	...	...
	70.31	70.10	68.03	68.66	67.48	68 98	77.05	66.68	68.44	73.17	69.63	71.29	69.73	69.84	70.23	66.97

FLA.—Continued.		GEORGIA.												IDAHO.		
Year.	Warrington.	Athens.	Atlanta.	Augusta.	Augusta Arsenal.	Berne.	Oglethorpe Barracks.	Penfield.	Savannah.	Sparta.	The Rock.	Whitemarsh Island.	Zebulon.	Year.	Fort Boisé.	Fort Lapwai.
	°	°	°	°	°	°	°	°	°	°	°	°	°		°	°
1819	...	...	...	...	...	...	...	...	64.60*	...	...	...	...	...	...	...
														...	...	...
1826	...	...	...	...	67.10	...	...	...	...	...	...	...	...	...	...	...
1827	...	...	...	...	66.41	...	...	...	...	...	...	...	...	...	...	...
1828	...	...	...	...	67.40	...	...	...	...	...	...	...	...	...	...	...
1829	...	...	...	...	61.22	...	...	...	...	...	...	...	...	...	...	...
1830	...	...	...	...	65.64	...	...	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	61.78	...	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	64.23	...	66.35*	...	...	...	...	...	...	...	...	...
1833	...	...	...	...	65.72	...	...	...	67.64	...	...	...	...	...	...	...
1834	...	...	...	...	64.99	...	69.64	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	61.93	...	65.71	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	62.09*	...	...	...	...	...	...	...	...	...	...	...
1837	...	...	...	...	62.36*	...	...	...	62.20	...	...	...	...	...	...	...
1838	...	...	...	...	62.21*	...	...	...	61.96	...	...	...	...	...	...	...
1839	...	...	...	64.00	61.64	...	...	...	63.62	...	...	...	...	...	...	...
1840	...	...	...	61.42	61.24	...	...	...	67.06	...	61.71	...	...	...	...	...
1841	...	...	...	61.09	61.58	...	...	...	68.32	...	61.11*	...	...	...	...	...
1842	...	...	...	62.61	62.58	...	...	...	66.45	...	62.35*	...	...	...	...	...
1843	...	...	...	61.97	64.61	...	67.22	...	66.13	...	...	...	...	...	...	...
1844	...	...	...	...	65.14	...	66.41	...	65.36	...	...	...	...	...	...	...
1845	...	...	...	...	65.44	...	66.94	...	62.09	...	...	...	...	...	...	...
1846	...	...	...	...	...	...	66.96*	...	64.27	...	...	...	...	...	...	...
1847	...	...	...	...	...	...	...	...	65.51	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	...	...	66.63	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	67.46*	...	66.34	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	67.41	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	65.80	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	66.09	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	65.45	...	...	...	...	...	...	...
1854	69.42	...	...	...	...	...	...	...	66.37	63.24	...	64.71	...	...	...	...
1855	68.23	...	...	...	...	...	...	...	65.83	61.97	59.37	65.13	...	...	...	...
1856	69.07	...	...	...	...	...	...	...	64.42	60.78	...	63.49	63.01	...	...	...
1857	68.69	...	...	...	...	...	...	...	63.87	61.31	61.00	63.48*	62.53	...	...	...
1858	...	59.47*	...	...	...	...	...	...	66.27	62.74	...	65.80	...	...	...	...
1859	69.60*	60.73*	59.44	66.46*	...	...	...	...	65.84*	60.77*	...	66.01	...	...	...	...
1860	68.82	...	...	...	...	...	...	...	...	61.32*	...	65.93*	...	...	...	...
														1864	51.43*	53.55
1866	...	...	57.60*	...	...	...	...	...	...	...	...	...	...	1865	51.39	51.82*
1867	...	...	...	...	...	...	65.87	...	...	...	...	...	...			
1868	...	...	56.85	...	...	...	65.74	...	...	...	...	...	...	1868	49.97	51.44
1869	...	...	56.98*	...	63.83	...	66.12	61.22	...	...	...	...	...	1869	54.16	53.73
1870	...	...	60.21*	...	63.67	63.49	65.64*	61.36	...	...	...	...	...	1870	52.11	52.54
	69.18	60.93	58.36	63.30	63.77	63.04	66.70	61.33	65.40	61.98	61.33	64.92	63.49		52.05	52.45

ILLINOIS.

Year.	Alto.	Andalusia	Athens.	Augusta.	Aurora.	Batavia.	Belleville.	Belvidere.	Brighton.	Carthage.	Charleston.	Chicago.	Coloma (near).	Decatur.	Elgin.	Elmira.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1833	...	...	...	...	...	...	...	...	...	...	...	49.25	...	...	...	...
1834	...	...	...	55.31	...	...	...	...	...	...	...	47.62	...	...	...	...
1835	...	...	...	53.12	...	...	...	...	...	...	...	44.00	...	...	...	...
1836	...	...	...	52.11	...	...	...	...	...	...	...	42.93	...	...	...	...
1837	...	...	...	49.47	...	...	...	...	...	...	...	...	...	...	...	...
1838	...	...	...	49.12	...	...	...	...	...	...	...	...	...	...	...	...
1839	...	...	...	54.43	...	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	50.53	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	53.17	50.80	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	49.66	...	...	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	50.82	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	54.89	52.79	...	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	52.21	50.19	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	50.51	47.41	...	...	...	...	...	...	...	...	...	...	...	...
1857	...	45.56*	48.00*	47.66	...	45.90*	...	...	51.44	...	...	44.15*	...	...	...	...
1858	...	49.13	51.55	50.30	48.33	46.91	...	...	54.21	...	...	...	...	...	46.61	...
1859	...	48.67	...	49.52	46.92	46.77	...	...	...	49.97*	...	...	...	...	46.07	...
1860	...	50.14*	...	...	46.88*	...	...	...	...	...	...	44.86	...	...	46.13	...
1861	...	...	...	50.97	...	...	...	...	...	...	...	45.41	...	...	46.74*	...
1862	...	...	...	49.63	...	...	57.11	...	...	...	...	45.14	...	...	...	...
1863	...	...	...	49.60*	...	...	...	...	...	...	...	44.29*	...	...	...	...
1864	...	...	...	49.34	...	...	...	...	...	...	...	42.48	...	...	...	...
1865	...	...	...	50.83	...	...	...	...	...	...	...	44.33	...	...	...	49.93*
1866	...	49.87	...	51.39	46.07	...	...	...	...	...	...	46.18	48.81	...	...	47.96
1867	46.48	49.68*	...	52.25	45.89	...	...	...	...	...	...	49.45	51.38*	...	...	48.70
1868	44.75	49.16	...	51.66	44.80*	...	...	44.16*	...	...	...	47.90	48.95	...	...	48.13
1869	45.47	48.68	...	49.91	...	...	...	44.19	...	...	...	47.21	52.83	...	...	46.18*
1870	47.63*	51.29	...	52.36	48.22	...	...	47.75	...	...	51.65*	50.73	54.75*	51.92	...	...
	46.15	49.07	51.92	50.87	47.15	46.90	57.13	45.36	52.43	50.37	51.65	45.85	51.53	51.19	46.15	48.41

ILLINOIS.—Continued.

Year.	Evanston.	Farm Ridge.	Fort Armstrong.	Fremont Center.	Galesburg.	Golconda.	Hennepin.	Highland.	Hoyleton.	Jacksonville.	Lebanon.	Loami.	Louisville.	Manchester.	Marengo.	Mattoon.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1824	...	...	49.33	...	...	...	...	...	...	...	...	...	...	...	...	...
1825	...	...	52.18	...	...	...	...	...	...	...	...	...	...	...	...	...
1826	...	...	50.19	...	...	...	...	...	...	...	...	...	...	...	...	...
1827	...	...	51.42	...	...	...	...	...	...	...	...	...	...	...	...	...
1828	...	...	51.25	...	...	...	...	...	...	...	...	...	...	...	...	...
1829	...	...	49.07	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	...	...	52.89	...	...	...	...	...	...	...	...	...	...	...	...	...
1831	...	...	45.46	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1833	...	...	50.51	...	...	...	...	...	...	...	...	...	...	...	...	...
1834	...	...	49.71	...	...	...	...	...	...	...	...	...	...	...	...	...
1835	...	...	46.22	...	...	...	...	...	...	...	...	...	...	...	...	...
1841	...	...	...	...	...	...	...	53.69	...	...	...	...	...	...	...	...
1842	...	...	...	...	...	...	...	54.45	...	...	...	...	...	...	...	...
1843	...	...	...	...	...	...	...	50.44	...	...	...	...	...	...	...	...
1844	...	...	...	...	...	...	...	54.43	...	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	...	54.37	...	...	...	...	...	...	...	...
1846	...	...	...	...	...	...	...	55.82	...	...	...	...	...	...	...	...
1847	...	...	...	...	...	...	...	55.08	...	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	...	55.85	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	...	55.88	...	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	...	56.68	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	56.97	...	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	56.10	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	...	...	...	...	...	...	...	...	51.26	...	...
1856	...	...	...	...	...	...	...	...	...	...	...	...	...	48.82	45.69*	...
1857	...	...	...	45.13	...	...	...	...	...	...	...	...	...	48.59	45.23	...
1858	...	...	...	...	...	...	...	...	...	53.22*	...	...	...	51.88	48.47	...
1859	...	...	...	...	...	...	...	...	...	...	...	...	...	51.24	45.97	...
1860	...	46.58*	...	...	...	...	...	...	...	...	...	...	...	53.69	44.96	...
1861	...	...	...	...	48.71*	...	...	55.65*	...	53.21	56.30	...	...	52.95	45.81	...
1862	...	...	...	...	47.42	...	...	53.43	...	...	...	...	...	51.59	45.02	...
1863	...	...	...	...	48.62*	...	...	52.84*	...	...	...	...	...	50.87*	...	...
1864	...	...	...	...	47.53	...	...	...	52.46*	...	...	...	...	51.38	...	...
1865	48.54	...	...	...	49.45	...	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	47.20	59.03	...	...	...	...	...	49.97	...	52.31	...	...
1867	...	...	...	...	48.38	57.04	...	...	...	...	...	51.05*	...	52.16	...	...
1868	...	...	...	...	48.24	58.65	...	...	...	...	...	...	...	52.05	44.89	...
1869	46.71	...	...	...	47.52	57.82	...	...	...	...	...	50.08*	52.74*	51.33	...	...
1870	49.02	...	...	...	51.62*	57.85*	52.48	...	...	...	...	...	55.13	53.63	...	53.09
	47.67	46.58	49.82	46.19	48.48	58.08	52.48	54.73	...	52.82	55.79	50.34	53.93	51.60	46.04	52.62

ILLINOIS.—Continued.

Year.	Milford.	Mt. Sterling.	Orchard Farm.	Osceola.	Ottawa.	Pana.	Pekin.	Peoria.	Pleasant Ridge Nursery.	Riley.	Rock Island Arsenal.	Sandwich.	South Pass, near.	Springfield.	Upper Alton.	Warsaw, near.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49.27
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.37
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.07*
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	49.42	...	...	...	51.28	...	...	...	...	...	...	...	...	...	55.41*	...
1855	...	...	...	...	48.84*	...	48.77	...	...	...	...	...	...	...	52.51	48.56*
1856	...	...	...	...	47.60	...	46.47	50.22*	...	44.15*	...	...	...	...	50.32*	46.23
1857	...	...	...	...	45.47	...	46.82	46.31	...	42.73	...	...	...	...	...	49.18
1858	...	...	...	...	48.60	...	49.68	52.05	...	45.86	...	...	...	...	...	...
1859	...	...	...	...	47.96	...	49.98	51.81	...	45.60	...	48.08	...	...	52.28*	...
1860	...	...	50.47	50.12	48.94*	...	...	52.80	...	45.32*	...	49.14	...	...	...	...
1861	...	...	50.04*	...	48.68	...	...	52.96	...	44.42	...	49.14	...	...	...	...
1862	...	...	48.68	...	48.32	...	...	51.78	...	44.04	...	48.33*	...	...	...	...
1863	...	...	50.29*	...	48.37*	...	...	51.97*	...	44.12*	...	49.21*	57.04*	...	...	...
1864	...	...	...	...	47.17	...	50.50	51.57	48.32	44.27	...	46.58	58.74*	...	...	...
1865	...	...	...	...	49.12*	...	51.63*	52.35	50.15	45.85*	...	48.22	...	54.28	...	...
1866	...	51.89	...	...	48.30*	...	...	50.40	48.17	43.67*	...	45.42	...	49.59	...	...
1867	...	52.85	...	...	49.82	...	...	50.81	48.00	...	48.97	46.22	...	49.71	...	...
1868	...	52.48	...	...	48.88*	...	...	50.44	47.84	...	49.03	45.40	...	48.83	...	...
1869	...	49.89	...	...	49.15*	...	...	50.09	47.83	...	47.94	45.27	54.90*	49.71	...	50.13
1870	...	54.15*	...	...	52.39*	52.84	...	53.48	...	47.86	51.83*	...	...	...	...	52.69
	49.42[1]	52.25	49.81	49.54	48.92	52.09	49.09	51.36	48.37	44.76	49.40	46.94	56.62	49.74	51.10	50.49

	ILLINOIS.—Continued.									INDIANA.						
Year.	Waterloo.	Waverly.	Waynesville.	West Salem.	West Urbana.	Wheaton.	Winnebago.	Wyanet, near.	York Neck.	Aurora.	Bloomington.	Cadiz, near.	Cannelton.	Columbia City.	Evansville.	Harveysburg.
1855	...	...	...	...	...	...	...	...	...	...	...	45.41	...	...	...	...
1856	...	...	...	52.15*	...	...	...	...	...	...	...	42.40	...	...	...	...
1857	...	...	...	52.88	47.82*	...	...	...	...	...	...	43.80	...	...	54.06*	...
1858	...	...	50.25	55.76	51.70	47.19	47.35	...	...	..	...	47.44*	54.04*	...	57.42*	...
1859	...	...	...	55.73	51.14	46.72	46.00	...	...	55.55	...	45.99*	55.47	...	...	...
1860	...	...	...	...	...	...	45.86	...	...	...	...	48.43	...	...	...	...
1861	...	...	...	...	...	...	44.70	...	...	...	...	50.36	55.58	...	...	...
1862	...	52.85*	...	...	...	...	44.84*	...	...	...	...	...	...	...	...	...
1863	...	50.08*	...	...	...	...	45.96*	...	...	...	...	50.62*	...	...	...	...
1864	...	50.84	...	...	...	...	45.07	...	50.47	...	...	50.04	...	...	...	...
1865	...	51.69	...	...	...	...	46.86	49.59	51.94	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	44.37	48.01	...	52.90*	...	...	...	46.97	...	...
1867	56.12	...	...	...	...	...	45.10	48.66	...	52.17	...	...	...	48.14	...	...
1868	56.53*	...	...	...	...	...	44.22	48.14*	...	52.30*	51.02*	...	...	47.76*	...	...
1869	...	...	...	...	...	...	43.96	47.78	...	51.51	...	...	...	48.08*	...	50.14
1870	...	...	...	...	...	...	47.55	49.16*	...	54.27	...	...	...	52.18*	...	...
	56.31	51.37	50.58	54.46	50.18	47.07	45.53	48.61	51.20[1]	53.09	51.38	47.32	54.86	48.79	55.74	49.91

[1] Hours of observation unknown.

INDIANA. —Continued.

Year.	Indianapolis.	Jeffersonville.	Kentland.	Laconia.	Laporte.	Laporte, near.	Logansport.	Madison.	Merom.	Michigan City.	Milton.	Mt. Carmel.	Mt. Hope.	Muncie.	New Albany.	New Harmony.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1819	...	60.17	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	43.41	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	. .	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	51.38	...	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...	52.95	...	...	...	...	57.72
1855	...	...	...	...	...	...	...	...	...	...	50.80	...	...	...	...	55.21
1856	...	...	...	...	...	...	47.82	...	...	...	...	...	...	...	...	52.86
1857	...	...	...	...	...	...	47.64	...	...	45.73	...	...	...	...	...	52.85
1858	...	...	...	...	...	...	52.38	52.85	...	48.50*	...	...	...	...	...	56.10
1859	...	...	...	...	...	...	52.37	...	...	...	...	...	...	...	...	55.32
1860	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	56.33
1861	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	56.35
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	55.81
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	54.72*
1864	50.67	...	...	...	...	...	...	...	...	...	...	...	...	...	52.82*	54.19*
1865	51.84	...	...	...	...	...	...	...	...	...	...	...	...	...	54.96	56.31
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	55.49
1867	50.42*	...	...	...	...	...	...	...	51.83	...	...	...	...	49.79	...	55.05
1868	49.65	...	...	...	...	...	...	...	53.11	...	...	...	...	49.36	...	55.04
1869	50.04	...	48.27*	...	...	...	...	...	51.77	...	...	...	50.01	49.57	...	54.60
1870	52.07	...	...	54.87	...	51.03	...	...	55.39*	...	...	52.63	52.98	...	...	56.03
	50.66	60.17	48.22	54.20	43.41[1]	49.39	50.66	54.63	52.81	47.66	51.62	52.05	51.32	49.90	53.41	55.22

[1] Hours of observation unknown.

	INDIANA.—Continued.							INDIAN TERRITORY.					IOWA.			
Year.	Rensselaer.	Richmond.	Rockville, near.	Rockville.	South Bend.	Spiceland.	Vevay.	Caney.	Fort Arbuckle.	Fort Gibson.	Fort Towson.	Fort Washita.	Algona.	Algona, near.	Bellevue.	Boonesboro.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1828	...	...	...	...	...	...	...	...	...	63.00	...	...	...	...	...	...
1829	...	...	...	...	...	...	...	...	...	60.85	...	...	...	...	...	...
1830	...	...	...	...	...	...	...	...	...	64.65	...	...	...	...	...	...
1831	...	...	...	...	...	...	...	...	...	57.71	...	...	...	...	...	...
1832	...	...	...	...	...	...	...	...	...	61.32	...	...	...	...	...	...
1833	...	...	...	...	...	...	...	...	...	61.67	61.58	...	...	...	...	...
1834	...	...	...	...	...	...	...	...	...	62.75	61.60	...	...	...	...	...
1835	...	...	...	...	...	...	...	...	...	55.78	58.59	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	59.49	59.69	...	...	...	...	...
1837	...	...	...	...	...	...	...	...	...	61.06	61.72	...	...	...	...	...
1838	...	...	...	...	...	...	...	...	...	58.03	59.32	...	...	...	...	...
1839	...	...	...	...	...	...	...	...	...	62.18	62.83	...	...	...	...	...
1840	...	...	...	...	...	...	...	...	...	59.66	62.49	...	...	...	...	...
1841	...	...	...	...	...	...	...	...	...	59.79	59.59	...	...	...	...	...
1842	...	...	...	...	...	...	...	...	...	60.69	63.67	...	...	...	...	...
1843	...	...	...	...	...	...	...	...	...	58.94	61.19	60.82	...	...	...	...
1844	...	...	...	...	...	...	...	...	...	60.64	63.00	63.94	...	...	...	...
1845	...	...	...	...	...	...	...	...	...	61.58	62.19	63.41	...	...	...	...
1846	...	...	...	...	...	...	...	...	...	61.03	...	64.02	...	...	...	...
1847	...	...	...	...	...	...	...	...	...	58.91	...	61.23	...	...	...	...
1848	...	...	...	...	...	...	...	...	...	59.37	...	61.66	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	59.20	...	61.70	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	60.24	61.95	62.13	...	..	...	...
1851	...	...	...	...	...	...	...	...	61.14	61.22	62.92	63.08	...	...	...	...
1852	...	...	...	...	...	...	...	...	59.58	59.54	...	60.42	...	...	...	...
1853	...	...	...	...	...	...	...	...	61.18	60.53	61.69	61.24	...	...	...	...
1854	...	52.63*	...	...	...	...	...	...	62.55	62.22	...	63.28	...	...	...	...
1855	...	...	...	...	...	...	...	...	61.91	59.98	...	62.73	...	...	...	...
1856	...	...	...	...	...	...	...	...	58.70	58.34	...	60.45	...	...	43.76*	...
1857	...	48.11	...	...	...	...	...	...	58.46	...	...	60.60	...	...	44.16	...
1858	...	51.75	...	...	...	...	...	...	...	...	...	...	...	...	47.39	...
1859	...	52.40	...	...	...	...	...	...	62.31	...	...	...	...	...	47.13	...
1860	...	53.02*	...	...	...	...	...	59.01*	64.01	...	...	...	...	...	...	...
1861	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	50.40	...	...	...	...	...	...	...	...	...	41.94	...	...	...
1863	...	...	50.40	50.13*	47.62*	...	...	...	...	...	...	...	43.08*	...	...	...
1864	...	...	50.20	...	47.99	49.77	...	...	...	...	...	...	43.55	...	...	...
1865	49.02*	50.13*	51.30	...	...	51.34	55.40	...	...	...	...	...	...	...	...	...
1866	...	48.17	50.00	...	...	49.54	55.55	...	...	...	...	...	...	...	...	...
1867	...	48.58	...	...	...	50.22	55.70	...	...	...	...	...	43.06*	41.10	...	...
1868	48.37*	...	...	...	...	49.74	54 99	...	...	...	...	...	42.71	42.26*	...	44.65*
1869	...	...	...	...	...	49.69	...	...	59.64	...	...	...	42.63	41.89	...	...
1870	50.81*	...	...	...	...	52.16	54.96	...	...	...	...	...	45.49	...	...	46.69
	48.70	50.78	50.11[1]	49.71	48.78	50.27	54.68	59.01	61.05	60.48	61.50	62.18	43.29	41.86	46.00	45.75

[1] Hours of observation unknown.

IOWA.—Continued.

Year.	Border Plains.	Bowen's Prairie.	Burlington.	Brookside.	Ceres.	Clinton.	Council Bluffs.	Dakota.	Davenport.	Des Moines.	Bubuque.	Fairfield.	Fairfield.	Fayette Village.	Forrestville.	Fort Atkinson.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1820	...	...	...	...	...	...	48.19	...	...	...	...	...	...	...	...	...
1821	...	...	...	...	...	...	47.12	...	...	...	...	...	...	...	...	...
1822	...	...	...	...	...	...	50.25	...	...	...	...	...	...	...	...	...
1823	...	...	...	...	...	...	51.28	...	...	...	...	...	...	...	...	...
1824	...	...	...	...	...	...	48.25	...	...	...	...	...	...	...	...	...
1825	...	...	...	...	...	...	52.21	...	...	...	...	...	...	...	...	...
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.87
1843	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	41.76
1844	...	...	...	...	...	...	...	...	...	49.54	...	...	...	...	...	45.36
1845	...	...	...	...	...	...	...	...	...	50.20*	...	...	...	...	...	46.21
1854	...	...	...	...	...	...	...	...	...	...	50.18	...	...	...	...	...
1855	...	...	...	...	...	...	...	...	...	...	47.80	50.08	...	...	...	...
1856	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1857	44.31	...	...	...	...	...	...	...	...	...	...	...	47.20	...	...	...
1858	47.48	...	...	...	...	...	...	...	...	...	47.98	...	49.49	...	...	...
1859	47.97*	...	51.31*	...	...	...	...	...	...	...	47.62	...	48.91	...	...	...
1860	...	...	...	...	...	...	...	...	...	...	49.72	...	...	45.23*	45.64*	...
1861	...	...	...	...	...	47.14	...	...	47.59*	...	47.65	...	...	...	44.86	...
1862	...	...	...	45.85*	...	46.28	...	...	46.24	...	46.65	...	...	...	...	...
1863	...	...	...	46.74*	...	47.02*	...	...	...	...	47.96	...	...	...	...	...
1864	...	...	...	45.32	...	47.41*	...	...	46.60	...	46.92	...	...	...	...	...
1865	...	...	...	45.18	...	49.08	...	...	48.45	...	48.31	...	...	...	...	...
1866	...	...	...	43.19	43.62	47.24	...	...	46.91	46.82	45.76	...	...	...	...	...
1867	...	...	...	43.47*	46.33	48.76*	...	41.33*	47.32	...	47.10	...	...	...	...	...
1868	...	...	...	43.57	...	48.37	...	...	46.86	...	46.09	...	...	...	...	...
1869	...	44.45	...	43.55*	...	46.01	...	...	46.51	...	46.15	...	...	...	...	...
1870	...	48.17	...	47.37*	...	48.75	...	...	...	...	49.54	...	...	...	...	...
	46.45	46.28	51.36	44.94	45.35	47.65	49.55	42.63	47.33	48.94	47.69	50.08[1]	49.00	...	44.83	45.29

[1] Hours of observation unknown.

IOWA.—Continued.

Year.	Fort Croghan.	Fort Dodge.	Fort Madison, near.	Franklin.	Grant City.	Guttenberg.	Harris Grove.	Independence.	Iowa City.	Iowa Falls.	Manchester.	Monticello.	Mt. Vernon.	Muscatine.	Mt. Pleasant.	North Union, near.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1839	...	...	...	...	...	...	...	...	...	...	...	...	...	51.32	...	...
1840	...	...	...	...	...	...	...	...	...	...	...	...	...	49.09	...	...
1841	...	...	...	...	...	...	...	...	...	...	...	...	...	46.49	...	...
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	47.29	...	...
1843	45.65*	...	...	...	...	...	...	...	...	...	...	...	...	43.71	...	...
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	47.75	...	...
1845	...	...	...	...	...	...	...	...	...	...	...	...	...	47.33	...	...
1846	...	...	...	...	...	...	...	...	...	...	...	...	...	48.64	...	...
1847	...	...	...	...	...	...	...	...	...	...	...	...	...	43.19	...	...
1848	...	...	50.57*	...	...	...	...	...	...	...	...	...	...	43.91	...	...
1849	...	...	49.09	...	...	...	...	...	...	...	...	...	...	45.32	...	...
1850	...	...	50.34	...	...	...	...	...	...	...	...	...	...	47.00	...	...
1851	...	48.26	51.00	...	...	...	...	...	...	...	...	...	...	47.66	...	...
1852	...	...	50.03	...	...	...	...	...	...	...	...	...	...	46.90	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	47.79	...	...
1854	...	...	54.82	...	...	...	...	...	...	...	...	...	...	49.53	...	...
1855	...	...	50.64	...	...	...	...	...	...	...	...	...	...	47.14	...	...
1856	...	...	48.08	...	...	...	...	...	...	...	...	...	...	43.84	...	...
1857	...	...	47.38	43.08	...	...	...	...	...	...	...	...	...	44.11	...	...
1858	...	...	50.16	47.38*	...	...	...	...	48.17	...	...	...	...	47.40	...	...
1859	...	...	49.57	...	...	...	...	...	...	...	...	...	...	46.63	...	...
1860	...	...	51.17	...	...	...	...	...	...	...	...	...	...	48.06	...	...
1861	...	...	50.95	47.38	...	...	...	...	45.77	...	...	...	46.24	48.96	...	...
1862	...	...	49.32	...	...	...	...	...	44.60	...	...	...	45.24*	47.35	...	...
1863	...	...	50.31	...	...	...	...	...	46.07*	...	...	...	46.65*	...	...	...
1864	...	...	49.56	...	...	...	...	45.69	47.44	44.85	...	...	45.63	47.18*	48.19*	...
1865	...	...	50.81	...	...	45.79*	...	46.30*	49.79	45.78	...	...	47.55	48.27	...	...
1866	...	...	49.27	...	...	42.48*	...	44.51	47.34	45.21	43.09*	44.60	45.61	...	...	...
1867	...	43.78	49.55	...	...	42.79	46.26	44.84	47.56	44.06	...	45.43	45.42	...	...	...
1868	...	44.45	49.42	...	...	42.41	46.78*	43.04*	47.52*	46.37*	...	45.83	45.70	...	...	...
1869	...	...	48.92	...	44.73	42.86	45.72	43.53	46.98	46.80	...	44.69	45.17	...	...	45.49
1870	...	...	52.12	...	47.94*	45.96	48.78	47.72	49.80	...	...	48.55	48.30	...	...	48.74
	45.65	45.94	50.13	45.33	46.34	43.75	46.87	45.29	47.45	45.93	43.55	45.54	46.03	46.98	48.52	47.11

IOWA.—Continued. | KANSAS.

Year.	Pella.	Pleasant Plain.	Poultney.	Quasqueton.	Rolfe.	Rossville.	Sioux City.	Vawter's Grove.	Waterloo.	Webster City.	Whiteboro'.	Woodbine.	Woodlands, The	Atchison.	Baxter Springs.	Burlingame.
1854	...	...	46.60	48.23*	...	...	...	...	...	...	...	...	...	...	...	...
1855	45.63	...	45.04	45.51*	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	45.72	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1857	...	46.11	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1858	...	49.31	...	...	...	44.45*	45.55*	...	...	...	...	...	...	...	...	52.30
1859	...	48.28	...	...	...	44.09	...	...	...	...	...	...	...	...	...	52.49
1860	...	49.50	...	...	...	...	...	...	...	...	...	...	...	...	...	56.56
1861	...	48.98	...	...	...	...	44.07*	...	...	...	...	...	...	...	...	...
1862	...	49.12	...	...	...	...	44.29*	...	...	...	...	...	...	...	...	...
1863	...	49.16*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	48.60	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	47.08	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	44.57	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	45.79	44.27	...	...	...	...	50.54	...	...
1868	...	...	...	...	43.19*	...	...	46.41	44.87	...	45.15*	...	...	51.17*	57.32	...
1869	...	...	...	...	43.52	...	...	46.06	44.15	...	...	45.31*	44.44	50.64	57.04	...
1870	...	...	...	...	...	...	...	49.26	...	46.51*	...	47.51*	48.19	53.31	58.62	...
	46.71	48.35	44.82	46.16	43.53	44.57	45.22	46.83	45.38	46.51	45.51	46.41	46.31	51.35	58.00	53.66

KANSAS.—Continued.

Year.	Council Grove.	Fort Atkinson.	Fort Dodge.	Fort Harker.	Fort Hays.	Fort Larned.	Fort Leavenworth.	Fort Riley.	Fort Scott.	Holton.	Lawrence.	Leavenworth.	Le Roy, near.	Manhattan.	Neosho Falls.	Olatha.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1830	...	...	...	...	...	...	56.56	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	...	...	49.78	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	...	...	53.39	...	...	...	...	...	...	...	...	...
1833	...	...	...	...	...	...	55.54	...	...	...	...	...	...	...	...	...
1834	...	...	...	...	...	...	52.40	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	...	...	51.65*	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	48.73	...	...	...	...	...	...	...	...	...
1837	...	...	...	...	...	...	52.89	...	...	...	...	...	...	...	...	...
1838	...	...	...	...	...	...	51.14	...	...	...	...	...	...	...	...	...
1839	...	...	...	...	...	...	53.64	...	...	...	...	...	...	...	...	...
1840	...	...	...	...	...	...	51.36	...	...	...	...	...	...	...	...	...
1841	...	...	...	...	...	...	51.20	...	...	...	...	...	...	...	...	...
1842	...	...	...	...	...	...	52.85	...	...	...	...	...	...	...	...	...
1843	...	...	...	...	...	...	49.01	...	52.58	...	...	...	...	...	...	...
1844	...	...	...	...	...	...	52.67	...	55.00	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	54.79	...	55.85	...	...	...	...	...	...	...
1846	...	...	...	...	...	...	55.31	...	55.95	...	...	...	...	...	...	...
1847	...	...	...	...	...	...	49.79	...	52.65	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	...	...	54.00	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	52.22	...	53.67	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	52.04	...	55.12	...	...	...	...	...	...	...
1851	...	55.44	...	...	...	...	53.19	...	56.05	...	...	...	...	...	...	...
1852	...	53.04	...	...	...	...	51.54	...	54.85	...	...	...	...	...	...	...
1853	...	55.34*	...	...	...	...	53.12	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	55.94	57.40	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	...	54.30	54.59	...	...	...	...	...	...	...	...
1856	...	...	...	...	...	...	49.98	52.08	...	...	...	...	...	...	...	...
1857	...	...	...	...	...	...	52.19	51.14	...	...	...	...	...	53.71	...	...
1858	...	...	...	...	...	...	55.35	53.93	...	...	54.10	53.28*	...	...	...	...
1859	...	...	...	...	...	...	52.86	54.20	...	...	...	...	...	53.92	54.19*	...
1860	...	...	...	...	...	...	56.04	58.46	...	...	...	...	...	...	58.35	...
1861	...	...	...	...	...	54.50	54.01	52.61	...	...	55.05*	54.72	...	53.98	55.46*	...
1862	...	...	...	...	...	54.41	52.72	54.88	...	...	...	...	...	52.38	...	...
1863	...	...	...	...	...	54.20	52.95	55.04	...	...	54.01*	...	...	53.87*	...	...
1864	...	...	...	...	...	52.66	51.99	55.91	...	...	...	...	...	53.05*	...	51.25*
1865	53.50*	...	...	...	...	53.77	53.53	54.57	...	...	...	...	...	...	...	51.30*
1866	53.50	...	...	...	...	...	...	...	...	...	...	50.44	...	...	...	50.97
1867	52.96	...	...	51.06*	...	54.72	52.00	52.89	...	...	...	50.21	...	51.39	...	50.42
1868	54.15	...	54.62	...	53.89	57.62*	52.87	52.32	...	52.05	52.81	50.51	...	50.96	...	51.59
1869	53.67	...	54.63	...	52.92	...	50.82	51.09	...	51.30	49.59	49.71	53.66	49.21	50.14*	50.27*
1870	55.54	...	56.38	53.24*	54.42	53.71	53.72	53.73	...	53.62	53.70	52.25	...	53.76	...	53.11
	53.88	54.77	55.32	51.81	54.44	53.91	52.75	54.21	54.58	52.51	53.49	51.45	53.26	52.89	54.27	51.27

KAN.—Continued.		KENTUCKY.											LOUISIANA.			
Year.	Paola.	Arcadia.	Ballardsville.	Bardstown.	Chilesburg.	Danville.	Louisville.	Millersberg.	Newport Barracks.	Nicholasville.	Paris.	Springdale.	Baton Rouge.	Benton.	Black River Plantation.	Fort Jackson.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1822	...	..	...	...	...	...	...	...	...	...	...	...	67.87	...	...	69.95
1829	...	...	...	...	...	...	...	...	...	...	...	...	66.97	...	...	...
1830	...	...	...	...	...	...	...	...	...	...	...	...	68.77	...	...	...
1831	...	...	...	...	...	...	...	...	...	...	...	...	64.56	...	...	67.51*
1832	...	...	...	...	...	...	...	...	...	...	...	...	68.22	...	...	73.50
1833	...	...	...	...	...	...	...	...	...	...	...	...	68.74	...	...	...
1834	...	...	...	...	...	...	...	...	...	...	...	...	68.80	...	...	71.04*
1835	...	...	...	...	...	...	...	...	...	...	...	...	65.96	...	...	...
1837	...	...	...	...	...	...	...	...	...	...	...	...	69.54*	...	...	...
1838	...	...	...	...	...	...	...	...	...	...	...	...	68.05*	...	...	...
1839	...	...	...	...	...	...	...	...	...	...	...	...	68.02	...	...	...
1840	...	...	...	...	...	..	...	...	...	...	...	...	70.88*	...	...	...
1842	...	...	...	...	...	...	...	...	...	...	...	51.55	...	...	...	...
1843	...	...	...	...	...	...	...	...	...	...	...	50.65	68.43	...	...	...
1844	...	...	...	...	...	...	...	...	...	...	...	54.39	69.26	...	...	...
1845	...	...	...	...	...	...	...	...	...	...	...	52.76	67.18	...	...	...
1846	...	...	...	...	...	...	...	...	...	...	...	55.32	68.55	...	...	...
1847	...	...	...	...	...	...	...	...	...	...	...	52.78	...	...	...	...
1848	...	...	...	...	...	...	...	...	55.58	...	...	53.46	...	...	...	...
1849	...	...	...	...	...	...	...	...	55.36	...	...	53.03	70.10*	...	...	...
1850	...	...	...	...	...	...	...	...	50.12*	...	...	53.00	69.85*	...	...	...
1851	...	...	...	...	...	...	...	...	56.08	...	...	53.68	66.86	...	...	...
1852	...	...	...	...	...	...	...	...	55.55	...	...	53.55	66.85	...	...	...
1853	...	...	...	...	...	59.23*	...	...	54.64	...	...	...	66.01*	...	...	...
1854	...	...	57.21	...	...	59.73	...	56.30*	56.47	...	...	56.18	68.01	...	...	...
1855	...	...	...	...	...	58.32*	...	54.16*	54.69	...	...	55.02*	67.71	...	...	...
1856	...	...	52.36	...	...	...	...	...	51.14	...	50.49	52.51	66.05	...	...	...
1857	...	...	...	...	...	54.64*	...	...	51.44	...	50.08	51.80	66.29	...	65.13	...
1858	...	...	...	55.81	...	...	55.99*	...	55.06	...	53.83	55.11	67.58*	...	66.96*	...
1859	...	...	...	55.66	...	57.55*	...	...	54.57	...	53.68	54.23	68.46	...	...	...
1860	...	...	...	...	...	57.33*	...	...	54.42	...	...	...	...	...	...	...
1861	...	...	55.43	56.10*	...	57.23*	56.09*	55.80	54.71	54.47*	...	54.87	...	...	...	...
1862	...	...	...	...	....	...	55.49	...	54.39*	56.35	...	55.26	...	...	...	...
1863	...	...	...	...	...	...	...	...	54.51	...	...	53.29*	...	...	...	...
1864	...	...	...	...	...	...	...	...	53.33	...	...	52.57	...	...	...	...
1865	...	...	...	...	54.99*	56.32	...	...	54.61	...	...	55.00	...	...	...	...
1866	...	...	...	...	53.82*	...	...	...	...	...	...	53.59	...	...	...	...
1867	...	...	...	...	54.00	...	...	...	54.08	...	...	54.16	...	...	...	...
1868	...	...	...	...	52.42	...	...	...	53.27	...	...	53.81	...	64.43	...	...
1869	...	...	...	...	52.93	56.82*	...	...	53.38	...	...	53.53*	...	...	...	...
1870	54.38	54.79*	...	...	53.77	57.08*	...	...	55.19	...	...	55.49	...	65.74*	...	...
	53.46	54.00	55.15	55.87	53.65	57.07	55.70	54.36	54.37	55.34	52.04	53.71	68.03	65.25	66.35	70.91

LOUISIANA.—Continued.							MAINE.								
Year.	Fort Jesup.	Fort Pike.	Fort Wood.	New Orleans.	New Orleans.	New Orleans.	Blake.	Belfast.	Bethel.	Biddeford.	Year.	Brunswick.	Year.	Brunswick.	Carmel.
	°	°	°	°	°	°	°	°	°	°		°		°	°
1823	67.33	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1824	69.16	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1825	67.74	70.26*	...	69.17	...	...	...	...	...	...	...	...	...	...	...
1826	68.91	...	...	72.16	...	...	...	...	...	...	...	...	...	...	...
1827	69.10	70.67	...	71.11*	...	...	...	...	...	...	...	...	...	...	...
1828	68.13	72.59	...	...	...	...	...	...	...	...	...	...	...	...	...
1829	65.08	69.16	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	66.41	72.26	...	...	...	...	...	...	...	...	...	...	...	...	...
1831	62.57	67.80	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	66.04	70.63	...	...	...	...	42.97	...	...	...	...	...	...	...	...
1833	67.15	70.37	68.91	...	...	...	42.87	...	...	...	...	...	...	...	...
1834	67.54	70.10	...	...	...	...	43.57	...	...	...	...	...	...	...	...
1835	63.95	68.71*	68.16	...	...	...	42.37	...	...	...	...	...	...	...	...
1836	63.69	...	...	...	66.17	...	41.27	...	...	...	1807	43.66*	...	...	...
1837	65.12	...	...	...	...	...	41.37	...	...	...	1808	43.43	...	...	...
1838	64.18	70.14*	...	67.49	...	...	42.97	...	...	...	1809	42.14	...	...	...
1839	67.30	...	...	69.28	...	...	44.97	...	...	...	1810	43.57	1835	44.42	...
1840	67.80	...	...	71.95	...	...	46.17	...	...	...	1811	44.71	1836	43.00	...
1841	65.05	...	...	70.33	...	...	45.47	...	...	...	1812	40.94	1837†	49.60	...
1842	66.41	...	...	68.12	...	...	...	...	...	...	1813	43.18	1838†	50.69	...
1843	64.29	67.84	68.19	68.98*	...	...	...	...	...	...	1814	43.29	1839†	51.45	...
1844	66.26	69.64	70.06	71.32*	...	...	...	...	...	...	1815	42.87	1840†	51.60	...
1845	65.71*	...	69.45*	...	...	...	...	...	...	...	1816	42.09	1841	46.58	...
											1817	41.64	1842	45.84	...
1847	...	...	...	69.39	...	...	...	...	...	...	1818	44.78	1843	43.87	...
1848	...	...	...	70.45	...	...	...	...	...	44.60	1819	45.46	1844	42.32	...
1849	...	...	...	...	...	68.96	...	...	...	44.28	1820	44.03	1845	43.27	...
1850	...	...	...	68.60*	...	...	...	...	...	46.57	1821	43.91	1846	44.01	...
1851	...	...	...	...	...	...	...	...	...	45.76*	1822	43.06	1847	43.08	...
											1823	41.03	1848	43.70	...
1854	...	...	...	67.74	...	...	...	...	...	...	1824	43.86*	1849	43.00	...
1855	...	...	...	68.35	...	...	...	...	...	...	1825	45.73	1850	43.37	...
1856	...	...	...	68.97	...	...	...	...	...	...	1826	45.46	1851	42.60	...
1857	...	...	...	69.24	...	...	...	...	...	...	1827	43.87	1852	43.91	...
1858	...	...	...	71.40	...	...	...	...	...	...	1828	46.94	1853	44.53	...
1859	...	...	...	71.07	...	...	...	...	...	...	1829	46.19	1854	42.73	45.06
1860	...	...	...	72.23*	...	...	...	43.21	...	...	1830	47.50	1855	42.95*	41.44*
1861	...	...	...	...	...	...	...	41.75	41.91	...	1831	47.66	1856	41:78	40.54*
1862	...	...	...	...	...	...	...	40.75*	...	...	1832	45.17	1857	43.62	...
											1833	45.61	1858	43.75	...
1870	...	...	...	65.70	...	...	...	...	...	...	1834	45.36	1859	40.31	...
	66.32	69.88	69.32	69.06	66.17[1]	68.96[1]	43.58	41.72	41.68	45.57				44.40	41.46

[1] Hours of observation unknown.

† Values for 1837–8–9–40 doubtful, about 6.40 too high.

MAINE.—Continued.

Year.	Castine.	Year.	Castine.	Cornish.	Year.	Dennysville.	Year.	Dennysville.	Dexter.	Eastport.	Fort Fairfield.	Fort Kent.	Fort Preble.	Fort Sullivan.	Year.	Gardiner.
	°		°	°		°		°	°	°	°	°	°	°		°
...	...	...	...	...	...	...	1822	...	...	...	...	...	...	42.20	...	...
...	...	...	...	...	...	...	1823	...	...	...	...	...	...	40.90	...	...
...	...	...	...	...	...	...	1824	...	...	...	...	...	45.46	41.54	...	...
...	...	...	...	...	...	...	1825	...	...	...	...	...	46.87	43.98	...	...
...	...	...	...	...	...	...	1826	...	...	...	...	...	46.67	44.55	...	...
...	...	...	...	...	...	...	1827	...	...	...	...	...	45.52	44.29*	...	...
...	...	...	...	...	...	...	1828	...	...	...	...	...	48.18	43.38	...	...
...	...	...	...	...	...	...	1829	...	...	...	...	...	45.03	42.22	1837	40.68
...	...	...	...	...	...	...	1830	...	...	...	...	...	46.34	43.10	1838	42.74
...	...	...	...	...	...	...	1831	...	...	...	...	...	46.63	44.21	1839	44.09
...	...	...	...	...	...	...	1832	...	...	...	...	...	44.13*	40.98	1840	45.04
...	...	...	...	...	...	...	1833	...	...	41.48	...	...	45.10	42.52	1841	45.52
1810	43.08	1838	43.07	...	1816	40.43	1834	...	...	42.64	...	...	45.60	42.74	1842	43.88
1811	44.88	1839	43.36	...	1817	40.63	1835	...	...	...	...	...	44.05	41.23	1843	42.57
1812	41.48	1840	43.65	...	1818	41.23									1844	40.54
1813	43.57	1841	43.91	...	1819	43.23	1841	...	...	...	...	...	43.81	43.14	1845	41.74
1814	44.00	1842	44.10	...	1820	41.13	1842	...	...	...	37.50	36.26	43.87	42.08	1846	44.47
1815	42.44	1843	43.68	...	1821	41.03	1843	...	...	...	...	...	43.53*	42.86	1847	44.26
1816	41.85	1844	42.94	...	1822	41.73	1844	42.03	...	...	...	...	43.05	43.49	1848	43.82
1817	41.95	1845	45.19	...	1823	40.73	1845	42.53	...	...	...	...	44.55*	...	1849	43.38
1818	42.81	1846	48.40	...	1824	42.23	1846	42.73	...	...	...	...	...	...	1850	44.19
1819	44.73	1847	45.02	...	1825	43.43	1847	43.33	...	...	...	...	...	...	1851	43.98
1820	43.50	1848	45.01	...	1826	43.73	1848	44.03	...	...	...	...	...	...	1852	44.71
1821	42.83	1849	44.02	...	1827	41.53	1849	42.33	...	...	...	...	...	...		
1822	44.51				1828	44.13	1850	43.83	...	...	...	...	44.97	43.17	1855	45.18
1823	42.97	1856	...	...	1829	41.73	1851	41.93	...	...	...	...	44.31	42.79	1856	43.53
1824	44.97	1857	...	42.12	1830	42.73	1852	43.33	...	...	...	...	44.63	43.56	1857	44.36
1825	46.34	1858	...	42.06	1831	43.33	1853	43.93	...	...	...	...	...	...	1858	42.42
1826	46.56	1859	...	42.43	1832	40.13	1854	43.13	...	...	...	...	...	...	1859	41.43
1827	43.98	1860	...	43.84	1833	40.83	1855	43.13	...	...	...	...	...	...		
1828	47.46	1861	...	42.64	1834	40.13									1861	43.10
1829	44.46	1862	...	42.39	1835	40.63	1861	...	41.56	...	...	...	...	...	1862	42.89
1830	44.65	1863	...	43.17	1836	40.33	1862	...	43.07	...	...	...	...	...	1863	43.14*
1831	44.95	1864	...	43.29	1837	40.23								...	1864	44.56
1832	42.08	1865	...	44.99	1838	40.93	1865	...	...	...	...	...	48.37*	...	1865	44.47
1833	42.02	1866	...	44.04	1839	42.33									1866	43.61
1834	43.03	1867	...	42.53	1840	42.33	1867	...	...	...	...	...	44.94	...	1867	42.52
1835	42.61	1868	...	42.00	1841	42.73	1868	...	...	...	...	...	42.49	...	1868	42.38
1836	40.86	1869	...	44.14	1842	42.23	1869	...	...	...	...	...	43.87*	...	1869	43.79
1837	41.20	1870	...	46.46	1843	41.93	1870	...	...	...	...	...	45.51	...	1870	46.09
			43.79[1]	43.30				42.13	42.65	42.06[1]	37.73	36.87	45.26	42.83		43.53

[1] Hours of observation unknown.

MAINE.—Continued.

Year.	Hancock Barracks.	Hiram.	Lee.	Lisbon.	North Bridgeton.	Oldtown.	Oxford.	Perry.
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...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...
1829	39.47	...	...	...	...	...	...	...
1830	41.87	...	...	...	...	...	...	...
1831	42.24	42.83	...	...	...	...	...	...
1832	39.26	41.03	...	...	...	...	...	...
1833	39.54	41.33	...	...	...	...	...	...
1834	40.11	41.13	...	...	...	...	...	...
1835	38.31	40.63	...	...	...	...	...	...
1836	39.29	39.43	...	...	...	...	...	...
1837	39.68	39.13	...	...	...	...	...	...
1838	40.82	39.33	...	...	...	...	...	...
1839	41.58	41.93	...	...	...	...	...	...
1840	41.36	42.33	...	...	...	...	...	...
1841	41.13	42.03	...	...	...	...	...	...
1842	40.12	42.13	...	...	...	...	...	...
1843	40.13	41.43	...	...	...	...	...	...
1844	39.09	42.03	...	...	...	...	...	...
1845	...	41.73	...	...	...	...	...	...
1846	...	43.03	...	...	...	...	...	...
1847	...	41.93	...	...	...	...	...	...
1848	...	42.73	...	...	...	...	...	...
1849	...	41.93	...	...	...	...	...	...
1850	...	41.53	...	...	...	...	...	...
1851	...	40.43	...	...	...	...	...	...
1852	...	42.53	...	...	...	...	...	...
1853	...	42.53	...	...	...	...	...	...
1854	...	40.53	...	...	...	...	...	42.35*
1855	...	41.93	...	...	...	...	...	40.93
1856	...	40.53	...	...	...	...	...	40.22
1857	...	41.33	...	...	...	...	...	41.38
1858	...	40.13	...	...	...	...	...	40.06
1859	...	40.93	...	43.18*	...	...	...	40.79
1860	...	42.23	...	45.35	...	...	42.97*	...
1861	...	40.83	...	44.69	43.03	...	...	40.97
1862	...	41.73	...	44.94	...	...	...	40.52
1863	...	42.13	...	45.38*	...	...	...	...
1864	...	42.33	...	44.09*	...	...	...	41.77
1865	...	...	42.82	...	...	...	...	...
1866	...	...	42.65*	43.01	...	...	...	...
—								
1868	...	...	...	...	...	...	40.84	...
1869	41.82*	...	...	...	...	...	42.55	...
1870	43.89*	...	...	45.67	...	43.76	45.25	...
	40.48	41.45	42.53	44.32	43.03	40.57	42.81	41.57

Year.	Portland.	Saco.	Standish.	Steuben.	Vassalboro.	West Waterville.	Williamsburg.
	°	°	°	°	°	°	°
1820	42.98	...	...	...	...	...	...
1821	42.73	...	...	...	...	...	...
1822	43.64	...	...	...	...	...	...
1823	41.64	...	...	...	...	...	...
1824	43.23	...	...	...	...	...	...
1825	45.23	...	...	...	...	...	...
1826	44.98	...	...	...	...	...	...
1827	43.23	...	...	...	...	...	...
1828	45.39	...	...	...	...	...	...
1829	43.23	...	...	...	...	...	...
1830	44.48	...	...	...	...	...	...
1831	44.23	...	...	...	...	...	...
1832	41.98	...	...	...	...	...	...
1833	42.23	...	...	...	...	...	...
1834	42.73	...	...	...	...	...	...
1835	41.89	...	...	...	...	...	...
1836	40.23	...	...	...	...	...	...
1837	40.23	...	...	...	...	...	...
1838	42.03	...	...	...	...	...	...
1839	43.06	...	...	...	...	...	...
1840	43.23	...	...	...	...	...	...
1841	43.06	...	...	...	...	...	...
1842	43.06	...	...	...	...	...	...
1843	42.05	...	...	...	...	...	...
1844	42.73	42.24	...	...	...	...	...
1845	43.31	44.24	...	...	...	...	...
1846	44.39	46.14	...	...	...	...	...
1847	43.06	44.74	...	...	...	...	...
1848	44.56	...	...	...	...	...	...
1849	43.64	...	...	...	...	...	...
1850	44.39	...	...	...	...	...	...
1851	43.11	...	...	...	...	...	...
1852	43.65	...	...	...	...	...	...
1853	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	...
1855	...	...	...	42.07	...	...	...
1856	44.30	...	...	40.63	...	...	...
1857	44.35	...	...	41.86	...	...	...
1858	43.48	...	...	40.53	...	...	...
1859	42.96	...	...	41.47	...	...	...
1860	...	...	...	42.47	44.22*	...	...
1861	...	...	...	42.10	42.13*	...	...
1862	...	...	...	41.30	42.84*	...	...
1863	...	...	...	42.08	...	...	...
1864	...	...	...	42.40	...	44.82	...
1865	...	...	...	42.83	...	44.61	...
1866	...	...	...	42.22	...	44.18	...
1867	...	...	43.40*	40.83	...	42.88	...
1868	...	...	42.25	39.56	...	42.01	...
1869	...	...	...	42.24	...	44.35	38.72*
1870	...	...	...	...	...	46.58	41.13*
	43.23	44.14	44.03	41.72	42.94	44.21	40.15

MARYLAND.

Year.	Agricultural College.	Annapolis.	Baltimore.	Bladensburg.	Catonsville.	Chestertown.	Cumberland.	Emmettsburg.	Eyrie House.	Year.	Fort McHenry.	Fort Severn.	Fort Washington.	Frederick.	Leitersburg.	Leonardtown.
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...	...	...	...	...	...	...	...	...	...	1822	...	57.02	...	...	...	...
...	...	...	...	...	...	...	...	...	...	1824	...	...	57.74	...	...	...
...	...	...	...	...	...	...	...	...	...	1825	...	...	58.92	...	...	...
...	...	...	...	...	...	...	...	...	...	1826	...	...	59.68	...	...	...
...	...	...	...	...	...	...	...	...	...	1827	...	...	58.50*	...	...	...
...	...	...	...	...	...	...	...	...	...							
...	...	...	..	...	...	...	...	...	...	1829	...	...	56.24	...	...	...
...	...	...	...	...	...	...	...	...	...	1830	...	...	59.25	...	...	...
...	...	...	...	...	...	...	...	...	...	1831	53.73	53.41	56.92*	...	...	...
...	...	...	...	...	...	...	...	...	...	1832	55.45	55.49	57.87*	...	...	...
...	...	...	...	...	...	...	...	...	...	1833	55.69	55.93	58.66	...	...	...
...	...	...	...	...	...	...	...	...	...	1834	55.28	54.91	57.34	...	...	...
...	...	...	...	...	...	...	...	...	...	1835	52.59	...	54.90*	...	...	...
...	...	...	...	...	...	...	...	...	...	1836	51.17	...	...	...	...	...
1817	...	...	52.68	...	...	...	...	...	...	1837	52.69	...	...	...	...	...
1818	...	...	51.89	...	...	...	...	...	...	1838	52.71	...	...	...	...	...
1819	...	...	54.04	...	...	...	...	...	...	1839	54.15	...	...	...	...	...
1820	...	...	52.30	...	...	...	...	...	...	1840	52.51	...	...	...	...	...
1821	...	...	52.86	...	...	...	...	...	...	1841	52.03	...	...	...	...	...
1822	...	...	56.08	...	...	...	...	...	...	1842	53.46	...	...	...	...	...
1823	...	...	53.76	...	...	...	...	...	...	1843	53.04	53.27*	...	...	...	...
1824	...	...	54.64	...	...	...	...	...	...	1844	53.45	55.57	...	...	...	...
										1845	54.30	...	...	...	...	...
1846	...	...	54.04	...	...	...	...	...	51.41*	1846	53.82	...	...	...	...	...
1847	...	...	52.89	...	...	...	...	...	...	1847	54.71	...	...	...	...	...
1848	...	...	53.47	...	...	...	...	...	...	1848	56.31	...	...	...	...	...
1849	...	...	52.27	...	...	...	...	...	...	1849	55.35	...	...	...	...	...
1850	...	...	53.08	...	...	...	...	...	...	1850	56.56	...	...	...	...	...
1851	...	...	53.93	...	...	...	...	...	...	1851	56.29	...	...	...	...	...
1852	...	...	52.56	...	...	...	...	...	...	1852	53.97	...	55.71	...	...	...
1853	...	...	54.04*	...	...	...	...	...	...	1853	55.45	...	57.30*	...	...	...
										1854	55.70	...	...	54.45	...	...
1855	...	...	...	53.23*	...	...	...	...	...	1855	55.69	...	...	52.89	...	...
1856	...	50.89*	...	50.14	...	...	...	...	...	1856	52.68	...	...	50.76	...	...
1857	...	53.02	...	51.85*	...	...	...	...	...	1857	53.56	...	...	50.82	...	...
1858	...	55.10	54.42	52.77	...	53.85	...	...	...	1858	55.37	...	...	52.92	...	...
1859	...	54.89	...	53.36	...	53.16	52.14	...	...	1859	...	...	...	52.83	51.44	55.17*
1860	...	...	...	...	...	...	52.53	...	...	1860	...	...	...	52.79	50.92*	...
1861	56.97*	55.80	...	43.08*	...	55.18	53.18	...	...	1861	55.25*	...	...	52.09	51.42	...
1862	...	55.33*	...	...	...	54.02	51.45	...	...	1862	...	...	...	52.39	...	...
1863	...	55.87*	...	53.50*	...	...	51.44*	...	...							
1864	...	55.61	...	54.92	...	...	51.63	...	...	1864	55.86	...	...	...	...	...
1865	...	56.68	...	...	...	...	52.25	...	...	1865	56.75	...	...	...	...	...
1866	...	55.62	...	...	51.59	...	50.65*	...	...	1866	...	...	...	52.20*	...	...
1867	...	55.80	...	...	51.12*	...	49.94*	50.41	...	1867	54.25	...	...	...	...	...
1868	...	55.38	...	...	...	...	50.44*	49.27	...	1868	53.92	...	...	...	...	...
1869	...	56.95	...	...	...	...	51.06*	50.50	...	1869	55.05	...	...	...	...	...
1870	...	58.12	...	...	...	...	52.43	52.34	...	1870	57.12	...	...	...	...	...
	56.60	55.38	53.46	53.02	50.93	54.04	51.59	50.67	51.41		54.50	55.27	57.17	53.09	51.10	55.30

MD.—Continued.				MASSACHUSETTS.
Year.	St. Mary's.	Shellman Hills.	Woodlawn.	Amherst.
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1836	...	...	...	41.12
1837	...	...	...	40.66
1838	...	...	...	42.35
1839	...	...	...	42.81
1840	...	...	...	45.62
1841	...	...	...	45.16
1842	...	...	...	45.95
1843	...	...	...	44.67
1844	...	...	...	45.26
1845	...	...	...	46.69
1846	...	53.64	...	47.39
1847	...	52.80	...	46.67
1848	...	52.77*	...	46.36
1849	...	51.55	...	45.56
1850	...	53.23*	...	46.06
1851	...	53.20	...	45.74
1852	...	52.64	...	46.57*
1853	...	53.63	...	46.52*
1854	...	54.32	...	46.38
1855	...	52.08	...	46.09
1856	...	48.83	...	44.56
1857	...	50.24	...	45.79
1858	...	52.35	...	46.18*
1859	...	52.27	...	45.73
1860	...	51.44	...	46.23
1861	...	52.10	...	45.98
1862	56.82*	50.77	...	45.98
1863	...	50.70*	...	46.52*
1864	56.13*	51.47	...	46.98
1865	57.59*	52.09*	54.10*	47.51
1866	...	...	52.86	46.37
1867	...	...	51.79	45.78
1868	54.03*	...	50.04*	44.90
1869	...	...	51.71	46.41
1870	...	...	53.35	48.87
	55.98	52.15	52.30	45.64

MASSACHUSETTS.					
Year.	Andover.	Baldwinsville.	Boston.	Bradford.	Bridgewater.
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...	...	...	...	...	...
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...	...	...	...	...	...
1772	...	...	...	48.88	...
1798	48.87	...	...	...	...
1799	47.97	...	...	...	...
1800	48.87	...	...	...	...
1801	49.87	...	...	...	...
1802	49.87	...	...	...	...
1803	49.57	...	...	...	...
1804	47.37	...	...	...	...
1805	50.37	...	...	...	...
1806	47.37	...	...	...	...
1807	43.27	...	...	...	...
1808	44.17	...	...	...	...
1820	...	...	47.95	...	...
1821	...	...	47.63	...	...
1822	...	...	49.40	...	...
1823	...	...	46.90	...	...
1824	...	...	48.82	...	...
1825	...	...	51.01	...	...
1826	...	...	50.30	...	...
1827	...	...	48.71	...	...
1828	...	...	51.72	...	...
1829	...	...	48.30	...	...
1830	...	...	49.85	...	...
1831	...	...	49.16	...	...
1832	...	...	48.12	...	...
1833	...	...	48.42	...	...
1834	...	...	48.30	...	...
1835	...	...	47.27	...	...
1836	...	...	45.63	...	...
1837	...	...	46.16	...	...
1838	...	...	47.81	...	...
1839	...	...	48.96	...	...
1840	...	...	49.79	...	...
1841	...	...	49.11	...	...
1842	...	...	49.95	...	...
1843	...	...	48.62	...	...
1844	...	...	49.30	...	...
1845	...	...	50.36	...	...
1846	...	...	50.57	...	...
1847	...	...	50.28	...	...
1848	...	...	50.04	...	...
1849	...	...	49.21	...	...
1855	...	...	49.53*	...	...
1856	...	...	46.07*	...	46.05*
1858	...	...	...	...	46.59*
1864	...	44.05*	...	...	...
1865	...	44.91*	...	...	...
	47.94	44.39	48.35	48.88	46.83

MASSACHUSETTS.				
Year.	Cambridge.	Cambridge.	Chelsea.	Deerfield.
	°	°	°	°
1781	49.81*	...	...	...
1783	50.00	...	...	...
1790	...	48.72	...	...
1791	...	49.71	...	...
1792	...	48.01	...	...
1793	...	50.67	...	...
1794	...	51.53	...	...
1795	...	49.79	...	...
1796	...	47.01	...	...
1797	...	46.82	...	...
1798	...	47.85	...	...
1799	...	46.76	...	...
1800	...	48.52	...	...
1801	...	49.32	...	...
1802	...	49.68	...	...
1803	...	48.57	...	...
1804	...	47.01	...	...
1805	...	49.47	...	...
1806	...	46.80	...	47.13*
1807	...	46.66	...	46.43*
1808	...	47.52	...	...
1809	...	46.14	...	...
1810	...	47.94	...	...
1811	...	48.80	..	...
1812	...	44.40	...	...
1813	...	47.20	...	...
1816	...	46.17	...	...
1817	...	45.00	...	...
1841	...	46.75	...	...
1842	...	46.73	...	...
1843	...	45.47	...	...
1844	...	46.15	...	...
1845	...	48.87	...	...
1846	...	49.06	...	...
1847	...	47.74	...	...
1848	...	47.83	...	...
1849	...	47.02	...	...
1850	...	47.38	...	...
1851	...	47.39	...	...
1852	...	47.69	...	...
1853	...	47.77	...	...
1854	...	47.47	...	...
1855	...	47.19	...	...
1856	...	45.66	...	...
1857	...	47.07	...	...
1858	...	46.77	...	...
1859	...	46.86	...	...
1861	...	...	50.00	...
1862	...	...	49.07*	...
1864	...	...	47.50	...
1868	...	46.94	...	...
1869	...	48.40	...	...
1870	...	51.41	...	...
	50.01[1]	47.54	49.03	45.61

[1] Hours of observation unknown.

MASSACHUSETTS.—Continued.

Year.	Fitchburg.	Fort Independence.	Fort Warren.	Georgetown.	Hinsdale.	Kingston.	Lawrence.	Lowell.	Lunenburg.	Medfield.	Mendon.	Milton.	Nantucket.	Nantucket.	Year.	New Bedford.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1813	48.25
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1814	48.35
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1815	47.35
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1816	46.65
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1817	47.25
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1818	47.95
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1819	49.35
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1820	48.55
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1821	47.95
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1822	50.05
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1823	47.45
1824	...	48.71	...	...	...	...	...	...	...	...	...	...	...	...	1824	49.35
1825	...	50.67	...	...	...	...	...	...	...	...	...	...	...	...	1825	50.85
1826	...	49.62	...	...	...	...	...	...	...	...	...	...	...	...	1826	50.65
1827	...	47.95*	...	...	...	...	...	...	...	...	...	...	49.60*	...	1827	48.75
1828	...	50.64	...	...	...	...	...	...	...	...	...	...	52.03	...	1828	50.45
1829	...	47.70*	...	...	...	...	...	...	...	...	...	...	...	...	1829	47.05
1830	...	50.44	...	...	...	...	...	...	...	...	...	...	...	...	1830	49.55
1831	...	49.26	...	...	...	...	...	...	...	47.02	...	...	...	...	1831	48.65
1832	...	48.41	...	...	...	...	...	...	...	45.84	...	...	...	...	1832	47.46
1833	...	49.07*	...	...	...	...	...	...	...	...	47.76	...	...	...	1833	48.18
1834	...	47.79	...	...	...	...	...	...	...	...	47.36	...	...	...	1834	48.17
1835	...	...	...	...	...	...	...	...	...	...	45.06	...	...	...	1835	46.65
1836	...	45.93	...	...	...	...	...	...	...	...	43.26	...	...	...	1836	44.90
1837	...	...	...	...	...	...	...	...	...	...	44.56	...	...	...	1837	45.72
1838	...	...	...	...	...	...	...	...	46.57	...	45.76	...	...	...	1838	47.09
1839	...	...	...	...	...	...	...	...	47.43	...	46.76	...	...	...	1839	47.70
1840	...	...	...	...	...	...	...	...	47.90	...	46.26	...	...	...	1840	47.47
1841	...	...	...	...	...	...	...	...	47.41	...	45.66	...	...	...	1841	46.63
1842	...	...	...	...	...	...	...	..	48.59	...	46.76	...	...	...	1842	47.24
1843	...	...	...	...	...	...	...	...	46.84	...	43.86	...	...	...	1843	47.17
1844	...	...	...	...	...	...	...	...	47.54	...	45.80	...	...	...	1844	48.47
1845	...	...	...	...	...	...	...	...	47.67	...	47.10	...	...	...	1845	49.13
1846	...	...	...	...	...	...	...	48.13	47.75	...	47.30	...	...	...	1846	49.33
1847	...	...	...	...	...	...	...	47.03	49.80	...	46.30	...	50.33	...	1847	49.13
1848	...	...	...	...	...	...	...	46.73	49.25	...	46.70	...	51.42	...	1848	49.20
1849	...	...	...	...	...	...	...	46.53	45.33	...	46.20	...	51.75	...	1849	48.52
1850	...	...	...	...	...	...	...	46.63	48.42	...	46.49	...	52.13	...	1850	48.41
1851	...	...	...	...	...	...	...	46.33	49.75	...	...	...	51.95	...	1851	48.08
1852	...	48.23	...	...	...	...	...	47.53	48.38	...	...	...	50.04	...	1852	48.36
1853	...	49.49	...	...	...	...	...	...	48.16	...	...	...	49.86	...	1853	46.10
1854	...	48.81	...	...	...	...	...	...	47.50	...	46.18	...	...	49.95	1854	48.53
1855	...	48.88	...	...	...	...	...	...	46.99	...	46.71	...	...	50.25	1855	48.06
1856	...	47.01*	...	...	...	...	43.61	...	42.15	...	44.93	...	...	49.02	1856	46.71
1857	...	48.01	...	...	...	...	45.80	...	46.34	...	46.29	...	...	49.45	1857	47.23
1858	...	48.22	...	...	...	...	45.39	...	45.73	...	46.39	...	...	49.45	1858	47.65
1859	...	47.42	...	...	...	...	45.48	...	45.80	...	46.47	...	...	50.37	1859	47.68
1860	...	49.31	...	...	...	...	46.21	...	46.86	...	47.25	...	...	...	1860	48.51
1861	47.87*	...	...	...	...	...	46.06	...	46.45	...	47.21	...	...	...	1861	49.25
1862	...	...	...	...	...	...	45.52*	...	46.90	...	46.78	...	...	...	1862	49.33
1863	...	...	47.94	...	...	...	45.72*	...	47.24	...	47.17	...	...	...	1863	49.61*
1864	...	...	47.76*	...	...	...	45.81	...	48.12	...	47.17	...	...	...	1864	48.19
1865	...	...	49.39	47.04*	...	...	...	...	47.69	...	48.73	...	...	...	1865	50.34
1866	...	...	...	...	...	...	46.17	...	46.43	...	46.94	...	...	...	1866	47.91
1867	...	48.77	47.36*	45.34*	...	46.30	45.44	...	45.30	...	45.19	...	...	...	1867	47.83
1868	...	45.64	45.47	44.01*	...	47.28	44.49	...	44.74	...	43.90	44.15	...	...	1868	46.32
1869	...	48.14	46.82	...	42.80	47.64	46.37	...	46.46	...	46.12	49:15	...	...	1869	47.95
1870	...	49.31	49.69	...	44.78*	49.04	48.37*	...	48.77	...	48.26	51.10	...	...	1870	49.00
	47.87	48.35	47.84	46.05	43.61	47.65	45.77	46.86	46.91	46.86	46.32	47.60	51.02[1]	49.74		48.21

[1] Hours of observation unknown.

MASSACHUSETTS.—Continued.

Year.	Newbury.	Newburyport.	North Attleboro.	North Billerica.	Princeton.	Richmond.	Roxbury.	Year.	Salem.	Year.	Sandwich.	Springfield.	Topsfield.	Watertown Arsenal.	Westfield.	Weymouth.
	°	°	°	°	°	°	°		°		°	°	°	°	°	°
...	...	...	...	...	...	...	...	1786	47.70	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1787	47.02	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1788	47.01	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1789	46.83	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1790	45.97	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1791	48.04	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1792	47.71	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1793	50.13	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1794	49.93	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1795	49.34	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1796	47.84	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1797	47.30	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1798	48.64	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1799	48.63	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1800	49.16	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1801	49.60	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1802	49.96	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	1803	49.41	1837	...	...	...	45.51	...	...
...	...	...	...	...	...	...	...	1804	47.49	1838	...	...	...	46.92	...	...
...	...	...	...	...	...	...	...	1805	49.96	1839	...	...	...	48.02	...	...
...	...	...	...	...	...	...	...	1806	47.15	1840	...	...	...	48.10	...	...
...	...	...	...	...	...	...	...	1807	47.30	1841	...	...	...	47.87*	...	...
...	...	...	...	...	...	...	...	1808	48.65							
...	...	...	...	...	...	...	...	1809	47.09	1843	...	...	...	46.25	...	...
...	...	...	...	...	...	...	...	1810	48.17	1844	...	...	...	46.40*	...	...
1849	...	...	...	...	...	...	49.41*	1811	49.24							
								1812	44.45	1854	...	47.33	...	...	...	...
1854	...	46.71	47.08	...	43.61	45.14*	...	1813	46.77	1855	...	47.82	...	...	45.54	...
1855	...	46.25	45.61	...	43.49	45.79*	...	1814	47.44	1856	...	...	...	...	44.41	...
1856	...	44.16	45.02	...	41.87	44.12	...	1815	46.77	1857	...	...	...	...	45.27	47.85
1857	...	46.88	...	...	...	45.61*	...	1816	46.28	1858	...	...	...	...	45.67	...
1858	...	46.11*	...	...	...	45.67*	...	1817	46.44	1859	...	...	...	...	45.13	...
1859	...	...	...	...	...	45.65*	...	1818	47.17	1860	...	...	46.07*	...	...	...
1860	...	...	...	...	...	46.12*	...	1819	49.87	1861	...	...	46.20	...	46.11	...
1861	...	...	...	...	...	47.07	...	1820	48.01	1862	...	...	...	...	46.06	...
1862	...	...	...	...	...	46.68*	...	1821	47.28	1863	...	...	...	...	46.23*	...
								1822	48.97	1864	48.11	49.89*	48.15*	...	46.98	...
1865	47.49*	...	...	...	...	48.08*	...	1823	46.73	1865	...	...	50.40	...	47.48	...
1866	46.36	...	...	47.39*	...	46.77*	...	1824	48.42	1866	...	...	49.83	...	...	...
1867	45.46	...	...	46.41	...	46.96*	...	1825	50.16	1867	...	...	48.50	47.77*	...	...
1868	43.37*	...	...	45.22	...	...	...	1826	49.46	1868	...	...	43.42	46.64*	...	...
1869	...	...	...	47.32	...	46.12*	...	1827	47.57	1869	...	...	45.64	48.87	...	...
1870	...	...	...	49.48	...	49.12*	...	1828	50.28	1870	...	...	47.59*	51.52*	...	...
	46.15	46.00	47.78	47.16	43.25	46.30	49.41		48.08		48.25*	48.71	47.20	47.61	46.39	47.27

MASS.—Cont'd.			MICHIGAN.													
Year.	Williams-town.	Worcester.	Ann Arbor.	Battle Creek.	Central Mine.	Coldwater.	Cooper.	Copper Falls Mine.	Dearborn-ville.	Detroit.	Eagle River.	Eureka Valley.	Flint.	Fort Brady.	Fort Gratiot.	Fort Mackinac.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1816	43.94	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1817	43.38	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1818	43.78	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1819	46.20	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1820	45.55	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1821	45.06	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1822	46.32	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1823	44.33	...	...	...	...	...	...	...	...	...	...	...	...	39.27	...	...
1824	45.46	...	...	...	...	...	...	...	...	...	...	...	...	40.54	...	...
1825	47.63	...	...	...	...	...	...	...	...	...	...	...	...	43.05	...	...
1826	47.72	...	...	...	...	...	...	...	...	...	...	...	...	40.89*	...	41.25
1827	45.42	...	...	...	...	...	...	...	...	...	...	...	...	41.05	...	...
1828	48.36	...	...	...	...	...	...	...	...	...	...	...	...	42.22	...	41.26
1829	44.91	...	...	...	...	...	...	...	...	...	...	...	...	40.48*	...	41.06
1830	46.70	...	...	...	...	...	...	...	...	...	...	...	...	42.97	48.56*	42.81
1831	45.63	...	...	...	...	...	...	...	...	...	...	...	...	41.04	46.17	40.15
1832	45.51	...	...	...	...	...	...	...	...	...	...	...	...	41.52	47.47	39.73
1833	45.19	...	...	...	...	...	...	...	...	...	...	...	...	40.93	47.70	40.74
1834	46.00	...	...	...	...	...	...	...	...	...	...	...	...	40.75	48.40	40.34
1835	43.73	...	...	...	...	...	...	...	...	...	...	...	...	39.67	46.46	38.69
1836	42.14	...	...	...	...	...	...	...	42.76*	...	...	...	...	36.62	42.28	36.71
1837	42.24	...	...	...	...	...	...	...	43.92	...	...	...	...	36.04	...	...
1838	43.54	...	...	...	...	...	...	...	45.30	...	...	...	...	37.49	...	...
1839	...	...	...	...	...	...	...	...	47.92	...	...	...	...	41.21	...	...
1840	...	47.26	...	...	...	...	...	...	...	48.70	...	...	...	40.68	45.94	...
1841	...	46.12	...	...	...	...	...	...	...	48.31	...	...	...	39.55	45.73	...
1842	...	47.45	...	...	...	...	...	...	...	49.05	...	...	...	38.26	46.04	41.91
1843	...	46.14	...	...	...	...	...	...	...	46.43	...	...	...	37.65	43.78	39.44
1844	...	46.80	...	...	...	...	...	...	...	49.62	...	...	...	38.76	46.90	41.43
1845	...	47.38	...	...	...	...	...	...	...	49.41	...	...	...	39.80	46.67	41.27
1846	..	47.84	...	...	...	...	...	...	...	50.27	...	...	...	44.24*	...	43.46
1847	...	47.21	...	...	...	...	...	...	...	41.91	...	...	...	39.34	...	38.26
1848	...	47.21	...	...	...	...	...	...	...	45.99	...	...	...	...	...	...
1849	...	47.59	...	...	...	...	...	...	...	48.71	...	...	...	...	...	39.87
1850	...	46.67	...	...	...	...	...	...	...	49.71	...	...	...	42.06	46.39	42.67
1851	...	46.91	...	...	...	...	...	...	...	49.18	...	...	...	39.53	46.03	41.47
1852	...	47.71	...	...	...	...	...	...	...	49.24	...	...	...	40.23	...	40.67*
1853	...	47.31	...	...	...	...	...	...	...	51.71	...	...	...	40.76	...	41.46
1854	...	47.35	48.13	51.22	...	...	...	...	...	49.43	...	...	48.46	39.14	...	41.27
1855	44.22	46.37	45.93	48.03	...	...	47.22*	...	...	47.56	...	...	45.88	38.33*	...	39.84
1856	42.40	45.70	...	45.48*	...	...	43.45	36.46	...	45.26*	38.59	...	...	38.11*	...	38.08*
1857	44.22*	46.67	...	45.91	...	...	44.56	...	...	...	...	...	...	...	...	...
1858	43.94	47.11	...	49.20	...	...	49.33	...	...	50.56*	...	...	...	...	...	...
1859	43.59*	47.21	...	48.20	...	...	...	...	...	49.72	...	...	...	...	...	40.71
1860	...	47.09	...	...	...	...	...	...	...	48.04	...	...	...	...	...	41.10
1861	44.49	47.53	...	...	...	...	48.38	...	...	48.56	...	...	...	...	...	...
1862	...	47.39	...	...	...	...	47.02*	...	...	48.44	...	40.35*	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	48.23	...	...	...	...	...	...
1864	45.58	...	...	...	...	...	...	...	...	47.63	...	...	...	...	...	...
1865	46.06*	49.38	...	...	...	...	...	...	...	49.12	...	...	...	...	...	...
1866	44.72	47.74	...	...	...	...	...	...	...	45.55	...	...	...	...	...	...
1867	44.32	46.80	...	...	...	...	...	...	...	46.55	...	...	...	...	...	...
1868	43.54	45.13	...	...	36.82	...	...	...	...	...	...	...	...	...	...	...
1869	44.45*	46.92	...	...	36.67	45.25	...	...	...	...	...	...	...	...	...	...
1870	46.94	48.59	...	...	39.95	48.11	...	...	...	48.54*	...	...	...	...	...	...
	44.92	47.20	46.94	48.10	37.75	47.32	46.84	35.79	44.97	48.28	38.68	40.06	47.17	40.11	46.08	40.61

MICHIGAN.—Continued.

Year.	Fort Wilkins.	Grand Haven.	Grand Rapids.	Holland.	Homestead.	Lansing.	Laphamsville.	Litchfield.	Marquette.	Mill Point.	Monroe.	Muskegan.	New Buffalo.	Northport.	Ontonagon.	Otsego.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1845	40.34	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	47.78*	...	...	...	...	...	...	...	...	...
1854	...	...	49.58*	...	...	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	45.62	...	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	43.58	...	...	...	...	...	...	...	...	...	...	...	...	...
1857	...	...	44.71	...	...	...	...	...	...	...	...	...	...	...	...	...
1858	...	...	47.73	...	...	...	...	...	40.73	...	...	...	48.76	...	...	...
1859	...	...	47.49*	...	...	...	...	...	39.46	...	...	...	47.78*	...	...	...
1860	...	46.89	...	45.57*	...	...	...	...	40.61	44.75	48.08	...	...	...	39.94	...
1861	...	46.99	...	45.95	...	...	...	...	40.32	...	46.04	...	...	...	40.13	...
1862	...	46.79	...	45.77*	...	...	...	...	39.51	...	48.42	...	...	...	38.23	...
1863	...	...	...	45.36*	...	...	...	...	41.42	...	48.86	...	...	...	39.83	...
1864	...	...	...	...	...	46.76	...	...	42.39	...	48.66	...	...	...	40.20	...
1865	...	...	...	...	44.77	47.28	...	...	43.33	...	49.66	...	...	...	40.68	...
1866	...	...	45.59*	45.33*	42.50	45.20	...	...	40.34	...	48.26	...	...	...	39.15	...
1867	...	...	47.15	46.75*	...	46.25	...	45.95	41.48	...	49.76	...	...	43.48	39.02	48.20*
1868	...	...	46.56	46.11	...	45.23*	...	44.62	...	...	45.09	...	...	42.86	40.53	44.21
1869	...	...	46.70	...	...	45.34	...	45.11	...	...	47.19	49.58*	...	42.34	41.27	48.61
1870	...	...	50.01	48.37*	...	47.52*	...	47.76	...	...	52.05*	...	...	45.71	43.78	51.62*
	41.10	46.95	46.90	46.37	43.99	46.55	47.82[1]	45.77	40.88	43.63	48.17	50.34	48.31	43.43	40.03	48.16

[1] Hours of observation unknown.

	MICHIGAN.—Continued.									MINNESOTA.						
Year.	Pleasanton.	Pontiac.	Port Huron.	Romeo.	St. James.	Saugatuck.	Tawas City.	Thunder Bay Island.	Ypsilanti.	Afton.	Beaver Bay.	Burlington.	Forest City.	Fort Ridgeley.	Fort Ripley.	Fort Snelling.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1820	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.00*
1821	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.86
1822	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.71
1823	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.38
1824	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.76
1825	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47.07
1826	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	44.45
1827	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.69
1828	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.96
1829	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.30
1830	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47.95
1831	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	42.44
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.44
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47.54
1834	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.68
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.00
1836	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.54
1837	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.65
1838	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	41.34
1839	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.79
1840	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	44.41
1841	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.89
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.83
1843	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	39.93
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.72
1845	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.80
1846	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48.33
1847	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	41.93
1848	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.56
1849	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.26
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	...	38.15	43.73
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	39.11*	46.74
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	...	39.21	43.79
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	39.43	42.34
1854	...	...	...	...	42.68*	49.96*	...	...	...	...	...	...	...	47.96	40.35	44.82
1855	...	...	...	...	42.60	49.36*	...	...	...	...	...	...	...	42.51	38.61	43.18
1856	...	...	...	43.53	...	...	...	...	...	...	...	...	...	40.93	37.89	42.42
1857	...	...	...	...	...	...	...	...	...	...	...	...	...	39.84	...	41.09
1858	...	...	47.37	...	...	...	...	...	...	...	...	39.00	...	43.41	41.65	...
1859	...	...	...	...	...	...	43.24	40.14	47.51	...	36.21	36.56	40.08	42.46	39.39	...
1860	...	...	...	...	...	...	44.06	41.29	46.52*	...	...	...	42.63*	45.24	40.82	...
1861	...	...	...	...	...	...	44.09	42.19	47.90*	...	37.63	...	41.92	43.02	40.41	...
1862	...	...	...	...	...	...	43.49	42.49	46.82	...	37.16*	...	...	40.96	38.76	...
1863	...	...	...	...	...	...	43.69	42.49	...	...	37.35*	...	43.21*	43.75	41.00	...
1864	...	46.24*	...	...	...	...	43.89	43.20	...	...	38.58	...	...	44.29	40.76	...
1865	...	...	...	...	...	...	44.29	43.80	...	...	39.78	...	...	44.95*	41.48*	...
1866	...	...	...	...	...	...	42.99	...	...	40.91*	37.92	...	...	...	...	...
1867	...	...	...	...	...	...	44.19	...	...	...	36.84	...	...	...	38.16	44.56*
1868	...	...	...	...	...	...	...	...	...	...	36.95	...	...	...	38.58	43.94
1869	41.17*	...	...	...	...	...	...	41.53*	...	40.80	38.12	...	...	...	...	42.62
1870	...	...	...	...	...	...	...	44.41	...	...	40.37	...	...	...	41.23*	46.65
	42.35	46.17	47.10	43.85	42.12	48.67	43.92	42.30	47.13	41.49	37.84	38.10	42.06	43.07	39.77	44.11

	MINNESOTA.—Continued.											MISSISSIPPI.				
Year.	Hazelwood.	Hennepin Co.	Koniska.	Madelia.	Minneapolis.	New Ulm.	Princeton.	St. Anthony's Falls.	St. Joseph.	St. Paul.	Sibley.	Brookhaven.	Columbus.	Enterprise.	Fayette.	Garlandsville.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1853	...	...	...	...	...	...	...	45.47*	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	...	44.57*	37.83*	...	...	...	...	...	...	68.55
1855	41.94*	...	...	...	...	...	...	...	...	...	...	...	63.84	...	...	...
1856	39.56*	...	...	...	...	...	...	...	...	...	...	...	60.37	...	...	...
1857	39.12*	...	...	...	...	...	39.20	...	...	...	...	...	60.13	...	...	...
1858	42.65	...	...	...	...	...	43.99*	...	...	...	...	...	62.63	...	...	...
1859	40.89	...	...	...	...	...	42.47	...	...	...	...	...	62.42	...	...	...
1860	...	...	...	...	...	...	...	...	...	...	...	...	63.17*	...	...	...
1861	42.39*	...	...	...	...	...	...	...	...	...	...	...	63.73	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	64.46	...	...	...
1863	...	...	...	...	...	...	...	...	...	42.22*	...	...	61.70	...	...	...
1864	...	...	...	...	...	44.87*	...	...	...	42.76	...	...	60.73	...	...	...
1865	...	43.61	...	...	43.92	45.62	...	...	...	43.22	...	...	63.35	...	...	...
1866	...	...	...	...	41.17	43.77	...	...	...	40.43	41.06*	...	61.86	...	...	...
1867	...	...	...	...	40.11	42.78	...	...	...	39.91	40.77	...	63.13	...	61.49	...
1868	...	...	...	...	40.78	43.37	...	...	...	41.67	41.08	63.93	62.43	...	...	...
1869	...	...	38.68*	42.25	40.71	42.51	...	...	...	42.38	41.12	64.68	61.15	...	...	...
1870	...	...	42.12*	45.40	43.84	45.62	...	...	...	45.99	44.47	63.26	62.19	64.90*	...	...
	41.24	43.61	40.40	43.83	41.67	44.08	41.63	44.63	37.94	42.32	42.01	63.94	62.19	64.90	61.64	68.25

	MISSISSIPPI.—Continued.							MISSOURI.								
Year.	Grenada.	Marion Court-House.	Natchez.	Oxford.	Paulding.	Philadelphia.	Vicksburg.	Allenton, near.	Athens.	Bolivar.	Brunswick.	Cape Girardeau.	Cassville.	East Prairie.	Easton.	Hannibal.
1799	...	...	64.89*	...	...	...	...	...	...	...	...	...	...	...	...	...
1800	...	...	65.05	...	...	...	...	...	...	...	...	...	...	...	...	...
1801	...	...	67.54	...	...	...	...	...	...	...	...	...	...	...	...	...
1802	...	...	66.70*	...	...	...	...	...	...	...	...	...	...	...	...	...
1803	...	...	67.58	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	...	...	65.03	...	...	...	...	...	...	...	...	...	...	...	...	...
1837	...	...	66.64	...	...	...	...	...	...	...	...	...	...	...	...	...
1838	...	...	63.85	...	...	...	...	...	...	...	...	...	...	...	...	...
1839	...	...	67.21	...	...	...	...	...	...	...	...	...	...	...	...	...
1840	...	...	66.76	...	...	...	...	...	...	...	...	...	...	...	...	...
1841	...	...	67.63	...	...	...	67.35	...	...	...	...	...	...	...	...	...
1842	...	...	67.62	...	...	...	66.60*	...	...	...	...	...	...	...	...	...
1843	...	...	66.61	...	...	...	...	...	...	...	...	...	...	...	...	...
1844	...	...	67.97	...	...	...	...	...	...	...	...	...	...	...	...	...
1845	...	...	66.79	...	...	...	...	...	...	...	56.76	...	...	...	...	...
1846	...	...	67.56	...	...	...	...	...	...	...	...	...	...	...	...	...
1847	...	...	66.40	...	...	...	...	...	...	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	66.07*	...	...	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	65.34	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	54.72*
1855	...	...	...	61.44*	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1857	...	...	...	...	...	...	...	...	...	...	...	53.14*	...	...	...	...
1858	...	...	66.27*	...	66.87*	...	...	...	...	...	...	...	...	...	...	...
1859	...	...	65.30	...	67.37*	...	...	...	...	...	...	...	...	...	...	...
1860	...	...	66.39	...	...	...	...	...	...	...	...	...	58.01*	...	...	...
1861	...	...	65.92	...	65.59*	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	66.57*	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	...	51.71*	...	...	...	...	...	...	...	...
1865	...	...	65.06	...	...	...	...	...	53.74*	...	...	...	...	...	53.41*	...
1866	...	...	64.37*	...	...	...	...	50.46*	...	...	...	...	...	...	...	...
1869	62.35*	...	65.24*	...	...	...	66.52	52.29	...	...	...	...	...	...	...	...
1868	62.86*	...	63.68	...	...	...	64.64	52.23	...	...	...	...	...	55.86	...	...
1869	63.06	63.67	63.52	...	...	...	64.53	51.88	...	56.59	...	...	...	55.56	...	...
1870	63.40	...	...	...	...	61.99*	...	53.60	...	...	...	...	...	55.26	...	...
	62.55	64.08	66.01	...	66.43	61.99	65.45	52.01	54.44	56.18	56.76	53.68	57.54	55.55	52.39	54.68

MISSOURI.—Continued.

Year.	Harrisonville.	Hematite.	Hermitage.	Hornersville.	Jefferson Barracks.	Jefferson City.	Kansas City.	Oregon.	Paris, near.	Rolla, near.	St. Joseph.	St. Louis.	Tower Grove.	Union.	Warrenton.	Wyaconda Prairie.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1827	...	...	...	...	58.86	...	...	...	...	...	...	...	...	...	...	...
1828	...	...	...	...	58.84	...	...	...	...	...	...	...	...	...	...	...
1829	...	...	...	...	55.12	...	...	...	...	...	...	...	...	...	...	...
1830	...	...	...	...	58.13	...	...	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	50.74*	...	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	55.66	...	...	...	...	...	...	...	...	...	...	...
1833	...	...	...	...	57.02	...	...	...	...	...	...	...	...	...	...	...
1834	...	...	...	...	55.81	...	...	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	52.89	...	...	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	53.19	...	...	...	...
1837	...	...	...	...	53.67*	...	...	...	...	...	...	54.58	...	...	...	...
1838	...	...	...	...	52.09*	...	...	...	...	...	...	53.29	...	...	...	...
1839	...	...	...	...	54.07	...	...	...	...	...	...	55.26	...	...	...	...
1840	...	...	...	...	53.31*	...	...	...	...	...	...	55.56	...	...	...	...
1841	...	...	...	...	54.37	...	...	..	...	...	...	55.48	...	...	...	...
1842	...	...	...	...	56.54	...	...	...	...	...	...	56.06	...	...	...	...
1843	...	...	...	...	52.33	...	...	...	...	...	...	53.56	...	...	...	...
1844	...	...	...	...	55.24	...	...	...	...	...	...	56.59	...	...	...	...
1845	...	...	...	...	57.30	...	...	...	...	...	...	56.33	...	...	...	...
1846	...	...	...	...	56.86	...	...	...	...	...	...	56.64	...	...	...	...
1847	...	...	...	...	...	...	...	...	...	...	...	53.79	...	...	...	...
1848	...	...	...	...	54.69	...	...	...	...	...	...	54.15	...	...	...	...
1849	...	...	...	...	54.47	...	...	...	...	...	...	53.73	...	...	...	...
1850	...	...	...	...	55.58	...	...	...	...	...	...	54.99	...	...	...	...
1851	...	...	...	...	56.11	...	...	...	...	...	...	55.15	...	...	...	...
1852	...	...	...	...	55.51	...	...	...	...	...	...	54.66	...	...	...	...
1853	...	...	...	...	56.57	...	...	...	...	...	...	54.91	...	...	...	...
1854	...	...	...	...	58.61	...	...	...	...	...	...	57.31	...	...	...	...
1855	...	...	...	...	55.63*	...	...	...	...	...	...	54.07	...	...	...	...
1856	...	...	...	...	...	...	...	...	...	...	...	52.40	...	...	...	...
1857	...	...	...	...	53.70	...	...	...	...	...	...	53.00	...	...	...	...
1858	...	...	...	...	56.07	...	...	...	...	...	...	56.28	...	...	...	...
1859	...	...	...	...	55.83	...	...	...	...	...	...	54.37	...	...	...	...
1860	...	...	...	62.21*	56.17	...	...	...	...	...	...	56.52	..	...	54.76	...
1861	...	...	...	...	56.41	...	...	...	51.85*	...	...	56.56	54.19	...	54.49	...
1862	...	...	...	...	...	...	...	...	...	...	...	55.61	53.19	...	52.98	50.50*
1863	...	...	...	...	...	...	...	...	...	...	...	54.45	...	...	...	50.38*
1864	53.20*	...	...	...	...	...	...	...	...	...	...	54.77	...	...	...	49.56
1865	53.08	...	...	...	...	...	...	...	...	...	...	56.36	...	...	...	51.38
1866	52.49	...	...	...	...	...	...	...	...	...	...	55.21	...	53.45*	...	...
1867	51.65	...	...	...	...	...	...	51.42	...	...	...	55.27	...	...	...	...
1868	50.80*	55.11*	52.79*	...	...	53.45*	...	49.96*	...	52.91	...	54.32	...	...	...	50.36*
1869	51.25	54.61	50.82	...	...	52.76*	...	50.25	...	52.67	53.47*	54.06	...	...	...	...
1870	53.80*	56.42	...	...	...	55.84*	54.82*	53.01	...	55.39	...	55.88	...	...	...	...
	52.36	55.38	52.53	62.01	55.38	54.02	54.82	51.16	52.40	53.81	53.24	55.00	53.49	53.05	53.85	50.40

Year.	MONTANA.							NEBRASKA.								
	Camp Cooke.	Deer Lodge City.	Fort Benton.	Fort C. F. Smith.	Fort Ellis.	Fort Shaw.	Helena City.	Bellevue.	De Soto.	Fontanelle.	Fort Calhoun.	Fort Kearney.	Fort McPherson.	Glendale, near.	Nebraska City.	Omaha.
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1820	...	...	...	...	...	...	...	...	...	...	48.19	...	...	...	...	...
1821	...	...	...	...	...	...	...	...	...	...	47.12	...	...	...	...	...
1822	...	...	...	...	...	...	...	...	...	...	50.25	...	...	...	...	...
1823	...	...	...	...	...	...	...	...	...	...	51.28	...	...	...	...	...
1824	...	...	...	...	...	...	...	...	...	...	48.25	...	...	...	...	...
1825	...	...	...	...	...	...	...	...	...	...	52.20	...	...	...	...	...
1826	...	...	...	...	...	...	...	...	...	...	51.40	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	...	...	45.30	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	...	46.53	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	...	48.97	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	46.48	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	48.40	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...	...	50.57	...	...	...	...
1855	...	...	...	...	...	...	...	...	...	...	...	48.70*	...	...	...	...
1856	...	...	...	...	...	...	...	...	...	...	...	45.83	...	...	...	...
1857	...	...	...	...	...	...	...	...	...	...	...	45.25	...	...	...	...
1858	...	...	...	...	...	...	...	48.73	...	...	...	48.10	...	...	...	...
1859	...	...	...	...	...	...	...	48.50	...	...	...	49.19	...	...	...	47.31
1860	...	...	...	...	...	...	...	51.78	...	...	...	51.30	...	...	...	...
1861	...	...	...	...	...	...	...	50.50*	...	48.17*	...	50.17	...	...	...	...
1862	...	...	...	...	...	...	...	48.91	...	...	...	49.09*	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	...	48.41	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	50.14	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	43.42	49.17	...	...	...	43.66*	...	46.76*	...	...
1867	41.99	...	...	47.56	...	...	...	...	45.66*	...	...	44.28*	...	45.83	...	...
1868	45.48	...	...	...	...	45.06	...	49.70*	46.65	...	...	...	51.60	46.90	...	...
1869	46.67	41.84	...	...	45.35	46.26	...	49.23	46.01	...	...	...	51.11	46.72*	50.00*	47.56*
1870	...	41.15	47.24	...	44.27	45.83	...	51.57	48.66*	...	...	...	52.76	...	51.39	51.24
	44.85	41.49	47.02	48.39	44.80	46.06	43.04	49.53	46.74	46.24	49.82	47.12	51.86	46.60	50.81	48.87

	NEB.—Cont'd.		NEVADA.						NEW HAMPSHIRE.							
Year.	Omaha Agency.	Richland.	Camp Halleck.	Camp McDermit.	Camp McGarry.	Camp Winfield Scott.	Fort Churchill.	Fort Ruby.	Claremont.	Concord.	Dover.	Dunbarton.	Exeter.	Farmouth.	Fort Constitution.	Francestown.
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1822	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47.49	...
1825	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47.77	...
1826	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48.07	...
1827	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.81	...
1828	...	...	...	...	...	...	...	...	...	47.52	...	...	...	...	49.11	...
1829	...	...	...	...	...	...	...	...	...	44.42	...	...	...	...	45.59	...
1830	...	...	...	...	...	...	...	...	...	46.42	...	...	...	...	46.98	...
1831	...	...	...	...	...	...	...	...	...	45.72	...	...	...	...	46.32	...
1832	...	...	...	...	...	...	...	...	...	44.02	...	...	...	...	44.84	...
1833	...	...	...	...	...	...	...	...	...	44.12	44.87	...	...	...	45.31	...
1834	...	...	...	...	...	...	...	...	...	45.82	45.86	...	...	...	45.39	...
1835	...	...	...	...	...	...	...	...	...	43.12	43.66	...	...	...	44.23	...
1836	...	...	...	...	...	...	...	...	...	42.72	43.39	...	...	...	42.45	...
1837	...	...	...	...	...	...	...	...	...	42.92	43.88	...	...	...	42.78	...
1838	...	...	...	...	...	...	...	...	...	...	45.90	...	...	...	44.17	...
1839	...	...	...	...	...	...	...	...	...	...	47.43	...	...	...	45.12	...
1840	...	...	...	...	...	...	...	...	...	...	47.36	...	...	...	45.62*	...
1841	...	...	...	...	...	...	...	...	...	...	47.38	...	...	...	...	...
1842	...	...	...	...	...	...	...	...	...	...	47.58	...	...	...	45.70	...
1843	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.25	...
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.31	...
1845	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	46.20*	...	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	45.80	...	...	...	...	45.62	...
1851	...	...	...	...	...	...	...	...	...	45.60	...	...	...	...	44.97	...
1852	...	...	...	...	...	...	...	...	...	45.70	...	...	...	...	45.06	...
1853	...	...	...	...	...	...	...	...	...	47.03	...	...	...	...	45.46*	...
1854	...	...	...	...	...	...	...	...	...	45.24	46.03	...	43.69	...	...	...
1855	...	...	...	...	...	...	...	...	...	45.28	...	...	43.57	...	...	...
1856	...	...	...	...	...	...	...	...	...	44.49*	...	...	...	...	...	...
1857	...	...	...	...	...	...	...	...	...	45.49*	...	...	...	...	...	44.05
1858	...	...	...	...	...	...	...	...	...	45.33*	...	...	...	...	...	...
1859	...	47.24	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1860	...	49.15*	...	...	...	...	...	...	45.23	...	...	...	...	...	...	...
1861	...	47.56	...	...	...	...	54.53	...	44.93	...	...	...	46.17*	...	...	...
1862	...	46.78	...	...	...	...	51.48	...	44.56	...	...	...	46.47	...	...	...
1863	...	...	...	...	...	...	54.27*	51.71*	45.37	...	...	...	...	...	...	...
1864	...	47.54	...	...	...	...	55.37*	52.10	46.13	...	...	...	47.16	...	...	...
1865	...	48.26	...	...	...	...	54.07*	51.79	44.94	...	...	...	...	...	...	...
1866	...	47.50	...	...	45.18*	...	...	...	44.45	...	...	...	...	...	...	...
1867	...	45.54	...	48.11	42.80	50.88	54.62*	47.42*	43.63	...	...	...	...	...	...	...
1868	48.94*	47.07	44.40	46.81*	40.26*	46.80	50.34*	45.67*	43.70*	...	...	46.99*	...	...	...	...
1869	48.77	47.01	48.74	49.87	...	52.03*	...	...	...	...	...	45.30	...	...	...	...
1870	50.92	...	47.29*	48.93	...	...	...	...	...	...	...	48.31	...	45.12	...	...
	49.77	47.26	46.80	48.59	42.59	50.28	53.72	49.31	44.74	45.24	45.60	46.87	45.08	45.03	45.68	44.49

	NEW HAMPSHIRE.—Continued.											NEW JERSEY.				
Year.	Hanover.	Littleton.	Londonderry.	London Ridge.	Manchester.	North Barnstead.	Portsmouth.	Shelburne.	Stratford.	West Enfield.	Whitefield.	Bloomfield.	Burlington.	Chester.	Dover.	Elwood.
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1806	...	...	...	...	...	...	46.87*	...	...	...	...	...	...	...	...	...
1835	40.97	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	39.97	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1837	40.15*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1839	...	...	...	...	...	...	46.09	...	...	...	...	...	...	...	...	...
1840	...	...	...	...	...	...	45.99	...	...	...	...	...	...	...	...	...
1841	...	...	...	...	...	...	45.07	...	...	...	...	...	...	...	...	...
1845	...	...	...	...	47.16	...	...	...	...	...	...	...	...	...	...	...
1846	...	...	...	...	48.17	...	...	...	...	...	...	...	...	...	...	...
1847	...	...	...	...	46.98	...	...	...	...	...	...	...	...	...	...	...
1848	...	...	...	...	47.50	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	46.96	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	...	47.17	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	47.58	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	47.67	...	...	...	...	...	...	...	...	...	...	...
1853	43.70	...	...	...	47.53	...	...	...	...	...	...	...	...	...	...	...
1854	41.88	...	45.71*	...	46.58	...	...	...	...	...	...	51.29	52.64	...	...	...
1855	...	...	45.79*	...	46.16*	...	...	...	...	...	...	50.17	52.11	...	...	...
1856	...	...	...	...	45.21*	...	...	...	39.57*	...	...	48.34	50.42	...	...	...
1857	...	...	...	...	45.89	...	...	44.72*	...	42.44*	...	49.66	50.33	...	...	...
1858	...	...	...	...	...	...	...	42.91	39.15*	41.45	...	50.80*	...	...	...	...
1859	...	...	...	...	...	...	...	...	39.70	...	...	...	...	...	...	...
1860	...	...	...	...	46.94*	45.86*	...	...	40.75	...	...	...	...	...	...	...
1861	...	...	...	...	...	46.11	...	...	39.28	...	...	...	...	...	...	...
1862	...	...	...	51.28*	...	45.29	...	...	39.14	...	...	50.04	...	...	...	...
1863	...	42.53*	...	...	...	46.36*	...	...	40.05*	...	...	...	...	...	...	...
1864	...	...	...	...	...	46.29*	...	42.12*	40.89	...	...	...	50.50*	51.30	...	...
1865	...	...	...	...	...	47.47	...	42.95*	40.41	...	...	...	51.47	52.03	...	...
1866	...	...	...	...	...	46.11*	...	...	39.45	...	...	...	51.47	51.48	...	...
1867	...	...	...	...	...	44.65	45.65*	...	38.61	...	...	...	51.60	50.36*	49.02	...
1868	...	...	...	...	...	...	...	...	38.94	...	...	...	...	49.03*	47.69	49.91*
1869	...	...	...	...	...	...	...	...	39.89	...	...	...	...	50.81	...	...
1870	...	...	...	...	...	...	...	...	42.69	...	43.38	...	...	52.88	...	...
	42.79	43.06	46.47	51.67	47.59	45.81	45.86	42.01	39.92	42.22	42.39	50.46	51.94	51.49	49.19	50.01

NEW JERSEY.—Continued. / **N. M.**

Year.	Freehold.	Greenwich.	Haddonfield.	Lambertsville.	Mt. Holly.	Newark.	New Brunswick.	Newfield.	New Germantown.	Paterson.	Rio Grande.	Seaville.	Sergeantsville.	Trenton.	Vineland.	Albuquerque. (N. M.)
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1840	...	...	...	...	...	...	...	...	...	...	...	...	...	49.63	...	...
1841	...	...	...	...	...	...	...	...	...	...	...	...	...	51.08*	...	...
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	52.50	...	...
1843	...	...	...	49.10	...	...	...	...	...	...	...	...	...	51.67	...	...
1844	...	...	...	49.45	...	50.34	...	...	...	...	...	...	...	52.92	...	...
1845	...	...	...	50.13	...	51.00	...	...	...	...	...	...	...	53.66	...	...
1846	...	...	...	50.18	...	51.46	...	...	...	...	...	...	...	...	...	...
1847	...	...	...	51.45	...	50.23	...	...	...	...	...	...	...	...	...	...
1848	...	...	...	52.73	...	50.80	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	51.08	...	50.52	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	51.52	...	52.52	...	...	...	...	...	...	...	...	...	53.81
1851	...	...	...	51.27	...	51.39	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	50.85	...	50.20	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	52.43	...	52.38	...	...	...	...	...	...	...	...	...	58.41*
1854	...	...	...	52.36	...	50.76	...	...	...	...	...	...	...	...	...	57.29
1855	...	...	...	50.82	...	50.31	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	48.85	...	47.75	...	...	...	...	...	...	...	...	...	56.28
1857	49.96*	...	...	49.75	...	48.02	...	...	...	...	...	...	52.19*	...	...	56.15
1858	51.12*	...	...	51.14	...	50.14	...	...	...	...	...	...	...	...	...	53.39
1859	50.88	...	...	50.82	...	49.74	...	...	...	...	...	...	...	...	...	51.84
1860	52.01*	...	...	...	...	49.63	...	...	...	...	...	...	...	...	...	55.54
1861	51.81	...	...	...	53.58	50.42	...	...	...	...	...	...	...	...	...	54.59*
1862	...	...	...	...	52.22	49.81	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	52.00*	49.93	50.10*	...	...	...	...	...	...	...	...	55.67
1864	...	53.08	52.21	...	52.41	50.75	...	...	...	...	...	...	...	...	...	54.47
1865	...	53.48	52.60	...	52.86	50.99	51.39*	...	...	52.01	...	...	...	...	...	56.91*
1866	...	52.83	51.99	...	52.12	50.28	50.38	...	...	49.75	...	...	...	52.71*	...	...
1867	...	52.38	50.75	...	51.27	49.36	49.42	...	...	49.39	...	51.94*	...	52.50	...	...
1868	...	51.42	50.11*	...	...	48.26	48.17	50.90	...	48.01	...	...	...	50.80	50.98	...
1869	...	52.73	51.14*	...	...	50.04	...	51.85	49.32	49.64	51.96*	...	...	54.77	52.83	...
1870	...	54.76	52.86	...	...	52.30	...	...	51.41	52.43	53.92	...	...	57.28	54.19	...
	50.97	52.95	51.67	50.81	52.22	50.41	50.22	52.64	50.27	50.22	52.91	52.21	52.71	52.76	52.67	55.52

NEW MEXICO.—Continued.

Year.	Cantonment Burgwin.	Cebolleta.	Fort Bascom.	Fort Bayard.	Fort Conrad.	Fort Craig.	Fort Cummings.	Fort Fillmore.	Fort McRae.	Fort Selden.	Fort Stanton.	Fort Sumner.	Fort Thorn.	Fort Union.	Fort Webster.	Fort Wingate.
1850	...	54.02	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	54.27*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	57.94	...	...	60.14	...	...	...	...	...	48.47	52.17*	...
1853	...	...	...	...	58.78	...	...	64.83	...	...	...	...	...	49.16	56.97	...
1854	...	...	...	...	...	60.20*	...	65.78	...	...	...	...	58.48	49.18	...	...
1855	46.54	...	...	...	...	61.21	...	65.28*	...	...	...	...	60.95	48.02	...	...
1856	43.60	...	...	...	...	60.98	...	64.71	...	...	52.53	...	57.67	46.56	...	...
1857	45.70	...	...	...	...	59.80	...	64.59	...	...	48.92	...	57.48*	48.27	...	...
1858	43.11	...	...	...	...	58.04	...	62.26	...	...	46.98	...	57.01	48.39	...	...
1859	45.23	...	...	...	...	58.28	...	61.41	...	...	52.38	...	...	48.07	...	...
1860	...	...	...	...	...	59.73*	...	62.89	...	...	53.50	...	...	49.78	...	...
1861	...	...	...	...	...	60.38	...	...	...	...	...	...	...	52.23	...	...
1862	...	...	...	...	...	61.46*	...	...	...	...	...	...	...	51.15	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	51.35*	...	50.32
1864	...	...	59.09*	...	...	...	...	...	...	...	...	57.82*	...	...	...	52.33*
1865	...	...	61.46	...	...	60.11*	...	...	...	...	...	57.14	...	...	...	51.55
1866	...	...	...	...	...	61.65*	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	55.47*	...	...	...	...	...	65.63	54.01*	60.24	...	55.39	...	53.72
1868	...	...	...	53.95	...	58.72	...	...	...	63.09	52.08	58.50	...	52.35*	...	50.49*
1869	...	...	57.19*	51.14	...	58.19	63.45*	...	59.65	62.96	51.56	...	...	50.56	...	51.73
1870	...	...	55.80*	54.26	...	57.98	64.82*	...	59.53*	60.66	52.74	...	...	52.42	...	50.72
	44.88	54.35	58.63	53.71	58.24	59.96	64.14	63.48	59.82	63.07	51.77	58.39	58.34	50.22	54.58	51.83

NEW MEXICO.—Cont'd.					NEW YORK.											
Year.	Las Vegas.	Los Pinos.	Santa Fé.	Socorro.	Albany.	Amenia.	Angelica.	Auburn.	Baldwinsville.	Beaver Brook.	Belleville.	Bellport.	Beverly.	Blackwell's Island.	Blooming-dale.	Bridgewater.
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1795	...	...	...	...	49.55	...	...	...	...	...	...	...	...	...	...	...
1796	...	...	...	...	46.61*	...	...	...	...	...	...	...	...	...	...	...
1813	...	...	...	...	47.92	...	...	...	...	...	...	...	...	...	...	...
1814	...	...	...	...	49.41	...	...	...	...	...	...	...	...	...	...	...
1820	...	...	...	...	48.57	...	...	...	...	...	...	...	...	...	...	...
1821	...	...	...	...	47.68	...	...	...	...	...	...	...	...	...	...	...
1822	...	...	...	...	48.77	...	...	...	...	...	...	...	...	...	...	...
1823	...	...	...	...	46.90	...	...	...	...	...	...	...	...	...	...	...
1824	...	...	...	...	47.47	...	...	...	...	...	...	...	...	...	...	...
1825	...	...	...	...	50.05	...	...	...	...	...	...	...	...	...	...	...
1826	...	...	...	...	50.59	...	...	...	...	...	...	...	...	...	...	...
1827	...	...	...	...	48.14	...	...	47.76	...	...	...	...	...	...	...	...
1828	...	...	...	...	50.88	...	...	48.48	...	...	...	...	...	...	...	...
1829	...	...	...	...	47.72	...	...	45.88	...	...	...	...	...	...	...	...
1830	...	...	...	...	50.17	...	...	46.89	...	...	44.63	...	...	...	...	...
1831	...	...	...	...	48.67	...	...	...	...	...	45.67	...	...	...	...	...
1832	...	...	...	...	47.62	...	...	46.44	...	...	...	...	...	...	...	...
1833	...	...	...	...	47.14	...	...	47.32	...	...	45.00	...	...	...	...	43.37
1834	...	...	...	...	48.05	...	...	48.45	...	...	46.04	...	...	...	...	42.31
1835	...	...	...	...	45.69	...	...	46.06	...	...	44.64	...	...	...	...	40.66
1836	...	...	...	...	44.25	...	...	44.27	...	...	42.63	...	...	...	...	...
1837	...	...	...	...	45.31	...	...	43.92	...	...	...	...	...	...	...	42.39
1838	...	...	...	...	46.67	...	...	44.63	...	...	...	...	...	...	...	...
1839	...	...	...	...	47.72	...	...	46.77	...	...	...	...	...	...	...	...
1840	...	...	...	...	48.22	...	...	47.07	...	...	...	...	...	...	...	...
1841	...	...	...	...	47.70	...	...	45.92	...	...	...	...	...	...	...	...
1842	...	...	...	...	47.98	...	...	46.65	...	...	45.71	...	...	...	...	...
1843	...	...	...	...	46.40	...	...	45.04	...	...	49.50	...	...	...	...	...
1844	...	...	...	...	47.68	...	...	47.84	...	...	49.65	...	...	...	...	...
1845	...	...	...	...	49.10	...	...	44.65	...	...	...	...	...	...	...	...
1846	...	...	...	...	49.91	...	...	48.28	...	...	...	...	...	...	51.95	...
1847	...	...	...	...	48.65	...	...	44.36	...	...	...	...	...	...	...	...
1848	...	...	...	...	49.35	...	...	44.83	...	...	...	...	...	...	...	...
1849	...	...	51.67*	...	47.32	45.98	...	44.16	...	...	...	...	...	...	...	...
1850	49.00	...	...	57.61	48.02	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	47.65	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	48.06	...	...	...	...	...	...	...	...	...	...	...
1853	...	...	49.80	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	50.57	...	...	...	...	...	45.89	48.18*	...	...	49.50	...	...	...
1855	...	...	50.44	...	...	...	44.14	...	44.76	...	...	...	48.26	...	...	...
1856	...	...	49.12	...	...	...	42.47	...	43.31	...	...	...	46.77	49.66	...	...
1857	...	...	50.03	...	...	...	...	...	44.25	...	...	...	47.97*	50.40*	...	...
1858	...	...	48.65	...	...	...	...	...	...	...	...	48.83	...	...	...	...
1859	...	...	47.31	...	...	...	...	...	...	...	...	48.94	47.36	...	...	...
1860	...	...	50.28	...	...	...	...	48.01	45.74*	...	...	49.36	47.79*	...	...	...
1861	...	...	52.08	...	...	...	...	47.64	45.76	...	...	50.12	48.72*	...	...	...
1862	...	...	...	...	46.35	...	...	47.74	45.75	...	...	...	...	...	...	...
1863	...	57.67	50.66	...	46.65	...	...	48.34	44.62*	...	...	...	...	...	...	...
1864	...	...	49.51	...	47.99	...	...	50.09	45.79	...	...	...	48.98	...	...	...
1865	...	55.15*	48.98	...	49.27	...	...	49.72	45.47	...	...	...	49.95*	...	...	...
1866	...	...	...	...	48.41	...	...	...	44.07	...	...	...	48.19	...	...	...
1867	...	...	...	...	46.99	...	...	...	...	...	...	...	48.49	...	...	...
1868	...	...	48.97	...	45.76	...	...	...	...	...	...	...	47.20	...	...	...
1869	...	...	48.12	...	47.01	...	...	...	...	...	...	...	49.08	...	...	...
1870	...	...	52.44	...	50.06	...	...	...	...	...	...	...	50.77	...	...	...
	49.06	55.40	50.13	57.92	47.95	45.86	43 65	46.80	45.28	48.18	45.94	49.33	48.66	50.03	51.95	42.19

NEW YORK.—Continued.

Year.	Buffalo.	Cambridge.	Canajoharie.	Canandaigua.	Canton.	Cazenovia.	Charlotte.	Cherry Valley.	Clinton.	Clyde, near.	Cooperstown.	Dansville.	Delhi.	Depauville, near.	East Hampton.	Eden.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1827	...	44.62	...	...	...	...	...	43.53	...	...	...	...	...	...	48.83	...
1828	...	48.52	...	...	...	...	...	46.60	...	...	...	...	46.41	...	50.81	...
1829	...	45.41	...	45.74	...	...	...	43.85	...	...	...	...	...	...	47.71	...
1830	...	47.44	46.05	47.08	...	44.89	...	44.69	...	...	...	...	...	...	49.34	...
1831	46.30	46.31	...	45.80	...	43.00	...	44.40	..	...	...	...	...	...	48.30	...
1832	45.03	45.13	...	46.68	...	43.88	...	44.30	...	...	...	...	...	...	47.52	...
1833	...	44.57	46.00	46.82	...	43.96	...	44.07	...	...	...	...	...	...	48.61	...
1834	...	45.72	...	46.44	...	44.49	...	44.74	...	...	...	...	...	...	48.90	...
1835	..	43.09	43.83	43.95	...	42.55	...	42.96	...	...	...	...	...	...	46.12	...
1836	...	42.20	...	43.30	...	41.10	...	40.77	...	...	...	...	...	...	46.44	...
1837	...	42.21	...	42.44	...	41.68	...	...	...	...	...	...	45.97	...	45.72	...
1838	...	43.73	...	43.72	...	42.49	...	...	...	...	...	...	...	...	46.51	...
1839	...	44.04	...	...	...	43.55	...	...	...	...	...	...	...	...	48.77	...
1840	...	...	...	...	...	42.21	...	...	...	...	...	...	...	...	48.98	...
1841	44.38	45.38	...	...	...	42.79	...	42.49	...	...	...	...	...	...	49.17	...
1842	46.72	...	...	...	...	43.69	...	43.80	...	...	...	...	...	...	50.42	...
1843	45.28	..	...	...	...	41.91	...	41.88	...	...	...	...	...	...	48.32	...
1844	47.21	...	...	...	...	43.32	...	43.63	...	...	...	...	...	...	...	...
1845	...	...	...	...	...	43.32	...	45.19	...	...	...	...	...	...	...	...
1846	...	...	...	...	...	43.67	...	...	...	...	...	...	...	...	...	...
1847	...	...	...	...	...	42.94	...	...	...	...	...	...	...	...	...	...
1848	...	...	...	...	...	43.42	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	42.25	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	44.45	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	46.68*	...	...	...	44.33	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	44.21	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	...	...	...	...	...	43.23*	...	...	...	...	...	...	...
1857	...	...	...	...	...	41.55	...	...	45.55	...	...	...	...	...	...	45.52*
1858	47.81	...	...	...	...	...	...	...	47.18	...	...	...	...	...	...	...
1859	47.33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1860	47.16	...	...	...	...	...	46.79	...	...	...	...	...	...	...	...	...
1861	47.25	...	...	...	...	43.63	46.89	...	...	46.46	...	47.94*	...	...	...	...
1862	47.29	...	...	...	...	43.39	47.39	...	47.54	...	...	...	...	...	...	...
1863	47.19	...	...	...	...	...	47.99	...	48.50*	...	...	...	...	...	...	...
1864	46.63	...	...	...	...	...	48.39	...	49.50	...	...	...	...	...	...	...
1865	47.31	...	...	...	...	...	48.89	...	...	...	...	...	...	46.18*	...	...
1866	45.29	...	...	...	...	...	47.19	...	...	...	...	...	...	43.75	...	...
1867	46.04	...	...	...	...	44.37	47.89	...	...	...	...	...	...	43.90	...	...
1868	45.63	...	...	...	...	43.25	...	...	...	...	...	...	...	43.09	...	...
1869	45.76	...	...	...	...	44.04	...	...	...	...	...	...	...	43.10	...	...
1870	48.44	...	...	...	...	46.56	...	...	...	...	46.92	...	...	46.19	...	...
	46.55	44.88	45.29	45.20	44.06	43.40	47.52	43.82	46.82	46.30	46.61	48.20	45.50	44.37	48.37	45.73

NEW YORK.—Continued.

Year.	Elmira.	Fairfield.	Fishkill, L.	Flatbush.	Flushing.	Fort Ann.	Fort Columbus.	Fort Edward.	Fort Hamilton.	Fort Niagara.	Fort Ontario.	Fort Porter.	Fredonia.	Friendship.	Gaines.	Geneva.
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1822	...	...	...	...	...	...	53.79	...	...	...	...	...	...	...	...	...
1823	...	...	...	...	...	...	50.21	...	...	...	...	...	...	...	...	...
1824	...	...	...	...	...	...	51.66	...	...	...	...	...	...	...	...	...
1825	...	...	...	...	...	...	54.00	...	...	...	...	...	...	...	...	...
1826	...	...	...	53.48	...	...	52.07	...	...	...	...	...	...	...	...	...
1827	...	42.70	...	51.18	...	...	51.36	...	...	...	...	...	...	...	...	...
1828	...	46.53	...	53.20	...	...	53.61	...	...	...	...	...	...	...	...	...
1829	...	43.07*	...	50.02	...	...	52.13	...	...	49.04	...	...	47.37*	...	...	...
1830	...	46.00*	...	52.05	...		54.42	...	...	...	...	...	49.09	...	...	...
1831	...	44.38	...	50.80	...	...	51.24	...	.	49.37	...	...	47.35	...	...	...
1832	...	44.40	...	51.06	...	...	51.13	...	...	...	...	...	48.75	...	...	...
1833	...	45.25	...	51.35	...	...	51.13	...	...	...	...	...	...	...	...	...
1834	...	...	...	50.88	...	...	50.63	...	...	...	...	...	49.96	...	...	...
1835	...	42.51	...	49.01	...	...	49.18	...	...	...	...	...	46.73	...	...	...
1836	...	42.00	...	47.25	...	...	46.82	...	...	...	...	...	44.06	...	...	...
1837	...	40.43	...	48.91	...	...	48.74	...	...	...	...	...	45.54	...	...	...
1838	...	40.38	...	50.01	...	...	49.94	...	...	...	...	...	45.15	...	...	...
1839	...	43.81	...	50.85	...	...	50.79	...	...	...	...	...	46.27	...	46.02	...
1840	...	42.69	...	50.86	...	...	50.77	...	...	46.94	...	...	47.56	...	46.64	...
1841	...	42.26	...	50.63	...	...	51.32	...	...	...	...	...	47.92	...	46.28	...
1842	...	43.46	...	51.57	...	...	52.87	...	...	46.83	...	...	49.46	...	46.32	...
1843	...	41.44	...	50.67	...	...	51.50	...	51.33	45.57	44.45	...	48.69	...	...	...
1844	...	41.90	...	51.33	...	...	52.13	...	51.25	46.90	45.81	...	49.60	...	...	...
1845	...	42.92	...	52.61	...	...	53.36	...	52.93	48.24	45.85	...	50.74	...	...	...
1846	...	...	...	52.57	...	...	52.38	...	52.33	...	...	...	50.60	...	...	...
1847	...	42.53	...	53.83	...	...	52.42	...	51.70	...	...	...	48.67	...	...	...
1848	...	42.45	...	52.40	...	...	52.28	...	51.98	...	...	...	46.08	...	...	...
1849	...	42.31	...	50.78	...	...	50.32	...	50.60	...	46.38	...	...	...	...	...
1850	...	...	...	50.74*	...	...	51.11	...	52.14	47.75	46.24	...	...	...	...	...
1851	...	...	...	50.96	...	...	52.25	...	52.57	47.03	46.21	...	46.84	...	...	...
1852	45.73*	...	...	51.10	...	...	51.50	...	52.15	46.49	45.25	...	47.06	...	...	47.17*
1853	...	...	...	...	...	...	52.34	...	52.26	48.39	...	...	...	...	...	...
1854	...	...	52.03	..	...	...	50.82	...	51.85	47.37*	...	...	...	...	...	...
1855	...	...	...	...	...	...	50.26	...	51.64	...	44.40	...	...	...	...	...
1856	...	...	...	48.18	...	...	49.50	...	50.03	...	44.71*	...	...	...	...	44.83*
1857	...	...	...	48.68	...	...	49.89	...	48.75	...	...	...	...	...	...	...
1858	...	...	49.33	49.83	...	...	50.60	44.67	50.36	...	...	...	...	...	...	...
1859	...	...	...	49.50	...	...	51.63	...	49.80	...	...	...	...	...	...	...
1860	...	...	48.96	...	...	...	51.45	...	49.96	45.49	...	...	...	...	...	...
1861	...	...	49.35	50.71	...	...	52.18	...	50.89	46.09	...	...	...	...	...	...
1862	...	...	48.88	...	...	...	51.36*	...	50.37	46.59	...	...	...	...	...	...
1863	...	...	48.89*	...	...	...	51.82	...	51.37	46.09	...	...	...	...	...	...
1864	...	...	50.12	50.41	...	54.83*	52.57	...	50.84	46.49	...	...	...	...	...	47.59
1865	...	...	50.05	51.19	...	...	53.19	...	52.29	46.59	...	...	...	...	...	47.62
1866	...	...	49.16*	50.10*	...	...	...	...	...	45.99	...	...	...	...	...	46.21
1867	...	...	...	49.73*	...	...	50.99	...	51.17	45.79	...	46.20	...	43.67*	...	46.58
1868	...	...	...	47.92	...	...	49.52	...	49.75	...	...	45.55	...	...	...	...
1869	...	...	...	50.66	...	...	50.91	...	49.97	...	...	45.40	...	...	...	...
1870	...	...	...	52.69*	52.70	...	52.38*	...	...	...	48.63	48.25	...	...	...	...
	45.73	43.06	49.47	50.83	51.72	53.46	51.41	46.64	51.19	47.19	45.81	46.55	47.93	43.72	46.33	46.73

NEW YORK.—Continued.

Year.	Glasco.	Goshen.	Gouverneur.	Greenville.	Hamilton.	Hartwick.	Henrietta.	Hermitage.	Homer.	Houseville.	Hudson.	Ithaca.	Jamaica.	Jamestown.	Johnstown.	Kinderhook.
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1826	...	...	...	47.58	...	46.12	...	...	...	...	...	...	51.71	...	...	...
1827	...	...	...	...	41.22	44.92	...	...	...	...	48.71	49.52	50.47	...	...	...
1828	...	...	...	...	46.98	46.46	...	...	...	...	52.36	50.87*	51.57	...	47.41	...
1829	...	...	...	...	44.00	45.01	...	...	43.01*	...	48.57	49.53*	48.03	...	45.54	...
1830	...	...	...	...	45.39	46.20	...	...	...	...	49.60*	49.19	50.37	...	46.79*	47.76
1831	...	...	43.00	...	45.27	43.48	...	...	...	...	50.77	...	49.03	..	45.52	54.42
1832	...	...	43.18	...	...	45.41	...	...	45.11	...	48.77	...	48.72	...	45.42	46.00
1833	...	...	44.21	...	44.51	...	...	...	45.20	...	48.15	47.80	50.86	...	43.97*	46.07
1834	...	...	44.92	...	44.01	...	...	...	...	...	47.43	47.42*	49.62	...	44.95	46.60
1835	...	45.31	41.77	...	43.35	44.91	...	...	42.69	...	44.14	45.83	46.36	...	42.16	44.24
1836	...	...	...	...	39.97	...	...	...	41.56	...	...	43.80	46.04	...	41.83	43.33
1837	...	...	...	...	...	43.17	...	...	42.22	...	...	44.36	46.75	...	42.95	43.62
1838	...	46.52	40.14	...	...	...	...	...	42.82	...	...	44.48	47.84	...	44.11	44.60
1839	...	48.10	41.03	...	43.57	44.71	...	...	43.52	...	...	45.23	48.83	...	...	44.19
1840	...	49.03	44.06*	...	...	...	...	..	44.91	...	...	47.47	49.43	...	...	46.96
1841	...	46.40	43.87	...	...	...	...	...	44.07	...	49.17	...	49.70	...	45.90	46.29
1842	...	47.05	45.77	...	44.03	...	...	...	44.88	...	48.02	48.41	49.56	...	46.07	46.66
1843	...	...	45.61	...	43.88	...	...	...	44.54	...	45.21	46.89	47.59	...	41.92	45.32
1844	...	46.29	44.70	...	44.23	...	...	...	43.33	...	46.65	48.58	48.54	...	44.47	45.77
1845	...	47.81	43.39	...	45.25	50.58	...	...	45.09	...	47.52	48.70	49.23	...	43.84	48.54
1846	...	48.06	45.63*	...	45.88	51.58	...	...	45.70	...	47.61	49.94	49.14	...	...	48.45
1847	...	47.11	42.55*	...	44.99	47.94	...	...	44.18	...	46.42	49.02	49.01	...	...	...
1848	...	...	44.11	...	45.93	46.39	...	...	45.11	...	47.20	49.68	52.51	...	...	...
1849	...	46.20	...	...	45.62	44.83	...	...	44.15	...	46.49	...	49.64	...	...	...
1850	...	...	...	...	...	45.36	...	...	46.38	...	...	...	50.57	...	...	...
1851	...	...	...	...	...	...	...	...	42.30	...	...	48.07	...	...	...	...
1852	...	...	...	...	...	...	...	...	42.62	...	48 25	48.89	...	46.07	...	...
1854	...	...	44.55	...	...	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	45.30	...	...	...	...	...	...	...	...	...	...	...	...	...
1858	...	...	...	...	...	...	...	...	...	42.63*	...	...	...	...	...	...
1860	...	...	...	...	...	...	49.99*	...	...	...	...	...	...	...	...	...
1861	...	..	41.35	...	...	...	51.62	42.78	...	...	...	...	...	...	...	...
1862	...	...	40.74	...	...	...	...	43.27	...	...	...	...	...	...	...	...
1863	...	...	42.36*	...	...	...	...	43.03	...	...	...	...	...	...	...	...
1864	...	...	44.44	...	...	...	...	...	...	...	...	...	...	45.90	...	...
1865	...	...	43.46	...	...	...	...	...	...	...	...	...	...	46.94	...	...
1866	...	...	43.02*	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	41.98	...	...	...	...	...	...	42.29	...	...	...	...	...	...
1868	...	...	41.46	...	...	...	...	...	...	41.72	...	...	...	...	...	...
1869	...	...	42.28*	...	...	...	...	...	...	42.22	...	...	...	...	...	...
1870	48.66*	...	44.35	...	...	...	...	...	...	45.02*	...	...	...	...	...	...
	48.66	46.90	43.26	47.58	44.66	46.01	48.40	43.16	43.72	43.30	47.96	47.81	49.27	46.18	44.56	46.10

NEW YORK.—Continued.

Year.	Kingston.	La Fargeville.	Lansingburgh	Ledyard.	Lewiston.	Leyden.	Liberty.	Little Genesee.	Lockport.	Lodi.	Lowville.	Lyons.	McGrawville.	Madison Barracks.	Madrid.	Malone.
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1824	...	...	..	...	...	...	...	...	...	...	...	...	...	46.33	...	...
1825	...	...	...	...	...	...	...	...	...	...	...	...	...	48.37*	...	...
1826	...	...	49.20	...	...	...	...	...	...	...	...	...	...	48.51	...	...
1827	...	...	47.64	...	...	...	...	...	...	...	43.29	...	...	...	...	...
1828	...	...	50.27	...	...	...	...	...	...	...	46.47	...	...	...	...	...
1829	47.95	...	47.22	...	...	...	...	...	...	...	42.90	...	...	47.11	...	...
1830	50.99	...	49.16	48.99	...	...	...	...	...	...	44.12	...	...	49.01	...	...
1831	50.58	...	47.15	48.00	49.04	...	...	...	...	...	43.49	...	...	48.56	...	...
1832	50.02	...	46.88	47.62	48.81	...	...	...	...	...	43.67	...	...	...	...	...
1833	50.92	...	47.63	...	49.21	...	...	...	...	...	43.54	...	...	...	...	...
1834	49.62	...	48.16	47.60	50·22	...	...	...	...	...	45.55	...	...	...	...	...
1835	47.77	...	47.62	...	47.88	...	...	...	...	...	42.06	...	...	...	...	...
1836	45.46	...	47.34	...	43.06	...	...	...	...	...	...	...	...	...	...	...
1837	46.64	...	48.07	...	44.03	...	...	...	...	...	41.19	...	...	...	...	...
1838	48.09	...	...	47.57	...	...	...	...	...	...	...	...	...	...	...	...
1839	50.01	...	46.98	...	46.43	...	...	...	...	...	44.62	...	...	46.49*	...	42.74
1840	48.92	...	46.68	49.14	48.46	...	...	...	...	...	44.39	...	...	...	...	44.42
1841	47.83	...	46.43	50.03	48.37	...	...	...	...	...	43.23	...	...	...	...	...
1842	51.03	...	45.74	51.14	47.39	...	...	...	...	...	43.60	...	...	44.75	...	41.63
1843	...	...	44.75	48.03	46.29	...	...	...	...	...	41.38	...	...	43.50	...	...
1844	...	...	45.12	47.04	47.28	...	...	...	...	...	42.25	...	...	44.15	...	...
1845	49.84	...	48.06	48.45	47.19	...	...	...	...	...	39.24	...	...	44.45	...	...
1846	45.69	...	48.76	49.96	50.24	...	...	...	...	...	44.88	...	...	...	...	...
1847	48.77	...	...	...	48.01	...	...	...	...	...	43.30	...	...	...	...	...
1848	48.68	...	...	...	49.33	...	...	...	...	...	43.82	...	...	...	...	...
1849	50.26	...	...	...	48.05	...	...	...	47.11*	...	...	...	...	46.95*	...	...
1850	...	...	...	49.28	...	...	...	...	46.26*	...	...	...	...	45.81	...	...
1851	...	46.49	...	...	...	...	...	...	...	...	43.86	...	...	45.18	...	...
1852	...	...	...	...	...	...	43.09*	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	47.88	...	...	...	...	43.41*	...
1855	...	...	...	...	...	...	...	...	...	45.24	...	...	...	...	...	...
1856	...	...	...	...	...	...	...	...	...	43.82	...	...	...	...	...	...
1857	...	...	...	...	...	...	...	...	...	44.97*	41.25	...	43.04*	...	...	...
1858	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1859	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1860	...	...	...	...	...	...	...	...	...	...	...	46.49	...	...	...	...
1861	...	...	...	...	...	...	...	...	...	...	...	45.87	...	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	44.31*	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	44.76	...	...	...	...	...	...	...	...
1868	...	...	...	...	...	...	...	43.82	...	...	...	...	...	...	...	...
1869	...	...	...	...	...	40.52*	...	43.58	...	...	...	...	...	...	...	...
1870	...	...	...	...	...	...	...	45.68	...	...	...	...	...	46.51	...	...
	49.16	46.49	47.29	48.68	47.86	41.14	43.09	44.43	47.39	46.21	43.33	45.95	43.12	46.15	43.94	42.93

NEW YORK.—Continued.

Year.	Mexico.	Middlebury.	Milo.	Millville.	Minaville.	Mohawk.	Montgomery.	Moriches.	Morrisania.	Mt. Pleasant.	Newark Valley.	Newburg.	New York.	Nichols.	North Granville.	North Hammond.
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1826	...	47.23	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1827	...	45.75	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1828	...	49.51	...	...	...	...	51.70	...	...	...	...	51.52	...	...	...	...
1829	...	45.87	...	...	...	...	48.55	...	...	...	...	48.18	...	...	...	...
1830	...	47.34	...	...	...	...	51.55	...	...	...	...	49.77	...	...	...	...
1831	...	45.87	...	...	...	...	48.98	...	...	48.21	...	...	...	...	...	...
1832	...	47.35	...	...	...	...	48.88	...	...	48.85	...	50.23	...	...	...	...
1833	...	48.30	...	...	...	...	49.42	...	...	...	...	49.48	...	...	...	...
1834	...	48.60	...	...	...	...	47.68	...	...	49.57	...	49.72	...	...	...	...
1835	...	45.27	...	...	...	...	47.08	...	...	48.50	...	47.69	...	...	43.28	...
1836	...	...	...	...	...	...	43.77	...	...	...	...	45.25	...	...	45.40	...
1837	43.97	...	...	...	...	...	44.96	...	...	44.79	...	47.34	...	...	...	...
1838	43.65	...	...	...	...	...	47.41	...	...	49.92	...	48.34	...	...	43.82	...
1839	...	46.56	...	...	...	...	...	...	...	50.35	...	46.09	...	...	44.11	...
1840	43.55	45.18	...	44.33	...	...	47.90	...	...	50.40	...	47.01	...	...	45.70	...
1841	43.26	41.65	...	44.54	...	...	...	...	...	49.40	...	...	...	...	47.61	...
1842	46.38	44.29	...	45.46	...	...	48.38	...	...	48.98	...	49.64	...	...	45.78	...
1843	42.47	43.89	...	44.56	...	...	...	...	...	47.41	...	48.31	...	...	42.13	...
1844	42.83	46.69	...	46.21	...	...	...	...	...	49.00	...	48.71	51.13	...	43.11	...
1845	43.77	44.78	...	47.90	...	...	...	...	...	...	...	45.64	...	...	44.50	...
1846	43.25	48.32	...	45.81	...	...	...	...	...	...	...	51.60	50.09	...	46.22	...
1847	...	...	...	46.27	...	...	...	...	...	...	...	50.18	50.15	...	45.10	...
1848	43.84	47.37	...	...	...	...	...	...	...	...	...	51.48	50.51	...	46.02	...
1849	42.58	...	...	...	...	...	...	...	...	...	...	49.92	49.42	...	45.02	...
1850	...	...	...	...	...	...	...	...	...	...	...	...	52.10	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	...	49.84	...	...	...	...
1852	44.39	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...	...	...	51.87	...	...	...
1855	...	...	...	...	...	...	...	...	...	...	...	...	50.50	...	...	...
1856	44.68*	...	...	...	...	...	...	...	...	...	...	...	50.14	...	...	...
1857	...	...	...	...	...	...	...	...	50.46	...	...	...	51.67	43.85	...	...
1858	...	...	...	...	...	...	...	...	...	...	...	...	...	46.90	...	...
1859	...	...	...	...	...	...	...	...	...	...	...	...	...	47.22	...	...
1860	...	...	...	...	...	...	...	...	...	...	...	...	52.13*	46.64	...	...
1861	...	...	...	...	...	44.49	...	...	...	...	...	...	52.71	46.97	...	...
1862	...	...	...	...	...	44.73	...	...	...	...	...	...	51.99	46.59	...	...
1863	...	...	...	...	...	46.23	...	...	...	...	...	...	53.90	46.70	...	...
1864	...	...	...	...	...	...	...	52.39*	...	...	...	...	53.26	47.58	...	...
1865	...	...	...	...	...	...	...	53.90	...	...	...	50.86*	53.28	47.55	...	...
1866	...	...	...	...	...	...	...	53.00	...	...	...	49.59	51.47	46.29	...	...
1867	...	...	...	...	...	44.10	...	52.13	...	...	...	51.43	50.44	45.95	...	43.18
1868	...	...	...	...	42.05	43.17	...	50.89	...	...	42.39*	48.80*	49.29	45.20	...	45.35
1869	...	...	...	...	45.10	...	...	52.34	...	...	44.39*	50.33*	51.45	45.94	...	45.74
1870	...	...	46.52	...	48.05	...	...	50.40	...	...	47.34*	53.66*	54.79	47.84	...	49.54
	43.83	46.29	45.59	45.93	44.80	44.79	48.18	52.15	50.77	49.14	44.71	49.51	51.66	46.57	44.90	45.52

NEW YORK.—Continued.

Year.	North Salem.	North Volney.	Ogdensburg.	Oneida.	Onondaga.	Oswego.	Ovid.	Oxford.	Oyster Bay.	Palermo.	Palmyra.	Penn Yan.	Plattsburg.	Pompey.	Potsdam.	Poughkeepsie.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1826	...	...	...	...	50.23	...	...	...	...	...	...	...	...	44.16	...	...
1827	...	...	...	...	47.79	...	...	...	...	...	...	...	...	43.02	...	...
1828	...	...	...	...	50.42	...	...	44.17*	...	...	...	...	...	46.85	45.53	55.39*
1829	50.16	...	...	...	47.33	...	...	44.51	...	...	...	46.36	...	42.75	43.58	51.34
1830	49.48	...	...	...	...	...	...	46.07	...	...	...	47.29	...	44.20	44.20	52.25
1831	48.17	...	...	...	...	...	...	45.68	...	...	...	44.45	...	42.44	43.00	50.12
1832	48.49	...	...	...	48.07	...	...	44.51*	...	...	...	47.26	...	42.92	42.36	49.09
1833	47.60	...	...	...	47.33	...	...	43.74	...	...	...	46.85	...	43.14	40.09	49.45
1834	47.48	...	...	...	...	...	...	45.35	51.37	...	...	47.42	...	43.27*	41.98	49.94
1835	45.74	...	...	...	46.36	...	...	43.84	...	...	44.85	45.27	...	42.00	42.09	48.47
1836	...	...	...	...	44.68	...	...	42.32	...	...	...	44.36	...	39.70	40.30	46.84
1837	...	...	...	...	44.76	...	...	43.29	49.79	...	...	44.95	...	39.54	40.88	45.75*
1838	44.91	...	43.01	...	45.58	...	...	42.97	...	...	...	44.34	...	39.79	43.62	...
1839	...	...	...	...	46.48	...	...	45.31	...	...	...	44.99	45.33	41.93	44.92	...
1840	45.83	...	...	...	47.15	...	...	45.47	...	...	...	47.04	44.45	42.17	43.78	...
1841	47.01	...	...	...	46.41	...	...	44.76	...	...	...	45.40	43.10	41.65	42.75	49.34
1842	47.96	...	...	...	44.71	...	...	44.34	...	...	...	46.42	43.49	41.81	42.10	49.70
1843	46.42	...	...	...	43.52	...	...	42.36	...	...	...	44.21	45.89	41.24	42.79	48.54
1844	47.43	...	...	...	44.69	...	...	43.94	...	...	...	44.87	42.18	...	43.05	49.80
1845	48.51	...	...	...	...	...	...	44.19	...	...	...	44.79	43.08	...	44.04	49.66
1846	48.76	...	...	...	...	...	...	46.64	...	...	...	45.57	...	...	45.30	50.67
1847	47.91	...	...	...	...	...	...	46.96	...	...	...	44.32	45.90	...	43.67	49.42
1848	47.69	...	...	...	...	...	...	...	...	...	...	45.35	45.90	...	45.20	...
1849	46.92	...	...	...	...	...	...	...	...	...	...	44.36	44.39	...	...	49.20
1850	47.52	...	44.36*	...	...	...	...	...	...	...	...	44.43	43.91	42.91	...	...
1851	...	...	...	...	...	...	...	44.22	...	...	...	44.85	43.62	42.46	...	...
1852	47.59	...	43.50	...	...	...	...	44.54	...	...	...	44.59	44.11	42.73*	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	45.99	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	...	...	46.80	...	...	...	...
1855	...	...	...	...	...	45.49*	...	...	...	...	...	44.94	...	...	...	...
1856	45.83*	...	...	...	...	43.35	44.48	...	...	...	...	43.92	...	...	...	...
1857	...	...	...	...	...	45.15	45.43	...	...	...	...	44.59	...	...	...	...
1858	...	...	...	...	...	...	...	...	...	...	...	46.24	...	...	...	...
1859	...	...	...	...	...	46.01	...	...	...	...	...	45.38	...	...	...	...
1860	...	...	...	...	...	...	...	...	...	45.64	...	...	...	...	...	...
1861	...	...	...	...	...	45.63	...	...	...	45.26	...	...	...	...	...	...
1862	...	...	...	45.23	...	45.44*	...	...	...	45.89	...	...	...	...	...	...
1863	...	...	...	45.35	...	45.66	...	...	...	44.85	...	...	...	...	...	...
1864	...	...	...	47.28	...	46.18	...	...	...	44.66	...	...	...	...	...	...
1865	...	...	...	47.31	...	46.02	...	...	...	44.31	47.87*	...	...	...	...	...
1866	...	...	...	45.92*	...	44.73	...	...	...	42.80	...	...	...	...	...	...
1867	...	...	...	45.61*	...	45.08	...	...	...	43.28*	...	...	...	...	...	...
1868	...	...	...	45.42	...	44.02	...	...	...	42.47	...	...	...	...	...	...
1869	...	...	...	45.96	...	44.84	...	...	...	43.26	...	...	42.01	...	...	...
1870	...	47.90	...	48.75*	...	47.62	...	...	...	46.35	...	...	45.97	...	...	...
	47.51	46.45	43.96	46.31	46.59	46.35	45.47	44.64	50.58	44.43	47.33	45.41	44.14	42.37	43.12	49.69

NEW YORK.—Continued.

Year.	Prattsburg.	Red Hook.	Rochester.	Rouse's Point.	Sackett's Harbor.	Sag Harbor.	Salem.	Saratoga.	Schenectady.	Seneca Falls.	Skaneateles.	Smithville.	South Hartford.	South Trenton.	Spencertown.	Springville.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1828	...	...	...	...	...	...	48.15	...	...	...	...	...	...	...	...	...
1829	44.13	...	...	...	...	...	44.04	...	46.29	...	...	...	...	...	...	...
1830	45.90	48.62	48.82	...	...	...	45.54	...	...	...	...	...	...	...	...	...
1831	...	48.83	48.45	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	...	47.38	50.22	...	...	...	...	...	...	...	...	...	...	...	...	...
1833	...	45.22	49.60	...	...	...	...	...	...	...	...	...	...	...	...	...
1834	...	48.20	50.16	...	...	...	...	...	...	...	...	...	...	...	...	48.42
1835	...	46.26	48.11	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	...	45.63	44.11	...	...	...	...	...	44.18	...	...	...	...	...	...	...
1837	...	45.93	45.76	...	...	...	...	...	45.57	...	...	...	...	...	...	...
1838	...	...	44.60	...	...	...	...	...	...	...	...	...	...	...	...	...
1839	43.64	48.28	47.17	...	...	...	...	...	...	...	...	...	...	...	...	45.76
1840	44.80	51.67	46.29	...	...	...	45.99	...	...	...	...	...	...	...	...	...
1841	44.01	48.87	45.37	...	...	...	45.59	...	...	...	...	...	...	...	...	...
1842	44.00	49.67	46.36	...	...	...	...	...	...	...	...	...	...	...	...	41.39
1843	43.62	...	44.80	...	...	...	44.69	...	...	...	...	...	...	...	...	41.93
1844	45.19	...	47.18	...	...	...	47.32	...	...	...	...	...	...	...	...	...
1845	46.47	...	46.99	43.34*	...	...	46.27	...	...	...	...	...	...	...	...	...
1846	46.01	...	48.40	45.34	...	...	46.42	...	...	...	...	...	...	...	...	...
1847	...	...	46.07	43.48	...	...	45.94	...	...	...	...	...	...	...	...	45.06
1848	...	...	47.94	44.68	...	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	46.32	42.94	...	...	...	...	...	...	...	...	...	...	...	45.10
1850	...	...	47.08	43.55	...	...	...	...	...	...	...	...	...	...	...	46.24
1851	...	...	47.05	42.54	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	46.99	42.80	...	...	...	...	...	46.99	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	50.79	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	51.30*	...	...	...	...	...	43.90	...	...	45.01	...
1856	...	...	45.72	...	...	49.18*	...	...	...	...	...	...	...	...	42.77	...
1857	...	...	46.75	...	...	49.98	...	45.46	...	...	...	...	...	...	44.78	...
1858	...	...	48.04	...	...	51.17	...	...	...	...	...	...	...	...	...	...
1859	...	...	47.94	...	...	...	...	...	...	...	...	...	...	...	...	...
1860	...	...	46.72	...	45.59	...	...	...	...	...	...	...	...	...	...	...
1861	...	...	46.99	...	44.59	...	...	...	...	...	45.80	...	...	...	...	...
1862	...	...	46.55	...	45.39	...	...	...	...	...	45.64*	...	...	...	...	...
1863	...	...	46.58	...	46.69	...	...	...	...	...	46.29*	...	...	...	...	...
1864	...	...	47.41	...	47.99	...	...	...	47.60	...	44.87	...	49.37	...	...	...
1865	...	...	47.79	...	47.99	...	...	...	...	...	45.21*	...	48.88	44.75*	...	...
1866	...	...	46.12	...	46.49*	...	...	...	...	...	44.52*	...	48.21	43.43	...	...
1867	...	...	45.44	...	44.69	...	...	...	...	...	...	...	47.29	43.31	...	...
1868	...	...	45.41	...	...	...	...	...	...	...	...	...	46.19*	41.11*	...	...
1869	...	...	46.06	...	...	...	...	...	...	...	...	...	47.46*	41.98	...	...
1870	...	...	48.54*	...	...	...	...	...	...	...	...	...	50.66	45.63	...	...
	44.67	47.89	47.06	43.64	46.04	50.62	46.08	45.92	45.90	46.73	45.39	44.41	48.31	43.37	44.84	44.79

	NEW YORK.—Continued.															N. C.
Year.	Syracuse.	Theresa.	Throgg's Neck.	Troy.	Utica.	Wampsville.	Waterbury.	Waterford.	Watertown.	Watervliet Arsenal.	Wellsville.	West Point.	White Plains.	Whitestone.	Wilson.	Ashville.
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1824	...	...	...	...	...	...	...	...	...	49.51	...	52.75	...	...	...	...
1825	...	...	...	...	...	...	...	...	...	50.48	...	...	...	...	...	...
1826	...	...	...	...	48.10	...	...	...	...	50.32	...	52.53	...	...	...	...
1827	...	...	...	...	46.64	...	...	...	...	47.85	...	51.28	...	...	...	...
1828	...	...	...	...	49.92	...	...	...	...	51.28	...	54.55	...	...	...	...
1829	...	...	...	...	44.03	...	...	...	...	47.81	...	50.25	...	...	...	...
1830	...	...	...	...	45.97	...	...	...	...	48.34	...	52.25	...	...	...	...
1831	...	...	...	...	44.77	...	...	...	...	47.83	...	51.42	...	...	...	...
1832	...	...	...	...	43.52	...	...	...	...	46.83	...	50.86	...	...	...	...
1833	...	...	...	...	43.81	...	...	...	...	46.27*	...	51.24	...	...	...	...
1834	...	...	...	...	44.43	...	...	...	...	48.60	...	51.13	...	44.69	...	...
1835	...	...	...	...	42.12	...	...	...	...	45.61	...	49.39	...	43.28	...	...
1836	...	...	...	...	40.42	...	...	...	...	43.91	...	47.41	...	43.83	...	...
1837	...	...	...	...	43.43	...	...	...	...	45.14	...	47.84	...	42.45	...	...
1838	...	...	...	...	45.37	...	...	...	...	46.35	...	50.41	...	43.88	...	...
1839	...	...	...	...	45.45	...	...	...	...	47.37	...	50.99	...	43.99	...	...
1840	...	...	...	...	46.63	...	...	...	...	47.82	...	51.01	...	48.35	...	...
1841	...	...	...	...	46.14	...	...	...	...	48.17	...	50.18	...	...	...	...
1842	...	...	...	...	46.40	...	...	...	...	48.67	...	52.99	...	...	...	...
1843	46.83	...	...	...	44.88	...	...	...	...	47.15	...	49.05	...	...	...	...
1844	...	...	...	...	46.43	...	...	...	...	47.36	...	48.86	...	...	...	...
1845	...	...	...	...	46.82	...	...	...	...	48.03	...	50.23	...	...	...	...
1846	...	...	...	...	47.73	...	...	...	...	47.21	...	50.69	...	...	...	...
1847	...	...	...	...	45.70	...	...	...	...	48.13	...	50.13	...	...	...	...
1848	...	...	...	...	45.05	...	...	...	...	48.93	...	50.28	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	46.49	...	48.86	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	46.11	...	49.11	...	...	...	...
1851	...	...	...	...	46.20	...	...	...	...	47.62	...	49.37	...	...	...	...
1852	47.49	...	...	...	46.27	...	...	...	...	49.39	...	48.87	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	48.36	...	50.50	...	...	...	...
1854	...	...	...	...	...	46.82	...	...	...	46.06	...	50.14	...	...	...	...
1855	...	...	...	...	...	46.35	...	...	...	...	...	50.18	...	...	...	...
1856	...	...	...	...	...	44.91	...	45.12*	43.60	...	...	50.15	...	...	...	...
1857	...	...	...	...	...	45.80	...	46.09	...	...	43.99*	50.92	...	...	...	...
1858	...	...	...	...	...	...	...	47.03	...	...	...	52.77	...	...	...	...
1859	...	...	...	...	...	44.95	...	47.36	...	...	...	53.20	...	...	...	...
1860	...	...	...	...	...	45.44*	...	...	...	...	...	52.59	...	...	...	...
1861	...	42.54*	...	47.35	...	44.77	...	47.61	...	...	...	52.17	...	...	47.01	...
1862	...	42.92	...	47.68	...	...	...	47.19	...	...	...	51.98	...	...	47.27	...
1863	...	42.69*	...	47.61*	...	...	...	...	...	...	...	51.57	...	...	46.93*	...
1864	...	44.71	51.39*	...	...	...	...	...	...	...	...	52.25	50.62*	...	47.39	...
1865	...	44.18	...	...	...	...	...	...	...	...	...	53.35	50.72*	...	...	...
1866	...	...	49.68	...	...	...	...	...	...	...	...	51.42*	48.23*	...	...	...
1867	...	...	50.09	47.32*	...	...	...	...	...	...	...	50.94	48.98*	...	...	...
1868	...	...	48.67	46.64	...	...	...	...	...	...	...	49.98	47.94	...	...	53.41
1869	...	...	50.07*	...	...	...	43.31	...	...	...	...	54.51	49.41	...	...	53.27
1870	...	...	52.83	...	49.04	...	45.54*	...	...	...	...	54.69	51.92	...	...	53.84
	47.28	43.37	50.50	47.93	45.54	45.60	44.43	46.77	43.60	47.73	45.04	51.06	49.46	44.18	47.13	53.83

NORTH CAROLINA.—Continued.

Year.	Attaway Hill.	Beaufort.	Bethmont.	Chapel Hill.	Davidson College.	Fort Johnson.	Fort Macon.	Gaston.	Goldsboro.	Kenansville.	Murfreesboro.	Oxford.	Raleigh.	Statesville, near.	Thornburg.	Warrenton.
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1822	...	...	...	...	...	67.46	...	...	...	...	...	...	...	...	...	...
1823	...	...	...	...	...	65.27	...	...	...	...	...	...	...	...	...	...
1824	...	...	...	...	...	66.55	...	...	...	...	...	...	...	...	...	...
1825	...	...	...	...	...	65.77	...	...	...	...	...	...	...	...	...	...
1826	...	...	...	...	...	67.66	...	...	...	...	...	...	...	...	...	...
1827	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1828	...	...	...	...	...	68.17	...	...	...	...	...	...	...	...	...	...
1829	...	...	...	...	...	64.37*	...	...	...	...	...	...	...	...	...	...
1830	...	...	...	...	...	65.76*	...	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	...	63.25	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	...	65.82	...	...	...	...	...	...	...	...	...	...
1833	...	...	...	...	...	64.48	...	...	...	...	...	...	...	...	...	...
1834	...	...	...	...	...	64.24	64.52	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	...	62.74	61.29	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1837	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1838	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1839	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1840	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1841	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1843	...	...	...	...	...	64.23	61.98	...	...	...	...	...	...	...	...	...
1844	...	...	...	...	...	64.41	61.79*	...	...	...	...	...	...	...	...	...
1845	...	...	...	61.45	...	...	...	...	...	...	...	...	...	...	...	...
1846	...	...	...	60.39	.	...	...	...	...	...	...	...	...	...	...	...
1847	...	...	...	58.82	...	...	...	...	...	...	...	...	...	...	...	...
1848	...	...	...	59.93	...	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	58.82	...	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	59.20	59.32	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	59.36	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	...	...	59.14	...	...	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	59.71	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	60.21	...	...	...	...	...	...	...	...	...	...	59.39*	...
1855	...	...	...	59.36	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	57.22	...	...	...	...	58.71*	...	...	...	...	...	...	...
1857	...	...	...	57.61	...	...	...	59.58	...	...	56.25	...	...	...	...	...
1858	...	...	...	58.89	58.68*	...	...	57.59	...	...	59.12	...	...	...	...	...
1859	...	...	...	59.41*	...	...	...	57.76	...	...	59.66	...	...	...	...	...
1860	...	...	...	...	...	...	...	56.89	60.81*	...	...	...	...	...	...	...
1861	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	61.79	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	57.69	...	...	...	...	...	...	...	61.12	...	...	58.04*	58.04	54.32*	...	...
1868	56.12	...	...	...	...	...	...	...	60.41	...	...	56.22	58.23	53.50	...	...
1869	56.41	...	...	63.16*	...	...	...	...	62.54*	62.85*	...	57.97*	...	53.79*	...	...
1870	57.58	...	...	...	...	...	...	...	63.44	...	...	56.85*	...	52.92*	...	56.61
	57.04	62.07	59.20	59.76	57.92	65.35	61.98	56.95	61.10	62.52	58.45	57.56	58.52	53.92	58.77	56.91

N. C.—Continued.		OHIO.									
Year.	Wilson.	Athens.	Austinburg.	Avon.	Bellefontaine.	Bethel.	Bowling Green.	Chilicothe.	Cincinnati.	Cincinnati.	Cleveland.
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...	...	...	...	...	...	...	...	...	...	...	...
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...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...
1806	...	...	...	...	...	...	...	...	54.1	...	...
1807	...	...	...	...	...	...	...	...	54.4	...	...
1808	...	...	...	...	...	...	...	...	56.4	...	...
1809	...	...	...	...	...	...	...	...	54.4	...	...
1810	...	...	...	...	...	...	...	...	52.8	...	...
1811	...	...	...	...	...	...	...	...	56.6	...	...
1812	...	...	...	...	...	...	...	...	52.6	...	...
1813	...	...	...	...	...	...	...	...	52.7	...	...
1819	...	...	...	...	...	...	...	58.34	56.8	...	...
1835	...	...	...	...	...	...	...	...	...	50.93	...
1836	...	...	...	...	...	...	...	...	...	51.17	...
1837	...	...	...	...	...	...	...	...	...	53.00	...
1838	...	...	...	...	...	...	...	...	...	51.80	...
1839	...	...	...	...	...	...	...	...	...	54.10	...
1840	...	...	...	...	...	...	...	...	...	53.41	46.12
1841	...	...	...	...	...	...	...	...	...	53.93	45.73
1842	...	...	...	...	...	...	...	...	...	53.52	46.27
1843	...	...	...	...	...	...	...	...	...	51.39	44.78
1844	...	...	...	...	...	...	...	...	...	54.43	47.01
1845	...	...	...	...	...	...	...	...	...	53.08	47.08
1846	...	...	...	...	...	...	...	...	...	54.93	48.98
1847	...	...	...	...	...	...	...	...	...	52.62	...
1848	...	...	...	...	...	...	...	...	...	54.00	...
1849	...	...	...	...	...	...	...	...	...	53.61	...
1850	...	...	...	...	...	...	...	...	...	54.12	...
1851	...	...	...	...	...	...	...	...	...	54.89	...
1852	...	51.64	...	...	...	...	...	...	...	54.25	...
1853	...	...	...	...	...	...	...	...	...	54.12	...
1854	...	...	...	...	...	...	...	...	...	56.15	...
1855	...	...	...	...	...	...	...	...	...	55.10*	...
1856	...	...	44.50*	...	...	...	...	...	...	52.78	45.87
1857	...	...	...	...	...	...	...	...	...	53.43	46.99
1858	...	...	51.85	...	51.51	...	50.71	...	...	57.17	49.57
1859	...	...	...	50.00	49.57	...	50.30	...	...	56.27	49.50*
1860	...	...	...	...	...	51.52*	...	...	...	56.12	49.10
1861	...	...	...	...	...	...	50.55	...	...	55.87	50.32
1862	...	...	...	...	...	...	50.60*	...	...	56.28	49.63
1863	...	...	46.75*	...	...	49.56*	50.60*	...	...	55.39*	49.88
1864	...	...	47.31	...	...	49.58	...	...	...	53.88	49.77
1865	...	...	47.68	...	...	51.43	...	...	...	56.40	50.38
1866	60.54*	...	...	...	...	48.48	49.83	...	...	54.75	48.65
1867	...	...	...	...	...	49.68	48.80	...	...	55.77	49.41
1868	...	...	...	...	...	49.57	48.95	...	...	54.33	47.10
1869	...	...	...	...	...	50.69	49.09	...	...	55.39	47.47
1870	...	...	...	...	...	52.44	52.43	...	...	55.82	48.89
	60.54	52.29	47.96	50.21	49.50	50.37	50.22	58.34	53.73[1]	54.29	48.14

OHIO.				
Year.	College Hill.	Columbus.	Croton.	Dayton.
	°	°	°	°
1814	52.0	...	...	...
1815	51.7	...	...	...
1816	51.0	...	...	...
1817	50.4	...	...	...
1818	50.4	...	...	...
1819	53.7	...	...	...
1820	52.1	...	...	...
1821	51.0	...	...	...
1822	52.2	...	...	...
1823	51.7	...	...	...
1824	52.5	...	...	...
1825	53.6	...	...	...
1826	53.1	...	...	...
1827	52.9	...	...	...
1828	54.0	...	...	...
1829	50.8	...	...	...
1830	53.5	...	...	...
1831	48.0	...	...	...
1832	51.8	...	...	...
1833	52.5	...	...	...
1834	52.6	...	...	...
1835	49.2	...	...	...
1836	49.0	...	...	...
1837	50.3	...	...	...
1838	49.5	...	...	...
1839	52.8	...	...	...
1840	52.3	...	...	...
1841	52.0	...	...	...
1842	52.7	...	...	...
1843	48.8	...	...	...
1844	53.0	...	...	...
1845	52.6	...	...	...
1846	54.0	...	...	...
1847	52.0	...	...	...
1848	52.6	...	...	...
1854	55.9*	...	...	...
1856	...	...	...	48.55*
1857	...	...	...	...
1858	...	...	...	...
1859	52.8*	...	...	...
1860	...	...	49.75*	...
1861	52.9*	...	51.74	...
1862	53.1*	...	50.67*	...
1863	52.4*	...	...	...
1864	52.1	53.42*	...	...
1865	53.5*	...	...	...
1866	51.1	...	...	...
1867	52.7	...	...	...
1868	50.8	...	...	...
1869	52.3	...	...	...
1870	54.6	...	...	...
	51.91	53.29	50.42	50.07

[1] Hours of observation unknown.

OHIO.—Continued.

Year.	East Fairfield.	Edinburg.	Freedom.	Gallipolis.	Germantown.	Gilmore.	Granville.	Hillsboro.	Hiram.	Hudson.	Jackson (Jackson Co.)	Jackson (Monroe Co.)	Jacksonburg.	Kelly's Isl'd.	Kenton.	Kingston.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1836	...	...	...	...	...	...	...	47.01	...	...	...	...	...	...	...	...
1837	...	...	...	...	...	...	49.51	48.21	...	...	...	...	...	...	...	...
1838	...	...	...	...	...	...	44.08	47.59	...	47.19*	...	...	...	...	...	...
1839	...	...	...	...	...	...	46.17	50.21	...	49.30	...	...	...	...	...	...
1840	...	...	...	...	...	...	43.87	51.87*	...	49.40	...	...	...	...	...	...
1841	...	...	...	...	...	...	43.54	50.06	...	48.80	...	...	...	...	...	...
1842	...	...	...	...	...	...	45.54	49.80	...	49.90	...	...	...	...	...	...
1843	...	...	...	...	...	...	42.33	48.67	...	47.89*	...	...	...	...	...	...
1844	...	...	...	...	...	...	45.41	52.10*	...	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	46.50	52.35*	...	...	...	...	...	...	...	...
1846	...	...	...	...	...	...	46.71	53.67	...	...	...	...	...	...	...	...
1847	...	...	...	...	...	...	47.09	50.43	...	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	45.09	51.45	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	44.66	49.84	...	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	44.33	51.51	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	45.17	50.94	...	...	54.05	...	...	...	...	...
1852	...	...	...	...	...	...	...	52.82	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	51.67	...	...	...	...	...	...	...	...
1854	...	...	...	56.86*	50.83	...	52.86*	53.32	...	...	54.56*	...	...	...	...	...
1855	...	...	...	55.19	50.39	...	50.82	50.69	...	...	53.64*	...	...	...	...	...
1856	...	...	...	...	47.60	...	47.50	49.68	45.51	...	...	...	...	...	...	...
1857	...	46.77*	...	50.88*	...	...	...	48.48	46.22	...	...	...	...	...	...	...
1858	...	49.18	...	...	...	...	...	51.78	49.16	...	...	52.40	...	...	...	...
1859	...	...	...	...	...	...	...	50.97	...	48.42	...	51.98	...	48.33*	...	...
1860	...	...	...	...	...	...	...	51.77	...	...	...	...	...	49.25	...	...
1861	49.04*	...	50.49*	...	...	...	...	...	...	50.24	...	...	...	49.92	...	...
1862	49.69	...	...	...	...	...	...	...	...	49.63	...	...	...	49.27	...	...
1863	49.07*	...	...	...	...	...	...	...	...	...	...	...	...	49.35	...	...
1864	48.35	...	...	...	...	...	...	51.11	...	...	...	...	...	49.65	...	51.83
1865	49.44	...	...	54.02*	...	...	...	52.00	...	...	...	...	...	51.12	...	52.40
1866	47.86	...	...	52.74*	...	...	...	50.45	...	...	...	...	...	49.31	...	51.23
1867	...	...	...	...	...	...	...	50.90	...	...	...	...	...	49.54	52.60	...
1868	...	...	...	...	...	...	...	49.90	...	...	...	...	...	48.51	50.37*	...
1869	...	...	...	...	...	50.35*	...	49.97	...	...	...	...	51.26	48.18	53.23*	...
1870	...	...	...	...	...	...	...	52.23	...	...	...	...	53.86	51.91	53.37	...
	48.69	48.17	49.15	53.53	50.40	50.96	46.58	50.65	47.32	49.09	52.85	52.19	52.11	49.64	51.68	51.60

OHIO.—Continued.

Year.	Lancaster.	Little Mountain.	Madison.	Margaretta.	Year.	Marietta.	Year.	Marietta.	Marion.	Montville.	Mt. Auburn.	Newark.	New Birmingham.	New Lisbon.	New Westfield.	North Base Island.
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...	...	...	...	...	1818	53.45*	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	1819	54.07	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	1820	53.07	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	1821	31.61	1846	54.03	...	...	...	...	...	...	...	...
...	...	...	...	...	1822	54.09	1847	51.62	...	...	...	...	...	...	...	...
...	...	...	...	...	1823	51.86*	1848	53.28	...	...	...	...	...	...	...	...
...	...	...	...	...	1824	...	1849	51.85	...	...	...	...	...	...	...	...
...	...	...	...	...	1825	...	1850	52.07	...	...	...	...	...	...	...	...
...	...	...	...	...	1826	54.07	1851	52.33	...	...	...	...	...	...	...	...
...	...	...	...	...	1827	54.25	1852	52.20	...	...	...	...	...	...	...	...
...	...	...	...	...	1828	55.38	1853	52.61	...	...	...	...	...	...	...	...
...	...	...	...	...	1829	52.33	1854	53.96	...	...	...	...	...	...	...	...
1855	...	...	48.01*	...	1830	54.67	1855	52.84	...	...	...	...	...	47.94	...	...
1856	...	...	44.95	...	1831	50.36	1856	49.71	...	...	51.33*	...	...	45.11	...	...
1857	...	...	46.80	...	1832	52.66	1857	50.84	...	46.57*	...	...	...	51.40	...	...
1858	51.81*	...	49.15	...	1833	53.04	1858	53.44	...	49.37	...	...	...	55.38	...	...
1859	...	...	49.18	...	1834	53.39	1859	52.93	...	48.64	...	...	...	52.56	...	...
1860	...	...	47.83	...	1835	50.54	1860	52.42	...	48.30	...	49.24	...	...	...	...
1861	...	...	48.98	...	1836	50.43	1861	52.54	...	49.16	54.28	51.85*	...	50.83	...	...
1862	...	...	48.60	...	1837	51.28	1862	52.42	...	49.02	54.37	52.49*	...	50.21	51.63*	...
1863	...	...	...	...	1838	50.57	1863	51.50	...	...	...	...	...	49.53*	...	...
1864	...	...	...	...	1839	52.42	1864	50.59	...	...	...	...	47.84*	49.53	...	...
1865	...	...	...	...	1840	52.27	1865	52.32	49.46*	...	...	...	49.05*	50.86*	...	...
1866	...	...	...	...	1841	52.05	1866	50.33	47.00	...	...	...	47.65*	49.28	...	...
1867	...	47.81*	...	...	1842	52.39	1867	50.45	48.22	...	...	...	...	49.30	...	...
1868	...	...	...	47.77	1843	50.38	1868	50.21	47.30	...	...	...	47.93*	49.72	...	...
1869	...	47.20*	...	49.04	1844	52.84	1869	50.32	47.64	...	55.62	...	47.59*	...	...	...
1870	...	49.64	...	51.36	1845	52.16	1870	51.91	50.18	...	55.29	...	...	...	...	51.39
	51.14	47.70	47.98	49.39				52.24	48.40	48.79	54.34	51.07	48.23	50.09	51.78	50.20

OHIO.—Continued.

Year.	North Bend.	North Fairfield.	Norwalk.	Oberlin.	Oxford.	Perrysburg.	Portsmouth.	Ripley (Brown Co.)	Ripley (Huron Co.)	Rockport.	Salem.	Savannah.	Saybrook.	Seville.	Steubenville.	Tarlton.
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1824	...	...	...	...	...	...	55.28*	...	...	...	...	...	...	...	...	...
1825	...	...	...	...	...	...	55.13	...	...	...	...	...	...	...	...	...
1826	...	...	...	...	...	...	55.73	...	...	...	...	...	...	...	...	...
1827	...	...	...	...	...	...	55.83	...	...	...	...	...	...	...	...	...
1828	...	...	...	...	...	...	57.43	...	...	...	...	...	...	...	...	...
1829	...	...	...	...	...	...	53.93	...	...	...	...	...	...	...	...	...
1830	...	...	...	...	...	...	55.63	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.20	...
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.32	...
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.85	...
1834	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.26	...
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48.59	...
1836	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48.19	...
1837	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49.01	...
1838	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48.59	...
1839	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.39	...
1840	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.90	...
1841	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49.84	...
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.69	...
1843	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49.12	...
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.33	...
1845	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.14	...
1846	...	...	...	...	...	...	...	...	...	...	...	...	...	...	52.61	...
1847	...	...	..	...	...	...	...	...	...	...	...	...	...	...	50 81	...
1848	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.27	...
1849	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.46	...
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.37	...
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.97	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.26	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.78	...
1854	...	...	...	50.65	...	53.16*	...	...	...	50.69	...	52.94*	...	...	53.63	...
1855	...	...	...	49.21	...	51.83	...	..	...	52.69	...	49.67*	...	...	50.44	...
1856	...	...	...	46.67*	...	48.92	52.47*	...	...	49.69	...	45.32	...	...	47.71	...
1857	...	...	...	...	...	49.68	...	...	...	51.69	...	47.82	...	...	48.56	...
1858	...	...	...	...	...	...	...	54.01	...	53.69	...	50.81	...	...	51.35	...
1859	...	...	...	...	...	...	55.30	...	...	52.64	...	50.62	...	...	50.01	...
1860	53.28	...	...	...	...	...	...	56.85*	...	52.35	...	49.47	...	...	50.34	...
1861	53.05	...	49.28	...	...	...	55.20	...	...	53.28	...	50.00	...	49.81*	51.12	...
1862	53.38*	...	48.51	...	...	...	56.24*	...	...	52.65	...	48.25	...	...	51.72	...
1863	...	...	48.72*	...	...	...	...	...	...	52.30*	...	...	...	...	51.28	...
1864	...	...	48.06	...	51.48	...	54.18	53.85*	...	...	...	...	...	...	50.52	...
1865	...	...	49.30	...	52.13	...	...	56.21*	...	...	...	...	48.03	...	52.22	...
1866	...	...	47.64*	...	50.61*	...	...	...	...	...	...	...	...	...	51.08	...
1867	...	50.71*	48.54	...	51.04	...	...	...	50.50*	...	...	...	...	...	52.10	...
1868	...	48.41	47.34	...	50.56	...	...	...	...	...	...	...	...	...	50.41*	...
1869	...	49.12	...	...	50.97	...	...	...	...	...	...	...	...	...	51.11	...
1870	...	51.23	...	...	52.97*	...	...	...	...	...	51.14	...	...	...	52.74	54.73*
	53.21	50.02	48.53	48.64	51.35	50.88	54.98	54.66	49.79	52.49	51.14	49.55	47.89	49.08	50.78	55.24

OHIO.—Continued.									**OREGON.**							
Year.	Toledo.	Troy.	Urbana.	Welchfield.	Westerville.	Windham.	Wooster.	Zanesville.	Astoria.	Block House.	Camp Harney.	Camp Lyons.	Camp Three Forks.	Camp Warner.	Camp Watson.	Eola.
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1851	...	...	...	...	...	...	...	...	51.92*	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	52.30*	...	...	...	...	...	48.67*	...	...	...	...	...	...	...
1855	...	...	49.59	...	...	...	...	51.47*	49.76*	...	...	...	...	...	...	...
1856	...	...	46.43	...	...	...	...	...	49.79*	...	...	...	...	...	...	...
1857	47.07	...	47.27	46.54*	...	46.57*	...	...	50.30	...	...	...	...	...	...	...
1858	50.00*	...	50.52	49.37	52.03	48.90	...	...	48.99	50.64*	...	...	...	...	...	...
1859	50.01	51.75	49.79	48.78	51.64	48.63	...	...	48.25	49.30*	...	...	...	...	...	...
1860	49.24	52.65	...	47.99*	51.23	...	...	...	49.81	50.71*	...	...	...	...	...	...
1861	50.01	52.05	...	48.80	51.71	...	...	...	48.49	...	...	...	...	...	...	...
1862	50.52	51.70	50.52	48.39	50.92	...	...	...	47.34	47.81	...	...	...	...	...	...
1863	50.81	...	50.72	47.87	48.85*	...	...	...	48.81	...	...	...	...	...	...	...
1864	49.56	...	49.19	47.59	49.71*	...	48.65*	...	49.13	...	...	...	...	...	...	...
1865	50.07	...	50.69	49.17	51.18*	...	50.08	...	47.46	...	...	...	...	...	...	...
1866	47.84	...	49.19	...	50.55	...	...	...	48.66	...	...	...	...	...	...	...
1867	48.43	...	50.17	...	...	...	50.63*	...	48.62	...	...	...	...	...	45.68*	...
1868	47.41	...	48.99	...	48.51*	...	50.71	...	47.94	...	45.90	48.01*	46.69	42.95	42.55	...
1869	48.19	...	49.12	...	49.45	...	50.32*	...	50.16	...	50.59	...	48.99	46.17	...	...
1870	...	...	51.46	...	52.06	...	...	...	49.48	...	49.57	...	...	46.62	...	49.24
	49.20	51.95	50.26	48.17	50.74	48.23	50.21	53.35	48.95	49.89	48.69	47.63	47.84	45.36	44.48	49.24

Year.	OREGON.—Continued.											PENNSYLVANIA.				
	Fort Dalles.	Fort Hoskins.	Fort Klamath.	Fort Lane.	Fort Oxford.	Fort Stevens.	Fort Umpqua.	Fort Yamhill.	Oregon City.	Portland.	Salem.	Abington.	Allegheny Arsenal.	Avondell.	Beaver Seminary.	Bedford.
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1825	...	...	...	...	...	...	...	...	...	...	...	...	52.75	...	...	...
1826	...	...	...	...	...	...	...	...	...	...	...	...	53.51*	...	...	...
1827	...	...	...	...	...	...	...	...	...	...	...	...	54.28	...	...	...
1828	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1829	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1834	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	...	47.84	...	...	...
1837	...	...	...	...	...	...	...	...	...	...	...	...	46.50	...	...	...
1838	...	...	...	...	...	...	...	...	...	...	...	...	49.61	...	...	...
1839	...	...	...	...	...	...	...	...	...	...	...	...	50.58	...	...	...
1840	...	...	...	...	...	...	...	...	...	...	...	...	50.15	...	...	...
1841	...	...	...	...	...	...	...	...	...	...	...	...	49.23	...	...	...
1842	...	...	...	...	...	...	...	...	...	...	...	...	50.42	...	...	...
1843	...	...	...	...	...	...	...	...	...	...	...	...	49.01	...	...	...
1844	...	...	...	...	...	...	...	...	...	...	...	...	50.91	...	...	...
1845	...	...	...	...	...	...	...	...	...	...	...	...	50.02	...	...	...
1846	...	...	...	...	...	...	...	...	...	...	...	...	52.94	...	...	...
1847	...	...	...	...	...	...	...	...	...	...	...	...	50.70	...	...	...
1848	...	...	...	...	...	...	...	...	...	...	...	...	50.92	...	...	...
1849	...	...	...	...	...	...	...	...	52.4	...	...	...	50.37	...	...	...
1850	...	...	...	...	...	...	...	...	53.8*	...	...	...	50.48	...	...	...
1851	...	...	...	...	...	...	...	...	54.1	...	...	...	50.94	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	50.46	...	...	...
1853	53.54	...	...	...	...	...	...	...	...	...	...	...	51.54	...	...	...
1854	52.10	...	...	...	...	...	...	...	...	...	...	...	52.67	...	...	52.16
1855	54.94*	...	...	54.51*	53.16*	...	...	...	...	...	...	...	49.78	...	...	49.40*
1856	...	...	...	...	...	...	...	...	...	...	...	...	47.38	...	...	48.30
1857	53.71	52.49	...	...	...	...	53.96	50.98	...	...	55.41*	...	49.48	...	...	49.02
1858	52.92	51.90	...	...	...	...	52.88	48.63	...	...	...	...	52.05	...	...	51.38*
1859	50.88	49.72	...	...	...	...	50.97	47.78	...	...	...	...	51.30*	...	...	50.83*
1860	53.89	51.58	...	...	...	...	52.64	49.89	...	...	...	...	52.41	...	...	50.91
1861	53.54	50.83*	...	...	...	...	52.44	49.63*	...	...	...	...	51.25*	...	...	51.66
1862	49.26	49.03	...	...	...	...	...	45.46	...	...	...	...	52.04	...	...	...
1863	54.62	51.24	...	...	...	...	...	49.46*	...	...	...	...	51.55*	...	...	...
1864	53.54*	51.66*	42.02	...	...	...	...	50.03	...	...	...	46.18	51.65	...	...	...
1865	52.02	...	38.21	...	...	...	...	...	...	...	...	46.74	53.04	...	...	...
1866	...	...	...	...	...	50.73*	...	...	...	...	...	45.72	...	...	...	...
1867	...	...	...	...	...	51.20	...	...	...	...	...	45.29	...	...	...	...
1868	...	...	...	...	...	50.16*	...	...	...	...	...	44.59	...	47.58	50.13	...
1869	...	...	...	...	...	...	...	...	...	...	...	45.42	...	...	49.91	...
1870	...	...	...	...	...	...	...	...	...	54.25	...	47.81	...	...	51.86	...
	52.82	50.96	40.06	54.37	53.46	50.52	52.16	48.90	53.45	53.23	55.41[1]	45.96	50.78	48.64	50.74	50.54

[1] Hours of observation unknown.

PENNSYLVANIA.—Continued.

Year.	Berwick.	Blairsville.	Blooming-grove.	Brownsville.	Byberry.	Canonsburg.	Carlisle.	Ceres.	Chambers-burg.	Chromedale.	Dyberry.	Easton.	Ephrata.	Fallsington.	Fayette Tannery.	Fleming.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1836	...	...	...	...	...	...	...	43.92	...	...	...	...	...	...	...	...
1837	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1838	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...
1839	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...
1840	...	...	...	...	...	...	49.48	...	...	...	...		...	...	...	...
1841	...	...	...	...	...	...	49.06	...	...	...	...	...	...	...	...	...
1842	...	...	...	...	...	...	49.29	...	...	...	...	...	...	...	...	...
1843	...	...	...	...	...	...	49.76	...	...	...	...	...	...	...	...	...
1844	...	...	...	...	...	...	53.27	...	...	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	55.75	47.24*	...	...	...	...	...	...	...	...
1846	...	...	...	...	...	...	...	45.79*	...	...	...	...	...	...	...	...
1847	...	...	...	...	...	...	49.04	46.03*	...	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	50.22	46.20*	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	50.35	45.76	...	51.21	...	...	...	...	...	...
1850	...	...	...	...	...	...	50.66	44.27	...	51.12	...	...	...	...	...	...
1851	...	...	...	...	...	...	50.49*	45.08	...	51.34	...	...	...	...	...	...
1852	...	...	...	...	...	...	50.03	46.23	...	50.28	...	...	...	...	...	...
1853	...	...	...	...	...	...	51.48*	...	...	51.30	...	...	...	...	...	...
1854	...	...	...	...	...	...	...	...	...	51.62	...	...	...	...	...	...
1855	...	...	...	...	...	...	50.38*	...	...	50.83	...	50.60	...	...	...	46.01*
1856	...	...	...	...	...	45.82*	47.84	...	...	49.08	...	48.64	...	...	...	46.01*
1857	49.24*	...	...	...	...	48.37	49.34	...	...	49.69	...	47.66	...	...	...	47.33
1858	50.85	...	...	...	...	51.93	51.54	...	...	...	...	49.14	...	...	...	49.49
1859	50.72	...	...	...	...	51.57	51.34*	...	52.60	...	...	49.16	...	...	...	49.85
1860	50.32	...	...	...	...	...	50.66	...	...	...	...	...	...	50.77	...	48.61*
1861	50.49*	...	...	...	53.15	49.83	51.78	...	53.28*	...	...	...	...	52.00	...	48.97
1862	...	42.12*	...	...	52.17*	...	50.98	...	...	...	...	...	...	51.34	50.54	48.82
1863	...	...	...	...	52.49*	48.45*	50.94*	...	...	...	...	...	...	51.64	50.04*	48.57
1864	...	45.63*	...	...	...	49.26	50.93	...	...	...	...	...	...	51.87	49.22	48.40
1865	...	...	...	...	...	49.18	52.03	...	...	...	42.81	...	...	52.79	50.61	48.22
1866	...	...	44.07*	...	...	48.52*	...	...	...	...	43.25*	...	51.71	52.00	49.01	46.86
1867	...	...	44.12	...	...	48.82*	50.43	...	...	...	43.60	...	52.42	50.88	49.07	...
1868	...	...	43.64	...	...	49.22	49.74	...	...	...	44.24	...	...	49.91	48.83	...
1869	...	...	44.37	...	...	49.53	50.69	...	...	...	44.90	...	53.65	51.57	48.57	...
1870	...	...	46.39*	55.33*	...	51.45	52.46	...	...	...	...	...	53.03	53.62	51.35	...
	50.15	44.51	44.48	55.36	51.94	50.23	50.83	45.48	53.07	50.86	44.05	48.91	52.59	51.67	49.80	48.38

PENNSYLVANIA.—Continued.

Year.	Fountaindale.	Franklin.	Fort Mifflin.	Germantown.	Gettysburg.	Harrisburg.	Haverford College.	Hollidaysburg.	Johnstown.	Lancaster Colliery.	Lehigh University.	Lewisburg.	Lewistown.	Meadville.	Mooreland.
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1820	...	...	...	49.94	...	...	...	...	...	...	...	...	...	...	...
1821	...	...	...	48.98	...	...	...	...	...	...	...	...	...	...	...
1822	...	...	52.95	51.78	...	...	...	...	...	...	...	...	...	...	...
1823	...	...	54.81	49.86	...	...	...	...	...	...	...	...	...	...	...
1824	...	...	54.94	51.76	...	...	...	...	...	...	...	...	...	...	...
1825	...	...	...	53.58	...	...	...	...	...	...	...	...	...	...	...
1826	...	...	...	53.83	...	...	...	...	...	...	...	...	...	...	...
1827	...	...	...	53.46	...	...	...	...	...	...	...	...	...	...	...
1828	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1829	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1834	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1837	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1838	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1839	...	...	...	...	49.37	...	...	...	...	...	...	...	53.04*	...	...
1840	...	...	...	...	49.80	...	...	...	...	...	...	...	...	...	...
1841	...	...	...	...	50.00	53.32	...	...	...	...	...	...	...	...	...
1842	...	...	...	...	51.77	53.43*	...	...	...	...	...	...	...	...	...
1843	...	...	51.87	...	49.11	52.12*	...	...	...	...	...	...	...	...	...
1844	...	...	52.98	...	50.45	53.52	...	...	...	...	...	...	...	...	...
1845	...	...	53.94	...	51.58	53.83	...	...	...	...	...	...	...	...	...
1846	...	...	...	...	51.52	54.26	...	...	...	...	...	...	...	...	...
1847	...	...	...	...	50.13	53.52	...	...	...	...	...	...	...	...	...
1848	...	...	...	...	50.35	55.06	...	...	...	...	...	...	...	...	...
1849	...	...	53.03	...	49.66	54.38	...	...	...	...	...	...	...	...	...
1850	...	...	54.18*	...	51.19	53.86	...	...	...	...	...	...	...	...	...
1851	...	...	55.29	...	51.90	53.93	...	...	...	...	...	...	...	...	...
1852	...	...	53.99	...	50.10	53.06	...	...	...	...	...	...	...	...	...
1853	...	...	54.17*	...	52.23	55.48	...	50.40	...	...	...	...	...	...	...
1854	...	...	...	...	52.50	55.26	53.41	...	...	...	...	...	...	...	...
1855	...	...	...	...	50.78	53.35	50.74	...	...	...	...	...	...	...	...
1856	...	...	...	...	50.96	51.88	50.75	...	...	...	...	46.47	...	44.68*	...
1857	...	...	...	...	49.32	51.37	51.54*	...	...	46.53	...	47.60	...	45.79	...
1858	...	...	...	...	51.64	53.27	52.66*	...	...	48.06	...	49.48	...	48.28*	...
1859	...	...	...	...	51.15	53.36	52.14	...	...	47.81	...	49.42	...	...	...
1860	...	...	...	...	...	54.56	...	...	...	...	...	49.03*	...	...	...
1861	...	...	...	...	51.60	54.45	50.50*	...	...	...	...	...	...	...	...
1862	...	...	...	...	50.78	53.44	51.97*	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	53.24*	...	...	...	...	...	...	...	...	...
1864	...	...	...	53.00	...	53.83	...	...	...	...	...	...	...	...	...
1865	...	...	...	52.37*	...	54.93	...	...	...	...	...	48.76	...	...	51.29
1866	...	...	...	51.62	...	54.01	...	...	...	...	...	48.14	...	...	50.61
1867	...	...	...	51.09*	...	52.60	...	...	...	...	...	47.72	...	...	49.62
1868	49.06*	45.64	. .	49.98*	...	51.04	...	...	45.78*	...	47.23*	46.52	...	...	48.97
1869	50.39	46.70*	...	51.74	...	52.66*	...	...	47.12	...	...	47.82	...	...	50.65
1870	52.73	48.84	...	53.95	...	...	...	...	49.61	...	...	50.19	...	...	52.44
	51.26	47.28	53.77	51.86	50.63	53.73	51.85	50.40	47.70	47.40	47.41	48.21	53.04	47.80	50.55

PENNSYLVANIA.—Continued.

Year.	Morrisville.	Year.	Morrisville.	Mossgrove.	Mt. Joy.	Murrysville.	Nazareth.	Newcastle.	Newtown.	Norristown.	Paradise.	Pennsville.	Year.	Philadelphia.	Philadelphia.	Philadelphia.
	°		°	°	°	°	°	°	°	°	°	°		°	°	°
1790	52.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1791	53.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1792	51.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1793	54.3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1794	50.5	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1795	51.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1796	52.1	...	...	...	...	...	...	...	...	...	...	...	1758	53.60	...	...
1797	51.6	...	...	...	...	...	...	...	...	...	...	...	1759	52.73	...	...
1798	52.1	...	...	...	...	...	...	...	...	...	...	...	1760	...	...	...
1799	51.5	...	...	...	...	...	...	...	...	...	...	...	1761	...	...	...
1800	51.8	...	...	...	...	...	...	...	...	...	...	...	1762	...	...	...
1801	52.4	...	...	...	...	...	...	...	...	...	...	...	1763	...	...	...
1802	54.2	...	...	...	...	...	...	...	...	...	...	...	1764	...	...	...
1803	52.2	1787	...	...	...	...	50.85	...	...	...	...	...	1765	...	...	...
1804	51.6	1788	...	...	...	...	49.13	...	...	...	...	...	1766	...	...	...
1805	52.0	1789	...	...	...	...	49.58	...	...	...	...	...	1767	53.25	...	...
1806	51.9	1790	...	...	...	...	48.85	...	...	...	...	...	1768	51.50	...	...
1807	52.4	1791	...	...	...	...	49.24	...	...	...	...	...	1769	51.83	...	...
1808	52.6	1792	...	...	...	...	47.42	...	...	...	...	...	1770	52.00	...	...
1809	51.6												1771	51.83	...	...
1810	51.4	1835	...	...	...	...	...	...	...	...	50.7	...	1772	52.50	...	...
1811	52.5	1836	...	...	...	...	...	...	...	...	51.4	...	1773	54.70	...	...
1812	51.4	1837	...	...	...	...	...	...	48.32*	...	50.9	...	1774	52.90	...	...
1813	50.9	1838	...	...	...	...	...	...	50.73	...	52.7	...	1775	54.40	...	...
1814	51.4	1839	...	...	...	...	...	...	52.76	...	53.3	...	1776	53.47	...	...
1815	51.7	1840	...	...	...	...	...	...	51.38	...	52.2	...	1777	50.96	...	...
1816	49.2	1841	...	...	...	...	...	...	48.80	...	53.6	...				
1817	53.1	1842	...	...	...	...	...	...	50.49	...	51.5	...	1798	...	54.9	...
1818	53.2	1843	...	...	...	...	...	...	...	...	52.9	...	1799	...	53.1	...
1819	51.6	1844	...	...	...	...	...	...	...	...	55.2	...	1800	...	53.4	...
1820	52.1	1845	...	...	...	...	...	...	...	...	53.9	...	1801	...	53.3	...
1821	51.9	1846	53.9	...	...	...	...	...	...	...	54.4	...	1802	...	54.9	...
1822	53.6	1847	...	...	...	...	...	...	...	...	54.3	...	1803	...	54.1	...
1823	53.9	1848	...	...	...	...	...	...	...	...	52.0	...	1804	...	54.5	...
1824	54.0	1849	51.2*	...	...	...	...	...	...	...	53.5	...	1805	...	...	...
1825	54.4	1850	52.2	...	...	...	...	...	...	...	54.0	...	1806	...	...	...
1826	53.4	1851	51.3	...	...	...	...	...	...	...	52.6	...	1807	...	...	54.5
1827	50.7	1852	50.4	...	...	...	...	...	...	...	52.9	...	1808	...	...	59.4
1828	56.7	1853	52.3	...	...	...	...	...	...	...	53.2	...	1809	...	...	57.2
1829	53.4	1854	51.0	47.63*	...	...	...	...	...	52.29	53.2	...	1810	...	...	58.2
1830	52.9	1855	50.1	46.83*	...	...	...	...	...	50.11	48.7	...	1811	...	...	59.2
1831	53.4	1856	48.9	43.26*	...	...	46.95	...	...	49.26	51.6	...	1812	...	...	57.4
1832	50.6	1857	49.2	...	...	47.82*	46.91	...	...	49.16	51.1	...	1813	...	...	58.3
1833	53.0	1858	51.1	...	54.29	49.93	...	...	...	50.87	52.8	...	1814	...	...	58.5
1834	52.8	1859	50.2	...	54.46	...	...	...	...	50.94	...	...	1815	...	...	58.5
1835	52.6	1860	...	...	53.25	...	...	...	...	50.66	...	...	1816	...	...	57.5
1836	50.6	1861	...	...	54.12	...	49.41*	...	...	51.09	...	...	1817	...	...	57.0
1837	52.7	1862	...	...	53.85*	...	...	...	...	50.26	...	...	1818	...	...	57.1
1838	52.7	1863	...	...	53.40*	...	...	...	...	...	...	...	1819	...	...	59.2
1839	52.4	1864	...	...	54.08	...	50.94	...	...	...	...	...	1820	...	...	58.0
1840	52.7	1865	...	...	55.99	...	50.67*	...	...	...	...	46.68	1821	...	...	58.3
1841	52.1	1866	...	...	52.97	...	49.79*	50.09	...	...	...	45.00	1822	...	...	60.9
1842	53.2	1867	...	...	51.77*	...	...	49.50	...	...	...	43.92	1843	...	...	57.7
1843	52.0	1868	...	...	50.93*	...	...	49.87	...	...	...	42.64	1824	...	...	58.5
1844	53.5	1869	...	...	52.46	...	...	49.95	...	...	...	42.69	1825	...	...	61.1
1845	54.3	1870	...	...	54.94*	...	...	52.00	...	...	...	45.27	1826	...	...	60.8
			52.19	46.79	53.52	48.93	49.15	50.28	50.32	51.61	52.61[1]	44.47		52.75[1]	54.2[1]	58.6[1]

[1] Hours of observation unknown.

PENNSYLVANIA.—Continued.

Year.	Philadelphia.	Philadelphia.	Pittsburg.	Pocopson.	Pottsville	Plymouth Meeting.	Reading.	St. Vincent's College.	Shamokin.	Silver Spring.	Sewickley-ville.	Somerset.	Tarentum.	Tioga.	Westchester.	Westtown.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1829	50.6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	53.4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1831	51.3	51.06	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	51.5	51.39	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1833	52.0	50.82	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1834	53.6	51.60	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1835	50.8	49.54	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	48.0	48.77	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1837	50.3	50.69	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1838	52.6	51.48	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1839	...	52.91	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1840	...	52.80	...	...	...	...	...	...	...	...	...	47.39	...	...	...	...
1841	...	51.89	...	...	...	...	...	...	...	...	...	47.19*	...	...	...	...
1842	...	53.22	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1843	...	51.72	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1844	...	52.61	...	...	...	...	...	...	...	...	...	46.79	...	...	...	...
1845	...	53.88	...	...	...	...	...	...	...	...	...	46.39*	...	...	...	...
1846	...	53.93	...	...	...	...	...	...	...	...	...	47.29	...	...	...	...
1847	...	53.38	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1848	...	53.54	...	...	...	...	...	...	...	...	...	45.99	...	...	...	...
1849	...	52.64	...	...	...	...	...	...	...	...	...	44.99	...	...	...	...
1850	...	53.58	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	54.00	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	53.12	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1853	...	54.63	...	54.28	...	...	...	...	...	...	...	42.29	...	...	...	...
1854	...	54.61	52.88	53.63	...	...	...	...	...	...	...	46.19	...	...	...	...
1855	...	53.65	50.41	52.57	48.20	...	...	...	...	...	...	44.49*	...	...	51.72*	...
1856	...	51.54	47.14	49.71	...	...	...	...	...	...	...	43.36	...	...	49.30	...
1857	...	52.09	48.62*	50.28	...	...	...	...	...	...	...	45.03	49.00	...	50.35	...
1858	...	53.77	52.43	52.35	...	...	...	...	...	...	...	48.79	50.91	...	51.24	50.87
1859	..	53.30	51.88	51.91	...	...	...	...	...	...	...	48.62	50.05*	...	50.87	...
1860	...	52.55	...	51.54*	...	...	...	...	49.94*	...	...	...	...	...	51.08	...
1861	...	53.13	...	52.18	...	...	...	51.53	52.05	...	48.63	48.68	...	...	51.72	...
1862	...	52.25	...	51.50	...	...	...	...	50.79	...	...	...	...	...	50.56	...
1863	...	53.80	...	51.61*	...	...	...	...	...	50.47*	...	...	...	...	51.09	...
1864	...	53.89	...	51.73	...	...	...	...	...	51.20*	...	...	...	48.38*	51.56	...
1865	...	56.84	...	52.42	...	...	...	...	...	51.61	...	...	...	48.60	51.88	...
1866	...	55.68	51.85	51.68	...	...	...	...	...	...	...	...	...	46.58	51.10	...
1867	...	54.95	...	50.88	...	...	51.47	...	...	...	...	...	...	46.98*	51.15	...
1868	...	52.63	...	49.87	...	49.57*	50.75	...	...	...	...	...	...	45.41	49.91	...
1869	...	54.32	...	51.54	...	51.09	52.20	...	...	...	...	...	...	42.85	50.89*	...
1870	...	55.39	52.62*	53.51	...	52.85	54.97	...	...	...	...	...	...	48.21	52.74	...
	51.4[1]	52.94	51.94	51.79	49.09	51.43	51.35	51.41	51.35	50.74	48.22	46.16	50.06	46.79	51.28	51.50

[1] Hours of observation unknown.

PENNSYLVANIA.—Cont'd.			**RHODE ISLAND.**					
Year.	Whitehall.	Worthington, near.	Fort Adams.	Fort Wolcott.	Newport.	North Scituate.	Year.	Providence.
	°	°	°	°	°	°		°
1822	...	...	..	51.54	...	..	...	...
1823	...	...	...	48.58	...	...	...	...
1824	...	...	...	50.51	...	...	...	...
1825	...	...	...	51.58	...	...	...	...
1826	...	...	...	50.98	...	...	...	...
1827	...	...	...	49.40	...	...	...	...
1828	...	...	...	52.09	...	...	...	...
1829	...	...	...	47.57	...	...	...	...
1830	...	...	...	49.40	...	...	...	...
1831	...	...	...	48.77	...	...	...	...
1832	...	...	...	47.59	...	...	1832	47.4
1833	...	...	...	48.18	...	...	1833	48.5
1834	...	...	...	48.22	...	...	1834	48.3
1835	...	...	...	47.50	...	...	1835	46.5
—							1836	45.0
1842	...	...	49.68	...	...	...	1837	45.8
1843	...	...	49.02	...	...	...	1838	47.4
1844	...	...	49.82	...	...	...	1839	48.3
1845	...	...	49.99	...	...	...	1840	48.7
1846	...	...	49.67*	...	...	...	1841	48.2
1847	...	...	...	...	...	...	1842	49.5
1848	...	...	...	...	...	...	1843	47.7
1849	...	...	50.00	...	...	...	1844	48.5
1850	...	...	50.44	...	...	...	1845	48.1
1851	...	...	50.37	...	...	...	1846	48.2
1852	...	...	49.94	...	...	...	1847	49.6
1853	...	...	50.90*	...	...	46.66	1848	50.0
1854	...	...	...	...	...	...	1849	48.8
1855	...	...	...	...	...	...	1850	49.0
1856	47.21	...	...	...	...	...	1851	48.7
1857	48.44	...	...	...	...	...	1852	49.1
1858	50.47	...	48.43*	...	...	...	1853	49.2
1859	49.89	49.83	48.56*	...	...	...	1854	48.1
1860	49.75	49.79*	...	...	...	...	1855	48.5
1861	50.48	49.90	...	...	...	...	1856	46.8
1862	49.44*	...	...	...	...	...	1857	47.7
1863	49.62	...	51.51*	...	...	...	1858	48.6
1864	50.34	...	51.46*	...	...	...	1859	48.1
1865	50.45	...	52.37*	...	...	...	1860	48.5*
1866	48.91	...	...	...	47.71	...	1861	47.5
1867	48.49	...	47.91	...	46.62	...	1862	47.4
1868	47.93	...	47.93	...	45.92	...	1863	48.3
1869	49.34	...	47.67	...	48.70	...	1864	48.1
1870	52.22	...	48.87	...	50.88	...	1866	47.7
	49.55	49.43	49.73	49.43	48.12	45.77		47.91

SOUTH CAROLINA.

Year.	Aiken.	All Saints.	Beaufort.	Bluffton.	Camden.	Charleston.	Columbia.	Edisto Island.	Fort Moultrie.	Gowdysville.	Greenville.	Hilton Head.	Nightingale Hall.	Robertville.	St. Johns.	Wilkinsville.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1738	...	...	...	...	...	66.03	...	...	...	...	...	...	...	...	...	...
1739	...	...	...	...	...	64.83	...	...	...	...	...	...	...	...	...	...
1740	...	...	...	...	...	63.93	...	...	...	...	...	...	...	...	...	...
1742	...	...	...	...	...	64.73	...	...	...	...	...	...	...	...	...	...
1750	...	...	...	...	...	64.63	...	...	...	...	...	...	...	...	...	...
1751	...	...	...	...	...	66.33	...	...	...	...	...	...	...	...	...	...
1752	...	...	...	...	...	66.93	...	...	...	...	...	...	...	...	...	...
1753	...	...	...	...	...	66.43	...	...	...	...	...	...	...	...	...	...
1754	...	...	...	...	...	67.43	...	...	...	...	...	...	...	...	...	...
1755	...	...	...	...	...	63.23	...	...	...	...	...	...	...	...	...	...
1756	...	...	...	...	...	66.63	...	...	...	...	...	...	...	...	...	...
1757	...	...	...	...	...	65.33	...	...	...	...	...	...	...	...	...	...
1758	...	...	...	...	...	63.93	...	...	...	...	...	...	...	...	...	...
1759	...	...	...	...	...	64.73	...	...	...	...	...	...	...	...	...	...
1823	...	...	...	...	...	...	...	...	64.31	...	...	...	...	...	...	...
1824	...	...	...	...	...	...	...	...	66.47	...	...	...	...	...	...	...
1825	...	...	...	...	...	...	...	...	66.80*	...	...	...	...	...	...	...
1826	...	...	...	...	...	...	...	...	67.95*	...	...	...	...	...	...	...
1827	...	...	...	...	...	...	...	...	67.03*	...	...	...	...	...	...	...
1828	...	...	...	...	...	...	...	...	70.73	...	...	...	...	...	...	...
1829	...	...	...	...	...	...	...	...	65.53*	...	...	...	...	...	...	...
1830	...	...	...	...	...	...	...	...	69.75	...	...	...	...	...	...	...
1831	...	...	...	...	...	...	...	...	65.44	...	...	...	...	...	...	...
1832	...	...	...	...	...	...	...	...	65.85	...	...	...	...	...	...	...
1833	...	...	...	...	...	...	...	...	65.66	...	...	...	...	...	...	...
1834	...	...	...	...	...	...	...	...	66.33	...	...	...	...	...	...	...
1835	...	...	...	...	...	...	...	...	63.78	...	...	...	...	...	...	...
1838	...	...	...	...	59.98	...	...	...	...	...	...	...	...	...	...	...
1840	...	...	...	...	...	66.57	...	...	65.59	...	...	...	...	...	...	...
1841	...	...	...	...	...	65.79	...	...	65.41	...	...	...	...	...	...	...
1842	...	...	...	...	...	...	...	...	64.83	...	...	...	...	...	...	...
1843	...	...	...	...	...	...	...	...	65.82	...	...	...	...	61.33	...	...
1844	...	...	...	...	...	65.17	...	...	67.10	...	60.12*	...	...	...	...	...
1845	...	...	...	...	...	...	...	...	66.35	...	60.84*	...	...	...	...	...
1846	...	...	...	...	...	...	...	...	67.18*	...	...	...	...	...	64.05*	...
1847	...	...	...	...	...	64.82	...	...	66.47	...	...	...	...	...	63.36	...
1848	...	...	...	...	...	...	63.23*	...	66.75*	...	...	...	...	...	64.04	...
1849	...	...	...	...	...	...	64.12	...	66.29	...	...	...	64.43*	...	64.00	...
1850	...	...	...	...	...	...	...	...	66.72	...	...	...	...	...	65.09	...
1851	...	...	...	...	...	65.85	...	...	66.71	...	...	...	...	...	63.73	...
1852	...	...	...	...	...	...	...	...	66.08	...	...	...	...	...	64.22	...
1853	...	...	...	...	...	...	...	...	66.78	...	...	...	...	...	63.26	...
1854	...	...	...	...	62.85	...	...	...	66.50	...	...	...	...	...	63.00	...
1855	...	63.42	...	...	62.38	65.56	...	...	65.67	...	...	...	...	...	62.37	...
1856	60.79*	61.84	...	...	59.90	64.00	...	63.96*	63.69	...	...	...	...	...	60.91	...
1857	61.70	61.92	...	...	59.54	64.16	...	...	63.67	...	...	...	...	...	60.16	...
1858	61.62	63.77	...	...	...	65.83	...	...	65.66	...	...	...	...	...	63.23*	...
1859	61.54	63.49	...	...	...	65.76	...	...	65.48	...	...	...	...	...	62.92	...
1860	...	63.75*	...	...	...	...	...	...	...	...	...	...	...	...	62.70	...
1861	...	...	...	...	...	65.92*	...	...	...	...	...	...	...	...	...	...
1864	...	...	64.89*	...	...	...	...	...	...	...	...	67.75*	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	...	66.59*	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	64.49*	...	...	...	...
1867	61.67	...	...	...	...	...	...	...	...	...	...	66.12	...	...	...	...
1868	61.11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	59.98*
1869	61.97	...	...	...	...	...	...	...	...	62.43*	...	...	...	...	...	...
1870	62.35*	...	...	67.09	...	...	...	...	...	62.33*	...	...	...	...	...	...
	61.61	63.02	64.69	67.09	61.75	65.53	61.62	63.96	66.16	62.38	60.83	66.11	64.43	61.33	63.22	59.86

	TENNESSEE.												TEXAS.			
Year.	Austin.	Dixon's Springs.	Elizabethton.	Fort Humboldt.	Gallatin.	Glenwood.	Knoxville.	Lookout Mt.	Memphis.	Pomona.	Trenton.	University Place.	Austin.	Blue Branch.	Burkeville.	Camp Colorado.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1819	...	...	...	...	60·6*	...	...	...	...	...	...	...	...	...	...	...
1852	...	58.63*	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	59.14	57.28	...	62.16*	...	...	...	66.02	...	...	...
1855	...	...	...	...	...	57.02	...	...	...	...	...	...	65.43	...	...	...
1856	...	...	...	...	...	53.82	...	...	...	...	...	...	64.23	...	...	...
1857	...	...	...	...	...	54.13	...	...	59.20*	...	...	...	65.44	...	...	63.67
1858	...	...	...	...	...	56.71	...	...	61.03	...	...	...	67.36	...	...	65.00*
1859	...	...	...	...	...	56.21	...	...	60.52*	...	...	...	67.35	...	...	66.00
1860	...	...	...	...	...	57.92*	...	...	61.55*	55.82	...	57.09	67.07	...	64.96	65.09
1861	...	...	...	...	...	57.26	...	...	...	...	...	...	67.17	...	...	...
1862	...	...	...	...	...	57.19	...	...	...	...	...	...	67.25	...	...	...
1863	...	...	...	...	...	55.43	...	...	...	...	...	...	67.16	...	...	...
1864	...	...	...	...	...	54.59	...	...	...	...	...	...	65.88	...	...	...
1865	...	...	...	...	...	57.19	...	...	...	...	...	...	66.20	...	...	...
1866	...	...	...	...	...	56.30	...	...	...	...	...	...	66.93	...	...	...
1867	...	...	...	...	...	56.25	...	59.12	...	...	...	...	68.21	...	...	...
1868	58.57	...	54.64	...	...	55.41	...	58.28*	59.43	...	...	...	66.41	...	...	...
1869	...	...	54.46	...	...	55.10	...	58.62*	58.25	...	59.11*	...	65.21	65.13	...	...
1870	57.35*	...	55.79	61.90*	...	56.44*	56.29*	59.08	...	...	60.46*	..	66.57	67.15	...	...
	58.09	58.63	54.96	61.90	60.6	56.53	56.74	58.92	60.71	56.16	59.76	56.98	66.72	66.14	65 00	64.83

TEXAS.—Continued.

Year.	Camp Concordia.	Camp Cooper.	Camp Hudson.	Camp Stockton.	Camp Verde.	Cedar Grove Plantation.	Clinton.	Corpus Christi.	Cross Roads.	Fort Belknap.	Fort Bliss.	Fort Brown.	Fort Chadbourne.	Fort Clarke.	Fort Croghan.	Fort Davis.
1846	...	...	...	...	...	...	...	70.47*	...	...	...	...	...	...	..	...
1847	...	...	...	...	...	...	...	...	...	...	...	74.57	...	...	...	...
1848	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	...	73.70	...	...	65.62	...
1851	...	...	...	...	...	...	...	71.52*	...	...	...	72.72	...	...	66.36	...
1852	...	...	...	...	...	...	...	...	...	62.13	...	73.92	...	...	66.50	...
1853	...	...	...	...	...	...	...	...	...	64.18	...	72.99	60.45	66.30	...	...
1854	...	...	...	...	...	...	...	...	...	65.58	...	74.01	63.80	68.85	...	...
1855	...	...	...	...	...	...	...	...	...	65.27	67.12*	73.12	63.66*	66.50	...	63.39
1856	...	...	...	...	...	...	...	...	...	63.65	62.76	71.88	61.78	68.23	...	60.10
1857	...	62.05*	...	...	62.70	...	...	...	...	62.96	63.01*	72.54	61.47	68.69*	...	61.35*
1858	...	...	...	...	62.14*	...	...	...	...	...	63.15	73.22	63.28	69.54	...	62.03
1859	...	...	69.23	...	66.29	...	...	...	...	...	63.62	...	64.40	70.21	...	62.33
1860	...	...	69.98	65.63	66.87	...	...	...	68.86*	...	65.41	...	64.89	70.06	...	63.19
1861	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	69.26*	70.25*	...	...	...	...	65.94	...	...	...	...	...
1868	66.33*	...	...	...	64.65	68.11	...	...	...	...	...	...	...	...	...	...
1869	...	...	...	...	...	...	67.95*	...	...	...	64.62*	...	...	...	...	...
1870	...	...	...	65.82	...	...	68.33	...	...	...	...	72.04	...	67.82	...	60.95*
	66.33	62.73	69.01	65.67	64.70	68.67	68.18	70.20	68.54	63.91	64.78	73.40	62.90	68.28	65.84	61.73

TEXAS.—Continued.

Year.	Fort Duncan.	Fort Ewell.	Fort Gates.	Fort Graham.	Fort Griffin.	Fort Houston.	Fort Inge.	Fort Lancaster.	Fort Lincoln.	Fort McIntosh.	Fort McKavett.	Fort Martin Scott.	Fort Mason.	Fort Merrill.	Fort Quitman.	Fort Richardson.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1842	...	...	...	...	...	73.03	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1850	71.14	...	65.51	65.61*	...	...	67.39	...	68.21*	73.11	...	62.32	...	...	...	...
1851	72.41	...	65.92	66.63	...	...	68.34*	...	...	73.29	...	62.68	...	70.40*	...	...
1852	71.76	...	...	65.99	...	...	67.31	...	...	74.86	63.57*	...	65.37*	...	...	...
1853	69.48	71.59	...	...	...	...	67.19	...	...	73.20	...	...	65.10*	...	...	...
1854	70.70	70.28*	...	...	...	...	68.76	...	...	72.98	64.08	...	...	72.82	...	...
1855	69.37	...	...	...	...	...	...	...	...	72.80	62.79	...	...	70.37*	...	...
1856	70.02	...	...	...	...	...	...	...	...	71.69	64.04	...	65.19*	...	...	...
1857	70.62	...	...	...	...	...	...	63.48	...	73.28	63.28	...	64.75	...	...	...
1858	72.97	...	...	...	...	...	...	64.79	...	73.50	63.70	...	67.11	...	...	...
1859	...	...	...	...	...	...	70.70	67.46	...	...	...	...	...	...	61.65	...
1860	...	...	...	...	...	...	70.58*	68.11	...	...	...	...	68.12*	...	62.75*	...
1861	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1868	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	64.43*
1869	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	64.27
1870	...	...	...	...	62.93*	...	...	...	...	72.40*	...	...	...	...	63.26	...
	71.51	71.40	65.95	65.87	63.17	73.03[1]	68.65	65.67	67.63	72.98	63.69	62.48	66.40	71.32	62.54	64.31

TEXAS.—Continued.

Year.	Fort Terrett.	Fort Worth.	Galveston.	Gilmer, near.	Goliad.	Gonzales.	Houston.	Jefferson.	Larissa.	Lavaca.	New Braunfels.	Oakland.	Pin Oak.	Phantom Hill.	Ringgold Barracks.	Round Top.
1848	...	...	...	...	...	71.36*	...	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	72.18	...	...	...	...	...	...	...	...	...	...
1850	...	64.29	...	...	...	...	...	...	...	...	...	...	...	...	75.22	...
1851	...	64.00	...	...	...	...	...	...	...	...	...	...	...	...	75.47	...
1852	64.40*	63.35	...	...	...	...	...	...	...	...	...	...	...	63.19	75.31	...
1853	63.29	...	...	...	...	...	...	...	...	...	...	...	...	64.26	73.88	...
1854	...	...	...	...	...	...	...	...	...	...	64.20	...	...	...	73.39	...
1855	...	...	...	...	...	...	...	...	...	...	68.44	...	...	...	72.11*	...
1856	...	...	...	...	...	...	...	...	...	...	68.48	...	64.29	...	71.32	...
1857	...	...	...	...	...	...	...	...	...	...	69.33*	...	...	...	72.44	...
1858	...	...	...	...	68.63	...	...	...	65.50	...	...	...	...	...	73.41	...
1859	...	...	...	...	...	...	...	...	66.38	...	69.66	...	...	...	...	69.76
1860	...	...	...	65.51	...	...	...	...	...	...	...	...	...	...	...	69.16
1861	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1868	...	...	70.44	64.77	...	...	67.16*	...	...	...	...	...	...	...	...	...
1869	...	...	68.78	63.92	...	...	...	...	...	68.05*	...	...	...	...	...	...
1870	...	...	...	66.52*	...	...	...	67.09	...	...	...	69.28*	...	...	...	...
	63.74	63.81	69.38	65.22	69.93	71.36	67.26	66.45	65.94	68.17	68.49	69.28	64.29	63.83	73.78	69.29

[1] Hours of observation unknown.

	TEXAS.—Continued.						UTAH.							VERMONT.		
Year.	San Antonio.	Sisterdale.	Union Hill.	Waco.	Washington.	Weberville.	Camp Douglas.	Coalville.	Camp Crittenden.	Great Salt Lake City.	Heberville.	St. Mary's.	Wanship.	Brandon.	Burlington.	Castleton.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1828	...	...	...	...	...	...	...	...	...	...	...	...	...	...	47.92	...
1829	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1831	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	...	44.09	...
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.64	...
1834	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1837	...	...	...	...	...	...	...	...	...	...	...	...	...	...	40.96*	...
1838	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.95	...
1839	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.82	...
1840	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.02	...
1841	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.09	...
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.92	...
1843	...	...	...	...	...	...	...	...	...	...	...	...	...	...	43.57	...
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	...	44.72	...
1845	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.74	...
1846	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.47	...
1847	...	...	...	...	...	...	...	...	...	...	...	...	...	...	44.78	...
1848	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.71	...
1849	...	...	...	...	...	...	...	...	...	...	...	...	...	...	44.72	...
1850	69.88	...	...	...	...	...	...	...	...	...	...	...	...	...	45.46	...
1851	67.47	...	...	...	...	...	...	...	...	...	...	...	...	...	44.86	...
1852	71.33*	...	...	...	...	...	...	...	...	...	...	...	...	...	45.11	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.55	...
1854	...	...	...	...	...	...	...	...	...	...	...	...	...	44.05	45.28	45.87
1855	...	...	...	...	...	...	...	...	...	...	...	...	...	44.20	45.28	...
1856	...	...	...	...	...	...	...	...	...	...	...	...	...	41.63	42.35	...
1857	...	...	...	...	66.76	...	...	...	...	...	...	...	...	42.55	...	...
1858	67.42	...	63.80	...	...	...	...	...	...	...	...	...	...	43.02	42.22	...
1859	69.91	66.12	66.45	...	66.98	69.67*	...	...	48.24	51.28*	...	...	...	43.81	42.43	...
1860	71.80	...	67.77*	...	...	...	...	...	48.60	...	...	...	...	44.35*	...	...
1861	...	...	...	...	...	...	...	...	...	51.23*	...	...	...	43.85	42.92	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	44.45*	42.17*	...
1863	...	...	...	...	...	...	52.42	...	...	...	...	...	...	45.65	42.12*	...
1864	...	...	...	...	...	...	52.22	...	...	52.41	...	...	...	...	43.38*	...
1865	...	...	...	...	...	...	50.96	...	...	50.54	61.80*	...	...	...	...	...
1866	...	...	...	...	...	...	52.39*	...	...	51.85	...	44.3*	...	45.21*	...	...
1867	...	...	...	...	...	...	51.78	...	...	...	...	...	45.97*	...	...	...
1868	...	...	...	65.91	...	...	50.46	...	...	...	...	...	...	...	...	...
1869	...	...	...	...	...	...	51.76*	...	...	...	...	...	...	...	...	...
1870	67.35	...	...	...	...	...	50.00	44.72*	...	...	..	...	...	...	...	47.06
	69.22	66.12	66.15	66.22	67.29	69.34	51.49	45.14	48.45	51.86	61.37	43.87	45.48	44.12	44.44	45.76

VERMONT.—Continued.

Year.	Craftsbury.	Fayetteville.	Ferrisburg.	Lunenburg.	Middlebury.	Montpelier.	Newbury.	Newport.	Norwich.	Randolph.	Rupert.	Rutland.	St. Johnsbury.	Shelburn.	Springfield.	West Charlotte.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1789	...	...	...	...	...	...	...	...	...	...	...	43.62	...	...	...	...
1827	...	43.87	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1828	...	46.96	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1829	...	42.75	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1830	...	45.09	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1831	...	43.98	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1832	...	42.75	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1833	...	42.14	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1834	...	43.41	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	39.55	...	...	...	...	...	...	...	...	...
1840	...	...	...	...	...	...	43.21	...	...	...	...	...	...	...	...	...
1841	...	...	...	...	...	...	43.32	...	...	...	...	...	...	...	...	...
1842	...	...	...	...	...	...	42.72	...	...	...	...	...	...	...	...	...
1843	...	...	...	...	...	...	42.10	...	...	...	...	...	...	...	...	...
1844	...	...	...	...	...	...	42.05	...	...	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	42.39	...	...	...	...	...	...	...	...	...
1846	...	...	...	...	...	...	44.38	...	...	...	...	...	...	...	...	...
1847	...	...	...	...	...	...	43.40	...	...	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	43.77	...	...	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	42.69	...	...	...	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	42.44	...	...	..
1854	40.72	...	...	...	...	...	...	...	...	...	...	...	41.55	...	...	...
1855	39.33	...	...	...	...	41.93	...	...	...	...	...	...	...	...	...	...
1856	39.05	...	...	...	...	...	...	...	...	...	...	...	...	41.81*	...	...
1857	39.55	...	...	...	...	...	...	...	43.13*	...	46.85	...	41.03	42.68	...	...
1858	39.49	...	...	...	...	...	...	...	...	...	47.99	...	39.30	...	...	...
1859	40.28	...	...	...	...	...	...	...	...	...	47.37	...	39.59	...	...	...
1860	41.19*	...	...	43.40*	...	...	...	...	...	...	47.86	...	...	...	...	...
1861	39.52*	...	...	41.98*	...	...	...	...	...	...	...	...	...	...	42.99	...
1862	39.38	...	...	42.21	...	...	...	...	...	...	47.17	...	...	...	43.65*	...
1863	39.36*	...	...	42.59*	...	...	...	...	...	...	...	...	...	...	...	...
1864	40.76	...	...	44.52	46.91*	...	...	...	...	...	...	...	...	...	...	...
1865	40.28	...	...	41.98	45.57	...	...	...	...	...	...	...	...	...	...	...
1866	39.58	...	...	42.13*	43.97	...	...	...	...	42.64	...	...	...	...	...	...
1867	39.44	...	...	40.20*	42.83	...	...	...	...	41.39	...	...	...	...	...	...
1868	39.78	...	...	39.70	42.24	...	...	...	...	41.00	...	...	...	...	...	...
1869	38.78	...	...	41.61	43.95	...	...	...	...	42.38	...	...	...	...	...	45.48
1870	40.99	...	47.00	43.92	...	...	...	44.28*	...	45.08	...	...	...	...	...	48.50
	39.89	44.26	46.65	41.41	44.57	42.14	42.46	44.20	42.78	42.61	47.44	43.62[1]	40.37	42.28	43.44	46.81

[1] Hours of observation unknown.

Year.	VERMONT.—Continued. West Fairlee.	Williams-town.	Windsor.	Woodstock.	VIRGINIA. Alexandria.	Bellona Arsenal.	Berryville	Cape Charles Light.	Cottage Home.	Crichton's Store.	Fortress Monroe.	Garrysville.	Glasgow, near.	Hampton.	Lewinsville.	Lexington.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1806	...	...	44.92	...	...	...	...	...	...	...	...	...	...	...	...	...
1824	...	...	...	...	...	56.39*	...	...	...	...	...	...	...	...	...	...
1825	...	...	...	...	...	...	...	...	...	...	61.95	...	...	...	...	...
1826	...	...	...	...	...	...	...	...	...	...	61.66	...	...	...	...	...
1827	...	...	...	...	...	60.16*	...	...	...	...	59.96	...	...	...	...	...
1828	...	...	...	...	...	61.74	...	...	...	...	63.18	...	...	...	...	...
1829	...	39.2*	...	...	...	57.41	...	...	...	...	59.07	...	...	...	...	...
1830	...	41.0	...	...	...	59.43	...	...	...	...	60.71	...	...	...	...	...
1831	...	39.7	...	...	...	...	...	...	...	...	57.26	...	...	...	...	...
1832	...	39.9*	...	...	...	59.26	...	...	...	...	54.10	...	...	...	...	...
1833	...	39.8	...	...	...	60.48*	...	...	...	...	57.18	...	...	...	...	...
1834	...	40.5	...	...	...	...	...	...	...	...	60.30	...	...	...	...	...
1835	...	39.1	...	...	...	...	...	...	...	...	58.19	...	...	...	...	...
1836	...	38.0	...	...	...	...	...	...	...	...	55.65	...	...	...	...	...
1837	...	37.8	...	...	...	...	...	...	...	...	58.33	...	...	...	...	...
1838	...	39.4	...	...	...	...	...	...	...	...	58.09	...	...	...	...	...
1839	...	40.5	...	...	...	...	...	...	...	...	58.49	...	...	...	...	...
1840	...	40.2	...	...	...	...	...	...	...	...	59.71	...	...	...	...	...
1841	...	40.3	...	...	...	...	...	...	...	...	59.03	...	...	...	...	...
1842	...	...	...	...	...	...	...	...	...	...	59.93	...	...	...	...	...
1843	...	...	...	...	...	...	...	...	...	...	57.77	...	...	...	...	...
1844	...	...	...	...	...	...	...	...	...	...	59.06	...	...	...	...	...
1845	...	...	...	...	...	...	...	...	...	...	59.76	...	...	...	...	...
1846	...	...	...	...	...	...	...	...	...	...	60.51	...	...	...	...	...
1847	...	...	...	...	...	...	...	...	...	...	58.19	...	...	...	...	...
1848	...	...	...	...	...	...	...	...	...	...	58.83	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	...	57.82	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	58.92	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	58.84	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	58.48	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	59.36	...	...	...	...	...
1854	...	...	...	...	56.06	...	...	...	...	61.02	61.24	...	...	...	...	...
1855	...	...	...	...	53.68	...	...	...	...	59.93*	59.58*	...	...	...	...	...
1856	...	...	...	...	52.45	...	51.37*	...	...	57.43	57.17	52.78	...	...	...	...
1857	43.35	...	...	...	54.18	...	50.43	...	...	58.07	57.68	...	...	...	...	...
1858	...	...	...	...	...	...	...	...	...	59.73	59.53	...	...	...	...	...
1859	...	...	...	...	...	...	...	...	...	59.83	59.97*	...	...	...	55.69*	...
1860	...	...	...	...	...	...	...	...	...	59.39*	59.70	...	...	...	...	...
1861	...	...	...	...	...	...	...	...	...	...	60.89	...	...	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	59.71	...	...	...	...	...
1863	...	...	...	...	54.86*	...	...	...	...	...	58.26	...	...	...	...	...
1864	...	...	...	...	...	...	...	...	...	...	58.30	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	59.55	...	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	56.56*	...	...	57.56	...	55.77	...	...	...
1868	...	...	...	39.01*	...	...	...	...	58.05	...	57.21	...	55.00*	...	...	...
1869	...	...	...	40.16	...	...	...	...	59.40	...	57.24	...	...	57.66	...	55.64
1870	...	...	...	42.86	...	...	...	...	60.27*	...	58.64	...	...	58.98	...	55.32
	42.90	39.68	44.92	40.65	54.45	59.21	50.45	56.02	59.41	59.49	59.11	52.78	55.30[1]	58.32	56.17	55.27

[1] Hours of observation unknown.

VIRGINIA.—Continued.

Year.	Lynchburg, near.	Meadow Dale.	Mechanicsville.	Montrose.	Mossy Creek.	Mt. Solon.	Mt. View.	Mulberry Hill.	Norfolk.	Peachlawn.	Piedmont, near.	Portsmouth.	Powhatan Hill.	Prospect Hill.	Richmond.	Rougemont.
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1822	...	...	...	...	...	...	...	...	63.05	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	...	57.43	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	58.09	...
1854	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	...	...	...	...	...	...	...	...	58.96*	...	...	...	54.88
1857	...	46.41	...	...	49.35*	...	...	...	...	...	...	56.87	...	...	...	54.85
1858	...	48.83	...	55.59*	...	...	...	...	...	55.86	...	58.87	...	...	...	56.97*
1859	...	...	...	54.19*	...	...	55.54*	...	...	56.52	...	58.32	...	...	...	56.90
1860	...	...	...	...	...	...	55.58*	...	...	55.83	...	58.29	...	...	...	...
1861	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1862	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	...	...	...	...	...	...	...	...	60.42*	...	...	...	...
1866	...	...	...	...	...	...	...	...	...	...	...	60.09	...	...	...	...
1867	58.80*	...	...	...	...	...	...	...	...	...	...	59.48	...	...	...	...
1868	56.51*	...	...	...	...	54.72*	...	...	...	...	...	...	55.15*	55.62*	...	...
1869	57.67*	...	...	...	...	...	...	58.32*	...	...	...	57.57*	56.27	56.01	...	...
1870	58.42	...	53.22	...	...	...	...	...	...	...	53.85	...	57.59	57.51	...	...
	57.18	47.74	53.27	54.31	50.05	56.22	55.29	58.48	63.05	56.08	53.68	59.24	56.61	56.66	56.91	56.18

	VIRGINIA.—Continued.								WASHINGTON TERRITORY.							
Year.	Ruthven.	Smithfield.	Snowville.	Staunton.	Vienna, near.	Westwood.	Wytheville, near.	Winchester.	Camp Simiahmoo.	Camp Steele.	Cape Disappointment.	Fort Bellingham.	Fort Cascades.	Fort Colville.	Fort Simcoe.	Fort Steilacoom.
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	49.59
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.65
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.58
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.68
1854	...	...	...	...	...	...	...	55.42*	...	...	...	...	...	...	...	50.69
1855	...	56.96	...	...	...	...	...	53.59*	...	...	...	...	...	...	...	51.26*
1856	...	54.22	...	...	...	...	...	51.86*	...	...	...	...	...	...	...	51.30
1857	54.62*	55.78	...	...	...	...	...	51.54*	...	...	...	51.68*	...	...	50.70*	49.47
1858	...	57.29	...	...	...	...	...	54.22*	47.8	...	...	49.39	...	...	53.11	49.08
1859	...	56.66	...	...	...	57.31	...	53.94*	48.6	...	...	...	49.27	...	...	47.88
1860	...	56.20	...	...	...	...	...	...	...	50.84*	...	...	52.06	44.81	...	51.82
1861	...	...	...	...	...	...	...	...	...	48.98	...	...	...	43.72	...	51.91*
1862	...	...	...	...	...	...	...	...	...	48.02	...	...	...	41.64	...	48.13
1863	...	...	...	...	...	...	...	...	...	50.11*	...	...	...	44.16	...	51.10
1864	...	...	...	...	...	...	...	...	...	49.58	...	...	...	...	...	51.44
1865	...	...	...	...	...	...	...	...	...	...	52.02*	...	...	...	...	49.82*
1866	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1867	...	...	...	...	...	...	...	...	...	49.36	51.30	...	...	43.98	...	50.21*
1868	...	...	50.05	...	...	...	50.72*	...	...	49.61	51.50	...	...	44.52	...	...
1869	...	...	50.18	53.53	...	...	51.29	...	...	51.96	...	...	...	46.49	...	...
1870	...	...	...	53.79*	54.79	...	52.12	...	...	50.56	...	...	...	45.96	...	...
	55.89	56.33	50.74	53.79	54.93	57.54	52.11	53.65	48.55	49.78	52.35	50.11	51.08	44.55	50.90	50.40

	WASHINGTON TER.—Cont'd.					WEST VIRGINIA.										
Year.	Fort Vancouver.	Fort Vancouver.	Fort Walla-Walla.	Nee-ah Bay.	Tatoosh Isl'd Light-house.	Ashland.	Ashland.	Buffalo.	Crack Whip.	Cross Creek.	Grafton.	Kanawah.	Kanawah.	Lewisburg.	Poplar Grove.	Romney.
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1829	...	...	...	...	...	...	...	...	...	...	...	53.2	...	...	...	...
1830	...	...	...	...	...	...	...	...	...	...	...	55.7	...	...	...	...
1831	...	...	...	...	...	...	...	...	...	...	...	52.0	...	...	...	...
1832	...	...	...	...	...	...	...	...	...	...	...	53.8*	...	...	...	...
1833	51.87*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	52.2	...	...	...	...
1840	...	...	...	...	...	...	...	...	...	...	...	53.7	...	...	...	...
1850	...	52.01	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1852	...	52.06*	...	...	...	...	...	54.29	...	...	...	...	...	...	...	...
1853	...	53.40	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	51.95*	...	...	...	57.65	...	...	...	...	...	...	...	54 96	...	...
1855	...	52.42*	...	...	...	54.10*	...	...	...	...	...	...	...	53.48	...	...
1856	...	52.12	...	...	...	...	...	...	46.88*	...	...	...	51.96	50.17	...	...
1857	...	53.19*	53.56*	...	...	50.88*	...	...	...	...	...	...	...	47.53	52.62*	...
1858	...	51.86	52.60	...	...	...	...	...	...	...	...	...	...	51.90*	55.52	...
1859	...	50.32	53.20	...	...	...	...	...	...	49.15	...	...	...	53.42	54.78	...
1860	...	52.61	53.78	...	...	...	...	...	...	...	...	...	...	50.64	54.85*	...
1861	...	51.93	54.17	...	...	...	...	...	...	...	...	...	...	...	...	...
1862	...	48.51	49.24*	...	...	...	...	...	...	...	...	...	...	...	...	...
1863	...	52.92	54.40*	...	...	...	...	...	...	...	...	...	...	...	...	...
1864	...	52.71	54.89	47.32*	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	51.19*	53.30*	45.96*	...	...	55.14*	...	...	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	53.57*	...	...	...	...	...	...	...	...	...
1867	...	51.40	...	...	...	...	55.06	...	...	...	55.04*	...	...	...	...	...
1868	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	51.57*
1869	...	...	...	...	51.07*	...	52.82	...	...	...	...	...	...	...	...	...
1870	...	...	...	...	51.19	...	...	...	...	...	...	...	...	...	...	...
	51.87	51.83	53.22	47.64	51.13	53.83	54.18	54.29	47.50	49.49	54.99	53.65	52.50	51.81	54.31	51.95

W. V.—Continued.		WISCONSIN.														
Year.	Wirt Court House.	Appleton.	Baraboo.	Bay City.	Bayfield.	Bellefontaine.	Beloit College.	Bloomfield.	Dartford.	Delafield.	Delavan.	Edgerton.	Embarrass.	Fort Crawford.	Fort Howard.	Fort Winnebago.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1822	...	...	...	...	...	...	...	...	...	...	...	...	...	45.09	43.64	...
1823	...	...	...	...	...	...	...	...	...	...	...	...	...	...	41.97	...
1824	...	...	...	...	...	...	...	...	...	...	...	...	...	46.27	43.96	...
1825	...	...	...	...	...	...	...	...	...	...	...	...	...	...	46.32	...
1826	...	...	...	...	...	...	...	...	...	...	...	...	...	...	44.72	...
1827	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.19	...
1828	...	...	...	...	...	...	...	...	...	...	...	...	...	...	45.40	...
1829	...	...	...	...	...	...	...	...	...	...	...	...	...	...	42.98	47.08
1830	...	...	...	...	...	...	...	...	...	...	...	...	...	51.42	46.36	52.05
1831	...	...	...	...	...	...	...	...	...	...	...	...	...	44.89	41.22	46.34
1832	...	...	...	...	...	...	...	...	...	...	...	...	...	45.58	44.31*	49.91
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	51.43	46.28	...
1834	...	...	...	...	...	...	...	...	...	...	...	...	...	47.78	46.48	...
1835	...	...	...	...	...	...	...	...	...	...	...	...	...	45.65	43.55	41.30
1836	...	...	...	...	...	...	...	...	...	...	...	...	...	44.32	42.38	39.73
1837	...	...	...	...	...	...	...	...	...	...	...	...	...	45.55	43.14	41.13
1838	...	...	...	...	...	...	...	...	...	...	...	...	...	45.75	42.17	40.16
1839	...	...	...	...	...	...	...	...	...	...	...	...	...	50.80	45.68	43.89
1840	...	...	...	...	...	...	...	...	...	...	...	...	...	48.03	44.42	42.26
1841	...	...	...	...	...	...	...	...	...	...	...	...	...	47.61	...	41.96
1842	...	...	...	...	...	...	...	...	...	...	...	...	...	48.07	...	43.23
1843	...	...	...	...	...	...	...	...	...	...	...	...	...	43.06	...	41.84
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	47.71	...	45.58*
1845	...	...	...	...	...	...	...	...	...	46.92	...	...	...	...	...	...
1846	...	...	...	...	...	...	...	...	...	48.99	...	...	...	...	...	...
1847	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	...	...	...	44.71	...	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	44.61	...	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	45.51	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	44.70	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	44.24	...	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	...	...	47.22*	48.85	...	...	...	...	...	...	...	...	...
1855	...	...	...	...	...	...	45.48	...	...	...	...	...	...	...	...	...
1856	...	42.24	...	...	...	...	45.10	...	...	...	...	...	...	...	...	...
1857	49.02	42.17	...	36.25	...	...	43.70	...	...	...	...	...	40.69	...	...	...
1858	53.09	45.45	...	38.54	...	...	47.35	...	...	...	...	...	...	...	...	...
1859	...	44.18	...	35.21	...	...	46.58	...	...	...	...	...	...	...	...	...
1860	...	44.40	...	36.64*	...	...	46.15	...	...	...	...	...	...	...	...	...
1861	...	44.00	...	36.38*	...	...	46.68*	...	46.26*	45.03	...	...	...	...	...	...
1862	...	...	...	33.62	...	...	46.74	...	...	43.27*	...	...	...	...	...	...
1863	...	...	...	...	...	...	46.76*	...	...	...	...	...	...	...	...	...
1864	...	...	...	...	...	...	45.15	44.34*	...	...	...	...	42.97	...	...	...
1865	...	...	47.86	...	...	...	46.07	45.18*	...	...	45.29	...	44.40*	...	...	...
1866	...	...	46.61	...	...	...	44.50	...	...	...	43.73*	...	41.90	...	...	...
1867	...	...	46.87*	...	...	...	...	...	...	...	44.31	...	41.62	...	...	...
1868	...	...	...	...	38.33*	...	...	44.79*	...	...	...	44.08	41.95	...	...	...
1869	...	44.45*	43.13	...	38.82*	...	...	43.73*	...	...	...	44.85	41.71	...	...	...
1870	...	...	47.97	...	41.50	...	...	47.28	...	...	...	50.28	44.90	...	...	...
	51.21	44.20	46.20	37.13	39.73	47.22	46.39	45.16	45.25	45.27	44.14	46.78	42.67	47.32	44.12	44.46

WISCONSIN.—Continued.

Year.	Green Bay.	Green Lake.	Holland.	Janesville.	Kenosha.	Lowell.	Madison.	Manitowoc.	Milwaukee.	Mosinee.	New Danemore.	New Lisbon.	Norway.	Parfreyville.	Platteville.	Plymouth.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1844	...	...	...	...	...	...	...	...	47.65	...	...	...	...	...	...	...
1845	...	...	...	...	...	...	...	...	49.21	...	...	...	...	...	...	...
1846	...	...	...	...	...	...	...	...	51.01	...	...	...	...	...	...	...
1847	...	...	...	...	...	...	...	...	46.44	...	...	...	...	...	...	...
1848	...	...	...	...	...	...	...	...	47.41	...	...	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	44.65*	...	...	...	...	...	...	...
1850	...	45.63	...	...	...	...	...	...	46.86	...	...	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	47.03	...	...	...	...	...	...	...
1852	...	...	...	...	...	...	...	45.19	45.84	...	...	...	...	...	...	...
1853	...	...	...	45.83	...	...	45.77	45.80	...	...	...	...	...	...	...	...
1854	...	...	...	47.19	...	...	46.80*	46.25	47.45*	...	...	...	...	...	48.48	...
1855	...	...	...	44.96	...	...	...	44.32	43.34	...	...	...	...	...	47.74	...
1856	...	...	...	42.95	43.15	...	...	42.23	42.00	...	...	...	43.77*	...	45.00	...
1857	...	...	...	44.66	43.74	42.93	43.16	43.01	42.13	...	...	...	...	...	44.83	...
1858	...	...	...	47.27*	46.93	...	45.97*	45.83	45.84	...	43.94*	...	...	...	48.29	...
1859	...	...	...	...	46.67	...	...	44.56	45.76	...	...	...	...	...	46.28	...
1860	...	...	...	47.04	...	...	...	45.11	46.12	...	...	...	...	...	...	...
1861	...	...	...	46.11*	46.84	...	44.47*	44.79	46.06	...	...	...	...	46.05*	...	...
1862	...	...	...	...	46.25	...	...	44.46	45.38	...	...	...	...	...	...	...
1863	...	...	...	...	...	...	...	44.93	46.28	...	...	...	...	...	...	...
1864	42.85	...	...	...	...	...	...	44.11	44.62	...	...	...	...	...	...	...
1865	43.61*	...	...	...	...	...	...	45.17	45.67	...	...	...	...	...	...	...
1866	...	...	...	...	...	...	...	42.97	43.80	...	...	...	...	...	...	42.13
1867	...	...	...	...	...	...	...	44.10	45.34	...	...	...	...	...	...	43.82
1868	...	...	...	...	...	...	...	43.15	43.90	...	...	...	...	...	...	41.89
1869	...	...	43.00	...	...	...	43.23*	42.96	44.16	...	...	43.70	...	...	...	42.24
1870	...	...	46.97*	...	...	...	47.31	46.65	47.29	42.03	...	...	...	...	...	...
	43.65	45.16	44.20	45.66	45.64	42.93[1]	45.40	44.48	45.75	42.33	43.06	44.85	44.33	45.91	46.81	42.71

	WISCONSIN.—Continued								WYOMING.							
Year.	Racine.	Rocky Run.	Sturgeon Bay.	Superior.	Waukesha.	Waupaca.	Wausau.	Weyauwega.	Fort Bridger.	Fort D. A. Russell.	Fort Fetterman.	Fort F. Steele.	Fort Halleck.	Fort Laramie.	Fort P. Kearney.	Fort Sanders.
1850	...	...	...	...	...	...	...	...	...	...	...	...	...	49.69	...	...
1851	...	...	...	...	...	...	...	...	...	...	...	...	...	50.64	...	...
1852	...	...	...	...	...	...	...	...	...	...	...	...	...	46.97	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	50.00	...	...
1854	...	...	...	...	...	...	...	...	...	...	...	...	...	52.76	...	...
1855	...	...	...	...	...	...	...	...	...	...	...	...	...	50.83	...	...
1856	41.98*	...	...	38.07	43.26*	...	...	...	...	...	...	...	...	48.78	...	...
1857	...	...	...	...	43.98*	...	...	...	...	...	...	...	...	48.90	...	...
1858	...	...	...	...	47.44*	...	...	...	...	...	...	...	...	48.08	...	...
1859	...	...	...	...	...	...	42.69	...	38.81*	...	...	...	...	48.90	...	...
1860	...	45.45*	...	38.74	...	...	...	...	41.35	...	...	...	...	49.31	...	...
1861	...	45.09	...	38.13	...	...	...	...	...	...	...	...	...	50.44*	...	...
1862	...	44.47	...	37.16	...	...	...	42.20	...	...	...	...	...	49.31	...	...
1863	...	45.76*	...	38.71	...	...	...	45.56*	41.78	...	...	...	43.12	50.02	...	...
1864	...	44.89	...	38.39	...	45.68	...	...	41.30	...	...	...	...	50.59	...	...
1865	...	45.71	...	38.89	...	46.92	...	...	38.86	...	...	...	40.81*	...	...	...
1866	...	43.66*	...	36.99	...	44.63	...	...	42.44*	...	...	...	...	...	...	...
1867	...	44.80	...	37.09	...	44.59	...	...	40.92	...	...	...	...	...	42.90	...
1868	...	43.57*	...	...	...	44.30	...	...	39.42	...	...	...	...	...	...	40.94*
1869	...	43.72*	...	...	...	44.04	...	...	41.48*	...	43.47*	42.38	...	44.43	...	41.26
1870	...	47.46	45.20*	...	...	47.47*	...	...	41.63	42.88	44.34*	44.66	...	47.46	...	41.70
	43.83	44.96	45.20	37.74	45.28	45.31	42.90	44.27	40.86	42.94	43.77	43.52	42.20	49.15	45.92	41.47

[1] Hours of observation unknown.

	Mexico.					Costa Rica.		Guatemala.	British Honduras.	Bahama Islands.	Bermuda Islands.		Caribbean Islands.			
Year.	Cordova.	Mazatlan.	Mexico.	Mirador.	Vera Cruz.	Heredia.	San José.	Guatemala.	Belize.	Nassau.	Bermuda.	St. George.	Antigua.	Barbadoes.	St. Thomas.	Sombrero Island.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1833	...	...	...	...	...	...	...	...	...	...	...	...	...	...	81.82	...
1834	...	...	...	...	...	...	...	...	...	...	...	...	79.38*	...	...	...
1836	...	...	...	...	...	...	...	...	...	...	...	...	79.68	...	...	...
1841	...	...	...	...	...	...	...	...	...	78.25	...	...	...	...	...	...
1844	...	...	...	...	...	...	...	...	...	...	...	...	...	80.93	...	...
1848	...	...	...	...	...	...	...	...	...	...	68.24	...	...	...	...	...
1849	...	...	...	...	...	...	...	...	...	...	68.50*	...	...	...	...	...
1850	...	...	...	...	...	...	...	...	...	...	68.87	...	...	...	...	...
1851	...	...	...	...	...	...	...	...	...	...	69.28	...	...	...	...	...
1852	...	...	...	...	...	...	...	...	...	...	68.27	...	...	...	...	...
1853	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1854	...	...	...	67.19	...	...	...	...	...	...	...	...	...	...	...	...
1855	...	...	...	65.81	...	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	61.00*	...	...	...	...	...	...	...	...	...	...	...	...	...
1857	...	...	...	...	...	...	...	64.89	...	...	...	69.04*	...	...	...	...
1858	68.76	...	...	67.83	78.16	...	...	65.57	...	...	...	...	...	...	...	...
1859	69.50	...	...	68.18	...	...	...	65.57	...	...	...	...	...	...	...	...
1860	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1861	68.89	...	...	66.77	...	...	...	...	...	...	...	...	...	...	...	...
1862	69.96	...	...	67.25	...	...	67.30*	...	...	...	...	...	...	...	...	...
1863	68.54	...	...	66.38	...	...	...	...	79.90	...	...	...	...	...	...	78.62*
1864	68.61	...	...	66.75	...	...	...	...	...	...	...	...	...	...	...	...
1865	...	...	...	67.43	...	...	68.86	...	...	...	...	...	...	...	...	...
1866	...	...	...	67.56	...	...	67.92	...	...	...	...	...	...	...	...	...
1867	...	...	...	68.30	...	...	...	...	...	...	...	...	...	...	...	...
1868	...	79.43	...	67.22	...	69.59	...	...	...	...	...	...	...	...	...	...
1869	...	...	...	67.65	...	...	...	...	...	...	...	...	...	...	...	...
1870	...	...	...	66.30	...	...	...	...	...	...	...	...	...	...	...	...
	69.04	79.43	61.10	67.19	77.72	69.59	69.28	66.26	79.90	79.59	69.46	69.10	79.53[1]	80.93	81.82	78.74

[1] Hours of observation unknown.

	Cuba.			Jamaica.	Hayti.	Dutch Guiana.		New Granada.	Venezuela.	Brazil.	
Year.	Havana.	Havana.	Havana.	Kingston.	Tivoli.	Catharina Sophia.	Rustenburg.	Aspinwall.	Colonia Tovar.	Pernambuco.	Rio de Janeiro.
	°	°	°	°	°	°	°	°	°	°	°
1779	...	...	...	...	73.72	...	...	...	...	...	...
1794	81.80	...	...	...	...	...	...	...	...	...	...
1832	...	...	...	78.77	...	...	...	...	...	...	75.89
1833	...	...	...	...	...	...	...	...	...	...	78.11
1834	...	...	...	...	...	...	...	...	...	...	76.11
1835	...	...	...	...	...	...	...	...	...	...	75.35
1836	...	...	...	...	...	...	...	...	...	...	75.51
1837	...	...	...	...	...	...	...	...	...	...	74.15
1838	...	...	...	...	...	...	...	...	...	...	75.40
1839	...	...	...	...	...	...	...	...	...	...	74.68
1840	...	...	...	...	...	...	...	...	...	...	76.41
1841	...	...	...	...	...	...	...	...	...	...	75.66
1842	...	79.69	...	...	...	...	...	...	...	78.95	76.49
1843	...	...	...	...	...	...	...	...	...	...	76.19
1854	...	...	...	...	...	...	...	...	62.40*	...	...
1855	...	...	...	...	...	...	...	...	...	...	...
1856	...	...	...	...	...	80.33*	...	...	...	...	...
1857	...	...	...	...	...	80.31*	...	...	...	...	...
1858	...	...	...	...	...	79.49	...	...	...	...	...
1859	...	...	77.96	...	...	79.64	...	...	...	...	...
1860	...	...	78.42*	...	...	...	...	...	...	...	...
1861	...	...	77.88*	...	...	...	...	...	...	...	...
1862	...	...	78.03	...	...	...	78.75	...	...	...	...
1863	...	...	77.72*	...	...	...	77.52*	77.69*	...	...	...
1864	...	...	78.24*	...	...	...	...	78.54*	...	...	...
1865	...	...	78.72	...	...	...	...	79.39	...	...	...
1866	...	...	78.53	...	...	...	...	78.93	...	...	...
1867	...	...	79.37	...	...	...	...	78.47*	...	...	...
1868	...	...	78.83	...	...	...	...	80.22*	...	...	...
1869	...	...	79.35	...	...	...	...	...	...	...	...
1870	...	...	78.30*	...	...	...	...	...	...	...	...
	81.80[1]	79.36	78.44	78.77[1]	73.72[1]	79.88	77.77	78.66	61.44	78.95[1]	75.83

[1] Hours of observation unknown.

Investigation of the Secular Variation.—The following discussion, which is based upon the preceding tabular numbers,[1] will be limited to the examination of the secular variations of the temperature for places within the United States or for adjacent stations. To ascertain in general the character of these variations a number of stations were selected possessing the requisite length of series or from which, by proper combination from several stations at no great distance apart, such a series could be produced having as few interruptions as possible. These separate or combined series were plotted (see accompanying illustration); this could be done either by plotting directly the annual means, as in the case of New Haven (see isolated dots), or by smooth curves, as shown for all the stations which resulted from the application of the process of successive means (to the 4th order) which has been explained before. This process, while it preserves all the characteristic features of any systematic progression of temperature during a succession of years, also relieves us in a great degree from the embarrassing presence of the accidental and minor irregularities. The 4th order of means was found quite sufficient; the 8th is given for New Haven.

Further, the process of combination of the results from several adjacent stations, either for the purpose of producing a more extended series, or for filling up gaps, must be such as to preserve exactly any feature or features *common* to all the stations, whether of a progressive or a periodic character as might be produced by a disturbing influence of a general or cosmical nature. This will be done by the method of differences, as will be explained further on. If we examine any of the numerical and graphical results, for instance those for New Haven, we recognize in the first place certain apparently altogether irregular fluctuations in the annual means, their influence will be greatly reduced or destroyed by successive means and by combination of series (since they are equally liable to + and — deviations, which will tend to cancel themselves); in the second place, we notice certain systematic changes or undulations of irregular epochs and extent which will be subjected to further study with respect to their character and geographical distribution. If all the series, proposed for combination to a normal series, were of equal extent and complete, the simple mean for each year would be all that is needed, but for indirectly connected, overlapping, or defective series, the combination is more laborious, as we must take account of all possible differences or combinations,[2] which can only be done by application of the method of least squares. After the series have all been rendered homogeneous, by application to each of the corrections indicated with consideration of all possible combinations and their weights, the means for each year can be taken as before. A full example of the method is given below,[3] and the same is intended to show also the amount of local variation in the annual means after they have been reduced to a uniform series.

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[1] The tables contain altogether about 1210 stations with an aggregate of about 8500 annual means. The general tables are estimated to represent nearly $11\frac{1}{2}$ millions of individual observations.

[2] The number of combinations of n elements by *twos* is expressed by $\frac{n(n-1)}{2}$.

[3] Suppose it be proposed to combine to a uniform system the results of the mean annual temperature of the 49-year series at Brunswick, the 37-year series at Portland, the 31-year series at Gardiner, the 40-year series at Castine, and the 14-year series at Cornish, all in the State of Maine, for which

The series of annual means thus obtained, after undergoing the process of successive means, are given in the following table. A combination series is indicated

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see preceding tables. Designating these series in the order named by $A\ B\ C\ D\ E$, we proceed to find the differences $A-B$ from each year from the 33 years common to the two series; this gives the mean value $A-B=+0^\circ.8$ with the weight 33; in like manner we form the other differences designated by $V_1\ V_2\ V_3\ .\ .\ .$ subject to the small corrections $v_1\ v_2\ v_3\ .\ .\ .$ as follows.

V_1	$A-B=+0.8$	$+v_1$	weight 33
V_2	$A-C=-0.1$	$+v_2$	17
V_3	$A-D=+0.3$	$+v_3$	36
V_4	$A-E=+0.4$	$+v_4$	3
V_5	$B-C=-0.1$	$+v_5$	20
V_6	$B-D=-1.6$	$+v_6$	30
V_7	$B-E=+1.4$	$+v_7$	3
V_8	$C-D=-0.8$	$+v_8$	13
V_9	$C-E=+0.3$	$+v_9$	13
	($D-E$ does not exist.)		

By means of the relation $V_2-V_1-V_5=0$ and similarly in the other four cases we establish the conditional equations:—

$$\begin{cases} 0=-0.8-v_1+v_2-v_5 \\ 0=+0.5-v_1+v_3-v_6 \\ 0=-1.8-v_1+v_4-v_7 \\ 0=+1.2-v_2+v_3-v_8 \\ 0=+0.2-v_2+v_4-v_9 \end{cases}$$

whence the equations of correlatives and the normal equations—

	$\frac{100}{p}$	C_1	C_2	C_3	C_4	C_5
v_1	9	—1	—1	—1		
v_2	18	+1			—1	—1
v_3	8		+1		+1	
v_4	100			+1		+1
v_5	15	—1				
v_6	10		—1			
v_7	100			—1		
v_8	23				—1	
v_9	23					—1

	C_1	C_2	C_3	C_4	C_5
$0=-0.8$	+42	+ 9	+ 9	—18	— 18
$0=+0.5$	+ 9	+27	+ 9	+ 8	
$0=-1.8$	+ 9	+ 9	+209		+100
$0=+1.2$	—18	+ 8		+49	+ 18
$0=+0.2$	—18		+100	+18	+141

hence:

$C_1=+0.0127$	$v_1=+0.02$	$A-B=+0^\circ.8$
$C_2=-0.0228$	$v_2=+0.60$	$A-C=+0.5$
$C_3=+0.0123$	$v_3=-0.29$	$A-D=\ 0.0$
$C_4=-0.0136$	$v_4=+0.55$	$A-E=+1.0$
$C_5=-0.0098$		

and applying these differences to the respective series—the Brunswick series remaining unchanged—they become as follows:—

Year.	Brunswick. A	Portland. B	Gardiner. C	Castine. D	Cornish. E	Brunswick. (C. V.)	Successive means, 4th order.
	°					°	
1807	43.7	...	...	...	...	43.7	...
1808	43.4	...	...	...	...	43.4	(43.1)
1809	42.1	...	...	...	...	42.1	43.1
1810	43.6	...	...	43.1	...	43.3	43.2
1811	44.7	...	...	44.9	...	44.8	43.2
1812	40.9	...	...	41.5	...	41.2	43.0
1813	43.2	...	...	43.6	...	43.4	43.0
1814	43.3	...	...	44.0	...	43.6	43.0
1815	42.9	...	...	42.4	...	42.7	42.7
1816	42.1	...	...	41.9	...	42.0	42.4
1817	41.6	...	...	42.0	...	41.8	42.7
1818	44 8	...	...	42.8	...	43.8	43.5
1819	45.5	...	...	44.7	...	45.1	44.1
1820	44.0	43.8	...	43.5	...	43.8	44.0
1821	43.9	43.5	...	42.8	...	43.4	43.7
1822	43.1	44.4	...	44.5	...	44.0	43.5
1823	41.0	42.4	...	43.0	...	42.1	43.5
1824	43.9	44.0	...	45.0	...	44.3	44.2
1825	45.7	46.0	...	46.3	...	46.0	45.2
1826	45.5	45.8	...	46.6	...	46.0	45.4
1827	43.9	44.0	...	44.0	...	44.0	45.4
1828	46.9	46.2	...	47.5	...	46.9	45.5

Year.	Brunswick. A	Portland. B	Gardiner. C	Castine. D	Cornish. E	Brunswick. (C. V.)	Successive means, 4th order.
	°					°	
1829	46.2	44.0	...	44.5	...	44.9	45.6
1830	47.5	45.3	...	44.6	...	45.8	45.5
1831	47.7	45.0	...	45.0	...	45.9	45.0
1832	45.2	42.8	...	42.1	...	43.4	44.2
1833	45.6	43.0	...	42.0	...	43.5	43.7
1834	45.4	43.5	...	43.0	...	44.0	43.4
1835	44.4	42.7	...	42.6	...	43.2	42.9
1836	43.0	41.0	...	40.9	...	41.6	42.2
1837	...	41.0	41.5	41.2	...	41.2	42.1
1838	...	42.8	43.2	43.1	...	43.0	42.8
1839	...	43.9	44.6	43.4	...	44.0	43.7
1840	...	44.0	45.5	43.6	...	44.4	44.3
1841	46.6	43.9	46.0	43.9	...	45.1	44.5
1842	45.8	43.9	44.4	44.1	...	44.5	44.2
1843	43.9	42.9	43.1	43.7	...	43.4	43.5
1844	42.3	43.5	41.0	42.9	...	42.4	43.3
1845	43.3	44.1	42.2	45.2	...	43.7	43.8
1846	44.0	45.2	45.0	48.4	...	45.6	44.4
1847	43.1	43.9	44.8	45.0	...	44.2	44.5
1848	43.7	45.4	44.3	45.0	...	44.6	44.3
1849	43.0	44.4	43.9	44.0	...	43.8	44.2
1850	43.4	45.2	44.7		...	44.4	44.1

Year.	Brunswick. A	Portland. B	Gardiner. C	Castine. D	Cornish. E	Brunswick. (C. V.)	Successive means, 4th order.
	°					°	
1851	42.6	43.9	44.5	...	...	43.7	44.1
1852	43.9	44.5	45.2	...	...	44.5	44.1
1853	44.5	...	...	...	...	44.5	43.9
1854	42.7	...	...	...	...	42.7	43.8
1855	42.9	...	45.7	...	...	44.3	43.8
1856	41.8	45.1	44.0	...	...	43.6	43.8
1857	43.6	45.1	44.9	...	43.1	44.2	43.7
1858	43.8	44.3	42.9	...	43.1	43.5	43.5
1859	40.3	43.8	41.8	...	43.4	42.3	43.4
1860	...	...	...	...	44.8	44.8	43.6
1861	...	...	43.6	...	43.6	43.6	43.7
1862	...	...	43.4	...	43.4	43.4	43.7
1863	...	...	43.6	...	44.2	43.9	44.0
1864	...	...	45.1	...	44.3	44.7	44.5
1865	...	...	45.0	...	46.0	45.5	44.8
1866	...	...	44.1	...	45.0	44.5	44.4
1867	...	...	43.0	...	43.5	43.3	43.8
1868	...	...	42.9	...	43.0	43.0	43.5
1869	...	...	45.3	...	45.1	45.2	(45.1)
1870	...	...	46.6	...	47 5	47.0	...

by having the letter *C* and a Roman numeral expressing the number of individual series attached to the name of the principal station. These combinations are as follows:—

Brunswick, Me.	Brunswick	49 years.		
	Portland	37 "	Constant Reduction	+0°.8
	Gardiner	31 "	" "	+0.5
	Castine	40 "	" "	0.0
	Cornish	14 "	" "	+1.0
Salem, Mass.	Salem	43 years.		
	New Bedford	58 "	Constant Reduction	—0°.5
	Cambridge	50 "		+0.4
	Boston	32 "		—1.1
	Fort Independence	25 "		—0.7
	Providence	34 "		—0.6
Montreal, Can.	Montreal	27 years.		
	Second series	5 "	Constant Reduction	—0°.3
	Third "	9 "		+0.7
	Fourth "	5 "		+0.9
	Fifth "	6 "		—1.1
	Sixth "	4 "		+1.2
	St. Martin	10 "		+0.6
New Haven, Conn.	New Haven	85 years.		
Toronto, Can.	Toronto	31 years.		
New York, N. Y.	Flatbush	39 years.		
	Fort Columbus	48 "	Constant Reduction	—0°.6
	Fort Hamilton	26 "		—0.3
	New York	21 "		—0.7
Philadelphia, Penn.	Philadelphia, series Nos. 80, 81, 83 of general table	30 years.		
	Philadelphia, series No. 82 of gen'l table	20 "	Constant Reduction	—5°.8
	Philadelphia, series No. 87 of gen'l table	40 "	" "	+0.5
	Morrisville, series No. 65 of general table to 1847	57 "	" "	+0.1
	Morrisville, series No. 65 of general table, 1849 to 1870	11 "	" "	+3.3
	Germantown, series No. 40 of gen'l table	15 "	" "	+2.2
	West Chester, series No. 119 of gen'l table	16 "	" "	+3.0
Charleston, S. C.	Charleston	25 years.		
	Fort Moultrie	33 "	Constant Reduction	—0°.1
	St. Johns	15 "	" "	+2.7

Savannah, Ga.	Savannah . . . . 25 years.		
	Augusta Arsenal . . 22 "	Constant Reduction	+2°.3
	Augusta . . . . 6 "	" "	+2.7
	Oglethorpe Barracks 12 "	" "	—0.9
Fort Brooke, Fla .	Fort Brooke . . . 27 years.		
Cincinnati, Ohio .	Cincinnati . . . 45 years.		
	Marietta . . . . 46 "	Constant Reduction	+2°.1
	College Hill . . . 47 "	" "	+2.3
	Portsmouth . . . 12 "	" "	—0.1
Fort Snelling, Minn.	Fort Snelling . . . 42 years.		
	St. Paul . . . . 8 "	Constant Reduction	+1°.9
Muscatine, Iowa .	Muscatine . . . . 26 years.		
	Fort Madison . . 22 "	Constant Reduction	—3°.4
St. Louis, Mo. . .	St. Louis . . . . 35 years.		
	Jefferson Barracks . 32 "	Constant Reduction	—0°.1
Ft. Leavenworth, Kan.	Fort Leavenworth . 40 years.		
	Leavenworth City . 5 "	Constant Reduction	+1°.6
Fort Gibson, Indian Territory . . .	Fort Gibson . . . 29 years.		
	Fort Towson . . . 16 "	Constant Reduction	—1°.2
	Fort Washita . . . 15 "	" "	—1.9
Fort Jesup, La. . .	Fort Jesup . . . 23 years.		
San Francisco, Cal.	Alcatraz Island . . 7 years.		
	Angel Island . . . 3 "	Constant Reduction	—1°.0
	Fort Point . . . 11 "	" "	+0.9
	Presidio . . . . 18 "	" "	+1.9
	San Francisco . . 11 "	" "	0.0

On the whole the constant reduction deduced by a rigorous method and applied to each separate series to refer to the central station, answered well enough, yet there were indications, when the several series were thus brought *side by side*, of deviations from constant reduction for some consecutive years, which imperfections may have been produced by a change of thermometer, a change in the location of the instrument, or a change of observing hours; in the latter case, it would indicate an imperfect correction for daily variation.

Year.	Brunswick, Me.		Salem, Mass.		Montreal, Can.		New Haven, Con.		Toronto, Can.		New York. N. Y.		Philadelphia, Pa.	
	C. V.	4th or.	C. VI.	4th or.	C. VII.	4th or.	C. I.	8th or.	C. I.	4th or.	C. IV.	4th or.	C. VII.	4th or.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1750	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1751	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1752	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1753	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1754	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1755	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1756	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1757	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1758	...	...	...	...	...	...	...	...	...	...	...	...	53.6	- - -
1759	...	...	...	...	...	...	...	...	...	...	...	...	52.7	- - -
1760	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1761	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1762	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1763	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1764	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1765	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1766	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1767	...	...	...	...	...	...	...	...	...	...	...	...	53.3	- - -
1768	...	...	...	...	...	...	...	...	...	...	...	...	51.5	52.1
1769	...	...	...	...	...	...	...	...	...	...	...	...	51.8	52.0
1770	...	...	...	...	...	...	...	...	...	...	...	...	52.0	52.0
1771	...	...	...	...	...	...	...	...	...	...	...	...	51.8	52.2
1772	...	...	...	...	...	...	...	...	...	...	...	...	52.5	52.9
1773	...	...	...	...	...	...	...	...	...	...	...	...	54.7	53.5
1774	...	...	...	...	...	...	...	...	...	...	...	...	52.9	53.7
1775	...	...	...	...	...	...	...	...	...	...	...	...	54.4	53.6
1776	...	...	...	...	...	...	...	...	...	...	...	...	53.5	53.2
1777	...	...	...	...	...	...	...	...	...	...	...	...	51.0	- - -
1778	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1779	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1780	...	...	...	...	...	...	49.7	- - -	...	...	...	...	...	...
1781	...	...	50.2	- - -	...	...	50.4	49.9	...	...	...	...	...	...
1782	...	...	- - -	- - -	...	...	49.1	49.1	...	...	...	...	...	...
1783	...	...	50.4	- - -	...	...	48.4	48.5	...	...	...	...	...	...
1784	...	...	- - -	- - -	...	...	47.3	48.1	...	...	...	...	...	...
1785	...	...	- - -	- - -	...	...	47.7	48.0	...	...	...	...	...	...
1786	...	...	47.7	- - -	...	...	48.5	48.3	...	...	...	...	...	...
1787	...	...	47.0	47.1	...	...	48.5	48.7	...	...	...	...	...	...
1788	...	...	47.0	47.1	...	...	49.7	49.0	...	...	...	...	...	...
1789	...	...	46.8	47.3	...	...	49.5	49.2	...	...	...	...	...	...
1790	...	...	47.6	47.8	...	...	49.5	49.3	...	...	...	...	52.8	- - -
1791	...	...	49.0	48.4	...	...	49.5	49.3	...	...	...	...	53.7	53.0
1792	...	...	48.1	49.1	...	...	48.2	49.3	...	...	...	...	52.0	52.9
1793	...	...	50.6	49.8	...	...	50.3	49.3	...	...	...	...	54.4	52.6
1794	...	...	50.9	50.1	...	...	50.2	49.3	...	...	...	...	50.6	52.1
1795	...	...	49.7	49.4	...	...	- - -	49.1	...	...	...	...	51.9	51.9
1796	...	...	47.6	48.3	...	...	48.4	48.7	...	...	...	...	52.2	52.0
1797	...	...	47.3	47.8	...	...	48.1	48.6	...	...	...	...	51.7	52.3
1798	...	...	48.4	48.0	...	...	49.3	48.8	...	...	...	...	53.5	52.6
1799	...	...	47.9	48.3	...	...	48.4	49.2	...	...	...	...	52.4	52.7
1800	...	...	49.1	48.9	...	...	50.2	49.8	...	...	...	...	52.6	52.9
1801	...	...	49.6	49.4	...	...	51.0	50.3	...	...	...	...	52.9	53.2
1802	...	...	50.0	49.4	...	...	51.3	50.5	...	...	...	...	54.6	53.6
1803	...	...	49.2	49.0	...	...	50.8	50.5	...	...	...	...	53.2	53.4
1804	...	...	47.5	48.6	...	...	49.8	50.4	...	...	...	...	53.1	52.9
1805	...	...	49.9	48.4	...	...	51.7	50.3	...	...	...	...	52.1	52.3
1806	...	...	47.2	48.0	...	...	49.7	50.1	...	...	...	...	52.0	51.9
1807	43.7	- - -	47.2	47.7	...	...	49.2	49.9	...	...	...	...	50.6	51.8
1808	43.4	43.1	48.2	47.6	...	...	50.3	49.7	...	...	...	...	53.1	51.9
1809	42.1	43.1	46.8	47.7	...	...	49.3	49.6	...	...	...	...	51.6	52.0
1810	43.3	43.2	48.3	47.8	...	...	50.0	49.4	...	...	...	...	51.9	52.1
1811	44.8	43.2	49.2	47.5	...	...	49.7	49.1	...	...	...	...	53.0	52.1
1812	41.2	43.0	44.7	46.9	...	...	46.9	48.7	...	...	...	...	51.6	52.0
1813	43.4	43.0	47.4	46.8	...	...	49.0	48.3	...	...	...	...	51.8	51.9
1814	43.6	43.0	47.6	47.0	...	...	48.6	48.0	...	...	...	...	52.1	51.9
1815	42.7	42.7	46.8	46.8	...	...	47.3	47.5	...	...	...	...	52.2	51.7
1816	42.0	42.4	46.3	46.6	...	...	46.6	47.2	...	...	...	...	50.5	51.6
1817	41.8	42.7	46.2	46.8	...	...	46.5	47.1	...	...	...	...	52.2	51.8
1818	43.8	43.5	47.3	47.4	...	...	46.8	47.3	...	...	...	...	52.3	52.1
1819	45.1	44.1	49.4	48.0	...	...	49.0	47.7	...	...	...	...	52.5	52.3

Year.	Brunswick, Me. C. V.	Brunswick, Me. 4th or.	Salem, Mass. C. VI.	Salem, Mass. 4th or.	Montreal, Can. C. VII.	Montreal, Can. 4th or.	New Haven, Con. C. I.	New Haven, Con. 8th or.	Toronto, Can. C. I.	Toronto, Can. 4th or.	New York, N. Y. C. IV.	New York, N. Y. 4th or.	Philadelphia, Pa. C. VII.	Philadelphia, Pa. 4th or.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1820	43.8	44.0	47.6	47.9	...	...	47.9	48.0	...	...	...	...	52.2	52.4
1821	43.4	43.7	47.1	47.8	...	...	47.6	48.3	...	...	...	...	51.9	52.7
1822	44.0	43.5	48.9	47.7	...	...	49.7	48.6	...	...	53.2	- - -	54.3	53.3
1823	42.1	43.5	46.5	47.7	...	...	48.1	49.0	...	...	49.6	50.9	53.6	53.8
1824	44.3	44.2	48.3	48.2	...	...	49.9	49.4	...	...	51.1	51.5	53.6	54.1
1825	46.0	45.2	49.6	48.9	...	...	50.7	49.7	...	...	53.4	52.1	55.2	54.4
1826	46.0	45.4	49.7	49.1	45.9	- - -	49.7	49.8	...	...	52.5	52.2	54.8	54.5
1827	44.0	45.4	48.1	48.9	43.5	44.8	48.9	49.9	...	...	51.0	52.0	53.2	54.5
1828	46.9	45.5	49.5	48.7	46.1	45.2	51.8	49.8	...	...	53.1	51.9	56.8	54.3
1829	44.9	45.6	47.9	48.4	44.8	45.5	48.7	49.7	...	...	50.8	51.8	52.1	53.6
1830	45.8	45.5	48.3	48.2	46.6	45.6	50.8	49.5	...	...	52.9	51.7	53.2	52.7
1831	45.9	45.0	48.6	48.1	45.6	45.1	49.2	49.0	...	...	50.7	51.3	52.1	52.2
1832	43.4	44.2	47.4	47.9	43.5	44.2	47.7	48.5	...	...	50.8	50.8	51.4	52.0
1833	43.5	43.7	47.6	47.5	43.6	43.6	48.3	48.2	...	...	50.9	50.5	52.1	52.0
1834	44.0	43.4	47.7	47.0	43.8	42.9	48.9	47.7	...	...	50.4	49.9	52.9	51.8
1835	43.2	42.9	46.3	46.2	41.7	41.7	46.6	47.0	...	...	48.8	48.8	51.2	51.2
1836	41.6	42.2	44.6	45.6	39.6	40.8	45.2	46.6	...	...	46.7	48.1	49.3	50.7
1837	41.1	42.1	45.2	45.7	40.7	40.8	46.4	46.9	...	...	48.5	48.4	51.4	51.2
1838	43.0	42.8	46.7	46.5	41.1	41.7	48.2	47.6	...	...	49.7	49.4	52.5	52.1
1839	44.0	43.7	47.6	47.2	43.6	42.6	49.2	48.5	...	...	50.5	50.2	52.9	52.6
1840	44.4	44.3	47.9	47.5	43.2	43.0	49.0	49.0	43.6	- - -	50.5	50.6	53.0	52.3
1841	45.1	44.5	47.2	47.6	43.2	43.0	49.5	49.1	43.9	43.8	50.6	51.0	52.3	52.8
1842	44.5	44.2	47.9	47.5	42.7	42.8	49.9	49.1	40.0	43.6	51.9	51.2	53.5	52.8
1843	43.4	43.5	46.8	47.5	42.5	42.6	47.4	49.1	42.4	43.6	50.9	51.3	52.2	53.0
1844	42.4	43.3	47.7	47.8	42.2	42.8	50.2	49.4	44.5	44.1	51.1	51.5	53.4	53.4
1845	43.7	43.8	48.7	48.3	43.4	43.3	50.2	49.6	44.6	44.8	52.7	51.8	54.4	53.9
1846	45.6	44.4	48.9	48.6	44.8	43.6	50.1	49.6	46.4	45.0	51.5	51.8	54.2	54.1
1847	44.2	44.5	48.7	48.6	42.6	43.6	49.4	49.4	43.7	44.8	51.6	51.5	53.9	54.0
1848	44.6	44.3	48.8	48.4	44.2	43.5	49.2	49.1	45.1	44.6	51.4	51.0	54.0	54.0
1849	43.8	44.2	47.9	48.2	43.1	43.4	48.3	48.9	44.1	44.4	49.9	50.8	53.8	54.1
1850	44.4	44.1	48.0	48.1	43.8	43.3	48.8	48.8	44.5	44.3	51.1	51.0	54.8	54.2
1851	43.7	44.1	47.8	48.0	42.4	43.2	49.0	48.8	44.0	44.2	51.6	51.2	54.5	54.3
1852	44.5	44.1	48.0	48.1	43.5	43.1	48.8	48.9	43.8	44.2	51.3	51.3	53.7	54.4
1853	44.5	43.9	48.5	48.1	43.5	42.9	49.6	49.0	44.8	44.5	51.8	51.3	55.3	54.6
1854	42.7	43.8	47.9	47.9	42.1	42.5	49.3	48.9	45.2	44.5	51.0	50.9	54.7	54.4
1855	44.3	43.8	47.9	47.5	42.2	42.0	49.0	48.5	44.0	43.8	50.3	50.2	54.1	53.7
1856	43.6	43.8	46.4	47.1	41.2	41.7	47.0	48.1	42.2	43.2	49.0	49.6	52.2	53.1
1857	44.2	43.7	47.1	47.1	41.7	41.5	47.5	47.9	42.8	43.3	49.3	49.5	52.8	53.1
1858	43.5	43.5	47.4	47.2	41.0	41.6	48.3	48.0	44.8	43.9	50.0	49.7	54.3	53.5
1859	42.3	43.4	47.2	47.4	41.6	42.3	48.0	48.3	44.2	44.2	50.0	50.1	53.7	53.7
1860	44.8	43.6	48.2	47.7	44.4	43.2	48.6	48.7	44.3	44.3	50.7	50.5	53.5	53.7
1861	43.6	43.7	47.8	47.8	43.6	43.6	50.1	49.1	44.2	44.3	51.2	50.9	54.1	53.7
1862	43.4	43.7	47.8	47.9	42.9	- - -	49.5	49.6	44.4	44.4	50.7	51.1	53.2	53.8
1863	43.9	44.0	48.4	48.0	...	...	50.0	49.8	44.6	44.5	51.8	51.3	54.2	54.1
1864	44.7	44.5	47.6	48.2	...	...	49.9	50.0	44.7	44.6	51.4	51.5	54.7	54.6
1865	45.5	44.8	49.8	48.3	...	...	50.0	- - -	44.9	44.4	52.1	51.3	55.6	54.9
1866	44.5	44.4	47.3	47.9	...	...	...	...	43.5	44.0	50.5	50.7	54.7	54.6
1867	43.3	43.8	47.7	47.4	...	...	...	...	43.8	43.7	50.2	50.1	54.2	53.9
1868	43.0	43.5	46.0	47.3	...	...	...	...	43.3	43.6	48.7	50.0	52.7	53.7
1869	45.2	45.1	47.9	47.8	...	...	...	...	43.1	43.8	50.4	50.6	54.2	54.2
1870	47.0	- - -	49.6	- - -	...	...	...	...	45.9	- - -	52.9	- - -	55.9	- - -

Year.	Charleston, S. C.		Savannah, Ga.		Fort Brooke, Fla.		Cincinnati, Ohio.		Fort Snelling, Minn.		Muscatine, Iowa.		St. Louis, Mo.	
	C. III.	4th or.	C. IV.	4th or.	C. I.	4th or.	C. IV.	4th or.	C. II.	4th or.	C. II.	4th or.	C. II.	4th or.
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1730	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1731	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1732	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1733	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1734	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1735	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1736	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1737	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1738	66.0	- - -	...	...	...	...	...	...	...	...	...	...	...	...
1739	64.8	64.9	...	...	...	...	...	...	...	...	...	...	...	...
1740	63.9	- - -	...	...	...	...	...	...	...	...	...	...	...	...
1741	- - -	- - -	...	...	...	...	...	...	...	...	...	...	...	...
1742	64.7	- - -	...	...	...	...	...	...	...	...	...	...	...	...
1743	- - -	...	...	...	...	...	...	...	...	...	...	...	...	...
1744	- - -	...	...	...	...	...	...	...	...	...	...	...	...	...
1745	- -	...	...	...	...	...	...	...	...	...	...	...	...	...
1746	- - -	...	...	...	...	...	...	...	...	...	...	...	...	...
1747	- - -	...	...	...	...	...	...	...	...	...	...	...	...	...
1748	- - -	...	...	...	...	...	...	...	...	...	...	...	...	...
1749	- - -	...	...	...	...	...	...	...	...	...	...	...	...	...
1750	64.6	- - -	...	...	...	..	...	...	...	...	...	...	...	...
1751	66.3	66.0	...	...	...	...	...	...	...	...	...	...	...	...
1752	66.9	66.5	...	...	...	...	...	...	...	...	...	...	...	...
1753	66.4	66.5	...	...	...	...	...	...	...	...	...	...	...	...
1754	67.4	66.0	...	...	...	...	...	...	...	...	...	...	...	...
1755	63.2	65.5	...	...	...	...	...	...	...	...	...	...	...	...
1756	66.6	65.3	...	...	...	...	...	...	...	...	...	...	...	...
1757	65.3	65.1	...	...	...	...	...	...	...	...	...	...	...	...
1758	63.9	64.5	...	...	...	...	...	...	...	...	...	...	...	...
1759	64.7	- - -	...	...	...	...	...	...	...	...	...	...	...	...
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1797	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1798	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1799	...	...	...	...	...	..	...	...	...	...	...	...	...	...

Year.	Charleston, S. C.		Savannah, Ga.		Fort Brooke, Fla.		Cincinnati, Ohio.		Fort Snelling, Minn.		Muscatine, Iowa.		St. Louis, Mo.	
	C. III.	4th or.	C. IV.	4th or.	C. I.	4th or.	C. IV.	4th or.	C. II.	4th or.	C. II.	4th or.	C. II.	4th or.
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1800	...	...	...	...	...	...	...	...	...	...	...	...	...	...
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1805	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1806	...	...	...	...	...	...	54.1	- - -	...	...	...	...	...	...
1807	...	...	...	...	...	...	54.4	54.8	...	...	...	...	...	...
1808	...	...	...	...	...	...	56.4	55.1	...	...	...	...	...	...
1809	...	...	...	...	...	...	54.4	54.7	...	...	...	...	...	...
1810	...	...	...	...	...	...	52.8	54.4	...	...	...	...	...	...
1811	...	...	...	...	...	...	56.6	54.3	...	...	...	...	...	...
1812	...	...	...	...	...	...	52.6	53.8	...	...	...	...	...	...
1813	...	...	...	...	...	...	52.7	53.5	...	...	...	...	...	...
1814	...	...	...	...	...	...	54.3	53.7	...	...	...	...	...	...
1815	...	...	...	...	...	...	54.0	53.7	...	...	...	...	...	...
1816	...	...	...	...	...	...	53.3	53.4	...	...	...	...	...	...
1817	...	...	...	...	...	...	52.7	53.5	...	...	...	...	...	...
1818	...	...	...	...	...	...	54.1	54.2	...	...	...	...	...	...
1819	...	...	64.6	- - -	...	...	56.3	54.9	...	...	...	...	...	...
1820	...	...	- - -	- - -	...	...	54.8	54.8	43.0	- - -	...	...	...	...
1821	...	...	- - -	- - -	...	...	53.5	54.5	42.9	43.2	...	...	...	...
1822	...	...	- - -	- - -	...	...	55.3	54.5	43.7	43.3	...	...	...	...
1823	64.2	- - -	- - -	- - -	...	...	54.0	54.6	43.4	43.5	...	...	...	...
1824	66.4	65.9	- - -	- - -	...	...	55.0	54.9	42.8	44.2	...	...	...	...
1825	66.7	66.8	- - -	- - -	72.0	- - -	55.4	55.2	47.1	45.0	...	...	...	...
1826	67.9	67.5	69.4	- - -	72.9	72.9	55.7	55.6	44.4	45.3	...	...	...	...
1827	66.9	67.9	68.7	69.1	73.8	73.1	55.8	55.8	45.7	45.5	...	...	58.8	- - -
1828	70.6	68.1	69.7	67.7	73.5	72.9	57.0	55.7	46.0	45.7	...	...	58.7	57.8
1829	65.4	67.9	63.5	66.5	71.2	72.4	53.8	55.0	45.3	45.8	...	...	55.0	56.6
1830	69.7	67.3	67.9	65.8	72.6	71.9	55.7	54.1	47.9	45.6	...	...	58.0	55.3
1831	65.3	66.5	64.1	65.8	71.0	- - -	51.4	53.6	42.4	45.1	...	...	50.6	54.4
1832	65.7	65.8	66.0	66.3	- - -	...	54.4	53.9	45.4	45.3	...	...	55.6	54.8
1833	65.6	65.6	67.8	66.9	- - -	...	54.9	54.4	47.5	46.1	...	...	56.9	55.5
1834	66.2	65.5	68.0	66.6	- - -	...	55.2	53.9	46.7	45.5	...	...	55.7	55.0
1835	63.7	- - -	64.5	65.4	- - -	...	51.7	52.8	43.0	44.1	...	...	52.8	53.9
1836	- - -	- - -	64.4	64.4	- - -	...	51.7	52.2	42.5	43.1	...	...	53.2	53.4
1837	- - -	- - -	63.5	63.9	- - -	...	53.0	52.4	43.6	43.0	...	...	54.1	53.5
1838	- - -	- - -	63.3	63.9	70.1	- - -	52.1	52.9	41.3	43.5	...	...	52.7	53.7
1839	- - -	- - -	64.7	64.4	71.6	70.9	54.6	53.6	46.8	44.4	51.3	- - -	54.6	54.1
1840	66.0	- - -	64.9	64.9	70.5	70.9	54.1	54.0	44.4	44.6	49.1	49.0	54.4	54.5
1841	65.6	65.5	65.3	65.2	71.2	70.9	54.1	54.0	43.9	44.0	46.5	47.5	54.9	54.9
1842	64.7	65.4	65.5	65.5	71.2	70.8	54.3	53.6	42.8	42.7	47.3	46.3	56.2	54.9
1843	65.7	65.6	66.0	65.7	70.3	70.7	51.7	53.5	39.9	42.0	43.7	46.0	52.9	54.8
1844	66.1	66.0	66.1	65.7	70.4	70.7	54.9	53.9	42.7	43.1	47.7	46.6	55.8	55.3
1845	66.2	66.2	65.3	65.6	70.6	70.9	54.1	54.5	45.8	44.9	47.3	47.2	56.7	56.0
1846	66.9	66.3	65.2	65.5	71.6	71.3	55.8	54.6	48.3	45.3	48.6	46.6	56.7	55.8
1847	65.8	66.3	65.5	65.8	71.7	72.0	53.5	54.4	41.9	43.9	43.2	45.5	53.8	54.9
1848	66.6	66.4	66.6	66.1	72.8	72.8	54.4	54.2	42.6	42.8	45.5	45.2	54.4	54.5
1849	66.4	66.6	66.3	66.4	74.4	73.4	53.8	54.2	42.3	43.0	45.5	45.8	54.1	54.6
1850	67.2	66.6	67.0	66.4	73.5	73.1	54.2	54.2	43.7	44.0	47.0	46.6	55.2	55.0
1851	66.3	66.5	65.8	66.1	71.3	72.4	54.6	54.3	46.7	44.6	47.6	47.1	55.5	55.2
1852	66.4	66.4	66.1	65.9	72.0	72.1	54.3	54.6	43.8	44.2	46.7	47.5	55.1	55.5
1853	66.3	66.2	65.4	65.9	73.0	72.1	54.4	55.0	42.3	43.6	47.8	48.2	55.7	56.0
1854	66.1	65.9	66.4	65.8	71.5	71.7	56.8	55.2	44.8	43.5	50.5	48.3	57.9	56.0
1855	65.4	65.1	65.8	65.4	70.9	71.2	55.0	54.6	43.2	43.2	47.2	47.1	54.8	55.0
1856	63.7	64.4	64.4	64.9	70.7	70.7	52.3	53.8	42.4	42.3	45.2	45.6	52.4	53.8
1857	63.6	64.4	63.9	65.0	70.5	- - -	53.1	54.0	41.1	- - -	44.1	45.3	53.3	54.0
1858	65.8	65.0	66.3	66.0	...	...	56.3	54.9	- - -	...	47.1	46.0	56.1	54.9
1859	65.6	65.5	67.5	- - -	...	...	55.4	55.4	- - -	...	46.4	47.0	55.1	55.6
1860	65.4	65.6	- - -	...	...	...	55.3	55.4	- - -	...	48.0	47.4	56.3	55.9
1861	65.9	- - -	- - -	...	...	...	55.2	55.3	- - -	...	48.3	47.5	56.5	55.9
1862	- - -	...	- - -	...	...	...	55.6	55.2	- - -	...	46.6	47.1	55.6	55.5
1863	- - -	...	- - -	...	...	...	55.1	55.0	44.1	- - -	46.9	46.9	54.4	55.1
1864	- - -	...	- - -	...	...	...	54.1	55.0	44.7	44.6	46.7	46.9	54.8	55.2
1865	- - -	...	- - -	...	...	...	56.1	55.0	45.1	44.1	47.8	46.8	56.4	55.5
1866	- - -	...	- - -	...	...	...	54.1	54.8	42.3	43.5	45.9	46.5	55.2	55.4
1867	- - -	...	65.0	- - -	...	...	55.4	54.5	43.2	43.2	46.2	46.2	55.3	55.0
1868	- - -	...	64.8	65.0	...	...	53.2	54.2	43.7	43.5	46.0	46.2	54.3	54.7
1869	- - -	...	65.6	65.3	...	...	54.1	54.2	43.1	44.2	45.5	46.4	54.1	54.6
1870	- - -	...	65.4	- - -	...	...	55.6	- - -	47.2	- - -	48.7	- - -	55.9	- - -

Year.	Fort Leavenworth, Kan.		Fort Gibson, Indian Ter.		Fort Jesup, La.		San Francisco, Cal.	
	C. II.	4th or.	C. III.	4th or.	C. I.	4th or.	C. V.	4th or.
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1820	...	...	...	...	...	...	...	...
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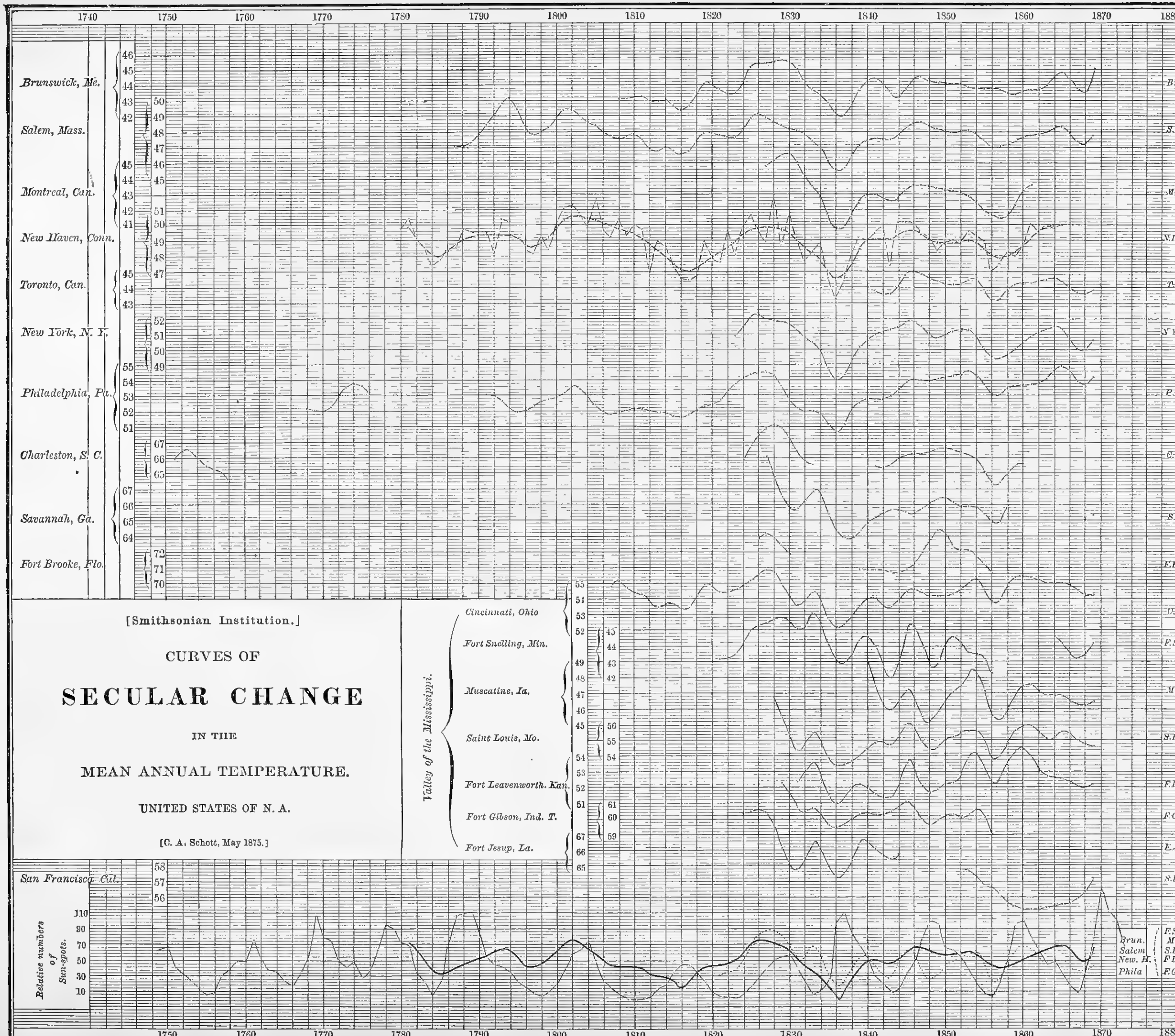
1822	...	...	...	...	...	...	...	...
1823	...	...	...	...	67.3	- - -	...	...
1824	...	...	...	...	69.2	68.4	...	...
1825	...	...	...	...	67.7	68.5	...	...
1826	...	...	...	...	68.9	68.6	...	...
1827	...	...	...	...	69.1	68.4	...	...
1828	...	...	63.0	- - -	68.1	67.6	...	...
1829	...	...	60.9	62.3	65.1	66.2	...	...
1830	56.6	- - -	64.6	61.6	66.4	65.1	...	...
1831	49.8	52.4	57.7	60.7	62.6	64.8	...	...
1832	53.4	53.1	61.3	60.5	66.0	65.5	...	...
1833	55.5	53.6	61.1	60.7	67.1	66.4	...	...
1834	52.4	52.8	61.5	60.3	67.5	66 1	...	...
1835	51.7	51.5	58.1	59.6	64.0	65.0	...	...
1836	48.7	51.0	59.0	59.5	63.7	64.4	...	...
1837	52.9	51.4	60.8	59.7	65.1	64.6	...	...
1838	51.1	52.0	58.1	60.0	64.2	65.4	...	...
1839	53.6	52.2	61.9	60.3	67.3	66.4	...	...
1840	51.4	52.0	60.5	60.4	67.8	66.6	...	...
1841	51.2	51.6	59.1	60.3	65.1	66.1	...	...
1842	52.8	51.4	61.6	60.3	66.4	65.7	...	...
1843	49.0	51.4	59.3	60.5	64.3	65.5	...	...
1844	52.7	52.3	61.5	60.8	66.3	65.7	...	...
1845	54.8	53.6	61.4	61.1	65.7	- - -	...	...
1846	55.3	53.3	61.5	60.7	...	...	...	...
1847	49.8	52.1	59.1	60.0	...	...	...	...
1848	51.7	51.7	59.6	59.6	...	...	...	...
1849	52.2	51.9	59.5	59.9	...	...	...	...
1850	52.0	52.2	60.4	60.2	...	...	...	...
1851	53.2	52.3	61.4	60.3	...	...	58.5	- - -
1852	51.5	53.0	59.0	60 1	...	...	- - -	57.8
1853	53.1	53.9	60.1	60.3	...	...	57.2	57.7
1854	55.9	54.1	61.8	60.6	...	...	56.3	57.3
1855	54.3	53.4	60.4	60.1	...	...	57.8	56.8
1856	50.0	52.4	58.4	59.0	...	...	56.3	56.6
1857	52.2	52.6	58.7	- - -	...	...	56.8	56.2
1858	55.3	53.6	...	...	...	...	55.7	55.7
1859	52.9	54.3	...	...	...	...	54.9	55.4
1860	56.0	54.4	...	...	...	...	55.4	55.2
1861	54.0	54.0	...	...	...	...	55.5	55.2
1862	52.7	53.1	...	...	...	...	54.7	55.2
1863	52.9	52.7	...	...	...	...	55.2	55.3
1864	52.0	52.6	...	...	...	...	56.3	55.4
1865	53.5	52.5	...	...	...	...	54.8	55.5
1866	52.0	52.3	...	...	...	...	55.4	55.6
1867	51.8	52.0	...	...	...	...	56.3	55.9
1868	52.1	52.0	...	...	...	...	55.3	56.3
1869	51.3	52.2	...	...	...	...	58.0	57.2
1870	54.1	- - -	...	...	...	...	57.6	- - -

The character of the secular variation in the mean annual temperature, as exhibited on the accompanying plate, is that of a series of irregular waves representing a succession of warmer and colder periods, during which, however, the mean temperature deviates only about one or two degrees, in excess or defect, from its normal value. Irrespective of the minor irregularities, which have to some extent been eliminated, some of the single progressions appear quite systematic; thus, for instance, at New Haven, the temperature steadily declined from 1802 to 1817, it then increased till 1827, after which it again decreased, reaching a decided minimum in 1836. These undulations, when compared for a number of stations exposed to similar climatological conditions, approach to parallelism over large tracts of country, and exhibit considerable uniformity in their general character;



To face page 310.

thus from Maine to Georgia these waves are of a broad and well-defined shape, as at New Haven, but they become somewhat changed in their appearance over the vast area watered by the Mississippi and its tributaries; here the undulations become more narrow and numerous, as at Fort Snelling. The change from one form into the other is very gradual, and with an increase of the geographical distances some of the old features become obliterated and new ones make their appearance. The curve for Cincinnati, for instance, partakes of an intermediate character between the eastern or Atlantic type and that of the Mississippi basin. On our western coast, as might have been expected, a new feature is developed, subject perhaps to less irregularities than in any other part of the country, and for this reason well suited for the study of the proximate causes which determine its laws. The curve for San Francisco is presented as a type for the Pacific coast.

The remarkably cold epoch about 1837 with cold years preceding and following is common to all stations represented between the Atlantic coast and the eastern flank of the Rocky Mountains, and the exceptionally warm period about 1827 perhaps extended likewise over a very large area.

There is nothing in these curves to countenance the idea of any permanent change in the climate having taken place, or being about to take place; in the last 90 years of thermometric records, the mean temperatures showing no indication whatever of a sustained rise or fall. The same conclusion was reached in the discussion of the secular change in the Rain-Fall, which appears also to have remained permanent in amount as well as in annual distribution.

The degree of parallelism of the curves is sufficiently close to warrant an additional consolidation of results for a few characteristic stations, for further study; one typical curve will be given for the Atlantic coast and another for the Mississippi valley.

The first is composed of the long series of mean annual temperatures at Brunswick, Me., Salem, Mass., New Haven, Conn., and Philadelphia, Penn., to represent during 91 years the type of the secular change for those eastern States which are situated between the Atlantic and the Alleghany Mountains. These four series are unbroken between 1807 and 1865, and for these 59 years the individual means are set down, as in the table below; to reduce those values which lie outside of these limits to uniformity, the 59 differences for each series from the mean series were formed, and the respective mean difference applied as reductions; they are, for Brunswick +4°.5, for Salem +0°.6, for New Haven —0°.4, and for Philadelphia —4°.7. After this the means were taken for each of these years, except for the years 1780, 1783, 1784, and 1785, which are covered by one series only.

Table of consolidated mean annual temperatures at Brunswick, Salem, New Haven, and Philadelphia.

	0	1	2	3	4	5	6	7	8	9
1780	49°.3	50.4	48.7	49.5	46.9	47.3	48.2	47.9	48.5	48.3
1790	48.5	49.2	47.9	50.3	49.1	48.7	47.9	47.5	48.9	48.1
1800	49.1	49.7	50.5	49.6	48.6	49.7	48.1	47.7	48.7	47.5
1810	48.4	49.2	46.1	47.9	48.0	47.2	46.4	46.7	47.8	49.0
1820	47.9	47 5	49.2	47.6	49.0	50.4	50.0	48.6	51.2	48.4
1830	49.5	48.9	47.5	47.9	48.4	46.8	45.2	46.0	47.6	48.4
1840	48.6	48.5	48.9	47.5	48.4	49.3	49.7	49.0	49.2	48.5
1850	49.0	48.8	48.8	49.5	48.7	48.8	47.3	47.9	48.4	47.8
1860	48.8	48.9	48.5	49.1	49.2	50.2	49.0	48.5	47.4	49.2
1870	51.0									
General mean, 48.52.										

From the preceding table we form the successive means of the 4th order, as follows:—

	0	1	2	3	4	5	6	7	8	9
1780	- - -	(49.6)	49.2	48.5	47.8	47.6	47.7	48.0	48.2	48.4
1790	48.6	48.7	49.0	49.2	49.1	48.6	48.1	48.1	48.3	48.6
1800	49.1	49.5	49.8	49.6	49.2	48.9	48.5	48.2	48.1	48.1
1810	48.1	48.0	47.6	47.5	47.4	47.2	46.8	47.1	47.7	48.1
1820	48.1	48.2	48.3	48.5	49.0	49.6	49.8	49.7	49.6	49.4
1830	49.1	48.6	48.1	47.8	47.5	46.8	46.2	46.4	47.3	48.1
1840	48.4	48.5	48.4	48.3	48.6	49.0	49.3	49.2	49.0	48.9
1850	48.8	48.8	48.9	49.0	48.8	48.4	48.1	48.0	48.1	48.3
1860	48.5	48.7	48.9	49.1	49.3	49.4	49.1	48.5	48.4	(49.2)
1870	- - -									

Also the following table of differences from the mean 48°.5, a + sign indicating a warmer, a — sign a colder year than the normal one.

	0	1	2	3	4	5	6	7	8	9
1780	- - -	+1.1	+0.7	0.0	—0.7	—0.9	—0.8	—0.5	—0.3	—0.1
1790	+0.1	+0.2	+0.5	+0.7	+0.6	+0.1	—0.4	—0.4	—0.2	+0.1
1800	+0.6	+1.0	+1.3	+1.1	+0.7	+0.4	0.0	—0.3	—0.4	—0.4
1810	—0.4	—0.5	—0.9	—1.0	—1.1	—1.3	—1.7	—1.4	—0.8	—0.4
1820	—0.4	—0.3	—0.2	0.0	+0.5	+1.1	+1.3	+1.2	+1.1	+0.9
1830	+0.6	+0.1	—0.4	—0.7	—1.0	—1.7	—2.3	—2.1	—1.2	—0.4
1840	—0.1	0.0	—0.1	—0.2	+0.1	+0.5	+0.8	+0.7	+0.5	+0.4
1850	+0.3	+0.3	+0.4	+0.5	+0.3	—0.1	—0.4	—0.5	—0.4	—0.2
1860	0.0	+0.2	+0.4	+0.6	+0.8	+0.9	+0.6	0.0	—0.1	(+0.7)
1870	- - -									

The use of this table for obtaining the normal annual temperature from a single year or from a few years of observation is obvious; we have only to apply the tabular quantity with its sign reversed as a correction to the mean (observed) temperature of each year

The second type-curve is made up from the stations: Fort Snelling, Minn., Muscatine, Iowa, St. Louis, Mo., Fort Leavenworth, Kan., and Fort Gibson, Indian Ter. These series have 19 years in common (1839 to 1857 inclusive), for each of which the means from the five values were set down, the observed annual temperatures for years before and after were first referred to the same mean series by the reductions $+7^\circ.9$, $+4^\circ.7$, $-3^\circ.2$, $-0^\circ.8$, and $-8^\circ.6$ to the stations respectively (these numbers were deduced from comparisons of each series with every other). We have the following tables:—

Table of consolidated mean annual temperatures at Fort Snelling, Muscatine, St. Louis, Fort Leavenworth, and Fort Gibson.

	0	1	2	3	4	5	6	7	8	9
1820	50.9	50.8	51.6	51.3	50.7	55.0	52.3	54.6	54.6	52.4
1830	55.6	48.9	52.7	54.1	53.1	50.2	49.7	51.7	49.6	53.6
1840	52.0	51.1	52.1	49.0	52.1	53.2	54.1	49.6	50.8	50.7
1850	51.7	52.9	51.2	51.8	54.2	52.0	49.5	49.9	53.1	51.7
1860	53.7	53.2	51.9	51.7	51.7	52.8	51.0	51.3	51.4	50.6
1870	53.6									
General mean, 51.95.										

From the above table we derive the following successive means of the 4th order:—

	0	1	2	3	4	5	6	7	8	9
1820	- - -	(51.1)	51.3	51.4	52.0	53.0	53.6	53.9	53.9	53.6
1830	52.9	52.1	52.3	52.9	52.3	51.1	50.5	50.7	51.4	52.1
1840	52.1	51.6	51.1	51.0	51.8	52.6	52.4	51.3	50.8	51.0
1850	51.6	51.9	52.1	52.3	52.5	51.8	50.7	50.8	51.8	52.5
1860	52.8	52.7	52.2	51.9	51.9	51.9	51.5	51.3.	51.3	(51.6)
1870	- - -									

Table of differences from the mean 52°.0.

	0	1	2	3	4	5	6	7	8	9
1820	- - -	(—0.9)	—0.7	—0.6	0.0	+1.0	+1.6	+1.9	+1.9	+1.6
1830	+0.9	+0.1	+0.3	+0.9	+0.3	—0.9	—1.5	—1.3	—0.6	+0.1
1840	+0.1	—0.4	—0.9	—1.0	—0.2	+0.6	+0.4	—0.7	—1.2	—1.0
1850	—0.4	—0.1	+0.1	+0.3	+0.5	—0.2	—1.3	—1.2	—0.2	+0.5
1860	+0.8	+0.7	+0.2	—0.1	—0.1	—0.1	—0.5	—0.7	—0.7	(—0.4)
1870	- - -									

[This table can be used to obtain normal temperatures at places in the Mississippi valley, as explained above.]

These differences from the normal values have been thrown into curves, and are given, together with the exhibit of the relative frequency and amount of solar spots, in the bottom line of the accompanying plate; the Atlantic type-curve is shown heavy, the Mississippi type-curve dotted, and the sun-spot curve by a zigzag line, according to Prof. R. Wolf's numbers.[1]

The distinguishing features, as described above, of these two type-curves appear well marked, the longer waves of the Atlantic stations show:

Principal maxima in 1802 1826 1846 1865
and principal minima in 1785 1816 1836 1857
the average interval being about 22 years; the shorter waves of the interior states show:—

Principal maxima in 1827 1833 1839 1845 1854 1860
and principal minima in 1831 1836 1843 1848 1856 1867
the average interval being about 7 years. These undulations, however, are not sufficiently regular nor sufficiently distinct, being mixed with subordinate fluctuations, to serve as a basis of prediction; all that can be claimed for them is a general exponent of the character of the secular change.

Comparison of the secular variation of the temperature with the variations in the frequency of the solar spots.—It is evident, from the preceding statements respecting the average duration of successions of warmer and colder years, that no intimate relation appears to exist between the two phenomena—they seem to have no feature in common, the sun-spot period of about 11 years is not systematically followed by any of the temperature waves; the chief characteristic of connection, that of equality of average periods, being wanting, we necessarily have coincidence, viz., greater development of sun-spots corresponding to greater *cold*, as for the years between 1810 and 1822, as well as opposition, viz., a greater development of sun-spots during a time of increased *heat*, as for the years 1799 to 1806, and in general we have phases of the two curves presented in all possible combinations. If we consider the small difference in the radiating energy of the surface of a spot and of the unbroken surface of the sun, as well as the comparatively small collective area of

[1] Prof. Wolf's relative numbers of sun-spots; from Astronomische Nachrichten, Nos. 1978 (March, 1874) and No. 2014 (Nov. 1874), those prior to 1759 from his "Mittheilungen."

	0	1	2	3	4	5	6	7	8	9
1740										63.8
1750	68.2	40.9	33.2	23.1	13.8	6.0	8.8	30.4	38.3	48.6
1760	48.9	75.0	50.6	37.4	34.5	23.0	17.5	33.6	52.2	108.3
1770	79.4	73.2	49.2	39.8	47.6	27.5	35.2	63.0	94.8	90.2
1780	72.6	67.7	33.2	22.5	5.0	21.2	68.6	104.8	107.8	110.7
1790	84.4	53.4	47.5	40.2	34.3	22.3	15.1	7.8	4.4	10.2
1800	18.5	38.6	57.8	65.0	75.0	50.0	25.0	15.0	7.2	3.4
1810	0.0	1.2	5.4	13.7	20.0	35.0	45.5	43.5	34.1	22.5
1820	8.9	4.3	2.9	1.3	6.7	17.4	29.4	39.9	52.5	53.5
1830	59.1	38.8	22.5	7.5	11.4	45.5	96.7	111.0	82.6	68.5
1840	51.8	29.7	19.5	8.6	13.0	37.0	47.0	79.4	100.4	95.6
1850	64.5	61.9	52.2	37.7	19.2	6.9	4.2	21.6	50.9	96.4
1860	98.6	77.4	59.1	44.0	46.9	30.5	16.3	7.3	37.3	73.9
1870	139.1	111.2	101.7	66.3						

the spotted surface as contrasted with the whole sun, the failure in the detection of any close relationship between the annual changes of spots and of terrestrial temperature (as examined by the comparatively crude process of annual means) should not be surprising, unless there should be connected with these solar disturbances some other less direct cause producing changes of radiation. Still it is very desirable to follow up the subject by further comparisons of the American results with those obtained on the Eastern Continent, and especially with results from stations in the Southern Hemisphere.[1]

Comparison of the secular variation in the temperature and the rain-fall, in the United States.—The data for the annual rain-fall are taken from p. 154 of my memoir on the Rain-Fall (Smithsonian Contributions to Knowledge, No. 222; Washington, May, 1872), from which groups I and IV have been selected as representative stations of the same climatological conditions to which the temperature types I and II refer. The fourth order of successive means are tabulated below; these proportional numbers have already been charted on p. 157 of the Rain-Fall Memoir. The average annual amount of rain deduced from the whole series is put equal to 100.

Secular variation in the Rain-Fall, sea-coast, Maine to Virginia.

	0	1	2	3	4	5	6	7	8	9
1800	---	---	---	---	---	(94)	96	102	106	101
1810	94	96	101	104	103	97	92	90	87	87
1820	93	94	96	97	94	89	91	96	102	108
1830	111	108	104	99	94	91	90	90	93	98
1840	103	105	106	103	98	96	100	102	99	100
1850	105	106	105	105	102	98	98	102	106	108
1860	108	108	111	110	106	104	(107)			

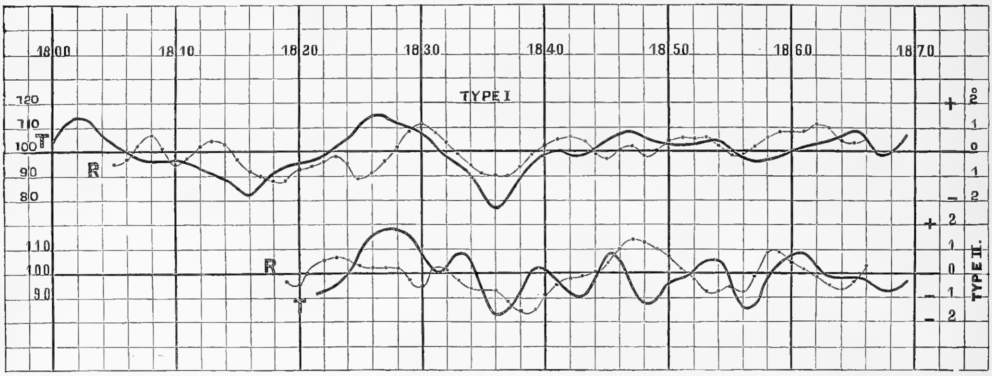
Secular change in the Rain-Fall, Ohio Valley, Ohio, Indiana, Illinois, Kentucky, and part of Missouri.

	0	1	2	3	4	5	6	7	8	9
1810	---	---	---	---	---	---	---	---	---	(96)
1820	95	100	105	107	106	104	103	103	102	97
1830	95	101	102	97	93	93	93	89	84	86
1840	92	95	98	99	100	104	110	114	113	110
1850	106	102	97	93	93	94	93	99	109	109
1860	103	101	99	95	93	97	(103)			

[1] To mention but one case of evidence, supposed to be in favor of a correspondence of the sun-spot and temperature periods, the reader may consult: The London, Edinburgh, and Dublin Phil. Mag., vol. xlii, July to Dec. 1871. "On the approximate decennial variation of the temperature at the Observatory at the Cape of Good Hope, between the years 1841 and 1870, viewed in connection with the variation of the solar-spots." By E. J. Stone, F.R.S, Astron. Roy. at the Cape of Good Hope. Here it is believed that the same cause which leads to an excess of mean annual temperature leads equally to a dissipation of the solar spots.

On the annexed diagram, the upper pair of curves refer to stations on the Atlantic coast, the lower pair to stations in the Mississippi valley; the heavy lines represent the secular change in the temperature, the light ones that of the rain-fall. Though the connection between the changes of temperature and rain-fall is not, in detail, any way conclusive, yet in general following out the larger waves, there seems to be some ground for concluding that years with a mean temperature above the normal have a rain-fall above the normal or average amount, and years deficient in the mean temperature present also a deficiency in the rain-fall.

That this apparent law is not expressive in the minor undulations may be explained by the small number of stations contributing information to both temperature and rain-fall, and thus admitting the presence to some extent of local peculiarities; yet it cannot be overlooked that there is some similarity in the general character of the two phenomena; further comparisons, however, are desirable.



In explanation it may be remarked, that the greater the heat of the air, the greater the amount of vapor it can hold, hence the greater the capacity for precipitation as well as for evaporation.

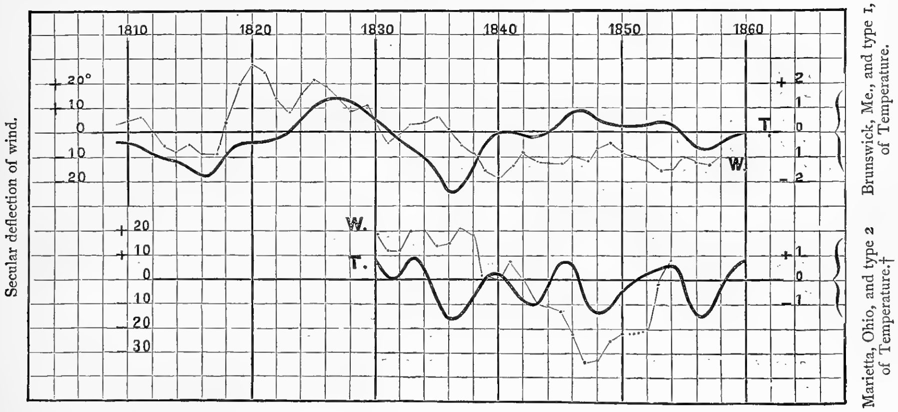
Comparison of the secular variation in the temperature with the average annual direction of the wind.—The following numbers have been extracted from p. 42 of my discussion of the Meteorological Observations[1] at Brunswick, Maine, made by Prof. P. Cleaveland; they give the deflections in degrees, + to the north (increasing azimuth), — to the south (decreasing azimuth), from the mean assumed direction of the wind $x = 101°$, counted like azimuths from the south around by west to 360°.

	0	1	2	3	4	5	6	7	8	9
1800	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	+ 3°
1810	+ 5	+ 6	0	— 6	— 7	— 6	— 8	— 8	+ 4	+20
1820	+28	+25	+13	+ 8	+16	+22	+19	+13	+ 9	+11
1830	+ 5	— 5	— 2	+ 3	+ 4	+ 6	+ 1	— 6	— 9	—15
1840	—18	—14	— 9	—12	—12	—12	—10	—11	— 7	— 5
1850	— 7	— 9	—11	—15	—15	—10	—11	—13	—10	- - -

[1] Smithsonian Contributions to Knowledge, No. 204; Washington, June, 1867.

The table below contains the deflections from the normal direction of the wind $x = 68°$ at Marietta, Ohio, taken from p. 36 of my discussion of the Meteorological Observations[1] at Marietta, made by Dr. S. P. Hildreth.

	0	1	2	3	4	5	6	7	8	9
1830	+18	+11	+11	+20	+20	+13	+14	+21	+19	+ 2
1840	0	+ 8	0	—10	—11	—12	—23	—35	—34	—25
1850	—22	- - -	—20	— 1	+ 7	- - -	- - -	- - -	- - -	- - -



† The temperature at Marietta closely follows this type.

To interpret the above diagrams correctly, the true relation between the secular change, as shown by a succession of annual means, of the direction of the wind and of the temperature, will appear with sufficient distinctness by considering the zero line or axis of abscissæ, not as a straight line but as a curve, drawn midway between the two curves; in other words, either the normal direction of the wind is imperfectly made out (through insufficiency or imperfection of observations), or the relation of the mean direction of the wind to the mean temperature of the air is not constant; I incline to the former alternative. So far as our evidence goes, for years of northerly (+) deflections of the winds, the temperature appears to be lower, and for southerly deflections higher than the normal value. This subject also demands further investigation.

Enough has been shown to make it evident that for final explanation the secular variations in the temperature, in the rain-fall, and in the direction of the wind must be studied together, and it will probably be found that the former depend directly on the latter, though, ultimately, the deflections in the resulting direction of the wind must be referred to effects of solar radiation; the discussion must take a wider range so as to include long series of records at stations representing all parts of the globe.

[1] Smithsonian Contributions to Knowledge, No. 120; Washington, June, 1868.

Range of variability in the secular variation of the annual temperature.—If we consider the deviations of the annual means from the normal temperature of the place as fortuitous, we may employ a simple formula for the mean deviation as a measure of the amount of variability, and deduce also a value for the *probable* uncertainty to which the normal temperature, or the mean of the whole series, may be liable.

Let $\varepsilon =$ the mean deviation of any yearly value,
$\Delta =$ the difference of any annual mean from the normal temperature,
$\Sigma\Delta =$ their sum, irrespective of sign,
$n =$ number of yearly values,

then, with sufficient precision for our comparison,

$$\varepsilon = \pm 1.253 \frac{\Sigma\Delta}{n},$$

which expression supposes the positive and negative Δ's to balance. The probable uncertainty attaching to the mean of the series is given by

$$r_0 = \pm 0.845 \frac{\Sigma\Delta}{n\sqrt{n}}.$$

Applying these expressions to a few of our larger and systematic series, we deduce the following results:—

Stations.	Normal T	n	ε	r_0	Lowest and Highest value.	Difference from normal.	Range.
Brunswick, Me.[1]	43.9	49	±1°.78	±0°.15	40.3 47.7	—3.6 +3.8	7°.4
Salem, Mass.	48.1	43	1.48	.15	44.5 50.3	—3.6 +2.2	5.8
New Bedford, Mass.	48.2	58	1.15	.10	44.9 50.9	—3.3 +2.7	6.0
New Haven, Conn.	49.0	85	1.25	.09	45.2 51.8	—3.8 +2.8	6.6
Marietta, Ohio	52.4	46	1.24	.12	49.7 55.4	—2.7 +3.0	5.7
Fort Snelling, Minn.	44.1	42	2.07	.21	41.3 48.3	—2.8 +4.2	7.0
Fort Leavenworth, Kan.	52.7	40	1.83	.20	48.7 56.6	—4.0 +3.9	7.9
Fort Brooke, Fla.	71.7	27	1.21	.16	70.1 74.4	—1.6 +2.7	4.3

[1] The annual means for 1837–8–9–40 are omitted, as defective.

The weighted average value of the mean annual direction ε is $\pm$ 1°.44, hence means derived from series of 25, 50, and 100 years are uncertain by a probable amount of $r_0 = \frac{0.6745\ \varepsilon}{\sqrt{n}} = \pm 0°.19, \pm 0°.14$, and $\pm 0°.10$ respectively. To these values any errors that may exist in the graduation of the instruments would have to be added.

Secular variation in the annual maxima and minima, compared with the variation in the annual means.—In conclusion of this section of the paper, it is still desirable to inquire into the changes of the maxima and minima, and to ascertain how far these partake of the character of the secular change of the mean annual temperature. For this purpose it will suffice to examine the two typical series at New Haven and Marietta. Since the minima fall generally in January and February, and the maxima in July and August, the respective mean temperatures of these months were formed and compared with the corresponding annual means. To eliminate irregularities, the fourth order means were employed and tabulated; comparing each value with the mean from the whole series, the differences were formed, a + sign indicating higher temperature, a — sign lower temperature than the mean—they are as follows:—

New Haven series.

	½ (J. & F.) 4th order.	½ (J. & A.) 4th order.	$\frac{1}{12}$ (J. to D.) 4th order.	Differences from Mean.				½ (J. & F.) 4th order.	½ (J. & A.) 4th order.	$\frac{1}{12}$ (J. to D.) 4th order.	Differences from Mean.		
				Jan. and Feb.	July and Aug.	Year.					Jan. and Feb.	July and Aug.	Year.
	°	°	°	°	°	°		°	°	°	°	°	°
1780	(29.6)	74.3	(49.9)	+2.4	+3.6	+1.0	1825	29.5	71.2	49.9	+2.3	+0.5	+0.9
1781	29.5	73.3	49.7	+2.3	+2.6	+0.7	1826	29.0	71.0	49.9	+1.8	+0.3	+1.0
1782	28.1	72.0	49.2	+0.9	+1.3	+0.3	1827	29.1	70.7	49.9	+1.9	0.0	+0.9
1783	26.0	71.3	48.5	—1.2	+0.6	—0.5	1828	29.1	71.0	50.0	+1.9	+0.3	+1.1
1784	24.5	71.1	48.0	—2.7	+0.4	—0.9	1829	27.5	71.4	49.9	+0.3	+0.7	+0.9
1785	24.7	70.7	47.9	—2.5	0.0	—1.0	1830	25.5	71.7	49.6	—1.7	+1.0	+0.7
1786	26.0	70.3	48.2	—1.2	—0.4	—0.7	1831	25.3	71.6	49.0	—1.9	+0.9	0.0
1787	26.5	70.6	48.8	—0.7	—0.1	—0.2	1832	26.5	70.6	48.5	—0.7	—0.1	—0.4
1788	26.5	71.7	49.2	—0.7	+1.0	+0.3	1833	27.7	69.9	48.2	+0.5	—0.8	—0.8
1789	27.1	72.2	49.4	—0.1	+1.5	+0.4	1834	27.3	69.8	47.8	+0.1	—0.9	—1.1
1790	27.8	71.7	49.4	+0.6	+1.0	+0.5	1835	25.0	69.8	46.8	—2.2	—0.9	—2.2
1791	27.1	70.9	49.2	—0.1	+0.2	+0.2	1836	23.5	68.8	46.3	—3.7	—1.9	—2.6
1792	26.5	70.7	49.2	—0.7	0.0	+0.3	1837	24.5	68.8	46.7	—2.7	—1.9	—2.3
1793	27.3	70.9	49.5	+0.1	+0.2	+0.5	1838	26.5	69.3	47.8	—0.7	—1.4	—1.1
1794	27.8	71.0	49.6	+0.6	+0.3	+0.7	1839	27.3	69.6	48.7	+0.1	—1.1	—0.3
1795	27.5	71.1	49.1	+0.3	+0.4	+0.1	1840	27.8	69.8	49.1	+0.6	—0.9	+0.2
1796	27.3	71.6	48.6	+0.1	+0.9	—0.3	1841	29.1	69.8	49.3	+1.9	—0.9	+0.3
1797	27.0	72.5	48.5	—0.2	+1.8	—0.5	1842	29.6	69.3	49.1	+2.4	—1.4	+0.2
1798	26.5	73.0	48.7	—0.7	+2.3	—0.2	1843	28.1	68.8	49.0	+0.9	—1.9	0.0
1799	26.4	72.9	49.2	—0.8	+2.2	+0.2	1844	27.1	69.3	49.4	—0.1	—1.4	+0.5
1800	27.3	72.5	49.9	+0.1	+1.8	+1.0	1845	27.4	70.3	49.9	+0.2	—0.4	+0.9
1801	28.9	72.5	50.6	+1.7	+1.8	+1.6	1846	27.7	71.2	49.9	+0.5	+0.5	+1.0
1802	29.8	72.7	50.8	+2.6	+2.0	+1.9	1847	27.7	71.4	49.4	+0.5	+0.7	+0.4
1803	29.3	72.7	50.7	+2.1	+2.0	+1.7	1848	27.1	71.0	49.0	—0.1	+0.3	+0.1
1804	28.3	72.6	50.6	+1.1	+1.9	+1.7	1849	27.1	70.6	48.7	—0.1	—0.1	—0.3
1805	28.2	72.3	50.5	+1.0	+1.6	+1.5	1850	28.4	70.3	48.7	+1.2	—0.4	—0.2
1806	28.6	71.8	50.1	+1.4	+1.1	+1.2	1851	29.1	70.0	48.9	+1.9	—0.7	—0.1
1807	28.4	71.2	49.8	+1.2	+0.5	+0.8	1852	28.7	69.8	49.1	+1.5	—0.9	+0.2
1808	27.9	70.3	49.7	+0.7	—0.4	+0.8	1853	28.6	70.0	49.2	+1.4	—0.7	+0.2
1809	27.7	69.6	49.7	+0.5	—1.1	+0.7	1854	27.9	70.4	49.1	+0.7	—0.3	+0.2
1810	27.8	69.4	49.5	+0.6	—1.3	+0.6	1855	26.1	70.4	48.5	—1.1	—0.3	—0.5
1811	27.2	69.5	49.1	0.0	—1.2	+0.1	1856	24.6	69.8	47.9	—2.6	—0.9	—1.0
1812	26.2	69.8	48.5	—1.0	—0.9	—0.4	1857	25.5	69.1	47.7	—1.7	—1.6	—1.3
1813	25.9	70.2	48.3	—1.3	—0.5	—0.7	1858	27.4	68.7	47.9	+0.2	—2.0	—1.0
1814	25.8	70.0	48.2	—1.4	—0.7	—0.7	1859	28.1	68.7	48.3	+0.9	—2.0	—0.7
1815	25.4	69.0	47.6	—1.8	—1.7	—1.4	1860	28.1	69.4	48.8	+0.9	—1.3	—0.1
1816	24.5	68.3	47.0	—2.7	—2.4	—1.9	1861	28.1	70.4	49.3	+0.9	—0.3	+0.3
1817	24.0	68.5	46.8	—3.2	—2.2	—2.2	1862	28.5	71.6	49.6	+1.3	+0.9	+0.7
1818	25.1	69.4	47.3	—2.1	—1.3	—1.6	1863	28.9	72.5	49.7	+1.7	+1.8	+0.7
1819	26.8	70.2	47.9	—0.4	—0.5	—1.1	1864	(28.5)	(72.7)	(49.7)	+1.3	+2.0	+0.8
1820	27.0	70.3	48.1	—0.2	—0.4	—0.8							
1821	25.9	70.2	48.2	—1.3	—0.5	—0.8							
1822	25.7	70.2	48.6	—1.5	—0.5	—0.3							
1823	27.0	70.5	49.1	—0.2	—0.2	+0.1	Mean of 85 years.	27.24	70.69	48.93			
1824	28.7	71.0	49.6	+1.5	+0.3	+0.7							

Marietta series.

	$\frac{1}{2}$(J. & F.) 4th order.	$\frac{1}{2}$(J. & A.) 4th order.	$\frac{1}{12}$(J. to D.) 4th order.	Differences from Mean. Jan. and Feb.	Differences from Mean. July and Aug.	Differences from Mean. Year.		$\frac{1}{2}$(J. & F.) 4th order.	$\frac{1}{2}$(J. & A.) 4th order.	$\frac{1}{12}$(J. to D.) 4th order.	Differences from Mean. Jan. and Feb.	Differences from Mean. July and Aug.	Differences from Mean. Year.
	°	°	°	°	°	°		°	°	°	°	°	°
1819		(75.2)	(53.7)		+3.0	+1.5	1847	33.6	70.9	52.5	+0.9	−1.3	+0.3
1820	(34.8)	74.5	53.1	+2.1	+2.3	+0.9	1848	33.3	70.7	52.1	+0.6	−1.5	−0.1
1821	32.0	74.1	52.8	−0.7	+1.9	+0.6	1849	33.2	71.3	52.1	+0.5	−0.9	−0.1
1822	31.0	73.5	52.8	−1.7	+1.3	+0.6	1850	33.4	72.0	52.1	+0.7	−0.2	−0.1
1823	32.0	72.9	52.8	−0.7	+0.7	+0.6	1851	34.1	71.9	52.2	+1.4	−0.3	0.0
1824	(34.3)	(72.9)	(53.2)	+1.6	+0.7	+1.0	1852	33.2	71.9	52.4	+0.5	−0.3	+0.2
1825	(35.3)	(73.2)	(54.1)	+2.6	+1.0	+1.9	1853	32.8	72.6	52.6	+0.1	+0.4	+0.4
1826	35.2	73.3	54.4	+2.5	+1.1	+2.2	1854	32.0	73.7	52.9	−0.7	+1.5	+0.7
1827	36.0	73.2	54.3	+3.3	+1.0	+2.1	1855	29.4	74.0	52.2	−3.3	+1.8	0.0
1828	36.0	72.8	54.2	+3.3	+0.6	+2.0	1856	27.8	73.5	51.3	−4.9	+1.3	−0.9
1829	33.8	72.6	53.6	+1.1	+0.4	+1.4	1857	29.6	73.1	51.4	−3.1	+0.9	−0.8
1830	31.2	72.3	52.9	−1.5	+0.1	+0.7	1858	32.6	72.9	52.2	−0.1	+0.7	0.0
1831	30.8	71.6	52.3	−1.9	−0.6	+0.1	1859	34.0	72.5	52.7	+1.3	+0.3	+0.5
1832	32.4	71.1	52.4	−0.3	−1.1	+0.2	1860	34.4	71.7	52.6	+1.7	−0.5	+0.4
1833	33.9	71.6	52.7	+1.2	−0.6	+0.5	1861	34.6	71.1	52.4	+1.9	−1.1	+0.2
1834	33.1	71.7	52.3	+0.4	−0.5	+0.1	1862	34.5	71.5	52.1	+1.8	−0.7	−0.1
1835	31.0	71.0	51.4	−1.7	−1.2	−0.8	1863	33.3	72.2	51.7	+0.6	0.0	−0.5
1836	29.8	70.8	50.8	−2.9	−1.4	−1.4	1864	31.1	72.0	51.4	−1.6	−0.2	−0.8
1837	29.9	71.8	50.9	−2.8	−0.4	−1.3	1865	29.6	71.1	51.2	−3.1	−1.1	−1.0
1838	30.8	72.6	51.3	−1.9	+0.4	−0.9	1866	29.2	70.8	50.9	−3.5	−1.4	−1.3
1839	32.2	72.0	51.8	−0.5	−0.2	−0.4	1867	29.3	71.5	50.5	−3.4	−0.7	−1.7
1840	33.0	71.2	52.1	+0.3	−1.0	−0.1	1868	30.4	72.4	50.5	−2.3	+0.2	−1.7
1841	33.6	70.6	52.1	+0.9	−1.6	−0.1	1869	(32.6)	(72.8)	(50.7)	−0.1	+0.6	−1.5
1842	34.8	70.5	51.8	+2.1	−1.7	−0.4							
1843	35.2	71.0	51.8	+2.5	−1.2	−0.4							
1844	34.9	71.8	52.1	+2.2	−0.4	−0.1	Mean of 49 years.	32.67	72.19	52.24			
1845	34.5	72.1	52.6	+1.8	−0.1	+0.4							
1846	33.9	71.7	52.8	+1.2	−0.5	+0.6							

Note.—Values in parenthesis are imperfect.

If we examine, by means of the successive signs of the tabular differences, whether or not a cold winter is followed by a cold summer, and whether the average temperature of the year is below or above the normal, we find, from the New Haven series, by comparisons of the signs for the cold months with those for the year, the following results: an accord, a + sign being followed by a + sign, or a — sign by a — sign, in 64 cases; and a discord, a + sign being followed by a — sign, or the reverse, in 18 cases; there are 3 indifferent cases, one of the differences being zero; in all, 85 cases. Comparing the signs of the warmest months with those of the year, we find 61 accords, 19 discords, and 5 indifferent cases; and comparing directly the coldest and warmest months there are 50 accords, 31 discords, and 4 indifferent cases. Altogether strongly favoring the conclusion that the changes which constitute the secular variation are generally exhibited in winter as well as in summer; in other words, the causes of these variations are alike, active at all seasons of the year. In the case of Marietta, we have likewise for winter and year 30 accords, 17 contradictions, and 3 neutral cases; for summer and year 32 accords, 15 contradictions, and 4 neutral cases, and for winter and summer 19 accords, 30 contradictions, and 1 neutral case. Here the evidence is somewhat weaker, probably owing to the greater number and shorter secular undulations, due to the more western position of the station.

LIST OF STATIONS.

LIST OF OBSERVERS.

INDEX.

ERRATA.

Page	15,	(California)	Station	54,	*read*	Frombes.
"	18,	Florida	"	2,	"	Atsena.
"	18,	Florida	"	4,	"	Pilatka.
"	21,	Georgia	"	13,	"	McAfee.
"	23,	Illinois	"	12,	"	Eldredge.
"	23,	Illinois	"	18,	"	Brookes.
"	23,	Illinois	"	18,	"	J. G. Langguth.
"	25,	Illinois	"	31,	"	Eldredge.
"	25,	Illinois	"	30,	"	Livingston.
"	27,	Illinois	"	82,	"	Jozéfé.
"	27,	Indiana	"	26,	"	Berthoud.
"	27,	Indiana	"	26,	"	Helm.
"	27,	Indiana	"	21,	"	Crosier.
"	29,	Indiana	"	35,	"	Crosier.
"	29,	Indiana	"	37,	"	Chappelsmith.
"	31,	Iowa	"	44,	"	Collin.
"	38,	Maryland	"	11,	"	Emmittsburg.
"	39,	Maryland	"	17,	"	Hanshew.
"	43,	Michigan	"	24,	"	Streng.
"	45,	Minnesota	"	7,	"	Hibbard.
"	46,	Minnesota	"	49,	"	Lapham.
"	48,	Missouri	"	22,	"	Keytesville.
"	50,	Nebraska	"	5,	"	De Soto.
"	53,	New Jersey	"	2,	"	Readington.
"	57,	New York	"	66,	"	Sias.
"	59,	New York	"	86,	"	Hibbard.
"	61,	New York	"	145,	"	Partrick.
"	61,	New York	"	150,	"	Malcolm.
"	62,	New York	"	193,	"	Throg's.
"	63,	New York	"	178,	"	Maurice.
"	63,	New York	"	193,	"	E. Morris.
"	65,	N. Carolina	"	1,	"	F. J. Kron
"	65,	N. Carolina	"	10,	"	Morelle.
Page	65,	N. Carolina	Station	23,	*read*	Morelle.
"	65,	Ohio	"	11,	"	J. H. Phillips.
"	67,	Ohio	"	38,	"	Samms.
"	67,	Ohio	"	45,	"	Owsley.
"	69,	Ohio	"	100,	"	Clung.
"	71,	Oregon	"	3,	"	Ironside.
"	71,	Pennsylvania	"	14,	"	Grathwohl.
"	71,	Pennsylvania	"	15,	"	Deering.
"	73,	Pennsylvania	"	31,	"	Spera.
"	73,	Pennsylvania	"	32,	"	Hance.
"	73,	Pennsylvania	"	40,	"	Meehan.
"	76,	S. Carolina	"	26,	"	Wickinsville.
"	77,	S. Carolina	"	2,	"	Ravenel.
"	77,	S. Carolina	"	25,	"	Ravenel.
"	78,	Tennessee	"	7,	"	Elizabethton.
"	79,	Tennessee	"	20,	"	J. M. Parker.
"	79,	Texas	"	3,	"	S. K. Jennings.
"	80,	Texas	"	65,	"	Pin Oak.
"	81,	Texas	"	61,	"	Ervendberg.
"	82,	Vermont	"	15,	"	Lunenburg.
"	83,	Vermont	"	16,	"	Sheldon.
"	85,	Virginia	"	4,	"	Kounslar.
"	85,	Virginia	"	5,	"	Principal.
"	85,	Virginia	"	39,	"	Mettauer.
"	85,	Virginia	"	41,	"	Appleyard.
"	91,	Wisconsin	"	37,	"	Dunegan.
"	91,	Mexico	"	1,	"	Laszlo.
"	91,	Mexico	"	3,	"	Laszlo.
"	214,	Nebraska	"	4,	"	Kearney.
"	220,	Oregon	"	6,	"	Hoskins.
"	257,	Maryland,	column	2,	"	Schellman.
"	296,	Virginia,	"	5,	"	Montross.
"	305,	Georgia,	line	4,	"	Oglethorpe.

TEMPERATURE CHART OF THE UNITED STATES

SHOWING THE DISTRIBUTION BY ISOTHERAL CURVES OF THE MEAN SUMMER TEMPERATURE OF THE LOWER ATMOSPHERE

WINTER

TEMPERATURE CHART OF THE UNITED STATES

SHOWING THE DISTRIBUTION BY ISOCHIMAL CURVES OF THE MEAN WINTER TEMPERATURE OF THE LOWER ATMOSPHERE

Lith by J Bien N Y

TEMPERATURE CHART OF THE UNITED STATES

SHOWING THE DISTRIBUTION BY ISOTHERMAL CURVES OF THE MEAN ANNUAL TEMPERATURE OF THE LOWER ATMOSPHERE

Lith. by J. Bien N.Y.