Hall, Maxwell

The meteorology of Jamaica

INSTITUTE OF JAMAICA

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KINGSTON, JAMAICA:

THE INSTITUTE OF JAMAICA: DATE TREE HALL.

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THE

METEOROLOGY OF JAMAICA

BY

MAXWELL HALL, M.A., F.R.A.S., F.R.Met.S.,

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PREFACE

In ancient times Meteorology included all the appearances of the heavens, whether astronomical or atmospheric. But as knowledge increased, these appearances, or phenomena, were gradually referred to either one or the other of the two divisions.

Astronomy became an exact science—that is to say, all the observed motions were found to be subject to strict laws and rigorous computation ; but the laws which regulate the ever-varying atmospheric motions and changes are so highly complicated, that, even at the present time, Meteorology can hardly be termed a science.

But in an uniform climate like that of Jamaica the diurnal and annual variations are so far regular that observation alone affords highly valuable and practical results ; and it is here proposed to give an account of some of the more important results of observation as detailed in the *Jamaica Weather Reports*, which were issued monthly between 1881 and 1902, and which form Vols. I., II., and III. of the *Jamaica Meteorological Observations.*

It is also proposed to give a few simple explanations of the changes which are found to occur, with the view of rendering such knowledge as we possess practically useful, and with the hope of aiding future research.

A few remarks will be made about the instruments employed in measuring the pressure, temperature, motion, and moisture of the atmosphere, and their management; and this part of the work is merely a revision of the article on Meteorology published in the first *Handbook of Jamaica*, 1881.

MAXWELL HALL.

MONTEGO BAY,
February, 1904.

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THE

METEOROLOGY OF JAMAICA

The Barometer

THIS instrument was invented by Torricelli in the year 1643, and its principle may be illustrated by the following experiment.

Take a glass tube about three feet in length, closed at one end, and fill it with mercury. Now close the open end by pressure of the finger, invert the tube, dip the end closed by the finger into a bowl containing mercury, and then remove the finger. It will be found that the mercury will fall a few inches in the tube, leaving a vacuum at the upper end; and upon measurement it will be found that the height of the column of mercury in the tube above the surface of the mercury in the bowl will be about 30 inches, provided that the experiment be made near the level of the sea.

Torricelli thus demonstrated that the pressure of the atmosphere on any area near the sea-level is counterbalanced by the pressure of a column of mercury on that area whose height is about 30 inches.

In the barometer the bowl is replaced by a small glass cistern; the cistern and the glass tube are enclosed in a suitable brass frame; and arrangements are made for measuring with great accuracy the height of the column of mercury above the level of the mercury in the cistern. This is what is to be understood by "the height of the barometer."

The brass framework has a thermometer attached to it, in order to show the temperature of the instrument—for the following reason.

The density of mercury varies with its temperature, so that a column of 30 inches of mercury at a temperature of 50° weighs more than a column of 30 inches of mercury at 80°. In order, therefore, to compare the readings of barometers at different temperatures, it is necessary to reduce all these readings to what they would have been, supposing that the mercury had always the same temperature.

It has been universally agreed to adopt 32°, the temperature of freezing water, as the temperature of reference for mercurial barometers.

Table I. gives the decimal parts of an inch to be subtracted from the reading of the barometer for every degree between 60° and 90°; it takes into account the expansion of the brass frame as well as the expansion of the mercury. It will be seen that the reduction varies with the height of the barometer; thus when the attached thermometer is 75° we must subtract 0·108 inch from the reading of the barometer when it is about 26 inches, but we must subtract 0·125 inch when the reading is about 30 inches.

Now, although Torricelli showed that the atmosphere exerted a pressure which could be measured by a barometer, it was left to Pascal to show that this pressure was due to the weight of the air. The atmosphere rests upon the surface of the sea and land in much the same way that the ocean rests upon its bed. The pressure at great depths in the ocean is enormous; the atmospheric pressure at the surface of the sea is about 15 pounds on every square inch; and this pressure continually diminishes as the elevation above the level of the sea increases.

In the year 1648, at the suggestion of Pascal, Perier ascended the Puy de Dome, a mountain near the centre of France; and he found that the barometer fell almost four inches as he ascended from the foot of the mountain to its summit. The pressure at the summit was relieved of the weight of the air below; and it only remained to ascertain the weight of a given quantity of air in order to compute differences of elevation by means of barometric observations.

This can be done with considerable accuracy; and conversely, when a barometer is read at a given elevation, the reading can be reduced to the level of the sea.

Table II. gives the reduction of the barometer to the sea-level for different temperatures of the air at the sea-level. When the temperature of the air at any given elevation is known, the temperature of the air at the sea-level can be obtained approximately from Table VI.; thus, at the Blue Mountain Peak, which is 7423 feet above the level of the sea, the temperature falls on an average 23°·5 below the temperature at the level of the sea; and at this elevation it makes little difference in the fall of temperature whether we consider the fall at the hottest or the coolest time of the twenty-four hours; but at other elevations the difference may be sensible, and should be allowed for if necessary.

The next correction to be applied to the barometer is for all the instrumental errors combined, including any very slight difference in the specific gravity of the mercury employed, and that of the mercury in the standard of the Royal Society. All barometers intended for accurate purposes are therefore sent to the Kew Observatory to be compared with the standard; the differences are carefully noted, and may be termed the reductions to the Kew standard. This reduction for a well-made instrument will never exceed a few thousandths of an inch.

Finally, a small correction depending on the latitude should be applied in consequence of the variation of gravity with the latitude. Terrestrial gravity is greatest at the poles and least at the equator; so that a column of mercury 30 inches high at the equator would balance a column of mercury of only 29·84 inches at the poles, the two columns having the same temperature. Consequently, in comparing barometric pressures in different latitudes, it becomes necessary to adopt some standard gravity; and it has been agreed to adopt gravity at the sea-level in lat. 45° as such standard.

Different nations have recently adopted this correction at different times; and I believe that it was agreed that all nations who had not previously done so should adopt it on January 1, 1901. In Jamaica the correction was adopted January 1, 1896; and 0·063 inch, corresponding to lat. 18°, was subtracted from all barometric readings reduced to the sea-level.

This reduction to standard gravity should be incorporated with the reduction to the Kew standard; and for any altitude not exceeding a thousand feet or so, a small table should be drawn up further reducing to 32° and to sea-level for each degree of temperature as usually experienced at the station in question, always supposing that the barometer is kept where its temperature as shown by the attached thermometer will not greatly differ from the temperature of the air as shown by the dry-bulb thermometer in Stevenson's screen on the lawn.

Commencing observations, the first thing which attracts our attention is the diurnal variation of the atmospheric pressure; two small waves pass daily with great regularity, the crests at 9.30 a.m. and 10.30 p.m., and the hollows at 4 p.m. and 3.30 a.m. The wave which passes during the daytime is about twice as great as the one which passes during the night; and neither of them is affected by heavy local rains, nor yet by cyclones, however widely extended.

Table III. gives the correction for this diurnal variation to be applied to the reduced reading of the barometer; and it cannot be neglected when accuracy is required. Thus, suppose about the middle of August that the reduced reading at 7 a.m. was 29·910, and at 3 p.m. 29·869: by neglecting the diurnal variation it would appear that the pressure was falling; but by applying the correction it will be found that the pressure was really steady, the corrected reading being 29·900 both at 7 a.m. and 3 p.m.

Now, the mean pressure of a day at any place is the sum of the twenty-four reduced readings of the barometer taken at each hour of the day and night divided by 24; the mean pressure of a month is the sum of the daily means divided by the number of days in the month; the mean pressure of a year is the sum of the monthly means divided by 12; and the mean pressure at the place is the sum of the annual means divided by the number of years of observation.

Table IV. gives the mean pressure at Kingston sea-level for every ten days throughout the year; and by its use we can ascertain whether the mean pressure of any day is above or below the average.

The mean pressure of a day is, of course, independent of the diurnal variation; and it will be noticed in Table III. that if we take the mean of the three reduced readings at 7 a.m., 3 p.m., and 11 p.m., we shall get a very close approximation to the mean pressure of the day as deduced from the twenty-four hourly readings.

The best hours for observation of pressure are therefore 7 a.m., 3 p.m., and 11 p.m., especially as it will be found in the next section that the 7 a.m. and 3 p.m. readings of the thermometer are the best hours for the observation of temperature.

The Thermometer

was invented by Galileo towards the end of the sixteenth century. His air thermometer consists of a glass bulb with a long neck, which is dipped into a small cistern or vessel containing coloured liquid. As the air in the bulb expands or contracts according as its temperature increases or diminishes, so the coloured liquid falls or rises in the neck, to which a scale is attached to mark the variations. But in order that the coloured liquid may have a convenient normal height in the neck, it is, of course, necessary to heat the bulb before the neck is plunged into the liquid.

Such an instrument as this will show variations of temperature, provided that the atmospheric pressure remains the same; if the atmospheric pressure increases or diminishes, the elastic glass bulb will contract or expand and vary the height of the liquid.

The instrument was afterwards improved; the neck became a thin stem; the bulb was greatly reduced in size and filled with spirits of wine or mercury; and the glass stem was hermetically sealed by means of the blow-pipe, so as to exclude the air entirely. Variations of temperature were now shown by the expansion or contraction of the fluid; and all that was required was a scale.

In the year 1701 Sir Isaac Newton pointed out that there were two temperatures adapted for the purposes of graduation.

These were the temperature of freezing water and the temperature of the human body; and it was not till afterwards that the latter temperature was replaced by that of boiling water. If a thermometer be placed in a tumbler containing ice and water, its temperature will remain steady until all the ice is melted or all the water frozen; if the thermometer be placed in an open vessel of boiling water, its temperature will again remain steady until all the water is boiled away. By increasing the fire under the open vessel the temperature of the water is not increased; it only boils away faster. The boiling-point, however, varies slightly with the pressure.*

Fahrenheit, a philosophical instrument maker of Amsterdam, constructed his scale about the year 1724. He divided the distance between the freezing- and boiling-points into 180 parts; and he took as the zero a point 32 of these divisions below the first; so that on his scale 32° and 212° are the freezing- and boiling-points respectively.

The centigrade division of the scale was introduced by Celsius, a Swede, in the year 1742. The freezing-point was taken as zero, and marked 0°; and the boiling-point was marked 100°.

The latter scale is well adapted for the study of physics; the former is, however, more convenient for everyday requirements. When using Fahrenheit's scale we have seldom to refer to *negative* temperatures, or temperatures below zero; and we have seldom to express temperatures in degrees and *tenths;* but when scientific purposes require registration to tenths of a degree, then Fahrenheit's scale again affords the required accuracy.

Fahrenheit's scale is used in English-speaking countries; the Centigrade scale is used in France, Sweden, and other countries; and Reaumur's scale is used in Germany and Russia. In the last scale the freezing-point is 0° and the boiling-point 80°; it possesses no known advantages.

Very accurate and comparatively cheap thermometers can now be procured with the divisions etched on their stems; but still it is necessary that all such thermometers should be compared with a standard thermometer at intervals of a few years in order to ascertain their errors.

* It is 212° when the pressure is 29·938 (stand. grav.).

For meteorological purposes it is the temperature of the air which is required. At night, or on a cloudy day, when the air is moving, the temperature may be easily found; but when the day is calm, and the solar radiation intense, it is no easy matter to obtain the temperature of the air. Uniformity of exposure therefore becomes very important, so that we may at least compare the temperature of different places.

Stevenson's screen for thermometers is now very generally adopted. It is a light wooden box, whose sides are made of double jalousie-work, so that the rays of heat from the sun or ground cannot reach the thermometers, and so that the air can freely circulate about them. The screen is supported by a firm wooden stand; it is freely exposed to the air on a grass lawn; and its height is such that the bulbs of the thermometers are 4 feet 6 inches above the surface of the ground.

There are two important modifications of the ordinary thermometer which may be briefly alluded to; the first is adapted for the self-registration of the highest temperature reached by the thermometer in any given interval of time. In the ordinary thermometer a small piece of steel or enamel is placed in the empty part of the tube; this *index* is free to move in the tube; it is brought into contact with the mercury during the cooler part of the day, and the tube is placed in a horizontal position. As the mercury expands the index is pushed forward to the highest point, and is left remaining there after the mercury contracts. This modification is called the maximum thermometer, and it is registered once in every twenty-four hours, so as to obtain the highest temperature of the day. There are, however, several forms of this instrument.

The other modification is called the minimum thermometer, as it registers the lowest temperature of the day. In this instrument alcohol is used instead of mercury, and the index is placed in the alcohol in the tube; as the alcohol contracts it drags the index down to the lowest point, and as it expands it passes by the index, leaving it stationary at the lowest point. The difference between the highest and lowest temperatures of any day is called the Range.

Now, the mean temperature of any day may be found with considerable accuracy by merely subtracting 1° from half the sum of the maximum and minimum temperatures of the day; or by taking half the sum of the temperatures at 7 a.m. and 3 p.m. And by combining these two precepts we get the following rule for mean temperature in Jamaica: add together the 7 a.m., 3 p.m., maximum, and minimum temperatures, subtract 2° from their sum, and divide the remainder by 4.

By employing monthly means we similarly get the mean temperature of the month.

Table V. gives the results for Kingston, about 50 feet above the sea-level, as deduced from careful observations made by the Weather Service between the years 1881 and 1898 inclusive; and it will be seen that the mean temperature of Kingston is 78°·8.

Now from similar observations made at the Cinchona Plantation (or Hill Gardens), elevation 4907 feet, by the Department of Public Gardens and Plantations, it appears that the mean temperature there is 62°·2; and from somewhat different observations made on the Blue Mountain Peak by the same Department, it appears that the mean temperature of the Peak is 56°·0 at an elevation of 7423 feet. The mean temperature therefore falls about 1° for every 300 feet of elevation; more accurately, the mean temperature falls 3°·4 for the fall of an inch of barometric pressure.

But the fall of mean maximum and minimum temperatures is more complicated, and Table VI. has been drawn up in a form convenient for general use.

With regard to extreme temperatures, at Kingston the highest maximum was 96°·7, recorded on August 20, 1891, and the lowest minimum was 56°·7, recorded December 4, 1887; at the Peak the highest maximum was 80°·9, recorded in February, 1889, and the lowest minimum was 33°·3, recorded in February, 1893.

From observations in Kingston extending over two years, it appears that the minimum temperature on the grass is 6° below the minimum temperature inside the Stevenson screen 4½ feet above the lawn. Now the temperature in the screen at the Peak fell to 38°, or below 38°, twelve times during the sixteen years of observation; consequently frost occurred on the Peak twelve times during those sixteen years.

The diurnal variation of the temperature is, of course, well understood; the minimum occurs at sunrise; the temperature then rises rapidly, the maximum occurring at noon. In the evening the temperature falls until the dew-point is reached, when the rate of fall is arrested, and then the temperature slowly decreases to the minimum at sunrise.

Table VII. gives the diurnal variation for Kingston in the form of a correction to be applied to the temperature at any hour to reduce it to the mean of the twenty-four hours. It was deduced from hourly observations made during the years 1899, 1900, and 1901, at the United States Station, Halfway Tree, by means of a self-recording instrument.

Vapour

Air consists of two gases, oxygen and nitrogen, which are mixed together in the proportion of 23 parts of oxygen to 77 parts of nitrogen, with respect to weight.

But the atmosphere also contains a little carbonic acid gas, and a variable quantity of the vapour of water. The amount of this aqueous vapour is measured by its pressure, or *tension*, as it is termed, in the same manner that the whole pressure of the atmosphere is measured. Thus, while the atmosphere at the sea-level exerts a pressure of about 30 inches of mercury, the amount of vapour generally present in the atmosphere exerts a tension of about a quarter of an inch in cool climates, and in warm insular climates about three times as much.

Now, while aqueous vapour resembles a true gas in most respects, such as elasticity, invisibility, etc., yet it differs in this important particular, that a given volume cannot contain more than a certain amount of vapour depending on its temperature.

If a little water be poured into a glass jar, which is then tightly closed, the jar will soon become filled with a certain definite amount of vapour depending on the temperature, but independent of the air which may be in the jar; that is to say, the amount of vapour will be the same whether the jar was full of air or whether it had been previously exhausted.

By increasing the temperature within the jar, the amount of vapour will be increased; by diminishing the temperature, the amount will be decreased, the vapour will be *condensed*, and form minute drops of water, which adhere to the sides of the jar, or trickle down to join the water at the bottom.

In this way dew is formed. At night the temperature of the grass, leaves of trees, roofs of houses, etc., is reduced by radiation; the air near them is chilled, and it cannot then contain all the vapour it previously sustained; the excess is quietly and gradually deposited in the form of dew. In the country the amount of dew is so large that it drips from the eaves of the houses like rain. In Kingston the air is much drier, and there is but little dew.

In this way, again, clouds are formed and rain produced. But we have said enough to show the importance of aqueous vapour, and we must now return to its measurement.

If from an elaborate series of experiments, we knew the tension of *saturated* vapour for each degree of temperature, we could ascertain the amount of vapour present in the air at any given time and place by noting the temperature of the *dew-point*, or the temperature at which dew begins to form.

Such experiments have often been made, but the best were conducted by Regnault, the French chemist; the results are given in the second column in Table VIII.

In order, therefore, to find the amount of vapour present in the air at any time, it is only necessary to find the dew-point and to employ Table VIII. Thus, if the average temperature of the dew-point is 70°·3 in Kingston, the aqueous vapour in the air there exerts an average pressure or tension of 0·741 inch.

But in order to find the dew-point, it is generally necessary to reduce the temperature. This may be done by ether; and Daniel's hygrometer is adapted to the direct observation of the dew-point.

Such observations, however, would be tedious, and the dry- and wet-bulb hygrometer is used in preference. If the bulb of a thermometer be wrapped in some very thin muslin and kept continually damp by means of a connecting thread which dips into a small cistern of water, the thermometer will show the temperature of evaporation, which depends on the *rate* of evaporation, which again depends on the amount of vapour there is in the air, and the amount of wind moving. By placing dry- and wet-bulb thermometers side by side in a Stevenson screen, the effect of the wind will be greatly reduced, and may then be neglected. And so we have left for consideration the difference of the readings of the dry- and wet-bulb thermometers and the amount of vapour.

Now, from a long series of experiments, it has been found that if the difference between the dry- and wet-bulb readings be multiplied by certain factors, or numbers, we shall obtain the difference between the temperature of the dry bulb and the temperature of the dew-point, which thus becomes known. Glaisher's experiments include observations made in different climates, and during balloon ascents. By means of Daniel's hygrometer, it has been found that they are equally applicable to the hot plains in Jamaica and to the Blue Mountain Peak. Glaisher's factors are given in the third column in Table VIII.

In practice, however, it will be convenient to subtract unity from these factors; and then after multiplying the difference between the dry and wet bulbs by the diminished factor, we get the difference between the *wet* bulb and the dew-point. As an example, suppose that the readings of the dry and wet bulbs are 85° and 75° respectively; we must multiply their difference 10° by 1·65, the factor corresponding to 85°; this gives us 16°·5, the difference between the dry bulb and the dew-point; hence the dew-point is 68°·5. Or, by diminishing the factor by unity, we must multiply 10° by 0·65, and subtract the product from 75°, which gives the dew-point as before.

In this way tables can be prepared which give the dew-point by mere inspection. Table IX. will be found generally useful in Jamaica.

The diurnal variation of the dew-point in Kingston is small—

7 a.m.	69°·1
3 p.m.	72°·0
11 p.m.	69°·9

giving an average, as already stated, of about 70°·3.

The annual variation of the dew-point is fairly large, and closely follows the minimum temperature; this is shown in

Table XI. The explanation of this fact is very simple; the temperature falls at night until the dew-point is reached; then dew is deposited, latent heat is given out, and the further fall of temperature is arrested.

Above the sea-level the tension of the aqueous vapour present might be expected to decrease with the atmospheric pressure; but the dew-point at the Cinchona Plantation is only 58°,* giving a tension of only 0·482 inch; and this shows that we have to consider distance from the seashore as well as elevation.

But besides the amount of vapour, we require to know the humidity of the air. Thus in the example given above the dry and wet bulbs were 85° and 75°, the dew-point was 68°·5, and the tension of vapour was 0·696 inch. On another day the dry and wet bulbs may both read 68°·5, and the tension of vapour will be the same as before; but the humidity is different. On the first day the air was dry, and on the second day the air was saturated with moisture.

Humidity may be defined as the ratio of the vapour-tension present at any time to the vapour-tension required for saturation; and humidity is recorded in whole numbers from 0, when the air is perfectly dry, to 100, when the air is perfectly saturated.

Thus on the first day the temperature of the air was 85°, and a tension of 1·203 inch was required for saturation. But the tension really was 0·696 inch; hence the humidity was 58—which is found by multiplying 0·696 by 100 and by dividing by 1·203. On the second day the humidity was, of course, 100.

Table X. gives the humidity by mere inspection. This and the two preceding tables were taken from Glaisher's *Hygrometrical Tables*, which have, of course, a far larger scope, and to which further reference may be made if necessary.

The diurnal variation of humidity in Kingston is fairly large—

7 a.m.	81
3 p.m.	68
11 p.m.	85

* This is the mean of the 7 a.m. and 3 p.m. readings, 55°·5 and 60°·5 respectively; the corresponding dew-point at Kingston is 70°·6.

giving an average of about 78. These results apply to the air 4 feet 6 inches above the ground; nearer the ground the humidity increases at night up to 100.

At the Cinchona Plantation the humidity at 7 a.m. is about 83, which is much the same as at Kingston; but at 3 p.m. it increases to 88—probably due to afternoon showers, which fall there nearly all the year round.

Rain

The amount of rain which falls at any place in any given interval of time is measured by its depth in inches and decimal parts of an inch.

Thus, let us suppose that at any time the depth of water in an open tank was 5 feet, and that after an interval of twenty-four hours, during which there were intermittent showers, the depth of water was increased to 5 feet 2 inches; then the total amount of rain which fell at the place during those twenty-four hours was 2 inches in depth; or, more shortly, the rainfall for that day was 2 inches.

It is to be noticed that the size and form of the tank will not affect the result, provided the sides of the tank are perpendicular; and, instead of a tank, we may use a small cylindrical receiver, neatly made of thin metal.

Again, in order to measure with accuracy the depth of the water caught at any time in the receiver, we can pour the water into a narrow cylindrical glass gauge, properly graduated, and thus easily read the rainfall to the nearest hundredth part of an inch. In graduating these glass gauges the scale must be multiplied by the ratio of the square of the diameter of the receiver to the square of the diameter of the gauge.

Such an apparatus is called a rain-gauge; and by registering the rainfall daily we get the total rainfall for the month or year. But on account of the extreme local irregularity in the rainfall, it is necessary to read a large number of rain-gauges in order to obtain the average rainfall for any district. These rain-gauges should be placed so that the receiving surfaces are all one foot above the surface of the ground; and, of course, they should be fully exposed to the sky, and in no way sheltered by trees or buildings. If the rain-gauges cannot be placed so near the ground with safety, as is often the case on sugar estates, they may be placed on the top of a post 5 feet high, firmly planted in any open ground. The height of the receiving surface above the ground, as well as the elevation of the place above the level of the sea, should always be stated in the register.

In Jamaica the hundredths of an inch are often called "parts"; thus a rainfall of 2·03 inches, or two inches no tenths and three hundredths, is often written 2 inches and 3 parts. It would often save confusion to adhere to the proper decimal notation. When no rain falls 0·00 should be entered in the register, and blanks should be left for omissions to register.

The rain-gauge should be registered daily at 7 a.m., before the sun gets hot, otherwise there will be loss from evaporation. But the rainfall should be entered in the register for the preceding day, and not for the day on which the entry was made. The necessity of this is obvious, as the rains generally fall after noon.

There are about 200 rain-gauges registered in Jamaica, but they are very irregularly distributed; and in consequence of this irregularity, the island was divided into four divisions. Now if the average rainfall be obtained for each division, the average rainfall for the whole island may be obtained by adding together the average for each division and by dividing by 4, no matter how many gauges may be registered in one division and how many in another.

The northern division comprises the northern shores from Port Maria to Davis' Cove, including the central part of the island, which forms the central sub-division; the southern division comprises the southern shores from Holland Bay to South Negril; the north-eastern and west-central divisions are the remaining parts of the island, bounded by the sea and the other divisions. Their relative areas are as follows:—

North-eastern division	25
Northern and central	22
West-central	26
Southern	27
	100

The north-eastern and northern divisions have winter rains in November, December, and January; the north-eastern and west-central divisions have summer rains; and the southern division is drier than the others, having rains for the most part during the May and October "seasons" only; and these characteristics of the Jamaica rainfall have not altered for two hundred years at least.

Tables XII. and XIII. give us general information about the rainfall; and it will be seen that the average annual rainfall over the whole island is about 70 inches; that in 1886 it rose to over 90 inches; and that in 1872 it fell to 45 inches, in consequence of the failure of both the May and October seasons. The heavy rainfall in 1886 was chiefly due to the flood-rains in June that year, which did immense damage to property—the Rio Cobre carried away railway bridges and embankments; the Rio Minho rose 40 feet above its bed at the May Pen bridge; and at the centre of the island Cave Valley and Greenock estates were submerged in consequence of the "sink-holes" being choked, the water rising in some parts as much as 100 feet.*

With regard to the distribution of the rainfall, Table XIII. shows that far more rain falls in the north-eastern division than in any other; then follows the west-central division, then the northern, and lastly the southern, as already stated. But the rainfall varies greatly over each division. In the north-eastern division the greatest rainfall occurs in the valley of the Rio Grande at the base of the Blue Mountains. A rain-gauge has been kept at Moore Town since February, 1896, and it shows an annual rainfall of about 248 inches. At the Blue Mountain Peak the annual rainfall is 175 inches; and at twelve other stations in the north-eastern division, where registers have been kept for seven years and more, the annual rainfall exceeds 100 inches.

In the west-central division there are only five stations where the annual rainfall exceeds 100 inches.

Kingston, Plumb Point Lighthouse (two miles south of Kingston), and Bull Bay (eight miles east of Kingston), are the driest places in the island, their annual rainfall being 35, 34, and 33 inches respectively.

* For further particulars see *Weather Report*, No. 67.

For further particulars reference should be made to the *Rainfall Atlas* published by the Institute of Jamaica in the year 1892, which shows the average rainfall over the island, for the year, and for each month of the year; and to *Weather Report*, No. 256 (A), which gives the average rainfall at 193 stations where registers have been continuously kept for at least six years.

The Winds

Wind is caused by local differences of atmospheric pressure, which, again, are chiefly caused by local differences of temperature; and its direction at any place and time is indicated by the true point of the compass from which it blows.

In Jamaica the difference between the true and magnetic north is small; at Kingston, in the year 1891, the magnetic north was 2° 16′ to the east of the true north; and this difference decreases at present at the rate of about 7′ per annum.

In order to show the prevailing direction of the wind at any place for any month or year, it is convenient to construct a table stating the number of times the wind was observed to blow from each point of the compass. In Kingston, for instance, the prevailing direction of the sea-breeze is south-east.

Besides the direction of the wind, we further require its velocity, or force. The velocity of the wind is measured in miles per hour. Dr. Robinson of Armagh invented a very useful anemometer. It consists of two light rods attached together crosswise, which carry four light cups at their extremities. These cups and rods are free to rotate horizontally about a light vertical axis firmly attached to the rods at their point of junction; and by means of an endless screw this vertical axis can be made to register the number of revolutions of the apparatus. Dr. Robinson showed that the centres of the cups rotate with one-third of the velocity of the wind; and the registering dials are made to record three times the number of miles passed over by the centre of the cups in consequence of their rotation, or the number of miles of wind which has swept past the instrument. If, therefore, we read the dials at the commencement and end of an hour or day, we can obtain the number of miles of wind which have passed the instrument in the hour or day. The former is alluded to as velocity—so many miles per hour; the latter as the total miles of wind in the day. These anemometers should be small and light; for otherwise short and strong gusts of wind produce a momentum so great that the cups and rods do not cease to rotate when the gusts stop, and consequently the readings are too large.

But besides the velocity, the force of the wind may be measured by its pressure in pounds upon a square foot of surface kept continually opposed to the wind by means of a vane. There is, of course, an intimate connection between the two—the pressure is equal to the square of the velocity divided by 300. In Table XIV. it will be seen that while the pressures are very small for small velocities, they increase rapidly as the velocities increase, until velocities of 100, 110, and 120 miles per hour produce pressures which sweep away trees and buildings.

There is considerable doubt as to the accuracy of these pressure-plate anemometers when the wind is violent; the clock-work recording apparatus is somewhat cumbersome, and the recording pencil seems to be jerked forward so as to indicate too high pressures. At the Kempshot observatory, near Montego Bay, all the usual recording apparatus has been removed from the pressure-plate anemometer, and a very light needle moves an index forward, which remains at the highest reading; the instrument therefore registers the strongest gusts only, and it registers them correctly as far as can be ascertained.

Another anemometer was devised a few years ago by Mr. Dines, on the principle that when the wind blows over the mouth of a pipe the pressure of the air within the pipe is diminished. It works very well; and it would be interesting to compare the indications of the three instruments when the wind is over 60 miles an hour.

It must, however, often occur that instruments are not at hand to measure the force or the velocity of the wind, and consequently arbitrary scales are used. In Great Britain the scale adopted was compiled especially for nautical purposes by Admiral Beaufort. But if we were to adopt this scale in Jamaica, all our land-breezes would be put down as calms; and indeed it is evident that this scale is not sufficiently refined for wind on shore with regard to the smaller velocities. The scale used in the United States of America has been adopted in Jamaica; it is given in Table XV.

The explanation of the sea and land breezes is very simple. During the daytime the land is heated by the sun, while the sea hardly changes its temperature; consequently the air above the land rises and expands; the barometric pressure is diminished; and the air from the sea flows in from all directions to replace the ascending currents. During the night the land is cooled by radiation, and the surface currents of air move from the land outwards in all directions. But these breezes in Jamaica are modified by the general easterly drift of the air over the Caribbean Sea; and the results are strong north-east sea-breezes on the north side of the island, and strong south-east sea-breezes on the south side.

The sea-breeze sets in about 10 a.m. and lasts until about 5 p.m. It is strongest at the level of the sea, and diminished with the elevation; so that at an elevation of 1000 feet it is hardly felt.*

Table XVI. gives the diurnal variation of the wind at Kingston from instruments placed on the roof of the Public Works Office. The constancy from 9 p.m. through the night to 8 a.m. is very remarkable, and there is no lull or calm at all between the south-east sea-breeze and the north land-breeze. Table XVII. gives the annual variation of the wind at Kingston.

The prevailing easterly winds over Jamaica and the West Indies generally are due to the great anticyclone which exists over the North Atlantic, and the position of whose centre is on an average in lat. 30°, long. 30°. They are, of course, part of the trade-wind system; and to study them we must get well above the sea-breeze limit. At both the Kempshot observatory and at the Cinchona Plantation the average direction is east; but at the former place the direction varies with the time of the year—east-north-east or even north-east in winter, and east-south-east or even south-

* At Iver, St. Andrew, elevation 1700 or 1800 feet, it is distinctly felt.

east in summer. This variation is in direct accordance with the diminution of the anticyclone in winter, and the low pressure over the North American continent in summer; and it is difficult to understand why the wind at the latter place hardly shows this variation.*

It is in this stratum of moving air that the thunderstorm cumuli are borne along, so that this stratum must reach at least 5 or 6 miles above the surface; and it is curious to watch the heavy thunder-showers at Lucea sweep up from the south-east in the summer months while the sea-breeze is often blowing hard from the north-east.

At sea this easterly trade-wind moves at the rate of about 240 miles per diem; at the Kempshot observatory this rate is reduced to 142 miles per diem.

There are still two higher currents of air shown by the upper cloud-drifts, to which reference will be made in the following section.

Clouds and Cloud-drift

There has been considerable confusion among writers on Meteorology in the naming and classification of clouds. Early in the nineteenth century Luke Howard proposed a system based upon the three primary forms *cirrus, cumulus, stratus,* and their compounds *cirro-stratus,* and so on; and probably it was the want of proper definitions of the forms and compound forms which led to the confusion.

Recently there has been an international movement towards uniformity in cloud nomenclature based upon Howard's system; and the International Committee have published a valuable cloud atlas. It is therefore advisable to state what clouds have hitherto been registered in Jamaica.

Between 1880 and 1895 the Weather Service in Jamaica followed the *Instructions to Observers* of the United States Signal Service—

"Clouds will be recorded on a scale of from zero to ten, zero being clear, and ten cloudy.

* Mr. R. Johnstone suggests the Blue Mountain range to the north of the Plantation, the range running east and west.

"The following will be recorded as upper clouds—cirrus, cirro-stratus, cirro-cumulus, and cumulus.

"The following will be recorded as lower clouds—cumulus, stratus, cumulo-stratus, nimbus, and fog.

"Cumulus may be reported either as upper or lower clouds, depending upon the position they occupy."

It was soon found that the clearest months of the year are January, February, and March, when on an average three-tenths of the sky are obscured; and that the cloudiest months of the year are August, September, and October, when on an average six-tenths of the sky are obscured.

Also it was found that the upper clouds are for the most part only seen from June to October inclusive, and during those months only in the early morning, as a rule; and that the lower clouds are seen during midday all the year round.

From January, 1896, onwards the clouds were divided into upper, middle, and lower, following the primary forms of cirrus, cumulus, and stratus. This was necessary for the following reasons:—cumulus in Jamaica is often 6 miles high, reaching from the rain falling on the ground to the upper regions of cirrus; and, during the hurricane months, clouds of the cirrus class move from the east-north-east; clouds of the cumulus class move from the south-east; and clouds of the stratus class according to local circumstances of sea-breeze, land-breeze, and mountain configuration; and for storm-warning purposes the importance of such generalizations cannot be over-estimated.

Moreover, the nomenclature was brought into accordance with the system adopted by the International Committee; and in *Weather Report* No. 193 a full account of these changes was given. It will here be sufficient to describe the different clouds as distinctly as possible.

(1) Cirrus.—This cloud consists of long fibrous threads, often blown by the upper currents into such forms as feathers, mares' tails, etc. When the threads or feathers point towards the observer, they appear like wisps of hay or straw. This is the pure form of cirrus, and it is caused by the condensation of thin ascending streams of vapour, and by the freezing of the particles of water. These ice-clouds are often at great elevations; from the rate of decrease of temperature with the

height above the sea-level it appears that the freezing-point of water is reached at an elevation of about 3 miles; this height is therefore the lower limit of cirrus over Jamaica. As already said, cirrus is often seen in the morning about sunrise during the summer and autumn months, but they rapidly disappear as the temperature of the day increases. Under these circumstances they are fine-weather clouds, and it is only when they increase in extent and develop into cirro-stratus that they can be connected with bad weather.

According to the following table, there is a well-marked upper current from the east-north-east during the autumnal months—

	Average drift of Cirrus.	Average drift of Cirro-stratus.
North	7	9
North-east	26	25
East	28	27
South-east	8	18
South	4	6
South-west	7	6
West	13	5
North-west	7	4
	100	100

The numbers given in this table refer to a long series of observations at Kempshot, and express the fact that out of 100 observations where the cirrus-drift was observed, 7 times the drift was from the north, 26 times from the north-east, and so on; and similarly for cirro-stratus.

The table also shows a still higher current from the west; and the existence of this current has been confirmed at times by the drift of long continuing trails of shooting-stars, and by the drift of dust from volcanoes in eruption.

(2) Cirro-stratus.—This cloud consists of thin sheets of fibrous texture; the threads often seem to interlace, when the clouds appear to be woven. Solar halos, mock suns, etc., are caused by the ice particles of which this cloud is composed. Cirro-stratus is always found to surround the advancing half of a cyclone; and hence its importance in forecasting the weather. The lower limit is the same as that of cirrus; it also shows the north-east current, but not the highest west current.

(3) Cirro-cumulus.—This cloud consists of thin sheets of small and separate flakes, arranged more or less regularly along two sets of parallel lines. When seen at great elevation, the arrangement resembles the scales of mackerel; when seen lower down, the large size of the lozenge-shaped flakes give the sky the appearance "of a gigantic chess-board." The flakes have no fibrous texture, but the parallel lines refer them to cirrus; for long cirrus stripes are often striated, or cut off into small and equal lengths, and if a number of such stripes were placed side by side, we would have the form but not the texture of cirro-cumulus. This may be some apology for the word *cirro;* but there can be little or none for the word *cumulus,* because the new cloud alto-cumulus is very similar to (3), with this difference, that the component parts are soft rounded masses—small cumuli, in fact.

(4) Strato-cirrus.—A cloud somewhat resembling cirro-stratus, but thick and woolly. It is a tropical cloud, and has not received much attention from the meteorologists of northern latitudes.

When rain begins to fall from a large cumulus, a quantity of cloud is poured into the air from the top of the cumulus, as smoke from a factory chimney. This takes place in all parts of the world when rain falls from cumuli, but in the temperate zones only a little cirriform cloud is thrown off. In Jamaica the process is on a gigantic scale, and the cloud is spread out as a sheet far and wide, so as to shade the land for some hours from the direct rays of the afternoon sun. It is therefore a common cloud in the west-central district of Jamaica during the summer and autumn months. Its texture at first is thick and woolly, but as it spreads the sheet becomes thinner. It then settles down, often passing through different forms, and finally disappears, leaving the evening sky perfectly clear.

Now, by means of a sextant, some careful observations were made of the altitude of the tops of well-formed cumuli, whose distances could be ascertained by their rain falling on mountain ranges or by the average interval between the distant thunder and lightning; and it was found that the average height of such well-formed cumuli was as much as

6 miles! At this elevation the temperature is below zero, and strato-cirrus, when spread out as described above, must be very fine *snow* as distinguished from the very minute particles of ice which form cirrus and cirro-stratus. This fine snow then falls slowly by its own weight, and, melting, it often produces those quiet after-rains which follow the heavy rains and squalls of the cumulus.

From what has been said about the spreading out of this cloud, it might be supposed that it had no average drift; but if well-formed cumuli at considerable distances be watched, it will be found that while their average drift is from the south-east over the western half of Jamaica, the drift of the strato-cirrus issuing from them is generally north-east.

(5) Cumulus.—This cloud consists of large rounded masses resting on flat bases; it is often called the thunder-cloud. Its texture is apparently very solid; and it is formed by ascending columns of heated vapour. When rain falls from the base of the cloud it is called—

(6) Cumulo-nimbus, and this rain takes up the drift of the whole cumulus. The velocity of the wind accompanying the rain is thus the same as the velocity of the whole cloud; and these squalls are sometimes very severe, especially on the mountains.

(7) Alto-cumulus.—A thin sheet of small separate clouds, arranged more or less regularly into groups or lines. The clouds are soft, rounded masses, like fleeces of wool, and the whole cloud often resembles a flock of sheep. Its average drift is from the south-east.

(8) Alto-stratus.—"A thin sheet of a grey or bluish colour, showing a brilliant patch in the neighbourhood of the sun and moon, and which, without causing halos, may give rise to coronæ." Thick and thin are merely relative terms; and this cloud is thin when compared with strato-cirrus. It has a soft, watery look. It is not often seen in Jamaica.

(9) Strato-cumulus.—"Large globular masses or rolls of dark cloud, frequently covering the whole sky, especially in winter, and occasionally giving it a wavy appearance. The layer of strato-cumulus is not as a rule very thick, and patches of blue sky are often visible through the intervening

spaces." The general appearance of this cloud is somewhat similar to a Venetian blind, the dark and light bars being all parallel to the horizon, wherever you look.

(10) Nimbus simply means rain-cloud; and as we have already had cumulo-nimbus, this form should certainly be called strato-nimbus.

(11) Stratus.—"A horizontal sheet of lifted fog. When this sheet is broken up into irregular shreds by the wind, or by the summits of mountains, it may be distinguished by the name of *fracto-stratus*."

Fogs lie during the night in the valleys in Jamaica, especially in St. Thomas-in-the-Vale and in the interior parts of Hanover, Westmoreland, and St. James, where those three parishes join; the morning sun dispels them about two hours after sunrise, and if the morning be still and calm, a cloud will be observed high above the valleys which the fog had previously filled. The above definition should be considered to include *any low horizontal sheet of smoke-like cloud* condensed out of lifted invisible vapour. In consequence,

(12) Fracto-stratus is the commonest cloud in Jamaica, winter and summer alike. In summer it develops into cumulus; in winter it develops into cumulus, stratus, or strato-cumulus.

Clouds (1) to (4) inclusive belong to the upper division; (5) to (7) inclusive belong to the middle division; and of course (8) to (12) inclusive to the lower division.

In the Register their order should be reversed, so that the column containing the lower cloud should follow the column containing the surface wind; then the middle cloud, and then the upper. For there is a well-known law respecting the relative direction of a succession of currents;* and it is convenient to see at a glance whether cyclonic (or anti-cyclonic) conditions prevail among the currents; for though these conditions seldom occur, yet the importance of keeping careful watch for cyclones is so great that an observer should regulate his system accordingly.

* In the northern hemisphere, if you stand with your back to the wind, the higher currents will come more and more from the left (or diverge more and more to the right), the higher the currents are. This law applies to both cyclones and anticyclones.

Cyclones

When the barometric pressure over a more or less circular area of sea or land is less than the pressure over the surrounding sea or land, the pressure diminishing from the outside towards the centre, and when the winds rotate about the centre, the whole mechanism is called a cyclone; and in the northern hemisphere the motion of rotation is opposite to that of the hands of a watch.

The above definition includes tornadoes, or violent whirlwinds, where the diameter of the disturbed area is comparatively very small; but as we have no tornadoes in Jamaica, we must confine our attention to cyclones properly so called, with diameters of 100 or 1000 miles.

At the centre of a cyclone there is a calm area generally 5 or 10 miles in diameter; and while the winds rotate round this calm area they are somewhat drawn in towards it; and the following is the rule to find approximately the direction in which the centre lies:—stand with your back to the wind, and the centre will lie in a direction between your left hand and your face. The rule respecting upper currents was given at the end of the last section on clouds and cloud-drift.

The whole cyclone may be stationary, or it may move on its course over sea and land with a velocity more or less uniform, seldom exceeding 10 or 15 miles per hour in the West Indies.

The fall of pressure at the calm centre may be very small—say one-tenth of an inch—and then the rotating winds will be very gentle; or it may be large—say one inch—and then the rotating winds may be violent, especially towards the calm centre; but the strength of the wind really depends on the barometric *gradient*, or the fall in pressure per mile of approach towards the centre.

It will be convenient to call the former cyclonic *depressions*, and to restrict the term " cyclones " to storms dangerous to life and property.*

The general principles given above apply to cyclones all

* Otherwise called "hurricanes," the term applied to them before their cyclonic nature was known.

over the northern hemisphere, and they are quite intelligible; but when we come to details it would seem that there is much we have yet to learn; and it is here proposed to give the result of twenty-five years' experience in Jamaica in connection chiefly with the Weather Service.

(1) Depressions often pass near or over Jamaica at all times of the year; they often throw down immense quantities of rain; and all our flood-rains are due to such depressions, or to cyclones proper, the latter being very few and far between. From June to November their course is the same as that of cyclones proper, namely, west-north-west; from December to May their course is in an opposite direction, namely, east-south-east. Some of the former develop into cyclones, as on October 15 and 16, 1897; some of them are "northers," which occur during the winter months, and get mixed up with the effects of the anticyclone over the United States; and others throw down enormous quantities of rain. The June floods of 1886 were due to a depression which passed near Jamaica, where the fall of pressure could not have exceeded 0·15 inch; and these rains were far in excess of those thrown down by the more developed cyclones of 1880 and 1886, which both crossed the island.*

(2) When a cyclonic depression is generating it is stationary, or nearly so; after a time it moves off, and may develop, or diminish and disappear. The June depression, 1886, is a good example. On the 5th and 6th it was generating south-east of Kingston; on the 7th it started on a course parallel to a line joining Kingston and Montego Bay at the rate of 10 miles an hour; so that, if instead of generating for two days and a half it had been advancing towards Kingston, its diameter must have been 1200 miles, which is out of the question with such a small fall at the centre. A better example occurred on October 26, 27, and 28, 1899. The barometric pressure at the Kempshot observatory gradually fell, and the wind from the south gradually increased in strength with torrents of rain,

* The following depressions give further examples:—

1885, December 1, 2.	1898, May 23, 27.
" December 26, 27.	1899, October 26, 27, 28.
1888, May 8 to 15.	" November 8.
" September 3.	

plainly showing that a depression was being generated between Jamaica and the Cayman Islands, where several other depressions have been noticed to generate (or to develop) before. On the afternoon of the 28th the depression suddenly started on its course, at first north-east, and then north, according to subsequent news.

In these and other cases the records show no unusual features immediately before the generation of the depressions. The wind, the rain, and the fall of pressure all take place together as a matter of course.

(3) Fully developed cyclones appear in the West Indies for the most part during the months of August, September, and October only; they follow a west-north-west course at first, then they turn north, and finally recurve east-north-east, if their course is long enough to permit of these changes.

If we look at the *Pilot Charts* published each month by the United States Hydrographic Office, we shall see that when the region of equatorial heavy rains between South America and Africa reaches as far north as latitude 15°, cyclones originate in about that latitude, but to the west of the region of heavy rains, and then move off on a westerly course. As the diverting effect of the earth's rotation upon currents of air is very important for the development and maintenance of cyclones, and as this effect varies as the sine of the latitude, there are no cyclones near the equator, or within 12° of it; but, as we have seen at 15°, the effect is sufficient to give the currents the necessary divergence. Now, as the region of heavy rains advances as far north as latitude 15° in August, somewhat farther in September and October, but withdraws far to the south in November, and remains there until the following July, it is evident that August, September, and October are the months in which cyclones usually occur in the West Indies. Of course, they may occur at other places and at other times if all the essentials are present and combine.

With regard to the course taken by cyclones, no doubt they follow the general atmospheric drift, and move round the anticyclone in the North Atlantic; a large number pass over the Bahama Islands, and a few pass over the Caribbean Sea. Both the hurricanes of October 3, 1780, and August 18, 1880, were passing south of Jamaica when they turned north and swept the island.

(4) When a large cyclone has developed, it often happens that a cyclonic depression makes its appearance and confuses the indications. For instance, in September, 1883, a large cyclone advanced through the Mona Passage on its course to the United States, and at the same time a depression passed south of Jamaica on a westerly course; and the *Weather Reports* contain a number of such cases.

(5) The rules given above as to the rotation of the wind and upper currents round the centre are more than useful as generalizations; but in forecasting they must be used with the greatest caution, especially when the cyclone is at a considerable distance. On the other hand, much more use can be made of the barometer than in the temperate zones, where the fluctuations are large, provided that every care be taken in its management, as detailed in the first section.

(6) Finally, there is a cyclonic feature often noticed in Jamaica, of which we have seen no account given elsewhere—after a cyclone has passed and is moving away, it draws after it our winds and clouds for one or two days. To whatever cause this effect may be attributed, it is very useful in letting us know in what direction the cyclone has gone.

In conclusion, a list of the more important articles among the *Weather Reports* is added, to which the reader may refer for further information than could be given in the above brief summary of Jamaica Meteorology.

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TABLES

TABLE I.

(*Subtractive.*)

REDUCTION OF THE BAROMETER TO 32° FAHR.

Attached thermom.	Height of the barometer in inches.				
	30	29	28	27	26
°	in.	in.	in.	in.	in.
60	−0·085	−0·082	−0·079	−0·076	−0·073
61	·087	·084	·081	·078	·075
62	·090	·087	·084	·081	·078
63	·093	·089	·086	·083	·080
64	·095	·092	·089	·086	·082
65	·098	·095	·091	·088	·085
66	·101	·097	·094	·090	·087
67	·103	·100	·096	·093	·089
68	·106	·102	·099	·095	·092
69	·109	·105	·101	·098	·094
70	·111	·108	·104	·100	·096
71	·114	·110	·106	·102	·099
72	·117	·113	·109	·105	·101
73	·119	·115	·111	·107	·103
74	·122	·118	·114	·110	·106
75	·125	·120	·116	·112	·108
76	·127	·123	·119	·114	·110
77	·130	·126	·121	·117	·112
78	·133	·128	·124	·119	·115
79	·135	·131	·126	·122	·117
80	·138	·133	·129	·124	·119
81	·141	·136	·131	·126	·122
82	·143	·138	·134	·129	·124
83	·146	·141	·136	·131	·126
84	·149	·144	·139	·134	·129
85	·151	·146	·141	·136	·131
86	·154	·149	·144	·138	·133
87	·157	·151	·146	·141	·136
88	·159	·154	·149	·143	·138
89	·162	·156	·151	·146	·140
90	−0·164	−0·159	−0·153	−0·148	−0·142

TABLE II.

(Additive.)

REDUCTION OF THE BAROMETER TO THE SEA-LEVEL.

Elevation above sea-level.	Temperature of the air at sea-level.				
	70°	75°	80°	85°	90°
Feet.	in.	in.	in.	in.	in.
100	+0·105	+0·104	+0·103	+0·102	+0·101
200	0·210	0·208	0·206	0·204	0·202
300	0·314	0·311	0·308	0·305	0·302
400	0·418	0·414	0·410	0·406	0·402
500	0·522	0·517	0·512	0·507	0·502
600	0·625	0·620	0·614	0·608	0·602
700	0·728	0·722	0·715	0·708	0·701
800	0·831	0·824	0·816	0·808	0·800
900	0·934	0·926	0·917	0·908	0·899
1000	1·036	1·027	1·017	1·007	0·998
1100	1·138	1·127	1·117	1·106	1·096
1200	1·240	1·228	1·217	1·206	1·195
1300	1·341	1·329	1·317	1·305	1·293
1400	1·442	1·429	1·416	1·403	1·390
1500	1·543	1·529	1·515	1·501	1·488
2000	2·042	2·024	2·006	1·989	1·972
2500	2·534	2·512	2·490	2·469	2·449
3000	3·019	2·993	2·967	2·943	2·919
3500	3·497	3·467	3·438	3·410	3·382
4000	3·967	3·934	3·902	3·870	3·839
4500	4·432	4·395	4·359	4·324	4·289
5000	4·890	4·849	4·809	4·770	4·731
5500	5·342	5·296	5·252	5·209	5·167
6000	5·788	5·738	5·689	5·642	5·597
6500	6·227	6·173	6·120	6·069	6·019
7000	6·660	6·601	6·544	6·488	6·433
7500	+7·088	+7·024	+6·962	+6·900	+6·840

TABLE III.

Correction for Diurnal Variation of Pressure in thousandths of an inch of mercury.

(For Jamaica, and for any place near the sea-level.)

Month.	Midnight.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.
January ...	−11	−2	+9	+17	+17	+11	−1	−18	−36	−51	−48	−31	−7	+21	+41	+49	+45	+35	+24	+8	−8	−19	−23	−19
February ...	17	0	14	21	21	14	−1	17	33	48	51	37	13	12	34	48	47	41	29	13	−6	19	28	23
March ...	9	+5	19	25	21	9	−6	22	37	47	50	38	17	5	30	43	45	39	28	15	−2	17	23	20
April ...	9	+2	15	20	17	8	−7	23	35	42	40	31	15	6	26	38	45	41	31	18	+1	18	24	22
May ...	13	+1	14	20	18	8	−6	22	30	38	38	29	15	3	20	33	43	40	30	16	−1	13	26	27
June ...	16	+1	12	16	15	13	−1	13	20	27	29	26	14	1	16	27	35	33	27	11	5	15	26	24
July ...	17	−4	11	18	17	15	+3	8	15	21	22	18	9	5	20	27	32	29	24	9	6	19	31	29
August ...	19	−4	9	18	17	13	+6	10	19	26	29	26	12	2	20	31	35	33	26	15	2	19	34	31
September	19	−8	9	16	17	9	−2	15	28	36	36	27	11	12	29	40	41	34	25	16	3	22	28	25
October ...	11	+5	16	21	21	13	+1	14	29	40	41	29	7	17	31	37	36	30	21	6	12	21	25	20
November...	8	+5	17	23	21	11	−5	20	39	51	50	32	5	22	39	46	44	35	22	3	13	22	25	18
December ...	−12	−3	+11	+21	+20	+13	−1	−18	−39	−52	−49	−31	−6	+23	+41	+50	+45	+36	+22	+5	−11	−25	−28	−21
Means ...	−13	0	+13	+20	+19	+12	−2	− 17	−30	−40	−40	−30	−11	+11	+29	+39	+41	+36	+26	+11	−6	−19	−26	−23

Weather Report, No. 192: Table IV.

TABLE IV.

Kingston Mean Pressure at Sea-level.

		inches.			inches.
Jan. 1 to 10	... ...	29·981	July 1 to 10	... ...	29·958
„ 11 „ 20	... ...	·991	„ 11 „ 20	... ...	·961
„ 21 „ 31	... ...	·991	„ 21 „ 31	... ...	·950
Feb. 1 „ 10	... ...	·989	Aug. 1 „ 10	... ...	·935
„ 11 „ 20	... ...	·986	„ 11 „ 20	... ...	·920
„ 21 „ 28	... ...	·983	„ 21 „ 31	... ...	·909
Mar. 1 „ 10	... ...	·978	Sept. 1 „ 10	... ...	·900
„ 11 „ 20	... ...	·971	„ 11 „ 20	... ...	·893
„ 21 „ 31	... ...	·965	„ 21 „ 30	... ...	·885
Apr. 1 „ 10	... ...	·955	Oct. 1 „ 10	... ...	·878
„ 11 „ 20	... ...	·945	„ 11 „ 20	... ...	·874
„ 21 „ 30	... ...	·933	„ 21 „ 31	... ...	·875
May 1 „ 10	... ...	·922	Nov. 1 „ 10	... ...	·885
„ 11 „ 20	... ...	·916	„ 11 „ 20	... ...	·899
„ 21 „ 31	... ...	·919	„ 21 „ 30	... ...	·912
June 1 „ 10	... ...	·927	Dec. 1 „ 10	... ...	·927
„ 11 „ 20	... ...	·937	„ 11 „ 20	... ...	·942
„ 21 „ 30	... ..	29·949	„ 21 „ 31	... ...	29·961

The numbers for the middle of each month were taken from *Weather Report* No. 123, and they are the means deduced from ten years' observations at the hours 7 a.m., 3 p.m., and 11 p.m. The other numbers were found from a curve drawn through the numbers at the middle of each month.

Mean pressure at Kingston sea-level for the year = 29·936 inches.

TABLE V.

Summary of the Kingston Monthly Temperatures, 1881–1898.

Month.	Mean.	7 a.m.	3 p.m.	Max.	Min.	Average highest max.	Average lowest min.
	°	°	°	°	°	°	°
January	75·8	68·9	83·1	86·1	67·0	90·1	62·8
February ...	75·7	69·4	82·7	85·6	67·0	89·3	63·2
March	76·4	71·3	82·8	85·6	67·8	89·3	63·9
April	78·2	74·9	83·3	86·3	70·0	90·1	66·6
May	79·9	78·1	83·7	87·0	72·5	90·2	68·9
June	81·1	79·1	85·2	88·2	73·7	91·8	70·4
July	81·6	78·7	86·4	89·5	73·4	93·4	70·4
August	81·0	77·6	85·7	89·5	73·4	92·6	70·2
September ...	80·7	76·9	85·2	89·2	73·5	92·3	70·7
October	79·3	75·6	84·5	88·0	72·4	91·8	68·8
November ...	78·6	73·4	84·3	87·9	70·7	91·1	66·6
December ...	76·9	70·7	83·3	86·7	68·4	90·5	63·7
Means, 18 years' observations	78·8	74·6	84·2	87·5	70·8	91·0	67·2

TABLE VI.

Average Annual Temperatures at Different Elevations in Jamaica.

Elevation above sea-level.	Mean.	Max.	Min.	Range.
Feet.	°	°	°	°
0	78·8	87·5	70·8	16·7
500	77·1	85·1	69·8	15·3
1000	75·3	82·8	68·6	14·2
1500	73·6	80·6	67·4	13·2
2000	72·0	78·6	66·1	12·5
2500	70·3	76·7	64·7	12·0
3000	68·7	74·9	63·3	11·6
3500	67·1	73·2	61·7	11·5
4000	65·5	71·6	60·1	11·5
4500	64·0	70·1	58·5	11·6
5000	62·4	68·8	56·8	12·0
5500	61·0	67·5	55·0	12·5
6000	59·5	66·3	53·1	13·2
6500	58·0	65·2	51·2	14·0
7000	56·5	64·3	49·3	15·0
7500	55·1	63·6	47·3	16·3

TABLE VII.

Correction for Diurnal Variation of Temperature, Kingston.

Month.	Midnight.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.
	+ °	+ °	+ °	+ °	+ °	+ °	+ °	+ °	°	− °	− °	− °	− °	− °	− °	− °	− °	− °	− °	°	+ °	+ °	+ °	+ °
January	4·6	4·8	5·3	5·4	5·7	5·9	6·0	6·4	+3·4	2·0	5·5	7·2	8·0	8·3	7·5	7·0	6·2	4·6	2·0	+0·2	1·4	2·0	2·8	3·9
February ...	4·9	5·4	5·7	6·0	6·2	6·4	6·6	6·7	+2·9	2·3	5·1	6·7	7·6	8·1	7·6	7·0	6·6	5·6	3·7	−1·2	0·7	2·3	3·4	4·2
March... ...	4·7	5·2	5·7	6·1	6·3	6·4	6·4	6·1	0·0	3·1	5·4	6·6	7·0	7·0	6·7	6·2	5·4	4·6	3·1	−0·9	0·5	1·9	3·2	4·0
April	4·3	4·8	5·5	5·9	6·2	6·1	6·7	4·7	−0·6	3·7	5·6	6·5	6·7	6·7	6·3	5·5	5·0	3·9	2·6	−0·8	0·5	1·8	2·8	3·6
May	4·3	4·8	5·2	5·5	5·8	5·9	6·1	3·6	−1·2	3·5	5·6	6·3	6·9	6·3	5·6	4·6	4·0	3·3	2·1	−0·5	0·7	1·7	2·7	3·4
June	4·5	4·9	5·2	5·5	5·6	5·7	6·1	3·7	−0·8	3·7	5·8	6·9	7·4	6·5	5·7	4·6	4·1	3·4	2·4	−0·7	0·7	2·1	3·1	3·7
July	4·3	5·0	5·3	5·5	5·9	6·2	6·1	4·0	−0·2	3·3	5·6	6·7	7·1	6·7	6·0	5·3	4·6	3·8	2·5	−0·7	0·6	2·1	3·2	3·8
August	4·7	5·0	5·6	5·8	6·0	6·3	6·4	4·1	0·0	3·8	6·1	7·4	7·6	7·1	6·0	5·0	4·5	4·1	2·3	−0·5	0·8	2·3	3·2	4·0
September ...	3·9	4·0	4·3	4·6	4·8	5·1	5·3	3·3	−0·1	4·0	5·8	6·7	6·9	6·5	5·2	4·0	3·2	2·2	1·1	+0·6	1·3	2·0	3·1	3·5
October ...	4·0	4·2	4·6	4·9	5·3	5·4	5·5	3·9	−0·2	4·7	6·8	7·4	7·6	6·4	5·2	4·4	3·6	2·4	0·3	+0·8	1·4	2·3	3·0	3·4
November ...	3·9	4·1	4·4	4·4	4·8	4·9	5·2	4·8	+0·7	2·7	5·0	6·4	6·7	6·8	6·3	5·5	4·7	3·2	0·8	+0·5	1·3	2·2	2·9	3·4
December ...	4·4	4·8	5·3	5·4	5·5	5·6	5·9	5·8	+2·3	2·6	5·7	7·3	7·8	7·8	7·5	6·7	5·7	4·0	1·2	+0·4	1·3	2·5	3·4	3·9
Means ...	4·4	4·8	5·2	5·4	5·7	5·8	6·0	4·8	+0·5	3·3	5·7	6·8	7·3	7·0	6·3	5·5	4·8	3·8	2·0	−0·2	0·9	2·1	3·1	3·7

The correction is to be applied to the temperature at any hour to reduce it to the mean of the twenty-four hours.

TABLE VIII.

Temperature.	Tension of saturated vapour.	Glaisher's factors.
°	inches.	
60	0·518	1·88
61	0·537	1·87
62	0·556	1·86
63	0·576	1·85
64	0·596	1·83
65	0·617	1·82
66	0·639	1·81
67	0·661	1·80
68	0·684	1·79
69	0·708	1·78
70	0·733	1·77
71	0·759	1·76
72	0·785	1·75
73	0·812	1·74
74	0·840	1·73
75	0·868	1·72
76	0·897	1·71
77	0·927	1·70
78	0·958	1·69
79	0·990	1·69
80	1·023	1·68
81	1·057	1·68
82	1·092	1·67
83	1·128	1·67
84	1·165	1·66
85	1·203	1·65
86	1·242	1·65
87	1·282	1·64
88	1·323	1·64
89	1·366	1·63
90	1·410	1·63

TABLE IX.

Temperature of the Dew-point.

Dry bulb.	Difference between the dry and wet bulbs.									
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
°	°	°	°	°	°	°	°	°	°	°
60	58	56	54	52	51	—	—	—	—	—
61	59	57	55	54	52	50	—	—	—	—
62	60	58	56	55	53	51	—	—	—	—
63	61	59	58	56	54	52	50	—	—	—
64	62	60	58	57	55	53	51	—	—	—
65	63	61	60	58	56	54	52	50	—	—
66	64	62	61	59	57	55	53	52	50	—
67	65	63	62	60	58	56	54	53	51	—
68	66	64	63	61	59	57	56	54	52	50
69	67	65	64	62	60	58	56	55	53	51
70	68	66	65	63	61	59	58	56	54	52
71	69	68	66	64	62	60	59	57	55	53
72	70	68	67	65	63	62	60	58	56	54
73	71	70	68	66	64	63	61	59	57	56
74	72	71	69	67	65	64	62	60	58	57
75	73	72	70	68	66	65	63	61	60	58
76	74	73	71	69	67	66	64	62	61	59
77	75	74	72	70	68	67	65	63	62	60
78	76	75	73	71	70	68	66	64	63	61
79	77	76	74	72	71	69	67	66	64	62
80	78	77	75	73	72	70	68	66	65	63
81	—	78	76	74	73	71	69	68	66	64
82	—	—	77	75	74	72	70	69	67	65
83	—	—	78	76	75	73	71	70	68	66
84	—	—	—	77	76	74	72	71	69	67
85	—	—	—	78	77	75	73	72	70	68
86	—	—	—	—	78	76	74	73	71	70
87	—	—	—	—	—	77	76	74	72	71
88	—	—	—	—	—	78	76	75	73	72
89	—	—	—	—	—	—	78	76	74	73
90	—	—	—	—	—	—	—	77	75	74

TABLE X.

HUMIDITY.

Dry bulb.	Difference between the dry and wet bulbs.									
	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
°										
60	94	88	82	76	71	—	—	—	—	—
61	94	88	82	77	72	67	—	—	—	—
62	94	88	82	77	72	67	—	—	—	—
63	94	88	82	77	72	67	63	—	—	—
64	94	88	82	77	72	67	63	—	—	—
65	94	88	83	78	73	68	63	59	—	—
66	94	88	83	78	73	68	64	60	56	—
67	94	88	83	78	73	68	64	60	56	52
68	94	88	83	78	73	68	64	60	56	52
69	94	88	83	78	73	68	64	60	56	53
70	94	88	83	78	73	69	65	61	57	53
71	94	88	83	78	73	69	65	61	57	53
72	94	89	84	79	74	69	65	61	57	54
73	94	89	84	79	74	70	66	62	58	54
74	94	89	84	79	74	70	66	62	58	55
75	94	89	84	79	74	70	66	62	58	55
76	94	89	84	79	75	71	67	63	59	55
77	94	89	84	79	75	71	67	63	59	56
78	94	89	84	79	75	71	67	63	59	56
79	95	90	85	80	75	71	67	63	59	56
80	95	90	85	80	75	71	67	63	59	56
81	—	90	85	80	76	72	68	64	60	56
82	—	—	85	80	76	72	68	64	60	57
83	—	—	85	80	76	72	68	64	60	57
84	—	—	—	80	76	72	68	64	60	57
85	—	—	—	80	76	72	68	64	61	58
86	—	—	—	—	76	72	68	64	61	58
87	—	—	—	—	—	73	69	65	61	58
88	—	—	—	—	—	73	69	65	61	58
89	—	—	—	—	—	—	69	65	61	58
90	—	—	—	—	—	—	—	65	62	59

TABLE XI.

DEW-POINT AND HUMIDITY AT KINGSTON.

Month.	Dew-point.	Min.	Humidity.
	°	°	
January	66·7	66·8	78
February	66·7	66·8	78
March	67·6	67·8	77
April	69·1	69·8	75
May	71·4	72·4	78
June	72·8	73·8	78
July	72·5	73·5	76
August	73·0	73·2	79
September	73·1	73·3	80
October	72·2	72·1	81
November	70·1	70·7	78
December	68·0	68·4	78
Mean	70·3	70·7	78

The above table contains the results of observations between June, 1880, and May, 1890, inclusive; the figures for the Min., therefore, slightly differ from the figures in Table V. (*Weather Report*, No. 123.)

TABLE XII.

The Jamaica Monthly Rainfall.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1870 ...	3·99	4·35	3·10	2·79	17·38	3·58	4·33	5·72	8·05	16·74	12·50	6·90	89·43
1871 ...	2·40	1·60	2·29	3·46	6·43	1·98	3·79	3·46	5·70	8·88	5·88	4·22	50·09
1872 ...	3·00	2·84	3·06	2·06	5·18	2·41	2·89	5·24	4·55	6·09	3·13	4·73	45·18
1873 ...	8·15	1·94	5·47	1·15	5·06	2·58	2·56	7·51	10·73	8·57	3·53	5·81	63·06
1874 ...	3·44	2·20	0·61	4·40	10·65	3·96	2·51	9·65	6·82	11·69	10·52	2·49	68·94
1875 ...	2·57	0·67	2·59	3·05	8·54	3·74	3·87	5·13	7·60	5·58	2·34	6·74	52·42
1876 ...	6·00	0·96	1·63	4·68	8·24	5·40	8·15	5·06	5·19	11·36	8·96	5·72	71·35
1877 ...	5·94	1·18	5·38	2·91	15·03	6·50	4·68	1·76	5·01	4·50	7·63	7·88	68·40
1878 ...	6·35	2·80	2·78	0·70	4·86	6·63	5·85	10·80	7·43	11·29	7·32	9·61	76·42
1879 ...	2·81	5·30	6·49	7·28	9·14	10·64	4·47	12·32	7·38	15·96	5·29	1·76	88·84
Means ...	4·46	2·38	3·34	3·25	9·05	4·74	4·31	6·66	6·85	10·07	6·71	5·59	67·41
1880 ...	4·36	0·96	1·10	2·77	11·60	3·09	3·86	9·58	3·97	4·00	2·21	7·94	55·44
1881 ...	1·22	4·01	1·30	4·63	10·28	5·56	4·77	6·21	7·68	12·08	7·52	3·34	68·60
1882 ...	2·92	1·93	3·54	3·32	8·22	2·33	3·76	4·80	8·78	8·96	5·36	3·95	57·87
1883 ...	5·49	3·50	4·08	3·34	5·29	4·98	3·15	5·42	7·82	8·15	5·12	2·92	59·26
1884 ...	4·72	3·44	2·51	1·85	6·72	6·89	2·52	5·06	6·23	9·52	5·00	2·44	56·90
1885 ...	1·73	1·49	1·47	4·73	4·90	3·32	3·01	6·19	6·22	6·37	4·74	15·69	59·86
1886 ...	5·23	4·65	2·68	6·39	5·30	23·36	6·22	13·54	5·90	7·98	3·70	5·66	90·61
1887 ...	6·02	2·32	2·38	4·47	9·32	8·89	7·19	6·91	5·77	8·47	8·17	0·75	70·66
1888 ...	1·36	1·89	1·70	3·61	21·24	6·77	2·65	5·47	8·10	4·38	4·59	10·35	72·11
1889 ...	4·78	0·90	4·19	6·71	7·82	12·52	6·08	5·12	8·20	10·49	4·37	2·97	74·15
Means ...	3·78	2·51	2·49	4·18	9·07	7·77	4·32	6·83	6·87	8·04	5·08	5·60	66·54
1890 ...	5·21	2·92	5·84	3·37	5·57	4·13	4·99	6·92	6·52	7·04	6·52	5·39	64·42
1891 ...	3·45	2·24	0·84	8·49	12·28	9·91	5·57	7·45	6·35	15·32	7·65	5·15	84·70
1892 ...	4·00	1·38	2·27	2·82	8·53	7·31	4·44	7·65	8·86	12·17	9·96	3·61	73·00
1893 ...	3·44	3·24	1·92	5·42	10·90	7·20	9·15	6·72	7·92	10·30	10·10	10·18	86·49
1894 ...	2·05	2·52	3·33	5·84	16·64	3·90	5·92	4·20	6·98	12·40	5·05	6·56	75·39
1895 ...	1·31	5·00	2·18	6·11	9·90	3·66	4·99	8·11	6·87	11·98	7·72	3·79	71·62
1896 ...	5·25	4·86	4·28	3·67	9·96	4·84	5·03	4·74	8·24	7·51	4·57	5·66	68·61
1897 ...	0·88	0·77	1·82	7·06	10·91	4·92	5·92	6·55	10·13	19·26	5·73	3·64	77·59
1898 ...	1·75	3·93	1·26	4·09	16·76	7·60	6·50	6·92	7·10	10·38	4·78	2·75	73·82
1899 ...	3·96	2·84	3·76	4·80	4·20	4·66	3·86	4·22	7·44	23·72	14·99	7·37	85·82
Means ...	3·13	2·97	2·75	5·17	10·56	5·81	5·64	6·35	7·64	13·01	7·71	5·41	76·15
1900 ...	5·20	4·15	2·42	5·67	7·77	6·16	7·18	5·38	8·12	6·50	5·22	5·88	69·65
1901 ...	3·91	1·17	3·32	2·57	6·13	14·03	7·59	6·49	10·60	9·76	10·02	5·37	80·96
1902 ...	5·68	3·06	4·24	5·40	8·97	10·28	3·44	5·39	5·89	7·19	5·60	8·23	73·37
1903 ...	1·94	1·40	3·19	4·90	10·63	6·00	4·30	12·79	5·34	7·28	5·78	4·83	68·38

TABLE XIII.

ANNUAL RAINFALL FOR EACH RAINFALL DIVISION IN JAMAICA.

Year.	Rainfall divisions.				The island.
	N.E.	N.	W.C.	S.	
	in.	in.	in.	in.	
1870	110·60	83·09	102·98	61·07	89·43
1871	69·45	41·88	54·56	34·46	50·09
1872	59·42	40·79	51·50	29·02	45·18
1873	84·08	52·64	67·79	47·71	63·06
1874	97·18	68·25	62·97	47·35	68·94
1875	71·89	47·15	56·16	34·47	52·42
1876	90·38	54·71	87·33	52·99	71·35
1877	100·72	56·53	64·06	52·27	68·40
1878	104·12	62·99	72·44	66·11	76·42
1879	122·55	65·44	87·54	79·85	88·84
Means ...	91·04	57·34	70·73	50·53	67·41
1880	76·37	47·01	64·91	33·47	55·44
1881	91·24	49·42	75·32	58·42	68·60
1882	65·48	43·76	78·59	43·67	57·87
1883	72·30	41·52	78·19	45·02	59·26
1884	69·00	41·87	73·10	43·63	56·90
1885	70·55	52·77	72·62	43·52	59·86
1886	126·61	60·98	88·21	86·64	90·61
1887	80·25	61·07	80·14	61·16	70·66
1888	98·00	54·42	70·43	65·58	72·11
1889	99·81	56·82	75·94	64·02	74·15
Means ...	84·96	50·96	75·74	54·51	66·54
1890	75·09	48·29	89·91	44·41	64·42
1891	110·56	66·71	100·50	61·03	84·70
1892	101·55	58·10	82·05	50·29	73·00
1893	106·50	63·17	108·66	67·65	86·49
1894	90·56	54·04	95·93	61·01	75·39
1895	97·38	56·35	85·38	47·36	71·62
1896	95·42	54·90	78·31	45·79	68·61
1897	93·95	58·25	95·46	62·67	77·59
1898	102·92	52·44	84·26	55·67	73·82
1899	112·10	61·31	101·28	68·62	85·82
Means ...	98·60	57·36	92·17	56·45	76·15
1900	96·91	50·67	79·84	51·15	69·65
1901	107·88	64·18	87·31	64·50	80·96
1902	95·97	58·78	89·75	49·14	73·37
1903	88·46	51·05	82·83	51·17	68·38

TABLE XIV.

Wind.

Miles per hour.	Pounds pressure per sq. foot.
5	0·1
10	0·3
20	1·3
30	3·0
40	5·0
50	8·0
60	12·0
70	16·0
80	21·0
90	27·0
100	33·0
110	40·0
120	48·0

TABLE XV.

U.S. Wind Scale.

	Miles per hour.
Light	1 to 2
Gentle	3 to 5
Fresh	6 to 14
Brisk	15 to 24
High	25 to 39
Gale	40 to 59
Storm	60 to 79
Hurricane	80 and upwards

TABLE XVI.

Diurnal Variation of the Wind in Kingston.

	Miles per hour.		Miles per hour.
1 a.m.	1·9	1 p.m.	8·2
2 ,,	2·0	2 ,,	7·9
3 ,,	2·0	3 ,,	7·4
4 ,,	2·1	4 ,,	6·5
5 ,,	2·1	5 ,,	5·3
6 ,,	2·1	6 ,,	4·1
7 ,,	2·2	7 ,,	3·1
8 ,,	2·5	8 ,,	2·5
9 ,,	3·7	9 ,,	2·1
10 ,,	5·4	10 ,,	1·9
11 ,,	6·8	11 ,,	1·8
Noon	7·8	Midnight	1·9

TABLE XVII.

Annual Variation of the Wind in Kingston.

	Miles per diem.		Miles per diem.
January	90	July	105
February	102	August	91
March	113	September	87
April	95	October	70
May	100	November	68
June	125	December	75

Mean: 93 miles per diem.

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