中國之溫度

附編

THE TEMPERATURE OF CHINA

APPENDIX

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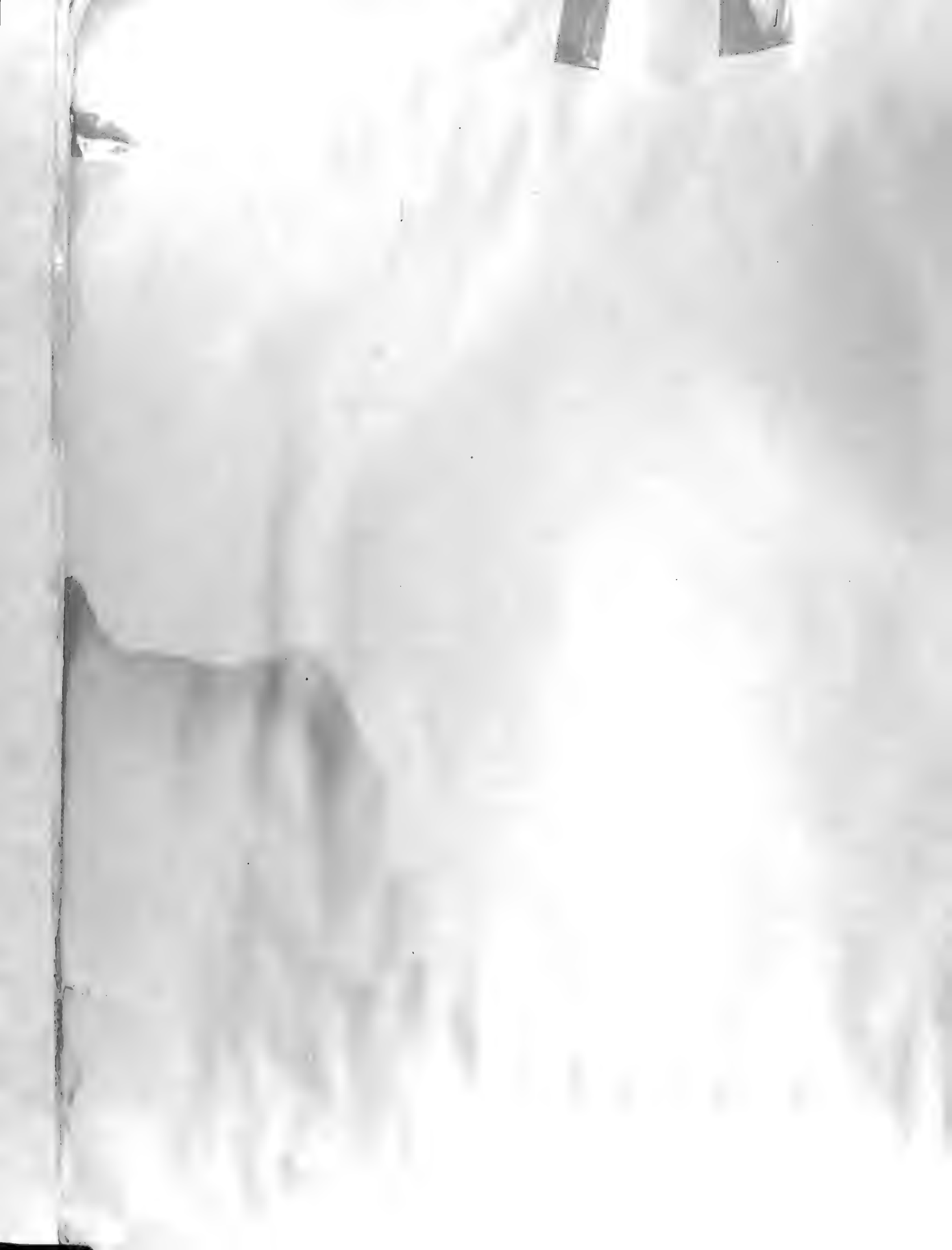

氣溫圖說明

溫度圖之繪製,初非易事,第一,須有長久之紀錄,第二,須有普遍之測候。此二條件在中國皆不具備,間有少數測候所,溫度紀錄年代較久;惟嚴格而論,此較久之紀錄,似不能與其他多數年代較短之紀錄同時並用。爲避免年代久暫不齊起見,本圖一律採用自一九三一至一九三五年之紀錄,因此五年中,中國之測候事業比較的發達,而紀錄亦比較可靠也。

研究中國溫度者,最先有 H. Gauthier,[1] 其後有 E. Gherzi。[2] Gauthier 之書作於 1918 年,紀錄簡單,自不待言。Gherzi 之書意在補充 Gauthier 之作,渠所用測候所站亦較多,年代亦較久。但彼似與 Gauthier 同出一轍,所用溫度紀錄,似未採取劃定時期。照 J. Hann 之意,在使各地溫度可以互相比較,時期之劃一,實爲一重要之因子也。[3]

本圖所用測候紀錄共一百零五處,時期皆自一九三一至一九三五年,紀錄期間雖較短,然因時間相同,自信尙可應用,不致有重大錯誤。且在可能範圍內,一切紀錄皆採取三小時平均制,卽六、十四、二十一小時是也。徐家匯兩神父所作中國溫度圖,皆爲實際溫度,未經海平面之訂正。本圖則實際溫度及海平面溫度兩種具備。海平面之溫度圖自一月至十二月,加年平均共十三幅;實際溫度圖除上述十三幅外,另添平均年較差,平均最高及平均最低三圖,兩合共二十九幅。

在使月平均及年平均溫度訂正至海平面時,吾人採取一致之溫度遞減率,卽假定每上升一百公尺,溫度減低攝氏表〇・五度。雖由南京之飛機紀錄及北平之風箏紀錄觀之,自由大氣之平均情形,在春夏秋三季中,以每上升一百公尺減低〇・六度之垂直溫度梯度較爲合理,然吾人之所以採用前者之溫度低減率者,亦無非求其符合國際之慣例耳。

照 J. Hann 之意見,尋常之溫度圖,如不訂正至海平面,則旣無科學上之價值,又無實際之效用。[4] 此在短距離中高度變遷甚大之地域內,尤爲確切。但從地理的觀點着眼,則實際溫度圖可以表示實際情形,亦有許多用處,如氣候區域及農業區域之分類等是,因此之故,實際溫度圖在本書中,仍行保存。

本圖中安南、暹羅及菲島之紀錄採自 Braak 著 Klima von Hinterindien und Insulinde,台灣、琉球、朝鮮之紀錄採自 T. Okada 著 Climate of Japan 一書。國外紀錄之時期

及久暫雖互異然以無法苟同,暫爲採用。此外復參考俄國出版之 Klima der Union der Sozialistischen Sowjet-Republiken, Teil I, Die Lufttemperatur, Lieferung 3 及英國出版之 Climatological Atlas of India 等。

(甲) 海平面溫度

全年平均溫度

我國幅員遼濶,東界太平洋,西接蒙古、西藏高原,南起夏至線,北抵北緯五十度,溫度之較差自必甚大。在全年平均溫度圖中,其最顯著者,卽爲等溫線趨近海岸而向赤道延展。吾人試一覽世界等溫線圖,如 Bartholomew 之圖[5],則知各大陸上當等溫線由陸入海,皆有此種偏向,尤以北美及歐亞大陸東岸更爲顯著。此種偏向之結果使中國本部東岸分外寒涼。

綜覽全圖,可得而述之特點有三:(一)雲南境內溫度特高;(二)中國沿海一帶,大致言之,外洋溫度高於陸地。惟沿岸島嶼之上,則較鄰近陸地及外洋均見寒冷,尤以山東半島南部及江蘇北部與台灣海峽中爲特甚;(三)山東半島等溫線之趨向,大致依照半島形勢。茲將上述三點逐一說明如下:

(一)在高原上,溫度隨高度之遞減率,遠較平原或高山爲緩,此爲吾人熟知之事實。高原上之溫度遞減率,據 Hann 之研究,約爲 0.4°C/100 公尺[6],而不爲 0.5°C/100 公尺。此外雲南省位於西藏高原之南部,北來嚴峻寒潮,受阻於北部之高原,故溫度自亦較高。

(二)中國沿海,外洋溫度之所以較附近陸地爲高者,因外海之溫度受黑潮暖流之影響,此可直接使海水表面溫度,間接使上面氣溫增高。沿海陸地及島嶼則相反,因適當中國沿岸寒流之衝[7],故其溫度較大陸上及外洋爲低。山東半島南部及江蘇北部全年溫度之所以較低者,一因冬半年北來之風,越過山東半島東端後,在適當情形之下,往往在黃海中因力學的關係,造成一旋流[8],雖青島、東台、徐州等處,全年最多風向爲南、東南或東風,但因此等風之淵源,皆來自北方之冷風,故使上述區域溫度減低。二因黃海中,自四月至八月,爲一寒涼中心所占據,遂使山東半島南部及江蘇北部之夏季風提早發生及加强勢力。有此二因,故上述區域內全年溫度所以比較低下也。至沿海島嶼上之溫度所以較低者(尤以台灣海峽中之島嶼上爲最),卽因直接爲中國沿岸寒流所冲刷,而此寒流,又爲北來之風自高緯度送入台灣海峽之故。峽中自九月至五月東北風盛行,而其風力亦較他處爲强[9]。

（三）山東半島上等溫線之所以與沿海有平行之傾向者,由於海陸地形之分布[10]。夏季海洋中涼爽之影響甚爲顯著,山東沿海陸上與島嶼上月平均溫度差數常達六、七度之多。即在朝鮮,等溫線亦有與海岸線相互平行之傾向,尤以夏季各月爲然[11]。夏季黃海中之水溫所以特低者,或由於海水自下上泛所致,其影響之大,甚至在全年等溫線圖中亦可覺察也。

冬季各月之溫度

冬季十二月、一月、二月三個月,中國全部均在西伯利亞高氣壓或蒙古高氣壓支配之下,夜間晴天輻射强盛,故自外蒙古至東三省北部,溫度最低。雲南高原因位置優良,受西藏高原之屏障,故冬季溫度最高。中國沿海外洋中之溫度較沿岸陸地上爲高,此蓋受暖流之影響,已如前述。但台灣海峽內之溫度,若與兩旁鄰近之測候所互相比較,則見特別低降,此中原因亦已在前節中述及,茲不贅。黃海中之等溫線向北突出,此則因海水溫暖之關係。至全國等溫線之趨向,大致言之,自西北趨向東南,及抵華中平原,始復折向東北。故華中華南之等溫線向北環抱,此實由於冬季北來寒潮路徑之關係[12]。一月溫度全國最低。平均自北而南,每越緯度一度,增加攝氏一·四度,可與同月美國東岸之溫度梯度相比擬[13]。二月陸上溫度已漸高,大陸之影響漸著,故山東半島之等溫線,已依半島形勢屈曲蜿蜒。

春季各月之溫度

春季三個月,即三月、四月、五月,因陸上溫度逐漸增高,自北而南,溫度梯度較前三個月爲平坦,即等溫線之密度漸小。至全國等溫線之趨向,大致與上季相似。惟自西北逕趨東南沿海岸,然後再折向東北耳。北方最冷之地帶,因沙漠逐漸加熱似向東移,至東三省之北部。山東半島上因加熱甚快,故等溫線沿半島之形勢愈形顯著。及至四月因陸上加熱更甚,黃海中遂成一較冷之區域。中國夏季開始後,東南季風之所以自華北沿海先發生者,即以此故[14]。台灣海峽內之等溫線,在春季向南突出甚劇,東中國海流在本季數月較陸地更爲寒冷。雲南高原仍爲全國溫度最高之地。

夏季各月之溫度

因夏季日射强盛之故,陸地加熱過甚,遂使夏季沿岸區域之等溫線大致與海

岸線相平行。甚至在內陸等溫線亦仍有與海岸線平行之傾向,而成同心之半圓,最熱部份在其中心。台灣海峽內寒流之影響,六月中尙顯著,七、八兩月,則漸次隱滅。黃海中之寒涼區始終存在。七月溫度以華中區爲最高。九江、武漢、長沙七月平均溫度均近攝氏三十度。青海西康一帶,就訂正至海平面之溫度而言,在夏季似爲一溫度最高之區域,雲南高原尙不足與之匹敵也。

秋季各月之溫度

秋季三個月,卽九月、十月、十一月爲冬夏之過渡期。夏季風衰退,西伯利亞寒潮又復漸次活躍。等溫線之密度及溫度梯度亦漸次增大,山東半島之等溫線亦漸復冬季之形態,卽多少與緯度相平行,至十一月駸駸乎已入冬令之象矣。秋季海岸與內陸之溫度梯度較春季爲平坦。如蘭州與青島在同一緯度上,十月溫度相差 2.1°C, 四月則相差 11.2°C, 皆以蘭州之溫度爲高。昆明秋季溫度亦較春季爲低。

(乙) 實際溫度

全年平均溫度

就實際溫度而言,則除沿海平原及島嶼上與訂正至海平面者,大致相似外,在西南高原及其他高地,則因高度關係,自較海平面圖爲複雜,而複雜之程度亦與測候站之數目成正比。北方寒冷區域,似在庫倫附近,而中國南部沿海一帶,則爲國內溫度最高之處,兩處溫度相差達 27°C。昆明貴陽一帶,因高度關係,溫度較低。四川盆地,因地勢低陷,北來寒流,不易侵入,南來氣流,有焚風現象,故溫度較高。山東半島上之等溫線,仍照地形屈曲。山東半島以南及江蘇北部,與夫台灣海峽中,仍較鄰近區域爲寒冷,此與海平面溫度圖之情形,初無二致。

冬季各月之溫度

冬季三個月溫度之分布,與海平面溫度圖,亦大致相似。主要之區別,卽在海平面圖中,等溫線自西北斜向東南,及至華中華南,始折向東北。在實際溫度圖中,等溫線之趨向,自西徂東,比較平直,換言之,卽多少與緯度相平行。台灣海峽內寒流之影響亦著。就各月個別而論,十二月之圖中,雲貴高原及四川盆地之影響,尙屬顯明。及

冬令漸盛,則地形之影響,漸不顯著。在一月中,昆明較牛山島溫度僅低0.8°C,此兩地在同一緯度上,不過牛山島較昆明低 1900 公尺耳。一月中在貴陽及其附近爲一寒冷中心,此蓋因該區雲量甚多,且多霧靄之故。南至昆明,雖高度高出一千公尺,但在冬季及早春享有豐富之陽光,故氣候反較溫和。山東半島上大陸之影響,至二月而始顯。一月中溫度,自爲全國最低。平均自北而南,每越緯度一度,溫度增加攝氏一·六度。故若有人自漠北向海南島旅行,勢必傾箱倒篋,由裘而葛,數日之內,歷盡冬夏寒暑。一月庫倫之平均溫度約爲 -27.6°C, 而海南島之臨高則達 17.8°C 矣。

春季各月之溫度

春季三個月之等溫線,因陸上溫度漸增,而地勢又高下不等,故曲折漸多。與春季海平面三個月之溫度相較,差異亦漸大。最冷區域,似仍在庫倫附近,中國南部沿海一帶,仍爲國內溫度最高之地,台灣海峽中寒流之影響亦著。四月、五月,黃海內有一寒冷區域出現,而使周圍陸上之溫度,因此較低。山東半島地形對於等溫線之影響,各月皆有,此亦與海平面春季各圖相似。此外在本季實際溫度圖中,有一特殊之點,卽除內外蒙古而外,溫度愈增,等溫線愈向華北突進,及五月而更甚,楔形尖端伸入山東半島;此蓋因中國西部地勢崇高,而東南又環海,故東西兩旁,溫度較低,中部溫度,因此特高。昆明高原約在暮春,雨季開始,昆明溫度之上升因此較緩。故在三月昆明較貴陽溫度高 2.6°C, 但至五月則貴陽反較昆明高 1.2°C 矣。

夏季各月之溫度

夏季三個月與海平面夏季三個月之溫度相較,其區別甚大。蓋海平面溫度圖中,溫度由海岸向陸地增加,至實際溫度圖中則相反。除直接沿海部分,因有海風關係,能使溫度稍形低降外,溫度概由沿海向內陸減低,而與高度成反比。內外蒙古及康藏高地,仍爲較冷區域。黃海中之涼爽中心依然存在。惟台灣海峽內寒流之影響,七、八兩月已不顯著。六月中我國境內溫度最高之區有二:一在華南;一在華北,以開封爲中心,包括山東半島西部,湖北北部及陝西東邊一小部。七、八兩月情形,大體與六月相似。不過溫度最高之區,已由華南北進而入華中區。山東半島西部,仍較溫暖。但在八月中,山東半島東西兩方溫度之差已甚微。綜觀夏半年數月中,自四月至七月,因黃海中有寒冷中心,而山東半島西部之大陸性又强,故島上自東向西,溫度梯度頗大。一省之中,夏季水平的溫度梯度如此之大,在中國境內,惟山東省而已。冬季

東三省與南海間之溫度梯度甚爲峻急。但在夏季,則極和暖,每向南越一緯度平均不過增加0.16°C而已。

秋季各月之溫度

秋季三個月爲由夏入冬之過渡期。本季各月可得而言者,爲突入山東半島成楔形之等溫線,漸次平直,而有與緯度相平行之傾向。若與訂正至海平面秋季各月之情形相較,差別漸小,惟雲貴地形之影響,在實際溫度圖中,則頗顯著耳。沿海一帶區域,春季較秋季爲寒涼,但雲貴高原以及中國西北部則反是,秋季較春季寒涼多矣。十一月之情形,已與冬季相似,而無甚軒輊矣。

平均年較差

平均年較差,乃就一九三一至一九三五年逐年之溫度年較差,加以平均而得之數也。較差自北而南,或自陸入海,逐漸減小,其理甚顯,無庸贅述。東三省及蒙古北部,年較差在攝氏四十度以上,而海南島之年較差,則僅十度耳。沿海一帶年較差亦較小,但在山東半島西北部及河北省大部,較差頗大。故就溫度年較差而言,山東半島東西兩側出入頗大。華中華南中央部分,其溫度較差亦較東西兩旁爲大,蓋中國西部爲高山,而東部沿海也。

平均全年最高溫度

平均全年最高溫度,自以蒙古沙漠區域爲最大,惜無可靠紀錄,故其確數無從懸揣,惟至少當在攝氏四十度以上,當較安南暹羅一帶爲高。中國西部爲高山區域,故最高值並不大。山東半島西部,河南全省,陝西東邊一小部,及河北省東南部,最高值頗大,達攝氏四十度以上,爲中國本部最高值中之最大者。四川重慶(即巴縣)以地勢低窪,爲羣山包圍,數亦較大。自西向東,以迄海濱,數值漸小,大概以黃海中爲最小。故山東半島上東西兩邊,最高值之懸殊,亦爲全國之冠。

平均全年最低溫度

平均全年最低溫度亦以蒙古及東三省北部爲最低,自以外蒙古最爲嚴寒,溫

度在攝氏零下四十度以下,亦不爲罕見也。海南島之最低溫度爲 8°C。四川重慶以在盆地之內,冬季北來寒潮不易侵入,夏季南來氣流,呈焚風現象,故較溫暖。故南方等溫線向四川突進而成舌狀。黃海及渤海之內,因海洋影響,故亦溫暖,等溫線遂向海灣內突入。考最低值與冬季寒潮頗有關係,地勢平衍之區,最易爲寒潮所侵入,如中國中部及東南部,等溫線自北向南突出,卽其例也。

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DESCRIPTION OF THE CHARTS

The drawing of isothermal charts requires well distributed records as well as records of long duration. These two requirements cannot be fulfilled in China. Some stations have records extending to many years, strictly speaking these stations cannot be used simultaneously with others which have very short temperature records. For the sake of homogeneity the records used in drawing present charts are those extending from 1931 to 1935, for within this period the records are more numerous and reliable.

Father H. Gauthier[1] was the first man who made an extensive study into this subject. His book appeared in 1918, and contains available data up till that time. Recently Father E. Gherzi published his "Atlas Thermométrique de la Chine"[2] which is purported to complement Gauthier's work. Gherzi employed more stations and records of longer duration than Gauthier in his study of temperature of China, but he, like Gauthier, did not seem to use the temperature records of a definite homogeneous period in constructing the isothermal charts, which according to J. Hann, should be an essential factor in making temperature of different places comparable[3].

In making isothermals for the present work we used the data of only 105 stations which cover the same period 1931-1935, believing that the shortness of period is amply compensated by the homogeneity of the series. Wherever possible the data have been reduced to the mean of term hours, i.e. 6^h, 14^h and 21^h. Besides the mean monthly and mean annual charts of sea level temperature, the present work also contains mean annual and mean monthly actual isothermal charts, one chart of mean annual range, one of mean annual maxima and one of mean annual minima.

In reducing the mean monthly and mean annual to sea level, a uniform lapse rate of 0.5°C per 100 meters is assumed. Even though aeroplane ascents made in Nanking and kite ascents made in Peiping all indicate that the average condition of free atmosphere calls for a vertical temperature gradient of 0.6°C rather than 0.5°C per 100 meters for spring, summer and autumn months, this latter lapse rate was employed for all the charts simply because it has become an international usage.

According to J. Hann, ordinary isothermal charts not reducing to sea level have neither scientific nor practical value[4]. This is especially so in a region where altitude changes greatly in a short distance. Still, from the geographical point of view isothermal charts of actual temperature represent the real condition and serve many purposes such as the subdivision of climatological and agricultural regions. For this reason they have been retained in the present work.

The temperature records of Indo-China, Siam and the Philippine Islands used in these charts are taken from Braak's "Klima von Hinterindien und Insulinde" and those of

Formosa, Korea and Ryukyu Archipelagoes are from T. Okada's "Climate of Japan." Futhermore, we have also consulted "Klima der Union der Sozialistischen Sowjet-Republiken" and "Climatological Atlas of India." It is to be noted that these data do not cover the same interval of time 1931-1935.

(A) Description of Sea Level Isothermal Charts

Mean Annual Isothermal Chart

With Pacific Ocean on its eastern border and with Mongolian and Tibetan plateaux on its west, and stretching from tropic of Cancer in the south to well toward latitude 50°N in the north, it is apparent that China should show a considerable range of temperature. The most noticeable feature in the mean annual chart is the swinging of isotherms equatorward as they approach the Pacific sea-board. A glance at the world isothermal charts, such as Bartholomew's[5], will convince us that such systematic deflections exist over all the continents as isotherms pass from the land to the ocean, but the deflections are more marked over the eastern coast of N. America and Eurasia. The result of this deflection is to make the eastern part of China proper abnormally cool.

There are three other points worth mentioning, namely: (1) the temperature of Yunnan plateau is exceptionally high; (2) temperature of open sea is higher than the temperature of the adjoining coast land, which in its turn is higher than that of the coastal islands, that is to say the coastal waters are abnormally cold, it is colder than both the coastal land and open sea, this is especially true along the southern coast of Shantung extending to the north of the province Kiangsu and in the Strait of Formosa; and (3) the isothermal lines of Shantung conform to the general shape of the peninsula. A word of explanation may be necessary for each of these features.

(1) It is well recognized that on a high plateau temperature decreases with height much slower than on a plain or on a mountain. J. Hann pointed out that the lapse rate on a plateau comes nearer to 0.4°C per 100 meters rather than 0.5°C per 100 meters[6]. Besides, the province of Yunnan is located to the south of Tibet plateau, sheltered from the severe northerly current, the temperature is accordingly high.

(2) The temperature of the open sea is higher than the temperature of adjoining land owing to the fact that the open sea temperature is influenced by the Kuro Shio warm current which increases the sea temperature directly, and the air temperature indirectly. The coastal islands, on the other hand, are just on the way of cold Chinese coastal current[7], chilled by it, and therefore has a temperature below that of the continent. The low temperature in the south of Shantung peninsula and the north of province Kiangsu is due to two causes: (a) in the winter half year when the northerly winds blow across the east point of Shantung peninsula, then they, under a favorable condition, due to the dynamical effect, develop into a vortex in the Yellow Sea[8]. Even though the prevailing wind direction at Tsingtao, Tungtai and Süchow may be southerly, southeasterly or easterly, but as the source of these winds is from a northerly direction, they are cold winds and reduce the temperature

of that region in winter; (b) from April to August there develops a cold center in the Yellow Sea (see the isothermal charts from April to August), the cool ocean water affects the temperature of coastal land nearby, and therefore the summer temperature of this region is also low. The temperature of islands along the coast, especially those in the Strait of Formosa, is abnormally low, because these islands are directly subjected to the influence of the Chinese coastal current, which is propagated by the northerly winds from a higher latitude through the Strait of Formosa, and hence has a low temperature.[9] The northerly winds prevail in the Strait for the greater part of the year, from September to May, and the wind force here is stronger than other parts of China.

(3) The isotherms of Shantung peninsula are parallel with the coast lines, and this is caused by the distribution of land and sea.[10] In summer the cooling effect of ocean is very pronounced, a difference of 6° to 7° in the mean monthly existed between stations along the coast and those inland. In Korea the isothermal lines also tend to conform to the coast lines especially in summer months.[11] The ex reme low water temperature in Yellow Sea in summer is probably due to the swelling up of ocean water from below, its influence is so extraordinary that it is discernible even in the mean annual isothermal chart.

Isothermal Charts of the Winter Months

In the winter three months, December, January and February, China is entirely under the influence of the Siberian or Mongolian high pressure, and Outer Mongolia and the three Eastern Provinces have very low temperature due to strong outgoing radiation under a clear sky. On account of its favored position as stated above the plateau of Yunnan has the highest temperature in our country in winter. For obvious reasons the temperature of open sea in Pacific Ocean is higher than the land, but the temperature in the Strait of Formosa is low as compared with the neighbouring land stations on both sides, the reason for this anomaly has been given in the foregoing paragraph. The isotherms in the Yellow Sea bent northward as they entered sea from land owing to the tempering effect of water. Generally speaking, the isotherms run from NW to SE, on reaching the lake basins of Central China they bent back towards NE, forming open loops, they follow closely the familiar tracks of cold waves[12]. January has the lowest temperature of the year and the horizontal temperature gradient from Lungkiang in the north to Hongkong in the south is roughly 1.4°C per 1° of latitude comparable with the temperature gradient of the eastern coast of the U. S. A. in the same month[13]. In the month of February the temperature of the land begins to rise slightly and this is sufficient to cause the isotherms of Shantung province to run parallel to the coast lines.

Isothermal Charts of the Spring Months

Owing to the rapid rise of the land temperature, temperature gradient from north to south of the three spring months gradually decreases. The general trend of the isotherms assumes the same shape as that of the winter season, i.e. the isotherms run from NW towards SE and then turn back towards NE. On account of rapid increase of temperature in the desert regions of Mongolia the low temperature region shifts to northern Manchuria.

The isotherms of Shantung peninsula conform more closely to the sea coast, which is caused by the rapid rise of the land temperature. In the month of April the land temperature becomes much higher than that of the sea, and the Yellow Sea appears to be a cold region in comparison with the surrounding land. This kind of temperature distribution explains why the summer monsoon first starts in the neighbourhood of the Gulf of Pechihli [14]. The isotherms make long loops in the Strait of Formosa during spring, which shows that the Chinese coastal current is much colder than the land during these months. Yunnan plateau still remains to be the warmest part of the whole country.

Isothermal Charts of the Summer Months

Due to the intensive incoming radiation in summer which results in the excessive heating of the continent, the isotherms of the coastal regions assume the general shape of the coast line in the summer months. Even in interior the isotherms tend to run parallel with the coast line, forming concentric semicircles, with the hottest part at the center. The influence of the coastal cold water current on the temperature of the Strait of Formosa persists till June, but in the months of July and August the influence gradually fades away. The Yellow Sea becomes the coldest spot on the charts. In actual temperature, Central China is the hottest region on the July chart and the mean monthly temperature of Kiukiang, Hankow and Changsha is as high as 30°C. On sea level isothermal charts Tsinghai and Sikang hypothetically takes the lead away from Kunming plateau and becomes the seat of excessive heating in summer months.

Isothermal Charts of the Autumn Months

Autumn season is the transitionary period between winter and summer monsoons. As the cold Siberian air masses gradually push southward the horizontal temperature gradient increases and the isotherms of Shantung peninsula again take on the winter shape, i.e. they are more or less parallel to the latitude. The temperature distribution of the November chart resembles already very much that of the winter months. The temperature gradient between coast land and interior is much more gentle in autumn than in spring. Thus the difference of temperature between Kaolan (Langchow) and Tsingtao, located practically on the same latitude, is 2.1°C in October and 11.2°C in April both in favor of the inland city. Kunming plateau, though becomes once more the warmest portion of the country, has a lower temperature than in the spring months.

(B) Description of Actual Isothermal Charts

Mean Annual Isothermal Chart

There is little difference between the actual temperature and the sea level temperature charts in the coastal regions as well as on the Yangtze and Yellow River Delta, but in the southwestern plateau and other regions of elevation the actual temperature charts are much more complex than the sea level temperature charts, and the complexity of the actual

temperature charts increases as the number of stations increases. On the mean annual isothermal chart for actual temperature, the coldest region is located near Urga and the warmest region is along the South China coast with a difference of 27°C. Owing to their great height Kunming and Kweiyang have rather low mean annual temperature. The Red Basin, on the contrary, being rather low and protected against cold wave invasion by high mountains on the north, and submitted to foehn effect from the south, has comparatively high mean annual temperature. The isothermal lines of Shantung peninsula still retain the general shape of the peninsula. The temperature in the southern part of Shantung peninsula and the northern part of province of Kiangsu and that on the islands in the Strait of Formosa is still lower than the surrounding districts as shown in the sea level chart.

Isothermal Charts of the Winter Months

The general trend of the actual isotherms of the winter months is similar to that of sea level isotherms. The main difference is that while the isotherms of the sea level temperature are more or less inclined from NW to SE, the isotherms of actual temperature, however, run from west to east, roughly parallel with the latitude. The effect of the cold coastal current is still prominent in the Strait of Formosa. The December chart shows that the orographical influences of Yunnan-Kweichow table-land and the Red Basin on the temperature are quite prominent. As winter advances the influence of topography becomes less apparent. In January Kunming is only 0.8°C colder than Turnabout, an island station situated on the same latitude but 1900 meters lower in altitude. A cold center begins to form over Kweiyang and its neighborhood in January, owing to the high cloudiness and frequent mist prevailing in this district. While further south the Kunming plateau, though located one thousand meters higher, enjoys plenty of sunshine throughout the winter and early spring, and hence has a much milder weather. The influence of land form of Shantung peninsula on its isotherms begins to show itself on the February chart. January is the coldest month of the year and the horizontal temperature gradient from south to north is about 1.6°C per 1° of latitude. When one travels from Outer Mongolia to the Hainan Island one has to experience every variety of climate from the arctic rigor of Mongolia to the balmy sunshine of the South Sea. In January Urga has a mean temperature of –27.6°C, while Lamko on the Hainan Island registers at 17.8°C.

Isothermal Charts of the Spring Months

On account of the rapid rise of the temperature of the land and the influence of the different land forms the isotherms of the spring months show irregularity, and their distribution differs more and more from the corresponding sea level temperature as the temperature rises. The coldest spot seems still to be located near Urga, South China coast still forms the warmest region in this country. The influence of the Chinese coastal current on the temperature of the Strait of Formosa is clearly shown on the chart. But on the April and May charts a cold region in the Yellow Sea begins to appear and this region

affects the temperature of its surroundings. The influence of land form of the Shantung peninsula on its isotherms is clearly shown in these charts as in the sea level spring charts. As summer is approaching the temperature of Central China and the great northern plain rises more rapidly than the temperature of the hilly regions of western China and the low lands along the coast, consequently the isotherms assume a wedge shape with the narrow end pointing northward. Rainy season begins on Kunming plateau and as spring advances, temperature in Kunming tends to rise only slowly, thus in March Kunming is warmer than Kweiyang by 2.6°C, but by May the latter city is warmer by 1.2°C.

Isothermal Charts of the Summer Months

The isothermal charts of these months differ radically from the sea level isothermal charts for the same months. On the latter charts temperature increases from coast to inland, while on the former charts, with the exception of the immediate coast, where the sea breeze has a moderating effect, and lowers the temperature somewhat, the degree of warmth decreases from coastland inward, in the inverse proportion to the increase of altitude. Mongolia in the north and Tibet plateau in the west seem to be the regions of comparatively low temperature. In actual temperature charts a cool center appears in the Yellow Sea. The June chart shows two hot belts, one in South China and one in North China. The hot belt in North China includes Honan, western Shantung, northern Hopeh and eastern Shensi. The July and August charts exhibit similar features as the June chart but the hot belt in South China advances northwards to Central China, and the effect of coastal current in Formosa Strait is not obvious in July and August. Western Shantung is still comparatively warmer than the east, but the temperature contrast between western and eastern Shantung is rather small in the month of August. From April to July the temperature gradient between western and eastern Shantung peninsula is steep and this is caused by the existence of a cold center in the Yellow Sea and a warm sector in Honan province. In contrast to the steep temperature gradient existing between Manchuria in the north to South Sea in the south during winter, the rate of change of temperature from north to south in summer is very gentle. It amounts to only 0.16°C per degree of latitude in July.

Isothermal Charts of the Autumn Months

Autumn is the transitionary period between summer and winter, the only feature worth mentioning in these charts is the flattening out of the wedge shaped isotherms on the Shantung peninsula into more or less parallel lines with the latitude. These three charts differ very little from the sea level charts for the same season, save for the fact that the topographical effect of Yunnan-Kweichow plateau is much more in evidence in the actual temperature charts. Along the coast spring is much cooler than autumn, but on Yunnan-Kweichow plateau as well as in Northwest China, autumn is the much colder of the two. The November chart is very similar to the winter charts and may be included with the winter months.

Mean Annual Range of Temperature

The mean annual range of temperature in China increases with the latitude and away from the coast. The mean annual range of more than 40°C occurs in northern Mongolia and Manchuria, while in the south it decreases to 10°C in Hainan Island. The range along the sea coast is also small, but in the great northern plain and western Shantung it is big. On the Shantung peninsula, range increases from east to west rather sharply. Temperature range is bigger in Central China than that of West China and provinces along the sea coast, the reason lies in the fact that the range of temperature of mountains and sea is usually smaller than that of plains area.

Mean Annual Maximum Temperature

The highest mean annual maximum temperature in China should occur in Gobi Desert, but unfortunately there is no reliable data to go upon so that we cannot guess at the exact figure. It is reasonable to believe that it is more than 40°C, a figure higher than that to be obtained in Indo-China and Siam. West China is mountainous and the maximum temperature cannot be very high. The mean annual maximum temperature of western Shantung, Honan, southeastern Hopei and eastern Shensi is more than 40°C, and is the highest figure in China proper. Owing to the enclosed position of Chungking it also has a big value. The mean annual maximum temperature decreases from inland toward the coast. The smallest value occurs in the neighborhood of Yellow Sea and this causes the gradient of maximum temperature between western and eastern Shantung to be the steepest in China.

Mean Annual Minimum Temperature

The lowest mean annual minimum temperature occurs in Outer Mongolia and northern Manchuria, it seems that Mongolia is the coldest spot in the country in winter, mean annual minimum temperature there goes below −40°C. The mean annual minimum temperature of 8°C occurs in Hainan Island. The Red Basin in Szechwan has a comparatively high value and this is because it is protected against cold waves invasion by high mountains in the north, and submitted to foehn effect from the south, hence the lines of equal mean annual minimum temperature protrude from south into the Red Basin like a tongue. Yellow Sea and the Gulf of Pechihli are comparatively warm and have high minimum temperatures. The value of minimum temperature is closely related to the cold wave invasion, and those regions frequently visited by cold waves, such as Southeastern and Central China, have usually a low value.

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中國地形圖
TOPOGRAPHY OF CHINA

第一圖 CHART 1

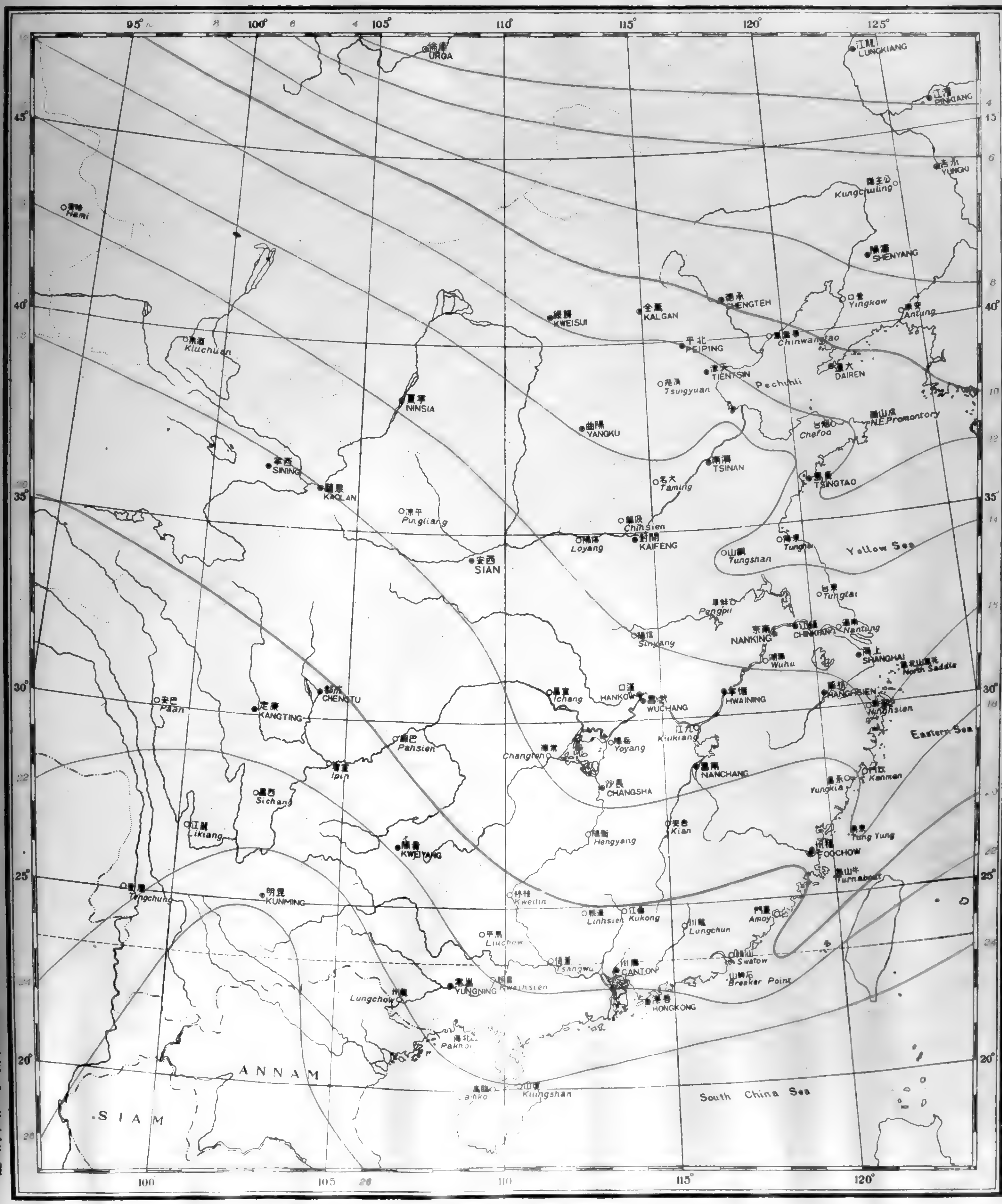
尺例比距緯

尺例比距經

全年海平面等溫線

SEA-LEVEL ISOTHERMS: YEAR (°C)

第二圖 CHART 2



尺例比距緯 尺例比距經

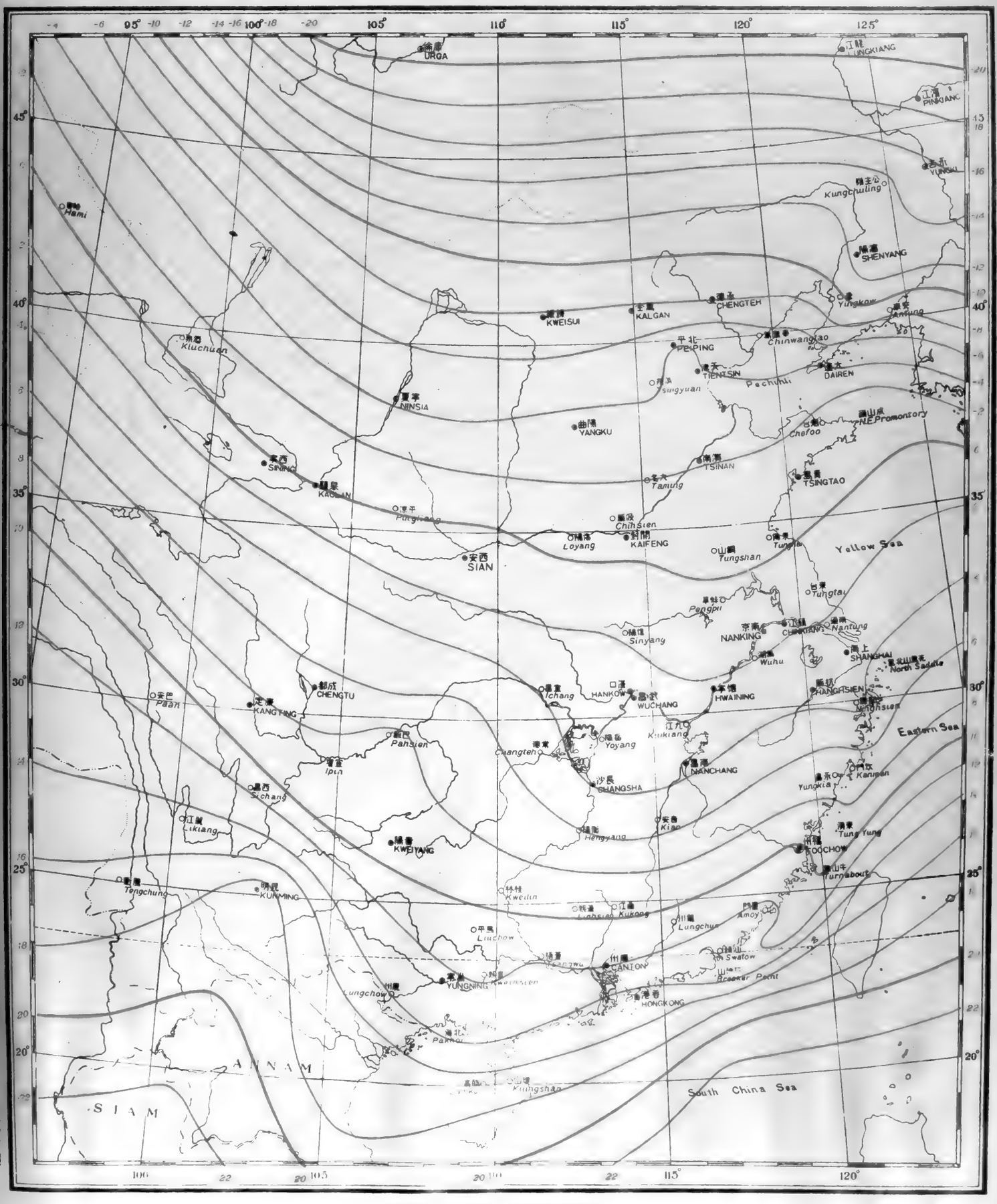
國立中央研究院氣象研究所製

一 月 海 平 面 等 溫 線

SEA-LEVEL ISOTHERMS: JANUARY (°C)

第 三 圖

CHART 3



尺 例 比 距 緯

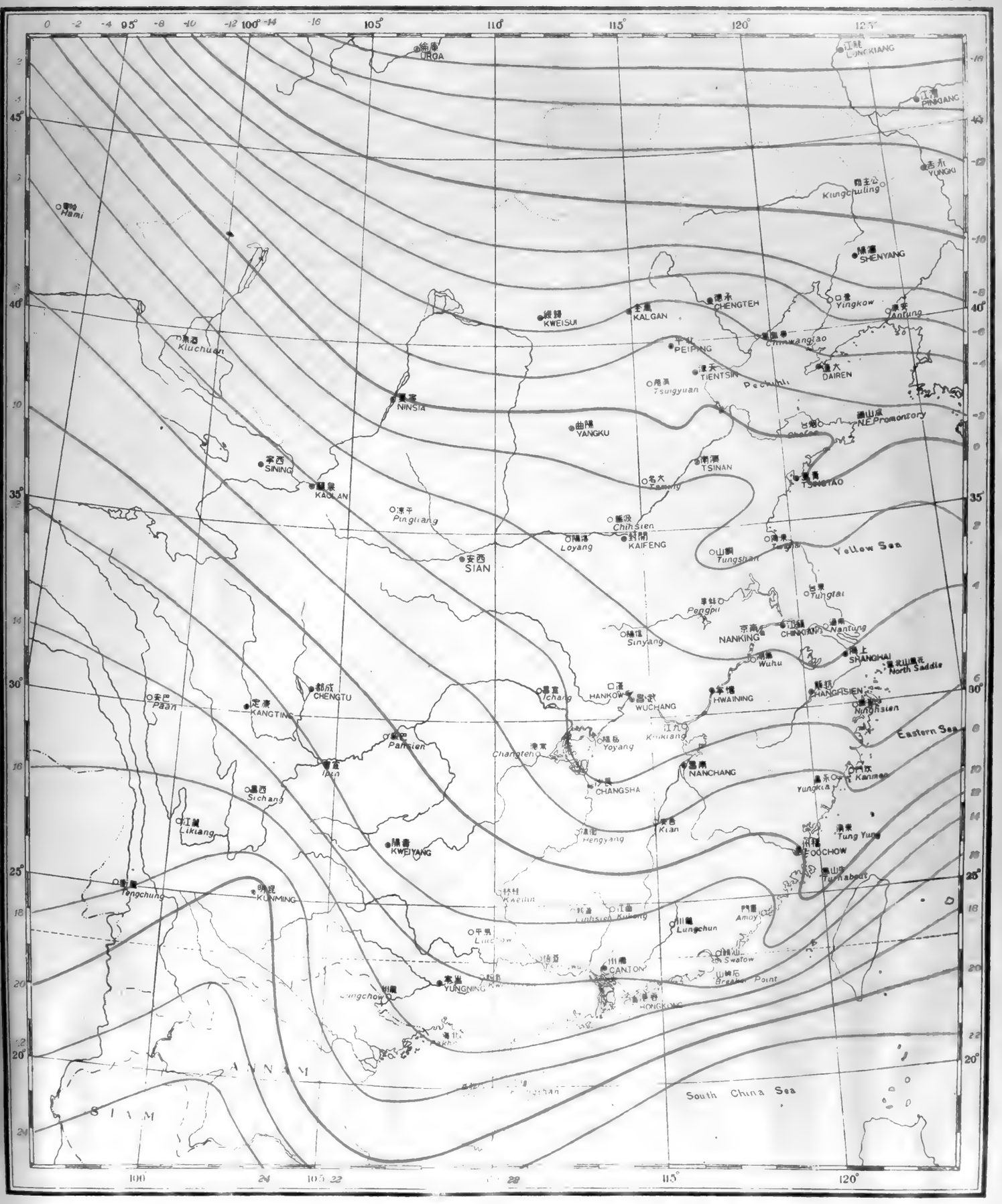
尺 例 比 距 經

二 月 海 平 面 等 溫 線

SEA-LEVEL ISOTHERMS: FEBRUARY (°C)

第 四 圖

CHART 4



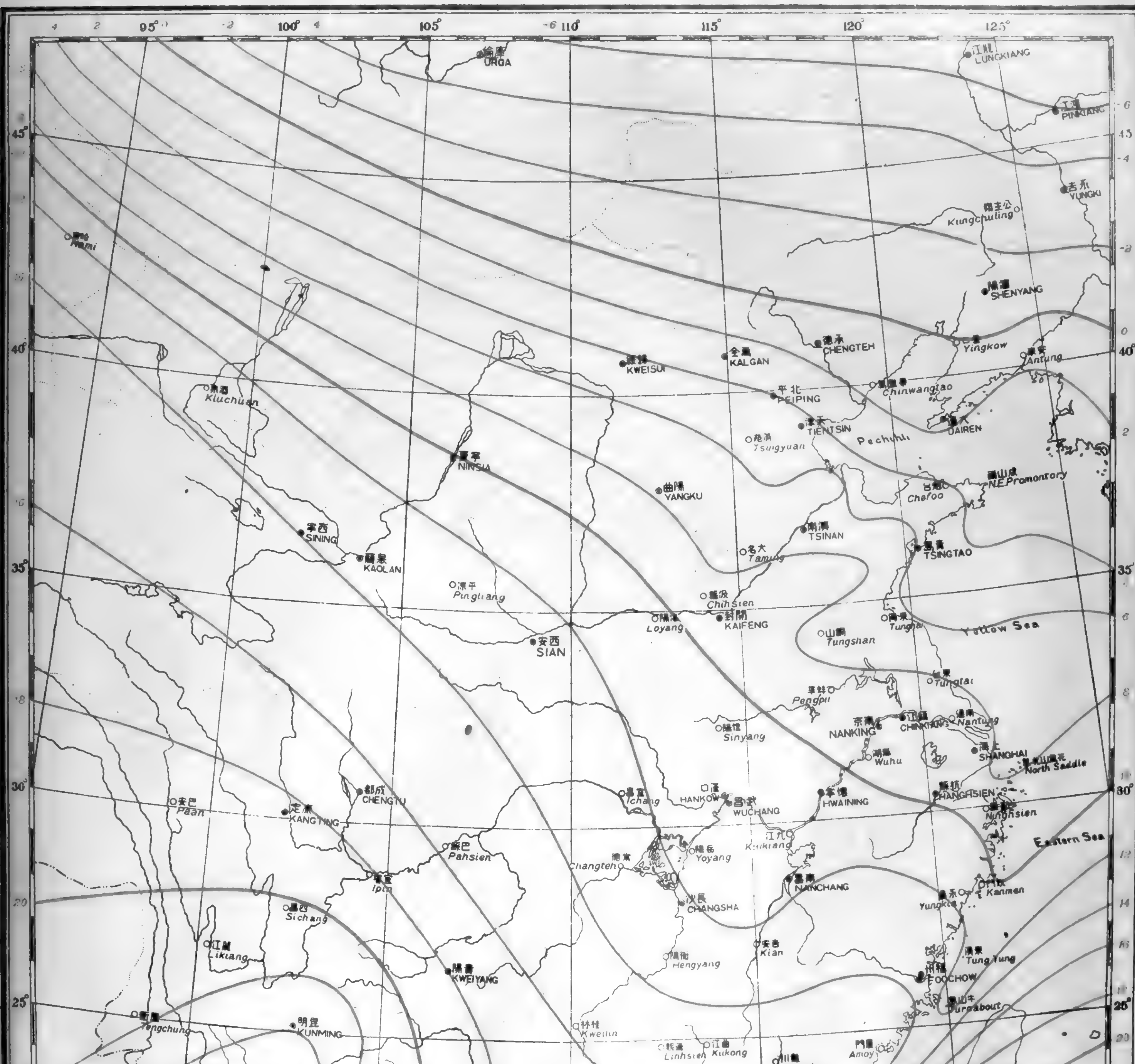
尺 例 比 距 緯

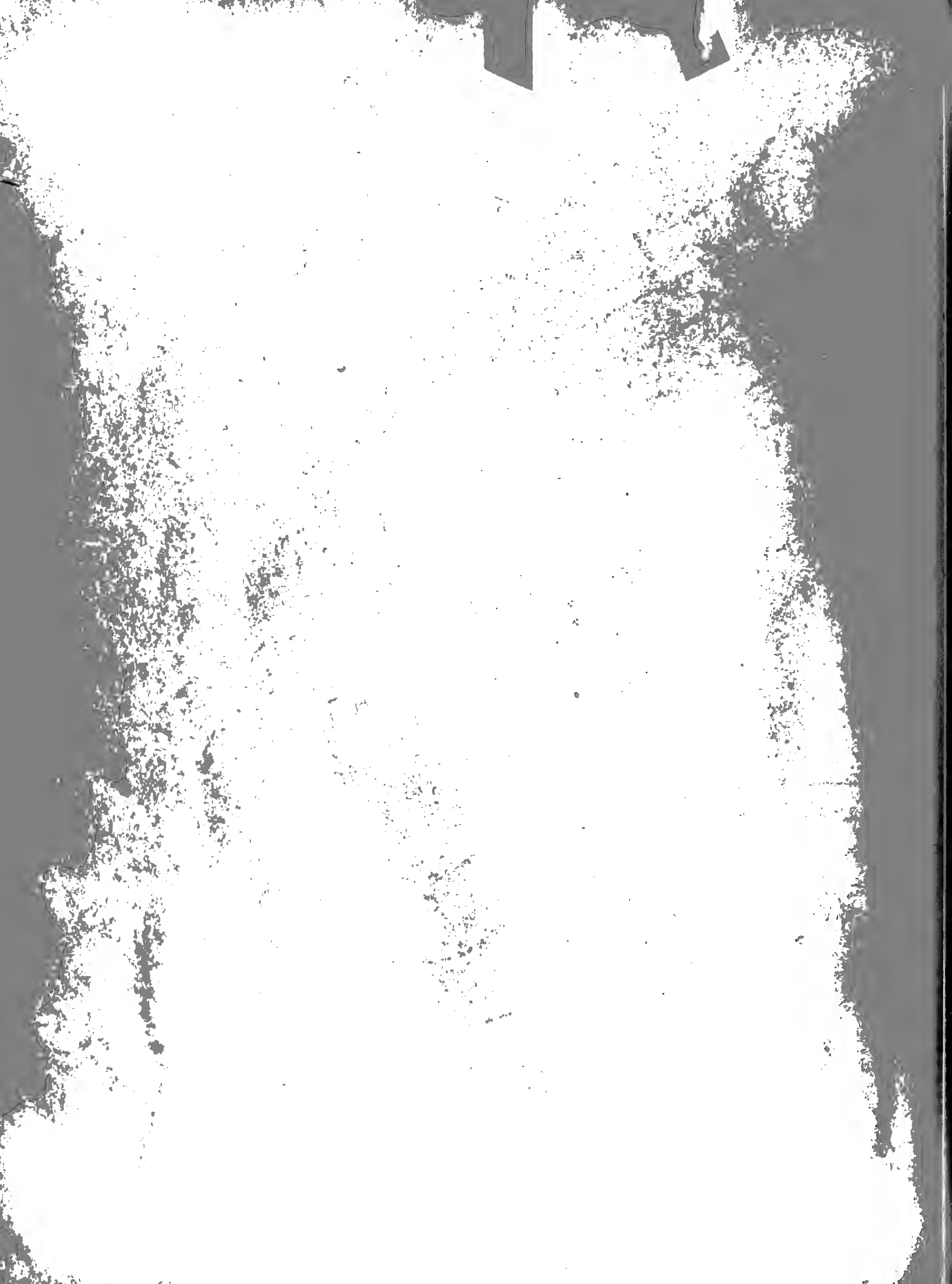
尺 例 比 距 經

三月海平面等溫線

SEA-LEVEL ISOTHERMS: MARCH (°C)

第五圖 CHART 5

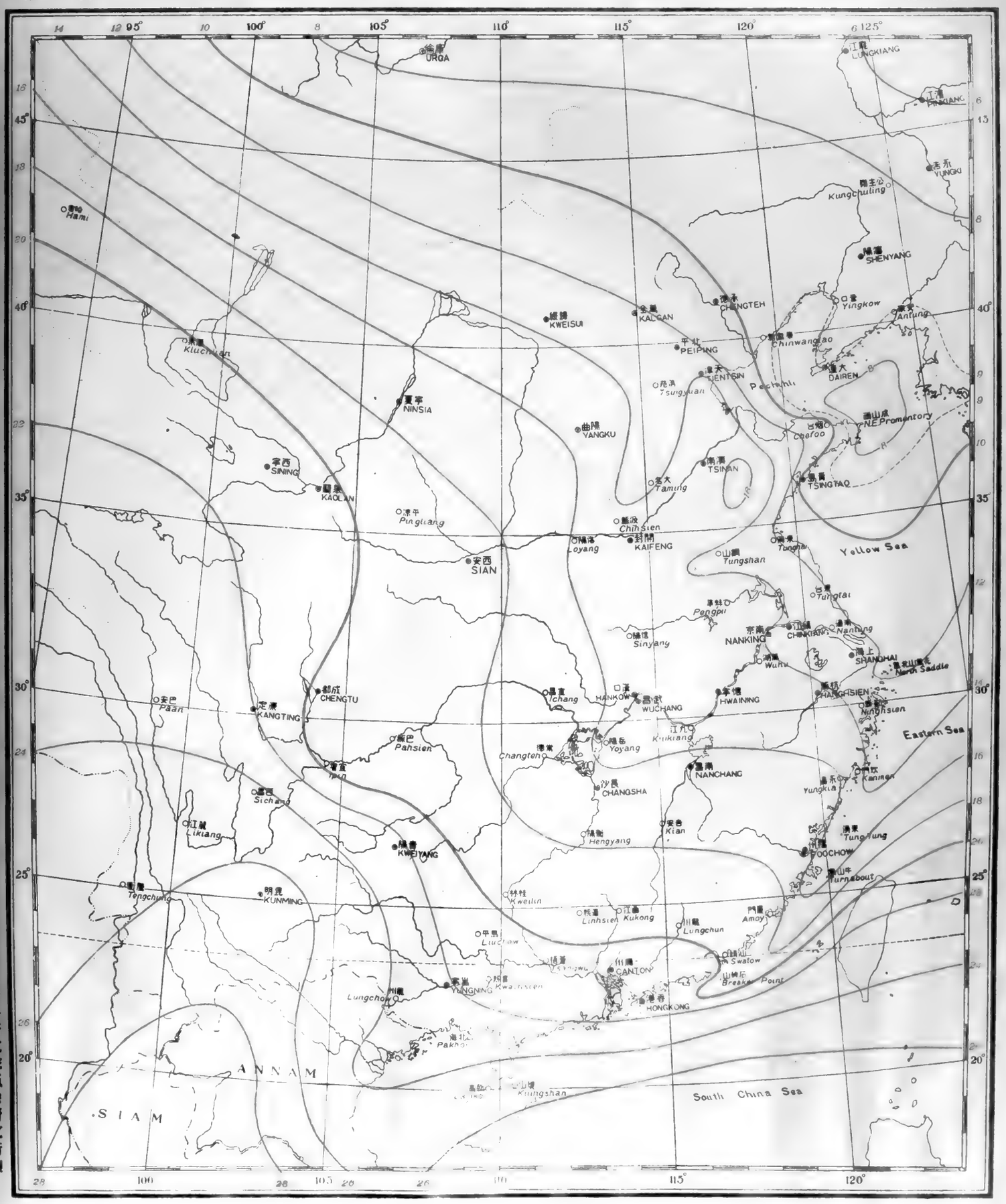




四 月 海 平 面 等 溫 線

SEA-LEVEL ISOTHERMS: APRIL (°C)

第 六 圖 CHART 6



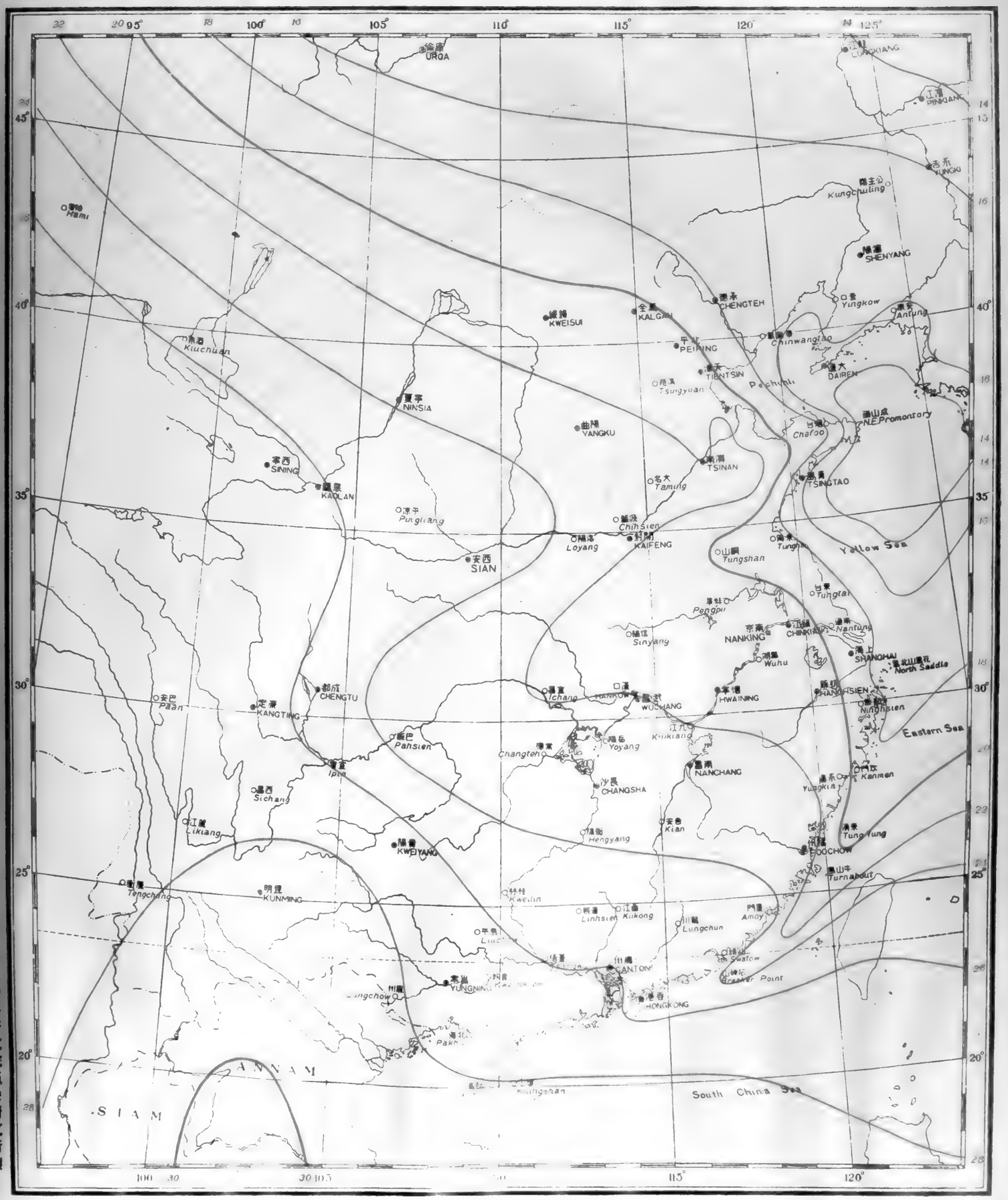
尺 例 比 距 緯

尺 例 比 距 經

五 月 海 平 面 等 溫 線

SEA-LEVEL ISOTHERMS: MAY (°C)

第 七 圖 CHART 7



尺 例 比 海 洋

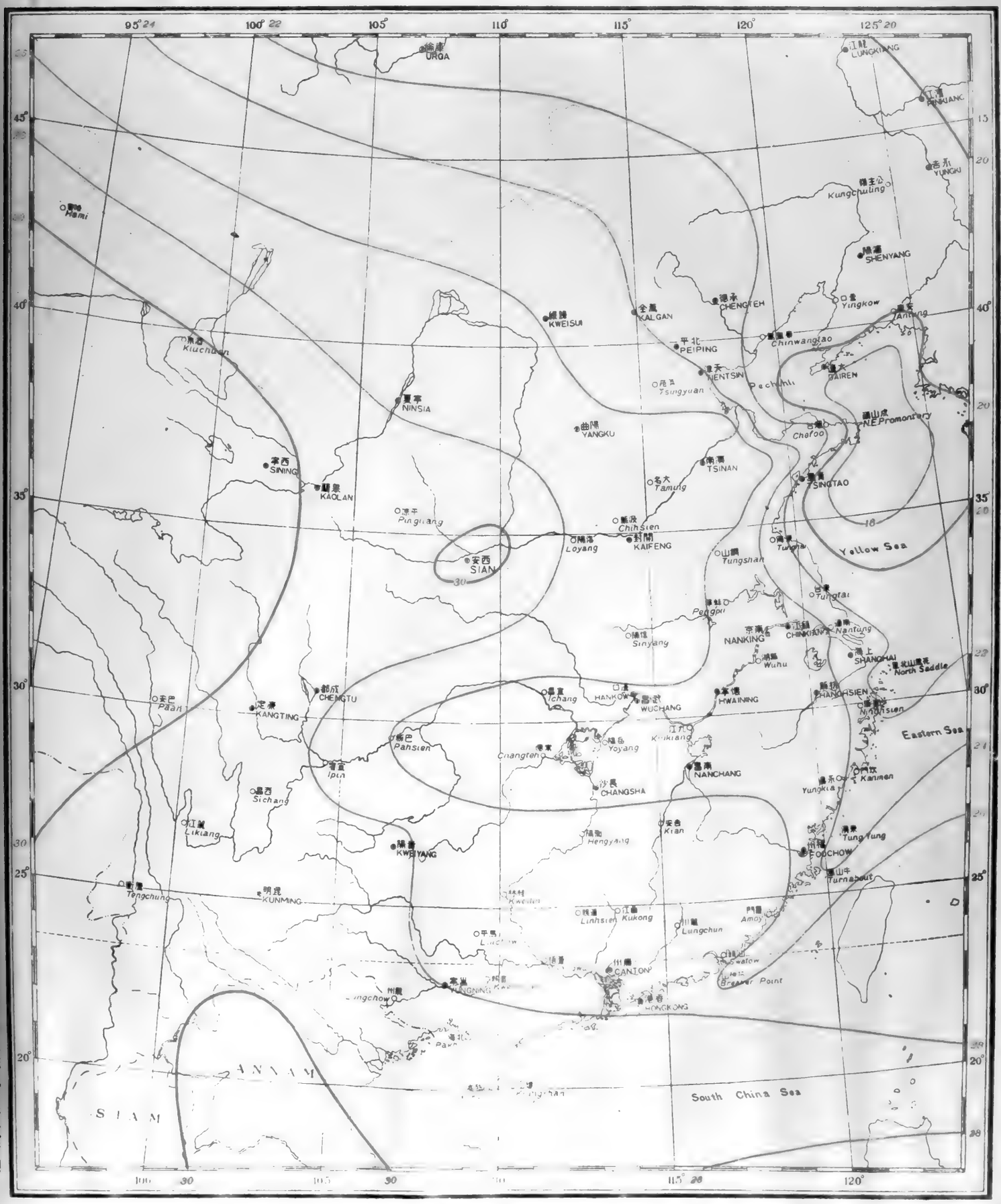
尺 例 比 距 經

六月海平面等溫線

SEA-LEVEL ISOTHERMS: JUNE (°C)

第八圖

CHART 8



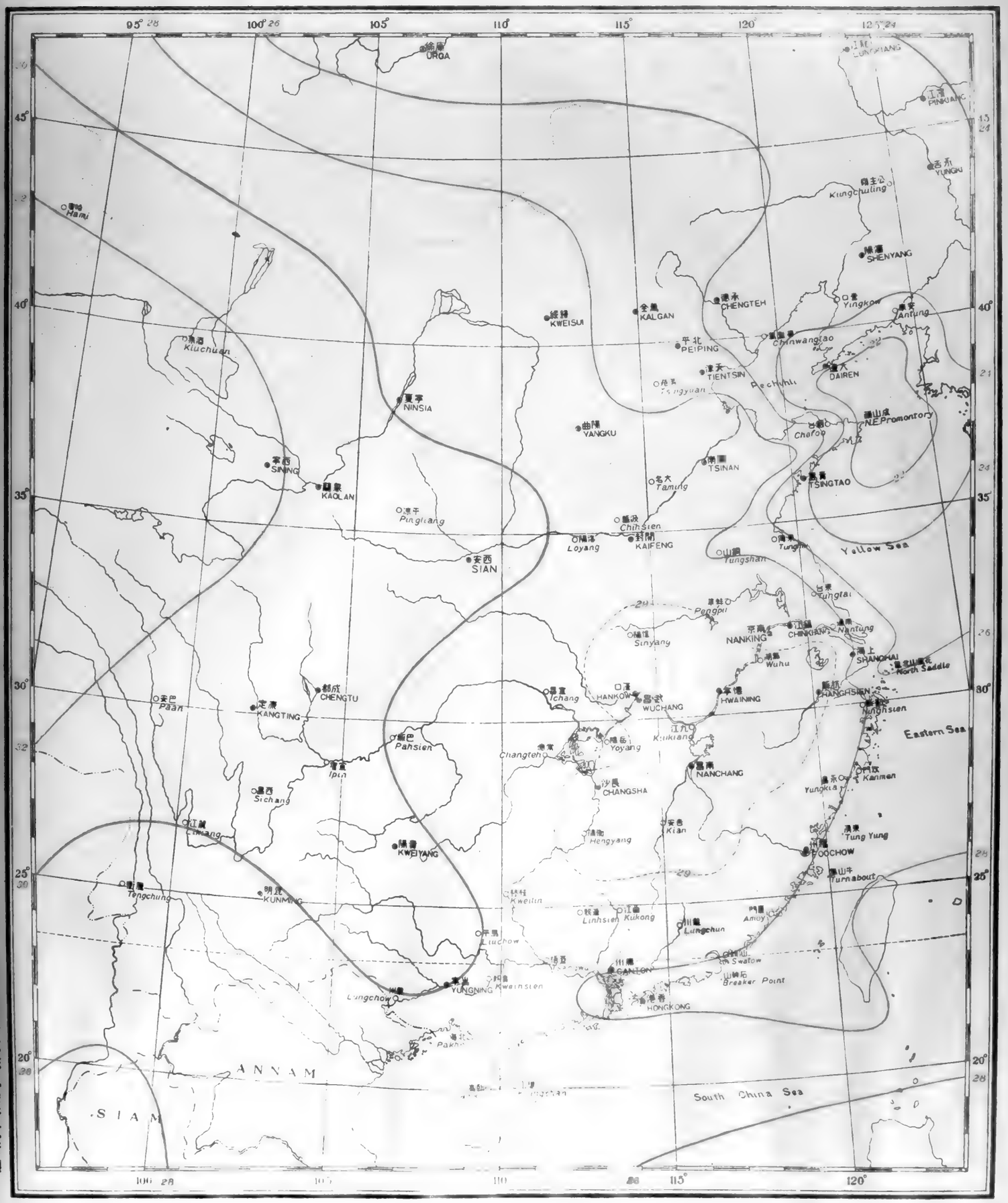
尺例比距緯

尺例比距經

七 月 海 平 面 等 溫 線

SEA-LEVEL ISOTHERMS: JULY (°C)

第 九 圖 CHART 9



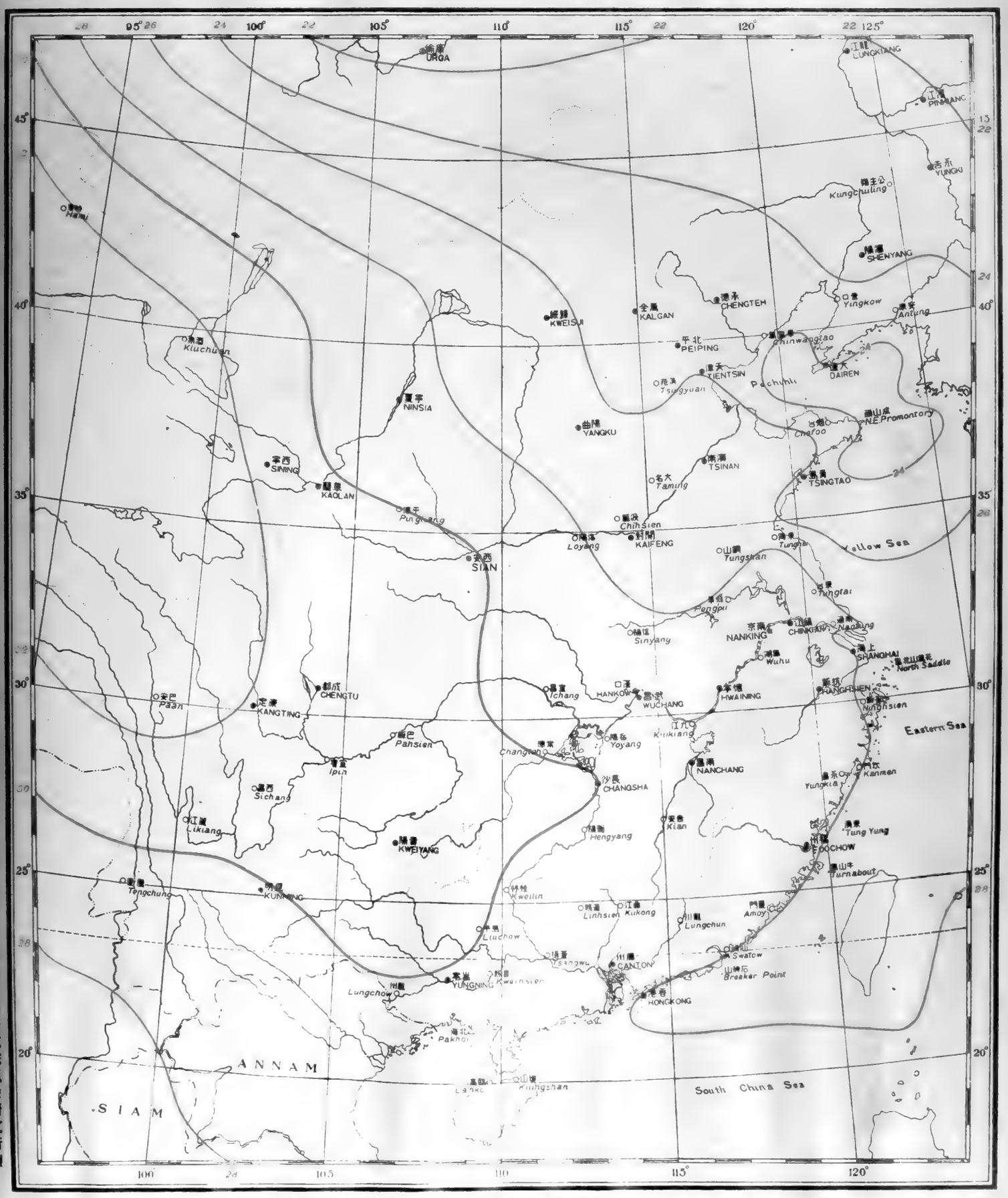
尺 例 比 距 緯

尺 例 比 距 經

八月海平面等溫線

SEA-LEVEL ISOTHERMS: AUGUST (°C)

第十圖 CHART 10



尺例比距緯

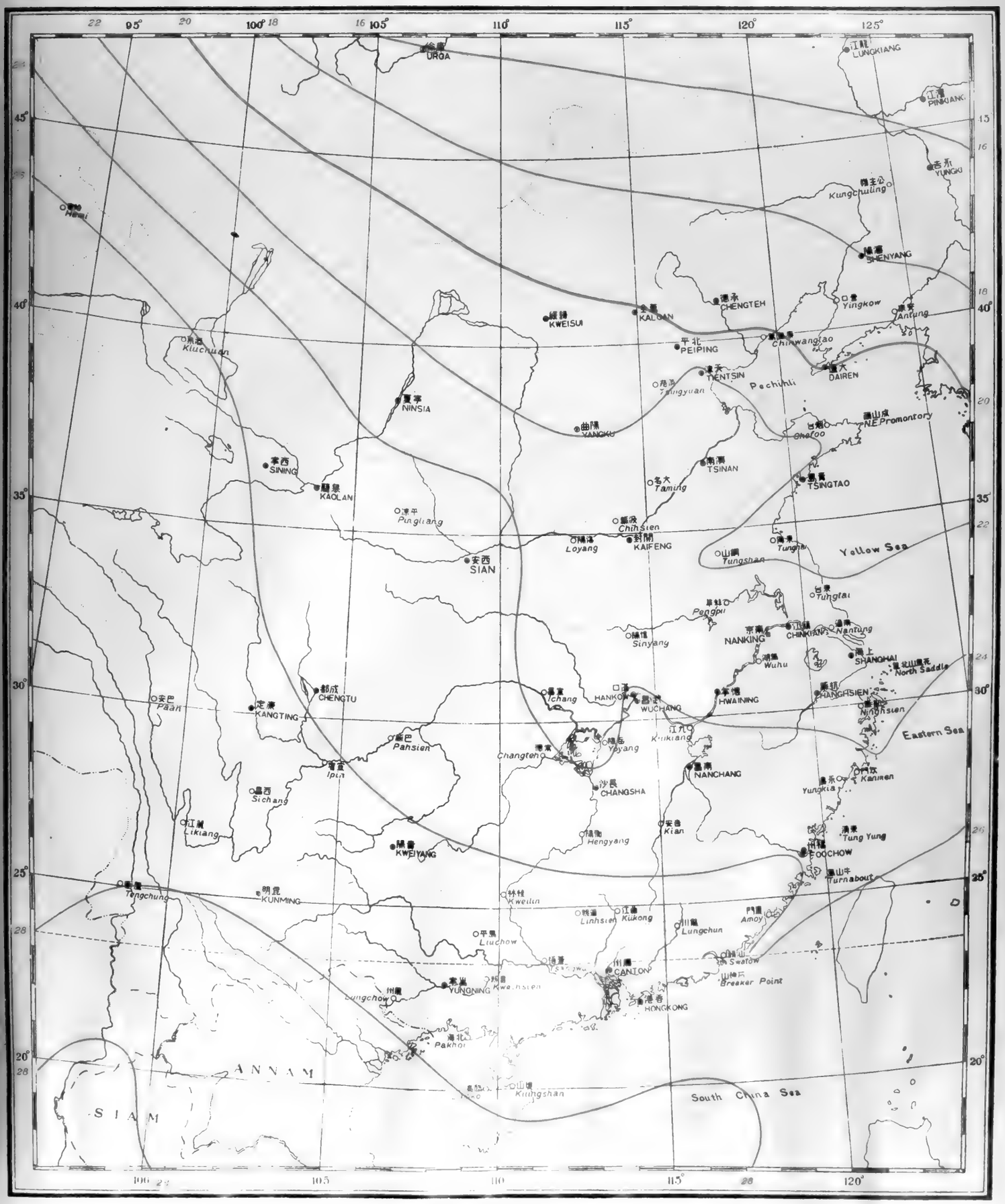
尺例比距經

九月海平面等溫線

SEA-LEVEL ISOTHERMS: SEPTEMBER (°C)

第十一圖

CHART 11



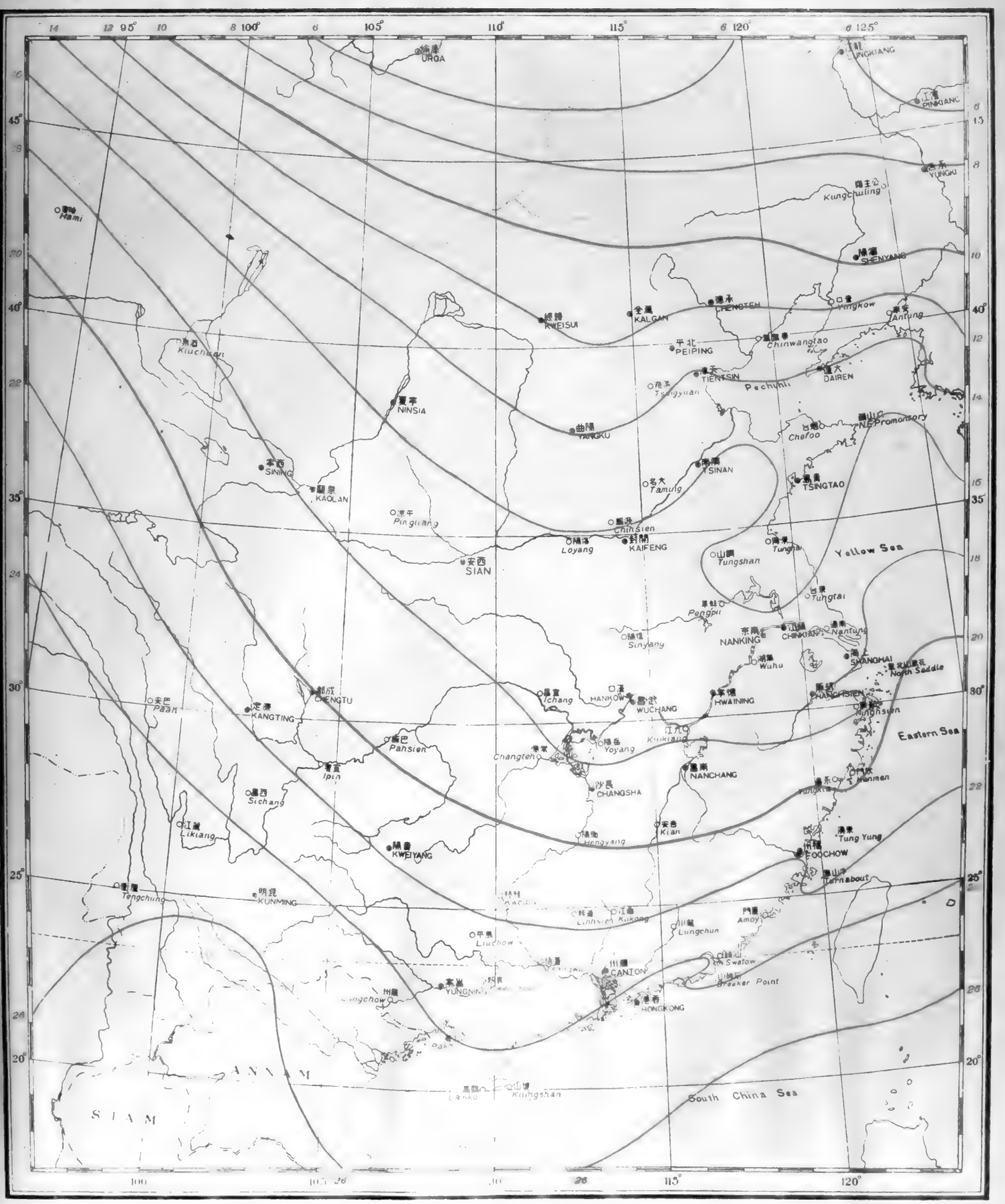
尺例比距緯

尺例比距經

十月海平面等溫線

SEA-LEVEL ISOTHERMS: OCTOBER (°C)

第十二圖 CHART 12



尺例比距經

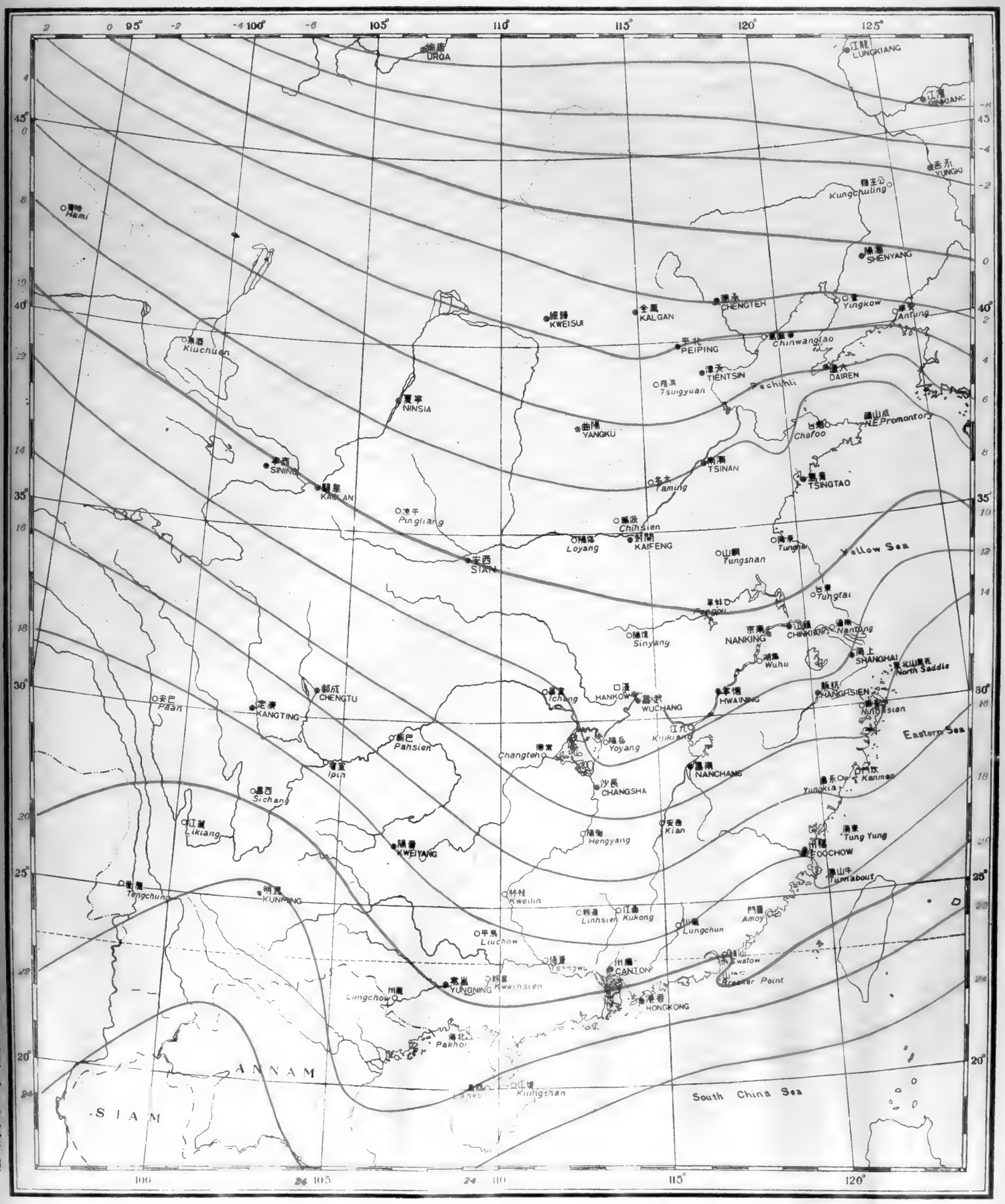
尺例比距緯

十一月海平面等溫線

SEA-LEVEL ISOTHERMS: NOVEMBER (°C)

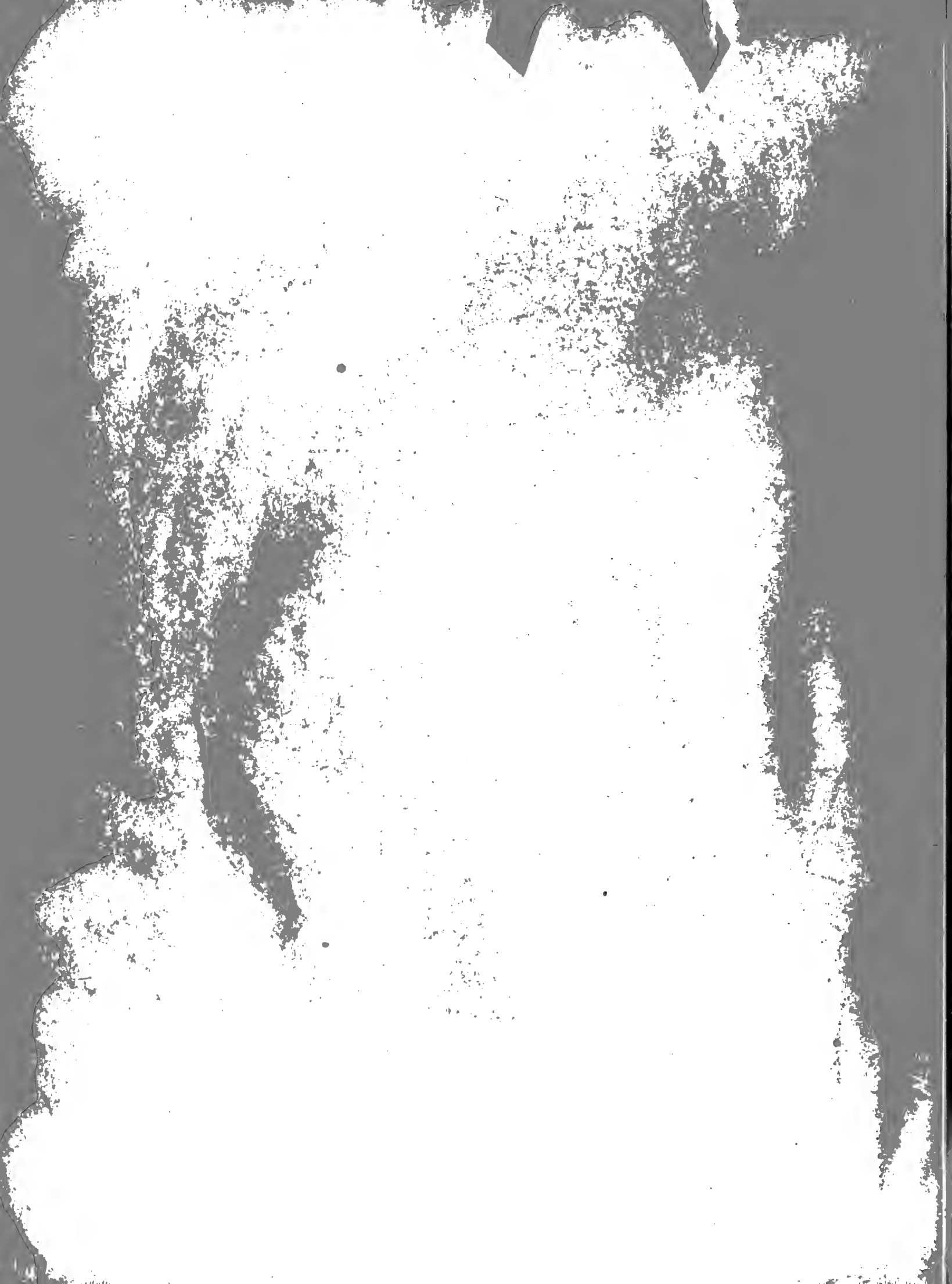
第十三圖

CHART 13



尺例比距緯

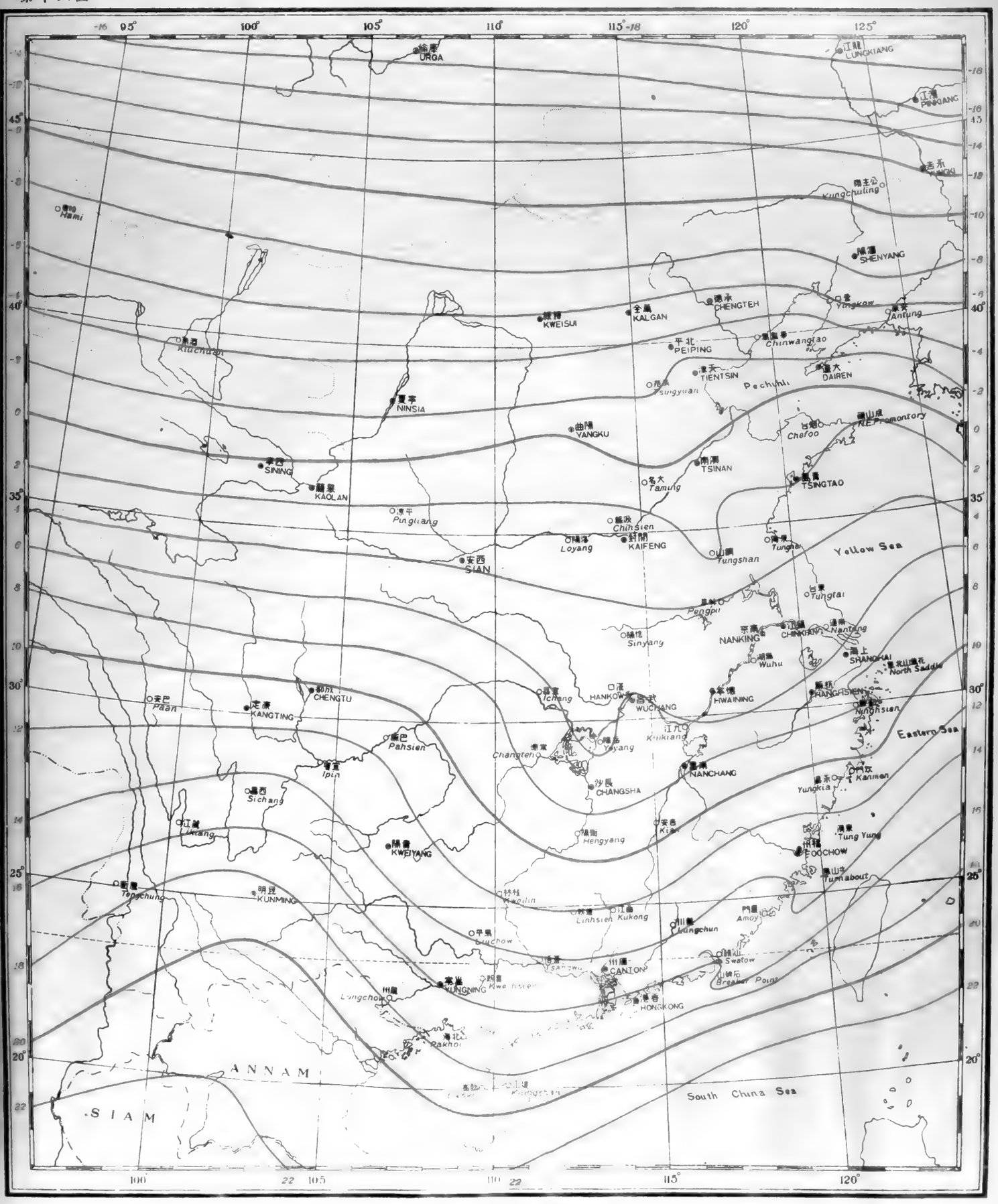
尺例比距經



十二月海平面等溫線

SEA-LEVEL ISOTHERMS: DECEMBER (°C)

第十四圖 CHART 14

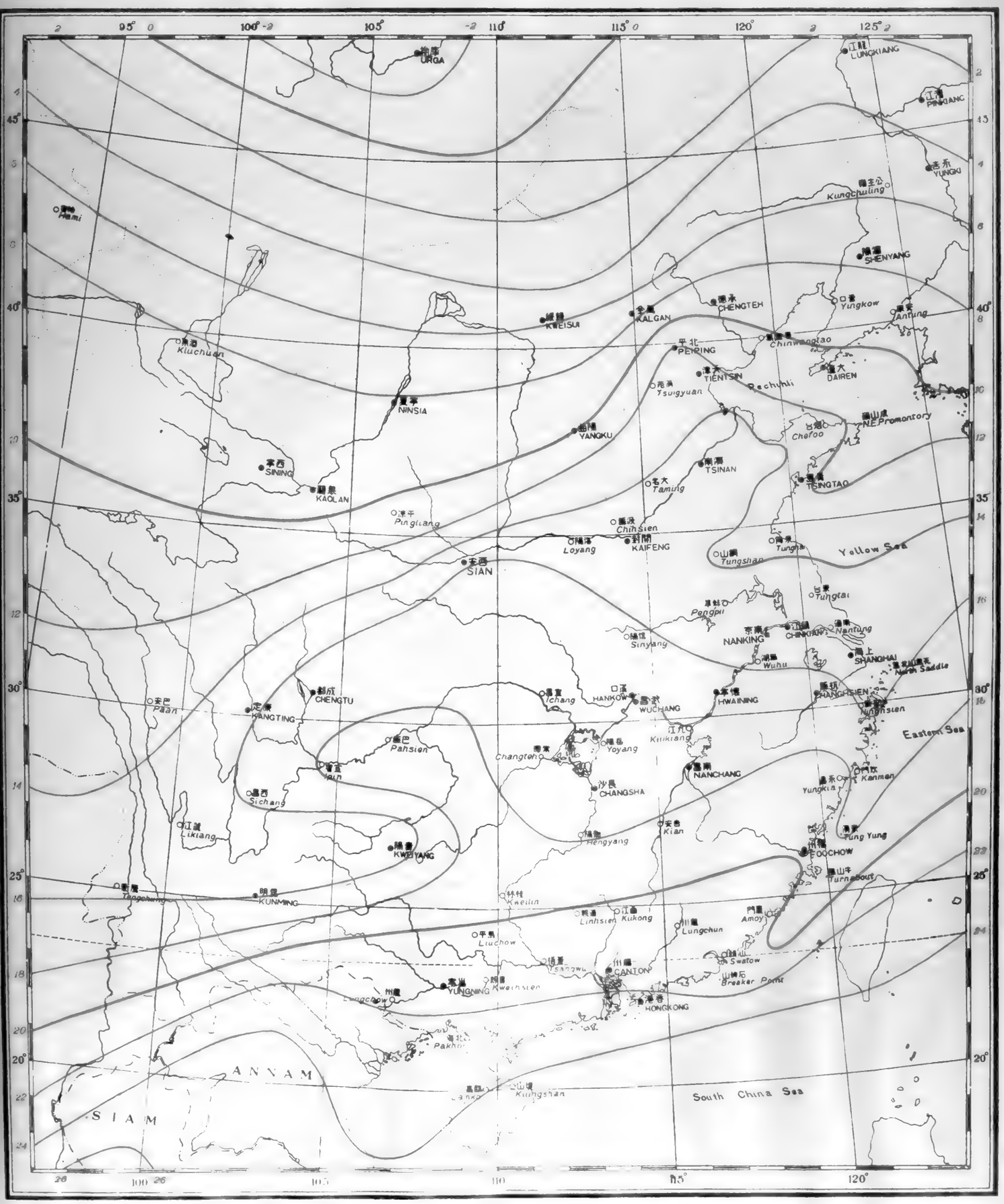


尺例比距緯

全 年 實 際 溫 度

ACTUAL TEMPERATURE: YEAR (°C)

第十五圖 CHART 15



尺 例 比 距 緯

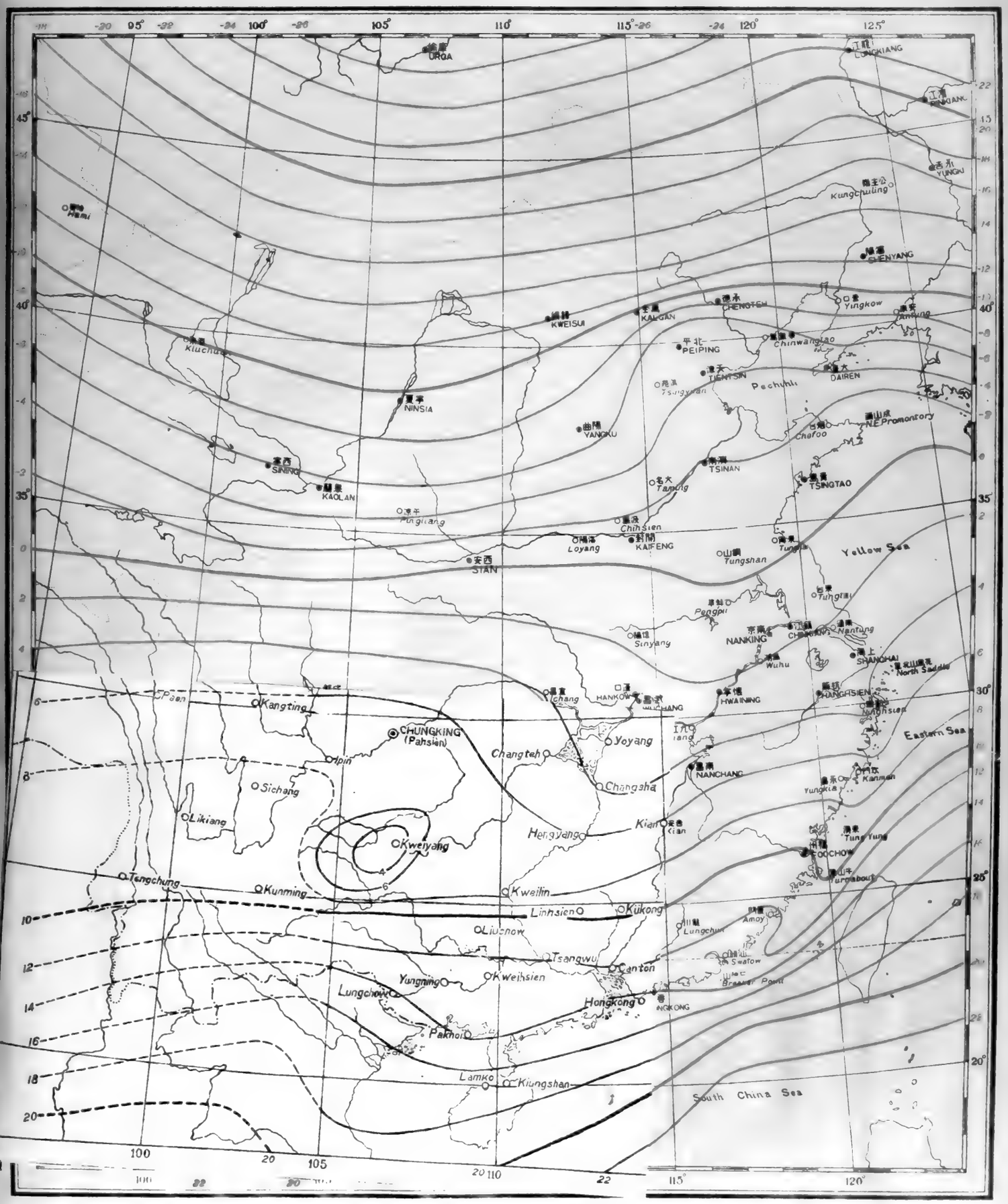
尺 例 比 距 經

一月實際溫度

ACTUAL TEMPERATURE: JANUARY (°C)

第十六圖

CHART 16



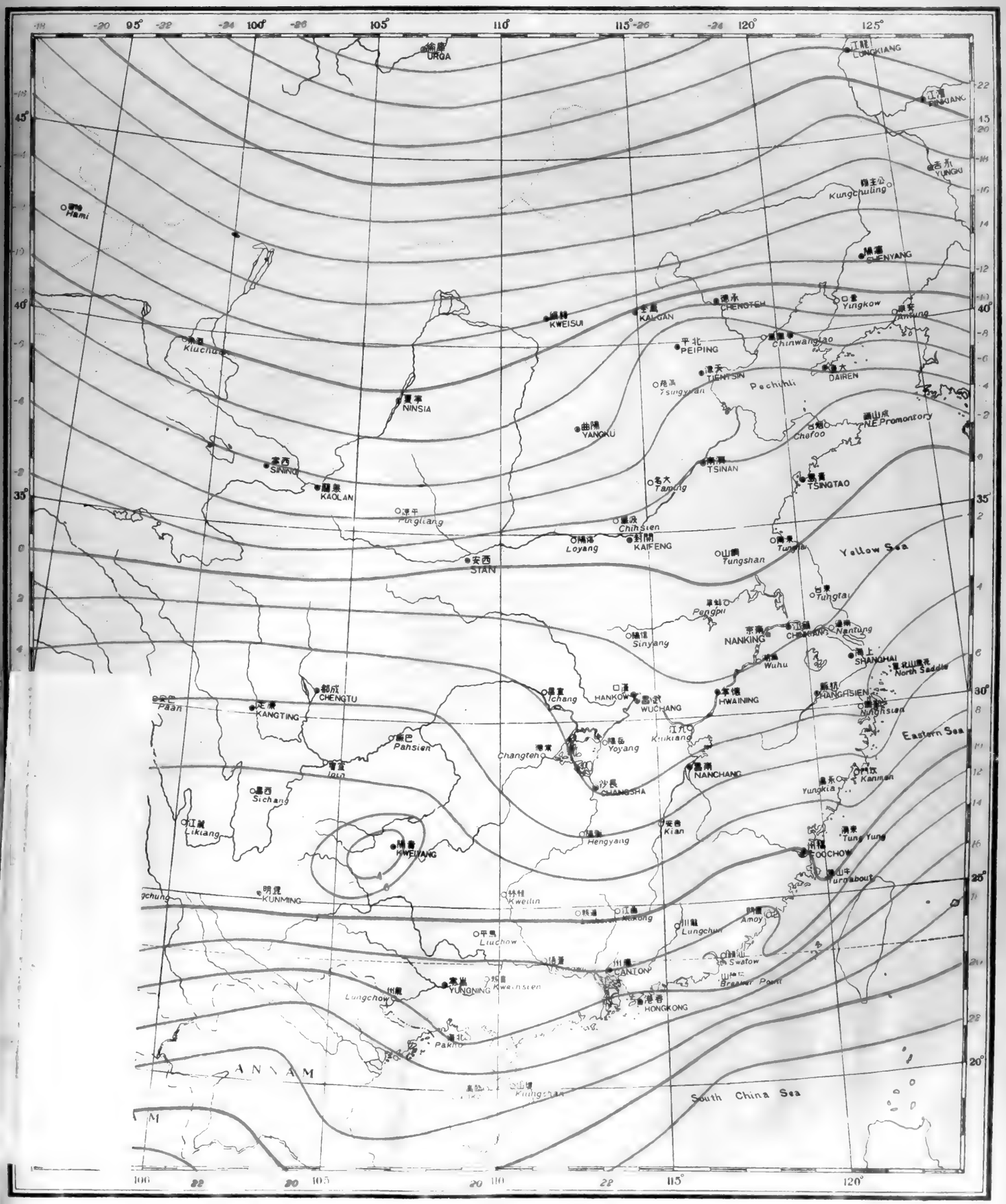
尺例比距緯

尺例比距經

一 月 實 際 溫 度

ACTUAL TEMPERATURE: JANUARY (°C)

第十六圖 CHART 16



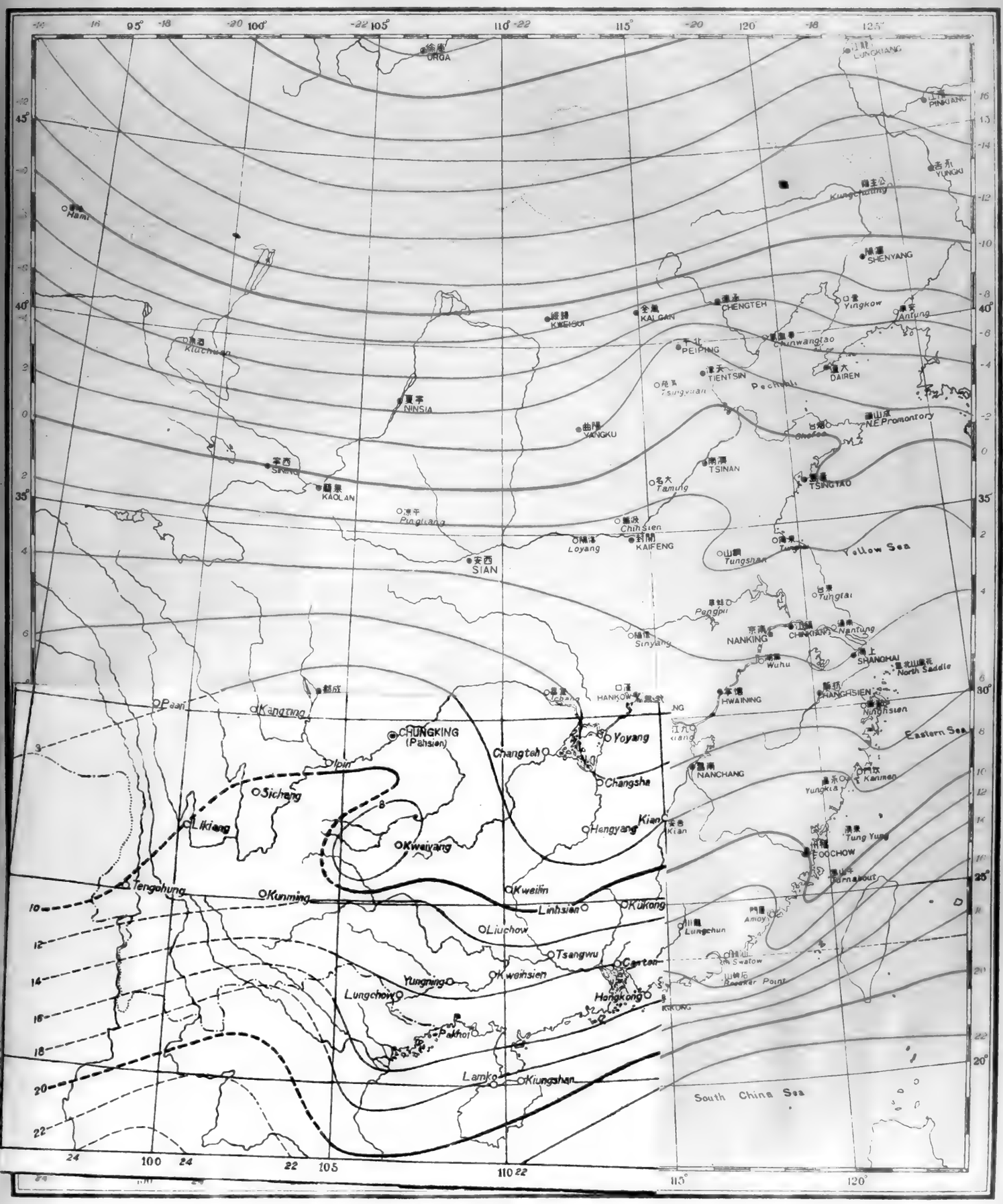
尺 例 比 距 緯

尺 例 比 距 經

二 月 實 際 溫 度

ACTUAL TEMPERATURE: FEBRUARY (°C)

第十七圖 CHART 17

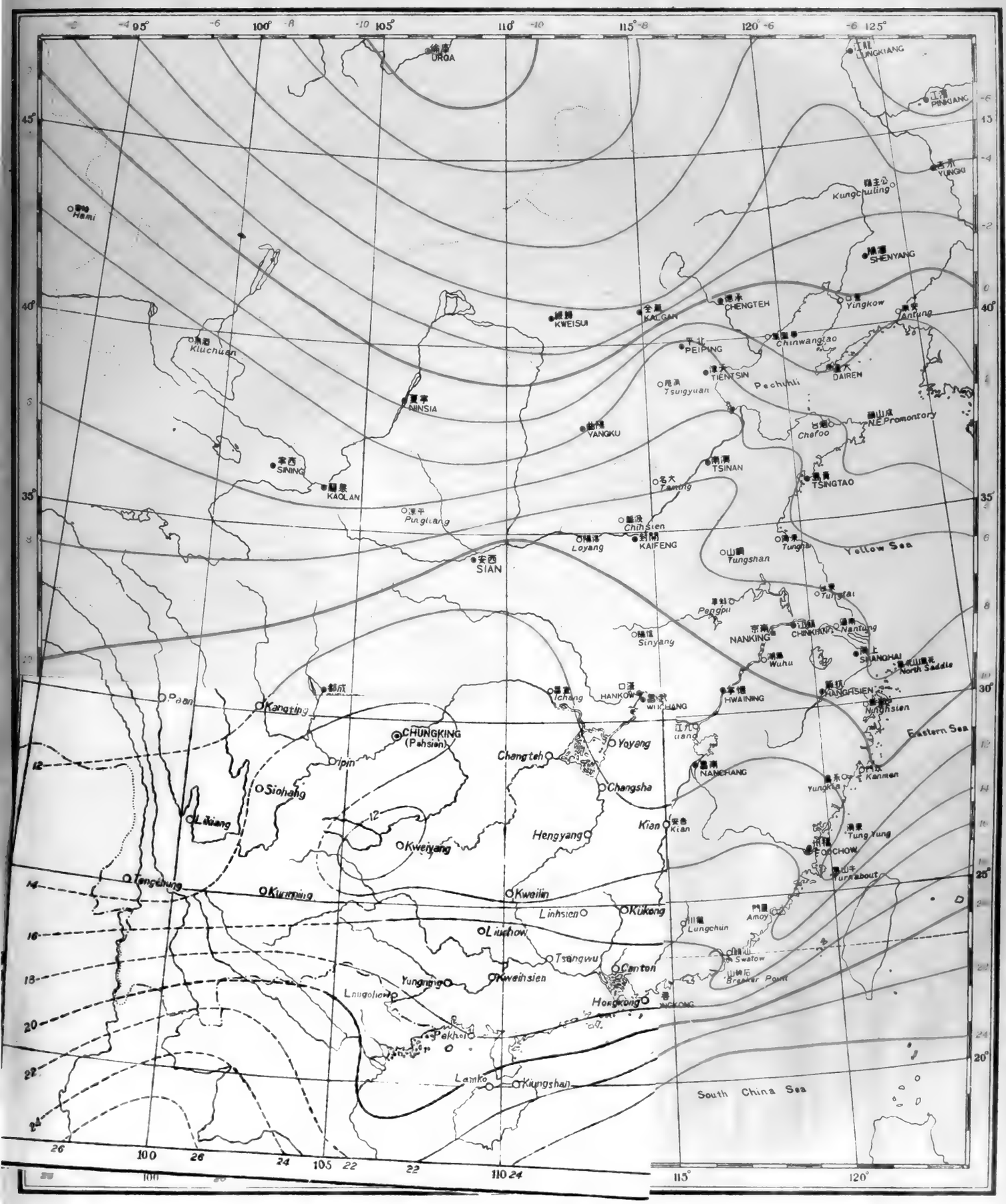


尺 例 比 距 緯

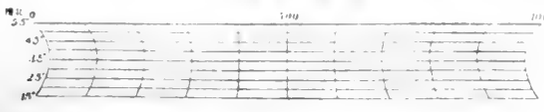
三 月 實 際 溫 度

ACTUAL TEMPERATURE: MARCH (°C)

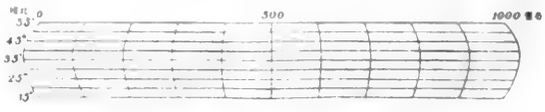
第十八圖 CHART 18



尺 例 比 距 緯



尺 例 比 距 緯

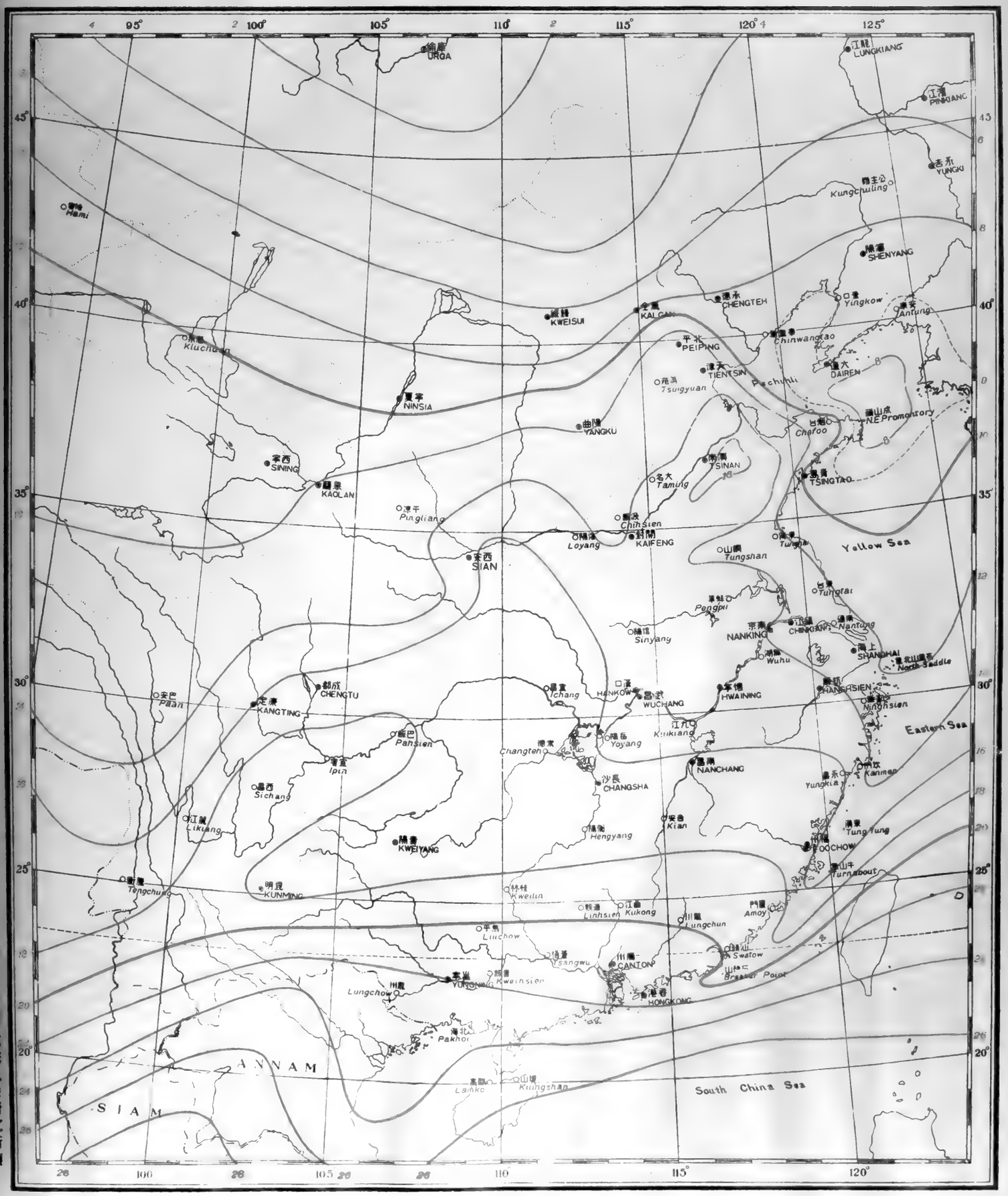


四 月 實 際 溫 度

ACTUAL TEMPERATURE: APRIL (°C)

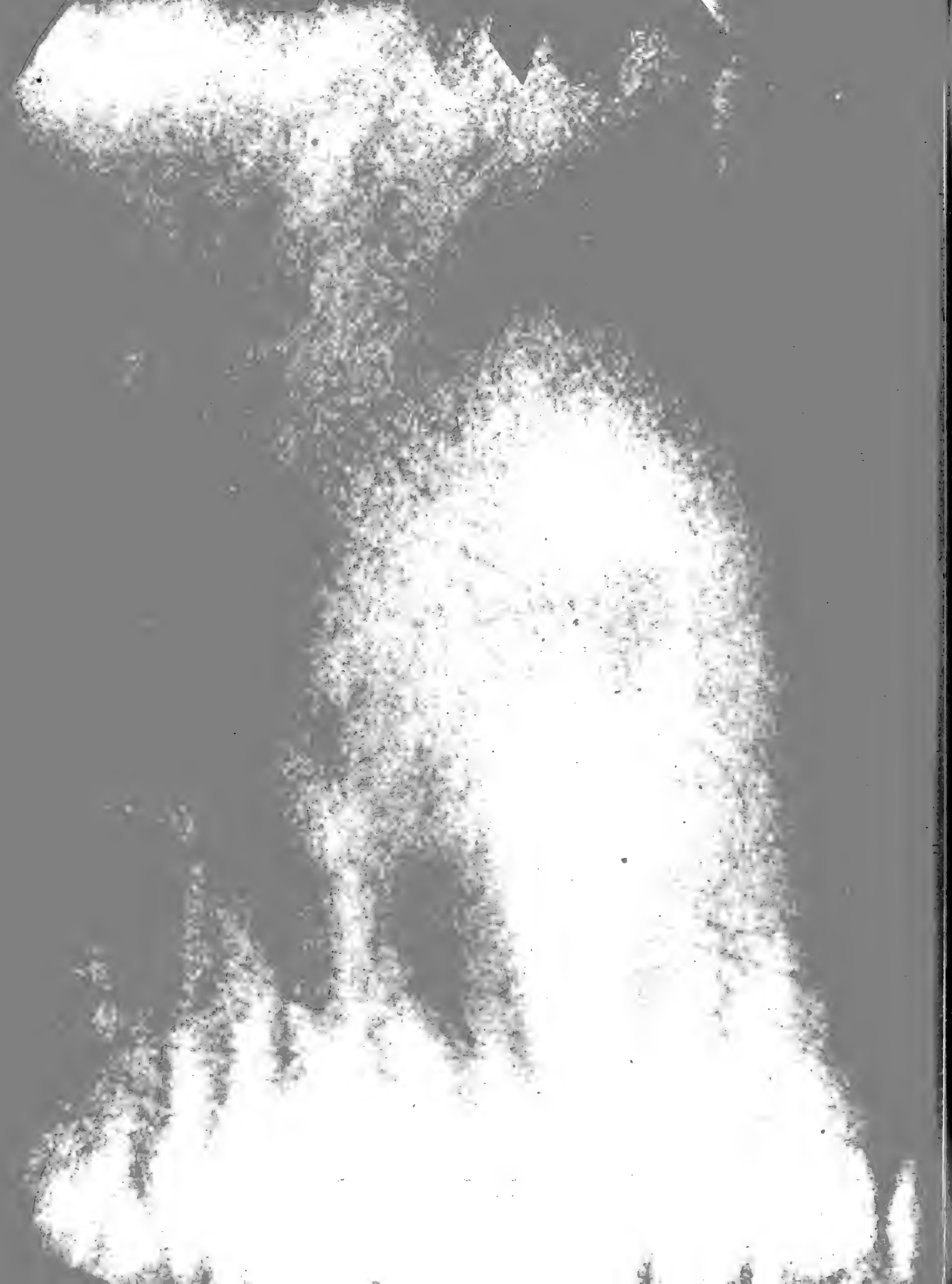
第十九圖

CHART 19



尺 例 比 距 緯

尺 例 比 距 經

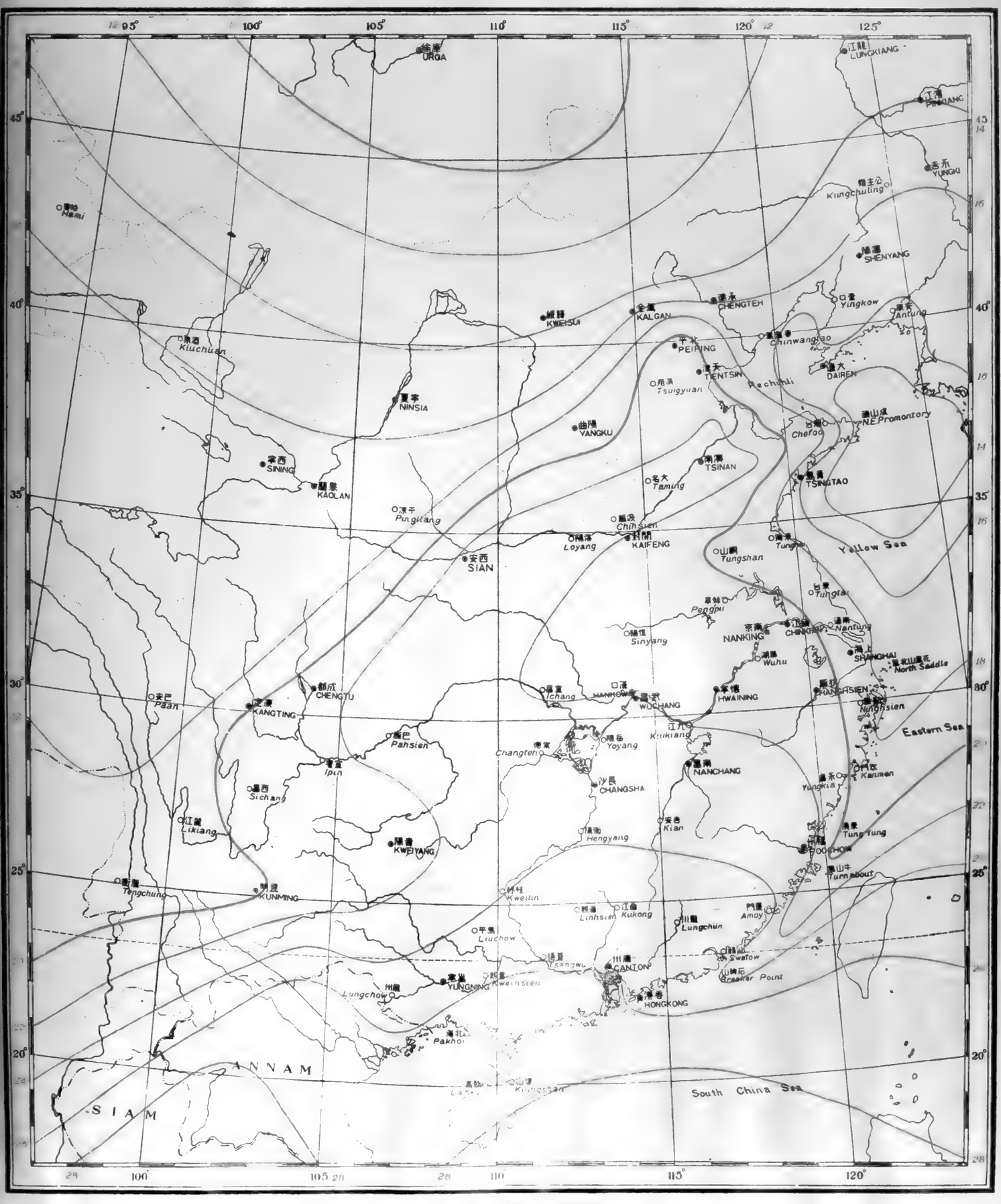


五月實際溫度

ACTUAL TEMPERATURE: MAY (°C)

第二十圖

CHART 20



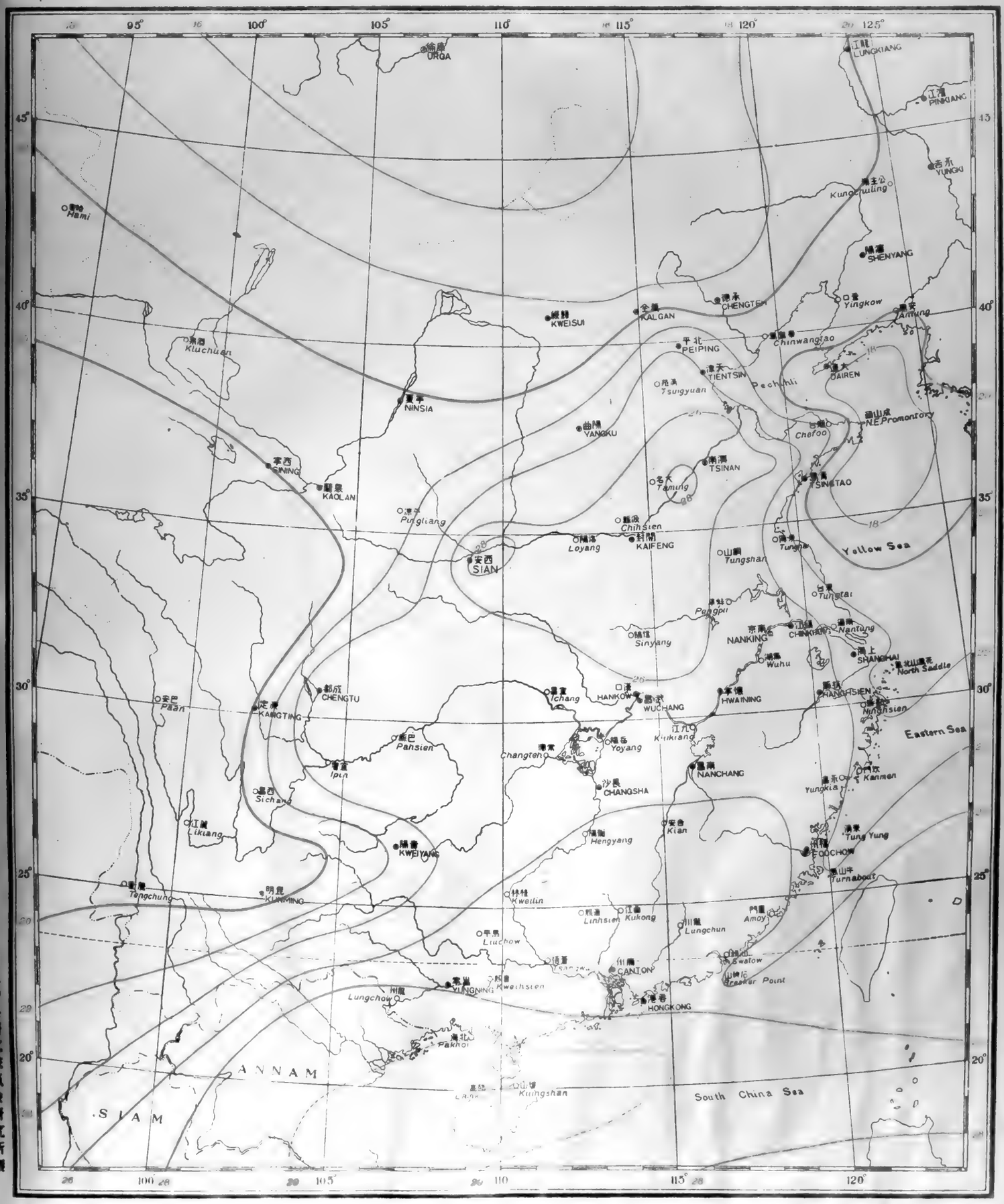
尺例比距緯

尺例比距經

六月實際溫度

ACTUAL TEMPERATURE: JUNE (°C)

第二十一圖 CHART 21



尺例比距緯

尺例比距緯

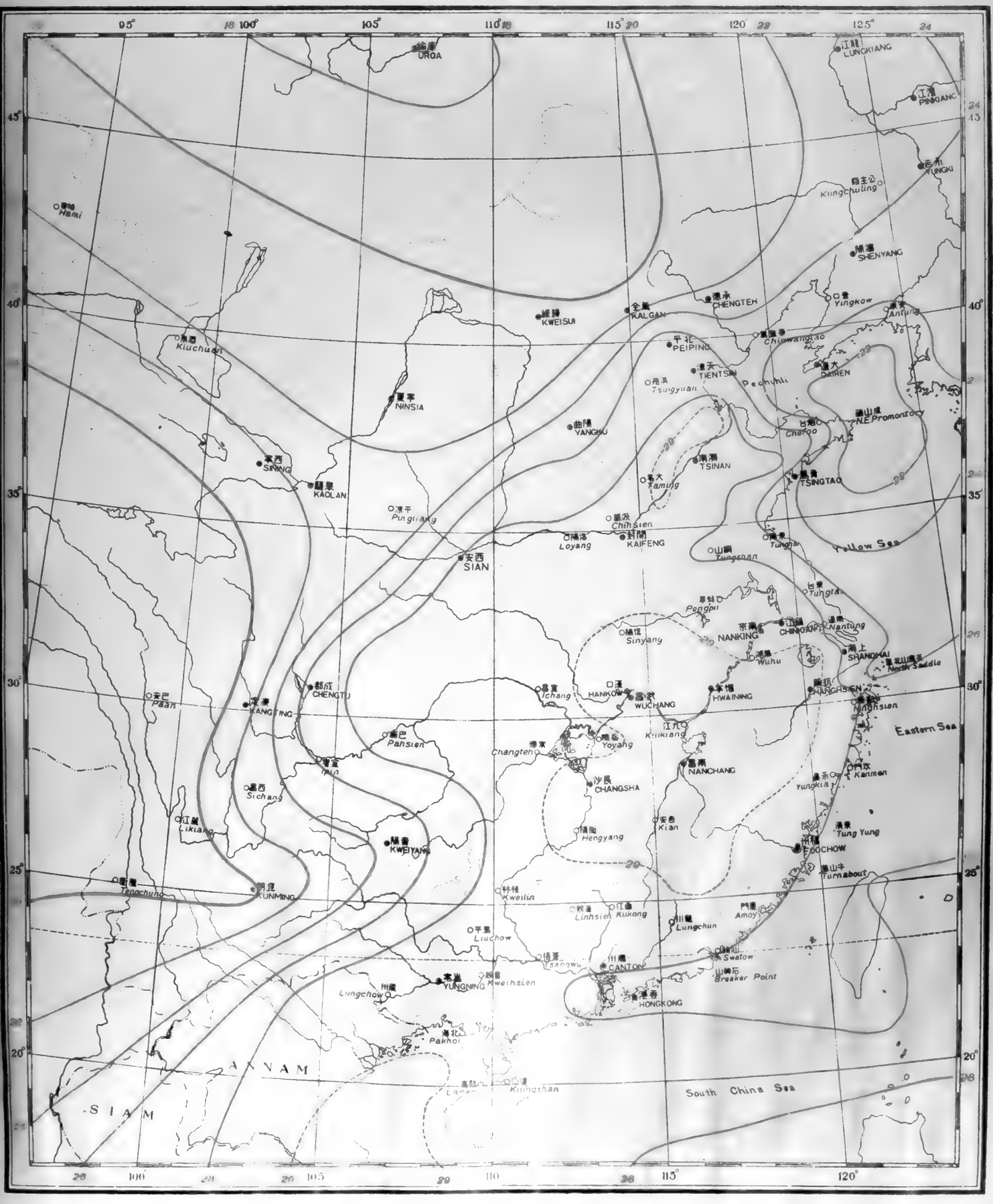
國立中央研究院氣象研究所製

七月實際溫度

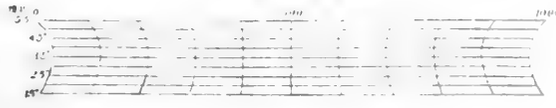
ACTUAL TEMPERATURE: JULY (°C)

第二十二圖

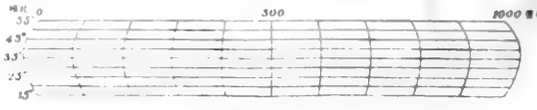
CHART 22



尺 例 比 距 緯



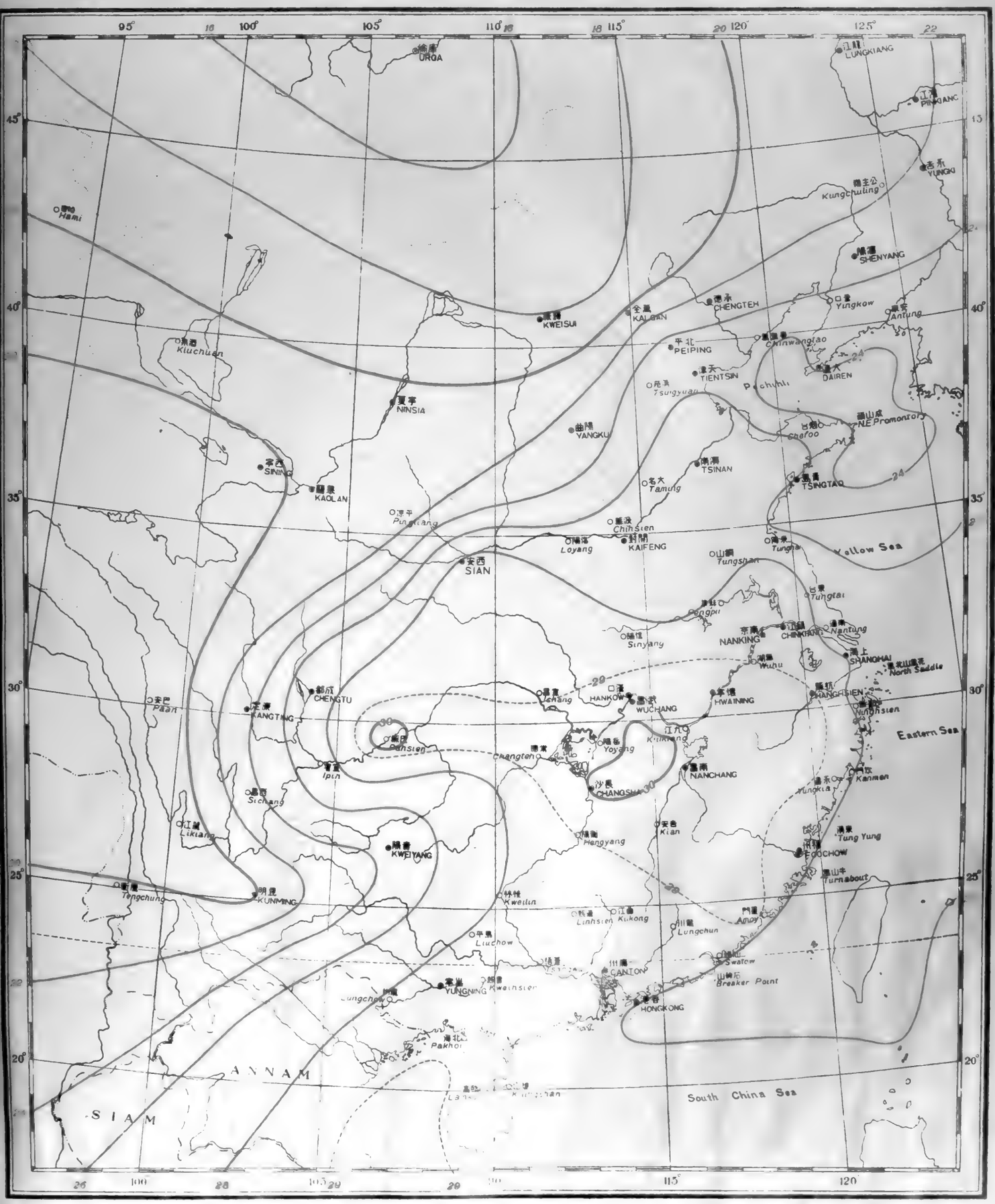
尺 例 比 距 緯



八 月 實 際 溫 度

ACTUAL TEMPERATURE: AUGUST (°C)

第二十三圖 CHART 23



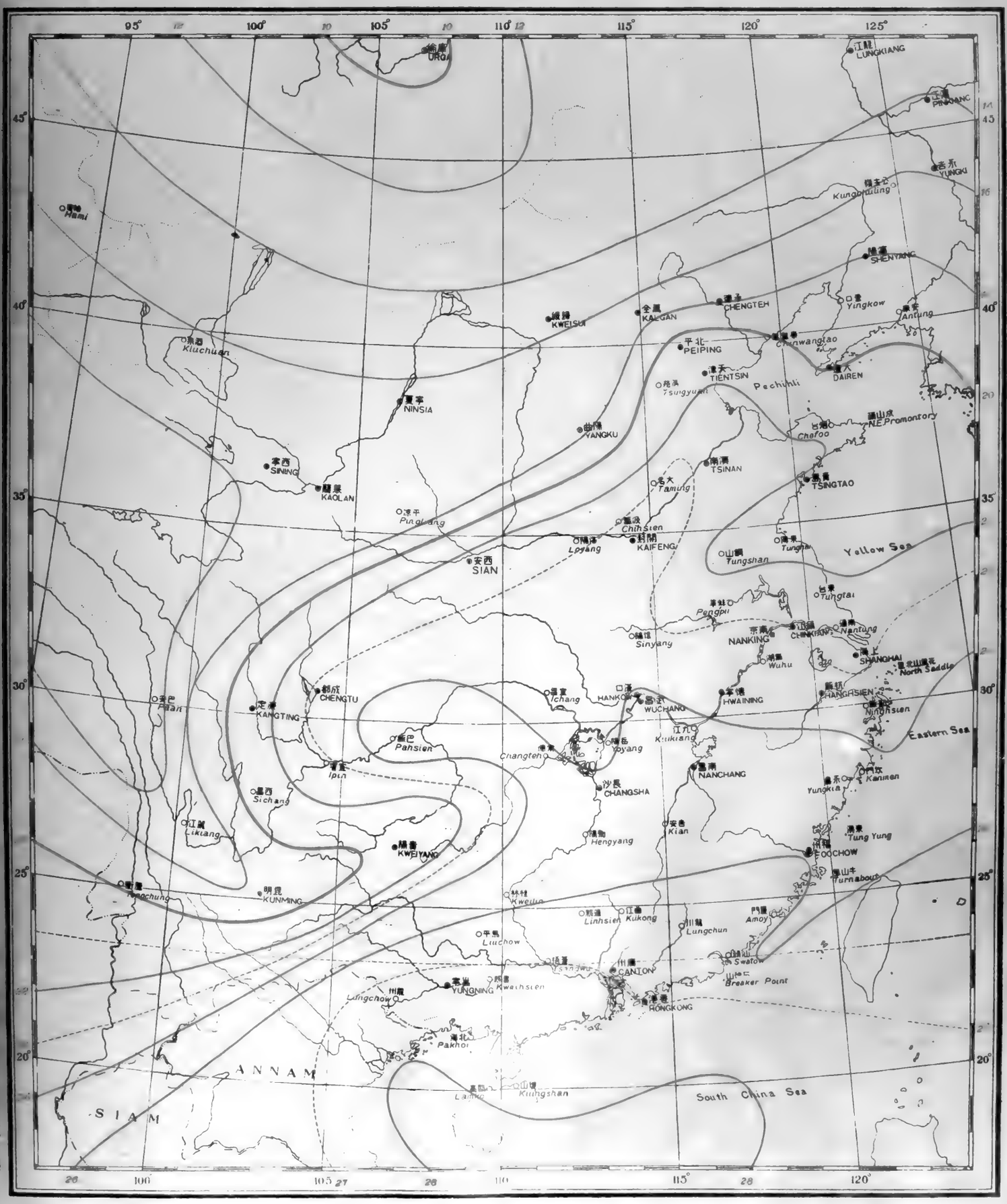
尺 例 比 距 緯

尺 例 比 距 經

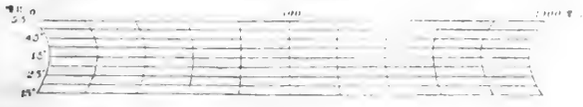
九月實際溫度

ACTUAL TEMPERATURE: SEPTEMBER (°C)

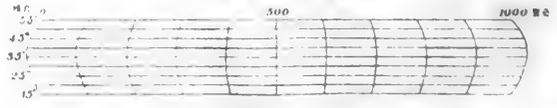
第二十四圖 CHART 24



尺例比距緯



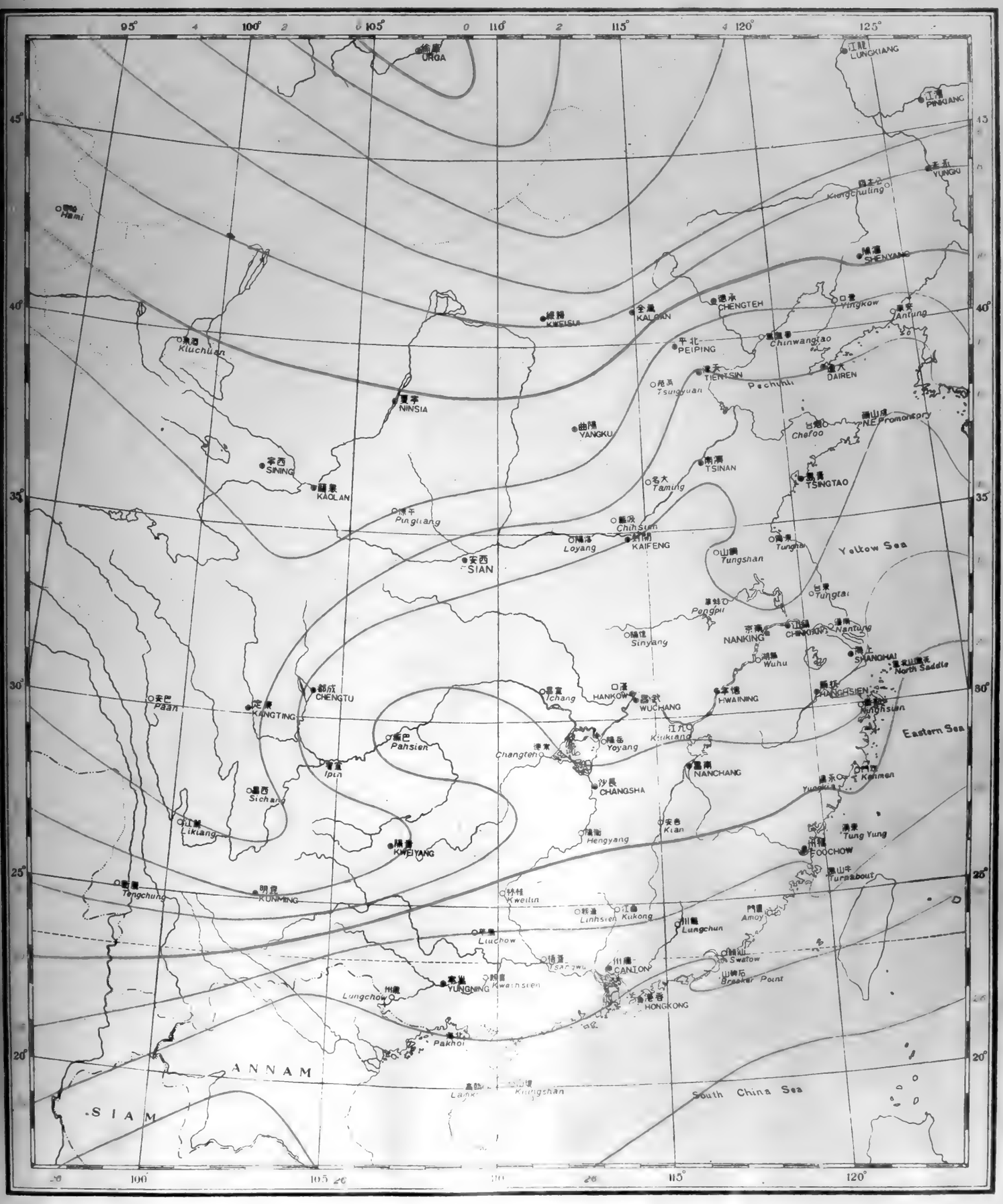
尺例比距經



十 月 實 際 溫 度

ACTUAL TEMPERATURE: OCTOBER (°C)

第二十五圖 CHART 25



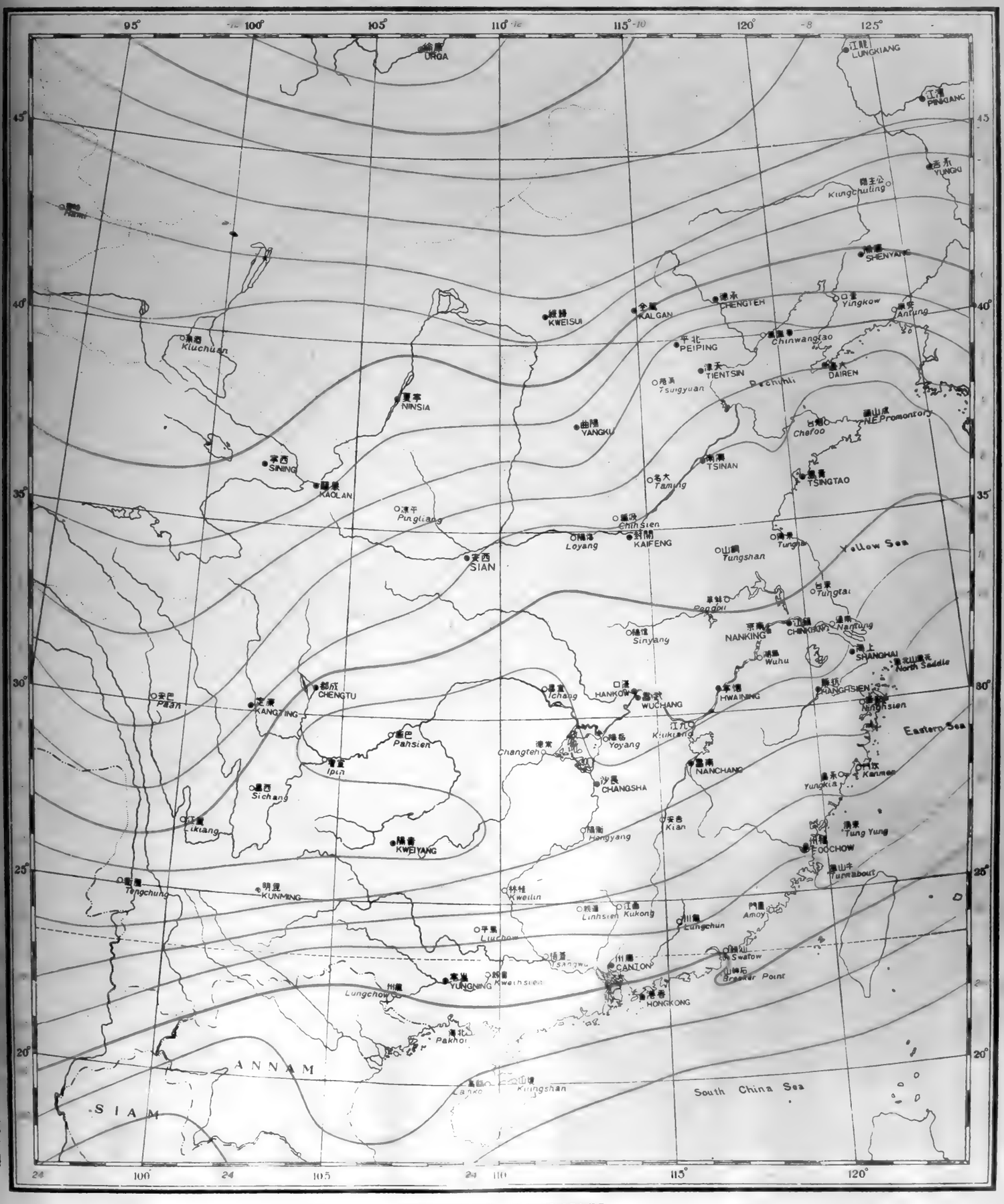
尺 例 比 距 緯

尺 例 比 距 經

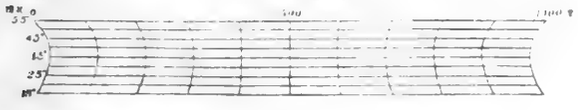
十一月實際溫度

ACTUAL TEMPERATURE: NOVEMBER (°C)

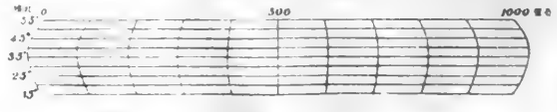
第二十六圖 CHART 26



尺 例 比 距 緯



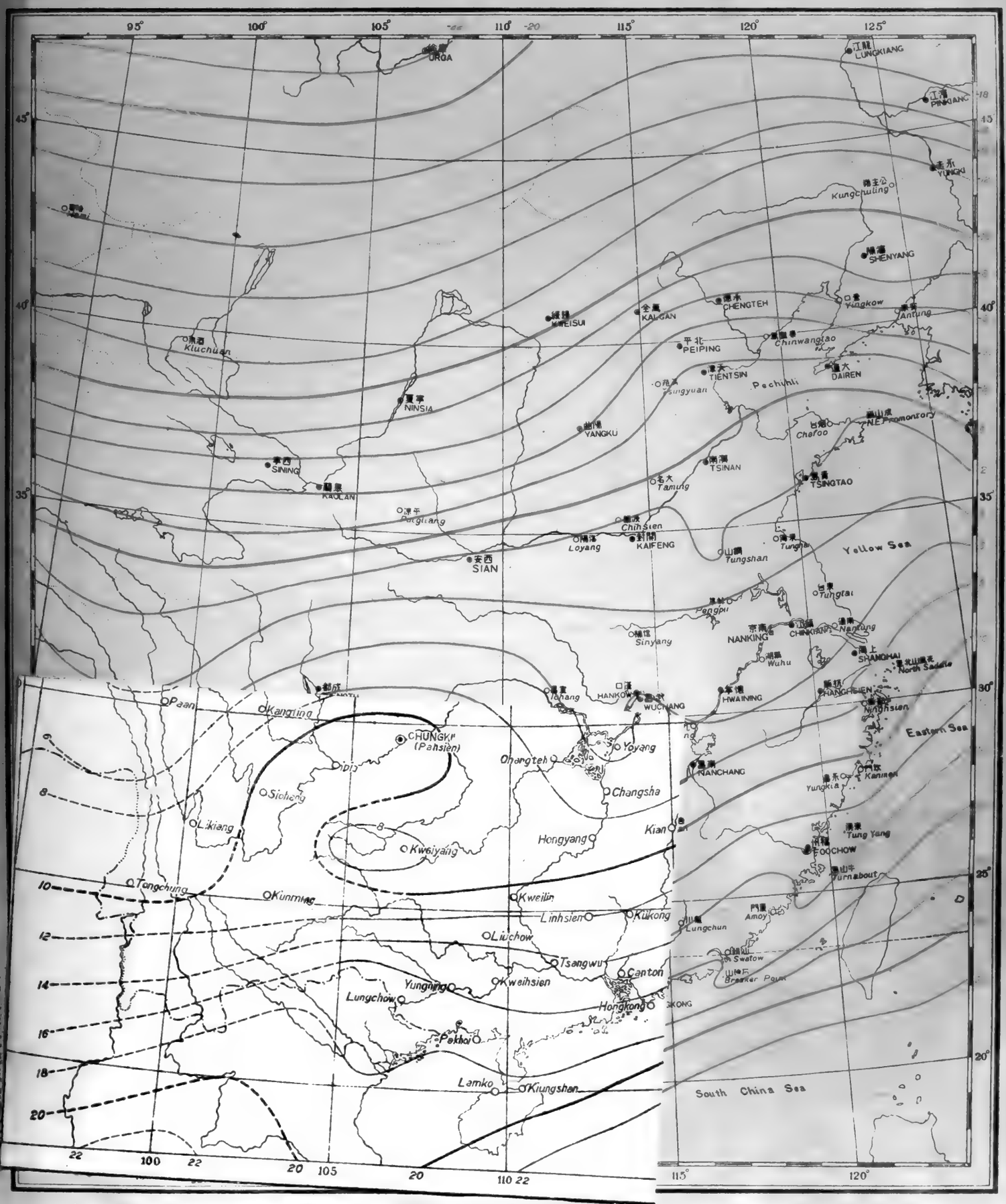
尺 例 比 距 經



十二月實際溫度

ACTUAL TEMPERATURE: DECEMBER (°C)

第二十七圖 CHART 27



尺 例 比 距 緯

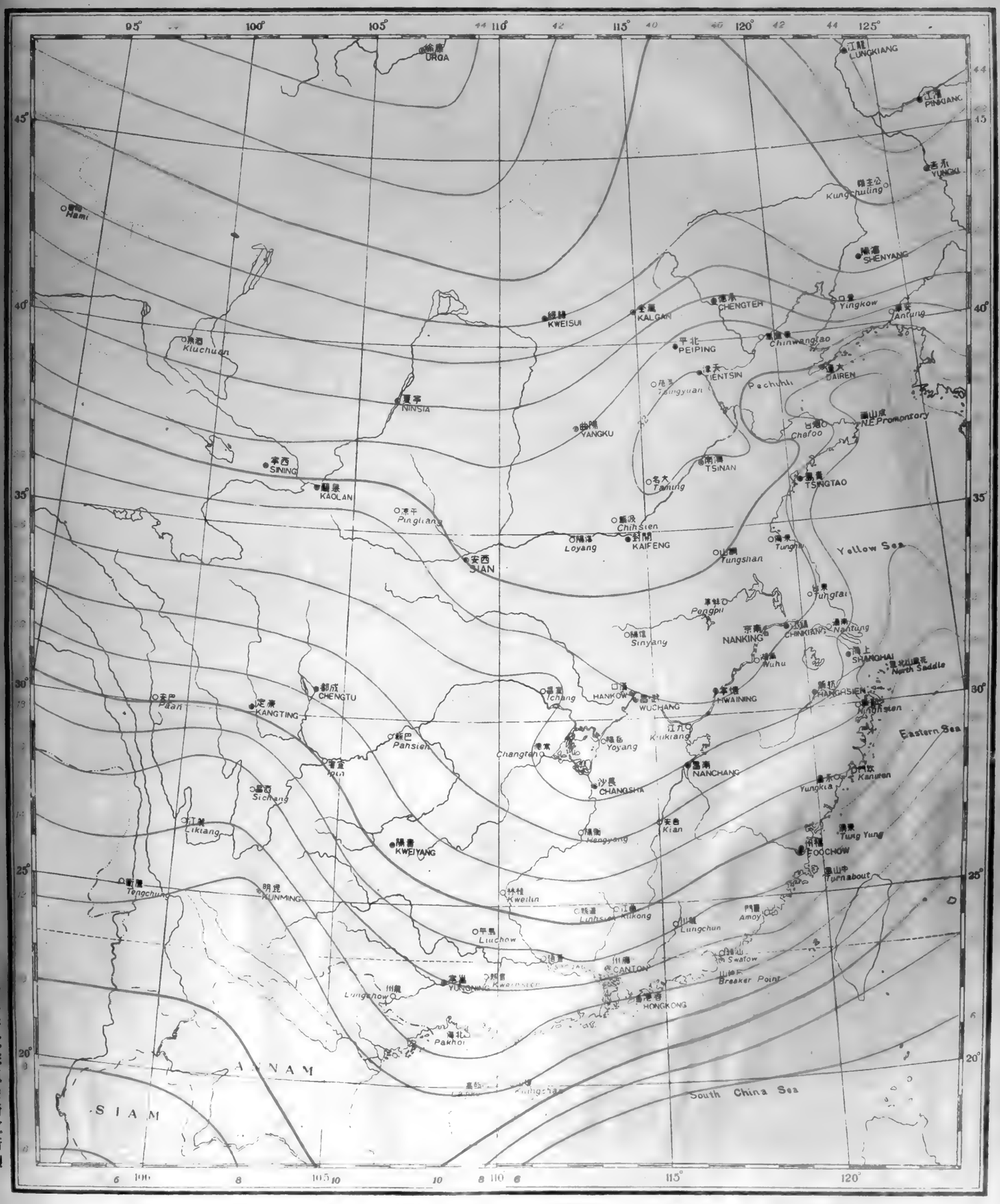
尺 例 比 距 經

平均年較差

MEAN ANNUAL RANGE OF TEMPERATURE (°C)

第二十八圖

CHART 28



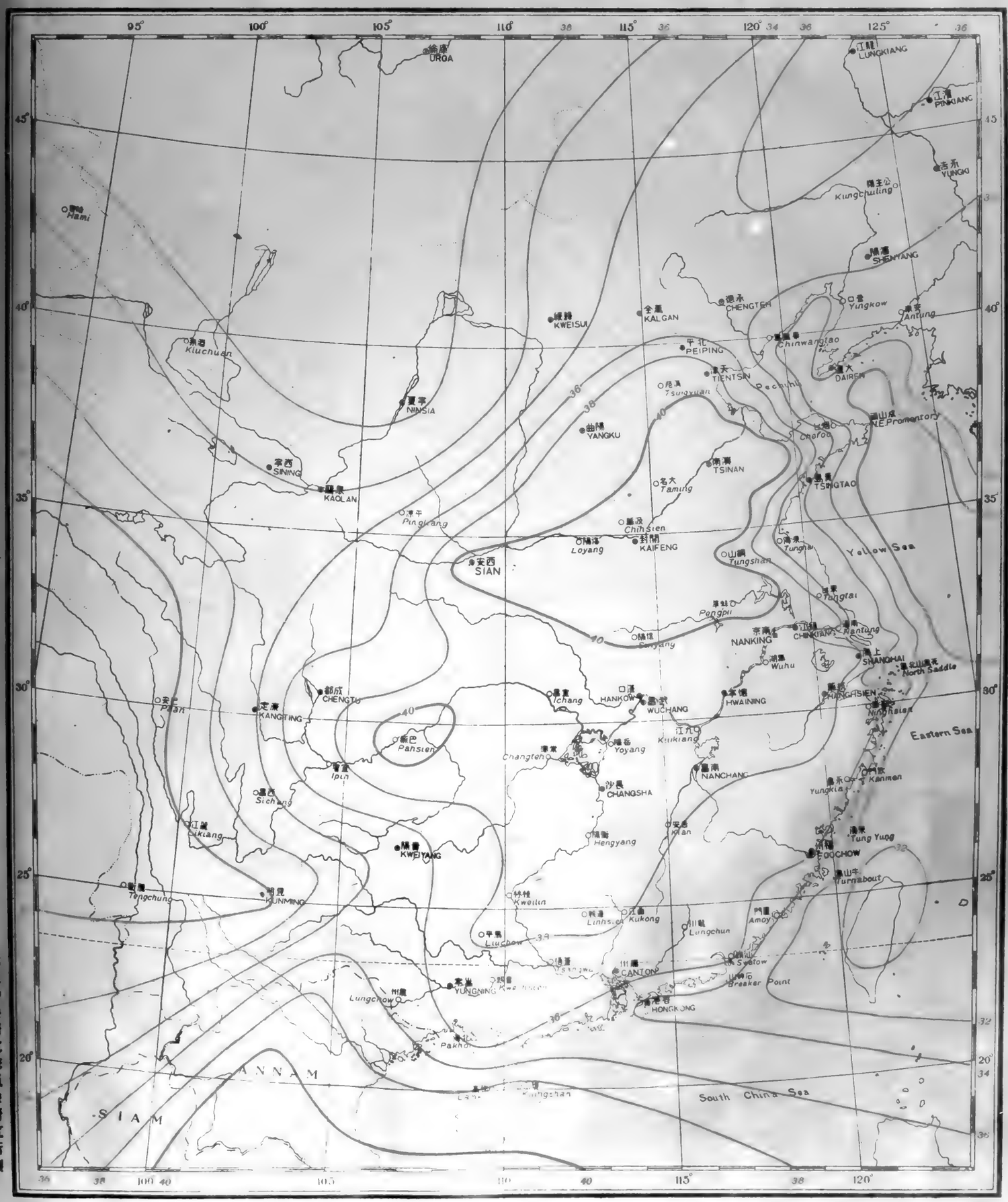
比例尺 緯度

比例尺 經度

平均全年最高溫度

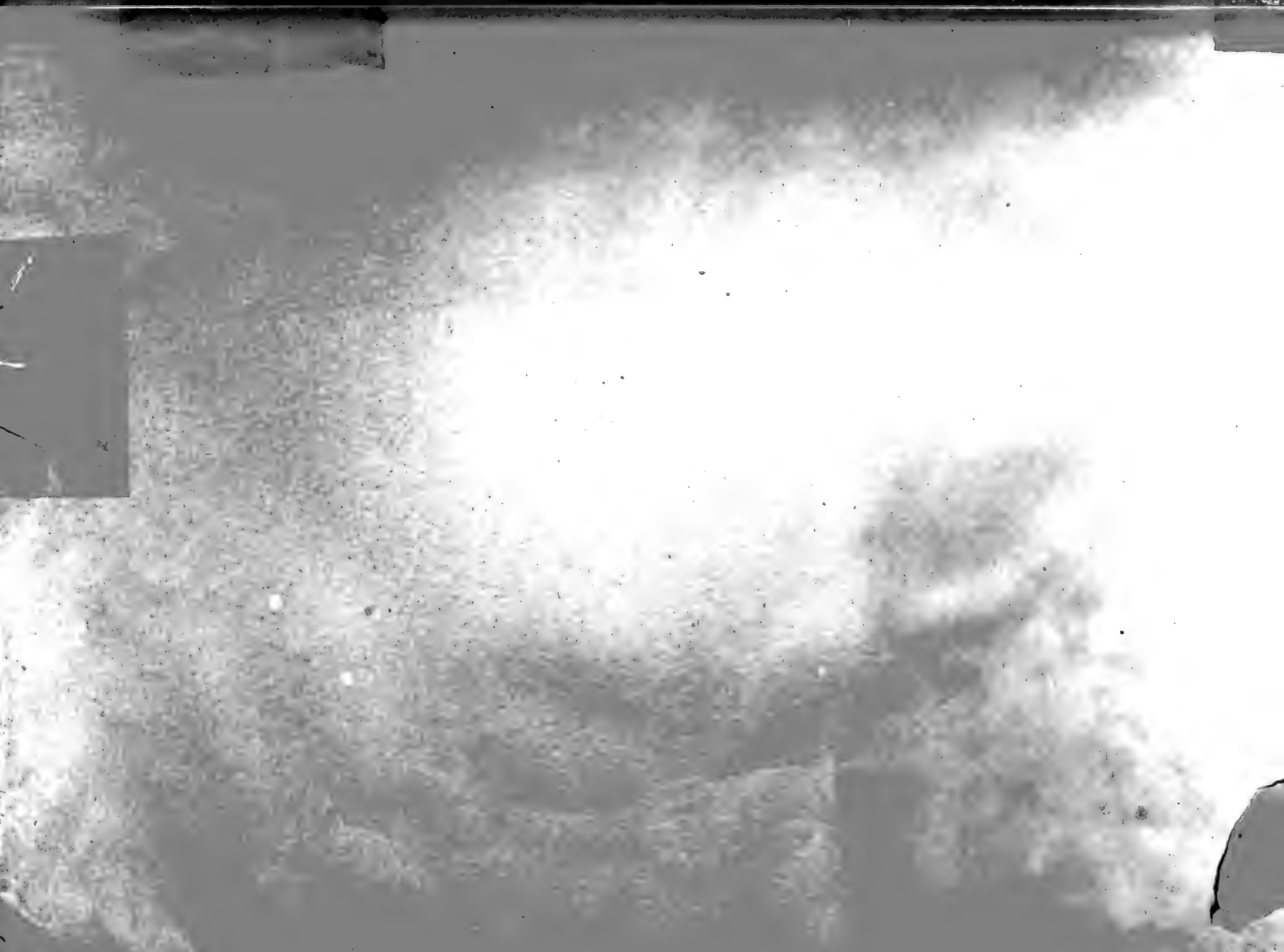
MEAN ANNUAL MAXIMUM TEMPERATURE (°C)

第二十九圖 CHART 29



尺 例 比 距 緯

尺 例 比 距 經

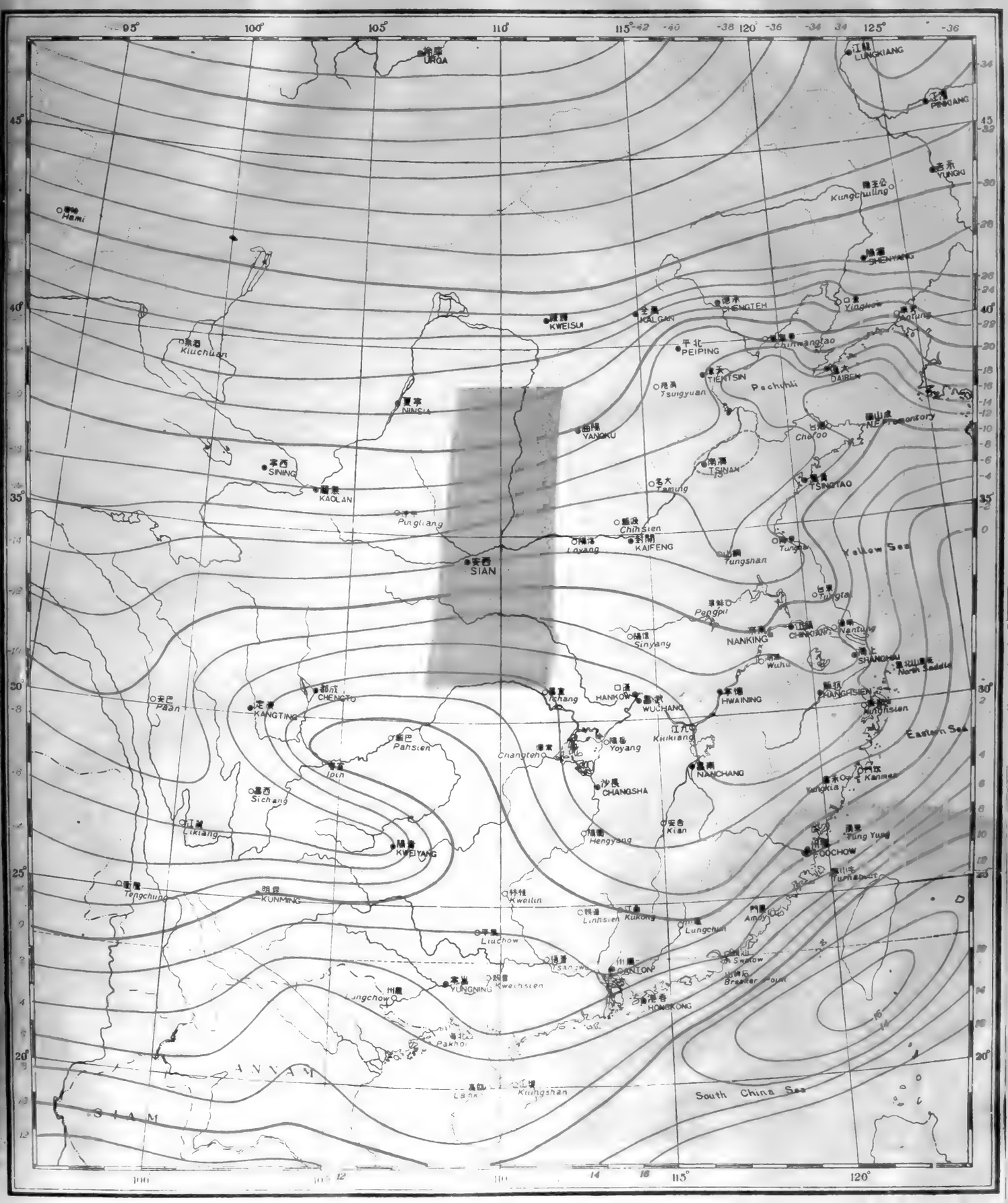


平均全年最低溫度

MEAN ANNUAL MINIMUM TEMPERATURE (°C)

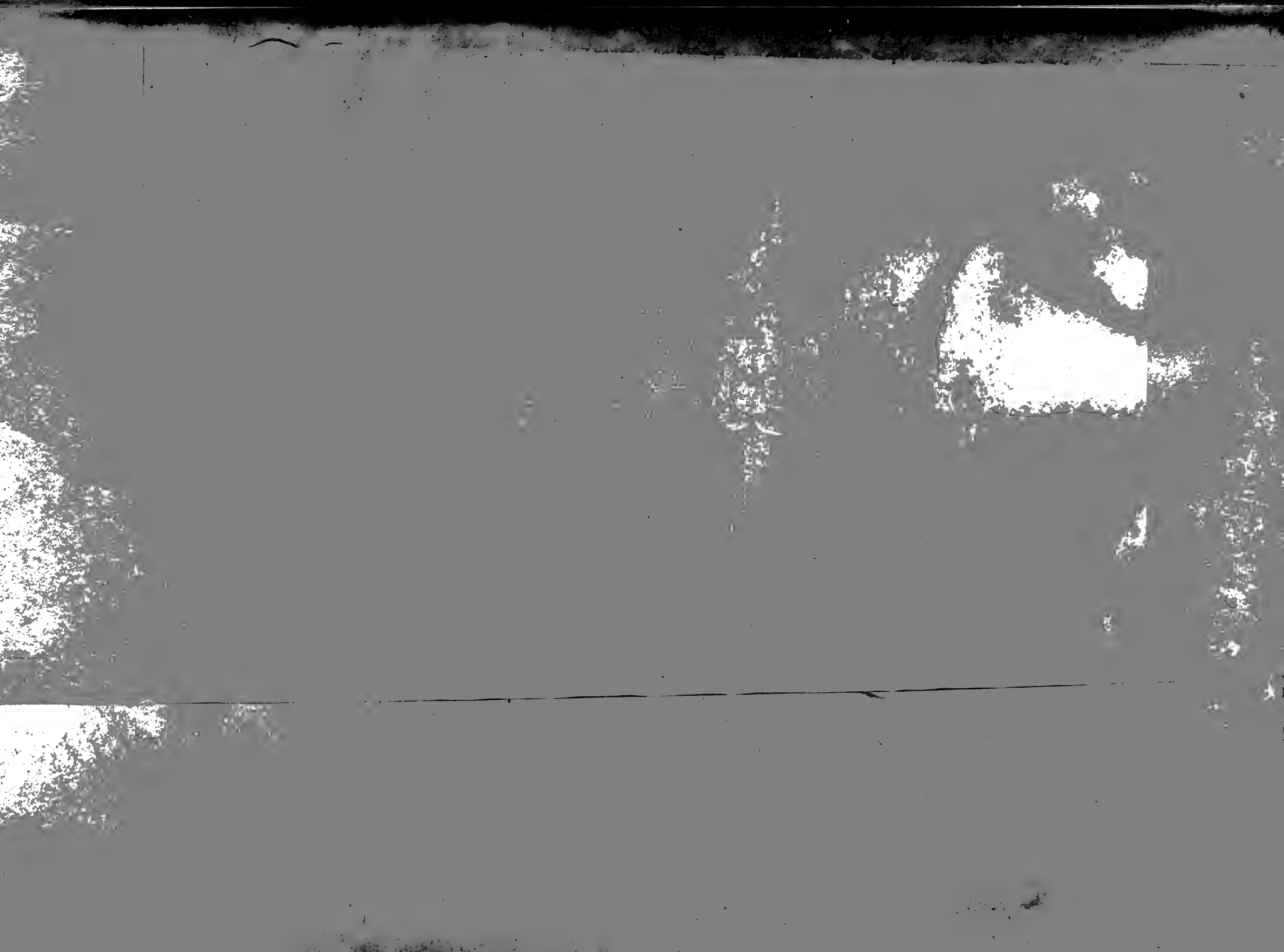
第三十圖

CHART 30



尺 例 比 距 經

尺 例 比 距 緯



中國之溫度

附編

The Temperature of China

APPENDIX

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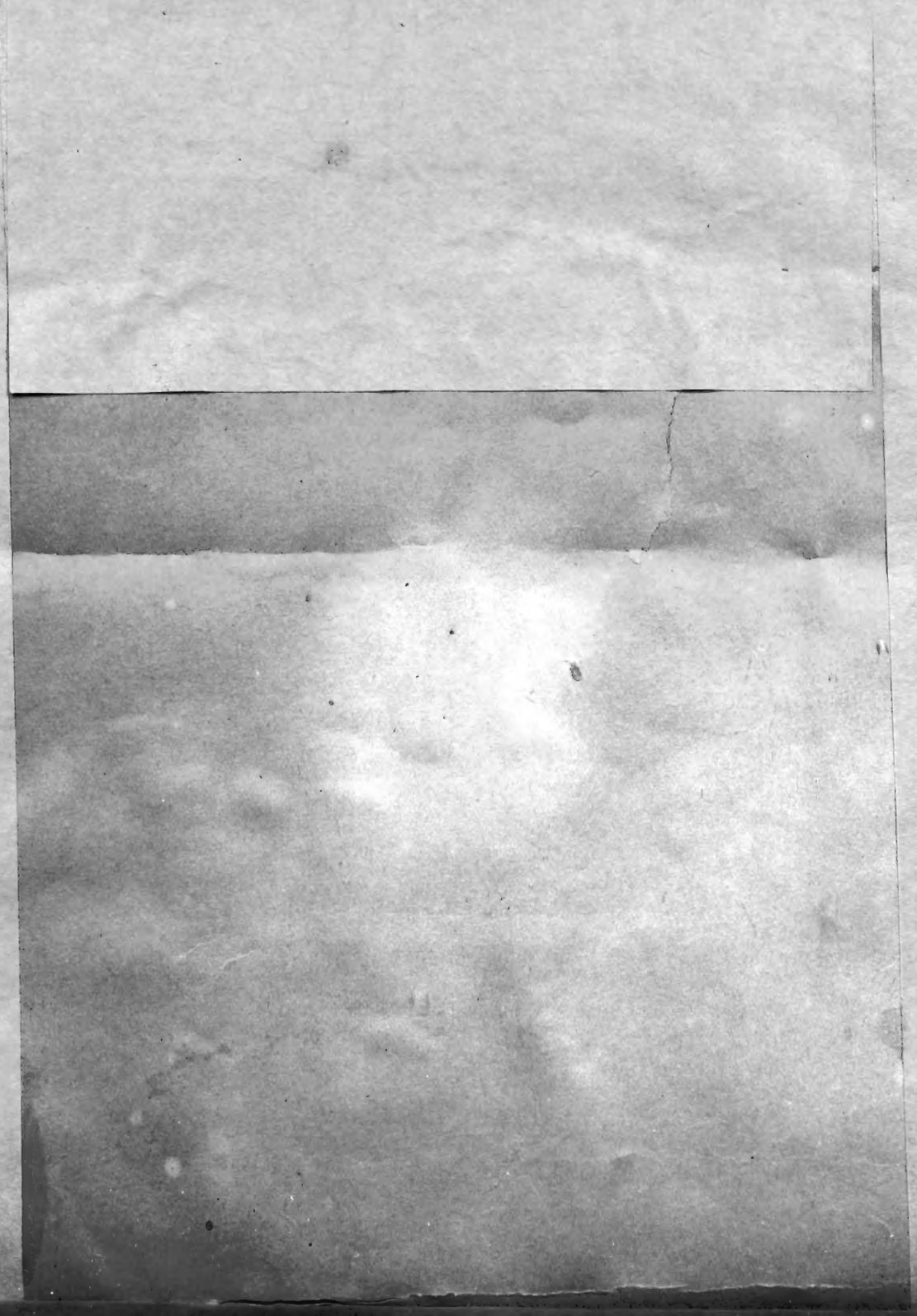

中国之温度（附编）

竺可桢等著