

INTERNATIONAL METEOROLOGY.

International charts, Nos. V and VI, accompany the present REVIEW. The former is published for the month of June, 1879, continuing the series of this chart begun in January, 1877. Chart No. VI. is prepared for the month of September, 1879, continuing the series of this chart begun in November, 1877.

Chart No. V. shows the mean pressure, temperature and the prevailing direction of the wind at 7.35 a. m. Washington, or 0.43 p. m. Greenwich, mean time, for the month of June, 1879, over the Northern and at certain isolated stations in the Southern Hemisphere. The area of 29.80 covers western Asia, the most of Europe north of the 40th parallel, and the Atlantic north of the 45th parallel and west of the 35th meridian. Within this vast area of comparatively low pressure appear two small areas of lower barometric minima, viz: 29.60 covering northwestern Siberia, and 29.70 embracing the western half of the British Isles, together with that portion of the ocean included between the 50th and 60th parallels and east of the 25th meridian. The pressures over central and southern Europe range from 29.85 in Austria to 30.06 in Spain. In Turkey and Asia Minor the barometer is generally below 29.90; in Toorkistan, 29.65 to 29.91; in Hindostan, 29.43 to 29.77; along the Asiatic coast, 29.67 to 29.87. Over North America the regions of lowest pressure embrace the Canadian Maritime Provinces, barometer generally below 29.90, and that portion of territory between the meridians of 93° and 103° W., extending from Texas northward to the British Possessions, pressure ranging from 29.79 at Pembina to 29.99 at Galveston. The lowest mean pressures of the month are reported from the following stations: Lahore, 29.43 (747.5); Roorkee, 29.45 (748.0); Lucknow, 29.46 (748.4); Ekaterinburg, 29.55 (750.6); Barnaul, 29.60 (751.7); Kasan, 29.61 (752.1); Galway, 29.62 (752.3); Armagh, 29.66 (753.3); Monach Lighthouse, 29.67 (753.5); Stykkisholm, 29.78 (756.4); Fort St. Michaels, 29.84 (757.8). The area of highest pressure, 30.20, covers the Atlantic between the meridians of 23° and 52° W. and the parallels of 23° and 35° N. The area of 30.10 reaches eastward into Algeria, westward to the 77th meridian, northward to the 40th parallel and southward to 17° S. Over North America the isobar of 30.10 embraces a small area in central Mexico and in the Northern Pacific coast region. The following are the highest readings from isolated stations: Funchal, 30.19 (766.7); Melbourne and Ponta Delgado, 30.15 (765.7); Mauritius, 30.14 (765.5); Cape Town, Angra and Mogador, 30.12 (765.0). The extreme monthly range of mean pressure is 0.84 inch, which is 0.15 inch above that for June, 1877, but 0.09 inch below that for June, 1878. The maximum and minimum mean temperatures, given in Fahrenheit's scale, are reported from the following stations: highest, Fao, 100°; Biskra, 99°; Lagouat, 98°; Lahore, 97°; Deesa and Agra, 96°; Bridgetown, 83°; Free Town, 85°; Murcia, 89°; lowest, Godthaab, 41°; Hobart Town, 43°; Tromso, 46°; Stykkisholm, Farther Point, Virginia City and Sitka, 48°; Nikolaievsk on the Amoor, Moose Factory and Olympia, 49°; North Unst, 50°. The prevailing direction of the winds was, over the United States, *southwesterly* in the Atlantic Coast states; *southeasterly* in the Gulf states, Upper Mississippi and Lower Missouri valleys; *northerly* over the Lake region and Canada; *westerly* on the Pacific coast; elsewhere *variable*. Over the Atlantic ocean, south of the 30th parallel, *northeast* to *southeast*; north of that parallel, *southwest* to *northwest* and *northeast*. Over northern Europe *southwest* to *northwest*; over southern Europe *southwesterly*. In Algeria, *variable*. Along the Asiatic coast, *southerly*. Compared with the mean of the past two years, June, 1877 and 1878, the temperature and pressure over the United States, in general, bears a very close resemblance in every district. Over the Lake region the temperature is from 2° to 5° above the mean. In Canada and the Maritime Provinces there is a decline of from 2° to 7°. The pressure over the Lake region, Tennessee and the Ohio valley is from 0.03 to 0.10 inch higher; elsewhere slight deviations from the mean or the existence of a normal condition. Over the Atlantic comparison can only be made with 1878. Upon examination it is found that the positions of the areas of highest pressure nearly coincide, that is, if the area of 30.20 alone is considered; but in June, 1878, a very small area of 30.30 occupied the ocean in the vicinity of 26° N. 47° W., the maximum pressure being but 0.03 inch above the highest reading for June, 1879. Between the parallels of 50° and 60° N. and the meridians of 10° and 40° W. the pressure is from 0.10 to 0.15 inch lower. Along the parallel of 40° N. the conditions of pressure remain about the same. The temperature is considerably lower south of parallel 35° N. and north of parallel 50° N., while between these boundaries the difference is in favor of a rise of from 1° to 5°. Over the British Isles the pressure is from 0.14 to 0.25 inch below the average, and the temperature shows a decrease of from 2° to 6°. In central and western Europe (excluding Spain)

the pressure is from 0.02 to 0.15 inch below the average, while the temperature ranges from normal to -4° . Over Scandinavia the pressure is from 0.07 to 0.15 inch below the average, and the temperature from $+1^{\circ}$ to -4° . In Algeria the pressure ranges from -0.08 inch to $+0.02$ inch, and the temperature from $+2^{\circ}$ to $+4^{\circ}$. Over Spain and Portugal the pressure ranges from normal to -0.06 inch, and the temperature from normal to -3° . Over Russia, south of the 60th parallel, the pressure ranges from -0.06 to -0.22 inch, and the temperature from -7° to $+3^{\circ}$. In Hindostan the pressure ranges from $+0.02$ to $+0.07$ inch, and the temperature from -3° to -8° . The following deviations from the average in temperature and barometer, are reported from isolated stations: Nikolaievsk, $-3^{\circ}.5$; Vladivostock, normal and $+0.02$ inch; Pekin, $+2^{\circ}.5$ and -0.03 inch; Zi, Ka-Wei, normal and $+0.02$ inch; Yokohama, $+1^{\circ}$ and normal; Nagasaki, -5° and -0.07 inch; Yeniseisk, normal and normal; Barnaul, normal and -0.16 inch; Tashkend, $+4^{\circ}.5$ and -0.23 inch; Biskra, $+1^{\circ}$ and -0.08 inch; Fao, compared with 1877 only, $+16^{\circ}$ and $+0.10$ inch; Free Town, $+1^{\circ}$ and -0.01 inch; Mauritius, normal and -0.02 inch; Fort Napier, -2° and -0.09 inch; Cape Town, normal and -0.04 inch; Angra, $+1^{\circ}.5$ and -0.05 inch; Ponta Delgado, normal and -0.06 inch; Funchal, $-1^{\circ}.5$ and $+0.04$ inch; Paramaribo, normal and normal; Bridgetown, normal and -0.02 inch; St. Thomas, -1° and $+0.02$ inch; Navassa, $+2^{\circ}.5$ and normal; Medellin, $-3^{\circ}.5$; San José de Costa Rica, -2° ; Mexico, $-1^{\circ}.5$ and -0.08 inch; Melbourne, $+1^{\circ}$ and -0.02 inch; Hobart Town, $-8^{\circ}.5$ and $+0.05$ inch; Archangel, $-5^{\circ}.5$ and -0.14 inch; Stykkisholm, normal and $+0.02$ inch; Gotthaab, $-2^{\circ}.5$ and $+0.02$ inch; York Factory, $+6^{\circ}.5$ and $+0.07$ inch; Fort St. Michaels, -7° and $+0.03$ inch.

Chart No. VI.—This chart displays the tracings of the probable courses of 21 of the principal storm areas of the Northern Hemisphere for the month of September, 1879. The approximate paths of progressive movement are based upon daily simultaneous international observations to the number over 650, besides a large mass of irregular data which reaches this office in various ways from the logs of vessels of the merchant marine of the North Atlantic ocean. In connection with a study of the tracks of the centers of the areas of low barometer, attention should be directed to the unusual number of storms passing north of the British Isles and terminating on the northern coast of Russia; also the small number traversing Russia and Siberia. By an examination of the chart it will be seen that no area of barometric minima appeared over either eastern Europe or Asia after the disappearance of No. II on the 9th. From the 1st to the 7th the range of pressure over Russia and Siberia was comprised between the readings 28.88 and 30.11. On the 8th, as area No. II appeared central in the valley of the Obi, the barometer rose from 0.10 to 0.25 inch over Russia. To trace the incipient stages of this advent of high pressure it will be necessary to return to the relative distribution of pressure as indicated upon the daily charts for the 1st. Upon examination it will be found that an area of 30.40 covered the central portion of Western Europe and extended thence westward over the ocean to the meridian of 20° W. This area remained stationary during the 2d, but by the morning of the 3d was reduced to 30.20, and extended southward to the Mediterranean. On the 4th the central area was reduced to 30.10, and covered the region of the Black Sea. 5th, pressure reduced to 30.00, position stationary. 6th, moved eastward over Toorkistan, no change in barometer. 7th, position of center remained unchanged, pressure rose to 30.20; a second area (30.10) appeared over western Russia, and between these two areas of high the barometer ranged from 29.71 to 29.92. 8th areas of high combined over central Russia with a maximum pressure of 30.28 at Moscow. From the 9th to the 30th the pressure at the center of high ranged between 30.23 and 30.60, and for the most part the position of this area was confined to central and eastern Russia, occasionally reaching eastward to Yeniseisk. The maximum pressures on the successive dates following this advent of high pressure are given as follows: 9th, 30.23; 10th, 30.25; 11th, 30.39; 12th, 30.37; 13th, 30.34; 14th, 30.36; 15th, 30.39; 16th, 30.34; 17th, 30.34; 18th, 30.41; 19th, 30.47; 20th, 30.33; 21st, 30.32; 22d, 30.29; 23d, 30.35; 24th, 30.46; 25th, 30.58; 26th, 30.60; 27th, 30.54; 28th, 30.52; 29th, 30.50; 30th, 30.54. In view of these facts regarding the position and degree of the areas of high, the relative movement of the areas of low pressure become more clearly defined. So prolonged and excessive was the barometric maxima of northern Russia and western Siberia that the passage of the centers of barometric minima beyond the 40th meridian E. was rendered impossible. The general distribution of storm-paths is given as follows: Five, Nos. I, VII, IX, X and XV were confined throughout their paths to the United States and Canada. Two, Nos. XVI and XX formed over the northwestern portion of the United States, and moving thence eastward to the Canadian Maritime Provinces, passed over the ocean to the western coast of Europe. One, No.

XIII, of cyclonic origin, formed over the Caribbean sea, pursuing thereafter the characteristic northwesterly course to the Gulf of Mexico, whence it curved eastward, crossing northern Florida and moving thence northeastward over the ocean. Seven, Nos. II, VI, XI, XIV, XVII, XVIII and XXI, formed over the ocean between 35° and 55° N., pursuing northeasterly paths, in most cases passing north of the British Isles. Two, Nos. III and IV, formed over southern Scandinavia and western Siberia, respectively, moving thereafter in easterly courses. Four, Nos. V, VIII, XII and XIX, first appeared over southern China and the China sea, and, moving in northeasterly courses to the north and south of the Japan islands, disappeared over the Pacific ocean. Concerning the storms of North America: No. I.—This storm appeared to result from the disturbing effects of area No. XIII, described in the July, 1881, REVIEW. The pressure over the Gulf of Mexico recovered very slowly after the passage of the latter storm, and before reaching the normal a rapid decline began on the 27th of August, continuing throughout the month, the area taking definite form on the 1st of September. During this day it left the northern Gulf coast accompanied by heavy rains and very low pressures. On the 2d and 3d passed northeastward over Tennessee, the Ohio valley and the Lower Lake region, accompanied by heavy rains and followed by rapidly rising pressures. On the 4th and 5th, moved northeastward over Canada, disappearing thence over the British Possessions. This storm caused great destruction of property, principally vessels, along the Gulf coast from Pensacola to New Orleans, the loss, as estimated, reaching between \$200,000 and \$300,000. On lakes Huron and Erie considerable damage to vessels occurred. No. VII.—While area No. 1 was moving over Canada the pressure fell to the westward in Manitoba, and on the morning of the 5th an area of 29.80 prevailed over the entire region north of the Lakes and south of Hudson's bay. On the 6th the area of 29.80, considerably circumscribed, was confined to the Lake Superior region; lowest barometer at Duluth 29.72. 7th. Central over Canada, but with diminished energy, disappearing on the following day to the northward. No. IX.—This area first appeared, as a slight depression, over western Nebraska, on the morning of the 6th, and during this day and the following passed eastward to Lake Michigan, accompanied by light local rains, occasionally heavy. On the morning of the 8th the depression was central over the northern portions of Vermont and New Hampshire; barometer at Burlington 0.31 inch below the normal. On the 9th central in New Brunswick, with considerably diminished energy, and passing thence eastward over the Gulf of St. Lawrence during the day, disappeared off the eastern coast of Newfoundland on the 10th. No. X.—This area entered the Pacific coast of North America between the parallels of 40° and 50° N. during the 7th, on which day the pressure was generally 0.20 inch below the normal throughout Oregon and Washington Territory. From the 8th to the 12th the depression pursued an irregular easterly path, reaching Lake Michigan on the morning of the latter date. Very light and extremely local precipitation attended the course of the area thus far, although the barometer was from 0.21 to 0.27 inch below the normal. After crossing the northern portion of Michigan and the Province of Ontario the area disappeared on the 13th over the territory southeast of Hudson's bay. No. XV.—During the presence of No. X over western Canada area No. XV formed as a secondary depression in rear of the latter over the Ohio valley. High winds and stormy weather were experienced over Lake Erie on the night of the 13th, continuing on the 14th, with heavy rains and occasional thunder-storms. On the morning of the 15th the depression was central in northern New Brunswick, accompanied by brisk to high winds and local rains over the Canadian Maritime Provinces. During the day disappeared northeastward beyond the Gulf of St. Lawrence. No. XVI.—On the morning of the 14th an area of 30.20 prevailed over the eastern portion of the Lower Missouri, and throughout the Upper Mississippi valleys. On either side of this high area obtained an area of low (No. XV.—central over Lake Erie, and No. XVI, central in northern Montana.) Moving eastward the latter depression was central over Lake Superior on the 15th, and during the two following days passed over the Province of Ontario, and down the St. Lawrence Valley, reaching the coast of Labrador by the 18th. Attending the movement of the area over the course as above indicated, light rains with occasional thunder—storms began after leaving Dakota, and over Lake Superior considerable changes in pressure occurred, the barometer reading from 0.30 to 0.33 inch below the normal. On the morning of the 18th the barometer at Quebec was 0.51 inch below the normal, and brisk to high winds with local rains prevailed in the Lower St. Lawrence valley. On the morning of the 19th the depression appeared to be central south of Greenland; barometer at Gothaab 29.55, a fall of 0.70 inch in past 48 hours wind shifted from ESE. to NNE.; 20th barometer at Gothaab rose to 29.85, wind still NNE. So far as indicated upon our charts the dispo-

sition of the central area of atmospheric disturbance is somewhat uncertain, owing to the rapid advance of a high area from Newfoundland, and the lack of sufficient reports to define the location. On the 22d, however, the depression appeared clearly determined by the following barometric readings and wind directions: In $44^{\circ} 30' N.$, $17^{\circ} W.$, 29.34 E. gale, heavy rain; in $49^{\circ} 20' N.$, $23^{\circ} W.$, 29.65 SW., brisk, heavy rain; in $51^{\circ} 34' N.$, $15^{\circ} 06' W.$, SW., strong gale, heavy squalls, high sea; in $50^{\circ} 13' N.$, $12^{\circ} 36' W.$, wind rapidly rising, strong westerly swell. During the day, as the storm passed northeastward along the western coast of the British Isles, very violent southwest to southeast gales were experienced. On the north coast of Ireland, 3 miles northwest of Irishtrahull Light, ship *Spartan* experienced cyclone from SW. to SSE., and then to WNW.; barometer 28.43, lost entire suit of sails. Over the British Isles on this day the barometer was generally above 29.85, (lowest, 29.53 at North Unst,) with southwest to northwest winds and cloudy or partly cloudy weather; 23d central northwest of Scotland; Monach Light-house, 28.60 W., force 8; Nairn, 28.82 SSW., force 7; North Unst, 28.88 SE., force 8; Thorshavn, 28.76 NE., force 7; Sandwick Manse, 28.70 S., 44 miles per hour; Aberdeen, 29.06 SW., 33 miles; in $55^{\circ} 15' N.$ $9^{\circ} 20' W.$, 29.19 W., force 6; in $49^{\circ} 45' N.$ $17^{\circ} 45' W.$, 29.47 W., force 6; in $51^{\circ} 30' N.$ $19^{\circ} 58' W.$, SW. and NW. strong gales, heavy squalls and high seas; in $50^{\circ} 33' N.$ $21^{\circ} 17' W.$, heavy NW. squalls, high confused sea. The following report will in a measure indicate the extent of the depression to the southwestward, and the violence with which the atmospheric equilibrium was being restored: in $47^{\circ} N$ $22^{\circ} 30' W.$, barometer about 29.70, violent gale from the NW. lasting 48 hours. Over the British Isles south of the 46th parallel the winds were still southwest to northwest, but with increased energy, while the pressure fell from 0.20 to 0.60 inch in the past 24 hours. 24th. Over the British Isles the winds at southern stations shifted to the north, while at northern stations they remained west and southwest with diminished force; the barometer rose rapidly with a variation of from 0.03 to 0.85 inch in past 24 hours. Over the ocean from 48° to $52^{\circ} N.$, and between 7° and $27^{\circ} W.$, heavy W. and NW. gales, with fierce squalls and high seas prevailed. 25th. Central over the northern portion of Scandinavia; Tromso, 29.38 N., rain; Bergen, 29.80 SSW., rain; Brono, 29.68 SW.; along the western shores of the Baltic Sea and the Gulf of Bothnia, the barometer ranged from 30.04 at Stockholm to 29.68 at Haparanda, with southwest winds, force 6 to 7. 26th. Probably central north of North Cape, where during the day it disappeared to the eastward; Tromso, 29.72, SSW.; Haparanda, 30.03, S. No. XX.—This storm developed from an area of low pressure central in northwestern Montana on the morning of the 20th. During this day and the following the depression passed rapidly eastward to Lake Superior, where it was central on the morning of the 22d, followed by rapidly rising pressure, (from 0.20 to 0.30 inch above the normal.) The area crossed the Canadian and Maritime Provinces during the 23d and 24th, accompanied by light rains and a fall in pressure of from 0.20 to 0.36 inch in 24 hours. Morning of the 25th, probably central north of Newfoundland; barometer at St. John's 29.77, wind SW., a fall of 0.23 inch in the past 24 hours. 26th, the depression passed rapidly northeastward to near the 60th parallel; Godthaab, 29.07, NNE., a fall of 0.50 inch in past 24 hours; Stykkisholm, 29.65, E., a rise of 0.19 inch in past 24 hours. 27th, central southeast of Iceland, near the 30th meridian; Godthaab, 29.38, ENE.; Stykkisholm, 28.82, S., a fall of 0.83 inch in past 24 hours. 28th, central off the northwestern coast of Iceland; Stykkisholm, 28.71, SW.; Godthaab, 29.53, NW.; Thorshavn, 29.54, SW., a fall of 0.22 inch in past 48 hours; wind shifted from NW. to S. and SW. 29th, Stykkisholm, 29.10, SE.; 30th, 29.06, SE. On the 29th the central area appeared to remain about stationary off the northeastern coast of Iceland, disappearing very slowly on the 30th in a high pressure area to north of Scandinavia. No. XIII.—This storm developed over the Carribean sea under much the same conditions that preceded the origin of No. X, (August, 1879,) of the July, 1881, REVIEW. During the night of the 11th there was a general but slight fall in barometer at all West India stations south of parallel $20^{\circ} N.$, supplemented by two similarly conditioned reports from U. S. N. *Vandalia*, in $9^{\circ} 50' N.$, $79^{\circ} 55' W.$, and from ship *Iron Cross*, in $16^{\circ} 46' N.$, $68^{\circ} 31' W.$ 13th, *Vandalia* at Aspinwall, barometer 29.82, SW., no change in the past 24 hours; Kingston, Jamaica, 30.15, NE., a fall of 0.05 inch in past 24 hours; Navassa, 29.82, E., a fall of 0.05 inch in past 24 hours. Ship *Iron Cross*, in $17^{\circ} 20' N.$, $71^{\circ} W.$, 29.98, ENE., force 5; on the 12th, in $16^{\circ} 46' N.$, $68^{\circ} 31' W.$, 30.02, E., force 3; St. Thomas, 29.62, E., a fall of 0.03 inch in past 24 hours. During the 14th, 15th and 16th the barometer at the above-named stations, except St. Thomas, remained about stationary, winds steady from the east and northeast. It is safe to presume, knowing the narrow diameter possessed at times by this class of storms, that the stations from which reports have already been given were situated without the influence of

the central area of disturbance, and therefore the passage of the depression would not be indicated in all cases by a change in pressure or wind direction. During the first two days of development the area was probably much less circumscribed, and therefore, a general fall in the barometer, as before noted. On the 17th, at stations in Cuba and southern Florida, the barometer fell from 0.02 to 0.06 inch, with winds shifting from south to northeast. On this day and the following, vessels reported heavy storms north and east of the Yucatan Peninsula. On the morning of the 19th, as the depression lay to the eastward, the barometer at Havana read 29.88, wind S.; Key West, 29.92, SE.; Punta Rassa, 29.94, NE.; along the northern Gulf coast the pressure ranged from 30.00 to 30.09, winds north and northeast, which directions had been constant since the 3d. During this period of 17 days the pressure over the Gulf states ranged from 30.03 to 30.25. 20th, in 20° 10' N. 84° W., wind S., force 5, misty; in 20° 25' N., 85° 40' W., 29.84 SSE., light rain; Havana, 29.88 SE., fair; Key West, 29.90 S., cloudy, 1.74 inches of rain in past 24 hours; Punta Rassa, 29.89 E., cloudy, 0.48 inches of rain in past 24 hours; along the northern Gulf coast, east of Galveston, the barometer had fallen from 0.07 to 0.26 inch in the past 24 hours, winds NE., accompanied by light rains. 21st, in 22° N. 85° 35' W., 29.85 SSE., force 6; in 23° 20' N. 87° 30' W., 29.84 SW., gale; Havana, 29.90, SSE., light, fair; Key West, 29.90 S., light, fair; Punta Rassa, 29.87, SE., brisk, cloudy; on this day rain became general along the South Atlantic and Eastern Gulf coasts, with brisk to high north and northeast winds. By morning of the 22d the barometer had risen from 0.05 to 0.15 inch, at all stations in the Eastern Gulf, the depression having crossed northern Florida during the night and was now central off the South Atlantic coast in the form of an elongated area, extending northeast and southwest; in 40° 39' N. 67° 30' W., NE. and ENE. storm, high seas and heavy rain. 30 miles off Cape Hatteras, violent gale from N., heavy cross-seas, schooner *White Wing* foundered. Light rains with north and northeast winds, and the barometer generally above 30.05, prevailed along the South and Middle Atlantic coasts. 23d, in 41° N. 66° W., 29.82 NE., violent gale, heavy rain; in 40° N., 58° W., 29.96 ENE., violent gale, gloomy weather, drizzling rain; in 40° 32' N., 58° 47' W., 29.94 SE., violent gale, heavy rain. 24th, depression moving northeastward in about 40° N. 60° W.; in 41° 37' N., 55° 38' W., 29.79 NNE., threatening; in 42° 18' N., 57° 12' W., 29.93 NE., heavy gale, light rain; in 41° 37' N., 54° 04' W., 29.83 NNE., foggy; in 41° N., 55° W., 29.82, SW., violent gale, heavy rain. 25th, central depression inclosed by the isobar of 29.80, which extended northward to Greenland, thus in a measure combining with area No. XX, then central northeast of Newfoundland, its center inclosed within the isobar of 29.60. 26th, depression rapidly filled up, disappearing between two areas of high pressure, (30.40,) one covering the Middle Atlantic and New England coasts and extending thence eastward to the 40th meridian, and the other embracing the Azores. Of the storms forming over the North Atlantic ocean and passing thence eastward to the mainland of Europe, the following descriptions are given: No. II.—This storm appeared to form as a secondary depression to No. XVI of July, 1881, REVIEW; in 53° N., 30° 20' W., 29.63, SW., hurricane, heavy rain; in 52° N., 34° W., 29.67, S., violent gale; in 49° N., 36° W., 29.71, SSW., hurricane, heavy rain; in 43° N., 55° W., 29.71 NNE., violent gale, thunder storm. During the day the depression moved rapidly northeastward, and was, on the morning of the 2d, central east of Iceland; Thorshavn, 29.30, W., brisk, a fall of 0.61 inch in past 24 hours; over the British Isles the winds were southwest and south, and from brisk to high; light rains prevailed, with the pressure over Scotland generally below 29.70. 3d, central north of Scandinavia; Tromso, 29.04, SE.; Haparanda, 29.34, SE.; Brono, 29.45, W. 4th, depression passed southeastward over northern Scandinavia; Tromso, 28.92, NNE; Brono, 28.99, W., gale, rain. Haparanda, 28.83, E., brisk, rain; north of parallel 60° and between the meridians of 10° and 40° E., the pressure at all stations fell below 29.40, winds SE. to SW. and NW. 5th, depression central north of the White sea; Archangel, 28.88, SW. high, and a fall of 0.61 inch, in past 24 hours; over central and northern Russia the pressure fell from 0.15 to 0.25 inch, with winds shifting to south and southeast. 6th, central in northeastern Russia; Archangel, 29.30, NW.; Ekaterinburg, 29.35, WSW.; Barnaul 29.56, SE.; Kasan, 29.50, WSW.; Yeniseisk, 29.81, ESE. 7th, central in the valley of the Obi, course southeastward; Ekaterinburg, 29.49, W.; Barnaul, 29.78, SW.; Yeniseisk, 29.77, ESE. 8th, course changed more to the east, barometer at Barnaul remained stationary, while at Yeniseisk there was a rise of 0.10 inch. 9th, barometer at Barnaul fell 0.09 inch, and at Yeniseisk, 0.04 inch, winds shifted toward NW. No. VI.—On the 4th and 5th the barometer fell quite rapidly in the vicinity of 50° N., 30° W., forming an area of 29.80, which on the 6th embraced the whole of the British Isles, western Germany and northern France; lowest pressures at Monach Lighthouse, 29.49, and at Galway, 29.48;

cloudy or rainy weather prevailed over the British Isles. 7th, depression still central off the Irish coast; Galway, 29.23, WNW.; Armagh, 29.26, SE.; the area of 29.60 covered the British Isles, over which cloudy or rainy weather prevailed. 8th, depression about stationary; Galway, 29.10, W.; Armagh, 29.20, S.; Monach Lighthouse, 29.22, SSE.; during this day the depression crossed the British Isles, and on the morning of the 9th was central over the White sea; the barometer rose rapidly at all stations, from 0.10 to 0.70 inch, with winds shifting to north and northwest; during the day depression passed northeastward over southern Scandinavia, and on the morning of the 10th was central over the Gulf of Bothnia; Umea, 29.42, N., 2.39 inches of rain in past 24 hours; Hernosand, 29.42, NNW.; Stockholm, 29.43, WNW., rain; Upsala, 29.39, W., rain. 11th, central, with much diminished energy, over northern Finland, and on the 12th disappeared north of the White sea. No. XI.—A very sudden fall of the barometer during the night of the 7th revealed on the following morning an area of 29.40, in the vicinity of 44° N., 50° W.; in 45° N., 45° 30' W., 29.37, SE.; in 43° N., 47° W., 29.58, NNW., hurricane, heavy rain. 9th, central near 50° N., 45° W.; in 48° N., 40° W., 29.62, NE., overcast and rain. During the 10th and 11th central between the parallels of 50° and 60° N., inclosed by the isobar of 29.80. On the morning of the 12th central northwest of the Hebrides; Monach Lighthouse, 29.14, WSW.; Sandwick Manse, 29.25, SSW.; North Unst, 29.22, S.; Thorshavn, 29.19, SSE.; pressure over the British Isles and Norway below 29.60, with cloudy or rainy weather and south and southwest winds. 13th, central north of the Shetland Isles; Thorshavn, 29.43, W., force 2; North Unst, 29.35, W., force 6; pressure rose slightly along the Norway coast. During the 14th remained about stationary, center slowly filling up, but on the 15th the barometer at Tromso indicated renewed energy in the central depression by a fall of 0.23 inch in the past 24 hours. 16th, passed eastward to northern Lapland, followed over northern Scandinavia by a rise of 0.15 to 0.25 inch, with winds shifting to west and northwest; during the day disappeared to the eastward in a high pressure prevailing over eastern Russia and western Siberia. No. XIV.—During the 11th and 12th as area No. XI passed northwest of the British Isles, the pressure over northern Spain and the Bay of Biscay fell from 0.10 to 0.20 inch. This rapid change in the barometer was followed on the morning of the 13th by the development of an area of 29.60 over the Bay of Biscay, accompanied by southwest winds and light rains over Spain, and southeast to northeast winds with occasional rains along the western coast of France and the southern coasts of the British Isles. During the day the center of depression passed rapidly northeastward over the English channel and southern England to the North sea, where, on the morning of the 14th, the depression was central off the southwestern coast of Norway. This movement to the northeast was followed over Spain, western France and the southern portion of the British Isles by rapidly rising pressure, northwesterly winds and clearing weather, except over the first-named district, where light to heavy rains still continued. 14th, Vestervig, 29.52, S., rain; Bergen, 29.69, NNW., fair; Christiania, 29.58, calm, cloudy; during the day the central depression merged with area No. XI, then covering the northern portion of Norway. No. XVII.—During the disappearance of areas No. XI and XIV over northern Europe, and before complete restoration of the atmospheric equilibrium north and west of the British isles, a rapid decline in the pressure to the south of Iceland was reported. On the morning of the 17th the isobar of 29.80 covered Iceland and the ocean southeastward to the Hebrides and Shetland Islands, and eastward to the meridian of Greenwich; in 61° N., 17° W., 29.64, SW., violent gale, gloomy weather and rain. 18th and 19th, depression remained about stationary in the vicinity of the Faroe islands, with a tendency to fill up, the barometer at Thorshavn having risen 0.19 inch in the 24 hours ending the morning of the 19th. 20th, depression moving slowly northeastward; very decided change during the past 24 hours, the barometer at Thorshavn having fallen 0.68 inch; at North Unst, 0.40 inch; at Sandwick Manse, 0.54 inch, and at Bergen 0.22 inch, the winds shifting to the southwest, with cloudy and rainy weather. 21st, central on the southwestern coast of Norway; Brono, 29.44, calm; Bergen, 29.57, W., rain; North Unst, 29.55, SW.; during the day the depression passed eastward across northern Scandinavia, disappearing in an area of high pressure then prevailing over western Russia. No. XVIII.—As the winds shifted to the southeast and southwest over northern Spain during the night of the 15th, the pressure fell from 0.09 to 0.17 inch at coast stations; and an area of 29.80 probably formed over the Bay of Biscay. Along the western coast of France and the southern coast of England the winds shifted to northeast, with slowly falling barometer at stations along the former coast, and slowly rising barometer at stations along the latter. The depression as yet had taken no decided form, so far as indicated on the daily charts, but on the morning of the 17th the isobar of 29.80 inclosed the central area,

covering the ocean to the west of Portugal; Lisbon, 29.81, SSW., a fall of 0.21 inch in past 24 hours; Santiago, 29.79, SE., a fall of 0.05 inch. 18th, Santiago, 29.78, NE.; Lisbon, 29.87, E. During the day the depression disappeared in an area of high barometer (30.20) then prevailing over western Europe. No. XXI.—This storm developed as a secondary depression to area No. XX, the latter being central east of Iceland on the 30th, inducing, through an extension of its elongated area of barometric minima, a fall in 24 hours of 0.20 to 0.30 inch in the vicinity of 50° N., 20° W. On the morning of the 30th lowest pressures as follows: In 52° N., 27° W., 29.65, W., force 9, gloomy, rainy weather; in 52° N., 22° W., 29.71, NW., violent gale; in 49° N., 25° W., 29.81, WNW., force 7, rain; in 49° 30' N., 16° 20' W., 29.77, S., cloudy. The further course of this area will probably appear on chart No. VI, for October, 1879. Of the storms confined to Russia and Siberia, No. III appeared over the Gulf of Bothnia on the 1st, probably as a result of the easterly movement of area No. XVI of the August, 1879, chart, which, on the 31st of that month, was central northeast of Iceland. On the morning of the 2d the depression was central just south of the White sea, inclosed by the isobar of 29.60; Archangel, 29.69, NE., rain, a fall of 0.28 inch in past 24 hours; Kasan, 29.87, SE., a fall of 0.11 inch; Moscow, 29.92, SSE., a fall of 0.23 inch; St. Petersburg, 29.71, WNW., a fall of 0.21 inch. 3rd, depression much contracted in size moved eastward to near the western line of Siberia; Archangel, 29.40, NNW.; Kasan, 29.75, WSW.; Ekaterinburg, 29.73, WSW.; during the day disappeared over western Siberia partly through the influence of a high-pressure area to the eastward and low area No. II then covering northern Scandinavia and Lapland. No. IV.—Coincident with the appearance of No. III over the Gulf of Bothnia, the distribution of pressure at surrounding stations indicated the presence of an area of low in the valley of the Obi south of the 60th parallel. The position of this depression taken in connection with the course of No. XV of the August, 1879, chart shows that the former is very probably a continuation of the latter. On the morning of the 1st the position of No. IV was indicated by the isobar of 29.60, inclosing portions of the provinces of Tobolsk, Omsk and Tomsk; Barnaul, 29.68, S., a fall of 0.30 inch in past 24 hours; Ekaterinburg, 29.79, NNW., a rise of 0.35 inch in past 24 hours; Yeniseisk, 29.89, E., cloudy, a fall of 0.24 inch in past 24 hours. 2nd, depression central over the western portion of the province of Tomsk and the southern portion of Yeniseisk; Barnaul, 29.69, SW.; Yeniseisk, 29.67, ENE., thunder-storm. 3d, central over the province of Irkoutsk; Barnaul, 30.04, NW., cloudy; Yeniseisk, 29.88, W., rain. The further course of this area cannot be traced, owing to the lack of reports from eastern Siberia. Of the storms leaving the Asiatic coast, No. V first appeared on the 2d over southeastern China, and moved thence during the day east-northeast to the Yellow sea, where, on the following morning, it was probably central. 3d, Nagasaki, 29.66, S., a fall of 0.10 inch in past 24 hours; Zi-Ka-Wei, 29.73, NE., rain. 4th, central over the Japan sea; at all coast stations winds shifted to north and northwest with rapidly rising pressure; at Yokohama the wind continued SE., with a fall of 0.16 inch; at Nagasaki and Wakayama, in rear of the storm, the winds shifted to NE., with a rise of 0.11 inch at the former and a fall of 0.07 inch at the latter station. 5th, central east of Yesso, disappearing during the day in a high pressure (30.20) southwest of Kamtchatka. No. VIII.—This depression first appeared over southern China on the 5th; Hong-Kong, 29.77, calm, a fall of 0.06 inch in past 24 hours; Zi-ka-Wei, 29.96, wind shifted to NE., with a rise of 0.06 inch. 6th, central southwest of Formosa; Manilla, Phillipine Islands, 29.78, E., a fall of 0.06 inch in past 24 hours; no change at Hong-Kong. During the 7th, 8th and 9th the depression passed slowly northeastward over the ocean south of the Japan islands. The changes of pressure at coast stations were comparatively unimportant until the morning of the 9th, when the barometer at Wakayama indicated a fall of 0.14 inch in past 24 hours; at Nagasaki, 0.18 inch; Yokohama, 0.28 inch; winds shifted to north and northeast with heavy rains except at Nagasaki; 10th, disappeared northeastward near 150° E., followed on the 11th by a rise of 0.10 to 0.13 inch at Wakayama and Yokohama. No. XII.—This storm developed over the China sea on the 10th and 11th. On the morning of the latter date the barometer in 22° 19' N., 115° E., showed a fall of 0.17 inch in past 24 hours, heavy rain, wind ENE., force 5; Manilla, 29.80, S.; 12th, depression central near 20° N., 130° E., with an elongated area of barometric minima (29.60) running from near the Phillipine Islands northeastward to 145° E.; rain, with northeast gales, were reported from Yokohama, the former condition continuing since the 10th. 13th, depression central with area of disturbance more circumscribed, in 33° N., 140° E.; Yokohama, 29.42, N., a fall of 0.48 inch in past 24 hours; Tokei, 29.54, N., heavy rain, a fall of 0.40 inch in past 24 hours; Wakayama, 29.65, NNW., a fall of 0.21 inch in past 24 hours. 14th, depression moved northeastward to near the 40th parallel, followed over the eastern portion of Japan by

clearing weather and a rise in the barometer of from 0.20 to 0.33 inch; winds still north and northeast. No. XIX.—On the 19th an area of 29.80 covered the China sea and Pacific ocean in the vicinity of the islands of Formosa and Luzon; Manila, 29.73, WNW. 20th, Manila, 29.70, WNW.; Macao, 29.80, NW.; in 26° 17' N., 121° 27' E., 29.50, E., force 6, heavy rain, very rough sea; Zi-Ka-Wei, 29.93, NNE., cloudy. 21st and 22d remained about stationary southwest of the Japan Islands, barometer slowly falling at all stations, accompanied by north-east winds and occasionally heavy rains. 23d, depression moved rapidly eastward to near 144° E., followed at all Japanese stations by rising pressure and clearing weather; in 36° 59' N., 150° 47' E., 29.77, NNE., force 5, cloudy weather; the remainder of the storm's course as charted depends upon the reports of the S. S. *Belgic*, of the Occidental and Oriental S. S. Co., during a portion of her voyage from Yokohama to San Francisco. 24th, in 37° 50' N., 156° 26' E., 29.83, N., force 5, cloudy. 25th, in 39° 03' N., 161° 54' W., 29.86, NNE., force 4, cloudy. 26th, in 40° 08' N., 167° 03' W., 29.83, ENE., force 4, squally. 27th, in 41° 07' N., 171° 38' W., 29.61, E., force 6, heavy rain and violent squalls. 28th, 42° 04' N., 176° 21' W., 29.54, S., force 5, cloudy weather, heavy sea. 29th, in 43° 05' N., 177° 37' W., 29.61, WSW., force 5, cloudy, moderate sea. 30th, in 43° 32' N., 171° 13' W., 29.75, NNW., force 6, heavy squalls. On the following day the ship encountered an area of high pressure, (30.10,) with clearing weather and winds shifting to west and northwest.

TEMPERATURE OF THE AIR.

The mean temperature of the air for August, 1881, is shown by the isothermal lines (in red) on chart No. II. The table of mean and comparative temperatures in the right-hand corner of the chart shows, in the first column, the average for the month throughout the various districts, as deduced principally from observations taken at Signal Service stations. In the two remaining columns are shown the means for the present month and the departures of such means from the average for many years. In all districts east of the 100th meridian, except the Florida peninsula, which is normal, the temperature is everywhere above the average, the excess being most marked over that portion of the country lying between the 87th and 97th meridians, where the departure ranges from +2°.5 to +3°.6. This region of high mean temperature very nearly coincides with that over which the excessive and dangerous heat of the month occurred. West of the 100th meridian the mean temperature is below the average in every district, except the Southern Pacific coast region, which is normal. At Salt Lake City and Pike's Peak the temperature is above the average, the former 1°.4 and the latter 2°.1. The region of greatest deficiency (−3°.1 to −5°.6) covers that portion of the country north of the 40th parallel and west of the 110th meridian.

Ranges of Temperature at Signal Service Stations.—Monthly ranges in general varied from 30° to 45° over the country east of the Rocky Mountains, and from 40° to 55° to the westward of that region. The *smallest ranges* were: San Francisco, 18°; Galveston, Port Eads and New Orleans, 20°; Punta Rassa and Key West, 21°; Indianola, 22°; Fort Macon, N. C., and Pensacola, 24°; Portsmouth, N. C., and San Diego, 25°; Jacksonville, 26°; Pike's Peak and Hatteras, 28°. The *largest* were: Fort Beuton, 72°; Rock Creek, Mont., 71°; Fort Missoula, 67°; Winnemucca, 66°; Fort Sully, Dak., 65°; Fort Lapwai, 64°; Boise City, 61°; Smithville, Dak. and Forts Custer and Shaw, 59°. The *daily ranges* varied in the different districts as follows: New England, 14° at New Shoreham and 17° at Wood's Holl and Mt. Washington to 30° at Boston; Middle Atlantic states, 15° at Cape May to 30° at New York, Philadelphia and Washington; South Atlantic states, 15° at Macon and 16° at Smithville, N. C., to 23° at Kitty Hawk, Charlotte and Atlanta, and 24° at Augusta; Eastern Gulf states, 19° at New Orleans to 24° at Pensacola and 25° at Vicksburg; Western Gulf states, 17° at Port Eads and 18° at Indianola to 31° at Shreveport and 33° at Fort Gibson; Rio Grande valley, 24° at Brownsville to 32° at Castroville, Uvalde and Laredo; Ohio valley and Tennessee, 25° at Memphis to 33° at Pittsburgh and 35° at Morgantown; Lower Lake region, 22° at Erie to 31° at Detroit and 33° at Cleveland; Upper Lake region, 22° at Grand Haven to 29° at Marquette and Alpena, and 32° at Port Huron; Upper Mississippi valley, 23° at La Crosse to 31° at Des Moines and 32° at Keokuk; Missouri valley, 27° at Omaha and 28° at Huron to 35° at Leavenworth and 41° at Fort Bennett; extreme Northwest, 32° at Moorhead to 42° at Bismarck and St. Vincent and 50° at Fort Buford; Northern slope, 32° at Helena and 36° at North Platte to 53° at Fort Custer and 54° at Fort Assinnaboine; Middle slope, 21° on Pike's Peak to 31° at Dodge City and 33° at Fort Elliott; Southern slope, 27° at Henrietta to 33° at Jacksboro' and 38° at El Paso; Northern plateau, 42° at Lewiston and Spokane to 51° at Eagle Rock and 57° at