played on the 12th at Indianola was justified by a maximum velocity of 47, N. In advance of low area No. III, Cautionary Signals were displayed on the 14th from New Haven to Boston, which were only justified at Thatcher's Island and Boston. In no part of its course did depression No. II exhibit any special energy. In advance of low area No. IV, Cautionary Signals were displayed on the 14th from Cape Henry to Eastport, and Cautionary Off-shore Signals from Savannah to Macon; during the storm, Cautionary Signals were changed to Cautionary Off-shore Signals from Cape Henry to Portland. The following are the maximum velocities reported: Cape Henry, 52, N.; Norfolk, 35, N.; Chincoteague, 39, NW.; Delaware Breakwater, 45, N.; Cape May, 43, NW.; Atlantic City, 27, NE.; Barnegat, 40, N.; Sandy Hook, 38, NE. and 40, NW.; New Haven, 26, N.; New Shoreham, 60, NE.; Newport, 30, NW.; Wood's Holl, 36, NW.; Boston, 34, NE.; Thatcher's Island, 55, NE.; Portland, 35, NE.; Eastport, 52, NE.; Savannah, 33, NW.; Smithville, 28, N.; Macon, 52, N.

No. V.—On the 14th, while low area No. IV was pursuing its course along the Atlantic coast, a depression of slight energy, moving in a southeasterly track from Manitoba, entered the Mississippi valley; it was accompanied by light rains in its northwest quadrant, and after the morning report of the 15th ceased to exist as an independent depression.

No. VI.—On the 24th, a depression moving from the Saskatchewan valley, advanced in a southeasterly track over Minnesota. On the 25th the low area moved over Wisconsin and Michigan. On the 26th the centre passed over the St. Lawrence valley and New England. At no point of its track did it exhibit special energy and the rain-fall accompanying it, while general, was light. The only signal displayed for this storm was at Milwaukee, which was justified by a maximum velocity of 28, NW.

No. VII.—The circulation of the winds and the fall and rise of the barometer, showed the passage of a centre of depression to the eastward on the 26th and 27th, as charted. At no time was the centre of low area within the limits of the United States. No signals were displayed for this storm, and at no time did it exhibit special energy within the limits of the chart.

INTERNATIONAL METEOROLOGY.

Two international charts, Nos. V and VI, accompany the present REVIEW. The former, prepared for the month of May, 1877, is published in accordance with an explanation given in the leading paragraph under *International Meteorology* in the January, 1881, REVIEW; the latter, which has not appeared since December, 1880, owing in part to a delay in the publication of the May, 1879, number of the "Monatliche Übersicht der Witterung" of the "Deutsche Seewarte," has now been provided for the month of May, 1879, and will make continuous the series of chart No. VI begun in October, 1877, the last of which was published for the month of April, 1879, in the December, 1880, REVIEW.

Chart No. IV, will hereafter be discontinued, as it is considered more practical and satisfactory, to study the development and progress of areas of low barometer, based upon later and therefore a more complete collection of ocean and land data, as exemplified in the preparation of chart No. VI, by which it will be replaced. The data for chart No. IV must necessarily be meagre and imperfect, as logs of vessels cannot be examined for the current month, neither can the land reports from stations in Europe and elsewhere over the Eastern Hemisphere, be received in time to make the study of storms as attempted on this chart of much value.

Chart No. V, shows the mean pressure, temperature, wind force 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 May, 1877, over the Northern, and at certain isolated stations in the Southern Hemisphere. The Atlantic area of low pressure, which in January, 1877, covered the region beyond latitude 55° N., and between longitude 10° and 50° W., passed slowly southeastward, entering continental Europe over the British Isles and the North Sea, reaching the southern portion of Russia and southeastern Austria, where it remained nearly stationary during May, 1877. The lowest pressures of the month were reported from the following stations situated within the low area above named: Hermannstadt, 29.75 (755.6); Kieff, 29.76 (756.0); Lugan, 29.77 (756.3). A second area of low pressure covers the Canadian Maritime Provinces and a portion of the Atlantic north of latitude 50°, the pressures at Heart's Content, Newfoundland, and Godthaab, Greenland, being 29.80 (757.0) and 29.98 (761.6), respectively. The highest monthly mean pressure, 30.10 (764.6), was reported from the following stations: York Factory, Funchall, Kingston, Jamaica and the City of Mexico. Other regions of comparatively high pressure were reported as follows: Honolulu, 30.08 (764.1); Toronto and Kingston, Canada, and Angra, 30.06 (763.5); Wilmington, N. C., and Batavia, 30.05 (763.3), and Stykkisholm, 30.04 (763.1). These pressures give a monthly barometric range of only 0.35 inch, which exhibits a steady decrease since the maximum of 1.28 in January. The regions of greatest cold were found in the neighborhood of the following stations, as indicated by the accompanying thermometric readings given in Fahrenheit's scale: Fort St. Michaels, 34°; Nikolaievsk, on the Amoor, 36°; Godthaab, 37°, and Haparanda, 39°. The prevailing direction of the wind was *westerly* along the Pacific coast of North America, and from

northeast to *southeast* in the interior; along the European coast from *southeast* to *southwest*, and over the Continent and in Asia from *northeast* to *northwest;* along the Mediterranean Sea *variable*, with a tendency to *southerly*. In comparison with the preceding month, few changes of importance have occurred. The variation of pressure, particularly over the Canadian Maritime Provinces, has been considerable, ranging from —0.1 to —0.16 inch. The decrease elsewhere is indicated as follows: At Godthaab, —0.08 inch; Bergen, Archangel, Barnaul and Tromso, —0.07; St. Petersburg and Pekin, —0.09; Brono, —0.1; Tashkent, Knopio and Fort St. Michaels, —0.11; Christiana, —0.31; over the British Isles from —0.05 to —0.20 inch. The increase in pressure was not a marked feature of the month. There was slight evidence of it along the southern coast of the Mediterranean, over western and northern Asia and in Iceland. The temperature variations show a decided rise over the northern latitudes, as follows: In Siberia and Russia, from 10° to 20°; in Europe, 5° to 15°; along the northern boundary of the United States and at York Factory, Hudson's Bay Territory, from 15° to 28°. Compared with May, 1877, the month of May, 1878 has but one area of low pressure, which occupies a decidedly different position, covering the ocean to the northwest of the British Isles, with barometric readings 0.25 inch lower than for the low areas of May, 1877. The pressure is generally higher over the central portions of the United States, but considerably lower in the vicinity of Hudson's Bay. Along the Pacific coast the pressure remains about the same. Over Europe the isobar of 29.9 has moved from 15° to 20° farther to the north, while that of 29.8, expanded from its narrowed isolation north of the Black Sea, stretches from central Siberia westward to the North Atlantic and northward to Greenland. Over Iceland there is a fall of 0.28 inch, but only a slight change of —0.04 at Godthaab, Greenland. Along the eastern coast of Asia the fall has been from 0.05 to 0.15 inch. The change in temperature has also been quite marked, particularly in the vicinity of Hudson's Bay, where at York Factory there is a fall of 17°.7. The following stations show a lower mean temperature for 1878: Fort St. Michaels, —8°.5; Godthaab, —2°.0; Stykkisholm, —2°.0; Nikolaievsk, on the Amoor, —3°.3; Vladivostock, —1°.2. Over Europe and Asia the temperature is considerably higher for 1878, but over the United States the reverse prevails with marked emphasis, particularly west of the 100th meridian, where the isotherm of 40° extends southward to Santa Fé, which in 1877 reported a mean temperature of 54°.4.

Chart No. VI.—Upon this chart are traced the paths of 30 of the principal storm areas of the Northern Hemisphere during the month of May, 1879. Of these, 13 are located over North America, 6 over Europe, 1 in Siberia, 3 over Hindoostan, 1 in China, 1 over the China and Japan Seas and the remainder (5) over either the North Atlantic or North Pacific Oceans. The storms of North America are, with but one exception, confined almost entirely to the boundaries of the United States; four, Nos. IV, VIII, XVIII and XXIII appear to have originated on the Pacific coast north of San Francisco and passed in an easterly direction over the country north of latitude 40°. Only two of the above reached the Atlantic, one of which, No. XXIII, after leaving the Gulf of St. Lawrence, passed north-northeast to the western coast of Greenland, and thence nearly across that country in an easterly track. The remaining two, Nos. VIII and XVIII, were lost sight of in the region between Manitoba and Hudson's Bay. Three, Nos. XIV, XXI and XXIX, first appeared in the Middle and Northern Plateau regions, and passing thence eastward, the latter disappeared north of Canada. No. XIV, continuing its course, passed from the Lower St. Lawrence valley northeastward over Labrador, thence in an easterly direction beyond the southern point of Greenland, turning again to the northeast near the 40th meridian and passing to the north of Iceland. During the passage of this storm the barometer at Godthaab, though quite low, gave evidence of but slight change, and for five days the wind shifted alternately from north to west, while at Stykkisholm, Iceland, the lowest pressure of the month, 28.97 (wind SSE., gale), occurred on the 20th as the storm-centre lay to the north-northwest. No. XXI, after leaving the Gulf of St. Lawrence, passed northeastward across the southern portion of Greenland, southeastward over Iceland and Scotland, and thence eastward over the North Sea, disappearing in central Europe. At Godthaab, during the passage of this storm, the lowest pressure of the month, 29.38 (wind W., strong), was recorded on the 23rd. On the following day the barometer rose to 29.67 (wind SSW). At Stykkisholm the pressure fell decidedly, reaching its lowest point, 29.10 (wind W., gale), on the 24th, as the storm passed to the eastward. Four, Nos. IX, XXII, XXVI and XXX, appear to have originated in the Southeastern Rocky Mountain region. The last, No. XXX, reached southern Michigan on the 31st; its further course to the eastward will appear on the June chart in the next REVIEW. No. XXVI, after reaching the Lower Lake region, disappeared to the north of Canada. No. IX, passed southeastward down the Rio Grande valley, reaching the Gulf of Mexico on the 6th, where further evidences of its course could not be found. No. XXII, after leaving the Gulf coast at New Orleans, is of very doubtful movement in the course, as indicated upon the chart. On the 22nd and 23rd, while the storm centre passed to the southeastward between the Yucatan Peninsula and Cuba, heavy easterly winds, increasing to gales, with rapidly falling barometer and rain, prevailed along the western coast of Florida and Cuba. On the 24th, 25.°16′, N. 80°.0′, W., steamship *Webster* experienced very heavy gales from east and north-northeast, with terrific high sea; lost sails and hove to for twelve hours. At Kingston, Jamaica, on the 24th and 25th, heavy northeast winds, with rain and falling pressure, prevailed. At San Juan, Porto Rico, 23rd, wind blowing a gale from the northeast, exceedingly stormy, sea very tempestuous; 24th,

wind still northeast, very strong, unusually heavy rain, sea very rough; 25th, rain still falling, but considerably abated, winds strong from the northeast; 26th, fair weather, wind east, light, after which the storm apparently passed to the northeastward south of the Bermudas, where, on the 26th, the wind changed from north (after blowing from that point for three days) to west, with rapidly rising pressure and clearing weather. No. V, appeared in New England on the 1st, and passed thence northeastward to the Gulf of St. Lawrence, from which point it turned southward to Nova Scotia, where it again changed to the northeast and disappeared beyond the eastern coast of Newfoundland. Of the storms located over Europe, two came from the ocean, one from south of the Mediterranean, while the remaining three appeared to originate over the mainland. No. VII, pursued quite a remarkable course, first appearing in about 55°, N., 25°, W. On the 3rd, in 59°, N. 23°, W. barometer fell to 29.95, overcast with rain. From this point it pursued a northeasterly course to the south of Iceland, reaching the coast of Norway by the 5th, barometer at Tromso, 29.37, a fall of 0.75 inch in past 48 hours. 6th, Archangel, 29.50, wind SSW; St. Petersburg, 29.62, WSW.; Umea, 29.26, N.; Hernosand, 29.34, WNW.; Haparanda, 29.25, SW.; Stockholm, 29.44, W. 7th, St. Petersburg, 29.35, S.; Dorpat, 29.45, WSW.; Moscow, 29.46, S.; Umea, 29.40, NNW. 8th, Tromso, 29.24, SSW.; Brono, 29.38, WSW.; Haparanda, 29.46, S. 9th, Tromso, 29.24, E.; Brono, 29.38, SW.; Hernosand, 29.44, S. 10th, Brono, 29.42, SSW.; Bergen, 29.32, W.; Tromso, 29.41, NE. 11th, North Unst, 29.58, SSW., rain; Thorshavn, 29.85, NE., threatening; Thurso, 29.64, SW., rain; Holyhead, 29.95, WSW., rain; Nairn, 29.68, SW., threatening; on this day threatening weather and rain, with southerly winds, prevailed over the northern portion of the British Isles. 12th, Thorshavn, 29.76, W., rain; Vestervig, 29.98, SW., rain; Brono, 29.74, S. 13th, St. Petersburg, 29.70, S.; Dorpat, 29.68, NW., rain; Kieff, 29.54, SSW., rain; Nickolaiev, 29.77, SW., rain. No. XIX, first appeared over the southern portion of the British Isles and the North Sea on the 14th, where heavy rains and thunder-storms prevailed with northwest to southwest winds increasing to gales. On the 15th the storm centre passed northeastward beyond the Baltic, accompanied by heavy rains in northwestern Russia. On the 16th rain and threatening weather over the more northern portions of Russia, and from the 17th to the 21st over northern Siberia, where southerly winds prevailed. No. XXVII, apparently developed as a secondary depression over the English Channel and western France on the 28th, after the passage of area No. XXI, southeastward from the North Sea. On the 29th the storm moved northeastward over the British Isles, with heavy rains and thunder-storms, followed by southwest to northwest winds increasing to gales. On the 30th the centre of lowest pressure was transferred to the coast of Norway and thence eastward over Sweden into northern Russia. No. XV.—On the 10th low pressures, with occasionally heavy rains, prevailed over northern Italy and western Austria. On the 11th the lowest pressure was transferred to central Austria, with threatening weather and rain extending northward into Germany, lowest barometer, 29.41, wind, SE. at Lemburg; at Szathmar, barometer, 29.47, wind, SE., heavy rain. On the 12th and 13th the lowest pressure passed northeastward into central Russia, where further evidence of existence disappeared. No. VI, appeared to form on the 2nd, south of the Mediterranean and pass thence northeastward across southern Italy, where, from the 2nd to the 4th, occasionally heavy rains, with northeast to southeast winds, prevailed. There was no very marked change in the barometer; lowest pressure on the 2nd, 29.80, wind SE., at Cagliari; 3rd, 29.71, wind, ENE., at Leghorn. On the 4th and 5th the centre of lowest pressure was transferred to southwestern Russia, where it apparently filled up. No. XII, developed in southern Russia on the 8th (possibly a reappearance of No. VI) and, on the 9th and 10th, disappeared in the high pressure then prevailing over western Siberia. No. XXV, traversed southern Siberia; commencing its course near the mouth of the Volga river, it passed in an east-northeasterly direction and disappeared near the Baikal Sea in the district of Irkoutsk. Our charts, owing to want of sufficient data, give but partial evidence of the movement of this area. Nos. XX, XXIV and XXVIII, appearing over northern Hindoostan from the 16th to 31st, were due to the setting in of the spring monsoon. On the 16th heavy rains, with west to northwest winds, began along the western coast, with the lowest pressures prevailing over the northern districts. From this date to the 31st, the area of lowest pressure changed from west to east with great variability, and rain fell either in one district or another without intermission. On the 29th, at Deesa, terrific whirlwind, accompanied with heavy rain and much destruction to property; the centre of the area of lowest pressure at the time, appeared to be situated somewhat to the northeast. On the 30th heavy rain continued for 12 hours at Kuttack and Sibsigar, centre of lowest pressure to the northwest. No. XIII, probably appeared in central China on or about the 8th, and passed northeastward into the district of Mautchooria, where it disappeared on the 10th and 11th. On the 8th, barometer at Hong Kong 29.84, wind ESE., threatening; in 25°, N. 118°, E., barometer 30.00, wind SE., threatening; at Shanghai, barometer 29.88, wind SSE. 9th, Hong Kong, 29.84, SE.; in 25°, N. 118°, E., 29.92, SW.; Shanghai, 29.81, S., heavy rain. 10th, Hong Kong, 30.00, SSE.; in 25°, N. 118°, E., 29.87, SSE.; Shanghai, 29.66, SE., heavy rain. On the 11th the barometer rose at all the foregoing stations, with winds shifting to north and northwest. No. II passed northeastward over the China and Japan Seas from the 1st to the 4th. On the 1st at Shanghai, barometer 29.89, calm; on the east shore of the Island of Katsim, Japan, very boisterous weather. 2nd, Yeddo, 29.95, gloomy weather, wind southwest, strong gale. 3rd, near the Island of Formosa, 29.88, S.; Shanghai,

29.88, S., threatening; Yeddo, 29.80, calm, gloomy weather. 5th, Shanghai, 29.76, S., heavy gale; Yeddo, 29.75, calm, rain: in 35°, N. 160°, E., 29.72, SE., heavy gale, rough sea. No. X, appeared to develop in southeastern China on or about the 6th and passed northeastward over the ocean to the south and east of the Japan Isles, from thence northeastward over Behring's Sea to Alaska and eastward into British North America. On the 6th and 7th, very heavy rains, with northeast to northwest winds, prevailed along the south and east coasts of Japan; lowest pressure on the 7th at Yeddo, 29.50, wind NW., rain-fall 3.43 inches. On the 8th and 9th, as the storm passed to the eastward, clearing weather, with westerly winds, prevailed. On the 12th and 13th, as the centre of lowest pressure was approaching Alaska from Behring's Sea, snow and rain, with a SSE. wind, occurred at Ft. St. Michaels. 14th, Ft. St. Michaels, southeasterly gale all day, with snow, barometer 29.73; Unalaska, wind SE., heavy gale, rain-fall 1.07 inches, rising temperature. 15th, Ft. St. Michaels, high easterly gale, barometer 29.68; Unalaska, very heavy gales from SE., SW. and W., falling temperature, with light rain. 16th, Ft. St. Michaels, high easterly gale, barometer 29.24; Unalaska, strong west winds all day, rising temperature. 17th, Ft. St. Michaels, east to south gales, barometer 29.71; Unalaska, strong southeast wind all day, light rain, stationary temperature. 18th, Ft. St. Michaels, 30.08, strong SSE. wind: Unalaska, wind south all day, fresh, light rain and rising temperature. On the 19th wind changed to west, with clearing weather. No. XVII, probably made its first appearance in southern China on the 12th, and, on the 16th, moved northeastward over the China Sea; on the 17th and 18th over Japan Sea and Japan, and thereafter pursued an irregular easterly course to near the western coast of North America, between 40° and 50° north latitude, which locality it reached on the 30th, where it probably again gathered renewed energy and appeared on the Pacific coast of the United States as area No. III, in the June, 1879, REVIEW. The track of this storm is founded upon reports from stations in China and Japan, logs of vessels traversing the North Pacific ocean, and reports from Unalaska. No. III appeared as a slight depression over the Aleutian Islands on the 1st, and passed thence eastward across the Alaska Peninsula, reaching British North America on the 5th, where it disappeared in the high pressure then occupying the region north of Hudson's Bay. No. XI, developed off the South Carolina coast, on the 7th and 8th, in about latitude 30°, N., longitude 75°, W., and passed thence northeastward, disappearing on the 10th and 11th in a high-pressure area then prevailing to the southeast of Newfoundland. On the 8th schooner *McNeil*, in 31°, 21′ N., 79°, 22′ W., experienced violent E. to NE. gales and heavy cross-seas, lasting 48 hours. 9th, schooner *Nellie*, in about 32°, N., 75°, W., was struck by lightning and experienced very heavy seas. No. I appeared as a slight depression near latitude 35°, N., longitude 38°, W., where threatening and rainy weather, with rough seas, prevailed from the 1st to the 3rd. During the 4th and 5th the centre of depression moved southeastward, from latitude 35° to the African coast, followed over the Azores and Maderia Islands by rapidly rising pressure and westerly winds.

It is of interest to note in connection with the small number of storms crossing the Atlantic Ocean and their extreme northern latitude, the presence of an unusually high-pressure area over the North Atlantic Ocean between latitude 30° and 50° N. and longitude 25° and 45° W. The mean for the month in this region ranged from 30.23 to 30.38 and the temperature from 55° to 70°, while the prevailing winds were northeast to southeast south of latitude 40°, and southeast to southwest and northwest, to the northward of that parallel. From a record running back to October, 1877, no single month furnishes mean readings for this region of the North Atlantic to exceed 30.25, while the average of the highest mean readings for the 19 months, including April, 1879, was only 30.09. The average number of storms crossing the Atlantic north of parallel 40° for a period covering 17 months, between December, 1877, and April, 1879, was about 5, while May, 1879, presents barely 3. This places the month below the mean, but not lower than seems to be usual for this period of the year, as in May, 1878, only 2 storms were reported to have passed over the ocean from the main land of America. It is perhaps rather premature to make comparisons of this nature while the records of international storm charting are so meagre. Individual cases of very high barometric readings, as taken from the logs of vessels reported in the "Monatliche Uebersicht der Witterung" of the "Deutsche Seewarte," for May, 1879, are given as follows: 23rd, in 39°.5′, N., 37°.6′, W., 30.69; in 39°.4′, N., 35°.0′, W., 30.67; in 42°.5′, N., 41°.9′, W., 30.62. 24th, in 40°.9′, N., 37°.5′, W., 30.76; in 40°.2′, N., 34°.6′, W., 30.71; in 43°.2′, N., 40°.1′, W., 30.77; in 45°.5′, N., 45°.4′, W., 30.63; in 44°.1′, N., 38°.7′, W., 30.61; in 45°.1′, N., 36°.9′, W., 30.74. 25th, 42°.7′, N., 37°.2′, W., 30.81; in 42°.1′, N., 34°.5′, W., 30.77; in 44°.1′, N., 38°.8′, W., 30.77; 49°.6′, N., 33°.1′, W., 30.62; in 44°.4′, N., 37°.8′, W., 30.61; in 46°.5, N., 31°.5′, W., 30.71. 26th, in 44°.1′, N., 35°.8′, W., 30.73; in 43°.2′, N., 34°.3′, W., 30.69; in 44°.8′, N., 36°.7′, W., 30.69; in 47.°3′, N., 33°.5′, W., 30.68. 27th, in 44°.7′, N., 34°.2′, W., 30.67; in 43°.7′, N., 33°.4′, W., 30.65; in 45°.5′, N., 33°.9′, W., 30.70; in 46°.8′, N., 34°.0′, W., 30.66.

TEMPERATURE OF THE AIR.

The mean temperature of the air for April, 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 col-