36 NE. These signals were changed to Cautionary Northwest Signals on Lake Michigan on the 27th. Cautionary Off-shore Signals were ordered on the 28th from Smithville to Sandy Hook, and were generally justified, both as to velocity and direction, as follows: Macon, 26 NW.; Hatteras, 32 NW.; Kittyhawk, 26 NW.; Cape Henry, 28 NW.; Chincoteague, 39 NW.; Delaware Breakwater, 44 N.; Cape May, 52 NW.: Atlantic City, 27 NW.; Barnegat, 37 NW.; Sandy Hook, 40 W.

INTERNATIONAL METEOROLOGY.

Two International charts accompany the present REVIEW. No. IV is for the month of *January*, 1881. No. V is for the month of *March*, 1877, and is published in accordance with the explanation given in the opening paragraph under International Meteorology in the January, 1881, REVIEW.

Chart No. IV, for the month of January, 1881, indicates as well as is at present (March 16, 1881) possible the general course taken by the most prominent storm-areas over the North Atlantic Ocean and adjacent land areas during that month. Nos. II, V and VIII are continuations of low areas Nos. I, V and VII, respectively, of chart No. I for January, 1881. Nos. I, III, IV, VI, VII and IX are prominent low areas appearing during the month on the European coast and which have been traced from the daily charts published by the various meteorological offices of Europe. The most notable meteorological feature of the month occurring over the North Atlantic, between the parallels of 35 and 55, was the remarkably low barometric readings experienced, especially from the 4th to the 9th over the region marked by area No. II, and from the 17th to the 31st over the regions marked by areas Nos. VII and VIII. During these periods the barometer fell below 29.0 or 736.6 on nine days, and on the 26th 28.37 or 720.6 was experienced in mid-ocean. As the area of low barometer No. VIII progressed slowly eastward during the 22nd, 23rd and 24th it so increased in extent that from the 25th to the end of the month it included not only the whole region under consideration but extended its influence over the greater part of Europe; thus on the 28th the pressure at Cape Breton was 29.16, in mid-ocean about 29.24, near the centre of depression about 28.9, at Mullaghmore 28.84, and at Gris-Nez 28.89. On the 29th the barometer at Mullaghmore fell to 28.65. The individual storms will be treated of at length on the presentation of Chart No. VI for this month; in the mean time the following characteristics of the weather over eastern North America, the portion of the North Atlantic under consideration, and western Europe may be grouped together with interest. Attending the low pressures over the ocean gales were reported on 28 days and severe or violent gales or hurricane winds on 12 days. The general direction of the storm winds was SE. or ENE. to the eastward of the 40th meridian and northwesterly to the westward, the latter to the north of the 40th parallel being accompanied by severe snow-squalls and freezing temperatures throughout the first and last decades of the month. Over the eastern half of the United States high pressures predominated, and exceptionally cold northerly winds generally prevailed from Vera Cruz, Mexico, northeastward along the entire Gulf and Atlantic coasts. In Europe severe storms, accompanied by unusually heavy falls of snow or rain, were experienced in all the countries bordering upon the Atlantic. The severe frost which prevailed from the 7th to the 26th and the heavy snow-storm and severe gales, which culminated on the 18th and 19th over the British Isles, are perhaps without precedent. The heavy snows in Paris and inundations in Spain may also be instanced as remarkably severe.

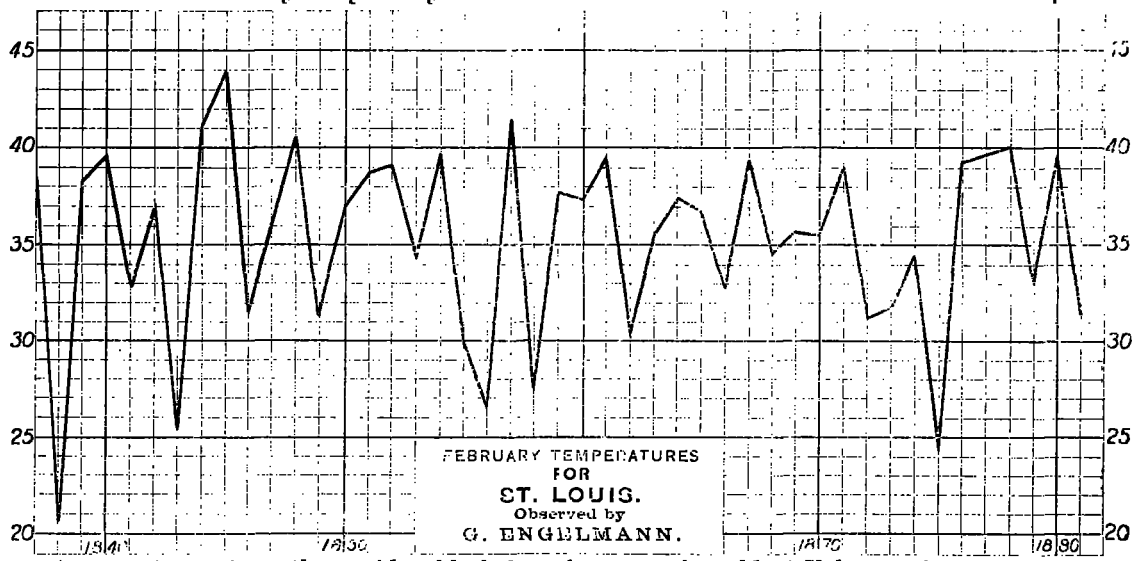
Chart No V—shows the mean pressure, temperature and wind force and the prevailing direction of the wind at 7.35 a. m. Washington, or 0.43 p. m. Greenwich, mean time, for the month of *March*, 1877, over the Northern, and at certain isolated stations in the Southern, hemisphere. During this month the Atlantic area of low pressure (as compared with January and February) is found more to the eastward, the lowest mean barometer (29.59 or 751.6) being that of Tromso, in northern Norway, while Thorshaven is 29.62 (752.3,) Stykkisholm, 29.66 (753.4,) and Godthaab, 29.74 (755.4.) The highest monthly mean is 30.24, or 768.1, at Barnaul, while the following means indicate other regions of comparatively high pressure: Angra, 30.17 (766.3,) Montgomery, Ala., 30.12 (764.8,) and Ft. Garry, Manitoba, 30.16 (766.0.) These give a barometric range in the monthly mean pressure of 0.65 inch, as compared with 1.28 in January, and 0.94 in February. The highest and lowest barometric readings, as reduced to sea level, were 30.70, or 779.8, at Barnaul on the 10th, and 28.76, or 730.5, at Thorshaven on the 12th, giving a total barometric range of 1.94 inches. The region of greatest continued cold is in Hudson's Bay territory, York Factory having a monthly mean of —22° F.; the lowest single reading observed during the month, —34° F., occurred at this station on the 4th, and again on the 11th. The prevailing direction of the wind was *north* or *westerly* over the North American continent, except *southerly* along the eastern slope of the Rocky Mountains, and *westerly* over Europe, trending to *southerly* over northern Asia, while *easterly* winds prevailed at Godthaab and Stykkisholm. In comparing the present with the preceding month, the most marked changes are found to be an increase in pressure from the Canadian Maritime Provinces (Sydney 0.19 inch and Heart's Content 0.36) to Godthaab (0.18), Stykkisholm (0.20) and northern Europe Tromso 0.15 inch), and a decrease elsewhere, amounting to 0.20 inch in Siberia, southwestern Europe and interior of the North American continent. The temperature changes show a decided fall over the last region,

which, at York Factory, amounts to 17°.4 F. and an almost general though only slight fall over western Europe; elsewhere a general increase is found, which, over eastern Russia and at all the Siberian stations, exceeds 20° F.

TEMPERATURE OF THE AIR.

Temperature of the Air.—The mean temperature of the air for February, 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 reduced in the main from observations taken at Signal Service stations, and covering periods ranging from three to eighteen years. In the two remaining columns are shown the present monthly means and departures from such means during February, 1881. Throughout the whole country east of the 107th meridian, including the northern Rocky Mountain slope but excluding New England and the Florida peninsula, the temperature has been below the normal. In the two latter districts and in the Northern Plateau region it has experienced no change, while to the westward in the remaining districts the temperature has risen above the normal. The following large abnormal deviations may be noted: Ft. Bennett, —14°.7; Omaha, —9°.7; Dodge City, —9°.0; Leavenworth, —7°.9; Yankton, —7°.2; North Platte, —6°.8; Ft. Gibson, —6°.6; Ft. Sill, —6°.2; La Crosse, —4°.5.

Deviations from Mean Temperatures.—Under this heading, departures exhibited by the reports from regular Signal Service stations are shown in the table of comparative temperatures on the right-hand side of chart No. II. The following items of importance, in connection with this topic, are reported from voluntary observers: *Illinois:* Belvidere, mean temperature 5°.7 below mean of February for past 14 years. Riley, mean temperature 5°.3 below mean of past 20 years; coldest February was in 1875; winter of 1880–81, 7°.2 colder than the mean of the winter seasons for the past 20 years; coldest winters, 1873 and 1875. *Iowa:* Clinton, mean temperature of month considerably below the normal. Logan, coldest in past 20 years. *Kansas:* Holton, coldest and roughest February ever experienced in the State. Lawrence, mean temperature 7°.21 below the mean of February for past 14 years; coldest February in 1875. *Maine:* Gardiner, mean temperature 0°.15 below that of February for past 45 years. *Maryland:* Sandy Springs, coldest in past 15 years. *Massachusetts:* Westborough, month unusually cold. Williamstown, month very cold. *Michigan:* Thornville, mean temperature 5° below that of February for past 10 years. Northport, month unusually cold, weather worst ever experienced. *Nebraska:* Howard, mean temperature 8° below that of February for past 5 years. *Missouri:* The Missouri Weather Service reports the



mean temperature of month considerably below the normal; coldest February in past 45 years occurred in 1838, mean temperature 20°.8; warmest, in 1845, 44°.0. The above diagram shows the curve of mean temperatures for February, as furnished by Prof. F. E. Nipher of the "Missouri Weather Service." As compared with the observations taken at the Signal Service stations in St. Louis during the past ten years, these curves appear to be reliable. *New Hampshire:* Grafton, month unusually cold and remarkable for rapid and extreme changes of temperature. Contoocookville, mean temperature about normal as compared with record of past 10 years. *New York:* North Volney, mean temperature, 2°.2 below that of past 12 years; coldest February in 1875, mean temperature 17°8; warmest in 1880, mean 28°.7. Palermo, coldest February in past 28 years, except 1868, 1875, and 1879; 1880–81, coldest winter in past 28 years, mean, 11°.7; warmest in 1877–78, mean, 27°.0. *North Carolina:* Portsmouth, coldest in past 20 years. *Pennsylvania:* Dyberry, coldest in past 17 years.