

MONTHLY WEATHER REVIEW,

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(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to June 20th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 133 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 197 monthly journals and 174 monthly means from the former, and 15 monthly means from the latter; 212 monthly registers from Voluntary Observers; 58 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from the local Weather Services of Iowa, Nebraska and Missouri, and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The distribution of mean atmospheric pressure over the United States and Canada for the month of May, 1881, is shown by isobaric lines (in black) upon Chart No. II. The area of low pressure, which remained about central over New England and the Canadian Maritime Provinces during the past three months, has now disappeared, being replaced by pressures ranging from 30.05 to 30.11, which are the highest on record for any June since 1874, and together with the Northern Pacific coast, are the regions of highest pressure for the month. The regions of lowest pressure occupy the Upper Mississippi and Lower Missouri valleys and California. Compared with the preceding month, the pressure is considerably higher east of the 87th meridian, ranging from +0.05 to +0.16, while to the westward of that boundary a decrease is observed, ranging from -0.02 to -0.14. Compared with the same month in previous years, the disposition of pressure is very much the same, except the remarkably high area over the Canadian Maritime Provinces. Heretofore the pressure has averaged about 29.95 in this section, while the high areas were common to the Northern Pacific coast and the Eastern Gulf States. It is interesting to note in this connection that in the preceding month (April) the lowest pressures for many years, prevailed over the Canadian Maritime Provinces, while in the present month, the reverse prevails to even a greater degree.

Departures from the Normal Values for the Month.—The pressure is everywhere above the normal, except in the Gulf States (excluding Texas) Florida and along the Pacific coast. From the interior of the country the departures increase to the east and west, the areas of greatest deviations coinciding with the regions of highest and lowest pressure, viz: New England and the Missouri valley. Along the Atlantic coast the departures steadily increase from -0.01 inch at Jacksonville to +0.13 inch at Eastport and on the summit of Mt. Washington, the latter being the largest reported for the month. Over the interior the departures increase from -0.01 inch at New Orleans to +0.10 inch at Bismarck, while along the Pacific coast the reverse prevails as you pass northward, diminishing from -0.07 inch at San Diego to -0.01 inch at Portland, Or. At Rocky Mountain stations a variation is shown as follows: from +0.04 inch at Santa Fe to +0.08 inch at Cheyenne and Pikes Peak. Salt Lake City reports a change of +0.01 inch, Key West, -0.03, and Punta Rasa -0.07. Stations maintaining a normal condition are as follows: Galveston, Ft. Gibson, St. Vincent and Wilmington.

Barometric Ranges.—The range of pressure during the month has varied in the extremes from 0.2 inch at Campo, Cal., to 1.01 inches at Moorhead, Minn. In general the range varies from 0.4 to 0.7 inch. Ranges of 0.9 and above were reported from the following stations: North Platte, 0.97; Burlington, Vt., and St. Vincent, 0.96; Alpena, 0.94; Yankton and Albany, 0.93; St. Paul and Oswego, 0.92; Springfield, Mass., and Rochester, 0.91; Marquette and Escanaba, 0.9. Ranges of 0.35 and below were reported as follows: San Diego, 0.23; Los Angeles, 0.24; Tucson, 0.26; Ft. Grant, 0.27; Florence, 0.28; El Passo, 0.29; La Mesilla, 0.3; Camp Thomas, Ariz., 0.31; Ft. Davis, Texas, and Key West, 0.32; San Francisco, 0.34; Sacramento, 0.35. Along the eastern and western coasts of the country the range increases with the latitude. Over the southern boundary the range increases from the southwestern and southeastern extremes (California and Florida) to the maximum in Texas, and along the northern boundary from the northeastern and northwestern extremes (Maine and Washington Territory) to the maximum in Minnesota. It is interesting to note that the region of greatest range (the Red River of the North Valley) coincides with the region of least departure from the normal, showing that a considerable variation of pressure for the month of May is consistent with the peculiarities of this region. The region of the greatest departure from the normal (the New England coast, particularly Maine,) coincides with the region experiencing but a moderate range in pressure, which for the month of May is not usual, as the variations of pressure in New England are generally among the largest of the country.

Areas of High Barometer.—Six such areas, during the month of May, have been sufficiently marked to merit description. The minimum temperatures for the month occurring in the Northwest on the 2d; in the Lake region on the 2d, 3d and 4th; in the Ohio valley on the 3d and 4th; in New England and the Middle Atlantic States on the 4th and 5th, are associated with high-area No. I. The minimum temperatures in Tennessee, the East Gulf and southern portion of the South Atlantic States occurring on the 18th and 19th, are associated with a depression then central off the South Atlantic coast.

No. I.—This area, which was described as high-area No. V in the April REVIEW, was central in the Middle Atlantic States at midnight of April 30th. It moved southward during the 1st of May and, at midnight, was off the South Atlantic coast. During the 2d the pressure gradually diminished in the South Atlantic States.

No. II.—At the morning report of May 1st, the pressure was above the normal at all stations east of the Rocky Mountains, excepting Marquette and Escanaba and an area of high barometer was approaching the Lake region from the Northwest, where the pressure was 0.2 inch above the normal. This area moved slowly eastward and, on the morning of the 2d, was central in Manitoba as an area of 30.4 inches. During the 2d the temperature fell decidedly in the Lake region. Continuing its eastward movement the area was central on the morning of the 3d in Ontario, when the isobaric line of 30.4 inches embraced the whole of the Lake region, where the temperatures were from 12° to 19° below the normal. The lowest temperatures reported were 26° at Alpena and 32° at Duluth. On the morning of the 4th, the area of 30.4 inches embraced New England, the Middle Atlantic States and the greater portions of the Lake region and the Canadian Maritime Provinces. The temperatures continued below the mean in all districts east of the Rocky Mountains, excepting the Gulf States. During the 5th and 6th the pressures on the North Atlantic coast gradually decreased, the area moving eastward and disappearing on the latter date. Cautionary Signals were ordered up on the morning of the 3d, from Delaware Breakwater to Cape Hatteras. They were lowered at Chincoteague and Delaware Breakwater at midnight of the 3d, and on the North Carolina coast on the morning of the 4th, having been fully justified.

No. III.—This area appeared in the St. Lawrence valley at midnight of the 7th, and moving in easterly direction during the 8th and 9th, caused easterly winds and local rains in the Canadian Maritime Provinces and New England. At midnight of the 9th it had disappeared.

No. IV.—During the 11th the pressure rapidly increased in the extreme Northwest, and on the morning of the 12th an area of high barometer was central in the northern portion of the Missouri valley, where the barometer was 0.3 inch above the normal. Following in rear of low area No. II this area moved across the Lake region and up the St. Lawrence valley, and at the afternoon report of the 14th had disappeared. In advance of this area the temperatures in the Lower Lake region, the Middle Atlantic States and New England were extremely high. On the 11th and 12th a decided fall occurred in the Mississippi and Missouri valleys, and on the latter date in the Lake region. An abnormal fall of 33° in eight hours was reported from Port Huron at Midnight of the 12th. The maximum temperatures for the month in the Middle Atlantic States occurred on the 13th, at which time the high area was in the Lake region, and the winds in the Middle Atlantic States were northwesterly. The temperature fell decidedly on the 14th.

No. V.—At the morning report of the 15th the pressures east of the Mississippi were below the normal. During the 15th the pressures recovered in the Lake region, New England and the St. Lawrence valley. The barometer continued to rise rapidly in the Canadian Maritime Provinces during the 16th, and an area of high barometer remained nearly stationary in the Gulf

of St. Lawrence during the 16th, 17th, 18th and 19th. On the latter date the pressures diminished somewhat, but recovered by the morning of the 20th, and continued high until midnight of the 21st, after which time the pressures decreased. This area, in connection with low areas Nos. III and IV caused strong northeasterly winds and heavy rains in New England and the Middle Atlantic States from midnight of the 15th until the 22d. Cautionary Signals were ordered up at Eastport, Portland, Boston and Wood's Holl at midnight of the 16th, and the signals ordered in advance of low area No. III from Chincoteague to New Shoreham were kept displayed until the afternoon of the 17th, when lowered. The signals on the New England coast were lowered on the afternoon of the 19th. All signals were justified by the following maximum velocities: Eastport, NE. 55 miles; Portland, NE. 32; Boston, NE. 36; Wood's Holl, NE. 28; Thatcher's Island, NE. 44; New Shoreham, NE. 48; Sandy Hook, NE. 26, and Chincoteague, NE. 28.

No. VI.—The pressures remained above the normal east of the Mississippi after the passage of area No. V. During the 22d the barometer rose in Canada, and on the morning of the 23d a high area, of 0.3 inch above the normal, was central north of Montreal. This area moved slowly eastward, and at the afternoon report of the 26th was central east of the Canadian Maritime Provinces. On the 27th it had disappeared.

Areas of Low Barometer.—Five such areas are charted for the month of May. Nos. IV and V are specially interesting from the unusual paths pursued by them. None of the storms charted displayed particular energy.

No. I.—On the morning of the 1st the barometer was above the normal at all stations east of the Rocky Mountains, excepting Marquette and Escanaba, and a depression of slight energy was central over Lake Superior. Light rain and cloudy weather prevailed in the Upper Lake region and in the Lower Missouri and Upper Mississippi valleys; elsewhere in the United States the weather was fair. The pressure diminished rapidly in the St. Lawrence valley during the 1st, and the depression moved eastward, north of the Lake region, and was central in the St. Lawrence valley at midnight. It crossed the Canadian Maritime Provinces during the 2d, and at the morning report of the 3d it had disappeared. In rear of this depression and in advance of high area No. II cautionary signals were ordered up at midnight of the 1st at Escanaba, Milwaukee, Grand Haven and Chicago. They were lowered at midnight of the 2d, having been justified at all stations excepting Chicago. This area caused rain in the Northwest, the Lake region, the Ohio valley and Tennessee, New England and the Middle Atlantic States. The weather cleared on the 1st in the Northwest and, on the 2d, in the Lake region and New England. Light local rains continued in the Middle Atlantic States until the 4th.

No. II.—The pressures remained low in the Northwest and in Manitoba from the 5th until the morning of the 11th, at which time an area of 29.7 inches was central in Minnesota. Cloudy weather and light rains were reported from the extreme Northwest; elsewhere in the United States fair weather prevailed. This depression, moving northeastward to Lake Superior, and thence eastward, was central near Montreal at midnight of the 12th. At the morning report of the 13th it had disappeared. This area was not accompanied by high winds. It caused light rains in the Upper Lake region during the 11th and 12th, and in New England on the latter date.

No. III.—During the 12th and 13th the barometer fell slowly in the extreme Northwest and on the afternoon of the 13th a depression was central north of Fort Buford. Cloudy weather and rain prevailed in the Lake region and in the northern portion of the Upper Mississippi valley during the 13th, and the depression taking a southeasterly course was central north of St. Paul on the morning of the 14th; thence the depression moved eastward and at midnight was north of Saugeen. During the 15th it moved southeastward and at midnight was central in New Jersey; thence it continued its southerly course and passed to the east of the South Atlantic coast, where the pressure remained below the normal until the 17th, on which date low area No. IV commenced to move northward. This area caused light rains in the Lake region, New England and the Middle Atlantic States. It did not exhibit much energy within the limits embraced in the weather maps. High winds were reported from the Lake region on the 15th. The cautionary signals displayed on the Atlantic coast have been considered in connection with high area No. V.

No. IV.—This area was probably a secondary development of No. III. During the 16th and 17th the barometer continued low on the South Atlantic coast, and threatening weather, with rain, continued in New England and the Middle Atlantic States, in which districts the winds were under the influence of high area No. V, which was in the Gulf of St. Lawrence. On the morning of the 18th a depression was central southeast of Cape Hatteras. At this time cloudy and rainy weather, accompanied by strong northeasterly winds, prevailed from Eastport, Me. to Cape Lookout. The cautionary signals which had been hoisted from Eastport to New Shoreham on the 16th were kept displayed. During the 18th the depression moved northward, and at the afternoon report was east of Cape May. Thence it moved westward, and at midnight was central west of Barnegat, and on the morning of the 19th was west of Philadelphia. Thence it moved north to Ontario; was northwest of Rockliffe on the morning of the 20th, and afterwards remaining nearly stationary, gradually filled up.

No. V.—On the morning of the 28th this area was central in the western portion of Minnesota. Light rains were reported from the Missouri valley, and heavy rains, accompanying thunder storms, from Texas. The depression moved slowly southward during the 28th, and on the morning of the 29th was southwest of Omaha, where it remained stationary until midnight. On the morning of the 30th it was southwest of Leavenworth; at the afternoon report it was central in Indian Territory. During the 31st it moved to Southern Texas, where it ceased to exist as an independent depression.

INTERNATIONAL METEOROLOGY.

Two International Charts, Nos. V and VI, accompany the present REVIEW. The former, prepared for the month of June, 1877, is published in accordance with an explanation given in the leading paragraph under *International Meteorology* in the January, 1881, REVIEW. The barometric pressure over India, which, beginning with the chart for January, 1877, was indicated by isobars in broken lines copied from the "Report on the Meteorology of India for 1877," published by the government of that country, has, for the present month (June, 1877), been prepared from the data of simultaneous observations which were commenced by the Government of India on the first of that month. Chart No. VI is for June, 1879, and continues the series of this chart begun in October, 1877.

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 June, 1877, over the northern, and at certain isolated stations in the southern hemisphere. The area of lowest pressure covers northwestern Siberia, extending thence eastward over the extreme northern portion of Russia and Scandinavia and still further eastward to Iceland and Greenland. The low area over Siberia appears to have been the result of a gradual translation northeastward of the low pressure of the previous month of *May*, which during that period occupied the region just north of the Black Sea. The depression over Iceland and Greenland appears to have resulted from a movement to the northeastward of a low pressure area, which in *May* prevailed over the Canadian Maritime Provinces. These two individual movements, pursuing almost parallel paths to the northeastward, appear to have combined their influences over the Arctic Ocean to the northward of Europe, affecting thereby in a marked manner the mean pressure over considerably more than 180° of longitude. The pressure is low throughout the interior of Asia and along the Asiatic coast. Over the United States the area of low extends northward from Texas to British America and thence eastward to Canada and the Maritime Provinces. The lowest pressures of the month were reported from the following stations: Yeniseisk, 29.65 (753.1); Ekaterinburg, 29.69 (754.1); Tromso, 29.70 (754.4); Godthaab, Stykkisholm, Kasan and Archangel, 29.74 (755.4); Barnaul, 29.75 (755.7). The area of highest pressure, except at isolated stations, occupies Algeria and probably extends thence westward into the Atlantic. The isobar of 30.00 incloses southwestern Europe while considerably higher pressures occur at isolated stations in Prussia, Turkey and Italy. Over the United States this isobar covers the southeastern portion, including the Gulf and South Atlantic States, Tennessee and the lower half of the Middle Atlantic States. Pressures of 30.10 and above were reported from the following stations; Melbourne, 30.34 (770.5); Ponta Delgada, 30.21 (767.2); Mauritius, 30.20 (767.1); Kingston, Jamaica, and Angra, 30.17 (766.2); Cape Town, 30.15 (765.7); Portland, Or., Mexico and Honolulu, 30.13 (765.3); Valona, 30.14 (765.5); Funchal, Tabessa and Laghouat, 30.12 (765.1); Breslau, Sfax and Geriville, 30.11 (764.7); Frankfort-on-the-Main, 30.10 (764.5). The extreme monthly range of mean pressure is 0.69 inch, the largest since *February* and nearly double that of *May*. The lowest temperatures, given in Fahrenheit's scale, were reported from the following stations: York Factory, 38°; Godthaab, 44°; Stykkisholm, 46°; Ft. St. Michaels and Nikolaievsk, on the Amoor, 47°. In this connection it is desired to call attention to an error in calculation which occurred in obtaining the mean temperature of York Factory for *May*. It should have been entered 36°.5 instead of 43°, as indicated upon the chart for that month. The highest temperatures were reported from northern India and central Algeria, in the former ranging from 95° to 101° and in the latter from 85° to 97°. The prevailing direction of the wind was *variable* over the United States west of the 100th meridian, in the Lake region and in Canada, *southerly* over the interior, and *southwesterly* along the Atlantic coast. Over Europe, *southwesterly* along the coast and to a considerable distance inland; beyond the 10th meridian *east* and in Algeria *north* and *northwest*. Over Asia *variable* and in India *southwest* to *west* and *northwest*. Compared with the preceding month there has been a general rise in pressure over North America south of parallel 50° ranging from +0.02 to +0.11 inch, while to the northward the decrease has been quite marked, being -0.16 inch at York Factory. Over Europe south of parallel 60° the increase in pressure has been quite large, ranging in the extremes from +0.08 to +0.22 inch. In Scandinavia and eastward over Russia and Siberia there has been a decided decrease, ranging from -0.02 to -0.27 inch. At isolated stations the following changes are noted: Melbourne, +0.39 inch; Ft. St. Michaels, +0.28; Hobart Town, +0.24; Ft. Napier, +0.21; Ponta Delgada and Angra, +0.15; Cape Town, +0.18; Mauritius, +0.10; Free Town, +0.06; Para-