

that was possible to render the observations useful in forecasting. They could not themselves issue forecasts. This, indeed, can only be done from a central office receiving information by wire, at short intervals, from a great many stations, near and remote.

The directors started in 1883 with the intention of performing a big and costly experiment in atmospheric physics, which, in their opinion, ought to cover a sun-spot period, that is, from eleven to twelve years. This experiment they have been able to complete by the aid of public generosity. For the first seven years after 1883, when the observatory at the top of Ben Nevis was opened, there were no hourly observations at sea level for purposes of comparison, so that the experiment began in a complete form only twelve years ago, 1890, when the low-level observatory at Fort William was also opened.

It will be borne in mind that the directors consist of men of high scientific standing—no higher could be found—and the members of the Scottish Meteorological Society should know that these gentlemen continue to hold the opinion expressed at the meeting of the British Association, at Manchester in 1887, namely, "That the Ben Nevis observations are of the highest utility in the development of meteorology and in framing forecasts of storms and weather for the British Islands."

**CORRIGENDA.**

Page 370, column 1, line 16, for "1893" read "May, 1894."  
Page 370, column 1, line 20, for "1895" read "December, 1896."

**THE WEATHER OF THE MONTH.**

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

**CHARACTERISTICS OF THE WEATHER FOR AUGUST.**

The amount of sunshine was normal in the upper Lake region; above normal in the Atlantic and west Gulf States, and the southern slope, southern and northern Plateau and north Pacific coast regions; elsewhere, below normal.

The relative humidity was normal in the middle slope and Middle Atlantic States; below in New England, Florida Peninsula, the South Atlantic and Gulf States, and the southern slope, southern Plateau, and middle and north Pacific coast regions, and above normal in the remaining districts.

Generally the precipitation was above the normal in North Dakota, the Missouri and upper Mississippi valleys, and the middle slope and southern Plateau regions; elsewhere it was below, except in the southern Pacific district where it was normal.

Temperatures were normal in the Ohio Valley and Tennessee; they were below in New England, the Middle and South Atlantic States, Lake regions, North Dakota, the Missouri and upper Mississippi valleys, and the Plateau and southern Pacific regions, and above in the remaining districts.

**PRESSURE.**

The distribution of monthly mean pressure is shown graphically on Chart IV and the numerical values are given in Tables I and VI.

The highest mean pressure obtained on the north Pacific coast, with readings slightly above 30.05 inches; and an area of somewhat lower mean readings overlay the upper Ohio Valley and the Lakes Huron and Michigan region. The lowest mean readings, generally somewhat below 29.85 inches, occurred over the southwestern portion of the country. The pressure was above the normal in the Pacific coast, Plateau and upper Lake regions and the upper Mississippi Valley, the greatest departures being +.08 inch; generally elsewhere the pressure was below the normal in values somewhat less than in the area of excess. Over the southeastern half of the United States and on the middle Pacific coast the pressure diminished from that of the preceding month, and generally by values ranging from -.05 inch to -.09 inch; elsewhere it increased, the area of greatest departure overlying the western part of the upper Lake region and upper Mississippi Valley, where the changes amounted to +.05 inch to +.07 inch.

**TEMPERATURE OF THE AIR.**

The distribution of monthly mean surface temperature, as deduced from the records of about 1,000 stations, is shown on Chart VI.

Generally the position of all isotherms was to the southward of their location in August, 1901, excepting in the Pacific coast districts where their trend was about the same, and in southeastern California and the extreme southwest where the mean temperatures were considerably lower during August, 1902. Maximum temperatures of 90°, or higher, occurred, except in the northeastern and north-central portions of the country, in scattered sections of the mountainous districts of the Virginias,

in the northern Plateau region, and along the Pacific coast; of 100°, or higher, in the southern portion of the South Atlantic States, in the Gulf States, southern and middle slope, southern Plateau, and the southeastern and extreme southern part of the middle Plateau regions; and 110°, or higher, in southeastern California and western Arizona. Minimum temperatures below 50° occurred generally over the northern half of the United States, in the northern portion of the southern slope and in the middle and northern slope, and the Plateau and Pacific coast districts, except in the interior of California. Temperatures of 32°, or lower, occurred in scattered portions of the Northwestern States. The temperature was above the normal from the interior of the South Atlantic States westward to the central parts of Arizona and Utah, and northward to central Nebraska, in north-central Montana, and in portions of the Pacific coast districts. The greatest departures, +4° to +5°, occurred in the central part of the east Gulf States, the northwestern part of the west Gulf States, and the northern part of the southern slope and southern part of the middle slope regions.

The average temperature for the several geographic districts and the departures from the normal values are shown in the following table:

*Average temperatures and departures from normal.*

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
New England	8	65.1	-1.6	+ 2.4	+0.8
Middle Atlantic	12	71.9	-1.3	- 3.8	-0.5
South Atlantic	10	78.5	-0.1	- 6.8	-0.8
Florida Peninsula	8	81.9	+0.6	- 3.6	-0.4
East Gulf	9	82.9	+3.2	+ 0.5	+0.1
West Gulf	7	83.5	+2.9	+ 5.3	+0.7
Ohio Valley and Tennessee	11	74.9	0.0	- 6.0	-0.8
Lower Lake	8	67.3	-2.2	- 2.6	-0.3
Upper Lake	10	64.0	-1.7	+11.4	+1.4
North Dakota	8	65.2	-1.1	+15.4	+1.9
Upper Mississippi Valley	11	71.0	-1.8	+ 2.7	+0.8
Missouri Valley	11	72.2	-0.8	+ 7.5	+0.9
Northern Slope	7	68.1	+0.3	+10.7	+1.3
Middle Slope	6	77.6	-3.0	+10.3	+1.3
Southern Slope	6	82.6	+4.0	+10.6	+1.3
Southern Plateau	13	75.0	-1.2	- 2.8	-0.4
Middle Plateau	9	68.8	-1.5	+ 1.3	+0.2
Northern Plateau	12	66.3	-1.7	+ 1.5	+0.2
North Pacific	7	61.9	+0.2	+ 1.9	+0.2
Middle Pacific	5	65.0	+0.3	- 1.7	-0.2
South Pacific	4	69.5	-2.0	- 4.5	-0.6

*In Canada.*—Prof. R. F. Stupart says:

The mean temperature of August was slightly above average in portions of Saskatchewan and Manitoba, and also in New Brunswick and Quebec bordering on the Gulf of St. Lawrence, but over all other portions of the Dominion departures from average were negative. In Northern British Columbia the departure was between 3° and 6° below, and in Ontario from 1° to 3° below.

**PRECIPITATION.**

The rainfall was, as a rule, unevenly distributed, and generally over the greater portion of the country deficient; the

greatest deficiencies occurred in the South Atlantic and Gulf States, yet at scattered stations within the East Gulf and South Atlantic States decided excesses of rainfall occurred, the total amounting to over eleven inches at some places. The greatest excesses of rainfall are reported from the central and lower Missouri and central Mississippi valleys, numerous stations within those districts reporting from five to eleven and one-half inches during the month. Practically no rainfall was reported from south-central Texas and southern California.

*Average precipitation and departure from the normal.*

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
New England.....	8	<i>Inches.</i> 2.44	64	<i>Inches.</i> -1.4	-2.3
Middle Atlantic.....	12	3.31	73	-1.2	-3.9
South Atlantic.....	10	4.50	63	-2.1	-11.1
Florida Peninsula.....	8	5.40	79	-1.4	-2.8
East Gulf.....	9	3.05	54	-2.6	-12.6
West Gulf.....	7	0.47	13	-3.1	-7.7
Ohio Valley and Tennessee.....	11	2.10	60	-1.4	-8.0
Lower Lake.....	8	1.88	46	-1.6	-0.3
Upper Lake.....	10	1.87	63	-1.1	-1.9
North Dakota.....	8	1.75	121	+0.3	+1.4
Upper Mississippi Valley.....	11	5.00	167	+2.0	+1.9
Missouri Valley.....	11	4.07	137	+1.1	+0.4
Northern Slope.....	7	0.77	66	-0.4	+0.1
Middle Slope.....	6	3.09	124	+0.6	+2.0
Southern Slope.....	6	1.44	62	-0.9	+1.1
Southern Plateau.....	13	1.75	118	+0.2	-1.6
Middle Plateau.....	8	0.21	34	-0.4	-1.4
Northern Plateau.....	12	0.44	81	-0.1	-0.3
North Pacific.....	7	0.46	53	-0.4	+3.0
Middle Pacific.....	5	T.	0	-0.1	+1.4
South Pacific.....	4	T.	100	0.0	-0.4

*In Canada.—Professor Stupart says:*

In southern Alberta, as for several months past, the rainfall was excessive, but over the Northwest Territories generally, it was less than average, as it also was in British Columbia. In Ontario it was for the most part below average, but from Montreal eastward it was well up to, or in excess of, average, especially in eastern Nova Scotia, where there were some extensive rainfalls during the first half of the month.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 6, 15. Arizona, 4, 9, 11, 25. California, 13. Colorado, 3, 11, 12, 14, 15, 20, 21, 22, 23, 25, 28, 30, 31. Connecticut, 27. Florida, 28. Georgia, 4, 15, 16, 21. Idaho, 12, 16. Illinois, 4, 7, 10, 14, 15, 17. Indiana, 3, 20. Iowa, 1, 2, 3, 4, 5, 9, 10, 14, 15, 17, 18, 19, 20. Kansas, 8, 9, 10, 18, 20, 21, 23, 29. Kentucky, 5, 6, 21. Maine, 8, 22, 23. Maryland, 1, 3, 4, 24, 27. Massachusetts, 4, 23. Michigan, 2, 6, 21. Minnesota, 1, 9, 10, 16, 20, 29. Mississippi, 20. Missouri, 3, 5, 8, 9, 10, 17, 18. Montana, 7, 8, 12, 13, 14, 16, 17, 25, 26. Nebraska, 4, 5, 7, 8, 9, 10, 18, 20, 21, 22, 25, 30. Nevada, 7, 8, 10, 11. New Hampshire, 8, 22, 23, 25. New Jersey, 3, 21, 24. New Mexico, 1, 6, 7, 21, 22, 24, 28. New York, 3, 16, 22. North Carolina, 6, 14, 21, 22. North Dakota, 1, 18, 19, 25, 31. Ohio, 2, 3, 6, 7, 20, 29, 30. Oklahoma, 7, 19. Oregon, 14. Pennsylvania, 3, 6, 19, 20, 21, 24, 28. South Carolina, 4, 5, 15, 20, 21, 22. South Dakota, 1, 17, 18, 19, 21. Tennessee, 4, 6, 15, 18, 19, 20, 21. Texas, 28. Utah, 3, 12, 28. Virginia, 4, 6, 9, 11, 15, 21, 28. West Virginia, 2, 3, 9, 20. Wisconsin, 7. Wyoming, 7, 28.

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the table below:

*Average cloudiness and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England.....	4.8	-0.2	Missouri Valley.....	5.4	+1.9
Middle Atlantic.....	4.6	-0.4	Northern Slope.....	4.0	+2.0
South Atlantic.....	4.7	-0.5	Middle Slope.....	4.0	+2.2
Florida Peninsula.....	4.7	-0.5	Southern Slope.....	2.8	-2.0
East Gulf.....	5.0	+0.1	Southern Plateau.....	3.3	+0.1
West Gulf.....	2.5	+1.9	Middle Plateau.....	3.3	+1.1
Ohio Valley and Tennessee.....	4.7	+0.2	Northern Plateau.....	2.7	+0.3
Lower Lake.....	4.8	+0.3	North Pacific.....	3.6	+0.3
Upper Lake.....	4.8	0.0	Middle Pacific.....	3.6	+0.3
North Dakota.....	4.4	+0.5	South Pacific.....	3.1	+0.6
Upper Mississippi Valley.....	5.5	+1.4			

HUMIDITY.

The averages by districts appear in the subjoined table:

*Average relative humidity and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England.....	80	-2	Missouri Valley.....	75	+8
Middle Atlantic.....	75	0	Northern Slope.....	58	+7
South Atlantic.....	79	-3	Middle Slope.....	61	0
Florida Peninsula.....	76	-5	Southern Slope.....	55	-9
East Gulf.....	75	-5	Southern Plateau.....	41	-7
West Gulf.....	73	-1	Middle Plateau.....	37	+5
Ohio Valley and Tennessee.....	73	+2	Northern Plateau.....	44	+1
Lower Lake.....	74	+4	North Pacific.....	73	-6
Upper Lake.....	75	+1	Middle Pacific.....	67	-1
North Dakota.....	71	+3	South Pacific.....	69	+6
Upper Mississippi Valley.....	76	+6			

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

*Maximum wind velocities.*

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Atlanta, Ga.....	19	51	n.	Kansas City, Mo.....	10	55	nw.
Cape Henry, Va.....	11	59	nw.	Lexington, Ky.....	21	52	w.
Do.....	16	51	ne.	Marquette, Mich.....	31	53	w.
Denver, Colo.....	9	52	n.	Mount Tamalpais, Cal.....	15	50	w.
El Paso, Tex.....	12	56	sw.	Do.....	16	63	nw.
Fort Smith, Ark.....	31	64	w.	Do.....	30	51	nw.
Hatteras, N. C.....	3	52	n.	New York, N. Y.....	11	56	nw.
Do.....	6	52	w.	Norfolk, Va.....	11	54	nw.
Huron, S. Dak.....	1	58	s.	Point Reyes Light, Cal.....	16	56	nw.

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

*Thunderstorms.*—Reports of 6,524 thunderstorms were received during the current month as against 5,891 in 1901 and 8,266 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 10th, 406; 20th, 329; 3d, 314; 5th, 297.

Reports were most numerous from: Missouri, 500; Iowa, 410; Nebraska, 360; Kansas, 349.

*Auroras.*—The evenings on which bright moonlight must

have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 15th to 23d.

In Canada: Thunderstorms were reported as follows: St. John, N. B., 4; Halifax, 5; Grand Manan, 8; Yarmouth, 8, 16, 23; Charlottetown, 4, 9; Father Point, 3; Quebec, 3, 6, 7, 8, 26; Montreal, 1, 21; Ottawa, 4, 26; Kingston, 3, 21; Toronto, 1, 3, 5; White River, 2, 3, 5, 8, 26; Port Stanley, 5, 7; Sau-

geen, 31; Parry Sound 3, 31; Port Arthur, 2, 5, 17; Winnipeg, 4, 6, 18, 28, 31; Minnedosa, 1, 16, 18, 31; Qu'Appelle, 1, 26, 28; Medicine Hat, 4, 13, 17, 18, 27; Swift Current, 3, 7, 15, 17, 26; Calgary, 16; Banff, 27; Prince Albert, 1, 12; Battleford, 1, 24; Barkerville, 16; Hamilton, Bermuda, 4, 5, 13, 17, 18, 23, 25, 26, 27, 28.

An aurora was reported from Swift Current, Assin., on the 31st.

**DESCRIPTION OF TABLES AND CHARTS.**

By W. B. STOCKMAN, Forecast Official, in charge of Division of Records and Meteorological Data.

Table I gives, for about 145 Weather Bureau stations making two observations daily and for about 25 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station, the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (. . .).

Table III gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table IV gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table V gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes.....	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates per hour (ins.).....	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table VI gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table VII gives the heights of rivers referred to zeros of gages; it is prepared by the Forecast Division.

**NOTES EXPLANATORY OF THE CHARTS.**

Chart I, tracks of centers of high areas, and Chart II, tracks

of centers of low areas, are constructed in the same way. The roman numerals show number and chronological order of highs (Chart I) and lows (Chart II). The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the observations at 8 a. m. and 8 p. m., seventy-fifth meridian time. Within each circle is also given (Chart I) the highest barometric reading and (Chart II) the lowest barometric reading at or near the center at that time, and in both cases as reduced to sea level and standard gravity.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all by 0.0.

Chart IV.—Sea-level pressure and resultant surface winds. The pressures have been reduced to sea level and standard gravity by the method fully described by Prof. Frank H. Bigelow on pages 13-16 of the Review for January, 1902. The pressures have also been further reduced to the mean of the twenty-four hours by the application of a suitable correction, to the mean of the 8 a. m. and 8 p. m. readings, at stations taking two observations daily, and to the 8 a. m. or 8 p. m. observation, respectively, at stations taking but a single observation. The diurnal corrections so applied will be found in Table 27, Volume II, Annual Report of the Chief of Weather Bureau, 1900-1901, pp. 140-164.

The isotherms on the sea-level plane have been constructed by means of the data summarized in chapter 8 of Professor Bigelow's Report on the Barometry of the United States and Canada, which can be found in the Annual Report of the Chief of the Weather Bureau for 1900-1901, Volume II. The correction  $t_0 - t$ , temperature on the sea-level plane minus the station temperature, by Table 48 of the Barometry Report, is added to the observed surface temperature to obtain the adopted sea-level temperature. On account of excessive local abnormalities of temperature in the great California Valley, between the Coast Range and the Sierra Nevada Mountains, the stations in that valley have been ignored in drawing the lines of equal temperature.

The wind directions are the computed resultants of observations at 8 a. m. and 8 p. m. daily. The resultant duration is shown by figures attached to each arrow.

Chart V.—Hydrographs for seven principal rivers of the United States, prepared by the Forecast Division.

Chart VI.—Surface temperatures; maximum, minimum, and mean of these. Lines of equal monthly mean temperature in red; lines of equal maximum temperature in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—West Indian monthly isobars, isotherms, and resultant winds.