

Heights of rivers above zeros of gauges—Continued.									Heights of rivers above zeros of gauges—Continued.								
Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.	Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.						Height.	Date.	Height.	Date.		
<i>Santee River.</i> St. Stephens, S. C.....	Miles. 50	Feet. 12	Feet. 8.1	27,28	Feet. 4.5	13,14	Feet. 7.0	3.6	<i>Susquehanna River.</i> Wilkesbarre, Pa.....	Miles. 178	Feet. 14	Feet. 12.0	13	Feet. 3.0	5-10,29,30	Feet. 5.2	9.0
<i>Congaree River.</i> Columbia, S. C.....	37	15	2.8	18	0.4	4,5	1.0	2.4	Harrisburg, Pa.....	70	17	8.8	13	2.5	8-10	4.2	6.3
<i>Wateres River.</i> Camden, S. C.....	45	24	13.0	17	4.3	13	6.9	8.7	<i>Juniata River.</i> Huntingdon, Pa.....	80	24	5.5	11	3.5	7-10	3.9	2.0
<i>Savannah River.</i> Augusta, Ga.....	130	32	17.4	17	7.4	11	9.8	10.0	<i>W. Br. of Susquehanna.</i> Williamsport, Pa.....	35	20	9.4	12	1.8	8-10,29,30	3.8	7.6
									<i>Waccamaw River.</i> Conway, S. C.....	40	7	4.1	26,27,30	1.4	12	2.7	2.7

\* Distance to Gulf of Mexico. † Record for 30 days.

THE WEATHER OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

The statistical aspects of the weather of the month are presented in the tables which form the closing part of this REVIEW. Table I, in particular, contains numerous details that are important in the study of climatology. The numerical values in the tables have been generalized in a number of cases, the results appearing on Charts Nos. III to IX, inclusive.

PRESSURE AND WIND.

*Normal conditions.*—The geographic distribution of normal barometric readings at sea level and under local gravity for November is shown by Chart V of the MONTHLY WEATHER REVIEW for November, 1898.

Normal pressure in November is highest over the middle Plateau region, where it is above 30.20 inches; it is above 30.15 over the interior of the middle and east Gulf and south Atlantic States. Normal pressure is lowest in November over the lower Colorado Valley and over the Gulf of Saint Lawrence, where it is below 30.00 inches.

As compared with October there is generally an increase of normal pressure, the increase being greatest over the middle Plateau region, where it exceeds .10 inch. The winter highs of the middle Plateau region and the south Atlantic States are now firmly established.

In November the prevailing winds of the south Atlantic States blow from the north, inclining slightly to the northeast on the Florida peninsula. Passing westward through the Gulf coast States, easterly or northeasterly winds prevail until central Texas is reached. Here the prevailing direction becomes southwesterly, which direction is preserved over a considerable area extending northeasterly to Arkansas and again from the middle Mississippi Valley to the Lake region. The prevailing winds of the upper Lakes, the Northwest, and the eastern slope of the Rocky Mountains blow from the northwest. On the Pacific coast the prevailing winds blow from the south from Oregon northward and from the north over California and portions of Arizona.

*The current month.*—The distribution of monthly mean pressure and the resultant winds are shown on Chart IV. The configuration of the isobars is in close accord with normal conditions, although both western and eastern highs are restricted somewhat in area. Pressure was below normal on the northeastern Rocky Mountain slope, the Lake region, New England, and the Canadian Maritime Provinces, although it is to be noted that pressure was reported .07 inch in excess at St. Johns, Newfoundland. As compared with the preceding month there was a rise in pressure over the southern three-fifths of the country and a fall over the remaining portion, the greatest decrease, .18 inch, occurring in Nova Scotia.

TEMPERATURE OF THE AIR.

*Normal conditions.*—The normal temperature of the air in the United States in November varies from about 74° at Key West, 61° at Jacksonville, 61° at New Orleans, 62° at Galveston, 59° at San Diego, to 37° at Eastport, 36° at Burlington, 38° at Buffalo, 38° at Detroit, 29° at Duluth, 21° at St. Vincent, 30° at Havre, 38° at Spokane, and 45° at Seattle, on Puget Sound. The warmest regions are the lower Rio Grande Valley and Florida; the coolest, Minnesota and North Dakota.

In studying the distribution of monthly mean temperatures it will be found very helpful to consult the charts at the end of this REVIEW, especially No. VI, Surface Temperatures, Maximum, Minimum, and Mean. This chart gives a very good idea of the variations of temperature with latitude and longitude, and also of the distribution of normal surface temperatures. Chart VI for any month will differ from a normal chart merely in the displacement or bending of the isotherms northward or southward according as the temperature of the particular locality is above or below the normal for the place and season.

*The current month.*—The month was devoid of abnormal conditions. Temperature continued low for the season over the Plateau region, Wyoming, parts of Montana, the Dakotas, and Kansas. Temperature was also below average in eastern Texas, the lower Mississippi Valley and Tennessee. Temperature was above average in Florida and the Lake region and also over small areas in Oregon and California.

Generally low temperatures prevailed, but the departures from the normal were not large, the greatest not exceeding 5° per day.

Two cold waves occurred during the month. The first one was widespread and rather severe for the season. On the morning of the 21st it had overspread the middle Missouri Valley, Kansas, northwestern Oklahoma and Indian Territory, and extreme northern Texas, causing a fall in temperature of from 30° to 50° from the middle Missouri Valley over the central Rocky Mountain districts and snow as far south as the panhandle of Texas. By the morning of the 22d the cold had reached the Gulf coast, extending thence in a northerly direction to the British Possessions. Minimum temperatures in the Gulf coast States were as follows: Texas, 23° at Fort Worth and 34° at Galveston; Louisiana, 25° at Shreveport and 34° at New Orleans; Mississippi, 26° at Vicksburg; Alabama, 26° at Montgomery and 31° at Mobile. The cold wave moved eastward during the succeeding twenty-four hours but the temperature fall was not so great in the lower Lake region and east of the Appalachians as it had been in the region to the westward. The second cold wave of the month moved

rapidly southeastward from the Lake Superior region during the night of the 26th. It was not so widespread as the one first described, but the temperatures registered in New England, the Middle and south Atlantic States, and the Ohio Valley and Tennessee were the lowest of the month.

Maximum temperatures of 90° and over were recorded in the lower Rio Grande Valley and portions of Arizona and southern California. The maximum temperature of the month was not above 60° in portions of Maine and from the western end of Lake Superior westward to the Pacific coast.

The lowest minimum temperatures of the month were recorded in North Dakota, the highest in Florida.

The distribution of the observed monthly mean temperature of the air is shown by red lines (isotherms) on Chart VI. This chart also shows the maximum and the minimum temperatures, the former by black and the latter by dotted lines. As will be noticed, these lines have been drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level; the isotherms relate, therefore, to the average surface of the country in the neighborhood of the various observers, and as such must differ greatly from the sea-level isotherms of Chart IV.

The average temperatures of the respective geographic districts, the departures from the normal of the current month and from the general mean since the first of the year, are presented in the table below for convenience of reference:

Average temperatures and departures from the 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	10	41.1	0.0	+ 14.1	+ 1.3
Middle Atlantic	12	44.4	- 0.3	+ 17.2	+ 1.6
South Atlantic	10	53.8	- 1.1	+ 9.6	+ 0.9
Florida Peninsula	7	67.4	+ 1.0	+ 5.3	+ 0.5
East Gulf	7	55.4	- 2.4	+ 0.9	+ 1.0
West Gulf	7	53.8	- 2.7	+ 10.5	+ 0.1
Ohio Valley and Tennessee	12	43.6	- 1.4	+ 17.6	+ 1.6
Lower Lake	8	39.0	- 0.1	+ 27.5	+ 2.5
Upper Lake	9	35.2	+ 1.8	+ 27.8	+ 2.5
North Dakota	7	22.3	- 1.0	+ 19.2	+ 1.7
Upper Mississippi	11	36.2	- 1.1	+ 18.5	+ 1.6
Missouri Valley	10	35.1	- 2.0	+ 18.3	+ 1.6
Northern Slope	7	29.6	- 2.8	+ 3.2	+ 0.3
Middle Slope	6	39.1	- 2.4	+ 7.2	+ 0.7
Southern Slope	6	46.2	- 2.4	+ 2.8	+ 0.3
Southern Plateau	13	47.4	- 0.6	+ 0.2	0.0
Middle Plateau	9	34.8	- 2.8	- 9.3	- 0.8
Northern Plateau	10	34.6	- 3.1	+ 2.8	+ 0.3
North Pacific	9	44.3	- 0.8	+ 8.3	+ 0.8
Middle Pacific	5	52.4	- 1.2	- 5.6	- 0.5
South Pacific	4	57.5	0.0	+ 3.9	+ 0.4

In Canada.—Prof. R. F. Stupart says:

Temperature was from average to 2° below in that portion of Ontario contained in the country from the St. Clair River northeast and east, respectively, to the southern shores of the Georgian Bay and the western portion of Lake Ontario, and above elsewhere to the eastward in all localities as far as our extreme eastern Atlantic and Gulf of St. Lawrence shores, the excess being as great as 6° at Halifax, 5° at Charlottetown, and 4° at Sydney. In northern Ontario it was as much as 3° above average. In Manitoba it was generally a little above average, so also in Vancouver Island. In the northern portion of Saskatchewan it was likewise above, generally, but elsewhere the temperature in the Territories was not up to average, the deficiency amounting to from 2° to 3° in southern Alberta.

FROST.

Alabama.—Mobile, first killing frost, or freezing temperature, 23d.

Florida.—Heavy frost at Crawfordville, 23d; De Funiak Springs, 20th, 23d, 24th, 27th, 30th; Haywood, 1st, 22d, 23d, 24th, 25th, 26th, 27th.

Georgia.—First killing frost at Jesup, Piscola, Crescent, and Savannah, 27th.

South Carolina.—First killing frost at Charleston, Edisto, Georgetown, Port Royal, St. Georges, Smiths Mills, and Ye-

massee, 27th; Cheraw, Holland, and Marion, 1st; Columbia, Gillisonville, Greenville, Pinopolis, St. Matthews, Statesburg, Summersville, Winnsboro, and Wolling, 25th; Society Hill, 24th.

Texas.—Killing frost at Boerne, 22d, 23d; Brenham, 23d; Corsicana, 10th, 22d, 23d, 24th; Dallas, 22d, 23d, 24th, 25th; Duval, 22d, 23d, 24th; El Paso, 10th; Fort Stockton, 27th; Golindo, 22d, 23d, 24th; Hallettsville, 22d; Houston, 22d, 23d; Llano, 22d, 23d, 24th; San Antonio, 22d; Waco, 23d, 24th.

PRECIPITATION.

Normal conditions.—Heavy rains in November (4 to 6 inches and over) occur in the Gulf States, lower Mississippi and Ohio valleys, Tennessee, over limited areas in New England, and on the coasts of Washington and Oregon. The normal rainfall east of the one hundredth meridian, excluding the territory above described, is from 1 to 3 inches. On the Pacific coast the area of 2-inch rains extends southward to the thirty-fifth parallel. South of the Tehachipi range in California the rainfall is less than an inch, except on the coast. Between the one hundredth and one hundred and twenty-second meridians the precipitation of November is light in quantity and variable in distribution.

The current month.—On the whole the month was one of rather more than the usual amount of precipitation. The whole of New England, the south Atlantic, and Gulf States (except small areas in Florida and western Texas), the north Pacific coast, the northern slope, the northern Plateau, the middle Plateau, southern Minnesota, Iowa, Kansas, and Nebraska received more than the average amount of precipitation.

The regions of deficient rainfall were California, the middle Mississippi and Ohio valleys, western Texas and New Mexico, and parts of the Lake region, the Dakotas, and Montana.

The greatest monthly falls occurred in southern Louisiana, southern Alabama, and on the north Pacific coast. The fall in California was considerably below the average, notwithstanding the fact that there was an abundance of rain on the coasts of Washington and Oregon.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
New England	10	6.21	155	+2.20	+ 6.80
Middle Atlantic	12	4.16	124	+0.80	0.00
South Atlantic	10	4.07	133	+1.00	- 5.80
Florida Peninsula	7	2.03	84	-0.40	- 6.90
East Gulf	7	5.70	150	+1.90	+ 2.70
West Gulf	7	3.36	85	-0.60	- 4.00
Ohio Valley and Tennessee	12	2.58	70	-1.10	+ 1.10
Lower Lake	8	3.08	97	-0.10	+ 0.20
Upper Lake	9	1.75	71	-0.70	- 1.20
North Dakota	7	0.59	86	-0.10	- 0.40
Upper Mississippi	11	1.82	86	-0.30	+ 6.20
Missouri Valley	10	1.18	80	-0.30	+ 3.20
Northern Slope	7	0.60	120	+0.10	- 0.10
Middle Slope	6	0.90	100	0.00	+ 2.30
Southern Slope	6	0.58	49	-0.60	- 3.50
Southern Plateau	9	0.55	85	-0.10	- 2.50
Middle Plateau	13	1.33	160	+0.50	- 1.40
Northern Plateau	10	2.10	130	+0.50	- 2.80
North Pacific	9	7.97	107	+0.50	- 6.10
Middle Pacific	5	1.54	51	-1.50	-10.20
South Pacific	4	0.14	10	-1.20	- 6.60

The geographic distribution of precipitation is shown on Chart III, and the numerical values for about 3,000 stations appear in Tables II and III, while the details as to excessive rains will be found in Table XI.

In Canada.—Professor Stupart says:

Precipitation was abnormally heavy throughout the Maritime Provinces, the average being exceeded by nearly 5.0 inches at Halifax and Grand Manan; by 4.2 inches at Sydney, 4.0 inches at Yarmouth, and

2.0 inches at Charlottetown. In Manitoba and also over the greater portion of the Northwest Territories precipitation was a little in excess of average, but in all the remaining portion of the Dominion it was below the usual amount, except locally in the lower Lake region, where the average was just maintained. The deficiency was very marked in Ottawa and St. Lawrence valley as well as over Vancouver Island. In the Northwest Territories and Manitoba precipitation was chiefly in the form of snow, and at the end of the month the ground was covered to a depth of 8 inches at Winnipeg to 6 inches at Battleford and 5 inches at Qu'Appelle. Several pronounced snowfalls occurred in many portions of Ontario and more locally in Quebec and the Maritime Provinces, but at the close of the month there was little snow on the ground over any portion of these Provinces except very locally. Along the north shore of Lake Superior the greatest amount on the ground reported from any station was only 3 inches.

HAIL.

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

Arizona, 20, 25. Idaho, 3, 5, 6. Illinois, 5, 17, 21. Indiana, 5. Kentucky, 5. Missouri, 5. New Mexico, 12. North Carolina, 12, 15, 19. Ohio, 5, 14. Tennessee, 5. Wisconsin, 5.

SLEET.

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

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

SNOWFALL.

The total snowfall for the current month is given in Tables I and II, and its geographic distribution is shown on Chart VIII. An examination of this chart shows that, aside from isolated mountain stations in Colorado and Wyoming, the snowfall of New England was greater than for any other region. The region about the southern end of Lake Michigan received a rather generous snowfall, two stations in Michigan reporting 24 and 33 inches, respectively. There was another but smaller region of heavy snow in central and western Iowa. Heavy snow, 10 inches and over, also fell in northern Wisconsin and eastern Minnesota. The snowfall of the middle and northern mountain regions of the West appears to have been fairly generous. The fall in the southern part of the mountain system was somewhat deficient.

The depth of snow on the ground at the end of the month is shown on Chart IX. The snow covering was heaviest in New England, the upper Mississippi Valley, and in the mountain regions of Colorado, California, and Idaho. The snow covering was very light in the Ohio Valley, throughout Indiana, Illinois, Missouri, western Kansas, Nebraska, South Dakota, western North Dakota, and Montana.

HUMIDITY.

The humidity observations of the Weather Bureau are divided into two series; the first or tridaily series began in

1871 and ended with 1887; the second or twice-daily series is continuous from 1888 to the present time.

The monthly means of the second or present series are based upon observations of the whirled psychrometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, which corresponds to 5 a. m. and 5 p. m., Pacific; 6 a. m. and 6 p. m., Mountain; and 7 a. m. and 7 p. m., Central standard time.

Mean values computed from the first series are naturally not directly comparable with those of the second. In general the means of the first series are lower than those of the second, since they include an observation in the afternoon when the relative humidity of the air is near the minimum of the day. At stations in the western plateau region, however, the converse holds good, the means of the second series being lower than those of the first by amounts ranging from 0 to 10 per cent on the average of the year.

In the present state of knowledge respecting the diurnal variation in the moisture of the air, we are scarcely warranted in combining the two series in a general mean.

The current month.—The relative humidity was above the normal in six districts, exactly normal in 4, and below in the remaining eleven.

The greatest contrast between the relative humidity of adjoining geographic districts obtained in the Plateau region. The relative humidity of the southern Plateau, embracing in the latter designation the eastern half of California below the thirty-seventh parallel, all of Arizona, and the western half of New Mexico, was 10 per cent below normal, while the middle Plateau, immediately to the northward, was 4 per cent above, and the northern Plateau, still farther north, was 7 per cent above the normal.

The relative humidity of the middle and south Pacific coast was 8 and 11 per cent below normal, respectively. Dry northerly and northwesterly winds prevailed throughout the month.

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 .....	65	- 6
Middle Atlantic .....	76	+ 0	Northern Slope .....	68	- 0
South Atlantic .....	77	- 2	Middle Slope .....	61	- 1
Florida Peninsula .....	80	- 1	Southern Slope .....	60	- 1
East Gulf .....	77	+ 0	Southern Plateau .....	58	-10
West Gulf .....	74	+ 1	Middle Plateau .....	55	+ 4
Ohio Valley and Tennessee.	75	+ 1	Northern Plateau .....	60	+ 7
Lower Lake .....	74	+ 2	North Pacific Coast .....	68	- 1
Upper Lake .....	82	+ 2	Middle Pacific Coast .....	65	- 8
North Dakota .....	79	- 0	South Pacific Coast .....	56	-11
Upper Mississippi Valley .....	73	- 1			

In using the table by means of which the amount of moisture in the air is computed from the readings of the wet and dry bulb thermometers, the pressure argument has almost always been neglected, an omission that has little significance except for low temperatures and at high stations, such as Santa Fe, El Paso, Cheyenne, and a few others. The failure to apply a correction for the influence of pressure on the evaporation and therefore on the temperature of the wet-bulb thermometer has had the effect of making the monthly means of relative humidity at high-level stations too small by quantities ranging from 5 to 10 per cent. In the application of the monthly averages of the above table, or those of individual stations in Table I, to special inquiries, whether in the departments of biology, climatology, or sanitary science, this fact should be kept in mind. It should also be remembered that the hours at which observations in the Rocky Mountain Plateau region are made, viz, at 5 or 6 local mean time, morning and afternoon, give approximately the maximum and minimum values of the relative humidity for the day;



probably the means of such hours approach more nearly the true mean of the month than is the case on the Atlantic seaboard and in the seventy-fifth meridian time belt.

**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.
Amarillo, Tex.	21	68	n.	Havre, Mont.	6	52	nw.
Block Island, R. I.	26	78	ne.	Memphis, Tenn.	5	50	w.
Do.	27	90	ne.	Do.	21	52	sw.
Boston, Mass.	27	60	ne.	Mount Tamalpais, Cal.	6	52	nw.
Buffalo, N. Y.	5	68	w.	Do.	7	7	nw.
Do.	6	68	w.	Do.	19	52	nw.
Do.	15	50	w.	Do.	23	51	nw.
Do.	22	54	w.	Do.	23	52	sw.
Do.	23	50	sw.	Nantucket, Mass.	27	37	e.
Cape May, N. J.	27	55	sw.	Do.	27	37	ne.
Cheyenne, Wyo.	4	54	nw.	Neah, Wash.	22	50	sw.
Chicago, Ill.	4	58	s.	New York, N. Y.	6	50	nw.
Do.	5	52	w.	Do.	7	52	nw.
Do.	7	76	s.	Do.	11	65	nw.
Do.	9	50	ne.	Do.	20	59	nw.
Do.	10	61	ne.	Do.	25	60	w.
Cleveland, Ohio	11	52	w.	Do.	26	54	nw.
Denver, Colo.	28	50	nw.	Do.	27	64	nw.
Duluth, Minn.	21	56	nw.	Do.	28	54	w.
Do.	22	50	nw.	Pierre, S. D.	20	52	nw.
Eastport, Me.	27	62	ne.	Do.	21	59	nw.
El Paso, Tex.	20	64	sw.	Port Huron, Mich.	10	52	n.
Fort Canby, Wash.	2	60	se.	Pueblo, Colo.	20	53	n.
Do.	16	63	s.	St. Louis, Mo.	21	56	sw.
Do.	21	60	s.	Sioux City, Iowa.	5	50	nw.
Do.	27	69	se.	Do.	21	58	nw.
Do.	30	58	se.	Do.	23	60	n.
Hatteras, N. C.	19	52	w.	Vicksburg, Miss.	21	50	nw.
Do.	26	56	nw.	Woods Hole, Mass.	11	50	nw.
Do.	27	52	nw.	Do.	27	78	n.

The winds were more boisterous than usual east of the Rocky Mountains, and especially on the north Atlantic coast. The great destruction of life and property on the New England coast on November 26-27, elsewhere referred to in this REVIEW, was not wholly due to the wind, although velocities higher than ever before recorded were registered at three stations, viz, Block Island, R. I., where the anemometer was blown down by a 90-mile per hour wind, the highest previous velocity during seventeen years being 84 miles per hour. Woods Hole with a velocity of 78 miles per hour; highest previous velocity in eighteen years, 72 miles. Nantucket, maximum velocity, 72 miles; highest previous velocity, eleven years record, 62 miles.

In comparison with the storm above referred to all others that occurred during the month seem insignificant. There were, however, three dates upon which the winds at interior points were severe, as follows:

5th. Severe local storms occurred in Ohio, Indiana, and Kentucky. Near Circleville, Ohio, a large barn was blown down killing one person and injuring another. A small local whirlwind or miniature tornado caused the destruction of fences and prostrated trees near the village of Summit, Cook County, Ill. The path of the storm was a mile and a half long and a few feet wide. A man was injured by trees falling upon him.

21st-22d. The winds were very high over a large extent of territory on these dates. A north wind of 68 miles per hour was experienced at Amarillo, Tex.; a southwest wind of 52 miles per hour at Memphis, Tenn.; a northwest wind of 50 miles at Vicksburg, Miss.; a northwest wind of 58 miles at Sioux City, Iowa; and a northwest wind of 56 miles at Duluth,

Minn. Other high winds were registered, as may be seen by an inspection of the table above. Telegraph and telephone wires, and, in some cases, transportation lines suffered on account of the drifting snow and high winds. Losses were also reported from the cattle and sheep raising districts of Oklahoma, Indian Territory, and Texas. The temperature fell as much as 60° in a short time at a number of places.

25-26th. The storm of the 25-26th proved very disastrous to shipping on Lakes Superior and Michigan, not so much by reason of the wind as on account of the heavy snow that fell in connection therewith. An account of disasters to vessels during this storm was published on the Meteorological Chart of the Great Lakes.

The total wind travel during the month was above 10,000 miles at 13 stations, as may be seen by an examination of Table 1. The station having the greatest wind travel was Chicago, with 15,250 miles, closely followed by Mount Tamalpais, Cal., with 15,191 miles.

**SUNSHINE AND CLOUDINESS.**

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic and at 47 by its thermal effects. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table IX for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun for an hour after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table IX for the stations at which instrumental self-registers are maintained.

The percentage of clear sky (sunshine) for all of the stations included in Table I, obtained as described in the preceding paragraph, is graphically shown on Chart VII. The regions of cloudy and overcast skies are shown by heavy shading; an absence of shading indicates, of course, the prevalence of clear, sunshiny weather.

The formation of fog and cloud is primarily due to differences of temperature in a relatively thin layer of air next to the earth's surface. The relative position of land and water surfaces often greatly increases the tendency to form areas of cloud and fog. This principle is perhaps better exemplified in the Lake region than elsewhere, although it is of quite general application. The percentage of sunshine on the lee shores of the Lakes is always much less than on the windward shores. Next to the permanent influences that tend to form fog and cloud may be classed the frequency of the passage of cyclonic areas.

*The current month.*—There was more than the normal cloudiness, and consequently less than the normal sunshine in 13 geographical districts, less than normal in 6, and exactly normal in the remaining 2 districts. In the 13 districts of diminished sunshine the temperature was below normal in 11, above in 1, and exactly normal in 1. In the 6 districts of increased sunshine, and consequently increased inso-

lation, temperature was below normal in 4, above in 1, and exactly normal in 1.

That temperature is not always controlled by insolation seems evident from the above. The station having the greatest sunshine, Yuma, Ariz., 91 per cent, had also a temperature 1.5° below normal, while the station having the next to the least sunshine, Eastport, Me., 14 per cent, had at the same time a temperature 2.3° above normal. The low temperature at Yuma might be explained by the fact that two-thirds of the observed winds were from a northerly, and consequently colder quarter, while but one-tenth was from a southerly or warmer quarter. At Eastport much the same conditions prevailed, but with different results as to temperature; 50 per cent of the observed winds were from a northerly quarter, and but 23 per cent from a southerly quarter. We must assume that in the latter case the local winds at Eastport were but a part of a much larger mass of air of relatively higher temperature than usual, and this seems to have been the case. (See remarks of Prof. R. F. Stupart, page 499, of this REVIEW.)

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England .....	6.3	+0.7	Missouri Valley .....	4.7	-0.2
Middle Atlantic .....	5.9	+0.6	Northern Slope .....	4.6	0.0
South Atlantic .....	5.1	+0.6	Middle Slope .....	4.0	+0.4
Florida Peninsula .....	5.0	+0.4	Southern Slope .....	3.8	+0.6
East Gulf .....	5.9	+0.8	Southern Plateau .....	1.9	-0.4
West Gulf .....	5.9	+0.7	Middle Plateau .....	4.8	+1.2
Ohio Valley and Tennessee.	3.5	+0.1	Northern Plateau .....	7.2	+1.2
Lower Lake .....	7.4	0.0	North Pacific Coast .....	7.6	+0.8
Upper Lake .....	6.7	-0.3	Middle Pacific Coast .....	4.3	+0.5
North Dakota .....	4.6	-0.5	South Pacific Coast .....	2.0	-0.9
Upper Mississippi Valley...	4.8	-0.4			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, 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.**—Three hundred and thirty-three reports of thunderstorms were received during the current month as against 511 in 1897, and 619 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 5th, 133; 21st, 29; 4th, 27; 9th, 25.

Reports were most numerous from Ohio, 48; Illinois, 40; Louisiana, 33; Missouri, 23.

**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, 1st, and from the 23d to the 30th.

The greatest number of reports were received for the following dates: 11th, 10; 3d and 21st, 5; 14th, 4.

Reports were most numerous from Montana, 11; Ohio, 7; North Dakota and Wisconsin, 5.

**In Canada.**—Auroras were reported as follows: Father Point, 3, 11, 21; Quebec, 2, 3, 11, 21; Port Arthur, 12; Minnedosa, 13, 21, 22; Qu'Appelle, 20, 21, 22; Swift Current, 21, 22; Battleford, 22, 23, 24; Prince Albert, 21, 22, 23.

The only thunderstorm reported was from Yarmouth, 6th.

NOTES ON THE WEATHER OF THE WEST INDIES.

The weather was generally tranquil at all stations. A small disturbance was reported near Trinidad on the 6th, but it apparently disappeared by the morning of the 7th.

Thunderstorms were observed as follows: Colon, 3d, 12th, 14th, 16th, 19th; Bridgetown, 10th, 11th; Curaçao, 6th, 8th, 9th.

Nephoscope observations were generally begun during the month.

The telegraphing of weather reports for the season ceased on the 16th.

At this writing (January 6, 1899) the regular monthly reports for November from Kingston, Santiago, Santo Domingo, and Port of Spain have not been received.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

**Alabama.**—The mean temperature was 50.2°, or 3.3° below normal; the highest was 87°, at Goodwater on the 6th, and the lowest, 12°, at One-onto on the 27th. The average precipitation was 5.60, or 2.64 above normal; the greatest monthly amount, 9.78, occurred at Healing Springs, and the least, 1.61, at Valleyhead.—*F. P. Chaffee.*

**Arizona.**—The mean temperature was 51.5°, or 1.0° below normal; the highest was 96°, at Parker on the 6th, and the lowest, 3°, at Flagstaff on the 9th and 12th. The average precipitation was 0.56 or 0.14 below normal; the greatest monthly amount, 1.75, occurred at Lochiel, and the least, trace, at Benson, Fort Mohave, Gila Bend, and Winslow.—*W. G. Burns.*

**Arkansas.**—The mean temperature was 47.5°, or 3.2° below normal, and is the lowest for November on record; the highest was 87°, at Stamps on the 5th, and the lowest, 9°, at Mossville on the 22d, and at Winslow on the 23d. The average precipitation was 3.20, or 0.98 below normal; the greatest monthly amount, 6.46, occurred at Elon, and the least, 1.50, at Lacrosse.—*E. B. Richards.*

**California.**—The mean temperature was 51.6°, or 1.3° below normal; the highest was 102°, at Pomona on the 7th, and the lowest, 11° below

zero, at Bodie on the 25th. The average precipitation was 0.99, or 1.20 below normal; the greatest monthly amount, 9.98, occurred at Crescent City, while none fell at many stations.—*W. H. Hummon.*

**Colorado.**—The mean temperature was 31.2°, or 3.1° below normal; the highest was 85°, at Minneapolis on the 7th, and the lowest, 20° below zero, at Breckenridge on the 22d. The average precipitation was 0.98, or 0.22 above normal; the greatest monthly amount, 4.14, occurred at Ruby, and the least, trace, at Hugo and Las Animas.—*F. H. Brandenburg.*

**Florida.**—The mean temperature was 65.0°, or normal; the highest was 94°, at Lakemont on the 4th and 5th, and the lowest, 30°, at Wausau on the 24th and 30th. The average precipitation was 2.57, or about normal; the greatest monthly amount, 7.53, occurred at De Funiak Springs, and the least, 0.40, at Lemon City.—*A. J. Mitchell.*

**Georgia.**—The mean temperature was 51.4°, or 3.1° below normal; the highest was 89°, at Hawkinsville on the 6th, and the lowest, 11°, at Diamond on the 27th. The average precipitation was 4.99, or 2.74 above normal; the greatest monthly amount, 7.90, occurred at Blakely, and the least, 2.96, at Cedartown.—*J. B. Marbury.*

**Illinois.**—The mean temperature was 38.0°, or 1.1° below normal; the highest was 80°, at Danville on the 4th, and the lowest, 6° below zero, at Lanark and Scales Mound on the 27th. The average precipitation was 2.21, or 0.73 below normal; the greatest monthly amount, 4.24, occurred at Atwood, and the least, 0.99, at New Burnside. Winter wheat and rye have made a heavy growth and are strong, vigorous, and well rooted. The growth has been so rank in many counties that wheat has been pastured. Generally the plants are in fine condition, although some damage by hessian fly is reported from central and southern counties.—*C. E. Linney.*