

given in Tables I and II. The geographical distribution of snowfall is shown on Chart VI. It will be seen that no snow of any consequence fell, except on the Sierra Nevada, in the Great Basin, Wyoming, Colorado, and the western and northern parts of Nebraska.

In Canada, Prof. R. F. Stupart reports snow as follows:

British Columbia: Alberni, first snow on the 22d; Kelowna, snow low down on the hills. Assiniboia: Regina, very little rain or snow; Swift Current, slight snowstorm on the 10th. Ontario, near the Georgian Bay, snow fell in most places during the last few days of the month but was soon melted; in several eastern districts snow fell on or about the 29th; Fort William, some snow on the 29th. Maritime Provinces: Light snow fell at the end of the month.

**HAIL.**

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

Alabama, 11. Arizona, 7, 9, 24. Arkansas, 9. California, 1, 14, 21, 23. Colorado, 3, 10, 13, 15, 16, 26, 27, 29, 30. Georgia, 9, 19. Idaho, 14. Illinois, 23. Indian Territory, 10. Kentucky, 10. Louisiana, 9, 11. Maryland, 22. Michigan, 5, 6. Mississippi, 11. Missouri, 10. Montana, 12, 25. Nevada, 1, 5, 6, 7, 8, 9, 13. New York, 21, 29. Oregon, 12, 13, 21. Pennsylvania, 22. South Carolina, 10. South Dakota, 10. Tennessee, 10. Utah, 1, 7, 9, 13, 25. Virginia, 22. Washington, 12, 13, 21.

**SLEET.**

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

Arizona, 15, 25, 26. Colorado, 15, 16, 25, 26. Kansas, 25, 26, 27. Michigan, 10, 29. Minnesota, 9, 10, 11, 16. Montana, 25. Nebraska, 16, 26, 27. Nevada, 3, 13, 24. New Mexico, 16, 27, 28, 29. New York, 29, 30. North Dakota, 9, 11, 13, 14, 25. Ohio, 30. South Dakota, 8, 9, 10, 15, 26, 27. Texas, 27, 28. Utah, 7, 15, 16, 24, 25. Washington, 13.

**WIND.**

The prevailing winds for October, 1897, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

Maximum wind velocities are given in Table I, which also gives the altitudes of Weather Bureau anemometers above the ground. Maxima of 50 miles or more per hour were reported during this month as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Atlantic City, N. J. ....	24	50	n.	Kittyhawk, N. C. ....	30	60	n.
Do .....	25	53	ne.	Do .....	24	60	ne.
Block Island, R. I. ....	2	52	ne.	Do .....	25	54	nw.
Do .....	21	59	ne.	New York, N. Y. ....	17	60	nw.
Fort Canby, Wash. ....	19	70	se.	North Platte, Nebr. ....	26	51	nw.
Do .....	20	68	se.	Pueblo, Colo. ....	26	56	n.
Do .....	21	60	e.	Tatoosh Island, Wash. ....	21	54	s. e.
Do .....	23	60	e.	Do .....	23	55	s. e.
Do .....	23	76	se.	Do .....	23	50	e.
Hatteras, N. C. ....	24	56	n.				

It will be seen by the table that the highest wind velocities observed during the month occurred at coast stations, except in two cases, viz: Pueblo, Colo., and North Platte, Nebr. The storm of which these winds were a special manifestation was rather widespread and severe. In Colorado and Wyoming business was generally suspended throughout the day, railroad trains moved with a great deal of uncertainty, snow was from 1 to 2 feet in depth and badly drifted, and street traffic in the larger cities was much impeded. The damage to telegraph and telephone wires in Denver alone is said to have

been \$25,000. The property loss elsewhere in the State of Colorado, where the storm seems to have been the most severe, was stated in the press dispatches to have been nearly \$3,000,000.

The resultant winds, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table VIII. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

**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.—The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 10th, 145; 11th, 83; 12th, 56; 15th, 40.

Reports were most numerous from: Colorado, 46; Louisiana, 50; Nevada, 41; Texas, 45; Utah, 40.

Thunderstorm days were most numerous in: Colorado, 16; Louisiana and Utah, 12; Nevada, 13.

In Canada.—Thunderstorms were reported on the following dates: Halifax, 17; Father Point, 14; Ottawa, 8; Port Stanley, 7; Saugeen, 11, 16; Parry Sound, 5, 8, 11, 12, 20; Banff and Prince Albert, 1.

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, from the 5th to the 13th, inclusive. On the remaining twenty-two days of this month 140 reports were received, or an average of about 6 per day. The dates on which the number of reports of auroras for the whole country especially exceeded this average were: 1st, 19; 27th, 43; 29th, 21.

Reports were most numerous from: Maine, 19; Nebraska, 20; New Hampshire, 15; North Dakota, 25.

The number of reports was a large percentage of the number of observers in: Maine, 136; New Hampshire, 107; North Dakota, 54.

In Canada.—Auroras were reported on the following dates: Halifax and Yarmouth, 1; Charlottetown, 27; Father Point, 1, 2, 19, 20, 25, 27, 29, 31; Quebec, 1, 2, 10, 17, 18, 27, 29; Montreal, 1; White River, 1, 30; Ottawa, 1, 29; Port Arthur, 28; Winnipeg, 27, 29; Minnedosa, 18, 29; Qu'Appelle, 27; Medicine Hat, 9, 27, 30; Swift Current, 15; Banff, 8, 18, 25; Prince Albert, 7; Battleford, 3, 23, 28.

**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 43 by its thermal effects; at one of these stations records are kept by both methods. 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 X 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 in the hours 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 X for the 64 stations at which instrumental self-registers are maintained.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the durations relative to possible sunshine are derived; the observers' personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for October, 1897, is 7 per cent for photographic and 6 per cent for thermometric records.

The details are shown in the accompanying table, in which the stations are arranged according to the *total possible* duration of sunshine, and not according to the *observed* duration. In obtaining the total possible sunshine the value for the parallel of latitude nearest the station is used.

Difference between instrumental and personal observations of sunshine.

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
Key West, Fla	24 34	T.	358.6	61	.....	.....	72	+11
Tampa, Fla	27 57	T.	356.3	66	.....	.....	80	+13
Galveston, Tex	29 18	P.	355.9	62	63	+1	.....	.....
New Orleans, La	29 58	T.	354.7	59	.....	.....	58	-1

Difference between instrumental and personal observations.—Cont'd.

Stations.	Latitude.	Apparatus.	For whole month.		Instrumental record of sunshine.			
			Total possible.	Personal.	Photographic.	Difference.	Thermometric.	Difference.
Savannah, Ga	32 05	P.	352.8	52	58	+6	75	+6
Vicksburg, Miss	32 23	P.	352.8	69	80	+11	75	+6
San Diego, Cal	32 43	P.	351.5	80	79	+1	.....	.....
Charleston, S. C.	32 47	P.	351.5	45	.....	.....	46	+1
Phoenix, Ariz	33 28	P.	351.5	75	85	+10	69	-3
Atlanta, Ga	33 45	P.	350.9	71	.....	.....	.....	.....
Los Angeles, Cal	34 03	P.	350.9	64	70	+6	.....	.....
Wilmington, N. C.	34 14	T.	350.9	53	.....	.....	56	+3
Little Rock, Ark	34 45	T.	350.1	72	.....	.....	87	+15
Chattanooga, Tenn	35 04	T.	350.1	75	.....	.....	76	+1
Santa Fe, N. Mex	35 41	P.	348.9	60	66	+6	.....	.....
Raleigh, N. C.	35 45	T.	348.9	46	.....	.....	54	+8
Nashville, Tenn	36 10	T.	348.9	82	.....	.....	86	+4
Fresno, Cal	36 43	T.	347.9	72	.....	.....	76	+4
Dodge City, Kans	37 45	P.	347.3	63	70	+7	.....	.....
San Francisco, Cal	37 48	T.	347.3	56	.....	.....	70	+14
Louisville, Ky	38 15	T.	347.3	75	.....	.....	82	+7
St. Louis, Mo	38 38	T.	346.0	77	.....	.....	88	+11
Washington, D. C.	38 54	P.	346.0	48	51	+3	.....	.....
Kansas City, Mo	39 05	P.	346.0	69	76	+7	.....	.....
Cincinnati, Ohio	39 06	T.	346.0	79	.....	.....	83	+3
Parkersburg, W. Va.	39 16	T.	346.0	73	.....	.....	75	+2
Baltimore, Md	39 18	T.	346.0	46	.....	.....	52	+6
Atlantic City, N. J.	39 22	P.	346.0	47	54	+7	.....	.....
Denver, Colo	39 45	P.	344.9	50	65	+15	.....	.....
Indianapolis, Ind	39 46	T.	344.9	71	.....	.....	81	+10
Philadelphia, Pa	39 57	T.	344.9	47	.....	.....	58	+11
Columbus, Ohio	39 58	T.	344.9	65	.....	.....	76	+11
Harrisburg, Pa	40 16	T.	344.9	45	.....	.....	59	+14
Pittsburg, Pa	40 32	T.	343.9	55	.....	.....	54	+1
New York, N. Y.	40 43	T.	343.9	50	.....	.....	56	+6
Salt Lake City, Utah	40 46	P.	343.9	42	61	+19	.....	.....
Eureka, Cal	40 48	P.	343.9	51	54	+3	.....	.....
Cheyenne, Wyo	41 08	P.	343.9	54	65	+11	.....	.....
Omaha, Nebr	41 16	P.	343.9	56	65	+9	.....	.....
Cleveland, Ohio	41 30	T.	342.5	46	.....	.....	55	+9
Des Moines, Iowa	41 35	T.	342.5	60	.....	.....	61	+1
Chicago, Ill	41 53	T.	342.5	71	.....	.....	73	+1
Erie, Pa	42 07	T.	342.5	40	.....	.....	57	+8
Binghamton, N. Y.	42 08	T.	342.5	53	.....	.....	61	+8
Detroit, Mich	42 20	T.	342.5	53	.....	.....	59	+6
Boston, Mass	42 31	T.	342.5	59	.....	.....	67	+8
Dubuque, Iowa	42 30	T.	342.5	73	.....	.....	69	-3
Albany, N. Y.	42 39	T.	341.8	61	.....	.....	85	+24
Buffalo, N. Y.	42 53	T.	341.8	37	.....	.....	56	+19
Rochester, N. Y.	43 06	T.	341.8	41	.....	.....	42	+1
Idaho Falls, Idaho	43 29	T.	341.8	46	.....	.....	46	0
Yankton, S. Dak	42 54	T.	341.8	49	.....	.....	58	+9
Portland, Me	43 39	T.	340.5	62	.....	.....	74	+12
Northfield, Vt	44 10	P.	340.5	56	64	+8	.....	.....
Huron, S. Dak	44 21	T.	340.5	47	.....	.....	50	+3
Eastport, Me	44 54	P.	339.8	53	67	+14	.....	.....
St. Paul, Minn	44 56	P.	339.8	41	47	+6	.....	.....
Minneapolis, Minn	44 59	T.	339.8	.....	.....	.....	86	.....
Portland, Oreg	45 32	T.	338.5	56	.....	.....	58	+2
Helena, Mont	46 34	P.	336.7	61	66	+5	.....	.....
Bismarck, N. Dak	46 47	P.	336.7	53	59	+6	.....	.....
Tacoma, Wash	47 16	T.	336.7	35	.....	.....	51	+16
Seattle, Wash	47 38	T.	335.8	46	.....	.....	31	-15
Spokane, Wash	47 40	T.	335.8	51	.....	.....	61	+10

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.

Snowfall and rainfall are expressed in inches.

**Alabama.**—The mean temperature was 67.2°, or 4.2° above normal; the highest was 97°, at Goodwater on the 17th, and the lowest, 30°, at Newburg on the 24th and at Hamilton on the 29th. The average precipitation was 1.34, or 0.74 below normal; the greatest monthly amount, 5.00, occurred at Daphne, while none fell at Brewton, Goodwater, and Mount Willing.—*F. P. Chaffee.*

**Arizona.**—The mean temperature was 62.2°, or 2.9° below normal; the highest was 108°, at Texas Hill, and the lowest, 21°, at Fort Defiance on the 18th and at Fort Whipple on the 27th. The average precipitation was 0.47, or 0.22 below normal; the greatest monthly

amount, 2.65, occurred at Williams, while none fell at several stations.—*W. T. Blythe.*

**Arkansas.**—The mean temperature was 67.7°, or 6.3° above normal; the highest was 99°, at Helena on the 3d, and the lowest, 28°, at Keesees Ferry on the 30th. The month was the warmest October on record. The average precipitation was 2.01, or 0.13 below normal; the greatest monthly amount, 5.36, occurred at Blanchard, and the least, 0.29, at Russellville.—*F. H. Clarke.*

**California.**—The mean temperature was 58.5°, or 2.6° below normal; the highest was 108°, at Salton on the 1st, and the lowest, 10°, at Bodie on the 16th. The average precipitation was 1.79, or 0.57 above normal; the greatest monthly amount, 7.85, occurred at Follows Camp.—*W. H. Hammon.*

**Colorado.**—The mean temperature was 47.0°, or 1.0° above normal; the highest was 93°, at Lamar on the 2d, and the lowest, 2° below zero, at Breckenridge on the 28th. The average precipitation was 2.07, or 1.17 above normal; the greatest monthly amount, 6.50, occurred at Santa Clara, and the least, 0.31, at Walden.—*F. H. Brandenburg.*