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.
			Height	Date.	Height.	Date.		
Tennessee River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Knoxville, Tenn.	614	29	.....	.....	.....	.....	.....	.....
Kingston, Tenn.	534	25	3.3	21,22	0.2	14-16	1.4	2.1
Chattanooga, Tenn.	430	33	5.6	22	1.6	15	2.9	4.0
Bridgeport, Ala.	390	24	4.6	23	0.6	12,15,16	1.6	4.0
Florence, Ala.	220	16	3.8	25	0.5	14	1.4	3.3
Johnsonville, Tenn.	94	21	4.3	2	1.4	16	2.7	2.9
Clinch River.								
Speers Ferry, Va	156	20	5.9	19	0.3	{6,7,9,10/ 13,16}	1.1	5.6
Clinton, Tenn.	46	25	11.5	21	3.4	15	5.2	8.1
Wabash River.								
Mount Carmel, Ill.	50	15	15.0	1	3.0	30	6.3	12.0
Red River.								
Arthur City, Tex	688	27	12.5	16	5.6	2	8.9	6.9
Fulton, Ark.	505	28	18.5	18	9.0	5,6,13	12.3	9.5
Shreveport, La	449	29	14.1	1	9.1	15	11.5	5.0
Alexandria, La	139	33	14.1	3	8.4	18	11.3	5.7
Atchafalaya Bayou.								
Melville, La.	100*	31	32.0	1-3	26.6	30	29.7	5.4
Ouachita River.								
Camden, Ark	340	39	12.0	20	5.8	30	8.0	6.2
Monroe, La	100	40	19.4	1	12.2	15	14.9	7.2
Yazoo River.								
Yazoo City, Miss.	80	25	17.4	2	4.0	30	10.3	13.4
Chattahoochee River.								
Columbus, Ga.	140	20	5.0	22	−0.4	1-3	0.5	5.4
Flint River.								
Albany, Ga	80	20	3.6	30	0.5	7-10	1.5	3.1
Cape Fear River.								
Fayetteville, N. C.	100	38	7.0	21,22	1.1	9,12	2.8	5.9
Columbia River.								
Umatilla, Oreg	270	25	21.8	17,18	19.2	30	20.7	2.6
The Dalles, Oreg	166	40	36.9	20,21	32.2	10	34.8	4.7
Willamette River.								
Albany, Oreg	99	20	4.5	2,3	2.0	27-30	3.0	2.5
Portland, Oreg	10	15	20.7	19,21,22	18.5	9,10,30	19.6	2.2
Edisto River.								
Edisto, S. C.	75	6	3.0	25-27	0.4	13-16	1.5	2.6
James River.								
Lynchburg, Va	257	18	1.3	1,30,21	0.4	{10,11,/ 28,30}	0.8	0.9
Richmond, Va	110	12	0.9	6	0.0	29,30	0.4	0.9

Heights of rivers referred to zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Alabama River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Montgomery, Ala.	265	35	1.5	24	−0.8	13	0.2	2.3
Selma, Ala.	212	35	1.4	27	−1.3	12,14,15	−0.2	2.7
Coosa River.								
Rome, Ga	225	30	3.6	20	1.2	12	1.8	2.4
Gadsden, Ala	144	18	2.1	23	−0.1	16	0.5	2.2
Tombigbee River.								
Columbus, Miss.	285	33	1.7	17	−3.1	13	−1.8	4.8
Demopolis, Ala	155	35	1.8	20	−1.5	14	0.0	2.3
Black Warrior River.								
Tuscaloosa, Ala	90	38	1.3	27	−0.7	13	00.0	2.0
Pedee River.								
Cheraw, S. C.	145	27	4.8	20	0.8	12-14	1.0	4.0
Black River.								
Kingstree, S. C.	60	12	6.8	30	0.2	18	2.3	6.6
Lumber River.								
Fairbluff, N. C.	10	6	1.0	28	−0.9	13-18	−0.1	1.9
Lynch Creek.								
Effingham, S. C.	35	12	6.4	23	1.7	15,16	3.1	4.7
Potomac River.								
Harpers Ferry, W. Va.	170	16	2.9	1	1.2	29,30	1.7	1.7
Roanoke River.								
Clarksville, Va.	155	12	3.6	19	0.3	10-12	1.1	3.3
Sacramento River.								
Red Bluff, Cal.	241	23	1.0	1	0.1	26-30	0.4	0.9
Sacramento, Cal.	70	25	13.3	4	9.0	30	10.9	4.3
Santee River.								
St. Stephens, S. C.	50	12	6.6	24	−2.0	15,16	1.2	8.6
Congaree River.								
Columbia, S. C.	37	15	2.2	20	1.0	11-13,15	1.5	1.2
Wateree River.								
Camden, S. C.	45	24	10.5	18	1.4	13,14	3.4	9.1
Savannah River.								
Augusta, Ga.	130	32	9.7	21	4.0	11,30	5.1	5.7
Susquehanna River.								
Wilkesbarre, Pa.	178	14	3.0	12	0.0	{11-13, 19-22, 27-30}	1.0	1.2
Harrisburg, Pa.	70	17	4.3	1	1.7	30	2.6	2.6
Juniata River.								
Huntingdon, Pa.	80	24	4.1	1	2.9	30	3.4	1.2
W. Br. of Susquehanna.								
Williamsport, Pa.	35	20	3.5	1	1.0	2.8	2.0	2.5
Waccamaw River.								
Conway, S. C.	40	7	2.8	9	0.1	16	1.4	2.7

*Distance to Gulf of Mexico.

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 VIII, inclusive.

PRESSURE AND WIND.

Normal conditions.—The geographic distribution of normal barometric readings at sea level and under local gravity for June is shown by Chart V of the MONTHLY WEATHER REVIEW for June, 1893.

Normal pressure in June is highest over the south Atlantic and north Pacific coasts and lowest over Arizona and the Plateau region. As compared with May, it is the same or slightly less in all districts, except the south Atlantic coast, where there is a slight increase, amounting to about 0.02 inch on the average.

The prevailing winds, except on the Pacific coast, are generally from a southerly quarter—southwesterly in New England and the lower Lake region, southerly in the Mississippi Valley, the south Atlantic and Gulf coasts, and southeasterly on the Plains. On the Pacific coast the general tendency is to blow from some westerly quarter.

The current month.—The distribution of monthly mean pressure, as shown by Chart IV, is closely in accord with normal conditions. Pressure was almost normal in the majority of districts, the greatest plus departures occurring in North Dakota and Manitoba and over a narrow strip of the Rocky Mountain region, extending from Denver to Helena. Pressure was below normal over Arizona, Nevada, California, Oregon, and part of Washington.

The changes from May to June were rather large, there being an increase of from 0.05 to 0.08 inch over the territory bordering the Atlantic from Connecticut southward, and extending inland to the Ohio Valley and the lower Lakes. There was a corresponding decrease over the upper Missouri Valley and the Northwest, amounting to 0.12 inch at Williston and 0.06 inch at Denver. Pressure also fell 0.05 inch and over in California from Sacramento southward.

The prevailing winds on the Atlantic coast were almost without exception from seaward or parallel with the coast line. Some distance inland they became southwesterly, shifting to westerly in the lower Lake region. On the upper Lakes the prevailing direction was in some cases from the northwest and in others from the east and southeast.

In the Mississippi Valley and the Plains region the winds were generally southeasterly; in the upper Mississippi Valley from the north and northwest. The winds over the Rocky Mountain and Plateau regions were generally from a southerly quarter, and on the Pacific coast from the northwest and west.

TEMPERATURE OF THE AIR.

Normal conditions.—The normal mean temperature of the air in the United States in June varies from about 82° at Key West, 80° at Jacksonville, 80° at New Orleans, 82° at Galveston, 64° at San Diego, to 55° at Eastport, 64° at Burlington, 65° at Buffalo, 68° at Detroit, 58° at Duluth, 61° at St. Vincent, 61° at Havre, 62° at Spokane, and 59° at Seattle, on Puget Sound. The warmest regions now are the lower Rio Grande Valley and southwestern Arizona, including a portion of the desert region of California. The seacoast is cooler than the interior on corresponding parallels. The coldest portion of tho United States is the region about Lake Superior.

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 temperature of June, 1898, was above normal in all districts save New England, North Dakota, the southern slope, and the southern plateau. The month opened with an abnormally cool spell in the Northwest, bringing with it freezing temperatures and killing frosts over the elevated portions of Wyoming, Colorado, Idaho, and Montana. Temperatures below freezing were also registered in Minnesota and North Dakota.

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	62.0	− 1.2	+ 7.1	+ 1.2
Middle Atlantic	12	71.0	+ 0.1	+ 8.6	+ 1.4
South Atlantic	10	77.7	+ 0.5	+ 6.0	+ 1.0
Florida Peninsula	7	81.1	+ 1.6	+ 2.4	+ 0.4
East Gulf	7	80.6	+ 1.5	+ 4.9	+ 0.8
West Gulf	7	79.7	+ 0.7	+10.5	+ 1.8
Ohio Valley and Tennessee	12	75.9	+ 1.9	+11.4	+ 1.9
Lower Lake	8	68.5	+ 1.4	+17.3	+ 2.9
Upper Lake	9	63.0	+ 0.5	+19.4	+ 3.2
North Dakota	7	62.6	− 2.0	+23.1	+ 3.8
Upper Mississippi	11	73.1	+ 1.9	+17.1	+ 2.8
Missouri Valley	10	72.8	+ 1.8	+19.4	+ 3.2
Northern Slope	7	62.9	+ 0.1	+ 8.1	+ 1.4
Middle Slope	6	72.8	+ 1.2	+ 9.2	+ 1.5
Southern Slope	5	75.7	− 0.6	+ 8.4	+ 1.4
Southern Plateau	13	74.3	− 0.2	− 0.7	− 0.1
Middle Plateau	9	65.6	+ 1.4	− 7.0	− 1.2
Northern Plateau	11	62.1	+ 0.6	+ 5.1	+ 0.8
North Pacific	9	58.8	+ 1.4	+ 5.3	+ 0.9
Middle Pacific	5	62.9	+ 1.1	− 4.3	− 0.7
South Pacific	4	67.9	+ 1.3	+ 0.2	0.0

The minimum temperature of the month was recorded at Breckenridge and Walden, Colo., viz, 17° on the 5th.

The maximum temperature of the month was recorded in the desert region of southeastern California. Maximum temperatures of 100° and over were observed in southern Georgia, central Alabama, and at a number of points on the Plains and eastern foothills of the Rocky Mountains. Maximum temperatures of 100° were also recorded in western Colorado, in southern Idaho, in the great valley of California, and throughout Arizona and southern Utah. The maximum temperature did not reach 90° in northern New England, western New York, and northern Minnesota.

But few prostrations from heat were reported during the month. A hot wave passed over the Lake region on the 24th and again on the 30th. The heat on the last-named date was general throughout the Mississippi Valley.

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 broken 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.

In Canada.—Prof. R. F. Stupart says:

> The most striking feature in the distribution of temperature was the great difference which occurred between the average mean of the upper and lower Lakes, White River being 3° below average and Parry Sound as much as 5° above. In the Georgian Bay region, the lower Lake region, and the Ottawa Valley, also in British Columbia and northern Alberta, the temperature was above average, but elsewhere in Canada it was generally average or a little below.

PRECIPITATION.

Normal conditions.—The regions of heavy precipitation, 4 to 6 inches in June, are mainly on the Gulf and south Atlantic coasts. There are, however, other areas, in various parts of the interior, which have, according to the present normal charts, an average precipitation of 4 inches and over. Some of these areas, doubtless, appear on the charts as a result of the practice of including months of torrential rains in the general sums and averages of a short series of observations. Their present boundaries are, therefore, uncertain.

There is, undoubtedly, a greater tendency to heavy downpours in some localities than in others, but it is difficult at present to delimit the precise areas thus liable to excessive precipitation.

The region eastward of the one hundredth meridian has a variable summer rainfall. In some part of the territory there is each year total or partial drought. Happily, however, much of the region has an average rainfall in excess of the actual needs of agriculture.

The current month.—While many localities received more than the average precipitation, the month, as a whole, must be classed as one of deficient rainfall. The rainfall east of the Mississippi River was below normal, except in portions of the Ohio Valley, especially in Kentucky and West Virginia, the upper Lake region, northern New York, and northern New England. There was also less than the normal rainfall in the upper Mississippi Valley (from La Crosse northward) and in the Missouri Valley between Yankton and Williston. The drought noted in former REVIEWS as prevailing in Florida was not broken at the close of the month, although local rains had relieved the situation in some sections. The rainfall of Georgia was very light and there was a general deficiency northward to New England.

Heavy rains for the season fell in Louisiana, Texas, except on the immediate coast, Oklahoma, western Arkansas, Missouri, Iowa, and eastern Kansas. The rainfall of the northern and part of the middle slope was also in excess of the normal.

Torrential rains fell in Kansas and Missouri on a number of dates, those of the 16th being especially destructive. A dam broke at Chelsea Park, in Kansas City, Kans., as a result of the heavy downpour, allowing the waters of a small lake to escape. A flood of water swept down the valley of Jersey Creek, through Kansas City, Kans., to the Missouri River, demolishing property and wrecking culverts and bridges. It is estimated that two hundred families lost more or less of their worldly possessions and that $100,000 worth of property was destroyed. Four lives were lost by drowning

June 23.—A so-called cloud-burst struck Galesburg, Ill., on the morning of the 23d. Walnut Creek rose 44 feet in a few hours and flooded the country for miles. One person was drowned. Cambridge, Ill., 23d, S. B. Randell, voluntary observer of the Weather Bureau, reports rain began about midnight of 23d, being exceedingly heavy between 5 and 7:30 a. m. Six inches of rain fell between midnight and 7:30 a. m. The Edwards River bottom for a mile in width was a sea of water. Corn and oats were destroyed and bridges were washed away. The heavy rain was local. Galva, the nearest reporting station; measured but 3½ inches. Two lives were lost.

Two freight trains on the Northern Pacific Railway encountered a cloud-burst a short distance above Coalspur, Mont. The engineers were surprised by a perfect avalanche of water, which came rushing down the mountain side, carrying with it débris of every description.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	1.47	51	−1.40	+ 2.20
Middle Atlantic	12	2.47	67	−1.20	− 2.70
South Atlantic	10	3.82	75	−1.30	− 9.80
Florida Peninsula	7	2.75	41	−4.00	−12.50
East Gulf	7	3.01	60	−2.00	−12.90
West Gulf	7	4.69	124	+0.90	− 2.10
Ohio Valley and Tennessee	12	3.83	91	−0.40	− 0.10
Lower Lake	8	2.73	75	−0.90	− 0.60
Upper Lake	9	3.71	100	0.00	− 0.10
North Dakota	7	3.50	90	−0.40	− 0.80
Upper Mississippi	11	3.84	85	−0.70	+ 3.70
Missouri Valley	10	4.60	135	+1.20	+ 3.20
Northern Slope	7	2.24	85	−0.40	+ 0.30
Middle Slope	6	2.92	94	−0.20	+ 3.30
Southern Slope	6	3.00	91	−0.30	− 1.60
Southern Plateau	13	0.76	211	+0.40	− 0.10
Middle Plateau	9	0.36	64	−0.20	− 0.90
Northern Plateau	11	0.76	60	−0.50	− 2.40
North Pacific	9	2.57	113	+0.30	+ 4.80
Middle Pacific	5	0.42	81	−0.10	− 8.10
South Pacific	4	0.02	17	−0.10	− 5.10

In Canada.—Professor Stupart says:

The distribution of rainfall for June is, in several respects, rather remarkable. Over the greater portion of Assiniboia it was below average, and to the extent of 2.0 inches at Medicine Hat. In Ontario, from the southern shores of the Georgian Bay south to Lake Ontario and east to the Ottawa River, it was below average, except locally in Northumberland and Hastings, and apparently generally in the eastern townships. The rainfall was especially light in York and Simcoe, likewise in Frontenac and Leeds. In all the large remaining portion of the Dominion it was above average, especially so from eastern Manitoba to Lake Superior, and also over the greater portion of the Province of Quebec. Winnipeg was 2.9 inches above average; Port Arthur, 4.4 inches above; Montreal, 2.0 inches above; and Quebec, 2.6 inches above.

SNOWFALL.

Heavy snow fell in Wyoming on the 3d and 4th, the total at Lander being 15 inches, with smaller amounts at other stations. Light snow fell at a number of stations in the mountain region of the west on the 2d and 3d, and again at a few stations in Montana on the night of the 30th. Press reports state that half an inch of snow fell at Collingwood, Ont., on the night of the 20th; also that snow fell at Chester, Orange Co., N. Y., on the 22d.

HAILSTORMS.

The following account of severe hailstorms has been compiled from newspaper reports and statements of voluntary observers:

2d.—A destructive hailstorm passed through that portion of Nelson County, Va., comprised between upper Rockfish and the Amherst County line, late in the evening of this date. Crops of every description were destroyed.

6th.—The vicinity between Rockyford and Lajunta, Colo., was visited on the evening of the 6th by a very severe hailstorm, 5 miles in width and 12 miles long, the storm being especially severe over a width of about 2 miles. Trees were stripped of foliage; young hogs, turkeys, etc., were killed; and much fruit was destroyed.

9th.—Minonk, Ill., hail on the 9th did considerable damage to fruit, corn, and oats, and broke hundreds of window lights.

10th.—Severe hailstorms occurred at different points in Lower Michigan. Stones measuring from 4½ to 5½ inches in circumference fell at Pawpaw.

11th.—A severe hailstorm occurred at Olivet, Mich.

12th.—A severe hailstorm visited a section of country on Stillwater Creek, 10 miles south of Perry, Okla. The track of the storm was about 1 mile wide; length, unknown.

Hail fell for about thirty minutes, accompanied by high wind northwest of Wellington, Kans. The damage was confined to a small area, but the destruction of crops was complete.

13th.—A severe rain and hail storm visited the southern part of King William County, Va., on the evening of the 13th. The length of the storm track, so far as known, was not more than a mile.

19th.—Hailstones from ⅜ to 1¼ inch in diameter fell at Rolla, Mo., from 9:12 to 9:26 a. m.

A severe hailstorm passed through Belt, Mont., on the evening of the 19th. The stones were reported to have been as large as hens eggs, many of them weighing an ounce and a half.

24th.—A very destructive hailstorm having its origin in Benson County, N. Dak., moved eastward in a path from 1 to 8 miles in width, passing through the counties of Ramsey and Walsh, N. Dak., and Marshall, Minn. Crops in the pathway of the storm were very much damaged. According to newspaper reports, the area of grain destroyed was about 50,000 acres, and the loss from $150,000 to $200,000. A few buildings were wrecked by the wind, and many head of stock were killed by lightning. Two persons were killed by lightning 12 miles west of Minnewaukon.

28th.—A severe hailstorm of limited area passed over portions of Somerset and Mercer counties, N. J.

30th.—Standing crops and vegetables and gardens were totally destroyed by a severe hailstorm that passed through the center of Lyon and Sioux counties, Iowa, at 8 o'clock of the above date. The path of the storm was about 2 miles wide. The storm moved from the northwest. Severe damage from hail was also reported from O'Brien County, just east of Sioux.

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

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

Hail was reported on the greatest number of dates in Colo-

rado, 17; Montana, 13; Idaho and Iowa, 10 each; New Mexico and South Dakota, 9 each.

SLEET.

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

California, 1. Montana, 2. Wyoming, 4.

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.—Several wide departures from the normal may be noticed. The Florida Peninsula was very much drier than usual, the mean for that region being 74 per cent, or about the same as obtains for the Middle States under normal conditions. The mean for the west Gulf States was 81 per cent, the same it will be noticed as for New England. The mean for Palestine, Tex., was 88 per cent, an unusually high record for an inland station. The lowest monthly mean was 17 per cent, viz, at Independence, Cal., followed by a mean of 25 per cent at Phenix, Ariz.. Independence is situated in Owens River Valley, east of the Sierra Nevada Mountains. The average rainfall is about 6 inches per annum.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	81	+ 1	Missouri Valley	72	+ 3
Middle Atlantic	71	— 2	Northern Slope	58	+ 2
South Atlantic	76	— 2	Middle Slope	65	+ 6
Florida Peninsula	74	— 7	Southern Slope	68	+ 8
East Gulf	75	0	Southern Plateau	32	+ 4
West Gulf	81	+ 7	Middle Plateau	42	+ 5
Ohio Valley and Tennessee	67	— 3	Northern Plateau	53	+ 1
Lower Lake	71	— 1	North Pacific Coast	74	— 5
Upper Lake	76	+ 3	Middle Pacific Coast	64	— 1
North Dakota	69	+ 1	South Pacific Coast	63	— 1
Upper Mississippi Valley	73	+ 2			

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 the prevailing pressure on the psychrometer has 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.

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.—The month was one of rather more than the usual amount of sunshine, the Atlantic coast, the Florida Peninsula, and the Ohio Valley and Tennessee being especially free from clouds. There were fewer clouds than usual on the Pacific coast, except in the vicinity of Eureka.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.9	+0.8	Missouri Valley	4.9	+0.1
Middle Atlantic	4.7	—0.3	Northern Slope	4.4	—0.4
South Atlantic	4.1	—0.8	Middle Slope	4.0	+0.3
Florida Peninsula	3.1	—2.4	Southern Slope	3.8	—0.6
East Gulf	5.0	+0.2	Southern Plateau	2.2	+0.3
West Gulf	5.7	+1.1	Middle Plateau	3.2	+0.2
Ohio Valley and Tennessee	4.1	—0.9	Northern Plateau	4.5	—0.6
Lower Lake	4.8	—0.1	North Pacific Coast	5.4	—0.7
Upper Lake	5.5	+0.3	Middle Pacific Coast	3.6	+0.4
North Dakota	5.2	0.0	South Pacific Coast	2.6	—0.6
Upper Mississippi Valley	4.9	—0.1			

There was much cloud and rain in the west Gulf States and lower Mississippi Valley.

WIND.

The table at the end of this section shows the cases where wind velocities of 50 miles per hour and over occurred during the month of June. It will be observed that high velocities were recorded chiefly at inland stations with the exception of Block Island and Fort Canby, the two latter being in exposed situations on the sea coast.

There were two periods of high winds and thunderstorms during the month, and more or less destruction of property, attended in some cases by loss of life. The first period began on the 11th and ended on the 13th. On the 11th the only States in which thunderstorms were not reported were Maine, Massachusetts, New Hampshire, North and South Carolina, Rhode Island, and Washington. The second period of thunderstorm activity began on the 23d and continued until the 28th. During this time a storm of considerable intensity moved across the northern part of the country. The barometric gradient was rather steep over the Lake region and the upper Mississippi and Ohio valleys on the 24th and 25th, and there was considerable destruction of property by squall winds. There were not, however, so many thunderstorms as during the first period, viz, from the 11th to the 13th.

No severe tornado was reported during the month.

The usual list of local storms follows:

1st.—The director of the Texas section of the Climate and Crop Service reports a tornado as having occurred in the vicinity of Corsicana about 5 a. m. of June 1. The path was about 300 yards wide, length unknown. The storm did not strike the city, but many oil well derricks, trees, and fences were blown down. The amount of damage can not be ascertained.

2d.—A violent thunderstorm struck the city of Brainerd, Minn., at 5:10 p. m., central time. Outbuildings were wrecked, shade trees uprooted, and much damage was done to roofs and glass fronts. No casualties; amount of damage unknown.

3d.—A violent windstorm passed over the town of Aberdeen, S. Dak., between 1 and 2 a. m. No loss of life; damage confined to awnings, roofs of buildings, and plate-glass windows.

12th.—A few barns and outhouses were destroyed, trees were uprooted and twisted off, by a minor tornado in Ecorse Township in Wayne County, Mich., on the afternoon of the 12th. Telephone and telegraph wires were torn down on several lines.

13th.—High winds prevailed over a considerable portion of Alabama on the evening of the 13th. Minor damages, such as the destruction of fences and outbuildings and, in a few cases, of buildings, were reported from the northern-central part of the State.

15th.—A tornado was reported as having swept over Concordia Parish, La., late in the evening of this date. No serious damage beyond the destruction of a few houses and more or less timber.

19th.—A very severe thunderstorm, with some of the characteristics of a tornado, passed over Niagara and Orleans counties, N. Y., on the early morning of the 19th. A funnel-shaped cloud appears to have been absent. Roofs of buildings, awnings, trees, fences, and shrubbery were seriously damaged in several localities. The path of the storm was probably a half mile wide. The greatest damage in any one place appears to have been at Lockport, N. Y. After leaving this point damages of a minor character only were reported until the storm reached the vicinity of Knowlesville and Gaines, in Orleans County. Prof. Grove K. Gilbert, of the United States Geological Survey, writes from Middleport, under date of July 13, as follows:

> I happened to be in Lockport during the passage of a notable storm early on the morning of June 19, and have since crossed its track at a number of points.
>
> I was awake when it began and heard its roar at a little distance before it reached me. It began suddenly, attaining full violence in a minute or two. The force of wind lessened more gradually, but there was an abrupt cessation. I did not note duration, but think it was between ten and twenty minutes strong wind. Heavy rainfall. Hail during the first third; nearly continuous lightning, but of moderate intensity. The direction of the wind was from south-southwest or south by west during period of greatest violence. Afterwards it had some other direction, which I could not observe from my window (facing west).
>
> There was damage from wind and hail, and this was limited to a path about three-fourths of a mile wide. Much grain was "lodged," still more was cut down by hail, and green fruit was bruised. * * *

25th.—High winds and severe squalls prevailed over the Lake region, the Ohio Valley, and western Pennsylvania on the 25th. Maximum velocities of over 50 miles per hour for five minutes were recorded at Sioux City, Chicago, Cleveland, and Parkersburg. At the first-named place a maximum velocity of 66 miles per hour was recorded. Three persons were killed and many were injured at Sioux City on the evening of the 24th, as a result of stormwinds blowing down a circus tent. Three men were drowned in the Ohio River at Marietta on the 25th as a result of the stormwinds. Property losses varying from $500 to $10,000, due to the severity of squall winds, were reported at numerous places from Iowa eastward to western Pennsylvania.

Hot winds of California.—Hot, dry, northwest winds began blowing over portions of California on the night of June 30. Considerable damage was done to fruit, much of which was blown from the trees; grain was shelled out or broken down with considerable loss.

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	26	50	n.	Memphis, Tenn	12	52	w.
Block Island, R. I.	4	50	ne.	Parkersburg, W. Va.	25	52	nw.
Fort Canby, Wash.	15	56	se.	Pierre, S. Dak.	2	55	nw.
Chicago, Ill	24	50	sw.	Port Huron, Mich.	12	52	w.
Cleveland, Ohio	12	60	nw.	San Antonio, Tex.	11	66	nw.
Havre, Mont.	28	52	sw.	Sioux City, Iowa	24	66	nw.
Independence, Cal	1	50	w.	Williston, N. Dak.	28	50	w.

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.—Five thousand four hundred and fifty-five reports of thunderstorms were received during the current month, as against 5,509 during the corresponding month of 1897.

The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 12th, 367; 13th, 366; 11th, 357; 25th, 280; 26th, 253.

Reports were most numerous from Missouri, 367; Ohio, 336; Illinois, 258; Mississippi, 224; Pennsylvania, 222.

Thunderstorms occurred in Missouri on every day of the

month, except the 28th and 29th. In Louisiana there were one or more thunderstorms on each day of the month. In Arkansas, thunderstorms were reported on every day except the 24th. In Colorado there were thunderstorms continuously from the 3d to the 23d, inclusive. On the Pacific coast reports of 99 thunderstorms were received, distributed as follows: 33 in Washington, 39 in Oregon, and 27 in California.

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 May 30 to June 7.

The greatest number of reports were received for the following dates: 22d, 6; 14th, 25th, and 29th, 4 each.

Reports were most numerous from Ohio, 6; Minnesota, North Dakota, and Wisconsin, 4 each.

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 80.4°, or 2.8° above normal, the highest was 103°, at Decatur on the 10th, and the lowest, 55°, at Madison on the 1st. The average precipitation was 3.60, or 0.87 below normal; the greatest monthly amount, 7.99, occurred at Evergreen, and the least, 0.90, at Riverton.—*F. P. Chaffee.*

Arizona.—The mean temperature was 79.6°; the highest was 119°, at Parker on the 26th and the lowest, 20°, at Snowflake on the 11th. The average precipitation was 0.60; the greatest monthly amount, 2.60, occurred at Fort Apache and Oro, while none fell at Agricultural Experiment Station at Phenix, and only trace at several stations.—*W. T. Blythe.*

Arkansas.—The mean temperature was 78.7°, or 2.3° above normal, the highest was 100°, at Lonoke on the 25th, and the lowest, 60°, at several stations on different dates. The average precipitation was 4.86, or 0.80 above normal; the greatest monthly amount, 11.15, occurred at Ozark, and the least, 1.85, at Stuttgart.—*E. B. Richards.*

California.—The mean temperature was 71.3°, or 0.1° below normal; the highest was 123°, at Volcano Springs on the 26th, and the lowest, 17°, at Bodie on the 4th. The average precipitation was 0.25, or 0.01 below normal; the greatest monthly amount, 3.32, occurred at Upper Mattole. No rain fell over the greater portion of the State.—*W. H. Hammon.*

Colorado.—The mean temperature was 62.6°, or about normal; the highest was 108°, at Crook on the 28th, and the lowest, 17°, at Walden on the 4th, and at Breckenridge on the 5th. The average precipitation was 1.73, or 0.50 above normal; the greatest monthly amount, 3.95, occurred at Cheyenne Wells, and the least, trace, at Rangely.—*F. H. Brandenburg.*

Florida.—The mean temperature was 80.9°, or 1.9° above normal; the highest was 101°, at Eustis on the 12th, and at Lake City on the 16th, and the lowest, 54°, at St. Francis on the 8th and 9th. The average precipitation was 3.08, or 3.92 below normal, it was the driest June on record; the greatest monthly amount, 9.07, occurred at Earnestville, and the least, trace, at Carrabelle.—*A. J. Mitchell.*

Georgia.—The mean temperature was 80.1°, or 2.2° above normal; the highest was 103°, at Brag on the 30th, and the lowest, 50°, at Ramsey on the 23d. The average precipitation was 3.27, or 1.43 below normal; the greatest monthly amount, 6.94, occurred at Fleming, and the least, 0.89, at Atlanta and Toccoa.—*J. B. Marbury.*

Idaho.—The mean temperature was 60.8°; the highest was 102°, at Nampa on the 18th, and the lowest, 23°, at Marysville on the 2d. The average precipitation was 1.07; the greatest monthly amount, 2.10, occurred at Yellowjacket, and the least, 0.15, at Marysville.—*D. P. McCallum.*

Illinois.—The mean temperature was 73.3°, or about 1.0° above normal; the highest was 97°, at Bloomington on the 4th and 6th, and the lowest, 41°, at Kishwaukee on the 22d. The average precipitation was 4.34, or 0.35 above normal; the greatest monthly amount, 9.88, occurred at Cambridge, and the least, 1.10, at Olney.—*C. E. Linney.*

Indiana.—The mean temperature was 73.2°, or 1.1° above normal; the highest was 99°, at Winamac on the 4th, and the lowest, 39°, at Auburn on the 1st. The average precipitation was 3.81, or 0.23 below normal; the greatest monthly amount, 7.80, occurred at Princeton, and the least, 1.18, at Topeka.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 71.4°, or about 1.0° above normal; the highest was 99°, at Belle Plaine on the 30th, and the lowest, 42°, at Forest City on the 27th. The average precipitation was 4.72, or slightly above normal; the greatest monthly amount, 12.48, occurred at Greenfield, and the least, 1.90, at Olin.—*G. M. Chappel.*

Kansas.—The mean temperature was 74.9°, or 0.9° above normal; the highest was 108°, at Dresden on the 25th, and the lowest, 40°, at Colby on the 1st. The average precipitation was 4.60, or 0.54 above normal; the greatest monthly amount, 9.96, occurred at Fort Scott, and the least, 1.43, at Wallace.—*T. B. Jennings.*

Kentucky.—The mean temperature was 76.2°, or 1.4° above normal; the highest was 101°, at Shelbyville on the 10th, and the lowest, 45°, at Maysville on the 22d. The average precipitation was 3.90, or about normal; the greatest monthly amount, 7.94, occurred at Lexington, and the least, 1.55, at Williamsburg.—*G. E. Hunt.*

Louisiana.—The mean temperature was 80.1°, or about 1.0° above normal; the highest was 100°, at Plaquemine on the 1st, and the lowest 60°, at Napoleonville on the 3d, 5th, and 11th, and at Opelousas on the 5th. The average precipitation was 7.64, or about 1.75 above normal; the greatest monthly amount, 14.56, occurred at Plain Dealing, and the least, 1.07, at Port Eads.—*R. E. Kerkam.*

Maryland and Delaware.—The mean temperature was 71.7°, or 0.6° above normal; the highest was 100°, at Bachmans Valley, Md., on the 25th, and at Westernport, Md., on the 30th, and the lowest, 35°, at Deerpark, Md., on the 24th. The average precipitation was 2.00, or 1.17 below normal; the greatest monthly amount, 3.99, occurred at Newark, Del., and the least, 0.35, at Maryland Agricultural College.—*F. J. Walz.*

Michigan.—The mean temperature was 65.7°, or 0.4° above normal; the highest was 96°, at Allegan on the 5th, at Ionia on the 24th, and at Rogers on the 25th; the lowest was 27°, at Iron River on the 15th. The average precipitation was 3.61, or 0.41 above normal; the greatest monthly amount, 7.29, occurred at West Harrisonville, and the least, 0.80, at Hart.—*C. F. Schneider.*

Minnesota.—The mean temperature was 67.0°, or about normal; the highest was 99°, at Beardsley on the 23d, and the lowest, 33°, at Mount Iron on the 15th. The average precipitation was 3.93, or about normal; the greatest monthly amount, 11.79, occurred at Pine River Dam, and the least, 1.94, at St. Olaf.—*T. S. Outram.*

Mississippi.—The mean temperature was 80.2°, or 1.1° above normal; the highest was 102°, at Aberdeen on the 25th and at Columbus on the 3d, and the lowest, 60°, at Corinth on the 1st, at Leakesville on the 2d, and at Waynesboro on the 16th. The average precipitation was 4.99, or 0.74 above normal; the greatest monthly amount, 10.75, occurred at Fayette, and the least, 1.19, at Booneville.—*R. J. Hyatt.*

Missouri.—The mean temperature was 75.3°, or 1.9° above normal; the highest was 100°, at Jefferson City on the 30th, and the lowest, 42°, at Potosi on the 20th. The average precipitation was 5.89, or 1.15 above normal; the greatest monthly amount, 11.08, occurred at Arthur, and the least, 2.42, at Downing.—*A. E. Hackett.*

Montana.—The mean temperature was 58.9°, or slightly below normal; the highest was 103°, at Glendive on the 19th, and the lowest, 28°, at Adel on the 1st. The average precipitation was 3.34, or about 0.50 above normal; the greatest monthly amount, 6.79, occurred at Wibaux, and the least, 1.08, at Columbia Falls.—*J. Warren Smith.*

Nebraska.—The mean temperature was 70.4°, or about 1.0° above normal; the highest was 109°, at Franklin on the 24th, and the lowest, 33°, at Camp Clarke on the 5th. The average precipitation was 3.54, or about 0.40 below normal; the greatest monthly amount, 11.62, occurred at Geneva, and the least, trace, at Lodgepole.—*G. A. Loveland.*

Nevada.—The mean temperature was 65.0°, or 0.7° below normal; the highest was 104°, at Panaca on the 27th, and the lowest, 20°, at Monitor Mill on the 2d. The average precipitation was 0.19, or about half the normal amount; the greatest monthly amount, 2.38, occurred at Toano, while none fell at many stations.—*R. F. Young.*

New England.—The mean temperature was 64.5°, or 0.7° below normal; the highest was 93°, at Middletown, Conn., on the 25th and 26th, and at Waterbury, Conn., on the 26th, and the lowest, 31°, at Flagstaff, Me., on the 11th. The average precipitation was 2.69, or 0.20 below normal; the greatest monthly amount, 7.36, occurred at Pittsfield, Mass., and the least, 0.10, at Narragansett Pier, R. I.—*J. W. Smith.*

New Jersey.—The mean temperature was 70.1°, or 0.5° above normal; the highest was 100°, at Vineland on the 28th, and the lowest, 38°, at Charlotteburg on the 16th and 23d. The average precipitation was