

property were secured and protected. Heavy rises occurred between 7 a. m. of the 19th and 7 a. m. of the 20th, varying from 14 feet at Chattanooga to 11 feet on the Clinch and Powell rivers. A stage of 32 feet was forecast for Chattanooga by the night of the 21st, and the information widely disseminated. Local interests were warned to prepare for a crest stage of a little over 33 feet during the night of the 21st. Numerous calls by telephone from parties up and down the river were promptly answered and full information and forecast given. A crest stage of 23 feet was forecast at Bridgeport, Ala., and 29 feet at Guntersville, Ala.; the actual crests were 23.4 feet at Bridgeport, 0.6 foot below the flood stage, and 29.8 feet at Guntersville, 1.2 feet below the flood stage. The river at Chattanooga reached its crest of between 33.3 and 33.4 feet after 12:35 a. m. of the 22d, and the first fall was recorded at 12:20 p. m. of the 22d. The crest stage exceeded all previous November records by a little over 3 feet. The back water caused considerable inconvenience at and below Chattanooga by covering public roads and by stopping various sawmills and other industries near the river. No property was lost, as far as can be ascertained, at or below Chattanooga. Above Chattanooga, on the headwaters of the Ocoee and Hiwassee rivers, much damage was done. Thousands of bushels of corn were damaged and pumpkin fields were completely washed away. The drift that passed Chattanooga was heavy, consisting of logs, pumpkins, large trees, straw, bridge timber, dead hogs, chickens, etc. The Louisville and Nashville Railway bridge at Reliance and the Isabella trestle were washed away on the afternoon of the 19th. A cloud-burst on the afternoon of the 18th on Thunderhead Mountain washed away about 25 miles of track of the Little River Lumber Company, near Townsend, causing a loss of nearly \$50,000. The Philadelphia Veneer and Lumber Company lost \$8,000 worth of logs at Clinton, Tenn., and the Tellico Lumber Company, at Tellico Plains, lost a large number of logs. It was reported that twenty lives were lost at McCays station, on the Knoxville and Marietta branch of the Louisville and Nashville Railway, but later information reduced that number to three. The persons lost were warned to move, as the river was rising rapidly, but they paid no attention to the warning, and within three hours they were swept away, with their cabin.

Warnings were also issued at the proper time for the lower Tennessee River, where the crest stages varied from 1 foot to 4 feet above the flood lines.

The crest of the Ohio River rise reached Cairo, Ill., on the 27th, and at the end of the month the Mississippi was rising steadily below Memphis, Tenn. In the vicinity of Paducah, Ky., the high water caused damage to the amount of about \$50,000, altho the highest point reached by the river was over 7 feet below the flood stage. The losses were due to the fact that the rise was a most unusual one for the month of November, when low-water stages are the rule, and much stock and lumber had accordingly been left on the lands subject to overflow. It has been stated, however, that the losses would have been more than doubled had it not been for the warnings issued in advance of the flood.

The Milk River at Havre, Mont., froze over on the 15th and the James at Huron, S. Dak., on the 17th. The Missouri was still open at the end of the month from Bismarck, N. Dak., southward, altho heavy floating ice was observed at Bismarck on the 18th. There was a small gorge at Sioux City, Iowa, on the 20th, and floating ice as far south as Kansas City, Mo., from the 22d to the 28th, inclusive.

The first ice in the Mississippi River was observed at Fort Ripley, Minn., on the 17th. Floating ice was also seen on the 23d at Prairie du Chien, Wis., but none below that point.

The highest and lowest water, mean stage, and monthly range at 281 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

## THE WEATHER OF THE MONTH.

By Mr. F. C. DAY, Assistant Chief, Division of Meteorological Records.

### PRESSURE.

The distribution of mean atmospheric pressure for November, 1906, over the United States and Canada is graphically shown on Chart VI, and the average values and departures from the normal are shown for each station in Tables I and V.

The mean atmospheric pressure was above the normal over all sections of the United States and Canada except the extreme southwest, along the Gulf coast, and over New England and the Canadian Maritime Provinces.

Over the interior portion of the United States from the Rocky Mountains eastward, pressure averaged unusually high, due in the main to the slow passage eastward of several well-defined areas of high pressure during the early part of the month. Pressure averages for the month were decidedly below the normal,  $-.05$  to  $-.15$  inch, from New England northeastward over New Brunswick and Nova Scotia.

Over the north Pacific coast and adjacent territory the almost continuous low pressure during the early part of the month gave way during the second decade, and unusually high pressure prevailed over that section during the remainder of the month.

### TEMPERATURE.

From the Rocky Mountain slope eastward to the Atlantic the monthly mean temperature averaged above the normal, except over eastern New York and northern New England, where slight deficiencies were noted. Over the lower Mississippi Valley the excess of temperature was marked, averaging about  $5^{\circ}$  daily above the normal in the southern portions of the States of Alabama, Mississippi, and Louisiana.

Temperatures along the northern border were generally above the average, especially over the upper Lake region, and under the influence of the prevailing southerly winds from the high pressure over the central part of the United States

the positive departures in Canada from the Lake region to Manitoba and northward showed marked increases.

From the Rocky Mountains west to the Pacific coast, except over small sections of northern California and western Oregon, the temperature was generally below the seasonal average. Over southwestern Utah, southern Nevada, and southeastern California, the month was an unusually cold one.

Maximum temperatures of  $90^{\circ}$ , or above, were recorded in southwestern Arizona and southeastern California and over the southern portion of Texas. Maximum temperatures of  $80^{\circ}$  to  $90^{\circ}$  were confined principally to the Gulf States.

Severe cold was experienced over the lower Mississippi Valley and east Gulf States from the 12th to the 14th, and freezing temperatures prevailed over the interior of that section with killing frosts almost to the Gulf coast. Unusually cold weather prevailed over California during the latter part of the month with heavy to killing frosts in many portions of the southern part of the State.

Minimum temperatures from  $10^{\circ}$  to  $25^{\circ}$  below zero were recorded over North Dakota and in the central Rocky Mountain districts during the progress of an extensive area of high pressure southeastward over the Great Plains and central valleys from the 18th to the 20th.

### PRECIPITATION.

The precipitation during November is usually heavy, above 4 inches, over the lower Mississippi Valley, and on the Pacific coast from central California northward over the district west of and including the Coast Range of mountains, and, including the higher elevations of the Cascades, where monthly amounts from 10 to 15 inches are frequently recorded.

Precipitation is usually light, less than 1 inch, over southern California, the Rocky Mountains, and the Great Plains, and comparatively light over the Florida Peninsula.

During November, 1906, normal conditions over southern Florida were reversed and the heaviest rainfall ever recorded in November, 10.82 inches, was measured at Key West. Nearly all of the above amount, 10.30 inches, occurred from the 1st to the 3d, during the prevalence of a slight barometric depression apparently central over western Cuba. Over the central Mississippi Valley precipitation was also far in excess of the average. The amount of fall over western Tennessee, northern Mississippi, and northeastern Arkansas from the 16th to 20th was at many points the heaviest ever recorded. Much damage was done by floods in the small streams, which in many cases were higher than ever known previously.

Over the north Pacific coast the rainy season, which began unusually early in September, continued thru October, and rainy weather was almost continuous from the 2d to the 21st of November. During the latter period the fall, especially on the western slopes of the Coast Range and the higher elevations of the Cascade Mountains, was unusually heavy. At Glenora, Oreg., a station on the western slope of the Coast Range of Mountains, at an elevation of about 2500 feet, the amount of fall from the 1st to the 20th reached the remarkable depth of 38.73 inches.

On account of the heavy rainfall during September and October the ground over the headwaters of the streams in the Coast and Cascade mountains was already thoroly saturated and the streams were bank full, so that the additional fall during November caused serious floods in all streams having their sources in the above-mentioned mountains.

Precipitation was also generally in excess of the normal over the upper Lakes, the upper Mississippi Valley, the area drained by the Missouri River, the mountain and plateau regions, and was unusually heavy over western Texas and eastern New Mexico. Over nearly all districts from the lower Lakes to the Atlantic coast and south to central Florida and the Gulf coast regions, except northern Mississippi, northeastern Arkansas, and the extreme southern coast of Texas, the precipitation for the month was unusually light. Less than 50 per cent of the normal occurred over all sections near the coast from New England to Florida and over nearly the entire Gulf region.

Over all of California precipitation was largely deficient.

SNOWFALL.

The total snowfall was generally not above the average, but the extent of territory over which snow occurred was unusually large, measurable amounts being reported from all districts except comparatively small areas near the south Atlantic, Gulf, and Pacific coasts. Over the southern Rocky Mountains snowfall was generally heavy, most of it occurring during the prevalence of an area of low pressure over that section from the 17th to 19th. The fall was especially heavy in eastern New Mexico and western Texas, where depths from 12 to 18 inches were general. High winds and severe cold weather immediately following drifted the snow badly and caused much suffering and some loss to animal life.

Rather heavy snowfall occurred in the northwest quadrant of the low area that moved from Texas to New England from the 14th to the 16th, the depth over parts of Pennsylvania, New York, northern New Jersey, and the interior of New England ranging from 5 to 10 inches. Heavy snows also occurred over Missouri and adjacent territory on the 14th, the amount of fall ranging from 3 to 12 inches, a very unusual depth so early in the winter.

At the end of the month but little snow remained on the ground except over interior New England, the northern portions of Michigan, Wisconsin, Minnesota, and North Dakota, and over the Rocky Mountain region.

RELATIVE HUMIDITY.

Relative humidity was deficient over the Atlantic, Gulf, and Pacific districts, but was largely in excess of the normal in all

portions of the mountain and plateau districts. Over Colorado, western Texas, New Mexico, Arizona, and Utah, the humidity averaged from 10 to 16 per cent above the normal. Cloudiness was also much in excess of the normal over the last-named region.

As a rule, the month was one of much pleasant weather over all eastern districts, where the usual outdoor occupations were pursued with little interruption, while from the Mississippi westward much cloudy and inclement weather prevailed.

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	9	39.4	- 0.6	+ 7.2	+ 0.7
Middle Atlantic	13	46.2	+ 1.3	+13.1	+ 1.2
South Atlantic	10	55.1	+ 1.0	+ 5.2	+ 0.5
Florida Peninsula*	8	68.0	+ 1.4	+ 2.0	+ 0.2
East Gulf	8	58.7	+ 3.0	- 3.6	- 0.3
West Gulf	7	57.6	- 1.3	- 3.5	- 0.3
Ohio Valley and Tennessee	12	46.0	+ 1.4	+ 4.8	+ 3.4
Lower Lake	8	39.6	+ 0.6	+14.0	+ 1.3
Upper Lake	10	36.5	+ 2.6	+22.1	+ 2.0
North Dakota*	8	26.0	+ 2.7	+25.0	+ 2.3
Upper Mississippi Valley	13	38.1	+ 1.3	+ 8.4	+ 0.8
Missouri Valley	11	37.3	+ 0.5	+10.3	+ 0.9
Northern Slope	7	31.6	- 1.2	+ 9.1	+ 0.8
Middle Slope	6	40.8	- 0.5	- 1.9	- 0.2
Southern Slope*	6	46.2	- 2.8	-17.7	- 1.6
Southern Plateau*	13	46.2	- 1.2	- 1.1	- 0.1
Middle Plateau*	8	35.1	- 2.1	- 3.0	- 0.3
Northern Plateau*	12	35.3	- 0.3	+17.6	+ 1.6
North Pacific	7	45.5	+ 0.1	+13.7	+ 1.2
Middle Pacific	5	53.1	- 0.4	+12.1	+ 1.1
South Pacific	4	56.3	- 1.3	+ 8.2	+ 0.7

\* Regular Weather Bureau and selected cooperative stations.

In Canada.—Prof. R. F. Stupart says :

The mean temperature of November was higher than the average from Saskatchewan to Lake Huron, and either average or about 1° above or below in other portions of the Dominion. The largest positive departure, amounting to 7°, occurred in Manitoba and to the northward of Lake Superior.

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	9	2.65	69	-1.2	-2.3
Middle Atlantic	13	1.68	53	-1.5	+0.4
South Atlantic	10	0.95	33	-1.9	-3.7
Florida Peninsula*	8	2.29	105	+0.1	+4.5
East Gulf	8	1.60	46	-1.9	+0.5
West Gulf	7	2.46	65	-1.3	-8.0
Ohio Valley and Tennessee	12	4.31	116	+0.6	-3.5
Lower Lake	8	2.19	69	-1.0	-2.8
Upper Lake	10	3.20	123	+0.6	-1.6
North Dakota*	8	1.53	184	+0.7	+2.1
Upper Mississippi Valley	13	3.11	147	+1.0	-0.4
Missouri Valley	11	1.43	116	+0.2	+1.3
Northern Slope	7	0.89	182	+0.4	+3.1
Middle Slope	6	1.31	144	+0.4	+2.6
Southern Slope*	6	2.51	156	+0.9	+4.8
Southern Plateau*	13	1.54	241	+0.9	+3.6
Middle Plateau*	8	1.27	190	+0.6	+4.4
Northern Plateau*	12	2.35	131	+0.6	-0.3
North Pacific	7	8.54	123	+1.6	-5.3
Middle Pacific	5	1.54	47	-1.7	+0.8
South Pacific	4	0.82	62	-0.5	+5.3

\* Regular Weather Bureau and selected cooperative stations.

In Canada.—Professor Stupart says:

The precipitation was very generally in excess of the average from Manitoba westward to the Pacific and also in the Maritime Provinces, while in Ontario and Quebec it was deficient in most districts. Near the coast in British Columbia it was almost wholly rain, and in the upper mainland it was part rain and part snow. In the western provinces it was almost wholly snow. In Ontario, Quebec, and the Maritime Provinces it was part rain and part snow, the former preponderating.

At the close of the month all the higher lands of British Columbia and the whole of the western provinces, exclusive of southern Alberta, were snow covered, with fair sleighing in many districts. In Ontario the ground was mostly bare, except in Algoma and Nipissing, and in some localities near the Ottawa River and in Quebec there was but a thin

covering, as was also the condition in some portions of Nova Scotia and Prince Edward Island.

*Average relative humidity and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	72	- 6	Missouri Valley	73	+ 2
Middle Atlantic	71	- 4	Northern Slope	76	+ 9
South Atlantic	74	- 4	Middle Slope	72	+10
Florida Peninsula	80	- 1	Southern Slope	78	+16
East Gulf	73	- 3	Southern Plateau	56	+11
West Gulf	73	- 1	Middle Plateau	66	+ 9
Ohio Valley and Tennessee	73	0	Northern Plateau	74	+ 2
Lower Lake	78	+ 1	North Pacific	84	0
Upper Lake	81	+ 1	Middle Pacific	67	- 7
North Dakota	84	+ 5	South Pacific	61	- 6
Upper Mississippi Valley	78	+ 4			

*Average cloudiness and departures from the normal.*

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.4	+ 0.8	Missouri Valley	6.4	+ 1.4
Middle Atlantic	4.5	- 0.7	Northern Slope	5.8	+ 1.2
South Atlantic	3.2	- 1.3	Middle Slope	5.6	+ 2.0
Florida Peninsula	4.3	- 0.3	Southern Slope	5.7	+ 2.4
East Gulf	4.0	- 1.4	Southern Plateau	3.6	+ 1.0
West Gulf	5.1	+ 0.5	Middle Plateau	5.7	+ 1.7
Ohio Valley and Tennessee	5.7	0.0	Northern Plateau	7.1	+ 1.4
Lower Lake	7.1	- 0.1	North Pacific	7.6	+ 0.8
Upper Lake	7.6	+ 0.6	Middle Pacific	4.0	+ 0.2
North Dakota	6.5	+ 1.2	South Pacific	2.9	0.0
Upper Mississippi Valley	6.9	+ 1.6			

*Maximum wind velocities.*

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Block Island, R. I.	11	54	e.	Nantucket, Mass.	15	59	e.
Do	15	61	ne.	New York, N. Y.	16	51	w.
Do	16	50	nw.	North Head, Wash.	2	50	se.
Buffalo, N. Y.	21	58	sw.	Do	3	52	se.
Do	22	70	sw.	Do	4	72	se.
Do	27	54	w.	Do	5	60	se.
Canton, N. Y.	22	53	sw.	Do	6	87	se.
Cheyenne, Wyo.	15	60	nw.	Do	9	68	se.
Chicago, Ill.	21	59	sw.	Do	10	67	se.
Cleveland, Ohio	21	52	sw.	Do	11	54	se.
Do	26	50	w.	Do	12	72	se.
Columbus, Ohio	21	56	sw.	Do	14	64	s.
Detroit, Mich.	21	50	sw.	Do	15	67	nw.
Eastport, Me.	12	60	e.	Do	25	56	nw.
Do	15	53	e.	Point Reyes Light, Cal.	3	57	s.
Do	16	61	e.	Do	4	60	s.
El Paso, Tex.	17	50	w.	Do	16	60	nw.
Fort Smith, Ark.	16	50	w.	Do	17	76	nw.
Grand Haven, Mich.	21	64	sw.	Do	18	58	nw.
Grand Rapids, Mich.	21	66	sw.	Do	21	62	nw.
Green Bay, Wis.	21	50	n.	Do	22	54	ne.
Helena, Mont.	10	50	sw.	Rapid City, S. Dak.	29	50	w.
Indianapolis, Ind.	21	58	sw.	Salt Lake City, Utah	15	66	nw.
Milwaukee, Wis.	16	55	se.	San Francisco, Cal.	30	64	ne.
Mount Tamalpais, Cal.	2	50	s.	Southeast Farallon, Cal.	18	51	nw.
Do	4	52	w.	Tatoosh Island, Wash.	4	58	s.
Do	17	66	nw.	Do	5	58	s.
Do	18	62	n.	Do	8	52	e.
Do	22	67	n.	Do	9	68	s.
Do	23	54	n.	Do	10	51	e.
Do	26	60	n.	Do	12	69	s.
Do	30	70	ne.	Do	14	55	sw.
Mount Weather, Va.	12	50	nw.	Do	15	61	nw.
Do	13	52	nw.	Toledo, Ohio	21	68	sw.
Do	27	56	nw.	Do	22	50	sw.
Do	28	56	nw.				