

these highs and lows will be found in the accompanying table:

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.										
I.....	*	35	90	5, a. m.	45	60	<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
II.....	5, p. m.	52	117	11, p. m.	46	57	2,140	5.0	428	17.9
III.....	10, a. m.	52	109	16, p. m.	33	79	4,090	6.0	681	33.4
IV.....	21, a. m.	51	110	23, p. m.	44	60	3,380	6.5	521	21.7
V.....	24, a. m.	48	94	26, p. m.	47	60	2,560	2.5	1,022	42.6
							1,640	2.5	655	27.3
Sums.....							13,810	22.5	3,307	
Mean of 5 paths.....									661	27.6
Mean of 22.5 days.....									614	25.6
Low areas.										
I.....	1, p. m.	39	99	6, p. m.	51	69	2,850	5.0	570	23.7
II.....	3, p. m.	52	119	9, p. m.	47	59	3,680	6.0	613	25.5
III.....	7, p. m.	48	127	12, a. m.	50	64	4,100	4.5	912	38.0
IV.....	11, p. m.	31	94	14, a. m.	45	59	3,110	2.5	845	35.2
V.....	12, a. m.	49	127	17, a. m.	49	66	3,950	5.0	590	24.6
VI.....	16, p. m.	43	124	19, a. m.	47	63	3,200	2.5	1,315	54.8
VII.....	21, a. m.	46	127	24, a. m.	52	63	2,940	3.0	980	40.8
VIII.....	23, a. m.	38	124	28, a. m.	46	70	3,390	5.0	666	27.8
Sums.....							25,250	33.5	6,491	
Mean of 8 paths.....									811	33.8
Mean of 33.5 days.....									754	31.4

* October 31, a. m.

HIGHS.

The highs were mostly formed to the north of Montana or were detached from the rather permanent high in that region. Nos. I, II, and III had most of their course in south latitudes in the Gulf States. All of the highs, except No. III, finally reached Nova Scotia, and were last noted to the south of Newfoundland. No. III disappeared on the 16th in a subpermanent high off the South Carolina coast, which remained stationary until the 18th, p. m. Reduced pressures of 31.00 and above were frequently noted in Montana and to the north. The mean of 30.27 at Havre was the highest mean November pressure ever noted in that region. There was also an abnormally high pressure in the southeast States, reaching 30.26 at Raleigh and Wilmington, which is the highest mean November pressure noted in the South Atlantic States.

LOWS.

All of the low areas of the month, except Nos. I and IV, originated on or off the north Pacific Coast, No. I was first noted p. m. of 1st in Kansas, and No. IV p. m. of 11th in east Texas. The general trend of the lows was to the east and a little south of east till the Mississippi Valley was reached, when they turned northeast, and nearly all crossed a point just to the east of Lake Superior. All the lows disappeared in or near the Gulf of St. Lawrence. No. I was very severe in the Lake Region on the 5th; Buffalo reported 63 miles per hour, and Detroit 52 miles on afternoon of that day. No. III caused 48 miles at Chicago on p. m. of 10th, and 38 miles at Sault Ste. Marie on a. m. of 11th, Buffalo also reported 60 miles per hour on afternoon of 11th. When No. VIII reached the Lake Region it caused winds of 52 miles at Chicago, a. m. of 27th.

A remarkable feature of the storms of this month was the very great velocity, 54.8 miles hourly for No. VI. Both the high area and low area velocity between the 16th and 24th was quite abnormal, averaging 46.1 miles per hour for the two lows and one high. This would seem to show a common origin for the motion of these conditions. It should be borne in mind, however, that during this same period there were sub-

permanent highs nearly stationary to the north of Montana and in the southeast Atlantic States.

LOCAL STORMS.

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

There were but two local storms properly so-called during November. Severe general storms, using that term as indicating a storm of wide extent, swept over the Lake Region on the 5th and 10th. Unusually heavy rains, at times mixed with snow and sleet, fell in Washington, Oregon, and Idaho on the 11th, 12th, 13th, 14th, 15th, and 16th, producing dangerous floods in the rivers and small streams. Travel was interrupted, transportation lines damaged, bridges washed away, and much movable property was swept down the rivers.

On the 23d an area of low pressure appeared on the California coast. It moved a little south of east, and on the morning of the 25th covered south-central Utah. About 3 p. m., central time, of the last-named date a minor tornado occurred in McLennan County, Tex., passing near the little town of Mart. One person was killed and three injured. Two dwelling houses were completely destroyed and five injured. The property loss was about \$2,000; path of greatest destruction, 30 to 60 yards wide and about 8 miles long. Moved northeast.

On the morning of the 26th the storm center covered Iowa, eastern Kansas, and northwestern Missouri. The temperature gradients westward were exceedingly sharp, and high winds and snow prevailed northward to the British boundary and westward to the Rocky Mountain Region, while the temperature of springtime prevailed over the southern Mississippi Valley and the Gulf Coast.

A minor tornado was observed at 10.30 p. m., central time, near Tunica, Miss. One person was killed and one injured. Property loss was about \$1,500. Path 300 yards wide; length unknown. Storm said to have moved northwest.

Strong winds and gales were reported in southern Illinois and western Kentucky. Press dispatches state that houses were blown down at Kuttawa, Eddyville, and Mayfield. No lives lost.

From four to eight lives were lost in Minnesota and the Dakotas as a result of the severity of the weather during the 26th and 27th.

LOCAL STORMS IN OCTOBER, 1896.

A West India hurricane moved slowly northeastward, but at some distance from the Atlantic Coast line on the 10th, 11th, 12th, and 13th, causing very high tides and dangerous gales, especially on the New Jersey, Long Island, and New England coasts. Much damage was done to bulkheads, wharves, piers, and other property on the immediate shore line. Beach property on the New Jersey and Long Island coasts suffered heavily. Probably half a million dollars will be required to repair and replace the property damaged and destroyed.

Minor tornadoes occurred in Texas, Oklahoma, Arkansas, Louisiana, and Mississippi, on the 22d, 28th, and 29th. The record in detail is as follows:

1st-2d.—A succession of heavy downpours in the upper San Pedro Valley (Arizona) caused a disastrous flood in the river. Five persons were drowned, and property valued at \$10,000 was destroyed.

9th.—The voluntary observer at Lake Butler, Fla., Mr. John A. King, reports that a "cyclone" (by which we presume he means merely a severe local storm) occurred near his station on this date. One dwelling and an outbuilding were destroyed. No details of the storm were reported.

22d.—A minor tornado was observed near Seguin, Tex., a little after 4 p. m., probably central time, of the 22d, by Mr. Samuel Neel. Property loss was small; path 300 feet wide

and about 6 miles long; no casualties; moved northeast; destruction confined principally to timber.

25th.—A severe wind and rain storm occurred at Santa Rosa, Cal., on this date. Dwelling houses and barns were moved from their foundations, and trees were prostrated.

28th.—The general meteorological conditions on the 28th were not greatly different from those of May 15, last. The area of low pressure on the morning map was to the north-westward. Snow was falling in the Rocky Mountain Region (on both dates), and warm southeast winds prevailed throughout the Mississippi Valley. Severe storms, and in some localities minor tornadoes, occurred in Texas, Oklahoma, and Indian Territory. The region of tornadic activity in Texas was almost identical with that traversed by the Sherman tornado (May 15, 1896), but the funnel-shaped clouds were narrow, and the rotary winds were not of unusual violence. Two funnel clouds were observed at Farmington, three at Howe, and one three miles east of Sherman. The funnel clouds observed at Howe were high in the air, and no destruction was wrought by them in that vicinity. The tornado path was from 30 to 200 yards wide, and its probable length 8 or 10 miles. Six persons were injured near Howe and Farmington. The property loss was not great, probably \$2,000 or \$3,000 in all.

Alderson, Ind. T., was visited by a minor tornado at 3 p. m., central time, of the same date. Two persons injured; property loss about \$2,500; path of destruction, 150 feet wide and one-half mile long; general progressive movement toward northeast. Press reports of tornadoes in Lincoln, Logan, and Payne counties, Okla., have not yet been verified.

Wewoka, Ind. T., was also visited by a small tornado about 10.15 p. m., central time, of the same date. Three persons were injured. Two residences, one church, one stone store building, and one warehouse were destroyed. The path of great destruction was about one-fourth mile wide and 4 miles long.

29th.—Tornadoes occurred on this date in Arkansas, Louisiana, and Mississippi. The most destructive storm passed through Tensas Parish, La., at about 11.30 a. m., probably central time. Two persons were killed and thirteen wounded; the property loss was about \$15,000. The path of the storm was about 200 yards wide; length unknown; movement toward northeast. About 10 a. m., central time, a destructive storm passed through Jefferson County, Ark., striking the edge of the small hamlet of Tucker. Seven dwelling houses were totally destroyed and three people were injured; the path was about 50 yards wide, increasing at some points to one-half mile; length unknown; storm moved northeast.

The western edge of Coffeyville, Miss., was struck by a tornado at 2 p. m., central time. One person injured; property loss about \$1,750. Width of path of great destruction, 150 feet; length, 750 feet; moved northeast.

The station Delay, in the eastern part of Lafayette County, Miss., was visited by a tornado at 3 p. m., probably central time, of the same date. No casualties; property loss, \$2,500. Storm moved northeast.

The following account of the waterspout-tornado that visited New Orleans, La., on this date is contributed by Mr. Robert E. Kerkam, Local Forecast Official, Weather Bureau, New Orleans, La.:

The storm commenced at 4 p. m., local time, by the coming together of two large, black clouds, on the Mississippi River, almost opposite Milan street, forming a waterspout that moved down the river, crossing toward the land and first assuming tornadic form at the head of General Taylor street. A mild thunderstorm was in progress over the city at the time, but there was little lightning or thunder, and the conditions did not appear to warrant anticipating tornadic development; the temperature and pressure showed no fluctuations at the station worthy of moment during the time the local storm was in progress.

The theory advanced is that common to waterspouts striking land in

this section. After leaving the water, the funnel lifted, only occasionally lowering to near the ground, at which times devastation occurred; but the cloud from which the funnel depended was heavy, and the cloud did not dissipate, or pass beyond the range of vision, after again reaching the river, until it had covered a mile or slightly more of river front.

The duration of the storm from the time it struck the head of General Taylor street until it passed Robin street in its northeastward movement to the river did not occupy more than a few minutes. Its course of movement was from southwest to northeast; funnel cloud black, surrounded by a misty, yellow covering about the lower part of the funnel; whirl from right to left, or contrary to the movements of the hands of a watch; rainfall only slight at 4 p. m., but heavy rain at 4.30 p. m., after the tornado had disappeared on the river; the noise accompanying the tornado's movement resembled a loud rumbling, similar to that of a railroad train; length of track, slightly exceeding a mile; width, variable; largest width of path of destruction about 200 feet; property destroyed estimated at from \$75,000 to \$100,000; no loss of life known; although it was reported that two negroes had been carried into the river, but ten persons were injured by falling or flying debris. No hail accompanied the storm, and but little lightning or thunder; after the storm passed there was a heavy fall of rain and a mild thunderstorm. The debris scattered along the path of the storm gave every indication of the usual whirling motion accompanying tornadoes; but as it consisted mostly of brick, slate roofs, etc., and as the funnel cloud frequently lifted and no material damage was done, therefore the path was not well defined, save in the last third of a mile where cotton presses and brick walls were demolished.

The local meteorological conditions at the observatory in the custom-house, distant some two miles from the tornado, were not materially affected; the temperature showed no fluctuations, there was only a very gradual rise in the pressure, as shown by the barograph, and the maximum velocity of the wind reached less than 20 miles per hour, with an extreme velocity of 24 miles per hour. The wind changed from south at 3.50 p. m., to southwest for two minutes, then to northwest for two minutes; to north for four minutes, to northwest for six minutes, with a sudden change to steady southeast from 4.05 to 4.40 p. m., local time.

Eye witnesses of the tornado differ as regards the appearance of surrounding clouds, two claiming that small funnel shapes were visible besides the general tornado funnel, and another stating that he watched the progress of the storm carefully, and noted only the one main funnel; the latter appears more credible, since the heavy clouds were at a low altitude, and a heavy rain apparent; it is possible that the masses of surrounding clouds confused the former witnesses.

Peculiar freaks of the wind were apparent along the path of the storm: At one point a bale of cotton was burst open and the cotton was strung and wound around the telegraph and other wires in the neighborhood, making them appear as if sleet and ice had frozen thereon; the telegraph poles and wires at this point were not disturbed, yet they were in the direct path of the storm. In one yard a tree in the center of the yard had been torn up by the roots, but no other vegetation or trees were injured, and no trace of damage could be found on the roofs of the buildings situated immediately next the yard.

The tornado, taken as a whole, was of a mild form and could not be classed with the storms that inflicted the great damage in Louisville or St. Louis, or others of like character.

Total known fatalities by tornado during the month, 4; by lightning, 5.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The mean temperature is given for each station in Table II, for voluntary observers. Both the mean temperatures and the departures from the normal are given in Table I for the regular stations of the Weather Bureau.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean temperature* of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by