

and detailed report of the tornado, with sketches and charts illustrating its prominent features, has been made by Sergeant J. M. Cline, Signal Corps, observer at Abilene, Tex.

9th. Kansas.—Wichita: high wind, accompanied by snow, prevailed; maximum velocity of wind, 30 miles per hour at 10 a. m., from the north, and at 2.35 p. m., from the northwest. Street cars were unable to run; business was generally interrupted; telegraph lines were reported down in all directions, and railroad trains were delayed. **Missouri.**—Kansas City: a snow storm caused much damage to telegraph and telephone wires. It is stated that this was the severest snow storm that

has occurred in this section so early in the season in many years.

10-11th. Michigan.—Detroit: a severe sleet and hail storm, moving from northwest to southeast, occurred during the night. The storm, which began and ended quite abruptly, seemed to pass in streaks, as in some parts of the city no hail or sleet fell.

23d-24th. Arizona.—Globe, Gila Co.: the storm which passed over this place is reported as the severest November storm in that section of which there is a record; 2.99 inches of rain fell in twenty-four hours.

INLAND NAVIGATION.

In the following table are shown the danger-points at the various stations; the highest and lowest depths for November, 1888, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, November, 1888 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, La.	29.9	28-29	7.2	4, 5, 6	0.6	6.6
<i>Arkansas River:</i>						
Fort Smith, Ark. ...	22.0	21	5.9	6, 7	1.1	4.8
Little Rock, Ark. ...	23.0	22	8.6	2, 3	1.9	6.7
<i>Missouri River:</i>						
Leavenworth, Kans. ...	20.0	11	5.9	29	5.0	0.9
Kansas City, Mo. ...	21.0	10, 11, 12	6.5	28, 29, 30	5.8	0.7
<i>Mississippi River:</i>						
Saint Paul, Minn. ...	14.5	4, 5, 6, 7	3.7	18-19	2.4	1.3
La Crosse, Wis.	24.0	3, 4, 5, 6	3.9	27-30	2.9	1.0
Dubuque, Iowa.	16.0	5, 6, 10, 11	3.8	28-29	3.0	0.8
Davenport, Iowa. ...	15.0	11-12	2.7	28, 29-30	1.9	0.8
Keokuk, Iowa.	14.0	13	3.0	1	1.4	1.6
Saint Louis, Mo. ...	32.0	16	9.0	5	5.1	3.9
Cairo, Ill.	40.0	17	31.5	1	19.0	12.5
Memphis, Tenn. ...	34.0	19	25.1	1	13.0	12.1
Vicksburg, Miss. ...	41.0	24-25	28.9	1	8.0	20.9
New Orleans, La. ...	13.0	29-30	8.9	5, 6, 7	3.2	5.7
<i>Ohio River:</i>						
Pittsburgh, Pa.	22.0	16	12.3	30	4.1	8.2
Parkersburg, W. Va. ...	38.0	12	17.8	25	2.5	20.3
Cincinnati, Ohio. ...	50.0	10	34.0	30	17.6	16.4
Louisville, Ky.	25.0	10	14.9	30	8.4	6.5
<i>Cumberland River:</i>						
Nashville, Tenn. ...	40.0	13	26.5	7	6.4	20.1
<i>Tennessee River:</i>						
Chattanooga, Tenn. ...	33.0	12	21.0	8	5.4	15.6
<i>Monongahela River:</i>						
Pittsburgh, Pa.	29.0	16	12.3	30	4.1	8.2
<i>Savannah River:</i>						
Augusta, Ga.	32.0	11	24.5	3, 4-7	9.4	15.1
<i>Willamette River:</i>						
Portland, Oregon ...	15.0	6	4.6	30	0.5	4.1

Oswego, N. Y., 2d: ice formed on the canal, between this city and Syracuse, during the past twenty-four hours, detaining boats several hours.

Dubuque, Iowa, 6th: navigation on the Mississippi River closed on this date.

Cairo, Ill., 13th: heavy drift-wood passed down the Ohio River up to this date, causing considerable damage to the steel bridge, tearing away its false work, and causing a loss of about \$2,000.

Fort Totten, Dak.: thick ice formed along the shores of

Devil's Lake on the 15th, and the lake froze over on the 16th, closing navigation for the season.

Fort Sully, Dak., 16th: the Missouri River is rapidly icing over, and navigation may be considered closed for the winter.

Fort Buford, Dak.: the Missouri River was full of floating ice on the 17th and 18th, and on the 19th was frozen over; it remained partially open until the 30th, when it was entirely frozen over.

Bismarck, Dak., 20th: the Missouri River is at an extremely low stage, with considerable slush ice.

Port Huron, Mich., 26th: navigation on the Saint Clair River is practically closed for the season.

FLOODS.

Seymour, Jackson Co., Ind., 10th: it has been raining here steadily for forty-eight hours; the White and Mascaticuck rivers have overflowed their banks, and the low-lying lands are inundated. Much live stock has been drowned, and quantities of corn have been swept away.

HIGH TIDES.

Hatteras, N. O., 24th; Key West, Fla., Norfolk, Va., 26th; Wood's Holl, Mass., 25th to 27th. Atlantic City, N. J.: the high wind of the 25th and 26th caused the tide to rise to an unusual height, doing much damage to property. Kitty Hawk, N. C., 24th: a severe storm has continued since 7 a. m. of the 20th; the wind blowing from the northeast until 3 p. m. of the 24th, when it backed to north and continued steady at about sixty miles per hour. The tide in Currituck Sound was lower than ever before known. At Kitty Hawk wharf, where there is usually enough water for small steamers and sailing vessels, the water receded about seventy-five feet from the wharf. Between Nag's Head and New Inlet, a distance of about twenty-one miles, the entire "banks" were flooded by the tide, and all cattle on this low beach perished.

New London, Conn., 26th: the tide in the afternoon was about four feet above the usual high water mark. In consequence, several of the wharves were partially submerged. No serious damage followed. The Signal Service observer reports that this was the highest tide observed in twenty-five years.

LOW TIDE.

Kitty Hawk, N. C., 24th; Cedar Keys, Fla., 10th to 12th.

ATMOSPHERIC ELECTRICITY.

AUORAS.

Faint auroral displays were observed as far south as Lake Forest, Ill. They were most frequently noted at Saint Vincent, Minn., and were reported on from two to three dates in New England, south-central New York, the upper lake region, and the upper Mississippi and Missouri valleys.

At Fort Buford, Dak., an aurora was observed at 9.48 p. m. of the 5th, consisting of a diffused white light which rose to an altitude of 10° and covered 75° of the horizon; the aurora attained its maximum intensity at 10.30 p. m., when streamers

rose to an altitude of 60°, above which a faint arch was visible. The display gradually faded away, and had entirely disappeared at 3.55 a. m. of the 6th.

Auroras were observed during the month, as follows: 1st, Pontiac, Mich.; 4th, Cornish, Me.; 5th, Fort Buford, Fort Sully, and Webster, Dak.; Hanover, N. H.; 6th, Fort Buford, Dak.; Escanaba and Traverse City, Mich.; 7th, Saint Vincent, Minn.; 10th, Lake Forest, Ill.; 12th, Nashua, N. H.; 13th, Wedgewood, N. Y.; 16th, Saint Vincent, Minn.; 17th, Madison, Wis.; 25th, Davenport and Webster, Dak.; Saint

Vincent, Minn.; 26th, Saint Vincent, Minn.; South Canisteo, N. Y.; 27th, South Canisteo, N. Y.; 30th, Independence, Iowa; Saint Vincent, Minn.

THUNDER-STORMS.

Thunder-storms were reported during the month, by states and territories, as follows: 1st, 9; 2d, 11; 3d, 4; 4th, 2; 5th and 6th, 9; 7th, 5; 8th, 9; 9th, 7; 10th, 5; 11th, 1; 13th, 1; 14th, 3; 15th and 16th, 1; 18th, 2; 19th, 3; 20th, 1; 22d, 1; 24th, 1; 25th, 3; 26th, 2. None were reported on the 12th, 17th, 21st, 23d, and 27th to 30th.

Thunder-storms were reported in the several states and territories, by days, as follows: Ala. and Ariz., 2; Ark., 1; Cal., 4; Colo., 1; Dak., 3; Fla., 7; Ga., 1; Ill., 5; Ind., 3; Ind.

Ter., 1; Iowa, 3; Kan., 4; Ky., 2; La., 3; Md. and Mass., 1; Mich., 6; Minn., 1; Miss., 3; Mo., 5; Nebr. and N. H., 1; N. J., 3; N. Y., 2; N. C., 1; Ohio, 6; Pa. and S. C., 2; Tenn., 4; Texas, 8; Wis., 2. In Conu., D. C., Idaho, Me., Mont., Nev., N. M., Oregon, R. I., Utah, Va., Wash., W. Va., and Wyo. no thunder-storms were reported.

Thunder-storms were reported in the greatest number of states and territories (11) on the 2d. On the 1st, 5th, 6th, and 8th they were noted in nine; on the 9th, in seven, and on the 7th and 10th in five.

They were reported on the greatest number of days (8) in Texas. In Iowa they were noted on seven; in Mich. and Ohio on six, and in Ill. and Mo. on five.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Jackson, Jackson Co., Minn., 2d: prairie fires are still raging in Sioux Valley township; five lives are reported to have been lost and a large amount of property has been destroyed.

Yankton, Dak., 13th: a large prairie fire is raging south of this place on the Nebraska side; the sky was lighted up by its flames during the early part of the evening.

Huron, Dak., 14th: a prairie fire swept along the north line of Sanborn and the south line of Beadle counties on the 12th; a large amount of hay and grain was burned.

Gary, Deuel Co., Dak., 14th: prairie fires raged in a forty-mile gale yesterday; this morning they are apparently out.

Aberdeen, Brown Co., Dak., 14th: large prairie fires are burning west and southwest of this place.

Prairie and forest fires also occurred on the following dates: Fort Sully, Dak., 1st to 3d; Fort Sill, Ind. T., 1st to 6th, 11th, 12th, 29th, and 30th; Bismarck, Dak., 6th, 13th, and 14th; Red Bluff, Cal., 8th, 9th, 11th to 14th.

HALOS.

Solar halos were most frequently reported in Michigan, where they occurred on thirteen days. In Tennessee they were noted on ten days; in Virginia on eight; in California and Illinois on seven; and in New York and South Carolina on six days. In Ariz., Conn., Ark., Dak., Fla., Ga., Idaho, Iowa, Kans., Ky., La., Me., Md., Mass., Minn., Miss., Mo., Mont., Nebr., Nev., N. H., N. J., N. C., Oreg., Pa., R. I., Tex., Utah, Wash., and Wis. on from one to five. They were reported in the greatest number of states and territories (13) on the 4th. On the 20th, 21st, and 29th no solar halos were reported.

Lunar halos were most frequently reported in Michigan, where they were noted on twelve dates; in Dak., Iowa, Kans., and Pa. on nine; in Va. on eight; in Ill., Minn., N. Y., N. C., Oreg., S. C., and Tenn. on seven. In Del., D. C., Md., N. M., and R. I. no lunar halos were noted. They were reported in the greatest number of states and territories (26) on the 13th. On the 4th, 6th, and 30th no lunar halos were noted.

METEORS.

The distribution of meteors, by dates, over the country was as follows: 1st, Vevay, Ind.; Barren Creek Springs, Md.; Egg Harbor City, N. J.; Wedgewood, N. Y.; Statesburgh, S. O.; Cleburne, Tex. 2d, Barren Creek Springs, Md.; Beverly, N. J. 3d, Parkston, Dak.; Dubuque, Iowa; Beverly and Egg Harbor City, N. J.; Randolph, W. Va. 4th, Parkston, Dak.; Manatee, Fla.; Wilmington, N. C. 5th, Fort Sully, Dak.; Archer, Fla.; Vevay, Ind.; Moorestown, N. J.; Fort Stanton, N. Mex. 6th, Parkston, Dak.; Barren Creek Springs, Md.; Amherst, Mass.; Beverly and Egg Harbor City, N. J.; Quakertown, Pa. 7th, Parkston, Dak.; Mantanzas, Fla.; Utica, N. Y. 8th, Mantanzas, Fla. 9th, Parkston, Dak. 10th, Independence, Iowa. 11th, Mantanzas, Fla.; Independence, Iowa. 12th, Mantanzas, Fla.; Independence, Iowa; Barne's Corners, N. Y.; Wauseon, Ohio. 13th, Vevay, Ind.; Kalamazoo, Mich.; Kansas City, Mo.; Wedgewood, N. Y.; College Hill, Ohio; Austin

Tex. 19th and 20th, Independence, Iowa. 21st, Independence, Iowa; Beverly, N. J. 22d, Fort Buford, Dak.; Havana, Ill.; Independence, Iowa; Beverly, N. J. 23d, Cleburne, Tex.; Green Bay, Wis. 25th, Little Rock, Ark. 26th, Fort Sully, Dak. 27th, Beverly, N. J. 29th, Parkston, Dak. 30th, McMinnville, Oreg.

The following are more notable meteoric displays reported:

Fallston, Md.: a brilliant meteor was observed above the eastern horizon at 6.43 p. m., 6th, passing towards the north.

Green Bay, Wis.: a brilliant meteor was observed at 6.30 p. m., 23d; it moved from near the zenith in a northeasterly direction, and burst into many fragments when about 15° above the horizon.

Little Rock, Ark.: a very brilliant meteor was observed in the southern sky at 10.12 p. m., 25th, about half way between the horizon and the zenith, and passing from east to west; the meteor remained visible about two seconds, and was accompanied by a trail which was apparently over 30° in length.

MIRAGE.

San Diego, Cal.: the Coronado Islands and Point Loma were distinctly seen on the 8th. At the latter place the small buildings adjoining the light-house were plainly visible.

Mirage were also observed as follows: Webster, Dak, 6th, 19th, 21st; Huron and Woonsocket, Dak., 12th; Parkston, Dak., 12th, 16th; Kimball, Dak., 12th, 25th, 26th; New England City, Dak., 30th; Hampton, Iowa, 26th.

SUN SPOTS.

Prof. F. P. Leavenworth, director, Haverford College Observatory, Pa. (observed by Mr. H. V. Gummere, assistant):

Date, November, 1888.	Number of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculae.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
1, 9 a. m. ...	0	0	0	0	0	0	0	0	2	5	Definition good.
2, 12 m. ...	0	0	0	0	0	0	0	0	5	34	Definition very good.
3, 3 p. m. ...	0	0	0	0	0	0	0	0	...	16	Definition good.†
5, 4 p. m. ...	1	9	0	0	0	0	1	9	2	2	Definition poor.
6, 2 p. m. ...	0	10	0	0	0	0	1	19	8	25	Definition very good.
7, 11 a. m. ...	0	3	0	0	0	0	1	23	1	1	Definition poor.
12, 11 a. m. ...	1	8	0	0	0	0	2	30	1	9	Definition very good.
13, 10 a. m. ...	0	4	0	0	0	0	2	27	2	5	Definition good.
16, 9 a. m. ...	0	0	0	0	0	0	2	17	1	8	Definition good; through cl'ds.
17, 9 a. m. ...	0	0	1	6	0	0	1	3	0	0	Definition poor.
20, 10 a. m. ...	0	0	0	0	0	0	1	1	4	9	Definition good.
21, 3 p. m. ...	0	2	0	0	0	0	1	3	1	9	Definition poor.
22, 9 a. m. ...	0	0	0	0	0	0	1	3	2	8	Definition poor.
30, 10 a. m. ...	1	25	1	3	1	25	1	25	Definition good.‡

* Observed by Prof. F. P. Leavenworth. † Clouds; count of faculae unfinished. ‡ Clouds previous to observation of faculae.

Sun spots were observed during the month as follows: Mr. John W. James, Riley, McHenry Co., Ill.: None seen