

Mich., left here during the night of the 13-14th. A mid-winter trip of that kind is unprecedented in lake navigation.

Pittsburgh, Pa.: floating ice in both rivers 21st to 24th, and floating ice in the Allegheny River, 28th to 31st.

Alpena, Mich.: Thunder Bay and Thunder Bay River, which had been free from ice since the commencement of the month, were partly frozen over on the 12th.

Keokuk, Iowa: The Mississippi River was full of floating ice on the 17th.

Leavenworth, Kans: floating ice in the Missouri River, 1st to 6th, 10th, 11th, 14th, 17th, 18th, 20th, 21st, 27th to 29th.

FLOODS.

Little Rock, Ark.: owing to heavy rains the Arkansas River rose very high on the 19th, overflowing a great extent of country below this city.

Shreveport, La.: rain, which fell at intervals after the 22d, and without interruption during the 25th and 26th, ended in sleet at 11.15 p. m., 26th. The Red River rose above the danger-line on the 26th and 27th, overflowing lowlands, driving some of the settlers out of their homes, and causing them to remove stock to the highlands.

HIGH TIDES.

Pysht, Wash., 7th.

Atlantic City, N. J.: owing to high northeasterly winds on the 5th and 6th, the tide rose very high on the latter date; much damage to property resulted.

New York City, N. Y.: the high tide at Coney Island on the 7th caused considerable damage to property.

Ocean City, N. J.: the severe northeast storm of the 5th and 6th caused the tide to rise very high on the 6th; washouts of about seven hundred feet occurred on the Ocean City branch of the West Jersey railroad, between this place and Sea Isle City; on the Sea Isle City Pleasure railroad, three hundred feet of Townsend's Inlet bridge were carried away.

Long Branch, N. J., 6th: most of the bulk-heads between Sea Bright and Monmouth Beach have been torn; the surf

has inundated the streets of Sea Bright and caused much damage to property.

STAGE OF WATER IN RIVERS AND HARBORS.

In the following table are shown the danger-points at the various stations; the highest and lowest depths for January, 1889, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, January, 1889 (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	31	31.6	1	13.9	17.7
<i>Arkansas River:</i>						
Fort Smith, Ark. ...	22.0	17	17.9	7, 8	5.8	12.1
Little Rock, Ark. ...	23.0	19	21.2	8	8.7	12.5
<i>Missouri River:</i>						
Leavenworth, Kans. ...	20.0	1	4.7	18	3.2	1.5
Kansas City, Mo. ...	21.0	31	5.4	8	3.4	2.0
<i>Mississippi River:</i>						
Saint Paul, Minn. ...	14.5					
La Crosse, Wis. ...	24.0					
Dubuque, Iowa ...	16.0			1, 2	0.6	1.4
Davenport, Iowa ...	15.0	9	2.0	1	0.7	3.7
Keokuk, Iowa ...	14.0	18	3.0	8	4.0	7.8
Saint Louis, Mo. ...	32.0	20, 21	11.8	6	14.8	16.2
Cairo, Ill. ...	40.0	22	31.0	7, 8	11.6	13.2
Memphis, Tenn. ...	34.0	24	24.8	1	13.1	20.7
Vicksburg, Miss. ...	41.0	28, 29	33.8	1, 15	6.3	2.4
New Orleans, La. ...	13.0	27	8.7			
<i>Ohio River:</i>						
Pittsburgh, Pa. ...	22.0	29	13.2	22	4.4	8.8
Parkersburg, W. Va. ...	28.0	30	20.2	25	7.9	12.3
Cincinnati, Ohio ...	50.0	31	34.0	1	20.5	13.5
Louisville, Ky. ...	25.0	31	12.3	1	8.0	4.3
<i>Cumberland River:</i>						
Nashville, Tenn. ...	40.0	31	24.5	1	6.0	18.5
<i>Tennessee River:</i>						
Knoxville, Tenn. ...	29.0	7	7.0	4	2.3	4.7
Chattanooga, Tenn. ...	33.0	31	14.0	1	5.5	8.5
<i>Monongahela River:</i>						
Pittsburgh, Pa. ...	29.0	29	13.2	22	4.4	8.8
<i>Savannah River:</i>						
Augusta, Ga. ...	32.0	28	25.1	4	10.3	14.8
<i>Willamette River:</i>						
Portland, Oregon ...	15.0	24, 25	4.2	8, 15, 16	2.2	2.0

\* Frozen.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The only auroras reported were noted at Wedgwood, N. Y., 7th, and Saint Vincent, Minn., and Leech Farm, Dak., 1st and 20th. At Saint Vincent an auroral arch, first observed 7.45 p. m., 1st, ended during the night. The arch attained altitude 10° and covered 90° of the horizon. The display reached its maximum brilliancy at midnight.

THUNDER-STORMS.

Thunder-storms were reported during the month, by states and territories, as follows: 2d, 1; 4th, 2; 7th and 8th, 1; 9th, 4; 12th, 1; 13th, 4; 15th, 5; 16th, 13; 17th, 1; 19th, 1; 20th, 6; 21st, 4; 23d and 24th, 1; 27th and 30th, 1; 31st, 4. None were reported on the 1st, 3d, 5th, 6th, 10th, 11th, 14th, 18th, 22d, 25th, 26th, 28th, and 29th. Thunder-storms were reported

in the several states and territories, by days, as follows: Ala., 3; Ariz., 2; Ark., 2; Fla., 7; Ga., 3; Ill. and Ind., 1; Ind. Ter. and Iowa, 2; Kans, 1; La., 5; Md., Mass., Mich., Miss., Mo., and N. J., 1; N. Y., 2; Oregon, 3; Tenn., 1; Tex., 10; Wash., W. Va., and Wis., 1. In Cal., Colo., Conn., Dak., Del., D. C., Idaho, Ky., Me., Minn., Mont., Nebr., Nev., N. H., N. Mex., N. C., Ohio, Pa., R. I., S. O., Utah, Vt., Va., Wis., and Wyo. no thunder-storms were reported.

Thunder-storms were reported in the greatest number of states and territories (13) on the 16th. On the 20th they were noted in 6, and on the 15th in 5.

They were reported on the greatest number of days (10) in Texas. In Florida they were noted on seven, and in Louisiana on five days.

MISCELLANEOUS PHENOMENA.

FOREST AND PRAIRIE FIRES.

Villa City, Fla.: forest fires to the east and southeast, 30th. Fort Sill, Ind. T.: prairie fires, 2d to 6th, 9th, 11th, 18th, 19th.

HALOS.

Solar halos were most frequently reported in Illinois, where they occurred on nineteen days. In Dakota they were noted on eighteen days, in California and New York on twelve, and in Minnesota on eleven days. In Ala., Conn., Del., Ind. Ter., N. Mex., R. I., Utah, W. Va., Wyo., no solar halos were reported. They were reported in the greatest number of states

and territories (18) on the 22d; in seventeen on the 4th; in fifteen on the 11th and 12th; and in thirteen on the 19th. There were no days during the month on which solar halos were not observed in one or more states or territories. The following is an extract from the report of the Iowa Weather Service for January, 1889: "The solar halo of the 11th formed a magnificent phenomenon in Montgomery and Adams counties. A vertical column of light preceded the rising sun on the 30th in southern Iowa county; a rather rare form of solar halo."

Lunar halos were most frequently reported in Kentucky and Tennessee, where they were noted on fourteen dates. In New

York they were observed on nine, and in California, Illinois, New Jersey, and Virginia on ten dates. In Colo., Del., Ind. Ter., N. Mex., R. I., and W. Va. no lunar halos were reported. They were observed in the greatest number of states and territories (23) on the 11th; on the 9th in twenty-one, and on the 12th, 15th, and 19th, in seventeen. No lunar halos were reported on the 2d and 30th.

METEORS.

The distribution of meteors, by dates, was as follows: 1st, Somerset, Mass.; Columbia and Montague, Mich.; Rolling Green, Minn. 2d, Fort Sully, Dak.; Villa City and Mantansas, Fla.; Lexington, Ky.; Farmington, Minn.; Nunnely, Tenn. 4th, Mesquite, Tex. 5th, Albany, Oregon. 7th, Egg Harbor City, N. J. 9th, Lead Hill, Ark.; Farmington, Minn.; Memphis, Tenn. 10th, Keeler, Cal.; Wauseon, Ohio; Nunnely, Tenn. 11th, Sumner, Ill.; Lebo, Kans. 12th, Vevay, Ind.; Manhattan, Kans.; Nashua, N. H.; Rio Grande, N. J. 14th, Nunnely, Tenn. 15th, Statesburgh, S. C. 21st, Lebo, Kans. 22d, Lebo, Kans.; Riddleton, Tenn. 24th, Willow Springs, Ariz.; Montrose, Colo.; New England City, Dak. 25th, Lake Forest, Ill.; Beverly, N. J.; Ilion, Setauket, South Canisteo, and Queensborough, N. Y.; Chambersburgh and Wellsborough, Pa. 26th, Fort Sully, Dak.; Villa City, Fla.; Wakefield, Kans. 28th, Fort Sully, Dak.; Corpus Christi, Tex. 29th, Parkston, Dak.; Lebo, Kans.; Mesquite, Tex. 30th, Flint, Mich. 31st, Lebo, Kans.

The following are more notable meteoric displays, noted chiefly on the 24th and 25th:

Rio Grande, N. J., 12th: a large meteor observed in the western sky, traveling very slowly towards the southeast. At times it shone very brilliantly, after which it would become very dim; it disappeared at 9.45 p. m. At 9.25 p. m., just before the meteor was seen, three distinct vibrations of my house were felt, each lasting about 30 seconds.—*Reported by Mr. William Bolton.*

Willow Springs, Ariz.: a brilliant meteor was observed, moving from northeast to southwest, at 8 p. m., 24th: several smaller ones were observed the same evening.

Montrose, Colo.: a brilliant meteor was reported to have passed across the sky from west to northeast at about 9 p. m., 24th; it was followed by a luminous trail.

Beverly, N. J.: a brilliant meteor passed slowly over this place in an easterly direction on the evening of the 25th; it burst into many fragments, like a rocket.

South Canisteo, N. Y.: a meteor was observed at 9 p. m., 25th, moving from south to northeast; it was followed by an unusually brilliant trail of light, of red and greenish colors.

Setauket, N. Y.: a very bright meteor, attended by a long trail of light, was observed at 9.10 p. m., 25th: it first appeared about 30° above the western horizon, moving northeastward. The meteor lighted up the surrounding country and finally exploded into four parts and disappeared.

Wellsborough, Pa.: a large and brilliant meteor was observed the evening of the 25th, passing from west to east; it moved slowly and appeared to burst into many pieces before reaching the eastern horizon. It flashed many brilliant colors.

Fort Sully, Dak.: a brilliant meteor was observed in azimuth 315°, altitude 45°, at 7.25 a. m., 28th; its course was almost

horizontal, and it disappeared in azimuth 290°. The meteor left a distinct trail of light which lasted a few seconds.

MIRAGE.

Poplar River, Mont.: a mirage was noticed in early forenoon of the 2d; distant ranges of hills in the north, which are ordinarily hidden from view, became distinctly visible, and appeared like islands in the midst of a body of water.

Mirage were also observed as follows: Garden City and Webster, Dak., 2d, 22d; Woonsocket, Dak., 20th, 21st, 24th, 25th, 28th; Parkston, Dak., 21st, 24th; Hampton, Iowa, and Genoa, Nebr., 7th; La Harpe, Kans., 17th.

SUN SPOTS.

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

Date, January, 1889.	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.
1, 2 p. m. ...	0	0	0	0	0	0	0	0	10	14	Definition good.
3, 11 a. m. ...	0	0	0	0	0	0	0	0	46	35	Definition good.
4, 12 m. ....	0	0	0	0	0	0	0	0	13	53	Definition good.
7, 10 a. m. ...	0	0	0	0	0	0	0	0	1	2	Definition very poor, clouds.
8, 11 a. m. ...	0	0	0	0	0	0	0	0	1	1	Definition poor.
10, 11 a. m. ...	0	0	0	0	0	0	0	0	4	6	Definition fair.
12, 11 a. m. ...	0	0	0	0	0	0	0	0	3	4	Definition poor.
14, 12 m. ....	0	0	0	0	0	0	0	0	0	0	Definition fair.
15, 12 m. ....	0	0	0	0	0	0	0	0	1	12	Definition poor.
16, 10 a. m. ...	1	8	0	0	0	0	1	8	2	22	Definition very good.
18, 10 a. m. ...	0	0	0	0	0	0	0	0	12	19	Definition very good.
19, 11 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition very poor.
21, 11 a. m. ...	0	0	0	0	0	0	0	0	4	5	Definition good; count of faculae stopped by clouds.
22, 11 a. m. ...	0	0	0	0	0	0	0	0	14	46	Definition very good.
23, 12 m. ....	0	0	0	0	0	0	0	0	10	39	Definition very good.
25, 11 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition poor.
29, 10 a. m. ...	0	0	0	0	0	0	0	0	0	0	Definition poor.
30, 11 a. m. ...	0	0	0	0	0	0	0	0	6	10	Definition good.
31, 11 a. m. ...	0	0	0	0	0	0	0	0	12	23	Definition good.

SAND STORMS.

Dodge City, Kans., 11th.

EARTHQUAKE.

Captain Walle, of the Norwegian bark "Beta," reports: "December 12, 1888, in N. 31° 44', W. 62° 16', at 2 a. m., wind ssw. to sw., blowing a gale; heavy rain and lightning; barometer, 29.90; air temperature, 73°; felt a heavy earthquake shock, lasting two minutes. The sensation was that of a ship striking the ground in smooth water and jumping her way over it. At the same time a shower of ashes fell, which appeared to be black or dark grey; was unable to obtain a sample as they were washed away by the heavy rain. After the shock the barometer rose to 30.00."

SNOW FROM A CLOUDLESS SKY.

Dysart, Iowa: snow began at 5.20 a. m., 31st, and continued twenty-five minutes; it fell in sufficient quantity to cover the ground. The stars were seen to the horizon, and no cloud was visible at the time.

VERIFICATIONS.

INDICATIONS FOR 24 HOURS IN ADVANCE.

The percentages of verifications of the 8 p. m. daily indications for January, 1889, as determined from comparison of succeeding telegraphic reports, are given in the table below.

The predictions for districts east of the Rocky Mountains for

January, 1889, were made by Capt. Robert Craig, Assistant Quartermaster, U. S. Army, Acting Signal Officer and Assistant, and those for the Pacific Coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps; the verifications for all districts were determined by Assistant Professor C. F. Marvin.