

was reported on the 5th, 7th, and 8th. At Marietta, Ohio, floating ice was reported on the 4th, 8th, 9th, 11th, and 20th.

**Detroit River.**—Floating ice at Detroit, Mich., on the 2d, 5th to 7th, 9th, 12th, 13th, 15th to 18th, and 25th to 27th.

**Saint Clair River.**—On the 4th the river was full of floating ice at Port Huron, Mich. On the 10th the river was closed by an ice jam 12 miles south of Port Huron. A steamer plying between Port Huron and Marine City was obliged to lay up after having made daily trips for 22 months.

**Mississippi River.**—Floating ice at Davenport, Iowa, 2d to 7th, 12th to 14th, 24th, and 25th. Floating ice at Alton, Ill., 9th to 15th; ice disappeared 16th.

**Missouri River.**—At Fort Sully, S. Dak., the river was frozen during the month. At Sioux City, Iowa, the river was frozen on the 4th. Floating ice at Leavenworth, Kans., 1st to 10th, and 21st to 29th. Floating ice at Saint Joseph, Mo., 2d, 3d, 5th, 6th, 11th to 13th, 16th, 21st, 22d, 24th, and 26th to 31st. Floating ice at Hermann, Mo., 14th and 15th.

FLOODS.

At Pittsburgh, Pa., the Monongahela River rose rapidly from the 1st to 3d, reaching 23.2 feet, 1.2 feet above the danger-line on the gauge, about 6 a. m., 3d, after which it fell slowly. The tracks of the Pittsburgh and Western Railroad and a part of the 1st ward in Allegheny City were under water. On the 2d the Ohio River was rising rapidly at Cincinnati, Ohio, and the river was full of drift. The river continued to rise until the 6th, when it reached 48.7 feet, at which point it remained several hours and then began to recede. Basements of buildings at the corner of River and Maine streets were flooded at noon of the 4th, when the river-gauge reading was 45.1 feet. On the 3d, 4th, 5th, 22d, 23d, and 30th the Tennessee River was rising at Chattanooga, Tenn., and considerable drift wood passed down. On the 10th heavy rain and melting snow caused streams to overflow and inundate low lands in Westchester Co., N. Y. On the 11th and 12th floods occurred in west New England, east New York, and east Pennsylvania. Ice gorges and unusually high water caused damaging floods in the Housatonic and Naugatuck valleys, Conn. Near Round-

out, N. Y., ice jams flooded streams. At New York City the high wind backed the water into Battery Park, washing away benches and depositing drift wood. Heavy rain and melting snow caused floods in the Schuylkill and Lehigh valleys, Pa. Considerable damage was caused at and near Allentown, Pa. On the 22d floods occurred in west Massachusetts, Connecticut, east New York, and east Pennsylvania, where great destruction to property was caused.

Heights of rivers above low-water mark, January, 1891 (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	24.1	1	9.8	14.3
<i>Arkansas River.</i>						
Fort Smith, Ark.	22.0	18	11.6	31	5.0	6.6
Little Rock, Ark.	23.0	13	15.2	30	9.3	5.9
<i>Missouri River.</i>						
Fort Buford, N. Dak.*						
Kansas City, Mo.	21.0	31	6.4	7, 8	2.7	3.9
<i>Mississippi River.</i>						
Saint Paul, Minn.*	14.5					
La Crosse, Wis.	13.0					
Dubuque, Iowa*	16.0					
Davenport, Iowa	15.0	4, 14	2.1	22, 23	0.7	1.4
Keokuk, Iowa	14.0	1	1.8	26	0.1	1.9
Saint Louis, Mo.	32.0	8, 9	5.3	1	2.9	2.4
Cairo, Ill.	40.0	12, 13	32.2	26	21.9	10.3
Memphis, Tenn.	34.6	15, 16	24.3	1	10.3	14.0
Vicksburg, Miss.	41.0	20, 21	33.6	1	11.8	21.8
New Orleans, La.	13.0	28	12.0	5	4.2	7.8
<i>Ohio River.</i>						
Pittsburgh, Pa.	22.0	3	23.2	10	4.5	18.7
Parkersburg, W. Va.	38.0	4	34.5	11	9.2	25.3
Cincinnati, Ohio	50.0	6	48.7	23	21.0	27.7
Louisville, Ky.	25.0	7	22.0	23	9.3	12.7
<i>Cumberland River.</i>						
Nashville, Tenn.	40.0	15	25.1	22	11.8	13.3
<i>Tennessee River.</i>						
Chattanooga, Tenn.	33.0	5	15.5	10	6.3	9.2
Knoxville, Tenn.		4	9.1	31	3.0	6.1
<i>Monongahela River.</i>						
Pittsburgh, Pa.	29.0	3	23.2	10	4.5	18.7
<i>Savannah River.</i>						
Augusta, Ga.	32.0	13	21.3	3	7.3	14.0
<i>Willamette River.</i>						
Portland, Oregon	15.0	16	3.7	20, 21, 22	1.0	2.7

\*Frozen.

MISCELLANEOUS PHENOMENA.

SUN SPOTS.

Haverford College Observatory, Pa. (observed by Prof. F. P. Leavenworth):

Date.	Number of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Faculae.	Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.		
Jan., 1891.										
2, 3 p. m.	0	0	0	0	0	0	0	0	1	Definition bad.
3, 10 a. m.	0	0	0	0	0	0	0	0	1	Definition poor.
4, 10 a. m.	0	0	0	0	0	0	0	0	1	Definition poor.
5, 12 m.	1	3	0	0	0	0	1	3	3	Definition fair; spots small.
6, 9 a. m.	2	4	0	0	0	0	3	7	2	Definition fair; 1 spot veiled.
7, 9 a. m.	0	0	0	0	0	0	1	5	2	Definition poor.
8, 4 p. m.	1	1	0	0	0	0	2	4	1	Definition poor.
9, 10 a. m.	0	0	0	0	0	0	3	1	1	Definition poor.
12, 10 a. m.	0	0	0	0	0	0	0	0	0	Definition fair.
13, 9 a. m.	0	0	0	0	0	0	0	0	0	Definition good.
14, 10 a. m.	0	0	0	0	0	0	0	0	0	Definition poor.
15, 3 p. m.	1	4	0	0	0	0	1	4	1	Definition fair; 1 spot very large.
16, 10 a. m.	0	5	0	0	0	0	1	9	1	Definition fair; 1 spot very large.
18, 3 p. m.	2	10	0	0	0	0	3	19	1	Definition fair; 1 spot very large.
19, 10 a. m.	0	2	0	0	0	0	3	21	1	Definition fair; 1 spot very large.
21, 10 a. m.	0	0	0	0	0	0	1	1	0	Definition bad; 1 spot very large.
22, 4 p. m.	0	0	0	0	0	0	1	13	0	Definition fair.
23, 10 a. m.	0	10	0	0	0	0	2	23	0	Definition fine.
24, 10 a. m.	2	7	0	0	0	0	4	28	2	Definition good.
26, 2 p. m.	0	8	0	0	0	0	4	36	2	Definition fair.
27, 9 a. m.	0	4	0	0	0	0	4	40	3	Definition fair; several large spots.
28, 9 a. m.	0	5	0	0	0	0	4	45	3	Definition fair.
30, 10 a. m.	0	0	1	2	0	0	3	28	1	Definition fair; 1 large spot.

Mr. D. E. Hadden, Alta, Iowa: 4th, small faculae near ne. and sw. limbs. 6th, faculae mottling on e. limb. 7th, glimpses of faculae through clouds. 15th, 1 group, 1 spot; large spot by rotation on se. edge of limb. 16th, 1 group, 4 spots; large spot had finely developed umbra and penumbra, with faculae surrounding and faculae on e. limb. 17th, 1 group, 4 spots; appearance unchanged. 18th, 2 groups, 6 spots; large spot unchanged in appearance; small new group in nw.; large area of faculae on se. limb. 19th, 2 groups, 6 spots. 20th, 2 groups, 4 spots; group nw., vanishing, faculae surrounding it. 23d, 1 group, 6 or 8 spots; glimpses through clouds; large spot sw.; numerous small spots, could not be seen on account of clouds. 24th, 1 group, spots could not be seen on account of clouds. 25th, 3 groups, 9 spots; large spot in sw. still had well-developed umbra and penumbra; 1 new group 1 day w. of meridian in s. latitude; other group surrounded by faculae on e. limb with 5 or 6 spots; it appeared by rotation. 26th, 4 groups, 10 spots; new group by rotation on e. limb with faculae 1 day e. of group number 3. 27th, 3 groups; too hazy to see faculae or count spots; large spot on w. limb, disappearing by solar rotation, having completed transit in 13 days. 29th, 2 groups, 8 spots; groups in n. latitude; faculae disappearing on w. limb. 30th, 2 groups, 8 or 10 spots; large group diminishing in size and brilliancy. Cloudy 1st, 9th, 21st, 22d, 28th, 31st.

Mr. John W. James, Riley, Ill.: 1st to 14th, observations on 9 days, none seen. 15th, large spot on east edge. 17th, 2 new small spots southwest of large one. 19th, immense areas of faculae, and 1 faint spot near east limb. 22d, only

large spot left. 25th, a new group, surrounded by very prominent faculae 1 day from east edge. 28th, large spot disappeared by solar rotation; it was over 30,000 miles in diameter. 30th, new group on sun's meridian, 1 spot 4 days from east edge.

Mr. H. D. Gowey, North Lewisburgh, Ohio: sun spots were observed on the 15th, 20th, 22d, 24th, 25th, 26th, and 30th.

**DROUGHT.**

The month was very dry and water scarce at Fayette, Mo. At Farley's Camp, Ariz., the month was reported the driest January since 1879. At Mount Carmel, Utah, and Eola, Oregon, the month was reported very dry. At San Diego and Santa Cruz, Cal., vegetation suffered for want of rain; at San Diego the drought was broken on the 28th.

**ATMOSPHERIC ELECTRICITY.**

**AURORAS.**

Auroras were reported as follows: 12th, Montevideo, Minn. 16th, Orono, Me.; Wolsey, S. Dak. 18th, Albany, Oregon. 19th, Webster, S. Dak.

**THUNDER-STORMS.**

Thunder-storms were reported as follows: east of the Rocky Mountains thunder-storms were reported in the greatest number of states, 14, on the 29th; in 12 on the 11th; in 10 on the 31st; in 9 on the 1st and 31st; in 8 on the 27th and 28th; in 4 on the 10th and 12th; in 3 on the 2d; in 2 on the 7th, 21st,

23d, and 24th; and in 1 on the 3d, 5th, 6th, 8th, 9th, 18th, 20th, and 22d. On the 4th, 13th to 17th, 19th, 25th, and 26th, no thunder-storms were reported.

East of the Rocky Mountains thunder-storms were reported on the greatest number of dates, 10, in La.; on 9 in Tex.; on 8 in Miss.; on 6 in Ala. and N. Y.; on 4 in Ohio, S. C., and Tenn.; on 3 in Ark., Fla., Ill., Kans., Mich., Mo., N. C., and Pa.; on 2 in D. C., Ga., Ind., Ky., N. J., Okla. T., and Va.; and on 1 in Conn., Md., N. H., and W. Va. West of the Rocky Mountains thunder-storms were reported as follows: Cal., 5th and 6th; N. Mex., 7th. In states and territories other than those named no thunder-storms were reported.

**VERIFICATIONS.**

[Verifications made by Assistant Professor C. F. Marvin, assisted by Mr. H. E. Williams, chief clerk of the Forecast Division.]

**FORECASTS FOR 24 HOURS IN ADVANCE.**

The forecasts for districts east of the Rocky Mountains for January, 1891, were made by Major H. H. C. Dunwoody, Signal Corps, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant John P. Finley, Signal Corps.

Percentages of forecasts verified, January, 1891.

States.		States.	
Maine.....	80.6	Kentucky.....	83.8
New Hampshire.....	78.2	Ohio.....	79.7
Vermont.....	76.7	West Virginia.....	81.9
Massachusetts.....	82.3	Indiana.....	89.5
Rhode Island.....	82.4	Illinois.....	86.9
Connecticut.....	84.2	Lower Michigan.....	85.0
Eastern New York.....	81.7	Upper Michigan.....	77.9
Western New York.....	83.5	Wisconsin.....	85.5
Eastern Pennsylvania.....	87.7	Minnesota.....	82.2
Western Pennsylvania.....	77.2	Iowa.....	90.4
New Jersey.....	87.0	Kansas.....	90.3
Delaware.....	84.3	Nebraska.....	90.0
Maryland.....	85.9	Missouri.....	89.4
District of Columbia.....	84.9	Colorado.....	87.7
Virginia.....	85.2	North Dakota.....	83.6
North Carolina.....	86.9	South Dakota.....	82.5
South Carolina.....	89.9	Southern California*.....	90.3
Georgia.....	90.6	Northern California*.....	91.2
Eastern Florida.....	90.6	Oregon*.....	83.3
Western Florida.....	89.8	Washington*.....	81.4
Alabama.....	88.3	By elements: Weather.....	86.7
Mississippi.....	89.5	Temperature†.....	83.0
Louisiana.....	89.0	Monthly percentage of weather and temperature combined‡.....	85.2
Texas.....	82.7		
Arkansas.....	90.3		
Tennessee.....	86.3		

and 3d days in advance. These are optional with the forecast official, and are only made when clearly in the public interest, and cover, in all cases, considerable areas of country, and are not confined to localities.

Percentages of verifications of forecasts made for second day in advance. Number of predictions made: weather, 73; temperature, 43. Percentages of verifications: weather, 56.6; temperature, 90.2; weather and temperature combined, 66.1.

**WIND SIGNALS FOR JANUARY, 1891.**

Statement showing percentages of justifications of wind signals for the month of January, 1891:

**Wind signals.**—(Ordered by Major H. H. C. Dunwoody). Total number of signals ordered, 87; justified as to velocity, wholly, 73, partly, 7; justified as to direction, 81. Of the signals ordered 52 were cautionary, of which 41 were wholly and 6 partly justified; and 35 were storm signals, of which 32 were wholly and 1 partly justified. 33 signals were ordered for easterly winds, of which 29 were justified, and 54 were ordered for westerly winds, of which 52 were justified. Percentage of justifications, 81.7.

**COLD-WAVE SIGNALS AND TEMPERATURE-FALL WARNINGS.**

[Ordered by Assistant Professor T. Russell.]

Number of cold-wave signals ordered, 188; justified, 94. Percentage of justifications, 50.0. Number of temperature-fall warnings, 119. Percentage of justifications, 49.6. Percentage of justifications of cold-wave signals and temperature-fall warnings combined, 49.9.

Percentages of verifications of weather and temperature signals reported by directors of the various State Weather Services for January, 1891.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Iowa.....	84	93	New Jersey.....	82	88
Illinois.....	78	78	North and South Dakota....	75	84
Michigan.....	82	86	Ohio.....	83	89
Minnesota.....	72	86	Pennsylvania.....	86	86
Nebraska.....	88	89	South Carolina.....	92	94

**FORECASTS FOR 48 HOURS IN ADVANCE.**

Appreciating the great importance that long time predictions possess for the general public the Chief Signal Officer has authorized forecasts for 48 and 72 hours, covering the 2d

\*In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. †The forecasts of temperature in districts east of the Rocky Mountains for January, 1891, were made with reference to the maximum temperature alone; that is, a prediction of warmer or cooler indicated that the maximum temperature of the day designated would be higher or lower than the maximum of the previous day. ‡The monthly percentage of weather and temperature combined is determined by multiplying the percentage of weather by 6, and the percentage of temperature by 4, and dividing their sum by 10.