27th, Postdam, N. Y.; Wolsey, S. Dak. 28th, Webster, S. Dak.; Hartland, Vt. 29th, Ardenia, N. Y.; Leech Farm and Wapeton, N. Dak.; Webster, S. Dak.; Newburyport, Mass. 30th, Manitowoc, Wis.

THUNDER-STORMS.

No severe thunder-storms were reported during the month. Thunder-storms were reported in the greatest number of states and territories, ten, on the 1st and 27th; in six on the 20th, 21st, and 25th; in from one to five, inclusive, on the 2d to 9th, 11th, 12th, 15th to 19th, 22d, 23d, 24th, 26th, 28th, 29th, 30th. The 10th, 13th, and 14th were the only dates on which no thunder-storms were reported.

Thunder-storms were reported on the greatest number of dates, thirteen, in Texas; on nine in Louisiana; on six in Kansas; and on from one to five, inclusive, in Alabama, Arkansas, California, District of Columbia, Florida, Georgia, Illinois, Indiana, Indian Territory, Maryland, Mississippi, Missouri, Montana, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and Washington. In states and territories other than those named above no thunder-storms were reported.

MISCELLANEOUS PHENOMENA.

PRAIRIE FIRES.

Prairie fires were reported as follows: Fort Reno, Ind. T., 10th, 13th, 17th, 18th 21st, 22d, and 23d; Fort Sill, Ind. T., 13th to 16th and 18th to 23d, inclusive; Rhome, Tex., 19th; Sacramento, Cal., brush fires, 2d.

HALOS.

Solar halos were most frequently reported in Illinois, where they were noted on ten dates; in Tennessee on eight dates; in Missouri, on seven dates; in Minnesota, New York, and Ohio, on six dates; and on from one to five dates, inclusive, in Arizona, Arkansas, California, Colorado, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Nebraska, Nevada, New Jersey, North Carolina, North Dakota, Pennsylvania, South Carolina, South Dakota, Utah, Virginia, and Washington. In states and territories other than those named no solar halos were reported. They were reported in the greatest number of states and territories, nine, on the 5th and 26th; in seven on the 7th; in six on the 15th; and in from one to five, inclusive, on the 1st to 4th, 6th, 8th to 14th, 16th, 18th to 21st, 23d, 24th, 25th, 27th to 30th. No solar halos were reported on the 17th and 22d.

Lunar halos were most frequently reported in Nevada, where they were noted on fourteen dates, and in California on twelve dates; on from six to nine dates, inclusive, in Illinois, Iowa, Michigan, Montana, Nebraska, Oregon, South Carolina, South Dakota, Tennessee, and Virginia; and on from one to five dates, inclusive, in Alabama, Arizona, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Indiana, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Texas, Utah, Vermont, Washington, Wisconsin, and Wyoming. In states and territories other than those mentioned, no lunar halos were reported. They were reported in the greatest number of states and territories, sixteen, on the 6th and 7th; in from eleven to fifteen, inclusive, on the 1st, 4th, 10th, 11th, and 29th; in from six to ten, inclusive, on the 2d, 3d, 5th, 8th, 9th, 12th, 27th, 28th, and 30th; and in from one to four, inclusive, from the 13th to 19th, and 26th. For dates other than those named no lunar halos were reported.

METEORS.

The distribution of meteors, by dates, was as follows: 1st, Richmond, Ind. 2d, Elyria and Westerville, Ohio. 3d, Auburn, Ala.; Villa City, Fla. 4th, Auburn, Ala.; North Sutton, N. H.; Setauket, N. Y.; Pittsburgh, Pa. 6th, New Castle, Pa. 8th, Whipple Barracks, Ariz. 10th, Vevay, Ind.; Webster City, Iowa; Alpena, Mich.; Egg Harbor City, N. J.; Quakertown, Pa. 11th, Statesburgh, S. C. 13th, Villa City, Fla.; Rolling Green, Minn.; Spearfish, S. Dak. 14th, Little Rock, Ark.; Red Bluff, Cal.; Villa City, Fla.; Barren Creek Springs, Md.; Quakertown, Pa.; Spearfish, S. Dak. 15th, Red Bluff, Cal.; State College, Pa. 16th, Kootenai, Idaho; Mount Saint Mary's, Md.; Woodbury, N. J.; Webster, S. Dak. 17th, Orono, Me.; Taunton, Mass. 18th, Bendena, Kans. 20th, Egg Harbor City, N. J. 22d, Villa City, Fla.; University, Miss.; Statesburgh, S. C.; Nashville and Riddleton, Tenn. 23d, Yates Centre, Kans.; Egg Harbor City, N. J.; Fort Washakie, Wyo. 24th, Webster City, Iowa; Factoryville, N. Y.; Centre Valley, Pa.; Spartanburgh, S. C. 25th, Berkeley, Cal. 28th, River Side, Cal.; Clinton, Iowa. 29th, Villa City, Fla.; Hilton, Ill.; North Sutton, N. H.; Albany, Oregon.

Elyria, N. Y.: a very large and brilliant meteor, about the apparent size of Jupiter, was observed at 6.15 p. m., 2d. It came from the southwest, and when near the ground it broke, sending out a shower of sparks.—*Report of Chas. W. Goodspeed, voluntary observer.*

Alpena, Mich.: a brilliant meteor was observed at 6.50 p. m., 10th. It passed across the sky from south to north about 30° above the horizon, and was visible about twelve seconds.—*Report of James J. Fitzgerald, observer, Signal Corps.*

Little Rock, Ark.: two very brilliant meteors were observed on the evening of the 14th. Both were moving from south to north, leaving trails of light in their paths.—*Report of W. U. Simons, observer, Signal Corps.*

Fort Sully, S. Dak.: a brilliant meteor was observed at 8.30 p. m., 17th. It dropped from altitude 10° and azimuth 135° below the horizon. The meteor appeared quite near, and illuminated the western sky with a distinct red light. Another brilliant meteor was observed in the eastern sky, passing from about altitude 25° to 15°, at 7.40 p. m., 30th, leaving a distinct trail in view.—*Report of I. G. Gardiner, observer, Signal Corps.*

Yates Centre, Kans.: a meteor was observed at 5.20 a. m., 23d, in azimuth 165°, altitude 45°. It passed diagonally toward the northeast, and disappeared in azimuth 190°, altitude 35°. It was of a pale yellow color, and left a quickly-vanishing trail.—*Report of Mr. F. R. Gray, voluntary observer.*

Berkeley, Cal.: a meteor of medium brightness was observed on the 25th, at 8.40 p. m. It started in the eastern sky and moved south at an angle of 40°. It was of short duration, and moved slowly.—*Report of Mr. Carl Rabe, voluntary observer.*

Palestine, Tex.: a brilliant meteor, moving from east to west, was observed in the northern sky at 11.15 p. m., 27th. It travelled about 25° before disappearing.—*Report of H. H. Curley, observer, Signal Corps.*

MIRAGE.

Mirage were observed as follows: 5th, Rolling Green, Minn.; 7th, Saint Vincent, Minn.; 8th, Kimball and Woonsocket, S. Dak.; 9th, Paoli, Colo., Webster, and Woonsocket, S. Dak.; 14th, Paoli, Colo.; 16th, Paoli, Colo., New England City, N. Dak.; 17th, New England City, N. Dak.; 18th, Yuma, Ariz., New England City, N. Dak., Kimball, S. Dak.; 19th, Kimball and Webster, S. Dak.; 22d, Paoli, Colo.; 25th, Yuma, Ariz., Bancroft, Iowa, Rolling Green, Minn., Kimball, S. Dak., San Diego, Cal.; 27th, Yuma, Ariz.

Saint Vincent, Minn.: a mirage was observed at 8 a. m., 7th. The towns of Hamilton and Bathgate, N. Dak., distant, respectively, eighteen and twenty-three miles from this place, were plainly seen. The buildings in each town were distinctly presented to view, as if seen from an adjacent eminence. A train of freight cars on the side track at Hamilton, and the

difference between the cattle and freight cars, as well as the spaces between the cars, were plainly distinguishable. The background of the whole showed an excellent view of the Pembina Mountains, twenty miles farther off. The phenomenon vanished at 9.20 a. m. Another mirage, presenting some Dakota town to view, was observed on the 19th.—*Report of R. J. Boylan, observer, Signal Corps.*

Duluth, Minn.: a mirage was observed at 7 a. m., 11th. About forty miles of the Wisconsin shore of Lake Superior and the mouth of the Bryle River were plainly visible.—*Report of W. H. Fallon, observer, Signal Corps.*

SAND STORMS.

Sand storms were reported as follows: San Diego, Cal., 4th; Wilcox, Ariz., 11th, 18th; Fort Verde, Ariz., 11th.

SUN SPOTS.

Mr. M. A. Veeder, Lyons, N. Y.: 1st, 2d, 3d, and 4th groups of faculæ appeared by rotation; portions of these groups were seen near the western limb on the 14th, and returned again by rotation at the eastern limb on the 26th and 27th. On the 12th, 14th, and 17th, other groups of faculæ appeared by rotation. Observations were lacking on the 5th, 7th, 8th, 9th, 11th, 13th, 15th, 18th, 19th, 21st, 22d, 23d, 24th, 25th, 28th, 29th, and 30th.

Mr. C. E. Buzzell, Leaf River, Ill.: no spots were observed during the month. Clouds prevented solar observations on the 1st, 2d, 5th, 7th, 8th, 9th, 20th, 21st, and 22d.

Mr. John W. James, Riley, Ill.: none seen during the month.

Mr. H. D. Gowey, North Lewisburgh, Ohio: no sun spots were seen during the month.

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.		Faculæ.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Faculæ.	
Nov., 1889.											
1, 10 a. m	0	0	0	0	0	0	0	0	0	....	Definition poor.
3, 5 p. m	0	0	0	0	0	0	0	0	0	....	Definition poor.
4, 12 m	0	0	0	0	0	0	0	0	1	....	Definition good.
5, 9 a. m	0	0	0	0	0	0	0	0	1	....	Definition good.
6, 9 a. m	0	0	0	0	0	0	0	0	1	....	Definition good.
7, 9 a. m	0	0	0	0	0	0	0	0	0	....	Definition good.
10, 10 a. m	0	0	0	0	0	0	0	0	0	....	Definition good.
12, 9 a. m	0	0	0	0	0	0	0	0	2	....	Definition good.
14, 9 a. m	1	1	0	0	0	0	1	1	1	....	Definition good, spots small.
15, 10 a. m	0	0	0	0	0	0	1	1	1	....	Definition good.
16, 10 a. m	0	0	0	0	0	0	0	0	0	....	Definition poor.
22, 10 a. m	0	0	0	0	0	0	0	0	1	....	Definition good.
23, 10 a. m	0	0	0	0	0	0	0	0	1	....	Definition good.
24, 10 a. m	0	0	0	0	0	0	0	0	0	....	Definition good.
26, 10 a. m	0	0	0	0	0	0	0	0	0	....	Definition poor.
28, 10 a. m	2	4	0	0	0	0	2	4	4	....	Definition good, spots small.
29, 9 a. m	1	1	1	2	0	0	2	2	5	....	Definition good, spots small.

VERIFICATIONS.

FORECASTS FOR 24 HOURS IN ADVANCE.

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

The forecasts for districts east of the Rocky Mountains for November, 1889, were made by 1st Lieutenant Richard E. Thompson, 6th Infantry, Signal Officer, and those for the Pacific coast districts were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps.

Percentages of forecasts verified, November, 1889.

States.		States.	
Maine	84.4	Kentucky	78.4
New Hampshire	77.1	Ohio	83.7
Vermont	76.5	West Virginia	81.9
Massachusetts	79.1	Indiana	81.1
Rhode Island	78.9	Illinois	80.2
Connecticut	72.5	Lower Michigan	85.4
Eastern New York	82.9	Upper Michigan	81.8
Western New York	80.8	Wisconsin	82.1
Eastern Pennsylvania	80.6	Minnesota	82.0
Western Pennsylvania	80.2	Iowa	86.3
New Jersey	80.0	Kansas	83.9
Delaware	78.5	Nebraska	80.6
Maryland	78.9	Missouri	80.2
District of Columbia	75.9	Colorado	77.5
Virginia	84.3	North Dakota	79.4
North Carolina	84.3	South Dakota	79.7
South Carolina	86.2	Southern California*	94.5
Georgia	86.9	Northern California*	83.7
Eastern Florida	85.0	Oregon*	84.9
Western Florida	86.7	Washington*	85.0
Alabama	77.0	*By elements:* Weather	85.4
Mississippi	81.7	Temperature‡	74.9
Louisiana	90.2		
Texas	88.4	Monthly percentage of weather and temperature combined†	81.2
Arkansas	79.4		
Tennessee	77.3		

* In determining the monthly percentage of weather and temperature combined, the Pacific coast states are not included. † 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. ‡ The forecasts of temperature in districts east of the Rocky Mountains for November, 1889, 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.

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 forty-eight and seventy-two hours, covering the second and third days in advance. Such forecasts are optional with the predicting officer, 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, 106; temperature, 62. Percentages of verifications: weather, 84.1; temperature, 88.4. Weather and temperature combined, 85.8.

No forecasts for seventy-two hours were made during the month.

CAUTIONARY SIGNALS FOR NOVEMBER, 1889.

Statement showing percentages of justifications of wind signals for the month of November, 1889:

Wind signals.—(Ordered by 1st Lieutenant R. E. Thompson.) Total number of signals ordered, one hundred and twenty-two; justified as to velocity, wholly, eighty-two, partly, four; justified as to direction, one hundred and twenty. Of the signals ordered, ninety-nine were cautionary, of which sixty-three were wholly, and one partly, justified; and twenty-three were storm signals, of which nineteen were wholly, and three partly, justified. Fifty-six signals were ordered for easterly winds, of which fifty-four were justified, and sixty-six were ordered for westerly winds, all of which were justified. Percentage of justifications, 70.1.

Cold-wave signals.—(Ordered by Assistant Professor T. Russell.) Total number of signals ordered, one hundred and sixty-one, of which fifty-one were justified.

Percentages of local verifications of weather and temperature signals reported by directors of the various State Weather Services for November, 1889.

States.	Weather.	Temperature.	States.	Weather.	Temperature.
Illinois	80.4	75.4	Nebraska	84.2	87.7
Indiana	81.0	83.0	New Jersey	86.7	96.0
Kansas	81.2	85.8	New York	87.3	84.8
Michigan	85.0	84.4	Ohio	84.0	83.0
Minnesota	77.0	82.0	Pennsylvania	89.0	86.0
Missouri	86.0	85.0	South Carolina	83.0	84.7