

were interrupted at the following stations: Escanaba, Michigan, on the 10h, 11th, 16th to 31st; Alpena, Michigan, from the 8th to 31st; Milwaukee, from 1st to 18th; Toledo, Ohio, from 7th to 31st; Detroit, Michigan, from 8th to 31st; Chicago, Illinois, from 8th to 31st; Cleveland, Ohio, from 16th to 20th; Buffalo, New York, from 15th to 31st. Sandusky, Ohio, from 7th to 31st. At Marquette, Michigan, no observations were made from 4th to 18th, owing to breakage of instruments. At Cleveland, Ohio, rough sea prevented observations from being made on 2d and 7th.

The table below shows the highest and lowest temperatures of water at the several stations; the range of water temperature; the mean temperature of the air at the station; and the depth of water at which the observations were taken:

Temperature of Water for December, 1882.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey .....	45.5	34.5	11.0	5 10	33.7
*Alpena, Michigan.....	34.5	28.7	5.8	7 6	24.2
Augusta, Georgia.....	48.0	42.0	6.0	8 8	45.0
Baltimore, Maryland.....	44.0	33.0	11.0	9 3	36.7
Block Island, Rhode Island.....	45.5	34.8	10.7	8 4	34.5
Boston, Massachusetts.....	36.0	33.2	2.8	25 0	30.5
*Buffalo, New York.....	39.0	32.0	7.0	8 10	27.8
Cedar Keys, Florida.....	65.0	46.0	19.0	8 8	54.9
Charleston, South Carolina.....	51.6	47.1	4.5	40 1	48.3
*Chicago, Illinois.....	34.8	32.4	2.4	7 7	26.0
Chincoteague, Virginia.....	43.0	31.0	12.0	5 11	36.4
Cleveland, Ohio.....	39.7	32.4	7.3	14 0	37.3
*Detroit, Michigan.....	35.0	33.0	2.0	23 10	31.0
*Delaware Breakwater, Delaware.....	44.3	36.6	7.7	5 6	35.7
Duluth, Minnesota.....	37.0	32.8	4.4	15 9	17.0
Eastport, Maine.....	44.3	38.7	5.6	17 5	24.5
*Escanaba, Michigan.....	36.8	33.0	3.8	15 0	22.9
Galveston, Texas.....	59.0	52.0	7.0	14 9	57.3
*Grand Haven, Michigan.....	34.5	28.0	6.5	19 0	28.2
Indianola, Texas.....	63.6	50.5	13.1	8 10	57.2
Jacksonville, Florida.....	67.0	63.0	4.0	18 0	54.2
Key West, Florida.....	77.8	67.6	10.2	15 7	69.5
Mackinac City, Michigan.....	40.6	32.0	8.6	13 0	26.5
*Marquette, Michigan.....	35.9	34.0	1.9	10 6	24.1
*Milwaukee, Wisconsin.....	34.6	31.6	3.0	8 0	24.3
Mobile, Alabama.....	64.0	47.0	17.0	15 8	46.5
New Haven, Connecticut.....	39.1	30.8	8.3	14 6	29.0
New London, Connecticut.....	43.0	39.0	4.0	12 0	31.3
Newport, Rhode Island.....	43.7	34.7	9.0	10 8	32.6
New York City.....	40.2	34.4	5.8	17 0	32.2
Norfolk, Virginia.....	45.0	37.0	8.0	18 2	40.5
Pensacola, Florida.....	59.8	49.7	10.1	17 3	50.5
Portland, Maine.....	40.0	32.0	8.0	18 2	28.7
Portland, Oregon.....	46.4	38.9	7.5	60 3	45.8
Port Eads, Louisiana.....	66.9	46.0	10.9	9 3	67.4
Provincetown, Massachusetts.....	44.5	35.0	9.5	14 0	32.8
Punta Rassa, Florida.....	71.6	59.6	12.0	10 9	62.6
*Sandusky, Ohio.....	33.0	32.0	1.0	10 0	28.2
Sandy Hook, New Jersey.....	47.6	34.3	13.3	1 5	33.3
San Francisco, California.....	52.4	50.0	2.4	31 10	51.0
Savannah, Georgia.....	48.6	43.7	4.9	12 5	50.8
Smithville, North Carolina.....	51.0	45.0	6.0	10 0	44.5
*Toledo, Ohio.....	35.9	32.9	3.0	10 2	30.1
Wilmington, North Carolina.....	48.0	37.5	10.5	13 0	46.0

\* Observations wanting, see text.

The largest monthly ranges of water temperature are: Cedar Keys, Florida, 19°; Mobile, Alabama, 17°; Sandy Hook, New Jersey, 13°·3; Indianola, Texas, 13°·1; Punta Rassa, Florida, 12°. The smallest are: Chincoteague, Virginia, 2°; San Francisco, California, 2°·4; Jacksonville, Florida, 4°; New London, Connecticut, 4°; Duluth, Minnesota, 4°·4; Charleston, South Carolina, 4°·5; Savannah, Georgia, 4°·9

ATMOSPHERIC ELECTRICITY.

AURORAS.

The most extensively observed display of the month occurred on the evening of the 15th. It was observed generally throughout New England; as far southward as northern New Jersey, and westward to stations in Iowa, Minnesota and Montana. The following description of this display are given:

Eastport, Maine, 15th.—Brilliant auroral arch was visible from 7.00 p. m. until the early morning of the 16th.

Portland, Maine, 15th.—An aurora was visible from 8.00 to 11.30 p. m.; it consisted of a segment of haze surmounted by an arch of greenish-white light extending to an altitude of 20°.

Gardiner, Maine, 15th.—Aurora first observed at 8.00 p. m.; at 9.00 p. m., a low double arch appeared, with dark segment

beneath the lower arch; faint beams were visible. The display continued throughout the night.

Boston, Massachusetts, 15th.—An aurora was observed at 10.00 p. m.; it consisted of a well-defined arch of about 8° width, with its centre about 20° above the horizon.

New Haven, Connecticut, 15th.—From 8.30 p. m. to midnight an auroral light of moderate brilliancy was observed in the north.

Point Judith, Rhode Island, 15th.—From 7.40 p. m. to daylight of the 16th, a bright yellow auroral light was observed; it extended from northwest to northeast and to an altitude of 15°.

Escanaba, Michigan, 15.—At 9.30 p. m., an aurora, consisting of a pale green light, with dark base, was observed. After midnight an arch was formed and waves of green light were visible. The display continued until 6.30 a. m. of the 16th.

Duluth, Minnesota, 15th.—At 6.45 p. m. a brilliant aurora was observed. It consisted of a dark arch of about 20° altitude from which pale straw and rose-colored streamers shot upward. The display ended at 9.35 p. m.

Springfield, Illinois, 16th.—An aurora was first observed at 4.40 a. m. of the 16th. Streamers extended from near the horizon to an altitude of 35°, and covered about 30° of the northern horizon. These display ended at 5.30 a. m.

Fort Assiniboine, Montana, 16th.—Auroral light observed from 4.00 a. m. to daylight.

Cresco, Iowa, 15th.—From 7.45 to 10 00 p. m., an aurora was visible in the north-northeast; it consisted of a low arch near the horizon.

Monticello, Iowa, 15th.—A very bright aurora was seen; it lasted all night.

This display was also observed at the following stations: Orono, Maine; Charlotte, Vermont; Grafton, New Hampshire; Cambridge, Fall River, and Somerset, Massachusetts; Narragansett Pier and Newport, Rhode Island; Factoryville, New York; Paterson, New Jersey; Northfield, Minnesota; Manitowoc, Wisconsin; Clinton, Cedar Rapids and Humboldt, Iowa.

Others displays were observed on the following dates:

Bismarck, Dakota, 2d.—At 6.00 a. m., a short nebulous auroral beam of 10° in length appeared on the northwestern horizon.

Rising Sun, Indiana, 2d.—Aurora at 7.00 p. m.

Northfield, Minnesota, 2d.

Ithaca, New York, 3d.—Aurora consisting of an arch of white light.

Bangor, Maine, 4th.—An aurora was observed at 4.00 a. m., extending a short distance above the horizon.

Saint Vincent, Minnesota, 6th.—Faint auroral light from 7.00 to 9.00 p. m. Northfield, Minnesota, 10th.

Springfield, Massachusetts, 11th.—Pale yellow auroral light in northern sky.

Fort Brady, Michigan, 11th.—Aurora at 9 p. m.

Tobacco Garden, Dakota, 11th.—Faint aurora at 9.00 p. m.

Fort Macon, North Carolina, 12th.—Faint aurora from 7.30 to 8.50 p. m., consisting of a uniform whitish glow extending in the form of an arch to an altitude of 12°.

Woodstock, Maryland, 14th.—An auroral arch with dark cloud beneath observed.

Fort Myer, Virginia, 16th.—Aurora in northeastern sky; it began during the night and continued till daylight.

Wellsborough, Pennsylvania, 16th.

Fort Keogh, Montana, 16th.—Aurora lasting until 5.50 a. m. of the 17th. Small beams of yellowish color shot upward toward the zenith.

Bangor, Maine, 18th, 19th, 20th.

Springfield, Massachusetts, 17th.—Pale auroral streamers reaching beyond the zenith. An arch was formed with its centre about 20° from the zenith.

Northfield, Minnesota, 17th.

Eastport, Maine, 18th.—Aurora from 11.00 p. m. to morning of the 19th, consisting of an arch of about 30° in altitude.

Springfield, Massachusetts, 19th.—Extensive pale auroral light in the north, with a few streamers.

Fort Myer, Virginia, 19th.—Aurora during night, lasting until daylight.

Mount Washington, New Hampshire, 20th.—Aurora from 7.10 to 9.35 p. m.

New Market, New Hampshire, 20th.—Brilliant aurora with beams of various colors.

Grafton, New Hampshire, 20th.—Aurora observed at 9.15 p. m.

Newport, Vermont, 20th.

Eastport, Maine, 20th.—Brilliant auroral arch from 8.00 p. m. to morning of 21st.

Gardiner, Maine, 20th.—At 7.20 p. m., low auroral arch with beams; at 9.00 p. m., arch disappeared; at 10.00 p. m., very brilliant beams of greenish light. The display continued throughout the night, and at 5.30 a. m. of 21st, a brilliant irregular arch appeared above a dark cloud.

Orono, Maine, 20th.

North Benton, Montana, 20th.—Aurora from 6.00 to 7.30 p. m.

Bismarck, Dakota, 21st.—Auroral light in the northern sky from 5.30 a. m. till daybreak.

Cedar Rapids, Iowa, 23d.

Fort Stevenson, Dakota, 27th.—Aurora in north from 9.30 until after 10.00 p. m.

Fort Brady, Michigan, 27th.—Aurora at 8.00 p. m.; obscured by fog at 9.00 p. m.

Buffalo, New York, 31st.—From 10.25 to 11.20 p. m., a faint orange-colored auroral light resembling the morning dawn.

#### ATMOSPHERIC ELECTRICITY INTERFERING WITH TELEGRAPHIC COMMUNICATION.

Fort Maginnis, Montana, 5th.—Atmospheric electricity rendered working of telegraph lines impracticable. The current was so strong that the office-wires were melted and the operator was severely stunned by contact with the instruments. A violent snow-storm prevailed at the time, during which all metal points in the vicinity of the wires, such as nails, screws, etc., were tipped with light.

#### THUNDER-STORMS.

Thunder-storms were reported in the various states, on the following dates:

Alabama.—Auburn, 22d; Mobile, 10th, 19th, 21st; Mount Vernon Barracks, 21st.

Arkansas.—Fort Smith, 19th.

Florida.—Cedar Keys, 22d; Fort Brooke, 10th, 15th, 22d; Jacksonville, 22; Pensacola, 10th, 21st, 22d.

Georgia.—Augusta, 21st; Savannah, 21st.

Illinois.—Cairo, 5th; Springfield, 4th.

Kansas.—Creswell, 19th; Independence, 19th, 20th; Leavenworth, 6th; Yates Centre, 19th.

Louisiana.—New Orleans, 5th, 10th, 15th, 21st; Point Pleasant, 19th; Port Eads, 15th, 21st.

Maine.—Bangor, 31st.

Massachusetts.—Menden, 31st; Fall River, 31st.

Missouri.—Pierce City, 19th, 20th; Protem, 19th.

North Carolina.—Cape Lookout, 21st; Fort Macon, 13th; Hatteras, 13; Portsmouth, 13th, 21st.

South Carolina.—Stateburg, 21st.

Tennessee.—Nashville, 20th.

Texas.—Coleman City, 21st; Denison, 19th; Fort McKavett, 19th; Galveston, 18th, 19th; Indianola, 20th, 24th; Palestine, 19th.

Washington Territory.—Fort Canby, 17th.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos have been observed in the various districts, on the following dates:

New England.—3d, 4th, 5th, 7th, 9th, 10th, 13th, 20th, 26th, 27th.

Middle Atlantic states.—4th, 6th, 14th, 17th, 18th, 20th.

South Atlantic states.—7th, 10th, 14th, 19th, 20th, 23d, 29th.

Florida peninsula.—7th, 16th, 21st, 24th, 26th.

Western Gulf states.—2d, 6th, 14th, 16th, 24th.

Ohio valley and Tennessee.—1st to 4th, 7th, 12th, 14th, 15th, 17th to 20th, 24th, 25th.

Extreme northwest.—2d, 5th, 6th, 12th, 20th.

Upper Mississippi valley.—1st, 2d, 3d, 7th, 10th, 12th to 16th, 18th, 24th, 25th, 31st.

Northern plateau.—1st, 18th, 19th, 20th, 22d.

Solar halos were also reported from the following stations, not included in the districts named above:

San Francisco, California, 2d, 10th, 16th, 20th, 23d, 26th, 27th, 29th, 30th; Oakwood, California, 27th; Poway, California, 28th; San Diego, California, 28th; Visalia, California, 1st, 3d, 17th; Fort Custer, Montana, 10th; Ruggles, Ohio, 7th; Lansing, Michigan, 8th; Riley, Illinois, 24th, 31st; Protem, Missouri, 4th, 12th, 13th, 24th, 30th; Topeka, Kansas, 11th; Creswell, Kansas, 8th, 30th; Fort Maginnis, Montana, 13th; Yates Centre, Kansas, 1st, 3d, 4th, 30th; Pretty Prairie, Kansas, 5th; Salt Lake City, Utah, 2d, 3d, 16th; Eagle Rock, Idaho, 20th; Fayette, Mississippi, 28th, 29th, 30th.

#### LUNAR HALOS.

Lunar halos have been observed in the various districts, on the following dates:

New England.—15th, 17th, 20th, 21st, 22d, 25th, 26th, 29th.

Middle Atlantic states.—2d, 8th, 15th, 17th to 20th, 22d, 23d, 25th, 26th, 27th.

South Atlantic states.—17th, 19th to 28th.

Florida peninsula.—24th, 25th.

Eastern Gulf states.—15th, 18th, 24th, 27th.

Western Gulf states.—17th, 18th, 22d, 23d, 24th, 26th, 27th, 31st.

Ohio valley and Tennessee.—14th, 16th, 17th, 19th, 21st, 24th, 25th.

Lower lake region.—4th, 19th, 20th, 25th.

Upper lake region.—5th, 15th to 19th, 21st to 25th, 29th.

Extreme northwest.—2d, 19th to 23d, 25th.

Upper Mississippi valley.—1st, 5th, 7th, 14th, 15th, 18th, 24th, 31st.

Missouri valley.—16th, 19th to 25th.

Northern slope.—2d, 18th, 19th, 22d to 25th.

Middle slope.—2d, 4th, 16th, 18th to 21st, 23d, 30th.

Southern slope.—18th, 23d.

Southern plateau.—5th, 17th, 18th, 24th, 29th, 30th, 31st.

Middle plateau.—1st, 2d, 4th, 22d, 31st.

Northern plateau.—2d, 18th, 19th, 22d, 23d, 27th, 28th, 29th.

Lunar halos were also reported from the following stations, not included in the districts named above:

San Francisco, California, 2d, 15th, 16th, 17th, 20th, 21st, 23d, 25th, 26th; Los Angeles, California, 27th; Visalia, California, 16th, 22d; Roseburg, Oregon, 19th, 21st, 26th; Eagle Pass, Texas, 18th.

#### MIRAGE.

Creswell, Kansas, 7th.

Pretty Prairie, Kansas, 4th, 17th, 23d, 28th.

Genoa, Nebraska, 1st, 17th, 18th, 26th, 27th.

Indianola, Texas, 1st, 2d, 3d, 16th, 17th, 27th.

#### MISCELLANEOUS PHENOMENA.

##### SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the twenty-four hours succeeding each observation taken at sunset, have been observed at all Signal Service stations. Reports from one hundred and seventy-nine stations show 5,469 observations to have been made, of which twenty-seven were reported doubtful; of the remainder, 5,442, there were 4,626, or 85.0 per cent., followed by the expected weather.

##### SUN SPOTS.

The following records of sun spots for the months of November and December, 1882, have been forwarded by Mr. D. P. Todd, Director of the Lawrence Observatory, Amherst, Massachusetts. The record for November was not received in time for publication in the REVIEW for that month: