

were justified by winds of twenty-five miles or more per hour, at or within one hundred miles of the station. Twenty-one off-shore signals were ordered, of which number, eight, or 38.10 per cent., were fully justified both as to direction and velocity; twenty-one, or 100.0 per cent., were justified as to direction; and eight, or 38.10 per cent., were justified as to velocity. One hundred and eighty-nine signals of all kinds were ordered, one hundred and two, or 53.97 per cent., being fully justified. These do not include signals ordered at display stations where the velocity of the wind is only estimated. Of the above cautionary off-shore signals, fourteen were changed from cautionary. Three signals were ordered late. In forty-four cases, winds of twenty-five miles or more per hour were reported for which no signals were ordered.

#### COLD-WAVE SIGNALS.

During May, 1885, there were thirty-three cold wave signals ordered, of which number twenty-five, or 75.76 per cent., were justified.

#### RAILWAY WEATHER SIGNALS.

The following extract is from the May report of the "Alabama Weather Service," under direction of Prof. P. H. Mell, jr.:

The verification of prediction for the whole state was 98 per cent. for temperature and 97 per cent. for weather.

The following roads comprise this system: Western, of Alabama; Atlanta and West Point, of Georgia; South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia; Northeastern, of Georgia.

#### ATMOSPHERIC ELECTRICITY.

##### AUROEAS.

The following reports of auroral displays have been received. It will be seen that the display on the night of the 11-12th, which was observed from central Montana to the New England coast, was most extensively reported. The display of the 13th was reported as exceptionally brilliant at Eastport, Maine:

4th.—Allison, Kansas, from 8 to 11.30 p. m.

6th.—Manchester, Iowa; Yutan, Nebraska.

7th.—Yutan, Nebraska.

8th.—Winnipeg, Manitoba; Yutan, Nebraska.

9th.—Fort Totten, Dakota: an auroral arch, with dark segment beneath, was observed from 10.30 to 12 p. m., altitude 15°. The display of the 9th was also observed at Webster, Dakota; Winnipeg, Manitoba; Vevay, Indiana, and Portsmouth, Ohio.

11th.—Bismarck, Dakota: a pale yellow auroral light in the northwestern sky, extending from the horizon to an altitude of 30°, was observed from 11 to 12 p. m.

11th.—Fort Bennett, Dakota: a faint aurora was observed from 12 p. m. to 1 a. m. of the 12th; it consisted of columns of pale light, varying in altitude from 9° to 15°; the display extended over 20° of the horizon; no arch was visible.

11th.—Moorhead, Minnesota: a faint aurora was observed in the north at 10.30 p. m.; no streamers were visible; the display continued until past midnight.

11th.—Duluth, Minnesota: a pale green auroral light was visible in the north from 8.25 p. m. until the morning of the 12th.

11th.—Escanaba, Michigan: a light yellow auroral light was visible from 10.08 p. m. until midnight.

11th.—Manistique, Michigan: from 9 p. m. to 2 a. m. of 12th.

11th.—Alpena, Michigan: an aurora appeared at 10.40 p. m. consisting of a diffuse light in the northwestern sky; no streamers were visible; the display ended at 1.40 a. m. on the 12th.

11th.—Oswego, New York: a faint auroral arch was visible from 11 p. m. until the morning of the 12th.

11th.—Cambridge, Massachusetts: an auroral arch was visible at 8.45 p. m.

11th.—Contoocook, New Hampshire: diffuse aurora at 9 p. m.

11th.—Portland, Maine: an auroral arch was observed from 9.45 p. m. until 1.33 a. m. on the 12th; it was of irregular form and extended over 90° of the horizon.

11th.—Gardiner, Maine: a faint aurora was observed at 9 p. m.; the display gradually grew brighter, and at 1 a. m. of the 12th was very brilliant, with flashing beams.

11th.—New Haven, Connecticut: aurora from midnight until 1.15 a. m. of 12th; there were no marked features.

11th.—Winnipeg, Manitoba; Boyne, Michigan; Le Roy, New York; Somerset, Massachusetts and Charlottetown, Prince Edward's Island.

12th.—Cornish, Maine: aurora at 2 a. m., the light extending to an altitude of 15°.

13th.—Manistique, Michigan: aurora from 8 to 11 p. m.

13th.—Northport, Michigan: a dim auroral light with a few beams extending to an altitude of 45° was observed at 9 p. m.

13th.—Alpena, Michigan: an aurora was first noticed at 8.15 p. m.; it consisted of an arch of pale green color from which beams, with an apparent motion from east to west, extending upward, some reaching an altitude of 30°.

13th.—Birmingham, Michigan: at aurora was observed at 9 p. m.

13th.—Ann Arbor, Michigan: an aurora appeared at 8 p. m., with streamers reaching nearly to the zenith.

13th.—Grampian Hills, Pennsylvania: a brilliant aurora was visible from 8.50 to 10 p. m., when the display became obscured by clouds.

13th.—North Volney, New York: faint aurora in the north at 8.45 p. m.

13th.—Mount Washington, New Hampshire: an aurora was observed from 9.20 to 11.10 p. m.; it consisted of waves of bluish light extending from the northern horizon to the zenith.

13th.—Bangor, Maine: "brilliant auroral light flashing beyond the zenith."

13th.—Orono, Maine: at 9 p. m. auroral streamers extended from all parts of the horizon to the zenith.

13th.—Eastport, Maine: an auroral display of unusual brilliancy was observed from 8 to 10.30 p. m.; from 9.20 to 9.45 "merry dancers" of pale yellow color appeared, having a motion from west to east; incomplete arches and nebulous masses were seen at all points between the altitudes of 30° and 45° and moved toward the zenith; dark segments also appeared on both the northern and the southern horizon. The effect of the aurora on the telegraph line between this place and Saint John, New Brunswick, was perceptible, although the current was not sufficiently strong to permit the transmission of signals.

The display of the 13th was also observed at the following places: Winnipeg, Manitoba; Westerville, Ohio; Franklin, Pennsylvania; Montreal, Quebec; Rowe, Massachusetts; Newport, Vermont; Charlottetown, Prince Edward's Island; Halifax and Sidney, Nova Scotia.

16th.—Cambridge, Massachusetts: a whitish band, apparently an auroral light, was observed in the north at 12.20 a. m.

18th.—Winnipeg, Manitoba.

25th.—Madison, Wisconsin: an aurora in the form of a bright arch, with streamers extending to an altitude of 45°, was observed at 12 p. m.

25th.—Saint Paul, Minnesota: a faint auroral arch was observed in the north at 1.30 a. m., being about 12° in height at the centre and extending over 30° of the horizon. At 2 a. m. numerous beams of a variety of colors appeared between the northeast and northwest and extended to an altitude of 70°; the streamers appeared and disappeared in rapid succession until 2.05 a. m., when flashes of light were observed moving towards the zenith. The telegraph lines running between Saint Paul and points to the northwestward were so affected during the display as to seriously interrupt communication.

26th.—Bismarck, Dakota: an auroral display was observed from 3.05 a. m. until daylight; it consisted of a greenish-yellow light, extending to an altitude of 35°; occasional streamers were also seen.

26th.—Grand Haven, Michigan: an aurora was visible from 1.45 to 2.50 a. m.; the light extended to an altitude of 15° and covered 40° of the horizon.