11th, a tornado occurred seven miles south of this place. The tornado cloud was funnel-shaped and the direction of movement was easterly, its path being about one hundred and fifty feet in width. No loss of life occurred, but several persons were injured. Five freight cars were blown from the railroad track and destroyed.

Zion, Lowndes county, Mississippi: at 6.30 p. m. on the 12th, a tornado occurred near this place. The cloud was funnel-shaped and moved in an easterly direction, causing much damage to buildings, fences and timber. The tornado's path was ten miles long and its width nine hundred feet.

Pulaski, Giles county, Tennessee: a tornado passed over a portion of this town at 4.20 p. m. on the 12th. Its path was about one-half mile in length and one hundred feet wide. About twenty buildings were unroofed and many trees and fences were blown down.

Greenville, Muhlenburg county, Tennessee: a violent storm of rain and hail accompanied by thunder and lightning occurred between 8 and 9 p. m. on the 27th. About two inches of water fell in fifteen minutes; fields were badly washed.

At 3.45 p. m. on the 27th a tornado passed in an easterly direction through Mitchell county, Georgia, for a distance of about twenty-five miles; several persons were injured; five houses, several cabins, and much fencing were destroyed.

NAVIGATION.

STAGE OF WATER IN RIVERS.

In the table below are shown the danger points in the rivers at the various stations, the highest and lowest stages for March, 1885, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, March, 1885.

[*Expressed in feet and tenths*]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, Louisiana	29 9	17	19 2	1, 2	16 8	2 4
Arkansas:						
Fort Smith, Arkansas	15 0	2	6 5	23	0 3	6 2
Little Rock, Arkansas	23 0	4	15 6	25, 26	8 7	6 9
Missouri:						
Yankton, Dakota‡	24 0	21	10 8	19	5 1	5 7
Omaha, Nebraska‡	18 0	10	12 2	20	8 4	3 8
Leavenworth, Kansas‡	20 0	16	12 2	24	9 8	2 4
Mississippi:						
Saint Paul, Minnesota†	14 5	.....	.....	.....	.....	.....
La Crosse, Wisconsin†	24 0	.....	.....	.....	.....	.....
Dubuque, Iowa†	16 0	.....	.....	.....	.....	.....
Davenport, Iowa†	15 0	.....	.....	.....	.....	.....
Keokuk, Iowa‡	14 0	14	14 5	30	6 1	8 4
Saint Louis, Missouri	32 0	16	24 2	1	7 6	16 6
Cairo, Illinois	40 0	18	31 6	1	16 2	15 4
Memphis, Tennessee	34 0	20, 21	24 0	1, 2	10 2	13 8
Vicksburg, Mississippi	41 0	27, 28	34 6	7, 8	22 5	12 1
New Orleans, Louisiana*	—3 0	28,29,30	— 3 5	10,11,13	— 6 2	2 7
Ohio:						
Pittsburg, Pennsylvania	22 0	3	8 9	26	2 0	6 9
Cincinnati, Ohio	50 0	6	25 6	31	9 7	15 9
Louisville, Kentucky	25 0	5 to 8	10 0	29	6 0	4 0
Cumberland:						
Nashville, Tennessee	40 0	19	13 5	12	7 1	6 4
Tennessee:						
Knoxville, Tennessee	.....	16	6 0	25,26,30	2 3	3 7
Chattanooga, Tennessee	33 0	18	9 2	12	5 0	4 2
Monongahela:						
Pittsburg, Pennsylvania	29 0	3	8 9	26	2 0	6 9
Savannah:						
Augusta, Georgia	32 0	30	15 0	23 to 27	7 5	7 5
Mobile:						
Mobile, Alabama	.....	17	18 0	14	15 0	3 0
Sacramento:						
Red Bluff, California	.....	1 to 4	2 2	29, 31	1 4	0 8
Sacramento, California	.....	1, 2	16 0	31	13 9	2 1
Willamette:						
Portland, Oregon	....	1	9 0	10	4 5	4 5
Colorado:						
Yuma, Arizona	.....	24, 25	18 0	1, 2, 3	14 4	3 6

* Below high-water mark of 1874 and 1883. † Frozen the entire month. ‡ Frozen part of month—see text.

The Mississippi river remained frozen throughout the month at Davenport, Iowa, and to the northward; at Keokuk the ice gave way on the 14th, on which date the water rose to one-half foot above the danger line.

The Missouri river was frozen at Yankton, Dakota, from the 1st to 13th; at Omaha, Nebraska, from the 1st to 9th; and at Leavenworth, Kansas, from the 1st to 6th.

The Ohio river was at a comparatively low stage throughout the month.

The observer at Chattanooga reports that the water in the Tennessee river during the month has averaged lower than for any corresponding period of which there is a record; the stage of water has barely permitted steamboat navigation and has not been sufficient for rafting.

ICE IN RIVERS AND HARBORS.

Barnegat bay.—Barnegat City, New Jersey: the bay froze on the 20th and remained frozen until the 25th.

Casco bay.—Portland, Maine: the harbor was free from ice on the 31st.

Cedar river.—Cedar Rapids, Iowa: the ice broke up on the 24th.

Chincoteague bay.—Chincoteague, Virginia: the bay froze over on the 23d; the ice broke up on the 24th.

Connecticut river.—Hartford, Connecticut; the ice broke up opposite this city on the 28th; on the 30th the first steamer of the season arrived.

Delaware river.—Easton, Pennsylvania: the river froze over on the 21st for the first time during the winter; the Morris canal was also closed, and the Lehigh canal and river between this place and Mauch Chunk were covered with ice two inches thick. At this date in 1884 the Lehigh canal was open for navigation.

Des Moines river.—Des Moines, Iowa: the ice broke up on the 11th.

Ottumwa, Wapello county, Iowa: the ice broke up on the 4th.

Detroit river.—Detroit, Michigan: floating ice from 1st to 13th, 20th, 22d to 28th.

Eel river.—Logansport, Indiana: the ice began to break up on the 13th; floating ice continued until the 20th.

Gardiner bay.—New London, Connecticut: reports from the bay on the 24th stated that both entrances were filled with large masses of ice.

Genesee river.—Rochester, New York: the ice broke up and passed out of the river on the 31st, causing no damage.

Hudson river.—Menand Station, (near Albany) New York: ice formed continuously until about the 25th, when it was about three feet in thickness.

Poughkeepsie, New York: on the 30th the river was open as far north as New Hamburg, ten miles south of this place.

Newburg, New York: the tug "Conqueror," with barge "Homer," forced passage through the ice from New York City to this place on the 29th; this was the first arrival of the season.

West Point, New York: ice in river broke up on the 27th; the first steamer of the season arrived on the 30th.

Kansas river.—Manhattan, Riley county, Kansas: the ice in the river broke up on the 1st.

Lake Champlain.—Troy, New York: reports from the lake on the 28th stated that the ice was three feet thick.

Lake Michigan.—Milwaukee, Wisconsin: at the close of March the lake was covered with heavy ice, preventing navigation. The iron propeller "Michigan" was nipped by the ice and sunk on the 19th.

Grand Haven, Michigan: the harbor entrance continued blocked with ice during the entire month, and with the exception of the arrival and departure of the propeller "Wisconsin" on the 11th, navigation was suspended. The "Wisconsin" cleared Milwaukee for this port on the 16th and arrived within twenty-five miles of the eastern shore of the lake, where she firmly lodged in the ice; she drifted with the ice until the 20th when a large hole was stove in her side; three hundred tons of freight were thrown overboard in order to save the vessel. On the 31st the propeller had drifted to within eighteen miles of this port.

Manistique, Schoolcraft county, Michigan: on the 31st the ice in the harbor was sixteen inches thick, and the lake was

frozen solidly between this shore and Beaver island, a distance of about thirty miles.

Lake Ontario.—Rochester, New York: the lake was covered with ice on the 8th; on the 15th the high wind broke up the ice.

Lake Superior.—Duluth, Minnesota: the lake continued frozen throughout the month at this place.

Lehigh river.—South Bethlehem, Pennsylvania: on the 21st the river was frozen across for the first time during this winter; this was due to a low stage of water and absence of wind, as the temperature was not as low as it had been previously.

Little Egg Harbor.—Little Egg Harbor, New Jersey: navigation was suspended on account of ice on the 21st; the ice broke up on the 24th.

Mississippi river.—Saint Paul, Minnesota: the river remained frozen throughout the month.

La Crosse, Wisconsin: the ice began to break up at about noon on the 31st, leaving the river open for a distance of about three miles opposite this place.

Dubuque, Iowa: crossing the river on the ice by teams and pedestrians was discontinued on the 14th; on the 19th crossing on the ice was resumed; the ice moved a short distance on the 25th, also on the 27th and 28th; the ferry-boats made regular trips on the 30th; the ice dam gave way on the 31st, leaving the river open for a considerable distance above Eagle Point.

Burlington, Iowa: on the 14th the ice began to break up at the head of Rock Island; on the 26th the ice in front of Burlington moved about three hundred feet, and on the 27th it moved about five hundred feet. On the 31st the ice dam broke, leaving the river open. The steamer "Wes Rambo" arrived on the 31st.

Muscatine, Iowa: ice went out of river on 26th.

Keokuk, Iowa: on the 14th the ice broke up at 12.30 p. m., and by 5 p. m. the river was nearly free from ice. The steamer "Gem City," arrived on the 20th, being the first steamer of the season.

Cairo, Illinois: navigation between this city and Saint Louis was resumed on the 1st.

Missouri river.—Fort Buford, Dakota: a slight break in the ice occurred near the mouth of the Yellowstone on the 18th.

Fort Yates, Dakota: on the 30th the ice broke up and formed a dam below this place.

Fort Bennett, Dakota: the ice broke up on the 18th; floating ice on 19th, 20th, 26th to 29th, 31st; on the 20th it was reported that the ice had broken as far northward as the mouth of Cheyenne river.

Fort Sully, Dakota: the ice in river broke up on the 18th.

Yankton, Dakota: river opened the 14th.

Omaha, Nebraska: river opened on the 10th.

Leavenworth, Kansas: the ice began to break up on the 5th, ice dams formed on the 6th; the ice dams gave way on the 8th and 9th.

Mohawk river.—Schenectady, New York: on the 26th, the ice in the river was more than two feet thick.

Monongahela river.—Pittsburg, Pennsylvania: floating ice from 2d to 11th, 16th to 23d, 25th and 31st.

New Haven harbor.—New Haven, Connecticut: the harbor was free from ice and open for navigation on the 7th; on the 22d the harbor froze; on the 26th, the ice went out of the harbor.

New York harbor.—David's Island: the ice between the island and shore disappeared on the 26th.

North and East rivers.—New York City: large quantities of floating ice obstructed navigation on the 21st; floating ice continued on the 22d and 23d.

North Branch, Susquehanna river.—Catawissa, Pennsylvania: the ice broke up and moved out of the river on the 30th and 31st.

Ohio river.—Portsmouth, Ohio: floating ice from 1st to 7th; on the 2d navigation was open to all points between Pomeroy and Cincinnati.

Cincinnati, Ohio: the ice broke up on the 1st; floating ice from 2d to 5th, 8th and 9th; navigation to points southward was resumed on the 3d, and to points northward on the 6th.

Vevay, Indiana: on the 5th the river was free from ice and boats made regular trips; on the 9th the river was full of floating ice.

Louisville, Kentucky: ice broke up on the 1st; navigation was resumed on the 2d; floating ice continued from 2d to 5th.

Passamaquoddy bay.—Eastport, Maine: floating ice on 3d, 16th, 17th, 27th.

Potomac river.—Washington, District of Columbia: the ice was broken up by tugs on the 2d, when navigation was resumed; on the 21st the river was again frozen; the ice broke up on the 24th.

Republican river.—Red Willow, Red Willow county, Nebraska: the ice broke up on the 1st.

Rock river.—Beloit, Rock county, Wisconsin: the river was free from ice at the close of the month.

Rockford, Illinois: the ice went out of the river on the 27th and 28th.

Sandusky bay.—Sandusky, Ohio: the steamer "American Eagle" forced passage through the ice to Kelley's Island and returned on the 31st.

Sandusky river.—Tiffin, Seneca county, Ohio: the ice began to break up on the 4th.

Sandy Hook bay.—Sandy Hook, New Jersey: the bay was filled with ice on the 23d and 24th.

Scioto river.—Portsmouth, Ohio: the ice-dam gave way on the 2d, causing considerable damage.

Seneca lake.—Elmira, New York: the lake, which has not been frozen for many years, was frozen from shore to shore on the 4th. Cayuga lake, about fifteen miles distant, freezes every winter, but Seneca lake for more than thirty years has not been known to have more than a thin border of ice during the severest weather.

Susquehanna river.—Port Deposit, Maryland: on the 30th the ice began to weaken and considerable apprehension was entertained that a break up would result in a destructive freshet. Reports from Collinsville, Pennsylvania, on this date stated that ice began to move and had formed a dam at Marietta. The large ice-dam at McCall's Ferry moved slightly on the 29th.

Wabash river.—Logansport, Indiana: the ice began to break up on the 10th.

Miscellaneous.—Humphrey, Cattaraugus county, New York: the ice went out of the streams in this vicinity on the 31st.

FLOODS.

Keokuk, Iowa, 6th: the breaking up of the ice in the lower Des Moines river has caused the destruction of much property along its course. During the 5th and 6th extensive ice dams formed, which caused overflows in numerous places. All of the neighboring streams were much swollen. The levees on the Missouri side of the river broke on the 6th, flooding the neighboring low lands. A number of farm houses were also flooded and the occupants were forced to abandon them. Numerous bridges were destroyed; at Pittsburg, Van Buren county; a wagon bridge, built last year at a cost of $40,000, was carried away. In the northern part of Lee county the streams were so much swollen that travel was rendered very difficult. On the afternoon of the 8th a part of a bridge at Eddyville, Wapello county, was carried away. On the 10th the town of Alexandria, Clark county, Missouri (opposite Keokuk), was inundated to a depth of three feet, and the inhabitants were driven to the upper stories of their dwellings.

Saint Louis, Missouri, 19th: reports from Carroll, Lafayette, and Ray counties state that the recent thaw resulted in serious damage in those counties. In Carroll county the water inundated an area several miles in extent, and many farmers abandoned their homes, and it is reported that several lives were lost; the losses sustained were very heavy, the wheat crop having been entirely ruined.

The low lands in the vicinity of Waverly, Lafayette county,

were inundated to depths of from one to fifteen feet for a distance of six miles. Many residents were driven to the upper stories of their dwellings. It is estimated that the losses will amount to $100,000.

HIGH TIDE.

Eastport, Maine, 4th, 5th.

LOW TIDE.

New Haven, Connecticut, 11th.

TEMPERATURE OF WATER.

The following table shows the highest and lowest temperatures of water observed at the several stations; the monthly ranges of water temperature; and the mean temperature of the air:

Temperature of water for March, 1885.

Station.	Temperature at bottom.		Range.	Average depth, feet and tenths.		Mean temperature of the air at station.
	Max.	Min.				
	°	°	°			°
Atlantic City, New Jersey	44.5	29.8	14.7	3	6	31.4
Alpena, Michigan*						
Augusta, Georgia	56.4	41.0	15.4	8	9	49.5
Baltimore, Maryland	38.5	33.7	4.8	10	0	35.3
Block Island, Rhode Island	37.0	29.2	7.8	6	9	29.8
Boston, Massachusetts	33.2	29.2	4.0	21	4	27.9
Buffalo, New York*						
Canby, Fort, Washington Territory	53.8	44.9	8.9	15	8	49.5
Cedar Keys, Florida	67.5	59.8	7.7	9	3	58.7
Charleston, South Carolina	53.3	49.7	3.6	40	9	52.2
Chicago, Illinois*						
Chincoteague, Virginia †	40.6	24.0	16.6	3	4	35.7
Cleveland, Ohio*						
Detroit, Michigan*						
Duluth, Minnesota*						
Eastport, Maine	34.2	32.2	2.0	15	7	22.8
Escanaba, Michigan*						
Galveston, Texas	64.7	54.2	10.5	12	7	60.7
Grand Haven, Michigan*						
Indianola, Texas	66.9	54.6	12.3	8	3	60.5
Jacksonville, Florida	64.6	57.0	7.6	18	0	57.6
Key West, Florida	83.0	69.4	13.6	17	2	70.8
Mackinaw City, Michigan*						
Macon, Fort, North Carolina	55.3	42.8	12.5	5	1	45.3
Marquette, Michigan*						
Milwaukee, Wisconsin*						
Mobile, Alabama	58.5	49.0	9.5	16	7	53.5
New Haven, Connecticut ‡	38.4	30.0	8.4	16	0	26.9
New London, Connecticut	35.8	33.2	2.6	11	0	29 7
New York City	35.8	31.2	4.6	14	0	29.7
Norfolk, Virginia	45.9	35.0	10.9	10	4	40.8
Pensacola, Florida	59.7	56.0	3.7	17	1	54.8
Portland, Maine	33.3	30.1	3.2	16	7	27.4
Portland, Oregon	52.5	43.3	9.2	56	3	52.0
Sandusky, Ohio*						
Sandy Hook, New Jersey	39.1	32.9	6.2	1	8	30.5
San Francisco, California	56.9	54.8	2.1	36	6	56.0
Savannah, Georgia	57.3	49.0	8.3	9	1	54.3
Smithville, North Carolina	57.2	43.6	13.6	11	0	45.8
Toledo, Ohio*						
Wilmington, North Carolina	51.3	43.8	7.5	14	5	49.3

* No observations made on account of ice. † Record for 29 days. ‡ Record for 23 days.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for March, 1885, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 85.87 per cent. The percentages for the four elements are: Weather, 90.00; direction of the wind, 81.68; temperature, 83.28; barometer, 90.09 per cent. By geographical districts, they are: For New England, 86.24; middle Atlantic states, 88.78; south Atlantic states, 88.50; eastern Gulf states, 87.34; western Gulf states, 86.73; lower lake region, 86.83; upper lake region, 83.98; Ohio valley and Tennessee, 86.05; upper Mississippi valley, 83.97; Missouri valley, 78.46; north Pacific coast region, 80.36; middle Pacific coast region, 97.32; south Pacific coast region, 99.11. There were sixteen omissions to predict out of 3,384, or 0.47 per cent. Of the 3,369 predictions that have been made, forty-seven, or 1.40 per cent., are considered to have entirely failed; one hundred and twenty-four, or 3.68 per cent., were one-fourth verified; three hundred and sixty-four, or 10.80 per cent., were one-half verified; six hundred and sixteen, or 18.28 per cent., were three-fourths verified; 2,218, or 65.84 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During March, 1885, two hundred and sixty-eight cautionary signals were ordered. Of these, two hundred and thirty-four, or 87.31 per cent., were justified by winds of twenty-five miles or more per hour at or within one hundred miles of the station. One hundred and fifty-six cautionary off-shore signals were ordered, of which number one hundred and twenty-two, or 78.21 per cent., were fully justified both as to direction and velocity; one hundred and forty-seven, or 94.22 per cent., were justified as to direction; and one hundred and twenty-eight, or 82.05 per cent., were justified as to velocity. Four hundred and twenty-four signals of all kinds were ordered, three hundred and fifty-six, or 83.96 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, one hundred and fifteen were changed from cautionary signals. In forty cases winds of twenty-five miles or more per hour were reported for which no signals were ordered.

COLD-WAVE SIGNALS.

During March, 1885, there were eighty cold-wave signals ordered, of which number, seventy, or 87.5 per cent., were justified.

RAILWAY WEATHER SIGNALS.

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

The predictions for the month of March, telegraphed by General Hazen, the Chief Signal Officer, were as follows:

Local rains.—4th, 12th, 13th, 15th, 21st, 22d, 25th, 26th, 27th, 28th.

Fair weather.—1st, 2d, 3d, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 14th, 16th, 17th, 18th, 19th, 20th, 23d, 24th, 29th, 30th, 31st.

Lower temperature.—13th, 17th, 20th, 22d, 28th, 29th.

Higher temperature.—3d. 4th, 6th, 10th, 11th, 12th, 14th, 15th, 16th, 18th, 19th, 21st, 23d, 24th, 27th, 30th, 31st.

Stationary temperature.—1st, 2d, 5th, 7th, 8th, 9th, 25th, 26th.

Cold-wave signals ordered on the 28th.

A careful examination of all reports shows the verification of predictions to be 92 per cent. for temperature and 93 per cent. for weather.

ATMOSPHERIC ELECTRICITY.

AURORAS.

An extended display of the aurora occurred during the night of the 15–16th Except at stations in Montana, where cloudiness prevailed, this display was observed throughout the northern part of the United States. To the eastward of the Missouri valley stations reporting it are very numerous, Nashville, Tennessee, being the southernmost point at which it was observed. In the northern plateau and north Pacific coast region this display was also reported by numerous observers.

The following reports have been received:

Spokane Falls, Washington Territory, 15th: a bright aurora appeared at 11.10 p. m.; there were three streamers of light pink color, which rose and fell at short intervals; the streamers were not vertical but were inclined towards the west.

Port Angeles, Washington Territory, 15th: an aurora was observed at 1.45 a. m., also at the 7 a. m. and at the 11 p. m. observations, with indications of its having continued uninterruptedly from the time of the first observation. When first seen no dark segment was observed, the horizon being obscured by groups of cirrus cloud, but an arch of light extended over about 150° of the northern horizon, with an elevation of about 40°; above the arch there appeared innumerable "merry dancers," which shot up to an elevation of about 70°. The maximum degree of brilliancy during the display was attained about 2.30 a. m. At the 7 a. m. observation the aurora was observed in the form of an arch of light, which flashed up in broad patches; at 11 p. m. the aurora was again observed, but was soon obscured by fog.

Lewiston, Idaho, 15th: an aurora was observed from 8.20 to 9.30 p. m.; it extended from 45° east of north to 15° west of