

Near Wetmore, Nemaha county, Kansas: 14th; during the night; course southwest to northeast.
 Three miles southwest of Fonda, Pocahontas county, Iowa: 14th, 3.30 p. m.; course northeast; cloud funnel-shaped.
 Sidney, Fremont county, Iowa: 14th, 4 p. m.; course southwest to northeast.
 Shubert, Richardson county, Nebraska: 14th, p. m.
 Island Ford, Rutherford county, North Carolina: 15th; evening; course southwest to northeast.
 Near Alexandria, Douglas county, Minnesota: 14th, p. m.
 Near Griswold, Cass county, Iowa: 14th, 4 p. m.; course north-northeast; much stock killed; fourteen dwellings, eighteen barns, and three school-houses destroyed.
 Coon Rapids, Carroll county, Iowa: 14th, 5.05 p. m.; course north-northeast; cloud funnel-shaped, whirling against the hands of a watch; thirty-two buildings destroyed.
 Story City, Story county, Iowa: 14th, 5.10 p. m.; course north 30° east; cloud funnel-shaped, whirling contrary to the movement of the hands of a watch; weather very warm and oppressive before the storm.
 Saint Cloud, Stearns county, and Sauk Rapids, Benton county, Minnesota: 14th, 4.27 p. m.; course of storm north-northeast; cloud funnel-shaped; very heavy rain fell before and after the passage of the tornado cloud; air preceding storm sultry and oppressive; rotation of cloud from right to left; two hundred and fifty buildings destroyed; seventy-four persons killed, and one hundred and thirty-six wounded; loss of property about \$400,000.
 Two miles south of Rome, Wise county, Texas: 14th, 10.30 p. m.; course of storm north-northeast; temperature 92° at noon; weather very oppressive; hail and rain fell before the tornado cloud approached.
 Six miles southwest of Skidmore (Burr Oak Grove), Nodaway county, Missouri: 14th, 7.30 p. m.; course southwest to northeast; six persons killed, and ten wounded; much stock killed, and many buildings destroyed.
 Lenox, Taylor county, Iowa: 14th, about 6.30 p. m.; several persons killed.
 Jamestown, Dakota: 14th, during the afternoon.

NAVIGATION.

In the following table are shown the danger-points at the various river stations; the highest and lowest depths for April, 1886, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, April, 1886.

[Expressed in feet and tenths.]

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>						
Shreveport, Louisiana.....	29.9	29	18.3	4, 5, 9, 10	15.3	3.0
<i>Arkansas River:</i>						
Fort Smith, Arkansas.....	22.0	19	12.9	25	6.1	6.8
Little Rock, Arkansas.....	23.0	21	14.1	11	7.7	6.4
<i>Missouri River:</i>						
Yankton, Dakota.....	24.0	14	16.5	2, 3	9.5	7.0
Omaha, Nebraska.....	18.0	15	9.3	21, 22, 26	7.7	1.6
Leavenworth, Kansas.....	20.0	17	14.1	28	9.8	4.3
<i>Mississippi River:</i>						
Saint Paul, Minnesota.....	14.5	1	8.2	11	4.4	3.8
La Crosse, Wisconsin.....	24.0	23, 24	11.8	7, 8	7.0	4.8
Dubuque, Iowa.....	16.0					
Davenport, Iowa.....	15.0	30	12.3	4 to 8	8.3	4.0
Keokuk, Iowa.....	14.0	1	14.3	15	10.6	3.7
Saint Louis, Missouri.....	32.0	21	23.7	15, 16	20.8	2.9
Cairo, Illinois.....	40.0	18, 19	51.0	30	32.0	19.0
Memphis, Tennessee.....	34.0	26, 27, 28, 29	35.7	1	27.0	8.7
Vicksburg, Mississippi.....	41.0	30	43.7	1	27.4	16.3
New Orleans, Louisiana.....	13.0	28	14.3	1	9.4	4.9
<i>Ohio River:</i>						
Pittsburg, Pennsylvania.....	22.0	7	22.6	30	3.2	19.4
Cincinnati, Ohio.....	50.0	9	55.8	30	13.0	42.8
Louisville, Kentucky.....	25.0	10	32.9	30	6.8	26.1
<i>Cumberland River:</i>						
Nashville, Tennessee.....	40.0	10	49.3	29, 30	6.2	43.1
<i>Tennessee River:</i>						
Chattanooga, Tennessee.....	33.0	3	52.1	30	6.0	46.1
<i>Monongahela River:</i>						
Pittsburg, Pennsylvania.....	29.0	7	22.6	30	3.2	19.4
<i>Savannah River:</i>						
Augusta, Georgia.....	32.0	1	32.2	27, 28	8.7	23.5
<i>Mobile River:</i>						
Mobile, Alabama.....		14	19.4	2	16.7	2.7
<i>Sacramento River:</i>						
Red Bluff, California.....		17	20.5	1	3.5	17.0
Sacramento, California.....		23	23.8	1	17.5	6.3
<i>Willamette River:</i>						
Portland, Oregon.....		19	9.9	1	4.4	5.5
<i>Colorado River:</i>						
Yuma, Arizona.....		28	20.0	3	16.5	3.5

STAGE OF WATER IN RIVERS.

The Mississippi River reached its highest stage during the month at all stations north of Keokuk, Iowa, on the 1st, while at Memphis, Tennessee, and stations south of that place, the river did not pass the danger-point until after the 25th.

The Ohio, on account of the floods of the latter part of March,

continued very high during the first decade of April; its volume of water, being increased by the heavy snow and rain of the 5th and 6th, reached its highest point at Cincinnati, Ohio, on the 9th.

ICE IN RIVERS AND HARBORS.

Connecticut River.—North Stratford, New Hampshire: owing to the ice gorge which formed on the 2d, the river overflowed, flooding the Grand Trunk Railway tracks and causing a suspension of traffic.

Israel River.—Lancaster, New Hampshire: on the 1st the ice in Israel River formed a jam below Mechanic street bridge and caused the river to be partially turned from its course; a part of the current was turned down the streets carrying with it huge blocks of ice, and flooding houses.

Lake Michigan.—Chicago, Illinois: navigation was resumed on the 8th. On the 21st vessels forced a passage through the ice in the Strait of Mackinac, and navigation between the upper and lower lakes was commenced, being a fortnight earlier than last year. A large number of steam and sailing vessels cleared from Chicago and Milwaukee for the lower lake ports.

Mackinaw City, Michigan: the strait on the 21st was partially free of ice. The first vessel passed through on that day, bound for Buffalo.

Lake Huron.—Alpena, Michigan: the fog and rainy weather caused the ice to break up during the 13th and 14th. A steamer from Detroit, the first vessel this spring, arrived at this port on the 15th.

Lake Superior.—Milwaukee, Wisconsin: the first vessel to pass through the strait from the lower lakes arrived on the 24th.

Marquette, Michigan: on the 29th the ice began to move out of the harbor, and navigation was resumed.

Lake Erie.—Buffalo, New York: navigation opened on the 15th, the first vessel arriving on that day.

Lake Ontario.—Oswego, New York: navigation was resumed at this port on the 1st, the schooner "Speedwell" arriving from Toronto.

Lake Quinsigamond.—Worcester, Massachusetts: the ice disappeared from the lake on the 2d, which was two weeks earlier than last year.

Missouri River.—Bismarck, Dakota: ice broke up and began moving out of the river on the 8th.

Fort Buford, Dakota: river opened about noon on the 6th.

Escanaba River.—Escanaba, Michigan: the high water in the river broke the ice on the 24th. The ice in the bay continued firm.

Red River of the North.—Fort Pembina, Dakota: the ice in the river began moving out on the 12th. On the 15th the river was clear of ice.

Grand Traverse Bay.—Traverse City, Michigan: ice began moving out of the bay on the 22d; by the 25th the bay was open for navigation.

Devil's Lake.—Fort Totten, Dakota: ice broke up on the 22d.

Mississippi River.—Saint Paul, Minnesota: the first steamer of the the season arrived at this port on the 17th.

Saint Clair River.—Port Huron, Michigan: the river was filled with floating ice during the entire month; several vessels which left port during the first half of the month were compelled to return on account of ice. An immense ice gorge, twenty-five feet high, formed at the foot of Lake Huron on the 7th and did not break for several days.

FLOODS.

Very heavy rainfalls occurred in the Southern States and Ohio Valley from the 26th of March to the 2d of April; the rains were excessively heavy in eastern Tennessee and northern Alabama, and caused unusually destructive floods concerning which the following reports, arranged by states, are given:

Alabama.—Montgomery: the flood of the latter part of March and first of April is considered the most disastrous that has ever occurred in this vicinity. The Alabama River, its tributaries, and all of the numerous rivers and creeks of this state

overflowed. On the 1st the city was completely surrounded by water, and all the low-lying part flooded. Much property was destroyed. The water began to subside on the 2d. Thousands of cattle, horses, mules, and hogs were swept away and corn, cotton seed, and provisions were destroyed. Nearly all the factories in the city stopped work on account of the flood. The only illumination in the city was by candles and oil. Viewed from the dome of the Capitol, the highest point in the city, was a lake of water to the north and west, fully seven miles square.

Birmingham, Jefferson county: the greatest disaster by flood in this state was along the Alabama and Coosa rivers, in Coosa, Elmore, Montgomery, Autauga, and Dallas counties. At Wetumpka, the county seat of Elmore county, the water was four feet deep in the business houses of the town, and the occupants were driven out of many of their residences. Many bridges and mills were destroyed in Elmore county, and large areas of the best farming country were under water.

Georgia.—**Augusta:** the flood of the latter part of last month still continued during the 1st and 2d. The river attained its maximum height at noon of the 1st. Hamburg, South Carolina, on the opposite side of the river, was entirely surrounded by water; railroad travel over the bridge crossing the Savannah was suspended; all the lower portion of the city was under water. The railroad companies have sustained heavy losses, while the damage suffered by the factories and other property in Augusta will not fall short of \$20,000. The water subsided rapidly during the 2d.

Rome, Floyd county: the gas-works were submerged on the 2d. The loss by flood at this place it is estimated will reach \$500,000. The entire town, except on the hills, was under water from one to eleven feet, and fifteen dwellings were washed away. The water came so rapidly that it was impossible to save furniture, etc.

Columbus: the Chattahoochee began falling on the 1st, leaving much mud in the city. Columbus is said to have been damaged \$50,000 by the flood. Plantations below this town were reported covered with water from five to eight feet deep.

Tennessee.—**Chattanooga:** the river rose steadily on the 1st. The city was surrounded by water, the fifth ward being almost submerged; the water-works shut down owing to the flood extinguishing the fires. Both gas-works suspended operations and business of all kinds was suspended. Several persons were drowned and many on the outskirts of the city had their homes washed away. On the 2d the water was fifty-three feet above low-water mark, and did not begin to subside until the afternoon of the 3d. At other places along the Tennessee the damage is reported very serious; more than fifty houses are known to have floated past Whitesburg, Alabama.

Nashville: the Cumberland reached its highest stage on the 10th. The river-gauge marked forty-nine feet, being five feet below the high-water mark of 1882. The damage sustained by mill-owners and lumbermen is not so great as was to have been expected, owing to the timely and continued warnings of the Signal Service. The city mills lost very little, except in time and the cost of making goods secure. Great loss was suffered by farmers; the destruction of the wheat crop in the Cumberland lowlands will possibly amount to half a million dollars, necessitating a second plowing of the ground and the planting of corn or some other grain.

Illinois.—**Cairo:** the Ohio River was very high from the 1st to the 27th, inclusive, causing great suffering and loss of property. In this city the Illinois Central Railroad was damaged by the track, near the river, being undermined and torn away. Traffic was suspended on this road for several days. Many families, between this city and Paducah, Kentucky, were compelled to move their goods to the second story for safety. The back-water from the Ohio inundated the land on the Missouri side for a distance of five miles, causing great loss to the farmers, their stock being drowned, growing crops buried in mud, and fences carried away. Between this city and Memphis the country resembled a lake, the water spreading for miles through the bottoms, with all landings submerged, and at some points

only roofs of houses being visible. At Metropolis, Illinois, thirty miles north of here, many houses were submerged, being accessible only by water; the lowlands were flooded from ten to twenty feet.

Kentucky.—**Louisville:** during the first week of this month the Ohio River at all points was above the flood-line, caused by melting snow and continuous heavy rains. In the lowlands many houses were abandoned. Wharf boats were moored to brick houses that stand two hundred feet back from the wharf, and craft floated within a stones' throw of Main street.

London, Laurel county: all tributaries of the Cumberland and Kentucky rivers were very high on the 1st; much lumber was lost and damage done to other property.

Arkansas.—**Helena, Phillips county:** on the 22d, about fifteen miles below this place, the levee crumbled from the immense pressure of water against it, and a large crevasse was soon washed out, emptying an immense volume of water into one of the finest agricultural sections in the Mississippi Valley, affecting immediately plantations containing about 8,000 acres in cultivation, many of them planted with this year's crops of corn and cotton.

Virginia.—**Richmond, 6th:** the steady rains of the past three days have caused the waters of Virginia streams to rise, submerging all the wharves in the lower part of the city. The water was highest on the 1st, nearly all that portion of the city known as the "Rocketts" being covered to a depth of five or six feet, cutting off communication between the upper and lower portions of the city.

West Virginia.—**Charleston:** the flood in the Kanawha and Elk rivers, which resulted in submerging half the city, began receding on the morning of the 2d. Hundreds of people living in small houses were great sufferers, having lost their entire possessions.

Maryland.—**Cumberland:** it is reported that the heavy rains of the latter part of March and the first part of this month caused the South Branch of the Potomac to rise to a greater height than has been known for nine years. Trains were not able to get through on the 1st, the Baltimore and Ohio Railroad being submerged at that point.

Havre de Grace, Harford county: four bents of trestle-work on the new bridge of the Baltimore and Ohio Railroad over the Susquehanna were washed away on the 2d. The river was very high.

Ohio.—**Cincinnati:** the Ohio River was very high from the 1st to 4th, flooding cellars and otherwise injuring property.

The following is from the "New York Herald" of April 3d:

CINCINNATI, OHIO, April 2, 1886.—At half past eight o'clock this evening the snow, which had been falling nearly all day, measured nearly four inches in depth and was still falling. This fact, together with the reported rains up the river, caused considerable apprehension as to a flood, and business houses in the bottoms have been busy all day removing their goods. Many cellars are already flooded, and the mills of the Licking River have closed. The river at eight o'clock was fifty feet nine inches and rising two inches an hour.

Pennsylvania.—**Mount Carmel, Northumberland county:** rain fell incessantly on the 5th and 6th, flooding the collieries and causing suspension of work. The lowland lying along the Shamokin Creek was submerged and the residents compelled to move to the upper stories of their houses.

Huntingdon, Huntingdon county: the continuous rain and melting snow from the mountains on the 5th and 6th caused the Juniata River to rise to an unusual height. On the 7th many out-buildings and trees were swept past this place. One lumber firm lost two million feet of logs.

Vermont.—**Montpelier:** the heavy rain of the 31st of March and the melting of the mountain snow raised the Winooski River, breaking the ice and flooding the banks. The main street of the town of Berlin was filled with ice. A heavy railroad bridge was carried away.

New Mexico.—**Santa Fé:** heavy rain and high southeasterly wind began on the 19th, continuing all day of the 20th, causing the Santa Fé Creek to assume the proportions of a rapid river. Telegraph communication was interrupted, railroad bridges were washed away and several miles of track destroyed.

Canada.—**Montreal:** this city was visited by a flood during the 18th, 19th, and 20th. Business was at a complete standstill. Hundreds of wholesale and retail houses were closed, being inaccessible except by boats. The suffering of the residents in the flooded part of the city was intense. In Griffintown thousands of persons were forced to the upper part of their houses by the water. Twenty-four streets were reported covered with water to the depth of five feet. The flood showed signs of abatement on the 20th.

HIGH TIDES.

Eastport, Maine, 6th.
Block Island, Rhode Island, 6th, 20th.
New Haven, Connecticut, 6th.
Sandy Hook, New Jersey, 6th.
Atlantic City, New Jersey, 6th.

LOW TIDES.

Indianola, Texas, 1st, 5th to 11th, 16th, 17th, 19th to 23d, 30th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for districts east of the Rocky Mountains during April, 1886, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 80.19 per cent. The percentages for the four elements are: Weather, 83.02; direction of the wind, 82.39; temperature, 75.31; barometer, 76.39 per cent. By geographical districts, they are: For New England, 68.57; middle Atlantic states, 79.53; south Atlantic states, 85.58; eastern Gulf states, 87.68; western Gulf states, 84.28; lower lake region, 75.00; upper lake region, 79.49; Ohio Valley and Tennessee, 82.29; upper Mississippi valley, 80.79; Missouri Valley, 78.87. There were eight omissions to predict, out of 2,736, or 0.29 per cent. Of the 2,728 predictions that have been made, eighty-five, or 3.12 per cent., are considered to have entirely failed; one hundred and seventy-seven, or 6.49 per cent., were one-fourth verified; four hundred and twenty-five, or 15.57 per cent., were one-half verified; four hundred and forty-one, or 16.17 per cent., were three-fourths verified; 1,600, or 58.65 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The percentages of verifications of special predictions for certain localities are, as follows:

Omaha, Nebraska (twenty-six days), 79.81; Arkansas (twenty-six days), 86.54; Baltimore, Maryland (twenty-six days), 71.64; Washington City, 75.41; Portland, Maine, 70.83; Boston, Massachusetts, 68.75; New Haven, Connecticut, 71.67; Albany, New York, 72.50; Pittsburg, Pennsylvania, 74.17; Cincinnati, Ohio, 74.17; Louisville, Kentucky, 70.00; Indianapolis, Indiana, 65.83; Columbus, Ohio, 62.07; Oswego, New York, 69.58; Rochester, New York, 72.50; Buffalo, New York, 69.17; Erie, Pennsylvania, 69.17; Cleveland, Ohio, 65.00; Davenport, Iowa, 72.91; Toledo, Ohio, 74.58; Sandusky, Ohio, 61.67; Milwaukee, Wisconsin, 73.73; Chicago, Illinois, 76.25; Lynchburg, Virginia, 79.17; Georgia, 84.58; northern Florida, 89.17; Shreveport, Louisiana, 67.50; Tennessee, 74.58; Memphis, Tennessee, 80.00; Saint Louis, Missouri, 74.17; Cairo, Illinois, 81.67; western Missouri, 79.17; Iowa, 81.67; Saint Paul, Minnesota, 85.00; Nebraska (seventeen days), 77.94; Palestine, Texas (twelve days), 75.00.

CAUTIONARY SIGNALS.

During April, 1886, one hundred and thirty-six cautionary signals were ordered. Of these, seventy-six, or 55.88 per cent., were justified by winds of twenty-five miles or more per hour at or within one hundred miles of the station. Sixteen cautionary off-shore signals were ordered, of which number, eight, or 50.00 per cent., were fully justified, both as to direction and velocity; sixteen, or 100 per cent., were justified as to direction; and eight, or 50.00 per cent., were justified as to velocity. One hundred and fifty-two signals of all kinds

were ordered, eighty-four, or 55.26 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, twelve were changed from cautionary. Two signals were ordered late. In fifty-nine cases, winds of twenty-five miles or more per hour were reported for which no signals were ordered.

COLD-WAVE SIGNALS.

No cold-wave signals were ordered during April.

RAILWAY WEATHER SIGNALS.

Prof. P. H. Mell, jr., director of the "Alabama Weather Service," in the report for April, 1886, states:

The verifications of predictions for the whole area was 93 per cent. for temperature, and 90 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; and the cities of Milledgeville, Georgia, and Talladega, Alabama.

ATMOSPHERIC ELECTRICITY.

AURORAS.

Auroral displays were not very numerous during April, 1886. The most brilliant and extensively observed display was that of the 20th; it was generally observed in the northern districts from Montana eastward to Maine.

The following notes refer to the displays reported during the month:

Prairie du Chien, Crawford county, Wisconsin: a white auroral arch above a dark segment was observed during the evening of the 1st.

Fort Yates, Dakota: an aurora was observed from 9.38 to 10.50 p. m. of the 1st. The auroral light consisted of a horizontal bar of white light extending from northwest to southeast. An aurora was also observed on the 20th, from 10.30 to 11.20 p. m.

Bismarck, Dakota: an aurora was observed from 9.45 to 11.20 p. m. on the 1st, having two separate pillars of light 5° wide and 30° altitude. The light was a pale yellow color, the maximum brilliancy occurring at 10.15 p. m.

Escanaba, Michigan: faint aurora observed at 10 p. m. on the 4th, and continued until after midnight. On the 12th a faint orange-colored arch 20° above the horizon was observed about 9 p. m.

Saint Vincent, Minnesota: an aurora was observed at 9.35 p. m. of the 12th, consisting of a pale whitish light shooting up to a height of 20°.

Gardiner, Kennebec county, Maine: on the 14th a brilliant aurora was observed at 10.45 p. m., with beams flashing up towards the zenith. At 2.30 a. m. the aurora was still visible but fainter on account of the moon which was then shining brightly.

Cambridge, Massachusetts: a faint auroral arch was observed from 8.30 to 9.45 p. m. of the 14th, which increased in brightness until about 11 p. m., when it began to fade away. An aurora was also seen at 10 p. m. of the 30th. This aurora was low and irregular with some appearance of streamers, with dark sky below; later a faint arch appeared. The display ended at 11 p. m.

Mackinaw City, Michigan: an aurora of 15° altitude and 30° azimuth was seen on the 20th during the evening. It was so faint that it could not be seen after the moonlight began.

Poplar River, Montana: a pale yellow aurora was seen at 10.30 p. m. of the 20th. Numerous beams, not well defined, rose to the altitude of 30°. The beams were interspersed with dark rays resembling dense smoke. The display ended at 11.30 p. m.

Fort Assinaboine, Montana: a bright auroral display was first seen at 10 p. m. of the 20th, consisting of an arch of pale white color above a dark segment. The arch was about 90° azimuth and 17° to 20° altitude. At midnight it had almost