

NAVIGATION.

STAGE OF WATER IN RIVERS.

No sudden or dangerous rises have occurred in any of the rivers during the month.

The Mississippi river was at its highest stage on the 1st, at all stations, except Keokuk, Iowa, and Saint Louis, Missouri. At Keokuk the river rose above the danger-line on the 14th, and continued to rise slowly, reaching its highest point, twenty-one inches above the danger-line, on the 18th. On the 21st, it was again below the danger-line. At New Orleans, Louisiana, the range for the entire month was only four inches.

The Ohio and Missouri rivers remained low during the month, but reached their highest stages between the 23d and 30th.

The highest and lowest stages of water observed at the Signal-Service stations during the month of May, 1883, are shown in the following table:

Heights of rivers above low-water mark, May, 1883.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.	
		Date.	Height.	Date.	Height.
<i>Red River:</i>	<i>Ft. In.</i>		<i>Ft. In.</i>		<i>Ft. In.</i>
Shreveport, La.....	29 9	1	21 10	29, 30	13 0
<i>Arkansas:</i>					
Little Rock, Ark.....	30 0	24	15 0	19	2 0
Fort Smith, Ark.....		22	10 6	17	*-2 11
<i>Missouri:</i>					
Yankton, Dakota.....	20 0	23	8 3	22	3 0
Omaha, Nebr.....	16 0	25	14 1	4 to 11	7 2
Leavenworth, Kans.....	21 0	27	10 10	8, 9, 10	3 11
<i>Mississippi:</i>					
Saint Paul, Minn.....	14 6	1	10 6	31	7 2
La Crosse, Wis.....	18 0	1	9 9	22	6 6
Dubuque, Iowa.....	21 10	1	16 4	29, 30, 31	10 5
Davenport, Iowa.....	15 0	1, 2	13 2	30, 31	8 5
Keokuk, Iowa.....	14 6	18	10 3	31	12 3
Saint Louis, Mo.....	30 0	2	26 6	1	18 7
Saint Louis, Ill.....	40 0	1	41 7	17	23 8
Memphis, Tenn.....	31 0	1	32 11	19	18 5
Vicksburg, Miss.....	41 0	1	42 3	25, 26	37 7
New Orleans, La †.....	-2 6	2 to 8 14, 15 19 to 24	- 1 - 2	27 to 31	- 1 6
<i>Ohio:</i>					
Pittsburg, Pa.....	20 0	23	13 4	13, 14	3 3
Cincinnati, Ohio.....	50 0	29	29 11	18	11 0
Louisville, Ky.....	24 0	1, 30	11 8	19	6 7
<i>Cumberland:</i>					
Nashville, Tenn.....	42 0	1	17 3	20	5 0
<i>Tennessee:</i>					
Chattanooga, Tenn.....	33 0	1	11 0	31	3 11
<i>Monongahela:</i>					
Pittsburg, Pa.....	29 0	23	13 4	13, 14	3 3
<i>Savannah:</i>					
Augusta, Ga.....	30 0	25, 26, 31	6 6	2	15 6
<i>Willamette:</i>					
Portland, Oreg.....		1	7 6	26, 27	16 7
<i>Sacramento:</i>					
Red Bluff, Cal.....		6	6 0	3, 4	2 6
Sacramento, Cal.....		24	20 8	4	16 3
<i>Mobile:</i>					
Mobile, Ala.....		10	18 4	31	15 4
<i>Colorado:</i>					
Yuma, Arizona.....		31	21 11	1, 2	17 5

† Below high-water mark of 1874.

* Below bench mark.

FLOODS.

The floods occurring during May were generally of local character and were confined to creeks and small streams. They were very destructive in Dakota, in the vicinity of Deadwood, where they were due mostly to the melting of winter snowfall in the mountains and hills of that region. With this exception, the damage resulting from floods during the month has been comparatively small.

Alabama.—Mobile: a very heavy rain storm occurred on the 19th, during which 5.50 inches of rain fell. The streets in many parts of the town were flooded, the water covering some to depths of six feet. No serious damage resulted.

Arkansas.—Eureka Springs, Carroll county: the heavy rain accompanying the storm of the 18th, flooded the yards in this vicinity, carrying away 5,000 feet of lumber. Leatherwood Creek valley was flooded to a depth of fifteen feet, damaging the Eureka Springs railroad.

Dakota.—Deadwood: On the 15th and 16th, the tem-

perature rose rapidly, and on the 17th a warm rain set in. These conditions caused the snow in the mountains to melt rapidly, which resulted in sudden rises in all streams in this vicinity. Whitewood creek, a stream running through Deadwood, rose with great rapidity, and at 4 p. m. the water was within four inches of the flooring of the Lee-street bridge. At 7.45 p. m. the bridge gave way, after which over seventy houses were washed away in a few hours. The rain continued during the 18th, on which date only three houses were left standing on Lee street. Many houses on Upper Sherman street, from Lee street to Chinatown, were washed away. On the 18th a six story brick school-house and a new church were wrecked, and three persons were drowned. The water began to subside at 1 p. m. The wagon roads for miles around were impassable, and the Military telegraph lines were prostrated. The damage to Deadwood and vicinity is estimated at more than \$1,000,000. Deadwood is situated at the junction of the Whitewood and Deadwood gulches, and numerous other gulches emptied their accumulating water from the mountains into these two main gulches, making a volume of water that rushed down Whitewood with resistless force. Central City, Anchor City, and Golden Gate are on Deadwood gulch, above Deadwood city. The greater portion of Central City was above the flood, but Anchor City and Golden Gate there was no escape, the gulch there being not over six hundred feet wide.

The main residential portion of Deadwood is from one hundred to three hundred feet above the gulch, and the main business portion is also above the danger line. The portion destroyed was occupied by cheap tenement houses, second-class hotels, laundries, small traders, &c. Some of the buildings are built over the stream, which at its ordinary stage is only a few feet wide, but during the flood it increased in width to fifty feet. This locality is generally avoided, however, its danger being recognized. When the flood came, timely warning was given by means of the telephone system which exists in the hills, and the most valuable articles were removed by the residents. All of Whitewood (or Pennington), about five miles south of Deadwood, was washed away, and also the greater part of Crook City and Spearfish. Operations are suspended in all of the mines in the vicinity of Deadwood, the Homestake mine being nine feet under water.

Meade, 20th: the damage caused between this place and Deadwood is so great as to render it impossible to make an estimate as to its extent. Men who were sent out to repair telegraph lines returned without success and narrowly escaped drowning.

Rapid City: this city was entirely surrounded by water on the 20th, and the Rapid City valley, more than forty miles in length, all of which had been seeded, was entirely submerged and many houses were washed away. The amount of the damage done in the valley cannot be accurately estimated, but it is very great.

Illinois.—Rockford: the heavy rain-storm of the evening of the 9th resulted in great damage to cellars and basements throughout the city. Reports from the surrounding country state that stock and the newly planted fields suffered great damage.

Elgin: this region was visited during the night of the 9th by a very heavy rain-storm. Railway traffic was considerably interrupted, owing to numerous wash-outs. The Fox river rose five feet, damaging the water power at this point to the extent of \$7,000.

Missouri.—West Plains, Howell county: the heavy rains of the 18th and 19th flooded a part of Howell valley, where bridges, embankments, and fences were washed away. At Augusta considerable damage was done by washing away embankments and culverts.

Nebraska.—Omaha, 8th: the heavy rain of this date caused the sewers in the city to overflow, resulting in damage to the extent of several thousand dollars. More than two inches of rain fell in three hours.

HIGH TIDES.

Cape Lookout, North Carolina, 2d: very high tide, covering the whole island, and drowning a large number of sheep and cattle. High tides also occurred at this station on the 3d, 4th, 6th, 7th, 8th, 15th, 18th, 19th, 20th, 22d.

Punta Rassa, Florida, 21st.

ICE IN RIVERS AND HARBORS.

Lake Erie.—Buffalo, New York: the lake at this place was clear of ice on the 5th.

Lake Superior.—Duluth, Minnesota, 2d: the barge "Osceola" departed on this date, being the first boat to leave this port for the lower lakes.

Marquette, Michigan, 5th: the barge "Osceola" was the first boat of the season to arrive from Duluth, Minnesota. The passenger steamers "Saint Paul" and "Winslow" arrived on the 10th, and reported having encountered considerable ice. On the 17th, the inner harbor became filled with ice. On the 18th, the captain of the steamer "Toledo" reported that the ice extended along the shore of the lake from this place to the mouth of Saint Mary's river, and in places it extended lakeward for a distance of fourteen miles.

Devil's lake.—Fort Totten, Dakota: the lake became clear of ice at this place on the 13th.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors at the Signal-Service stations, with the average depth at which the observations were made, are given in the following table. In this table is also shown the mean temperature of the air at the various stations, and the monthly ranges of water temperature. The smallest monthly ranges are as follows: Portland, Maine, 3°.7; Eastport, Maine, 4°.6; Smithville, North Carolina, 5°; Duluth, Minnesota, 6°.5; Pensacola, Florida, 6°.5. The largest are: Buffalo, New York, 23°.5; Cedar Keys, Florida, 20°.5; Alpena, Michigan, 20°.4; New Haven, Connecticut, 17°.5; Toledo, Ohio, 17°.1.

Temperature of Water for May, 1883.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey.....	58.6	47.0	11.0	ft. in.	56.7
Alpena, Michigan.....	58.4	38.0	20.4	11 2	44.0
Augusta, Georgia.....	79.0	62.0	17.0	8 1	70.5
Baltimore, Maryland.....	66.0	54.0	12.0	9 8	64.0
Block Island, Rhode Island.....	54.6	43.7	10.9	8 11	52.6
Boston, Massachusetts.....	59.1	45.7	13.4	21 3	55.5
Buffalo, New York.....	59.0	35.5	23.5	10 1	50.0
Cedar Keys, Florida.....	86.0	65.5	20.5	10 10	75.1
Charleston, South Carolina.....	75.1	65.0	10.1	39 11	70.8
Chicago, Illinois*.....	54.7	49.2	5.5	7 4	52.1
Chincoteague, Virginia.....	71.0	55.0	16.0	5 8	60.0
Cleveland, Ohio.....	56.7	44.4	12.3	14 0	54.2
Detroit, Michigan.....	55.0	45.0	10.0	23 7	54.0
Delaware Breakwater, Delaware.....	61.4	49.5	11.9	9 3	58.1
Duluth, Minnesota.....	44.0	37.5	6.5	14 10	45.5
Eastport, Maine.....	41.7	37.1	4.6	15 7	47.4
Escanaba, Michigan.....	50.0	37.5	12.5	15 0	45.1
Galveston, Texas.....	79.0	71.0	8.0	12 8	75.6
Grand Haven, Michigan.....	63.7	50.1	13.6	19 0	50.6
Indianola, Texas.....	81.5	73.6	7.9	9 4	76.2
Jacksonville, Florida.....	81.0	72.0	9.0	18 0	73.9
Key West, Florida.....	86.4	78.2	8.2	17 1	79.5
Mackinaw City, Michigan †.....	43.8	32.8	11.0	13 0	44.7
Marquette, Michigan.....	43.0	35.0	8.0	9 10	44.0
Milwaukee, Wisconsin.....	53.0	42.6	10.4	8 0	49.6
Mobile, Alabama.....	77.0	69.5	7.5	17 0	72.0
New Haven, Connecticut.....	65.7	48.2	17.5	15 1	56.5
New London, Connecticut.....	58.0	45.0	11.0	12 7	56.6
New York City.....	61.5	46.7	14.8	17 4	59.0
Norfolk, Virginia.....	72.0	58.0	14.0	16 11	66.3
Pensacola, Florida.....	78.6	73.1	5.5	17 9	72.2
Portland, Maine.....	44.7	41.0	3.7	18 11	54.9
Portland, Oregon.....	59.8	47.6	12.2	62 5	57.4
Provincetown, Massachusetts.....	59.0	44.5	14.5	14 0	53.9
Punta Rassa, Florida.....	87.5	76.1	11.4	11 1	75.3
Sandy Hook, New Jersey.....	56.0	46.2	9.8	1 5	58.6
San Francisco, California.....	61.8	52.6	9.2	29 4	56.8
Savannah, Georgia.....	76.8	66.9	9.9	12 4	72.7
Smithville, North Carolina.....	71.0	66.0	5.0	10 0	68.5
Toledo, Ohio.....	64.3	47.2	17.1	11 7	55.8
Wilmington, North Carolina.....	74.5	60.0	14.5	13 0	69.0

* No observations from 1st to 14th inclusive.
 † Observations interrupted by ice on the 1st, 2d, and 4th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for May, 1883, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 89.54 per cent. The percentages for the four elements are: weather, 93.28; direction of the wind, 90.01; temperature, 89.06; barometer, 85.74 per cent. By geographical districts, they are: For New England, 85.58; middle Atlantic states, 87.50; south Atlantic states, 91.13; eastern Gulf, 93.82; western Gulf, 92.42; lower lakes, 89.53; upper lakes, 87.43; Ohio valley and Tennessee, 90.72; upper Mississippi valley, 89.50; Missouri valley, 87.87.

There were twenty-six omissions to predict out of 3,720, or 0.70 per cent. Of the 3,694 reductions that have been made, seventy-three, or 1.98 per cent., are considered to have entirely failed; seventy-three, or 1.98 per cent., were one-fourth verified; three hundred and thirty-one, or 8.96 per cent., were one-half verified; three hundred and seventy-two, or 10.07 per cent., were three-fourths verified; 2,845 or 77.01 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During May, 1883, one hundred and thirty-nine cautionary signals were displayed. Of these, one hundred and seventeen, or 84.17 per cent., were justified by winds of twenty five miles or more per hour, at or within one hundred miles of the station. Six cautionary off-shore signals were ordered, of which three, or 50.0 were justified both as to direction and velocity, and the remaining three were justified as to velocity, but not as to direction. Fifteen cautionary signals were changed to off-shore signals. One hundred and forty-five signals, of all kinds, were displayed, of which one hundred and twenty, or 82.76 per cent., were fully justified. These do not include signals ordered at display stations, where the velocity of the wind is only estimated. Eleven signals were ordered late. One hundred and twenty-nine winds of twenty-five miles or over per hour were reported, for which no signals were ordered; many of these were high local winds or strong sea-breezes.

ATMOSPHERIC ELECTRICITY.

AUORAS.

But few auroral displays were reported during the month, none of which were noted for brilliancy or extent of observation.

On the 1st a display was observed at Saint Vincent, Minnesota; Toronto, Ontario; Newport, Vermont; Charlottetown, Prince Edwards' Island; Sydney, Nova Scotia, and on the summit of Mount Washington. At the latter station it was seen from 10.15 p. m. until midnight. It extended over about 40° of the northern horizon, and to an altitude of 20°.

Auroral displays were observed on other dates as follows:

2d.—Eastport, Maine: a faint display was observed at 11.30 p. m.

3d.—Litchfield, Michigan.

4th.—Eastport, Maine: faint straw-colored auroral light observed from 11 p. m. until the morning of the 5th. This display was also reported to have been visible at Oswego, New York, at 2 a. m. of the 5th.

5th.—Lansing, Michigan; Vevay, Indiana.

6th.—Saint Vincent, Minnesota: faint auroral arch observed at 9.40 p. m., extending over about 40° of the northern horizon, and to an altitude of 40°.

8th.—Vevay, Indiana.

9th.—Fort Assinniboine, Montana.

13th.—Eastport, Maine: a faint auroral light was visible from 9 p. m. until the morning of the 14th. This display was also seen at Gardiner, Maine, and Toronto, Ontario.

16th.—Sussex, Wisconsin: An aurora was observed from 8.30 to 8.45 p. m.

19th.—Woodstock, Maryland: An aurora was observed at