

New Orleans, La., where it was highest on the 6th, and Portland, Oreg., where the river was highest on the 30th and still rising. The high water at Shreveport and Vicksburg was largely due to the floods of the 18th to the 21st of March in Arkansas.

#### NAVIGATION OF RIVERS AND HARBORS.

The following special reports relative to ice and navigation have been received:

*Detroit River.*—Detroit, Mich., 1st, navigation on the lower Lakes was opened to-day.

*Mississippi River.*—St. Cloud, Minn., 6th, clear of ice.

*Missouri River.*—Sioux City, Iowa, 1st, very high and full of ice.

*Lake Erie.*—Buffalo, N. Y., 1st, navigation opened.

*Lake Michigan.*—Green Bay, Wis., 1st, the first boat of the season left port. Chicago, Ill., 1st, navigation opened.

*Lake Ontario.*—Rochester, N. Y., 1st, navigation opened.

*Lake Superior.*—Sault Ste. Marie, Mich., 17th, navigation opened. Duluth, Minn., 18th, navigation opened.

## OBSERVATIONS ON THE GREAT LAKES.

### REPORTS FROM VESSELS.

Navigation having opened about April 1, the Lake Marine Section of the Forecast Division has received reports from the captains of eighteen vessels navigating the Great Lakes. The following miscellaneous items are extracted from their reports:

Capt. H. Zealand, steamship *Simon Lanzell*, April 24, central part of Lake Huron: Aurora began 8.30; very bright and dancing at 11 p. m.; receded at midnight. April 25, 7.50 p. m., we sighted, by the help of mirage, Stannard Rock Light, which was distant 58 miles by chart measurement. We were on course from Whitefish Point to Manitou Island and had Caribou Island abeam. Aurora began at 9.10; quit at 10.45.

Capt. A. B. Drake, steamship *Thomas Maythan*, April 25, 12.30 a. m., Stannard Rock Light not lighted.

NOTE.—Capt. Zealand's hypothesis that the light was visible by the help of mirage, assumes, of course, that he was correct in estimating his own location. Capt. Drake's statement that this light was not lighted at 12.30 a. m. should be taken in connection with the possible existence of "mirage," since the same optical phenomenon that causes the light to be visible to distant vessels may cause it to be invisible to nearer vessels. In general, the noise from the fog horn and the light from a lighthouse are equally subject to the laws of irregular refraction and reflection by the atmosphere.

Capt. Edward Mooney, steamship *Wa-Wa-Tarn*, April 12, Milwaukee, aurora borealis display.

Capt. W. P. Robertson, steamship *Petroskoy*, April 24, Chicago, aurora borealis from 10 p. m. onward.

Capt. C. H. Lewis, steamship *John C. Gault*, April 12, Lake Erie, N. 52° 50', W. 82°, 9.45 p. m., aurora very bright, bearing north-northwest to northeast; died out at 10.30 p. m.

Capt. W. A. Russell, steamship *William A. Proctor*, April 17, Ogdeensburg, northern lights lasting about one-half hour. April 17, 12 miles west of Clayton, St. Lawrence River, 6 a. m., buoy in St. Lawrence not yet placed. 22d, 7.45 a. m., no buoy on Galloo Shoal.

### REPORTS FROM U. S. LIFE-SAVING STATIONS.

Through the kind co-operation of the General Superintendent of the Life-Saving Service and the Secretary of the Treasury, the Weather Bureau has received 14 weekly transcripts of journals for the month of April from the keepers of 4 Life-Saving Stations on the Great Lakes. The following special notes by the respective keepers are extracted from these journals:

*Middle Island, Lake Huron.*—Donald McKenzie, keeper. April 12, northern lights to-night very brilliant from about 8 p. m. to midnight; 24th, northern lights 10 p. m. to midnight; 26th, northern lights 9.30 p. m. to midnight.

### WRECKS ON THE GREAT LAKES.

The Weather Bureau has published a special report, with chart, showing the location of wrecks that have occurred on the Great Lakes during the years 1886-'93, inclusive. This report and chart show 227 wrecks, with a loss of 420 lives, and about \$5,000,000 of property, distributed as follows: Lake Superior, 32 vessels; Lake Michigan, 85; Lake Huron, 44; Lake Erie, 50; Lake Ontario, 16. Of ten important wrecks that occurred during the years 1892 and 1893, seven occurred during stormy conditions, of which timely warning had been given by the Weather Bureau, and of the remaining three, two were due to fog.

The present editor notes that a remarkably small proportion of these wrecks seem to have occurred near large ports; thus, on Lake Superior, near Duluth and Marquette, only 2 are located; on Lake Michigan, near Chicago, Milwaukee, and Grand Haven, 4; on Lake Huron, near Port Huron, Saginaw, and Alpena, 3; on Lake Erie, near Toledo, Sandusky, Cleveland, Erie, Dunkirk, and Buffalo, 12; on Lake Ontario, near Oswego, 6. In all, 27 out of 226.

## SUNSHINE AND CLOUDINESS.

### GENERAL REMARKS.

The quantity of sunshine, and probably of heat, received by the atmosphere above the cloud layer, is very nearly constant from year to year, but varies with the day and month. On the other hand, at the surface of the earth, the distribution of sunshine and, therefore, the resultant heat with its meteorological and biological consequences depends mostly on the distribution of cloudiness.

The *sunshine* is recorded automatically, either by its photographic or its thermal effects. The *cloudiness* is recorded by personal observations by the local observers.

### SUNSHINE.

During the month an instrumental record of sunshine has been kept at 16 stations by means of the photographic sunshine recorder and at 21 stations by means of the thermometric sunshine recorder; the results of these observations are given in Table IV, which shows the actual percentage of sunshine received on the average of the month for any hour of local mean time (not seventy-fifth meridian mean time).

The stations recording the largest percentage of sunshine between the hours of 11 a. m. and 1 p. m., are: Baltimore, Md., 86; Colorado Springs, Colo., 91.5; Key West, Fla., 98; San Francisco, Cal., 87.5; Tucson, Ariz., 91.5; Vicksburg, Miss., 87.5.

The stations having the least percentage during these hours are: Bismarck, N. Dak., 45; Portland, Oreg., 45.5.

The general average sunshine for the whole month is given in the next to the last column of Table IV. The highest percentages are: Key West, Fla., 91; Tucson, Ariz., 86; Santa Fe, N. Mex., 79; San Francisco, Cal., 75.

The lowest percentages are: Portland, Oreg., 37; Bismarck, N. Dak., 47; Boston, Mass., 51; Des Moines, Iowa, 52.

### CLOUDINESS.

The number of clear and cloudy days and the average cloudiness between sunrise and sunset, as based on numerous personal observations, are given for each Weather Bureau station in Table I. The complement of this average cloudiness gives the observer's estimated percentage of clear sky, and these