

stationary barometer, when an important area of high pressure is central over the Southern States.

9. That "the tidal waves," falsely so called, especially for Lake Erie, are due to large and rapid changes in atmospheric pressure such as are noticeable upon the barograph preceding or during thunderstorm conditions.

10. That the larger lake undulations may account for the existence of the greater waves encountered by fishermen and often termed the "three sisters."

The author adds that similar results to these for the lakes have been obtained by him from the study of the tidal records at St. John, N. B., and Halifax, N. S., and he is quite enthusiastic as to the useful results that may be attained in weather forecasting when such tidal records on the lakes and on the western seaboard are submitted to careful study.

Mr. Denison had the kindness to bring to the Weather Bureau samples of his interesting and valuable records, but after some consideration of the subject the Editor was forced to the conclusion that his large scale barograph curve will of itself be more useful in the study of and prediction of the weather than the record of the lake levels, which latter is full of fluctuations due to seiches and shorter waves and has no very close relation to the barograph or to the curve of air pressure. The study of the seiche is an important matter in the study of lake levels and engineering projects, but does not seem to be especially essential to meteorology.

#### HISTORIC DROUGHTS IN THE UNITED STATES.

From two well-known volumes (Peirce, "On the Weather," Philadelphia, 1847, page 272, and Perley, "Historic Storms," Salem, 1891, pages 58 and 66) we learn something about two of the severest droughts on record. The meteorologist will find it an interesting problem to explain, even in a general way, the reasons for these great departures from normal conditions.

1749. The spring was uncommonly dry, and by the end of May pastures were all scorched and burned in eastern Massachusetts. The drought probably continued longer and was felt more severely than any one that the people had before experienced. June 9 was appointed as a day of public fasting and prayer. Between July 1 and 6 plenty of showers fell in New England, and the period of drought was brought to an end. A small crop of hay, barley, and oats and a good crop of indian corn were harvested; flax and herbs of all kinds were a failure; cattle were killed in the autumn to save the great expense of keeping them through the winter.

1762. There was scarcely any rain from April 9 to August 18, and in some places, as at Danvers, until September 22. The month of April was cold. There was a slight drizzling rain at Boston May 7 and June 3 and showers on June 18. July 7 a fast was held at Falmouth, Me., and at Milton, Mass. July 28, being fearful that a famine would ensue, a public fast was proclaimed in a number of cities. Refreshing showers occurred near Falmouth, but not elsewhere until August 18, when bounteous rain descended throughout New England. Crops were, of course, very light and cattle were generally slaughtered because of the difficulty of keeping them through the winter.

1816. This summer, which is known as the cold one, was also a very dry one in many regions. In Vermont no rain fell during May and very little in Connecticut. During June intense heats were followed by freezing weather, with snow squalls in several of the New England States. The snowfall on the 8th of June in Vermont amounted in some places to 12 and 18 inches. In July there was abundant rain in northwestern Massachusetts and New Hampshire; from that time a drought continued until October 22, having pre-

vailed for one hundred and twenty days in Vermont. Owing to the cold and the drought the crops were an almost complete failure.

Our scanty records make it quite impossible to present a really satisfactory summary of the meteorological conditions that prevailed during these historic droughts, but it is sufficiently evident that any locality between Pennsylvania and Maine may count upon having an absolute drought of three months' duration at least once in a century and injurious droughts of a month's duration very much more frequently. It is by no means impossible for the farmer to secure admirable crops during such droughty seasons if he will make proper provision for artificial irrigation. It is much more business-like to profit by past experience and provide artesian wells, windmill water pumps, protected reservoirs, and irrigating ditches than to neglect all these and spend one's time in praying for rain. Fast days and prayers were all right for the early settlers of the country, before they knew the exact nature of our climate, but now that three hundred years of records have accumulated and we know or ought to know how to succeed in the struggle against the inexorable laws of nature, it behooves us to profit by our experience. New England farmers have been very slow to realize the profit that is to be drawn from a parched soil and a cloudless sunny sky by the simple means of irrigation. Methods of cultivation that have made the desert spots of central Asia, Algeria, northern India, Australia, and California profitable gardens have until lately been ignored in New England.

#### INTERNATIONAL BALLOON ASCENSIONS, JUNE 8, 1898.

The fifth series of international simultaneous balloon ascensions came off on the morning of June 8, with great success. The following brief summary is condensed from the full account that is published in *Ciel et Terre*, July 1, Vol. XIX, p. 203.

Owing to the interest in the subject, stimulated by the conference at Strasburg (see MONTHLY WEATHER REVIEW, November, 1896, pp. 365, 415, and 462, and April, 1898, p. 158), six nations, Austria, Belgium, Italy, France, Germany, and Russia took part in this most important meteorological campaign. The Daily Weather Map for Europe shows that on the morning of June 8 the isobar of 765 mm. covered central Europe with a very irregular curve, and that a pressure as low as 760 could only be found by going far to the west and south. Consequently, the most gentle barometric gradients prevailed throughout the region represented by the balloon ascensions, and very slight changes in pressure and temperature occurred during the twenty-four hours. Light rains had fallen on the immediate coast of the North Sea during the night before, and were again repeated during the following night, but the interior of the country was everywhere clear or partly cloudy, with rare cases of local thunderstorms. The morning temperatures ranged from 12° to 16°, the maximum temperatures 16° to 25° C., over this part of Europe. The operations at each station were as follows:

*Vienna*.—One sounding balloon and three ordinary military balloons, manned by officers of the army, were sent up successively at 6, 7, 8 a. m., and the last one at noon. The latter reached an altitude of 4,500 meters, where the temperature was -8° C.

*Berlin*.—Four balloons started, respectively, at 6 a. m., 9 a. m., and noon, and the last at 2 a. m. the next morning. Of course the winds near the ground were light and baffling, but the balloons moved slowly toward either west-northwest or west-southwest, according to their altitudes.

*Paris*.—The sky was so foggy in the morning that the sounding balloon could not be observed at the theodolite sta-