

Information contained in reports of observers and the daily press shows that a northeast gale of terrific force began over the lower Lakes the afternoon of the 4th. At Detroit high wind and heavy snow disabled the street car service. Managers of lines received ample warning but the snow was too heavy to be handled with the facilities at hand. All vessels in, and passing, that port were warned. Late in the afternoon telegraphic communication was cut off. At Cleveland the storm was reported the most severe of the season. The warning was heeded, and vessels and their cargoes, valued at upward of \$800,000 were sheltered in that port. The observer states that a disregard of the warnings would have resulted in a loss of vessels and lives. Throughout the interior of New York the high wind and heavy snow which began on the 4th continued during the 5th, 6th, and 7th, delaying railroad traffic. Considerable damage by high wind was caused along the New Jersey coast. Many captains heeded the storm signals hoisted on the 3d, and upward of 100 steamers and sailing vessels sought refuge at Sandy Hook and Gravesend Bay. At Long Branch, Sunday night, the wind reached a velocity of 70 miles an hour from the east, and heavy seas carried away 160 feet of the iron pier. The signals kept many vessels in port at New York and other harbors of the north Atlantic coast, and in view of the exceptional severity of the storm many casualties were doubtless averted by the general regard given to the warnings.

#### COLD WAVE WARNINGS.

The first well-marked cold wave of the month appeared over the upper Missouri valley on the 12th; extended over the States of the upper Mississippi valley and the western Lake region during the 13th, carrying the line of zero temperature to southern Iowa, and reached the Atlantic and Gulf coasts on the 14th, with a minimum temperature of 30° at New Orleans, 28° at Mobile, 30° at Savannah, and 38° at Jacksonville. The second wide-spread cold wave of the month extended over the northern Rocky Mountain region and the upper Mississippi valley the night of the 28th, and reached the Atlantic coast and Gulf States on the 31st, with zero temperature to the southern line of Kansas, and freezing weather almost to the west Gulf coast. All sections and interests, likely to be injuriously affected, received prompt and ample notification of the approach of these cold waves.

#### CHICAGO FORECAST DISTRICT.

The abnormally cold weather which prevailed during the last nine days of November in the district continued with almost remarkable persistence until the middle of December. In Chicago during the entire period of twenty-four days there was but one day on which the temperature was above normal. This condition seriously affected the shipments of perishable goods, and shippers in Chicago and at other points were in daily communication with the Chicago office by telephone and otherwise. Each morning during the winter the probable minimum temperature at Chicago for the ensuing night is forecast, and both shippers and transportation companies find this to be of great value in the movement and protection of perishable produce. With the breaking up of the western high pressure area on the 14th instant, shippers were advised that less caution was necessary, and the period of comparatively mild weather for more than a week was advantageously used by them.

A well-marked cold wave developed in the Canadian Northwest during the night of December 28, and spread eastward and southward over the entire district during the 29th and

30th. Ample warning of its approach was given for all sections except a portion of the Rocky Mountain region, where its advent was very sudden.

During the portion of the month in which storm signals were displayed, but one storm occurred on the lakes which seriously affected navigation, that of December 4 on Lake Huron. This storm first appeared as an unimportant disturbance over the western Gulf States on December 1, and remained nearly stationary for forty-eight hours. On the 3d it began to move northeastward, increasing very much in intensity. On the morning of the 4th it was central over the middle Ohio Valley, and in the evening its center was over Pennsylvania. Heavy snow and severe gales accompanied the disturbance. Storm signal orders and warning messages were sent to Lakes Michigan and Huron ports on the afternoon and evening of the 3d. Warnings of heavy snow were also sent to the southeastern portion of Lower Michigan on the morning of December 4.—*H. J. Cox, Forecast Official.*

#### SAN FRANCISCO FORECAST DISTRICT.

On the evening of December 8, it was evident that a severe northeast gale would prevail during that night and the following day in portions of California. An effort was made to reach the chief wharfinger at 6 p. m., and notify him to advise all shipping in the harbor to take unusual precautions. The office was closed and the official could not be found. The warning was given to the Merchants' Exchange, the principal maritime body in the city, with a request to distribute it as far as possible. However, some vessels either failed to get the warning or failed to take the necessary precautions to prevent injury. The northeast storm signal was displayed on the following morning at San Francisco and points to the northward, and the information signal on the coast south of San Francisco. Probably the most severe northeast gale in the history of the State occurred during the 9th of December. The wind attained a velocity of 96 miles an hour at Point Reyes, and 44 miles at San Francisco. A lumber raft which was tied to the wharf at the north end of the city, went to pieces during the gale. The damage to shipping in the harbor, and to wharves, amounted to upward of \$2,000. It would probably have been considerably more had not some precautions been taken.

On December 10 warning of a severe frost, probably injurious to citrus fruit, was distributed throughout California, which was verified in almost all portions of the State except southern California. Precautions were taken to reduce the damage to a minimum, and in the northern portion, where the most severe temperatures occurred, a large portion of the crop was picked and injury thus prevented, while in the southern portion the temperatures were not so severe but what the methods of protection resorted to were ample to prevent injury. Temperatures from 26° to 34° prevailed throughout the entire State except the extreme southwestern portion.

On December 13 the weather map showed conditions favorable for a storm in California and warnings of rain were distributed in the northern portion of the State. Prior to this storm one of the most severe periods of drought ever known in the history of California had prevailed. With the exception of two months of very light rainfall there had been a continued deficiency of rainfall for over twenty months, and the present season had progressed until near its middle with but little rainfall. The supply of feed and hay for stock had become exhausted throughout the entire southern portion of the State and stock had commenced to die from starvation. One large owner had just made arrangements to ship eighteen carloads of cattle from Monterey County to Nevada, and most extreme measures were being resorted to to prevent stock

suffering. This warning of rain did much to allay the existing anxiety, and caused many stockmen to delay undertaking expensive methods to prevent loss. About one-half inch of rain occurred in the Sacramento Valley and central coast section. This was followed by another rain in northern California from the 19th to 21st.

On December 28 warnings of a severe norther were distributed throughout northern California and northwest storm signals ordered at points from San Francisco northward, and a warning of much colder weather, accompanied by snow, was distributed in Nevada and Utah. A maximum wind velocity of 32 miles an hour occurred at Eureka and 72 miles northwest at Point Reyes, and high north to northwest winds and gales prevailed throughout the State north of the Tehachapi during the night of the 28th and the 29th. Maximum velocities of wind of 36 miles per hour were reported from Carson City and Winnemucca and 60 miles at Independence. A current velocity of 20 miles from the northwest was reported from Salt Lake City. The gales in Nevada and Utah were accompanied by snow, the temperature falling to 4° and 6° above zero on the morning of the 30th in Nevada and Utah.

On the last day of the month the conditions indicated that a storm of unusual severity was approaching the Oregon coast; southeast storm signals were ordered at points along the California coast north of San Francisco. This storm verified the signals which it is believed were of considerable value.—*W. H. Hammon, Professor, Weather Bureau.*

#### FROST WARNINGS FOR TEXAS.

The morning map of December 3 showed conditions which might give injurious weather in the sugar and trucking region. A cold wave and "norther" was forecast for Texas by the Central Office at Washington, and the following warning was issued by the Galveston office of the Weather Bureau:

Probably freezing in sugar and trucking region Sunday (4th).

At 2:25 p. m. the following additional warning was distributed:

Temperature will fall to 34° and probably freezing at Galveston, and to 28° 50 to 100 miles from Galveston Sunday morning.

All sugar planters and truck growers to the coast line were advised by telegraph and long-distance telephone to protect their crops, and action was taken accordingly. The sugar cane in the north half of the sugar belt had been cut on advice given November 21. This left standing in the southern portion of the sugar belt about 40,000 tons of cane which it was desired to windrow in case of a freeze. This at the selling price in the field, \$3 a ton, made the value \$120,000. Besides this there were vegetables subject to loss by freeze which in the aggregate were worth more than \$150,000. Sunday morning the temperature fell to 35° at Galveston, 34° at Houston, and to 30° at Brenham. The reports of Sunday morning indicated a further fall in temperature and additional warnings of frost were issued, and sugar planters were advised to prepare for freezing weather. Sunday night and Monday morning there was heavy frost on Galveston Island, and killing frost and temperature as low as 28° in the sugar and trucking regions, and had not the action advised been taken cane and vegetables to the value of many thousands of dollars would have been lost. Many acknowledgments of the value of the warnings have been made. Referring to these warnings the Galveston Daily News of December 6, 1898, remarks as follows:

A heavy white frost put in its appearance yesterday morning, just as predicted by the United States Weather Bureau. While heavy white frosts occur nearly every winter on the mainland, Galveston has an average of one winter in five without frost or freezing, and even with

freezing weather heavy white frosts are uncommon on the island. Everybody looked for and made preparation for this frost, because the weather service had said it would occur. The warnings of injurious weather conditions made for this section have been so accurate of late years, and consequently of so great value to the public, that they have become a great factor with the sugar planters and truck growers who care for their extensive crops, as the Weather Bureau advises them. One feature which demonstrates their marked confidence in the warnings is that they take action to protect their crops as the warnings suggest. The different localities have systems in operation for the distribution of information. Some localities have distribution by telephone, others by mounted messenger service, and in others the planters distribute the information from one to his adjoining neighbor until all are advised.

There are few, if any, sections where the weather service can be of greater value than to this part of the country. The large sugar and truck farming interests use the warnings to such an extent that it saves them hundreds of thousands of dollars annually.

*I. M. Cline, Local Forecast Official.*

#### PORTLAND, OREG., FORECAST DISTRICT.

Signals were ordered up on the 10th, 18th, and 31st; they were verified in each instance. Numerous freighters, steamers, and sailing vessels heeded warnings and no casualties are reported.

There was no damage resulting from rain, frosts, or high winds. The river had no material rise.

The railroads made considerable use of the snow forecasts during the early part of the month. Fires were kept up in the rotary snow engines and they were moved to the mountain districts upon information issued from this office.

Two carloads of bananas were moved into Oregon and this city upon information issued, and were received and marketed in good condition.

On December 14 forecasts for snow were issued. Snowfall was general, except in and about Portland, where fair weather prevailed.—*B. S. Pague, Forecast Official.*

#### AREAS OF HIGH AND LOW PRESSURE.

During the month seven highs and nine lows were sufficiently well defined to be traced on Charts I and II. On these charts the circle is placed at the position of the high or low at 8 a. m. or 8 p. m. of each day, and inside this circle are placed the date, time, and barometer reading at the center. The accompanying table exhibits the principal facts relating to the origin, disappearance, duration, and velocity of these highs and lows, and the following special notes are added.

The month has been characterized by pressures largely above normal in the southwest and west, and these conditions have controlled the development and motion of the highs and lows. Oftentimes the rather permanent high area in the Plateau region has spread southeastward into Texas but without any motion.

*Highs.*—High No. II was the only one originating on the Pacific coast; III and IV were first seen in the north Plateau region, VII to the north of Montana, I in Kansas, and V and VI to the north of Lake Superior. The general motion was to the eastward or southeastward. Nos. II, III, IV, and VII were merged in a subpermanent high in the Gulf of Mexico or over Florida, and I, V, and VI were last noted in the Gulf of St. Lawrence. The temperature oscillations accompanying these highs were very moderate up to the last week of the month. On the morning of the 27th, as No. VII approached Minnesota, Winnipeg experienced a fall of 50° in twenty-four hours and to -18°, and Moorhead a fall of 38° and to 4°. On the evening of the 28th, as the same high approached the Atlantic coast, Northfield reported a fall of 41° and to 8°, and the next morning Eastport reported a fall of