

SECTION III.—FORECASTS AND WARNINGS.

FORECASTS AND WARNINGS, DECEMBER, 1918.

By H. C. FRANKENFIELD, Supervising Forecaster.

[Dated: Washington, Jan. 9, 1919.]

GENERAL PRESSURE DISTRIBUTION OVER THE NORTHERN HEMISPHERE, EXCEPT EUROPE AND ASIA.

Over the Pacific Ocean pressure was above normal during the month, especially from the 2d to the 7th, inclusive, over that section in which Midway Island is located. Over the Aleutian Islands and Alaska the mean pressure was somewhat below normal, although quite high over extreme southern Alaska during the third decade of the month, the rise extending over interior Alaska during the last three days.

Over the United States proper there were no marked extremes of pressure, except from Ontario eastward where there was about a week of rather high pressure after the middle of the month. As a whole the pressure was somewhat below normal, except over the Canadian Northeast. Over the southwestern Atlantic Ocean, as indicated by the reports from Turks Island, West Indies, pressure was normal throughout the month, increasing to the northward after the first five days. On the 28th a disturbance passed the Island of Bermuda, moving northward, and on the 29th it was over Cabot Strait, with a barometer reading of 28.98 inches at Port Aux Basque, Newfoundland.

Reports from Horta in the eastern Atlantic were generally missing until the 20th, from which time until the end of the month moderately high pressure prevailed.

STORM WARNINGS.

A disturbance that was over western Minnesota on the 1st did not develop as strongly as had been anticipated, and storm warnings ordered at 4 p. m. for the Upper Lakes were not generally justified, although some moderately strong winds occurred on Lakes Michigan and Huron. There was a similar failure in development of a disturbance that was over northeastern Florida on the evening of the 1st, and a consequent absence of strong winds on the South and Middle Atlantic coasts, in anticipation of which northeast storm warnings were ordered at 10 p. m.

On the morning of the 2d, with the lake disturbance over Upper Michigan, small craft warnings were ordered from Port Huron, Mich., to Cleveland, Ohio, and southwest storm warnings from Erie, Pa., to Oswego, N. Y. These warnings were well verified, except on Lake Ontario. This disturbance continued eastward, and on the morning of the 4th, when it was central over eastern New York, northwest warnings were ordered along the Atlantic Coast from Sandy Hook, N. J., to Nantucket, Mass. Fresh gales followed.

On the 5th another northwest disturbance was central over Minnesota with an increasing tendency, and at 3 p. m. northwest and northeast warnings were ordered displayed on the Upper Lakes, except southern Huron. These warnings were also justified by the succeeding occurrences, except on western Michigan and eastern Superior. The evening observation of the 5th indicated a still further increase in intensity of this storm, coupled with a more rapid easterly movement, and at 10:30 p. m. southwest warnings were ordered on the Atlantic Coast from Norfolk to Boston, and northwest and southwest

warnings on the Great Lakes from Detroit to Oswego. These warnings were followed by strong winds as had been indicated, New York City and Block Island, R. I., reporting maximum velocities of 72 and 56 miles an hour, respectively, from the Northwest during the 6th. The warnings on the Atlantic coast had previously been changed from southwest to northwest.

On the morning of the 9th a Middle Plateau disturbance was central over northeast Nebraska in marked form, and at 10 a. m. northeast and southeast warnings were ordered on the upper Lakes for strong winds during the following afternoon and night. The disturbance did not develop materially, but a considerable increase in pressure to the northeastward created a strong gradient to the southwestward, and strong winds occurred during the ensuing 24 to 36 hours, the warnings having been continued on the morning of the 10th over the northern half of the region, with small-craft warnings over the southern half. Small-craft warnings were also ordered on the Atlantic coast from Norfolk to Boston for fresh to strong northeast winds.

By the evening of the 10th there was a more definite movement of the western disturbance, with its center over Indiana, and with strong high pressure to the northeastward, and at 10:30 p. m. southeast warnings were ordered on Lake Erie from Cleveland to Buffalo and on Lake Ontario. No strong winds followed, however, except in the vicinity of Erie, Pa. On the morning of the 11th on eastern Lake Superior and extreme northern Lake Huron the warnings were changed to southeast, another northwestern disturbance having moved to western Lake Superior. This disturbance moved northeastward, and no strong winds occurred.

The display of storm warnings on the Great Lakes was discontinued for the season at the termination of December 15.

On the morning of the 15th there was a very moderate depression off the North Carolina coast after a very slow four-day movement across the country from extreme southern California, while very high pressure prevailed to the northward. This distribution resulted in moderate gales along the Atlantic coast from Cape Henry to Nantucket during the 16th and 17th for which no warnings had been ordered.

On the evening of the 19th there was a moderate depression over the lower Rio Grande Valley, with widespread and marked high pressure throughout the eastern half of the country. Accordingly, northeast storm warnings were ordered on the Gulf coast from Bay St. Louis, Miss., to Cedar Keys, Fla., and on the Atlantic coast from Jacksonville, Fla., to Georgetown, S. C. On the following day fresh southeast gales occurred on the middle Gulf coast, but only fresh winds at other places where the warnings had been displayed. An offshoot from a plateau disturbance was over eastern Texas on the morning of the 23d, with much higher pressure to the northward, and at 11 a. m. southeast storm warnings were ordered on the Gulf coast from Bay St. Louis to Carrabelle, winds to become strong from east and south east, and to shift to colder west and northwest on the following day. During the night the wind at Pensacola, Fla., reached a velocity of 64 miles an hour from the southwest. At 9:45 p. m., with the disturbance over the lower Mississippi Valley, advisory warnings of strong northeast winds with snow were sent to open ports on Lake Michigan.

The disturbance moved northeastward with perhaps the best storm development of the month, and snows and strong winds occurred as forecast. At 8 p. m., December 24, the disturbance was over western Lake Erie, with a secondary center over New Jersey, and at 10:30 p. m. southeast warnings were ordered displayed on the New England coast.

However, although the pressure decreased during the night, there were no strong winds of consequence, and the warnings were lowered at 10:30 a. m. of the 25th, and small-craft warnings ordered displayed at New York City and Sandy Hook, N. J., for the strong northwest winds that followed during the day.

The last warning of the month and year was an advisory one for open ports on Lake Michigan. It was issued at 9:30 p. m. of the 30th, at which time a southwestern disturbance was central over eastern Iowa with a northeastward movement. Strong winds becoming north and northwest with snow and rapidly falling temperature were forecast. Snow followed, but the winds were not more than fresh, and the temperature fall was delayed by the rapid development and northeastward movement of another southwestern disturbance.

COLD WAVE AND FROST WARNINGS.

Following the moderate disturbance that was off the North Carolina Coast on the morning of the 2d, warnings of heavy frost on the following morning were issued for the East Gulf and South Atlantic States (light frost for central Florida). Frosts occurred generally, but they were mainly light. From this time until the 22d there was no occasion for the issue of frost warnings. On the morning of the 22d, with high pressure and low temperatures to the northwestward, and a well-defined disturbance over eastern Texas, cold wave warnings were issued for southern Kentucky, Tennessee, northern Mississippi, and northern Alabama, and for freezing temperatures, or lower, for southern Mississippi and southern Alabama by the morning of the 24th. On the evening of the 23d freezing temperatures were forecast for the morning of the 25th over northwestern Florida. The very slow northeastward movement of the Texas disturbance delayed the approach of the cold weather, and it did not arrive until the morning of the 26th, when freezing temperatures occurred into northwest Florida, with a moderate cold wave to the northward. The warnings for the Southern States were repeated on the morning of the 26th, and they were generally verified over the northern districts, cloudy weather prevailing to the southward. The frosts and freezing temperatures that occurred over northern and central Florida on the morning of the 30th were not forecast, the assumption being that the weather would remain more or less cloudy. However, the clouds soon reappeared and there were no frosts on the following morning.

On the evening of the 30th and the morning of the 31st there was a strong and decidedly cold high-pressure area over the North and Northwest, with a trough of moderately low pressure extending from Texas to the Upper Mississippi Valley, and warnings for a moderate cold wave were ordered for northern Mississippi, western Tennessee, the Ohio Valley, Indiana, Lower Michigan, and extreme northwestern Upper Michigan. These cold-wave warnings were generally verified, although the low temperatures were somewhat delayed in some localities by the slow movement of the depression to the eastward.

A single warning of substantial snowfall was issued in the late afternoon of the 23d for southern Lower Michigan, northern and central Indiana and north-

western Ohio, and the warning was well verified, except in central Indiana and northwestern Ohio.

WARNINGS FROM OTHER DISTRICTS.

Chicago, Ill., forecast district.—The month throughout the entire district was uneventful during the first two decades, mild temperature being the rule. During the last decade the weather conditions were quite active; first, because of the development and movement on the 23d and 24th of a severe storm from the southwest over the middle States; and second, because of another development a few days later of a storm and cold wave in the west.

The first storm brought general and heavy precipitation, mostly in the form of snow, with strong shifting winds. The conditions attending this storm were correctly forecast, and the area of precipitation closely defined, with the exception of the State of Wisconsin. It was not anticipated that the track of the storm would be far enough to the north to bring snow to that State. No marked cold followed this storm movement, except in the middle Plains States, where there was a gradual fall in temperature, and on this account cold-wave warnings were not issued nor justified.

During the closing days of the month the second storm which moved across the district was followed by a well-marked cold wave, with considerable falls in temperature. This storm developed on the eastern slope of the Rockies on December 29, moving southeastward to Texas, and thence northeastward over the Middle States, reaching the Great Lakes region by the 30th and 31st. The storm was accompanied by precipitation over a wide area, and the ensuing temperatures were by far the lowest experienced during the month. Warnings were issued for all sections affected. On the morning of December 29 warnings for snow, colder, and strong shifting winds were sent to stock and transportation interests in Montana, Dakotas, Minnesota, east and central Wyoming, and western Nebraska. On the evening of that day cold wave warnings were issued to the Dakotas, east and south Montana, Wyoming, western Minnesota, Nebraska, Kansas, and northwest Iowa. On the morning of the 30th cold wave warnings were repeated to western Minnesota, South Dakota, Nebraska, Kansas, and northwest Iowa. In the afternoon and night they were extended to eastern Minnesota and western Missouri, western Wisconsin and western and northern Iowa, and on the morning and afternoon of the 31st, over the balance of Iowa and Missouri, and in the evening to Illinois.

The cold wave did not move directly southeastward from the northwest, but rather in a roundabout way, first directly southward over the Plains States, and then finally eastward, not reaching Illinois until January 1, and eastern Wisconsin until January 2.

Doubtless the warnings issued were of great value, especially because of the moderate weather conditions preceding, although much information is not available at the time of writing. Under date of December 30, the section director in Cheyenne, in his weather and range report for Wyoming, reports, as follows:

Sunday morning warnings were sent out advising stockmen and shippers of approaching stormy weather with snow and colder. By Tuesday morning temperatures of 18 below zero were common over the central and north parts of the State, while snow had occurred over much of the State, being heavy in the Lander district.

Under date of December 23, Mr. P. H. McCauley, superintendent of transportation of the Northern Pacific Railway Co., St. Paul, writes, as follows:

Your wire yesterday giving prospective weather conditions received. This is first of the season and reminds us of the many similar advices

received last winter, which we were very glad to get, as they were always reliable and immediately telegraphed to our superintendents in the territory where weather changes are effective, the necessary action being taken for as much protection as possible. Hope that you will continue long in this service, as it has proven very reliable in the past.—*H. J. Cox.*

New Orleans, La., forecast district.—Frost or freezing warnings were issued on the 2d, 3d, 4th, 10th, 13th, 14th, 25th, 26th, and 28th, and were generally justified.

On December 23 an area of low pressure was centered over Texas and an area of high pressure to the northward with its crest over the Dakotas, where the temperature was zero to 10° below, indicating that a cold wave would extend to the Gulf coast. Cold-wave warnings were ordered on the a. m. map for Arkansas, Oklahoma, eastern Texas except Abilene, and for northwest Louisiana, and extended at night over Louisiana. The cold wave occurred as forecast at nearly all stations.

On December 30 the a. m. map showed an area of low barometer over the southern Rocky Mountain region and the Plains and West Gulf States, and an intense high pressure area to the northward. The conditions indicated that the low pressure from the southern Rocky Mountain region would develop southward into Texas and give a general and severe cold wave over this district. Cold-wave warnings were issued on the morning of the 30th for Oklahoma and the northern portion of west Texas, were extended at 3 p. m. to El Paso, Abilene, and Del Rio, and at 9:30 p. m. to all stations except the Gulf coast and eastern Arkansas. On the morning of the 31st warnings were issued for Arkansas, Oklahoma, the northeast and southwest portions of east Texas, and were extended to the Texas and Louisiana coasts at 3 p. m. Warnings were repeated at night to Louisiana, Arkansas, and eastern Texas except the northwest portion. A severe cold wave overspread the district, giving the minimum temperatures forecast in nearly all localities.

Live-stock warnings were issued on the 23d, 30th, and 31st.

Storm warnings were ordered for the Louisiana and Texas coasts on the 19th and 23d, and for the Texas coast on the 31st.—*I. M. Cline.*

Denver, Colo., forecast district.—No severe weather conditions requiring warnings occurred during the first and second decades. On the 21st a Pacific storm was central in Arizona, while an anticyclone was spreading southward over the northern Rocky Mountain region and the north Pacific States. Live-stock warnings were issued at 9:10 a. m. for the greater portion of eastern Colorado. Moderate to heavy snow fell and temperatures ranging from zero to 10° occurred in northeast Colorado. A portion of the storm moved southeastward into Mexico and reappeared on the Texas coast on the 23d, while the part remaining in Arizona dissipated. On the 29th an area of low pressure developed in the southern Plateau region, and at 8 p. m. warnings of a moderate cold wave were issued for northeast Colorado, as the pressure was increasing rapidly in the Canadian Northwest, while the southwestern depression increased in intensity. The following morning cold wave warnings were repeated for eastern Colorado, with a prediction of zero temperatures, and live-stock warnings were distributed. A moderate cold wave warning was also issued for districts in New Mexico east of the mountains. The warnings were fully verified. At 8 a. m. on the 31st the storm had moved slowly eastward to western New Mexico. Cold-wave warnings were ordered for northwest New Mexico and extreme southwest Colorado and a warning of freezing

temperature, with probably frost in localities, was issued for southwest Arizona. A sharp fall in temperature occurred on the morning of January 1st in the southern and central portions of the district, with temperatures considerably below zero in southern Utah, northern Arizona, northwest New Mexico, and Colorado. At Phoenix the lowest temperature was 26° and at Yuma, 28°.—*Frederick W. Brist.*

San Francisco, Cal., forecast district.—December weather in this district was largely controlled by high-pressure areas and, consequently, there was a predominance of fair weather with temperature below normal, especially at night. In the Sacramento Valley there were 18, and in the San Joaquin Valley 17 mornings with frost. Near the end of the month citrus fruit was badly damaged in a number of localities south of the Tehachapi. Warnings for frost in some one or more localities in California were issued on 26 days, and in nearly every instance they were verified. Forecasts of the minimum temperature expected at Pomona, in the heart of the orange district, were made every day, based upon information contained in the p. m. weather chart. These forecasts reached Pomona before 7 p. m., at which time our representative there amplified them to meet local conditions in the neighborhood. These forecasts, except on two or three occasions, were within two or three degrees of the exact temperatures registered by the minimum thermometer in the instrument shelter placed on the ground at Pomona. The greatest departure occurred on the morning of the 30th. It was raining at Pomona at observation time of the previous evening, and the conditions seemed to indicate that the rain might continue and be accompanied by winds sufficiently strong to prevent any great drop in temperature. A minimum temperature of 32° was predicted, but shortly before daylight the weather became still and clear, and the temperature quickly dropped to a minimum of 22°. Not much orchard heating was done on this night, but it is believed the damage was not great on account of the short time the minimum temperature below the freezing point.

Storm warnings were issued on 13 days, and small craft warning on eight days for one or more places in this district. Most of the warnings were placed at the entrances to the Strait of Juan de Fuca and the Gulf of Georgia, and at the mouth of the Columbia River, for storms central over southeastern Alaska, the outer edge of which barely reached to the northwest corner of the United States, but they caused a strong draft of air through the relatively narrow courses where the displays were placed, and much stronger winds were experienced after leaving the confines of the United States by vessels bound northward. The worst storms of the month occurred during the morning of the 28th, when a maximum wind velocity of 78 miles an hour from the southeast was reported from North Head, Wash., and during the 12 hours between 5 p. m., December 19, and 5 a. m., December 20, when a maximum velocity of 85 miles an hour from the northwest occurred at Point Reyes, Cal. Warnings for the North Head storm were ordered the evening before it occurred, and for the Point Reyes storm the morning before the high winds began. It is probable the oil-tank steamer *George Loomis*, 401 tons net, with a crew of 17 men, was so damaged by the storm of the 20th that she afterwards foundered with the loss of all hands. This vessel left San Francisco on the 19th, bound for Coos Bay, with a cargo of oil. She was seen by passing vessels on the 21st and 22d but since then no trace of her has been found.—*E. A. Beals.*