

SECTION III.—FORECASTS AND WARNINGS.

FORECASTS AND WARNINGS, NOVEMBER, 1918.

By ALFRED J. HENRY, Supervising Forecaster.

[Dated: Weather Bureau, Washington, Dec. 20, 1918.]

Pressure at Midway was considerably above the normal throughout the month except on the 3d, 20th to 23d and again on the 29th and 30th. At Honolulu, on the other hand, pressure was quite uniformly below normal, except for about a week beginning the 12th and ending the 18th.

In Alaska there were sharp alternations from high to low pressure in the Aleutians and at Nome during the first half of the month and quite low pressure thereafter. At interior stations in the Yukon Basin pressure alternately rose and fell but on the whole low pressure was the rule, there being but three short periods of above normal pressure. Along the coast the fluctuations were generally in close agreement with those of the interior.

The first great depression of the barometer in the Aleutians was felt almost simultaneously over the Canadian northwest and from the Rocky Mountains westward to the coast; in fact pressure began to fall at Prince Rupert on the British Columbia coast 24 hours in advance of its fall at Dutch Harbor. The second great depression of the barometer in the Aleutians beginning on the 17th was not immediately reflected in the Canadian northwest, the interior of Alaska, or the western portion of the United States but pressure continued low along the Alaskan coast and also in the Yukon Basin after the 21st.

THE WEATHER OF THE MONTH.

The weather of the month as conditioned upon the pressure distribution may be briefly summarized as follows: The lows during the first half of the month, as in the month of October, were decidedly lacking in intensity and generally moved eastward along the northern circuit. As a consequence temperature was above the normal in northeastern districts east of the Mississippi. The central portion of the country from the Atlantic to the Pacific was mostly under the influence of high pressure attended by clear radiation weather and little precipitation. In the south the prevalence of northerly winds caused a general lowering of the temperature and there was an excess of precipitation.

After the 15th there was a marked increase in the intensity of the LOWS but not a corresponding increase in the vigor of the HIGHS. There were no cold waves in any part of the country.

The absence of high winds in the Lake region and along the Atlantic coast was a prominent feature of the month, although cyclonic depressions of marked intensity crossed the Lake region on several occasions, as noted in the paragraphs under the caption "LOWS."

HIGHS.

The great majority of the HIGHS, plotted on chart I, apparently had their origin over the Pacific and moved inland as shown. It would seem that practically throughout the month pressure was above the normal off the California coast and considerably below along the Alaskan coast and indeed over interior Alaska during the last half of the month. This pressure distribution resulted in what may be called a "pinching off" from the semi-permanent Aleutians Low of more or less perfectly

organized systems of low pressure which moved eastward along the northern circuit. In the rear of each depression thus separated from the principal depression an area of high pressure would pass inland from the Pacific, some of which traversed the continent, while others disappeared over the Plains States and Mississippi Valley. The month affords several examples of the very rapid disappearance of highs over the Plains States entirely at variance with the somewhat prevalent idea that HIGHS are of greater stability than LOWS. HIGHS Nos. VI and VII and VIIA are examples in point. On the 17th a great area of high barometer with central pressure 30.40–30.50 inches occupied the Rocky Mountain region. A cyclonic depression of low barometer level (29.40 inches) was centered over Iowa and practically the whole territory east of the Rocky Mountains was under its direct influence.

Two days later the Rocky Mountain anticyclone had entirely disappeared and the Mississippi Valley cyclone had deepened and the orientation of its longer axis had changed from north-south to east-west. Meanwhile a fresh cyclone had moved inland from the Pacific over central California, the first of the present season to enter the continent below latitude 40° N. At this time, morning 19th, a marked rise in pressure had overspread Alberta. This rise advanced southward and eastward as two distinct waves, the first reached Montana in 24 hours and the West Gulf States 48 hours later; the second wave crested over Saskatchewan on the evening of the 21st with a pressure of 30.90 inches, track No. VII. This anticyclone spread southward, fan-shaped during the 21st–22d attended by northerly winds and light snow on its front; the snowfall overspread Oklahoma, the Texas Panhandle, and the Rocky Mountain region in the west and reached northern Illinois and southern Michigan to the east of the Mississippi. With the advance of this great anticyclone into lower latitudes on the 23d it began to disintegrate and quickly disappeared.

In connection with the disappearance of anticyclone represented by track No. VI, I venture the following forecasting precept: *An anticyclone central over the Rocky Mountains with its longer axis north-south and highest central pressure over Wyoming or Colorado becomes unstable on the approach of a cyclone from the Pacific, provided a second fairly strong cyclone is centered to the eastward over the Mississippi Valley.* The reasoning is as follows. The fact that pressure is highest in the central portion of the HIGH and not in the northern end suggests that the weather map HIGH is, more or less, artificial due to the inherent difficulty in the reduction of plateau pressures to sea level during cold radiation weather, further that the anticyclone's supply of air from higher latitudes is probably shut off and that the withdrawal of air toward the respective cyclone centers must diminish the volume of air within the anticyclone unless fresh air flows in aloft which seems improbable under the pressure distribution as described. As a consequence the anticyclone must quickly disappear.

LOWS.

Sixteen LOWS have been plotted on Chart III, rather evenly divided as to place of origin, or first appearance on the Weather Map, among the following provinces, Alberta, North Pacific, and Middle Rocky Mountains.

Lows of the last named group of which 4 were observed developed as secondary Lows over eastern Colorado as the primary Lows passing eastward over the northern circuit failed to preserve their original intensity and speed of progression. As has been noted previously in this section of the Review the failure of a primary Low to retain its intensity and speed of movement is almost invariably followed by the development of a secondary depression to the southwest which depression, so far as forecasting for the United States is concerned, becomes the principal one. The origin and development of these secondaries is, at times, obscure and practically impossible of detection 36 hours in advance. Such a secondary is plotted as Low No. I. This disturbance reached its greatest development on the morning of the 3d when it became circular in form with perfect cyclonic wind circulation. It gradually lost intensity thereafter and passed off to sea over the southern New England coast on the morning of the 4th.

Low No. II passed inland from the Pacific as a shallow depression which developed into a trough of Low pressure over the northern plateau on the morning of the 4th and moved thence northeastward into Canada. Pressure remained low in its rear and a secondary disturbance which has been plotted as IIA was the result.

Low No. III was probably a deep depression whose center was north of the field of observation. It was followed by another still deeper depression No. IV that appeared to lose momentum in Alberta during the afternoon of the 13th although the barometer sank to 29.08 inches. Pressure rose during the next 24 hours and a third deep depression—barometer 28.96 inches off Washington coast—moved inland. It likewise failed to continue its advance to the eastward and pressure rose rapidly along the Pacific coast; the center of the cyclonic activity was therefore displaced to the southward and eastward and a secondary disturbance developed over the Texas Panhandle which by the morning of the 16th appeared over eastern Kansas as a well defined cyclone (see No. VA). For some reason not evident from surface conditions, pressure on the evening of the 18th in the western end of this disturbance remained low and two separate centers, one in the east and one in the west, were in evidence. The western center has been plotted on Chart II as Low No. VB. The two separate cyclonic centers within one great depression persisted until the evening of the 20th when they apparently united off Cape Cod and passed off to sea on the 21st. Meanwhile Low-track No. VI had advanced from the Pacific to the Canadian Northwest where it disappeared on the evening of the 18th. No. VI was followed by No. VII which moved eastward over the southern circuit disappearing in the East Gulf States on the 21st.

Low No. VIII appears to have been a secondary depression which developed in the rear of No. VII; it was stationary over the southern plateau region from the morning of the 23d until the evening of the 25th when it disappeared owing to rising pressure to the north and west.

Low No. IX moved eastward with its southern margin barely touching the northern border of the weather map.

Lows No. X and XI followed the same course as the above starting the one 24 hours, the other 60 hours later. Both appear to have been merely the southern extension of principal Lows whose centers were to the northward of the present field of observations.

Low No. XII was a secondary that developed in the southern end of the trough of No. XI during the 27th. It recurred during the night of the 27th and on the morn-

ing of the 28th was central over Illinois as a vigorous cyclone with central pressure of 29.6 inches. It moved northeastward across the Lake region as a storm of high shifting winds, especially over Lake Erie with rain in the southern and snow in the northern portions, and reached the Gulf of St. Lawrence on the morning of the 30th.

Finally Low No. XII moved eastward from Alberta on the morning of the 30th and disappeared north of Lake Huron on December 3.

The chief characteristics of Lows during the month may be summarized as follows: Northern Lows predominated, a large portion of which either moved to the northeast beyond the field of observation or dissipated in the Canadian Northwest. An unusually large number of secondary depressions formed in or east of the Rocky Mountains resulting in abnormally low temperature and much snow in the southern Rocky Mountain and plateau regions, and, finally, in the absence of stormy weather on the Great Lakes until the last days of the month considering the number and intensity of Lows which traversed that region.

WARNINGS.

Storm warnings were issued for one or more of the Great Lakes on the 3d, 5th, 7th, 8th, 16th, 18th, 24th, 28th and 30th and for the Atlantic coast on the 17th, 18th, 24th, 25th, 28th and 30th.

No cold wave warnings were issued and none were necessary. Frost warnings were issued for some part of the Washington forecast district on the 1st, 2d, 3d, 11th, 12th, 13th, 14th, 18th, 20th, 21st, 24th, 25th, 28th, 29th and 30th.

The forecasting for the Washington district was divided between Forecasters Henry and Frankenfield, each working half of the month.

REPORT OF SPECIAL WARNINGS ISSUED DURING THE MONTH OF NOVEMBER, 1918.

Chicago, Ill., forecast district.—No warnings were issued during the month.—*Chas. L. Mitchell.*

New Orleans, La., district.—No cold wave or storm warnings were needed or issued. Frosts were frequent in the interior sections and reached some portions of the coast a few times during the latter half of the month and freezing weather prevailed during a large part of the last decade in the northern portion of the district. Timely warnings of these conditions were issued except for a frost nearly to the coast in southern Texas on the 28th. In this instance an area of low pressure, which was off the central Gulf coast on the 26th and the morning of the 27th, with attendant rainy weather and moderate temperatures, moved rapidly northward over the west Gulf States and the Mississippi Valley during the 27th–28th, increasing in intensity, and was followed by colder weather in Texas on the 28th, with a temperature of 30° at San Antonio and light frost at Corpus Christi.

Warnings of frost or freezing temperature for portions of the district were issued on the 1st, 8th, 9th, 11th, 12th, 13th, 18th, 19th, 20th, 21st, 22d, 23d, 26th, 28th, and 30th and were completely verified in most instances and partially verified at other times.

Stockmen were warned of the snow and hard freeze in the northwestern portion of the district on the 23d–25th, and at other times were advised when unfavorable conditions were expected.

Fire-weather warnings for the forested areas of Arkansas and Oklahoma were issued on the 4th, for Arkansas on the 15th, and for Oklahoma on the 25th, and were verified.—*R. A. Dyke.*

Denver, Colo., district.—Fine, settled weather was notably absent during November; the longest period not under the influence of low pressure somewhere in the district was from the 8th to the 13th, inclusive, an unusually brief period. November usually marks the beginning of the building-up of high pressure in the Great Basin, a stable condition whose influence frequently extends for weeks at a time throughout the western third of the country. While the centers of low-pressure areas from the northwest and north followed the usual track along the northern circuit extensions southward of several of these depressions resulted in the formation of secondary depressions in central and southern districts which, so far as the West is concerned, became more important storms than those from which they were offshoots. Southwestern lows also were an important feature of the pressure distribution in that as soon as their fronts crossed the Continental Divide there was a marked movement southward of high pressure from the region north of Montana, thus prolonging the period of cold and stormy weather. This was notably the case from the 22d practically to the end of the month. The eastward progress of western lows being blocked in the middle Rocky Mountain and Plains States, they were apparently forced southeastward toward the Gulf of Mexico. Almost simultaneous with the arrival of the front of the depression on the east side of the Continental Divide there was a rapid movement of high pressure southward on the eastern slope, blocking any further eastward movement of the depression. The high pressure extended to the lower Rio Grande, attended by abnormally cold weather and snow beyond the border of southern New Mexico.

The changes in temperature and weather conditions were for the most part included in the daily forecasts, and for southeastern New Mexico a special forecast was furnished on Sunday, the 24th. Cold-wave warnings were not needed, but frost warnings were issued for south-central Arizona on the 7th, 8th, and 9th and on four dates in the latter half of the month.—*Fredk. H. Brandenburg.*

San Francisco, Cal., district.—The month of November was about evenly divided into alternating fair and stormy weather periods of two to four days' duration. The precipitation was heaviest near the coast and was above normal as far north as Grays Harbor, Wash.; also in southeastern Idaho. Although ample precipitation occurred in practically all interior districts, the amounts were less than normal and considerably so in the Willa-

mette Valley and most of Washington. Temperatures averaged slightly above normal along the southern California coast and about 1° F. above in Oregon, Washington, and western Idaho, while in northern California, Nevada, and southeastern Idaho they averaged about 2° F. below normal. As a whole the month was favorable for agricultural operations and grazing, as well as for the growth of winter vegetation.

Small-craft warnings were issued for the north coast on the 1st, 8th, 13th, 21st, 22d, and 26th, and all were fully justified, though on the 8th the wind velocity attained over western Washington would have justified the issuance of southwest storm warnings for that section.

Storm warnings were sent out for the north coast on the 2d, 9th, 10th, 13th, 14th, 15th, 17th, and 23d, for the northern California coast on the 14th, 15th, 17th, and 23d, and for the southern California coast on the 18th, 23d, and 24th. On the 2d the pressure gradient justified the warnings, but the expected high winds did not occur, due to the apparently large center of depression which was not conducive to rapid surface wind movement; this condition could not be determined from our Chart "A" at the time the warnings were issued. On the 14th the warning was especially timely for northern California, and those of the 23d and 24th for southern California were much appreciated by shipping men, who were enabled to minimize the damaging effects of the ensuing high winds by making such precautionary preparations as were possible. No storm occurred without a warning, and the only damage to shipping reported was the wreck at Point Reyes of the gasoline fishing tug *Nata*, of the Monterey Packing Co., which was driven on the rocks early on the morning of the 18th; the captain and crew of three men escaped.

Frost warnings embracing California, Oregon, and Washington were issued on the 5th, 6th, 7th, and 11th, and for California alone on the 8th, 16th, 20th, and 24th to 30th, inclusive; of these warnings those for the 16th, 20th, and 27th were partly verified, and all the others were verified with the exception of one for southern California on the 26th, which failed because increasing cloudiness set in and prevented the formation of frost. The frosts caused little damage, though those early in the month stopped the growth of cotton in California.

During the last decade in southern California strong winds did a little damage by shaking trees and bruising some of the fruit.—*G. H. Willson.*