

## SECTION III.—FORECASTS.

## PRESSURE DISTRIBUTION DURING MARCH, 1915.

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The continued interruption of meteorological reports from European and Asiatic countries makes it impossible ascertain at present the pressure distribution over the greater part of the Northern Hemisphere during March, 1915. Available reports, however, show that the pressure for the month was about 0.35 inch below normal at the Azores, about 0.20 inch below normal at Bermuda, and 0.50 inch below at Sydney, Nova Scotia. The latter departure, together with reports received daily from the Canadian Maritime Provinces and adjacent portions of the United States, all clearly indicate that the North Atlantic was occupied by a deep depression. How far eastward it extended is problematical, although we might infer from the low pressure over the Azores that the pressure was high over Iceland.

In the central Pacific, as at Honolulu, pressure was practically normal. In interior Alaska pressure was very slightly above normal, but on the coast practically normal values prevailed. Hence we must infer that so far as Pacific and Alaskan pressures are concerned normal March weather in the United States should have been expected. On the contrary, the weather of the month, as controlled by the tracks of highs and lows, was indeed far from normal. The abnormality consisted of a preponderance of west winds over northeastern districts, a very general deficiency in the rainfall and almost unprecedented cold in the southwest.

The preponderance of westerly winds is clearly the result of the marked depression of the barometer over the northern Atlantic, as already mentioned; likewise the dryness is closely associated with the same cause.

The tracks of highs and lows are set forth as usual in Charts II and III, respectively, to which special attention is directed. Chart II, Tracks of Centers of High Areas, shows that there was a marked congestion in the tracks of highs over the Missouri Valley and thence southeastward to the Gulf and Atlantic coasts. The chart also shows a remarkable absence of highs over the northeastern part of the country north of latitude 40°; also that the main drift of the highs was southeastward rather than eastward; and, finally, that the level of the barometer in the highs sank rapidly as the highs advanced to the eastward.

Considering now the tracks of the centers of the lows, Chart III, we observe (1) a remarkable absence of North Pacific and Alberta lows, or of lows that ordinarily move eastward along the northern circuit; (2) we also note the entire failure of lows to move across the Missouri and upper Mississippi Valleys; and finally (3) that the lows, of which there were an average number, were confined almost wholly to the southwestern Plateau region of Nevada, Utah, Colorado, northern Arizona, and New Mexico. Only one of the lows (No. 1) attempted to cross over to the northern circuit, and that attempt was a failure by reason of the intervention of a marked high (No. 2 of Chart II). But perhaps the most interesting

feature of the movements of highs and lows was the avoidance by the lows of the snow-covered region of the middle Missouri Valley and the congestion of the highs in the same region.

It is well known from the studies of Voeikov<sup>1</sup> that snow does not thaw, or thaws very little, under the direct influence of the sun's rays so long as the air temperature is below freezing; therefore snow melting in general begins only when a mass of warm air from a snow-free land surface or an ice-free sea has raised the air temperature above freezing. The ground in Nebraska, South Dakota, and adjacent portions of the surrounding States was snow covered during practically the whole of the month. This of itself is a rare event, but the influence of the snow covering on the building and maintenance of highs was of especial interest to the forecasters. I have selected the station at North Platte, Nebr., latitude 41° 8' N., longitude 100° 45' W., as representing the snow-covered region; and Fort Wayne, Ind., latitude 41° 5' N., longitude 85° 10' W., as representing the snow-free region. The mean maximum temperatures during March, 1915, were as follows: North Platte, 34.1°F., Fort Wayne, 40.1°F.; mean minimum: North Platte, 19.4°F., Fort Wayne, 25.1°F.

Thus we perceive that the temperature conditions in the snow-covered region, even during the warmest part of the day, were but a few degrees above freezing, and thus the great congestion of highs in the snow-covered region is explained. Moreover, we feel justified in putting forth the opinion that the continued low surface temperatures and anticyclonic conditions acted as a bar to the entrance of lows into the region. Why lows did not originate in Alberta or the North Pacific and move eastward along the northern circuit, however, remains to be explained.

Considering the marked diminution in pressure over the North Atlantic, we would remark that the pressure relations over the continent to the westward of any deep oceanic depression are not the same as under normal pressure distribution. Thus the probability of precipitation over New England from barometric depressions approaching from the west is very considerably reduced and the duration of the precipitation is very much shortened. It is readily seen that, so long as the oceanic depression continues, New England is under the domination of west winds and the conditions for precipitation are unfavorable. A fresh depression from the west serves merely to disturb temporarily the existing pressure conditions and is immediately swallowed up in the greater oceanic low. The most puzzling condition, however, is the avoidance of the northern circuit by the highs. Ordinarily a low is almost immediately followed by a high; in fact, one of the precepts developed by empirical weather forecasting is the necessity of having a path for the high prepared in advance, so to speak, by the passage of a low. But here we have a vast depression that may continue for a month and not a single high from the west moves into the region of deficient pressure except in a round-about way from the southwest. See also the pressure distri-

<sup>1</sup> Penck's Geograph. Abhandlungen, Band 3, Heft 3. Wien, 1889.

bution and the tracks of centers of highs in February, 1902; December, 1903; January, 1903; and February, 1901.

#### CONTROL OF MARCH WEATHER BY PRESSURE DISTRIBUTION.

In this connection we wish to refer to a very comprehensive discussion of the subject by Dr. O. L. Fassig,<sup>2</sup> also to a paper by Prof. W. J. Humphreys entitled "Warm and Cold Winters of the Eastern United States" (this REVIEW, December, 1914). Prof. Humphreys, however, does not give the continental pressure distribution in his paper; therefore his charts and discussion are only partly applicable to the temperature distribution over the eastern United States. While low temperatures over northeastern districts are undoubtedly due in part to oceanic pressure distribution, the low temperatures

of March, 1915, were most pronounced in Texas and the Southwest. Indeed, the temperature over a small part of New England was slightly above the normal, notwithstanding the persistence of continental winds.

In order to produce abnormal cold in the eastern part of the United States a necessary concurrent condition, in addition to the development of a great depression over the North Atlantic, is that highs shall move eastward along the northern circuit, as in February, 1904. This is equivalent to saying that the continental high shall be developed farther to the northeast and east than in normal years.

Low temperatures of the Southwest resulted from the unusual development of the continental high over the Missouri Valley and the Plains States to the south; whereby northerly winds prevailed during a large portion of the time.

Forecasts and warnings for the month were made by Prof. H. C. Frankenfield.

<sup>2</sup> Fassig, Oliver L., in Amer. jour. sci., New Haven, (4) 1: 319-340.