

## ICE IN RIVERS AND HARBORS.

The following reports of ice in connection with navigation have been received:

*Williston, N. Dak.*—8th, the Missouri River frozen over at this place and at Fort Buford.

*St. Vincent, Minn.*—6th, the Red River of the North frozen over and foot passengers crossing on the ice.

*St. Paul, Minn.*—26th, the Mississippi River frozen and navigation closed.

*Sioux City, Iowa.*—21st, a small amount of running ice in Missouri River; 22d, much running ice in river; 23d, river channel full of running ice.

*Omaha, Nebr.*—25th, large quantities of floating ice running in the Missouri.

*Davenport, Iowa.*—24th, small quantities of floating ice in the Mississippi near shore; 26th, river full of floating ice.

## METEOROLOGY AND MAGNETISM.

By PROF. FRANK H. BIGELOW.

For general remarks relative to this subject see page 7 of

the REVIEW for January, 1895, and page 371 of the REVIEW for October, 1895.

The comparison of the air temperature with magnetic horizontal force is shown in detail on Chart V, and the special features of the November curves are as follows:

A comparison of the curves of vertical force for Washington and Toronto shows that, in order to minimize the deflections caused by the passing trolleys, the magnetic balance at Washington is damped very much more than that at Toronto. In order to bring these deflections approximately to the same amplitude the following method has been adopted: Each station is computed separately to obtain the values of  $dz$  or the deflections in the vertical force; then the values for Washington are multiplied by the factor 2, and those for Toronto by the factor  $\frac{1}{2}$ ; finally, the means are taken, which appear as  $dz$  in the table of Chart V.

## CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts in regard to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective services.

Snowfall and rainfall are expressed in inches.

*Alabama.*—The month was dry, with marked thermal changes, and unusually cool. The mean temperature was slightly above the normal. The highest temperature, 84°, was recorded at Ashville on the 7th, and the lowest, 18°, at Decatur and Newburg on the 27th. The average precipitation was 1.64, or 2.20 less than normal; the greatest amount, 3.60, occurred at Cordova, and the least, 0.46, at Livingston. Owing to the prolonged deficiency in moisture nearly all rivers were so low that navigation was nearly suspended. Thick ice formed in various sections on the 27th. Frosts were reported on all dates, except 6th to 9th, 15th, 19th, 23d to 25th, and 29th.

*Arizona.*—The mean temperature was 51.8°, or about 3° below the normal. The highest temperature, 91°, occurred at Mohave on the 1st, and Parker on the 19th, and the lowest, 8° below zero, at Holbrook on the 26th. Rains were general throughout the Territory from the 2d to 4th, 11th, 12th, and from 22d to 24th, inclusive. The average total amount, 2.70, was 1.85 in excess of the normal. The greatest monthly rainfall was 6.83 at Oracle, and the least, 0.01, at Texas Hill. Frosts occurred on the 1st to 14th, and from the 23d to 28th; hail on the 11th and 14th, and snow on the 2d, 3d, 4th, 12th, 22d, 23d, 24th, and 25th; the largest amount was 0.36 at Show Low.

*Arkansas.*—The mean temperature was 49.9°, or 0.08° below the normal. The highest temperature, 82°, was recorded at Bee Branch on the 18th, and lowest, 16°, at Winslow on the 25th, and Keesees Ferry on the 27th. The average precipitation, 4.87, was 0.23 less than the usual amount. The greatest monthly amount, 7.68, occurred at Osceola, and the least, 2.75, at Fulton. There was sufficient moisture for all agricultural needs, but the rivers were low during the greater part of the month, making navigation of the Arkansas extremely difficult.

*California.*—The mean temperature was 52.8°, or 0.6° below the normal. The highest temperature, 98°, was recorded at Salton on the 19th, and the lowest, 1° below zero, at Bodie on the 30th. The average precipitation was 1.43, or 1.00 less than normal. The greatest monthly amount, 5.34, occurred at Fort Ross, and the least, 0.00, at Pasadena, Ravenna, and Volcano Springs. Snow to the depth of from "trace" to 28 inches was reported from some of the mountain stations. Frosts occurred at one or more stations every day.

*Colorado.*—The mean temperature was about normal over Mesa and Montrose counties, but in other sections the month was cooler than usual; the deficiency averaged about 2° per day over the eastern Slope, 4° in the San Luis Valley, and 5° over the northwestern counties. The highest temperature was 80° at Crook on the 2d, and at Minneapolis on the 2d and 21st, and the lowest, 35° below zero, at San Juan (near) on the 25th. In the central mountain districts only half of the usual amount of precipitation occurred, while over the western valleys from 2 to 5 times the average amount was recorded. East of the mountains there were no marked departures from the normal. The greatest amount was 10.73 at Ruby, and the least, 0.06, at Julesburg. The depth of snow on the ground at the end of the month (as well as the area covered on the western side) was much greater than at the same date last year, Ruby having a depth of 5 feet.

*Connecticut.*—(See *New England*.)

*Delaware.*—(See *Maryland*.)

*Florida.*—The mean temperature was 66°, or about normal. The highest temperature was 90° at Orlando on the 10th, and the lowest, 30°, at Tallahassee, on the 27th. The average amount of precipitation, 2.71, was about 0.23 in excess of the normal. The greatest monthly amount, 5.53, occurred at St. Augustine, and the least, 0.24, at Key West. Frosts occurred on the 13th, 14th, 16th, 18th, 20th, 21st, 22d, and 27th.

*Georgia.*—The mean temperature was 54.6°, or about 1° above the normal. The highest temperature was 89° at Brunswick on the 9th, and the lowest, 19°, at Clayton on the 21st. The average precipitation was 1.75, or 1.35 less than the usual amount. The greatest monthly was 3.74 at Savannah, and the least, 0.73, at Fort Gaines. Although November is one of the driest months, it was this year even drier than usual. Frosts were general in the northern and central counties, and in exposed localities in the most northerly portions of the southern counties during the period from the 11th to 13th, when the first killing frosts of the season were recorded at many places.

*Idaho.*—The mean temperature was 33.1°, or about 7° below that for November of last year. The highest temperature was 72° at St. Anthony on the 28th, and the lowest, 17° below zero, at Warren on the 22d. The average amount of precipitation was 1.08; the greatest amount for the month, 2.91, at Murray, and the least, 0.15, at Payette.

*Illinois.*—The mean temperature was 39.2°, or but a fraction of a degree above the normal. The highest temperature was 79° at Carlinville on the 7th, but elsewhere the highest generally occurred on the 4th; the lowest temperature, 6° below zero, occurred at Winnebago on the 21st. The average precipitation was 3.85, or about 0.75 in excess of the usual amount. The greatest amount, 7.37, was recorded at Iron, and the least, 1.62, at Scales Mound. Snowfall was practically confined to the central and northern counties; that in the northeast counties being very heavy. The average depth for the State was above 6 inches.

*Indiana.*—The mean temperature was 41.1°, or but 0.4 above the normal. The highest temperature was 78° at Madison on the 6th, and the lowest, 6°, at Valparaiso on the 26th. Excessive rains fell everywhere on many days. The average precipitation was 5.51, or 1.71 in excess of the usual amount. The greatest monthly amount was 12.98, at Marengo, and the least, 2.55, at Valparaiso. Snow on the 9th, 16th, 20th, 21st, 24th, 25th, 26th, and 30th. The greatest amount of snow fell in the northern counties, where a depth of 15 inches was recorded. Stock-water in wells, springs, and streams was increased and navigation on the Ohio River resumed. Lightning occurred on the 7th.

*Indian Territory.* (See *Oklahoma*.)

*Iowa.*—The mean temperature, 34.3°, was about normal. The highest temperature, 86°, was recorded at Glenwood on the 4th, and the lowest, 12° below zero, at Williams on the 26th. The average precipitation was 1.51, or 0.25 less than normal. The greatest amount was 3.01 at Moorau, and the least, 0.45, at What Cheer. The month was generally favorable for farm work.

*Kansas.*—The mean temperature was 40.9°, or but 0.2° above the normal. The highest temperature, 82°, was recorded at Frankfort on the 4th, and the lowest, 2° below zero, at Coolidge, Ionia, and Jaqua on the 26th. The average precipitation was 1.43, or 0.48 in excess of the normal. The greatest amount, 4.19, occurred at Columbus, and the least, 0.20, at Grainfield. The average snowfall for the State was 1.5, the largest amount, 10.0, occurring at Oberlin, and the least, "trace," at several stations. Frosts occurred on every day except the 3d, 5th, 6th, 13th, and 28th.

*Kentucky.*—The month was slightly cooler than usual. The mean tem-

perature was 45.8°, or about 2° less than normal. The highest temperature, 85°, was recorded at Springfield on the 6th, and the lowest, 16°, at Bowling Green on the 27th. The heavy rains of the 8th, 9th, 23d, 24th, and 25th, broke the severe drought and replenished springs and streams that had been practically dry for months. The average precipitation was 4.29, or 0.34 in excess of the usual amount. The greatest amount for the month was 9.04 at Henderson, and the least, 0.90, at Sandy Hook. The precipitation averaged 5.20 for the Ohio Valley district 3.71 for the southern district, and 1.56 for the mountain district. Severe gales occurred at several stations on the 25th.

**Louisiana.**—The mean temperature was 51.4°, or but 0.4° below the normal. The highest temperature was 88° at Opelousas on the 20th, and the lowest, 23°, at Oxford and Davis on the 27th. The average precipitation was 3.55, or only 0.20 less than normal. The greatest monthly precipitation, 12.57, occurred at Lake Charles, and the least, 0.60, at Houma. Ice formed at one or more stations on the 2d, 11th, 12th, 13th, 17th, 19th, 20th, 21st, 26th, and 27th. Frost was reported on all days except the 5th to the 9th, 14th and 22d to 25th inclusive.

**Maine.**—(See *New England*.)

**Maryland.**—The mean temperature was 45.9°, or 1.9° above the normal. The highest temperature was 81° at Hancock on the 9th, and the lowest, 0°, at Deer Park on the 14th. The average precipitation, 1.41, was 2.21 less than normal. The greatest amount for the month was 3.51, at Mardela Springs, and the least, 0.34, at Cumberland. The largest snowfall was 3.0 at Oakland.

**Massachusetts.**—(See *New England*.)

**Michigan.**—The mean temperature was 34.6°, or 1.3° below the normal. The deficiency in temperature was very evenly distributed. The highest temperature was 76°, at Berlin on the 6th, and the lowest, 6° below zero, at Alma, Cheboygan, and Grayling on the 21st. The monthly range of temperature is the greatest for November of which there is record. The average precipitation was 3.28, or 0.26 above normal. It was below the normal over the Upper Peninsula and the northern counties of the Lower Peninsula, while over the central and southern counties it was above, the excess being greatest over the extreme southern portion. The greatest monthly amount of precipitation was 6.02 at Adrian, and the least, 0.20, at Hesperia. The average total snowfall was 11.6; that for the northern counties, 17.7, being the greatest.

**Minnesota.**—The mean temperature was 27.8°, or only 0.4° above the normal. The highest temperature was 72° at Wabasha on the 5th, and the lowest, 19° below zero, at Albert Lea on the 26th. The average precipitation, 1.22, was 0.38 above normal. The greatest monthly amount was 2.39 at Wabasha, and the least, 0.20, at Belle Plain.

**Mississippi.**—The mean temperature was 53.5°, or practically normal, as it was but 0.2° above. The highest temperature, 89°, was recorded at Vaiden on the 5th, and the lowest, 17°, at French Camp on the 27th. The average total precipitation was 2.54, or 2.10 less than the usual amount. The greatest amount for the month was 5.16 at Austin, and the least, 0.45, at Biloxi. A flurry of snow occurred at Pontotoc on the 30th, and "traces" of sleet at Itta Bena on the 12th and Pontotoc on the 13th. Frosts occurred on the 1st to 4th, 9th to 13th, 16th to 18th, 20th, 21st, and 26th to 28th and 30th. Killing frost reached the coast line at Biloxi on the 27th.

**Missouri.**—The mean temperature was 49.4°, or only 0.1° above the normal. The highest temperature, 82°, was recorded at Willow Springs on the 18th, and the lowest, 2°, at Elmira and Sublet on the 26th. The average precipitation was 3.40, or 0.96 above normal. In the southern sections there was an excess of 1.20; in the central section, 1.25; and in the northeast section, 0.95. Over the northern portion of the northwest section there was a deficiency. The greatest monthly amount was 7.06 at New Madrid, and the least, 0.52, at Maryville. The average snowfall was 3.2. Over the northeast, central and southwest sections, and the northern portion of the southeast and southern portion of the northwest sections the snowfall (the greater part of which fell during the storm of the 25th and 26th) was unusually heavy, many stations reporting from 4 to 6 inches.

**Montana.**—The mean temperature was 31°, or about 3° above the normal. The highest temperature was 77° at Toston on the 4th, and the lowest, 19° below zero, at Glasgow on the 6th; the coldest portion of the month was on the 22d and 23d. A warm wave prevailed during the middle of the month, accompanied by high winds, commonly known as chinooks. The average precipitation was 0.92, or about 0.28 above normal. The greatest amount for the month was 3.00 at Red Lodge, and the least, "trace," at Radersburg.

**Nebraska.**—The mean temperature was 34.8°, or 0.1° below normal. The highest temperature was 82° at Hickman on the 5th, and the lowest, 13° below zero, at Lynch and Springview on the 26th. The average precipitation was 0.94, or 0.26 above normal; in the southeastern section, 1.07; in the western section, 0.61. The greatest monthly amount was 2.95 at Creighton, and the least, 0.40, at several stations. Snow formed about half of the precipitation, and averaged 4.8 in depth for the month. Over the northern half of the State much snow remained on the ground at the close of the month. Hail was reported from Spencer on the 5th; sleet on the 6th, 7th, 13th, 21st, 24th, and 30th.

**Nevada.**—The mean temperature was 35.9°, or 2.1° below the normal.

The deficiency was general, except at Carson City, where there was an excess of about 2°. The highest temperature was 80° at St. Thomas on the 1st and Silver Peak on the 19th, and the lowest, 10° below zero, at Halleck on the 5th. A sudden fall of about 30° in temperature, to or below freezing, occurred on the 22d, accompanied by high winds. In some instances, notably at Hamilton and San Antonio, the maximum temperature of the 22d was 43° lower than that for the day previous. The average precipitation was 0.67, or 0.05 below the normal. The greatest monthly fall was 1.90 at Cortez, and the least, 0.00, at Hot Springs and Lovelock. The amount of snowfall, 5.2, was seasonable and well distributed throughout the month.

**New England.**—The mean temperature was 41.3°, or 2.5° above the normal of 22 stations having records for more than ten years. The maximum was 78° at Lake Cochituate on the 8th, and the minimum, 3° below zero, at West Milan on the 22d. The average precipitation was 6.03, or 2.04 above the normal of 31 stations having records of more than ten years. The greatest monthly amount was 10.44 at Roxbury, and the least, 3.39, at Simonsville. The rainfall was generally heaviest in the east-central districts, but considerable fell over all New England, so that most reservoirs are full.

**New Mexico.**—The temperature averaged a little above normal; the highest was 80°, at Roswell on the 21st, and the lowest, 5° below zero, at Chama on the 25th. The precipitation was above the normal and was very well distributed. The greatest amount was 3.60, at Fort Wingate, and the least, 0.27, at Raton. A total of 34 inches of snow fell at Chama.

**New York.**—The mean temperature was 39.0°, or 1.9° above the normal. The highest temperature was 76°, at Bedford on the 7th, and the lowest was 2° below zero at Canton on the 22d. The average precipitation was 4.14, or 0.71 above the normal. The greatest general precipitation (exceeding 6.00) fell over the western portion of the Adirondack plateau; the least (under 3.00) fell at several stations in the central part of the State. The average snowfall for the State was 2.8, and the greatest amount, 12.9, at Malone.

**North Carolina.**—The mean temperature was 50.8°, or 1.1° above the normal. The highest temperature was 84°, at Newbern on the 10th, and the lowest 15°, at Highlands on the 27th, and at Linnville on the 28th. The average precipitation was 3.15, or 0.25 below the normal. The greatest monthly amount was 7.78, at Hatteras, and the least, 1.24, at Morganton. Ice formed on many days and there were killing frosts everywhere, except along the extreme east coast over the "Banks."

**North Dakota.**—The mean temperature was 20.6°, or 1.5° below the normal. The highest temperature was 76°, at New England City on the 3d, and the lowest, 25° below zero, at Steele on the 30th. The average precipitation was 1.08, or 0.46 above the normal. The greatest monthly amount was 1.91, at Williston, and the least, 0.09, at Woodbridge.

**Ohio.**—The mean temperature was 41.9°, or 0.9° above the normal. The highest temperature was 85°, at Hillsboro on the 6th and 7th, and the lowest, 5°, at Norwalk on the 21st. The average precipitation was 4.11, or 1.03 above the normal. The greatest monthly total was 6.35, at Oberlin, and the least, 0.87, at Thurman. The greatest amount of snow fell between the 19th and 24th, and in many of the more northern counties the average on those dates was nearly 2.00. There is, in general, an abundance of water for all purposes.

**Oklahoma.**—The mean temperature was 46.6°, or 2.7° below the normal. The highest temperature was 86° at Ponca on the 11th, and the lowest, 6°, at Anadarko on the 25th. The average precipitation was 3.79, or 1.93 above the normal. Greatest monthly rainfall was 5.80 at Tulsa, and the least, 1.13, at Woodward. The first destructive frost occurred on the morning of the 1st. The snow of the 25th averaged 2.5 throughout the Territory, which is the heaviest snowfall ever recorded in November.

**Oregon.**—The mean temperature was 41.3°, or 41° below the normal. The highest temperature, 79°, was recorded at Langlois on the 16th, and the lowest, 3° below zero, at Lone Rock on the 22d. This is the first time that the temperature in Oregon has fallen below zero during November. The average precipitation was 4.03, or 1.31 below the normal. The greatest monthly total precipitation was 13.25, at Glenora, and the least, 0.30, at Canyon City and Happy Valley. The snowfall for the month was not very heavy.

**Pennsylvania.**—The mean temperature was 42.9°, or 2.9° above the normal. The highest temperature, 78°, occurred at Somerset on the 8th, and at Lancaster on the 9th, and the lowest, 6°, at Smithport on the 22d. The average precipitation was 2.43, or 0.74 below normal. The largest monthly total rainfall was 5.73 at Warren, and the least, 0.97, at Hollidaysburg. The snowfall for the month was light.

**South Carolina.**—The mean temperature was 54.4°, or 0.7° below the normal. The highest temperature was 88°, at Kingstree on the 9th, and the lowest, 21°, at Cheraw on the 21st. The average precipitation was 2.35, or 0.26 below the normal. The greatest was 4.43, at Pinopolis, and the least, 0.40, at Shaw's Forks. The first general killing frost occurred on the 21st.

**South Dakota.**—The mean temperature was 29.3°, or 4.4° below the normal. The highest temperature was 79° at Cherry Creek on the 1st, and the lowest, 20° below zero, at Watertown on the 22d. The average precipitation, was 1.21, or 0.69 above the normal. The greatest monthly total was 4.89 at Webster, and the least was 0.02 at Cherry Creek.

*Tennessee.*—The mean temperature was 49.1°, or about 2° above the normal. The highest temperature was 86° at Elizabethton on the 7th, and the lowest, 17°, at Franklin and Hohenwald on the 27th. The average precipitation was 2.97, or 0.75 below the normal. The greatest rainfall was 7.68 at Osceola, and the least, 0.78, at Harriman. Killing frosts were reported at various times during the month.

*Texas.*—The temperature on an average for the State was 2.1° below the normal. The highest temperature was 87° at Alice on the 8th, and the lowest, 10°, at Dean on the 25th and at Graham on the 26th. The precipitation averaged 0.79 above the normal. The rainfall was not well distributed; there was a deficiency over the northern and eastern portions of the State, and an excess over the central and southern portions. The greatest monthly rainfall was 9.35 at Angleton, and the least, 0.65 at Dean. There was a general snowstorm over the northern portion of the State on the 25th.

*Utah.*—The mean temperature was 32.7°. The highest recorded was 75° at Fillmore on the 2d, and the lowest, 24° below zero, at Koosharem on the 3d. The average precipitation was 1.47, or about normal. The greatest monthly amount was 2.44, at Salt Lake City, and the least, 0.40, at Loa. The average snowfall for the month was 11.0.

*Virginia.*—The mean temperature for the State was 48.0°. The highest temperature recorded was 82°, at Bon Air on the 9th, and the lowest, 12°, at Buckingham on the 28th. The average precipitation was 2.38. The greatest monthly total was 6.45, at Rocky Mount, and the least, 0.69, at Alexandria.

*Wisconsin.*—The mean temperature was 3.13°, or 1.10° above the normal. The highest temperature reported was 74°, at Pine River on the 4th, and the lowest, 8° below zero, at Osceola Mills on the 26th. The average precipitation was 1.66, or 0.80 below the normal. The greatest amount was 3.68 at Sharon, and the least, 0.28, at Butternut. The ground was covered with snow from the 19th to the end of the month.

*Wyoming.*—The mean temperature was 30.0°, or several degrees below the normal. The highest temperature was 70° at Fort Washakie on the 17th, and the lowest, 18° below zero, at Sheridan on the 23d. The average precipitation was 1.30, or about twice the normal value. The greatest amount was 2.72, at Sundance, and the least, 0.32, at Laramie. All the precipitation during the month was snow.

*Washington.*—The mean temperature was 41.1°, or 2° below the normal. The highest temperature, 70°, was recorded at Connell on the 10th, and the lowest, 8°, at Ellensburg on the 5th, Hunters and Moxee on the 23d. The average precipitation was 3.76, or 1.49 below the normal. The greatest amount during the month was 11.55, at Neah Bay, and the least, 0.00, at Connell.

*West Virginia.*—The mean temperature was 44.6°, or about 2° above the normal. The highest temperature was 87°, at Nuttallburg on the 7th, and the lowest, 12°, at Beverly on the 13th. The average precipitation was 2.17, or below the average, but, on the whole, was well distributed. The greatest monthly total was 4.00, at Spencer, and the least, 1.34, at Bloomery.

## STUDIES BY FORECAST OFFICIALS.

### WEATHER TYPES OF THE NORTH PACIFIC SLOPE.

By B. S. PAGUE, Local Forecast Official (dated Portland, Oreg., Dec. 30, 1895).

There are two distinct, well-defined types of weather on the North Pacific Slope, viz, the summer type and the winter type. These are illustrated by the following sketch of the meteorology of 1895:

On April 20 the first type of summer weather conditions appeared over the North Pacific Slope, viz, an area of high barometric pressure moving northward along the coast to northwestern Washington, and thence eastward over the State of Washington. In the synopsis of April 20 it was officially announced at Portland that the conditions which would prevail until the first appearance of a winter type of weather would be more in favor of fair weather than of rain, for it had been observed that after the first appearance of a pure type of summer conditions there is seldom a recurrence of the winter type until the autumn.

The spring, summer, and autumn were unusually dry. This was especially true of the period from September 15 to November 1, which was the driest recorded in the history of this portion of the country during the past fifty years. Experience had shown that no general or continued rain would occur until the first appearance of the winter type of storms, and this knowledge was used in the daily forecasts issuing regularly from the Weather Bureau office at Portland, Oreg. This winter type finally appeared on the morning of Tuesday, November 12.

On Monday morning, November 11, 1895, there was no appearance of any storm disturbance, but by noon of that day the rapid fall in the barometer indicated the approach of a well-defined disturbance, and from the evening reports of this date the approaching storm was forecast. The morning reports of November 12 showed that the storm area was central over northwestern Washington and that the trough of the depression extended northeastward over British Columbia, thereby indicating the probable path of the storm. Warnings of approaching rains and high winds had been issued on the evening of November 11, or from twelve to twenty hours before the storm arrived. The morning reports of November 12 showed that an area of high barometer was approaching from the southwest toward California. General precipitation occurred over Washington, Oregon, and Idaho on the 12th and 13th, and heavy gales from the south and east prevailed along the coast of northern Oregon and Washington.

The morning reports of November 13 showed that the low was now central north of eastern Montana and that the high pressure was moving inland over southern Oregon and northern California. The morning reports of November 14 showed the low area in about the same position, but more distinctly defined, and the high area central near the region where Oregon, Idaho, Nevada, and Utah come nearest together. The morning reports of the 15th showed the high over Oregon and northern Nevada and the low slightly east of its position of the previous day.

The feature to which attention is especially called is the passage of the low eastward over Washington and the formation of the area of high pressure. This movement of the low and formation of the high were the first of the kind to occur in the autumn of 1895, and indicated that the wet or winter season had set in over the north Pacific Slope.

The conditions under which areas of high pressure form and move are those under which chinook winds are formed over the northwestern portion of the United States. As the low pressure passes to the north and the movement of the wind is from the high on the south or southwest to the low on the northeast side of the mountains, therefore the air flowing down the mountain sides is dynamically heated.

That the high pressure produced the rise in the temperature and the winds called chinook winds in the present case is shown by the following:

On the morning of November 12 the barometer at Portland was 29.86, the temperature 36°; on the morning of the 15th the barometer was 30.62 and the temperature 56°, a rise in the pressure of 0.76 of an inch and a rise of 20° in the temperature. At Roseburg the rise in the barometer was 0.72 of an inch and the temperature rose 16°; at Seattle the barometer rose 0.72 of an inch and the temperature 16°; at Baker City the barometer rose 0.66 of an inch and the temperature 12°; at Spokane the barometer rose 0.42 of an inch and the temperature rose 26°; at Helena the barometer rose 0.20 of an inch and the temperature 30°. Chinook winds occurred in Montana on November 16 and 17.

The following, from the November report of the Montana State Weather Service, may, in this connection, be of interest:

A cold-wave signal having been ordered for that date (November 17), and the weather at the time of receipt of order being very warm and pleasant, the observer [Mr. R. M. Crawford, at Helena] decided to pay more than ordinary attention to the expected change. About 3.30 p. m. the wind, which had been blowing gently from the north, veering at