MONTHLY WEATHER REVIEW.

Editor: Prof. Cleveland Abbe. Assistant Editor: Herbert C. Hunter.

Vol. XXXV. MAY, 1907. No 5.

The Monthly Weather Review is based on data from about 3500 land stations and many ocean reports from vessels taking the international simultaneous observation at Greenwich noon.

Special acknowledgment is made of the data furnished by the kindness of cooperative observers, and by R. F. Stupart, Esq., Director of the Meteorological Service of the Dominion of Canada; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. I. S. Kimball, General Superintendent of the United States Life-Saving Service; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Director Meteorological Office, London; H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Rev. L. Gangoiti, Director of the Meteorological Observatory of Belen College, Havana, Cuba.

As far as practicable the time of the seventy-fifth meridian is used in the text of the Monthly Weather Review.

Barometric pressures, both at land stations and on ocean vessels, whether station pressures or sea-level pressures, are reduced, or assumed to be reduced, to standard gravity, as well as corrected for all instrumental peculiarities, so that they express pressure in the standard international system of measures, namely, by the height of an equivalent column of mercury at 32° Fahrenheit, under the standard force, i. e., apparent gravity at sea level and latitude 45°.

FORECASTS AND WARNINGS.

By Prof. E. B. Garriott, in charge of Forecast Division.

A COLD SPRING.

For the period that began about April 1, and continued thru the first decade of June, the mean temperature for the United States generally east of the Rocky Mountains was lower by several degrees than for the same period of any previous year of which there is a record. April was the coldest month of that name in thirty-two years, May the coldest May in twenty-five years, and the cold period was not broken until the early part of the second decade of June.

The primary cause of this period of abnormal cold is not known. That periods of unseasonable weather over any considerable area of the earth's surface are due to certain disarrangements of our atmosphere is, however, apparent, and the association of the various normal and abnormal arrangements of the atmospheric areas with certain types of seasonal and unseasonable weather has been fixt.

The arrangement of the earth's atmosphere in waves, or crests, and troughs, or depressions, is indicated by barometric observations. When the crests, or high barometer areas, and depressions, or low barometer areas, have a normal distribution over the Northern Hemisphere, seasonable weather is experienced. When the distribution of the great barometric areas is abnormal, the weather will be unseasonable over the greater portion of the hemisphere. The character of the departures from the average seasonal conditions will be governed by the character of the disarrangement of the continental and oceanic high and low barometric areas, or " centers of action ".

Air, like water, flows from crests toward depressions. It is apparent then, that air will flow from areas of high barometer toward areas of low barometer. It is also apparent that during periods of abnormally high pressure over British America, and persistently low pressure over the southern portions of the United States, the air that flows from the northern latitudes of the continent toward the depressions in the south is cold air. This was the general character of the barometric arrangement, or disarrangement, during the spring of this year. And a similar distortion of atmospheric pressures over the North Atlantic Ocean, that showed abnormally high barometer over the Iceland area, caused unseasonably cold weather over continental Europe. With a knowledge of the cause of disarrangements of the greater atmospheric areas will come the ability to foresee weather changes for considerable periods in advance.

The month opened with low barometric pressure over the Iceland area. This depression reached its greatest depth on the 3d, and during the succeeding five days drifted slowly eastward over Europe and the western portion of Asiatic Russia. A second depression covered Iceland from the 8th to 12th. During the balance of the month pressure was high over the extreme North Atlantic. Azores and Lisbon pressures were prevailingly low thruout the month.

Of special interest at the present time is the following description of the cold summer of 1816. This description is taken from The Half Century, published in 1851, written by Emerson Davis and containing an introduction by Dr. Mark Hopkins of Williams College:

> During the first half of January, 1816, the weather was extremely cold. At Springfield, Mass., on the morning of the 11th, the mercury fell 11° below zero. The summer of that year is still remembered as the cold summer. There were frosts in Massachusetts during each of the summer months, and in low grounds pretty severe. On the mountains of Berkshire, on the 6th of June, the snow fell several inches in depth, and travelers suffered much from the severity of the storm. The snow was 10 inches deep in the central parts of Vermont and New Hampshire. On the morning of July 4, ice was formed of the thickness of common window glass in the Northern and Middle States, and much of the corn was killed. August was a most cheerless month; ice formed half an inch in thickness. The cold extended to Europe. Some of the English papers said "1816 will be remembered as the year in which there was no summer". Very little corn ripened that year. Farmers paid $5 a bushel for seed corn the next spring.

The types of unseasonable weather that have been experienced in the past will be experienced in the future. The cold summer of 1816 will doubtless be repeated. When? We do not know. We have had years and periods of years of drought and plenteous rainfall, and will have them again. Nothing new in the weather line has occurred in historic times, and nothing new can occur until the order of our solar system is changed.

IN GENERAL.

In extreme western districts May temperature was about or slightly above the normal. During the early portion of May heavy frosts occurred in northern districts of the United States, and light frosts to northwestern Texas, Oklahoma, Arkansas, Tennessee, and the interior of the Middle Atlantic States. In the second decade of the month light to heavy frosts were reported in the Lake region and north-central valleys, and light frost in Arkansas, Tennessee, and interior districts of the Middle Atlantic States. In the third decade cold weather records for the season were broken in some sections of the interior-central, east-central, and Northeastern States. On the 27th a temperature of 42° was noted at St.

Louis—the lowest noted for that date and place in seventy-one years. On the same day the temperature was below freezing in southwestern Kansas. From the 20th to 22d a frost-bearing cool wave swept from the Northwestern States over the Lake region, Ohio Valley, and the Middle Atlantic States.

In the second decade excessive rainfalls occurred in the central and lower Mississippi Valley and the east Gulf States. In the third decade heavy rains caused the overflow of many streams in Texas, and heavy rains on the 18th and 19th caused flood stages in the Willamette River. On the 3d and 4th snow fell from the States of the lower Missouri Valley over the upper Lake region, northern Illinois, and northern Ohio, breaking generally thruout that region the snowfall record for May. At Omaha 4 inches fell on the 3d, and at Chicago the fall amounted to 0.8 of an inch. In the second decade snow fell in the lower Missouri Valley on the 14th, and in the upper Mississippi and Ohio valleys and the Lake region on the 15th. Snow was reported in the third decade of May from the middle and northern Rocky Mountain districts over the Great Lakes.

The first important storm of the month advanced from Texas over the Ohio Valley, lower Lakes, and the Canadian Maritime Provinces during the 3d and 4th. From the 11th to 16th a barometric trough that extended from Canada to the Gulf of Mexico moved slowly from the Rocky Mountain districts to the Atlantic coast. The third notable barometric depression of the month advanced from the southern Rocky Mountain region to the middle and northern Atlantic coasts from the 24th to 27th. In all cases vessels were forewarned of the approach of dangerous gales in ample time to seek shelter.

On the 6th a tornado was reported 40 miles west of Mount Pleasant, Tex., and the towns of Ridway, Birthright, and Antioch suffered damage. On the 19th severe thunderstorms with heavy rain and hail occurred in the Middle Atlantic States. On the 24th and 25th severe rain and local storms were reported in Texas and Oklahoma.

BOSTON FORECAST DISTRICT.

The average temperature was the lowest recorded for May since observations have been compiled in the present form, beginning in 1888. Precipitation was unevenly distributed, but was, as a whole, below the normal. At a number of stations having long records snow has never been known to fall at so late a date as in May, 1907. There were no gales, and no storm warnings were ordered. Frost warnings were issued to cranberry growers on the 11th and 21st, the temperature in the bogs falling to 25° or below on the 11th, and to 28° or below on the 21st. Berries that were not protected doubtless suffered damage.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month was abnormally cold and precipitation was excessive generally thruout the district. On the 3d frost warnings were issued for the northwestern portion of the district and warnings of freezing temperature for the Texas panhandle. Subsequent conditions justified the warnings. No general gales occurred on the coast.—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

The month was remarkably cold and, with the exception of three periods of one to three days each, the temperature continued below the normal. On the 5th, 12th, 21st, and 28th frost occurred over the whole or the greater portion of Kentucky, and on the 5th over northern Tennessee. Frost warnings were in each instance issued in advance of the occurrence of frost.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.

Abnormally low temperature continued thruout the district. Frost warnings that were issued on several dates were justified at practically all stations. Storm warnings were issued on the 11th, 12th, 13th, 14th, and 26th. The warnings were well in advance of approaching storms and, as no casualties occurred, were evidently of material benefit to navigation.—*H. J. Cox, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.

Precipitation, often in the form of snow, was frequent, and as a rule in excess of the normal, while low mean temperatures were noted at all stations. In southern Wyoming, Colorado, and northern New Mexico the month was the coldest May on record. Freezing temperatures occurred at intervals, except in southern portions of New Mexico and Arizona. The frosts and freezes were covered by the forecasts and special warnings.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

Altho the mean temperature was normal at many stations, in the matter of storm frequency, amount and frequency of precipitation, and air circulation the month was unlike the normal May. There was a well-marked tendency for depressions originating apparently over the Valley of the Colorado to pass eastward over northern Texas, the lower Mississippi Valley, and thence northeastward.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.

The month was slightly warmer than usual, and rainfall was deficient. There were but two periods of general rains, on the 10–11th and 18–19th. The first was attended by high winds. There were a number of light frosts in the eastern portion of the district, and two mornings of heavy frost in southern Idaho. The annual rise in the Columbia River began on the 10th and the rise thereafter was slow and steady. Timely warnings were issued for all storms and for most of the frosts that occurred.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The slow drift from Texas northeastward of a poorly defined depression from May 5 to 8, inclusive, was attended over the Southern States by the general rains usually incident to depressions of this type. Over eastern Texas, Louisiana, Arkansas, Mississippi, Alabama, and western Tennessee, the rainfall, altho not evenly distributed, was heavy, especially over the lower Red and lower Arkansas valleys, and the States of Louisiana and Mississippi generally. The resulting floods were moderate, except in the Blue and White rivers of Arkansas, where the crest stages ranged from 4 to 18 feet above the flood line, the greatest excesses occurring over the upper portions of the rivers. In the lower Mississippi River the crests were slightly above the flood stages; in the rivers of southeastern Mississippi from 3 to 5 feet above, and in the lower Tombigbee River 12 feet above.

Over portions of eastern Texas considerable damage was done, especially along the creeks and smaller rivers; but elsewhere the losses were moderate and in some localities the high waters were of great assistance in moving logs to the mills. However, a large amount of property was saved by removal in accordance with the Weather Bureau warnings, which were issued with the usual promptness and were fully justified.

Special commendations of the work of the Bureau have been received from southeastern Mississippi, where the service is of comparatively recent establishment, one observer reporting that there has been no loss of stock since the service was inaugurated.

Warnings on the 23d and 26th for rises in the Rio Grande between Albuquerque and El Paso were also correct to within a small fraction of a foot.

The annual rise of the Columbia was well in progress by the 17th of the month, and the usual forecasts and warnings began on that date.

The river district of Phoenix, Ariz., was established on May 1, 1907, with territory comprising the watershed of the Gila River. Special river stations have been located at Tempe,