

water. Advisory warnings of winds of force sufficient to interfere with navigation on Lake Michigan were issued on the 5th, 8th, 9th, 10th, and 11th. After the 15th the storm warnings for the Great Lakes were issued from the district forecast center at Chicago.

CHICAGO FORECAST DISTRICT.

The limits of the Chicago Forecast District were much enlarged during the month of April, 1922. For many years the district comprised the following States: Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, North and South Dakota, Montana, and Wyoming. On the 16th of April the States of Michigan and Indiana were added, as well as the storm-warning service for the Great Lakes and flying forecasts for zones 4, 7, 8, and 10, these zones embracing the area covered by the forecast district and the Great Lakes. These additions to the Chicago Forecast District were through transfer from the Washington District.

The month of April was marked by frequent storm movement across the district, so that the precipitation over most of the region was considerably above the normal, and excessive even at several points in the central valleys. At the opening of the month flood stages had already developed along the Illinois River, and these conditions became more aggravated from the frequent rains during the month of April, and gradually extended to the section of the Mississippi in the vicinity of the confluence of the Illinois with that river. The task of forecasting river and flood stages is in the hands of the local forecasters, under the direction of the River and Flood Division at Washington, and reference to this portion of the work of the Bureau is made elsewhere in this publication. (See pp. 216.)

April 16 was the date fixed for the beginning of the storm-warning season on the Great Lakes, coincident with the time of the transfer of that service from Washington to the Chicago Forecast District. Immediately thereafter two storms in quick succession moved across the Great Lakes with increasing intensity, one on the 17th and the other on the 19th and 20th. The first of these disturbances was attended by fresh to strong winds reaching gale force on the Lower Lakes with thunder squalls of considerable intensity. The second disturbance was more general, the wind reaching gale force over a wide area. Unusual velocities were attained at several stations, but no damage to shipping was reported, in spite of the fact that early warnings were not possible on account of the sudden and rather freakish development of the storm. The lack of casualties was chiefly due to the fact that a comparatively small number of ships were in commission at the time of the storms.

On the 8th and 9th a rather unusual storm for the season of the year developed in the Rocky Mountain region, pushing southeastward to Montana and Kansas; considerable snow with strong winds and freezing temperature followed in the northern and central Rocky Mountain region and adjoining sections. Live-stock warnings were sent to points in Montana, Wyoming, and the Dakotas on the morning of the 8th, and these doubtless resulted in preventing great loss to stock.

With the advance of vegetation, warnings of the occurrence of frosts became necessary, gradually reaching northward over all the district by the end of the month, except in the more northerly and westerly sections.

During the second half of the month frost occurred a few times in the eastern, southern, and central portions

of the forecast district, and warnings were in practically every case sent in advance to the threatened sections.—*H. J. Cox.*

NEW ORLEANS FORECAST DISTRICT.

Small-craft warnings were displayed on the Texas coast April 2, 3, 7, 10, and 16 and were justified. Southeast storm warnings were ordered for the Texas coast April 4, 7, and 8, and storm-verifying velocities as a rule occurred generally during these displays. No general storm occurred without warning.

Frost occurred in the northwestern portion of the district on the 11th and in the northern portion on the 18th and 19th, for which warnings were issued.

Norther warnings were issued for Tampico April 19.—*I. M. Cline.*

DENVER FORECAST DISTRICT.

The month was abnormally cold in the Denver Forecast District, retarding the development of fruit buds.

On the morning of the 8th an area of low pressure was central in the northern Rocky Mountain region. It moved southeastward across the district, attended by freezing temperatures in western Utah on the 9th, Modena, Utah, reporting a temperature of 8°. Freezing temperatures prevailed on the morning of the 10th, except in the extreme southern portion of the district, with readings of 18° at Durango and Santa Fe, and on the morning of the 11th freezing temperatures were reported as far south as the Pecos Valley, with a heavy frost at Roswell. Timely warnings were issued for these conditions. A disturbance, that was over Colorado on the morning of the 15th, moved southward to northern New Mexico on the 16th, and was followed by an anti-cyclonic area that overspread the entire district by the 18th. Freezing temperature or frost warnings were issued for the greater part of the district on the 15th, 16th, 17th, and 18th, and included southeastern New Mexico on the 17th and 18th. Freezing temperatures occurred as forecast, with readings of 15° to 20° in the fruit valleys of Colorado on the 18th and 24° to 28°, with heavy frost in the Pecos Valley on the morning of the 19th. Another area of high pressure occupied the northeastern slope on the morning of the 27th and the barometer was rising in most western districts. Warnings of frost or freezing temperature were issued for western Colorado and frost in northern and eastern New Mexico. While cold weather, with freezing temperatures, occurred in localities in the Gunnison Valley, in western Colorado, a trough of low pressure developed on the western slope and the attending cloudiness prevented the formation of frost.—*Frederick W. Brist.*

SAN FRANCISCO FORECAST DISTRICT.

The weather during the first half of the month was much like that of March, when a succession of small depressions moved inland over British Columbia and thence southeastward over the Plateau. This condition gave many days of precipitation, but the amounts were small, over the northern portion of this district. The precipitation seldom extended south of Cape Mendocino on the coast and southern and eastern Nevada in the interior. In California only a few light showers fell. The latter part of the month was marked by a change to fair weather which was unbroken except for rain in Washington and Oregon on the 22d and western Washington on the 27th and 28th.

The cause producing this sudden transition from a wet to a dry condition is undoubtedly the position of the Pacific HIGH. During the wet period it was central near the middle of the ocean, but about the 17th it moved much nearer the coast and this movement was followed by the dry weather. It is further believed that the proximity of the high to the coast is more controlling than the latitudinal position, although the latter is also an important factor in producing this weather sequence.

Storm warnings were issued five times during the month, as follows: Washington and Oregon coast on the 7th and 13th and on the California coast on the 4th, 8th, and 11th. The warnings were generally verified.

Frost warnings were issued in northern California on the 8th, 9th, 15th, 16th, and 17th and in Washington and Oregon on the 15th, 16th, 17th, 23d, 24th, and 25th, and were all timely.

Live-stock warnings were issued in eastern Washington, eastern Oregon, and Idaho on the 22d. This warning was only partly successful; the expected fall in temperature occurred, but instead of rain or snow the weather was clear.—*G. H. Willson.*

RIVERS AND FLOODS.

By H. C. FRANKENFIELD, Meteorologist.

Reference to the flood table at the end of this report will disclose the wide distribution of floods during the month of April. Virtually every stream east of the Rocky Mountains, except those in the Northwest, was in flood at some time during the month. The great floods in the Mississippi and its larger tributaries were at their height, but there were also other destructive floods of a more local character, notably in the upper Trinity River of Texas.

As the Mississippi flood was still in progress at the close of the month, report thereon will be delayed until after its final subsidence over the lower reaches, which will be sometime during the first half of June. A somewhat elaborate special report of this flood is contemplated, but its appearance will be delayed for several months. However, a summary thereof will appear in the MONTHLY WEATHER REVIEW for June, 1922, and mention may be made here that the flood from the mouth of the Arkansas River to the Passes was the greatest in history, and only the failure of portions of the levee system prevented still higher stages from Vicksburg, Miss., southward to the Gulf of Mexico.

Omitting further reference to the floods in the Mississippi drainage basin, those over other areas will be taken up in order, beginning with the Atlantic Basin.

Connecticut River.—In magnitude this flood is the 15th within the history of authentic flood records at Hartford, extending back to 1841 and probably to 1801. Prior to 1870 no systematic attempt had been made at this point to measure the daily water stage. Before that time the highest water of the floods was permanently marked by driving iron spikes into a wooden building (a brewery) that stood near the river's edge, so when the Army engineers began surveying the river in the early seventies they established a gage here and by careful leveling referred these flood crest marks to the present gage. It is believed that this record at Hartford of flood heights and continuity is not exceeded elsewhere in the United States, covering, as it does, the annual crest wave since 1838 and dates of the opening of the river since 1817.

On January 9, 1841, there was a crest of 26.3 feet, with a note, "the highest flood since 1801, and destroyed

many bridges over the river in the upper valley. The Hartford bridge was much damaged."

1801, March 20, 27.5 feet, with note, "no mark so high since 1692. It was the result of a three-day heavy rain, causing streams to rise rapidly to unexampled height, and resulting in an immediate inundation, loss of life and destruction of property.

1692. February 23, 26.2 feet. (Massachusetts Historical Society Proceedings.) *Diary of Capt. Lawrence Hammond of Charlestown and Boston.* "Feb. 23, 1692. Rain in ye nite & Continued all ye week, more or less to rain wth much wind betw ye S. E. & N. E. 28th. Likewise much rain and wind, som raine ye 29 also. March 1, Wind at NW & cleare weather. These rains wth ye Violent sudden melting of ye snow in ye Wilderness caused such a sudden & Violent flood yt hath done abundance of damage in most parts of ye country, carrying away bridges, Mills, & c. Connecticut River higher yn ever it was known before, destroyed much cattel in ye meadows, carryed away some Houses & washed away in many places ye very land wth ye English graine sown in it."

History of Northampton, Mass. "Flood February 1692 was the highest experienced in this section of the valley previous to 1801. Medad Pomeroy's account of it represents the rain as falling for 5 days almost continuously, during which time the sun was not seen and the water rose to such a height as was scarce known in the country before. Much damage done throughout this entire region."

1683. July-August, flood, 26.0 feet.

1639. March 19, great flood. This is the earliest flood of which we have record. (Mass. Col. 4th series, vol. 6, page 355.) Letter from John Haynes to John Winthrop, dated Wethersfield, 27th, 1st. month, 1639 (i. e. March 27): "Wee have lately hadd a great floode that came upp to some of our houwses and carryed away a good parte of our fences in our lowe grounds. Otherwise wee blesse the Lord, wee are generally in good health." Matthew Grant, Windsor Church records, original mss. at Conn. His. Soc. Hartford, "I found in the old book that the great flood began the 5th. of March 1638/9. On the 11th. day of March it began to fall, but by reason of much rain on the 12th. day, it rose very high. On the 14th. two youths were drowned being in a canoe on the flood gathering up pales swimming on the flood against Thomas Dewey's house. Matthew Ramond and Henry Lush. On the 15th and 16th days it (the flood) had fallen near two feet, but on the 16th day was much rain and great wind out of the southeast which made it exceeding great storm. It indamaged houses and break down many trees so that by the cause of which rain all the 17h and 18th days the water rose very high, more than had ever before been known by the Indians. It drowned many houses very deep and indamaged many cattle over (i. e. east of) The (Great) River, for all the ground there was drowned to one little ridge where Samual Grant now lives. (This was in the present town of South Windsor just in rear of the Theological Seminary.) It carried away much timber and hay and beat up pales out of the ground, and post and rails, and carried them away and whole trees and all. On the 18th day at night there was a great fear of another storm of wind and rain. It began but it pleased the Lord, it ceased quickly, and by the morning one might perceive the water was begun to fall, and so it continued. On the 22nd day at night it was well fallen, and yet it was as high as the highest flood we had known before."