

MONTHLY WEATHER REVIEW.

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The MONTHLY WEATHER REVIEW summarizes the current manuscript data received from about 3,500 land stations in the United States and about 1,250 ocean vessels; it also gives the general results of the study of daily weather maps based on telegrams or cablegrams from about 200 North American and 40 European, Asiatic, and oceanic stations.

The hearty interest shown by all observers and correspondents is gratefully recognized.

Acknowledgment is also made of the specific cooperation of the following chiefs of independent, local, or governmental services: 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; Señor Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. 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; Dr. W. N. Shaw, Director of the Meteorological Office, London; Maxwell

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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.

There was a remarkably uniform progression of high and low barometer areas over the Northern Hemisphere during February, 1909. In the United States the interval between centers of areas of low barometer, or general storms, averaged about four days. The Asiatic area showed crests above 31.00 inches in the first and third decades of the month, with comparatively low pressure from the 12th to 17th, and a gradual decrease of pressure after the 20th to a minimum for the month below 30.00 inches on the 27th and 28th. Variations in pressure over this great continental area are associated with general weather changes that occur over the United States one to two weeks later. It will be observed in the present instance that following the prevailing high pressure of the first two decades of the month over Siberia temperature averaged unusually high in the United States, and that the depression over that region at the close of February was followed by a period of unseasonably cold and stormy weather over the United States during the second week in March.

High barometric pressure over the Asiatic area is usually attended by abnormally low pressure over extreme northwestern Europe, and during the opening days of February the barometer in the Iceland area fell to a reported minimum of about 28.60 inches on the 2d. During this period heavy rains in the river districts of Germany caused enormous flood damage. The barometer again fell below 29.00 inches over Iceland on the 9th, and at the close of the month, when the barometer was low over Siberia, pressure was abnormally high over Iceland and severe winter weather was experienced generally in Europe.

In the United States the month opened with high barometric pressure east of the Rocky Mountains, and decreasing pressure on the Pacific coast. From the 2d to 6th a disturbance of marked strength crossed the country, attended by general precipitation and followed by a cold wave. The following special forecast was issued on Saturday, the 6th, in connection with a storm that advanced from the Pacific to the Atlantic coast from the 6th to the 10th:

A storm that now occupies the north Pacific coast will move southward over the Rocky Mountains Sunday, and then eastward over the Plains States Monday and Tuesday, and reach the Atlantic coast about Wednesday, attended by snow in middle and northern districts, and followed by a cold wave that will appear over the Northwestern States Sunday or Monday, advance over the central valleys and Lake region Monday and Tuesday, and reach the Atlantic States about the middle of next week.

The following are among the press comments that have been made regarding this forecast:

Fort Smith, Ark., Times, February 8, 1909:

On Saturday there was sent out from the Washington Weather Bureau headquarters a general forecast reporting a storm disturbance on the northern Pacific coast that would advance southeast, followed by a cold wave. They made good. The Monday morning chart indicated that the storm advanced over the Rocky Mountain region accompanied by snow or rain which covered the whole Mississippi Basin. Following it an area of high barometer is sweeping down from the north, which is accompanied by a fall of as much as 36° in temperature. * * *

Courier-Post, Hannibal, Mo., February 9, 1909:

* * * The storm is the one predicted from the Washington Weather Bureau as early as last Saturday, and the prediction has proven remarkably accurate for such a long time ahead. It is central to-day over Iowa, where it is very pronounced. Heavy snows are predicted for the northwestern part of the State, and strong gales. The zero line has been pushed down into northern Kansas. * * *

Commercial Tribune, Cincinnati, Ohio, February 11, 1909:

Within a few days the Weather Bureau has come up to all expectations. As early as last Monday the signs indicated rain and snow, and Tuesday morning we were told to look out for rain, snow, and much colder weather on Wednesday. Everything came to pass. The reason for calling attention to this fulfillment of prophesies grows out of the fact that there are countless thousands who find fault whenever there is a little slip up. As a rule the predictions are quite accurate and there has been a distinct improvement over other years. In short, the business is beginning to rest more nearly upon a scientific basis, and improvements and observations which are to be expected in the future will make this branch of the Government one of the most important, not to the few, but to many millions. * * *

Another depression from the 7th to the 10th, and from the 11th to the 16th a severe storm, attended by heavy precipitation and by heavy sleet and snow, moved northeastward over

the country from the States of the Missouri and upper Mississippi valleys over the Lake region, Ohio Valley, New England, and northern portions of the Middle Atlantic States. Following this disturbance a cold wave carried temperature below the freezing point along the Gulf coast.

The Leader-Democrat, of Springfield, Mo., of February 15, 1909, comments, editorially, regarding this storm and cold wave:

Along the middle of last week when the sun was shining and little birds twittering Uncle Sam said he saw a rather fierce blizzard in the Rockies and he was certain it had packed its belongings and expected to arrive in Springfield and vicinity about Sunday. Naturally we gave the matter little attention, depending upon the fine Italian hand of our Ozark weather to circumvent any such plot. Nevertheless Sunday came and with it one of the worst blizzards for a long time. Uncle Sam's weather boys are becoming wiser all the time. It has only been within the past few months that they have attempted to forecast more than forty-eight hours ahead. Now they can do pretty well for a week in advance.

Disturbances advanced eastward over the country from the 15th to the 19th, and 20th to 24th. The latter disturbance was attended by heavy snows in the northern Lake region, and by heavy rains that initiated floods in the Ohio River and tributaries and in rivers and streams in the east Gulf States.

BOSTON FORECAST DISTRICT.*

[New England.]

The month was warmer than usual and precipitation was excessive. Snowfall was light for the season and at the end of the month the ground was generally bare over the southern half of the district. An unusually severe sleet storm occurred in central and northern portions on the 16th. Storm warnings were ordered on the 6th, 7th, 14th, 16th, 19th, 20th, 24th, and 25th, and high off-shore winds for which warnings were not ordered prevailed along the coast on the 10th, but fortunately without damage or delay to shipping.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.*

[Louisiana, Texas, Oklahoma, and Arkansas.]

Warm weather for the season prevailed and precipitation was in excess in Louisiana and Arkansas, and deficient in Oklahoma and Texas. A cold wave occurred over the northern portion of the district on the 8th and 9th and another cold wave of marked severity covered the district from the 13th to the 15th, when minimum temperatures of 26° to 28° were recorded along the Gulf coast. All warnings were justified and no severe weather conditions occurred in the sugar and trucking regions without warnings. In commenting on the cold weather of the 14th and 15th the Daily Picayune, of New Orleans, La., of February 16, says:

When it is taken into consideration that such low temperatures are of such rare occurrence so far south, the specifying almost to the exact degree of temperature that would be recorded in every portion of so large an area shows that weather forecasting under Chief Moore's management of the Bureau has reached a remarkably high degree of accuracy, not only as to the extent of the cold, but also as to the place, the time, and the degree of cold. Such forecasts are the rule when conditions call for them, and the exact verification of the warnings in this case is not exceptional. When the public receives the Weather Bureau warnings advising them what temperature to expect they take the action which such conditions call for. The stock farmer shelters his herds; the sugar planter protects his sugar cane in the spring and his matured crop in the autumn, on the advice of these warnings. The orange growers and the truck and berry growers all are governed by these forecasts in saving their crops from injury. Every intelligent producer of any crop has learned the degree of temperature which injures his product, and with the accurate and timely forecasts of the Bureau at his command, he successfully covers his crops thru the abnormally cold spells which occasionally visit the Gulf region, and in this way the Weather Bureau saves to the people of this part of the country millions of dollars annually. It enables the grower to occasionally protect valuable and remunerative crops which would otherwise have to be abandoned.

—*I. M. Cline, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.*

[Kentucky and Tennessee.]

The month was warmer than usual, and there were no very

low temperatures, except the night of the 1st, when zero was reached at a few places in Kentucky. Precipitation was heavy, the amount being two or three times the normal in Kentucky and from 60 to 75 per cent in excess in Tennessee. Extraordinarily heavy and general rains on the 22d, 23d, and 24th caused destructive floods, especially in the smaller streams. Cold-wave warnings were issued on the 8th, 9th, and 14th in advance of decided falls in temperature.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.*

[Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Montana.]

Temperature was above the seasonal average thruout the district. Warnings were issued well in advance of a cold wave that advanced eastward and southward from the British Northwest Territory from the 7th to 10th. A second cold wave appeared in the British Northwest the morning of the 11th. It gradually extended over northern and western portions of the district, but its movement farther was retarded by a storm which developed in the southwest. This storm, in fact, was the principal one of the month. It caused heavy precipitation, much of it in the form of snow and sleet over a considerable portion of the district, with accompanying high winds. Warnings for heavy snows were issued to threatened localities, and cautionary advices were sent to the open ports on Lake Michigan. Another cold wave appeared in the northwest on the morning of the 23d, as an extensive storm approached the central valleys from the southwest. This storm caused extensive precipitation, especially heavy snow, in the northern Lake region, for which warnings were issued. As the storm past eastward over the Lake region a cold wave followed in the rear, but only moderately low temperatures occurred. Warnings for the cold wave and accompanying high winds, in addition to the snowfall warnings above referred to, were issued well in advance. No other storms or cold waves of consequence occurred during the month.—*H. J. Cor, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.*

[Wyoming, Colorado, Utah, New Mexico, and Arizona.]

The most conspicuous feature of the month was the almost continuous snowfall in the mountains from the 5th to 23d. The snow, altho not especially heavy was frequently accompanied by high wind which caused much drifting and interfered seriously with mountain travel. This stormy period was, in the mountains, preceded and followed by severe cold. Over the Plateau the temperature changes were comparatively slight and there was no general cold wave. The weather of the Plains region on the contrary was decidedly changeable, and cold waves crost the northern half on the 8th, 14th, and 23d, followed by moderately heavy falls of snow. The changes were all forecast, and special warnings were issued for the last two.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.†

[California and Nevada.]

The month opened with generous rains thruout California, and heavy snows in the mountains and high southerly winds along the coast. During the first decade the weather was almost continuously rainy. Floods caused much damage in the valleys and there were numerous washouts along the southern coast. During the second decade storms appeared to approach the coast farther south than usual. Rains were frequent and heavy until the 14th, and showery weather continued in the northern counties during the remainder of the decade. A storm of considerable violence past southeastward over California from the 20th to 22d. There were no cold waves and no frost warnings which is unusual for the month of February.

The official in charge of the Weather Bureau office at San Diego, Cal., reports as follows regarding the storm of the 20th-21st:

The benefits derived from warnings issued in connection with this storm were marked. The fishing fleets were on the point of departure for the banks, but the flags caused them to remain. Numerous excursion parties had chartered sloops and other craft and were ready to sail on cruises lasting over the approaching holiday, and they too remained in port. Extra moorings were placed by many of the craft at anchor in the bay, and only those thus safeguarded escaped being thrown on the beach. The wind was so severe that signals and halyards were carried away at the display stations, and the Spreckels Brothers Commercial Companies' bunkers were carried away after twelve hours strain.

—*Alexander G. McAdie, Professor of Meteorology.*

PORTLAND, OREG., FORECAST DISTRICT. †
[Oregon, Washington, and Idaho.]

The month was about as stormy as usual altho no noteworthy marine casualties occurred. The principal storm period was from the 12th to 20th, and during this period gales of 60 to 70 miles an hour were of frequent occurrence along the coast, and the winds in the Puget Sound country were at times as high as 40 or more miles an hour. Another stormy period occurred later in the month. Warnings of all gales were issued in time to be of benefit to marine interests on the north Pacific coast. On the morning of the 8th a cold wave threatened to overspread the eastern portion of the district and warnings for the expected change were issued. The appearance in the afternoon of a low-pressure area off the Washington coast prevented a sinking of temperature to a point to justify the warnings and they were accordingly canceled in the evening. Altho rivers were nearly all at stages above the normal no floods occurred nor were there any damaging wash-outs.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

THE FLOODS OF JANUARY AND FEBRUARY, 1909, IN THE SACRAMENTO VALLEY OF CALIFORNIA.

In the State of California the month of January, 1909, was characterized by heavy and almost continuous precipitation, the total amount ranging from 7 to 10 inches in the great valleys to much greater amounts at the higher elevations. At Kennett, near the mouth of the Pitt River, the precipitation for the month reached the astonishing total of 54.08 inches, probably the greatest precipitation ever recorded in a single month in the entire United States. This was followed by 24.30 inches during February. At Colgate, on the Yuba River, the total amount for the month was 29.10 inches, followed by 11.61 inches in February. There was also a considerable quantity of snow over the Sierras. The result, of course, was a great and very destructive flood. There was a moderate flood during the first decade of January, but the great flood did not begin until the 14th, when a rapid rise set in over the entire Sacramento River. There was an intermission during the last week of the month, followed by more heavy rains and another flood during the first week of February, and the last of the flood waters were just passing into Suisun Bay at the end of the month.

The flood did not differ materially in character from the one of March, 1907, except that the latter one was the more destructive of the two, and the losses and damage were such as usually result from great floods. At Red Bluff and Sacramento the crest stages of 30.5 feet on February 3, and of 29.6 feet on January 17, respectively, were the highest of record, while the crest stage of 23.9 feet on January 16 in the Yuba River at Marysville was 0.6 foot above the previous high-water record of March 19, 1907.

About 150,000 acres of land were overflowed, but, as the flood occurred during the winter season, the crop loss was reduced to a minimum. Efforts were made to secure reliable estimates of the losses and damage, and from these it appears that the amounts were approximately as follows:

Property exclusive of crops	\$1,715,000
Crops	611,000
Erosion of farm lands.....	76,000
Suspension of business.....	100,000
Total.....	\$2,502,000

The value of property saved thru the warnings of the Weather Bureau was about \$300,000, comprising practically everything that could be moved.

The warnings issued by the Weather Bureau in connection with this flood were timely and accurate, and many testimonials relative to their high character and value have been received. They were instrumental in saving many lives as well as a large amount of property, and have demonstrated the fact that the River and Flood Service is an important adjunct to the further development of the great valley of the State of California.

GENERAL REMARKS.

High temperatures over the Ohio Valley watershed on February 22 and 23, combined with heavy rains on the latter date, resulted in a general, tho not severe, flood in the Ohio River and its western tributaries. It was most marked from Cincinnati, Ohio, westward, and at the end of the month the crest had just past Evansville, Ind., with a stage of 42.9 feet, 7.9 feet above the flood stage. The flood stage of 40 feet at Paducah, Ky., was exceeded by 1 foot at the same time.

At Cincinnati the crest stage was 54.6 feet, 4.6 feet above the flood stage, and at Louisville, Ky., 33 feet, 5 feet above the flood stage.

The interior rivers of the States of Ohio, Indiana, and Illinois were also in moderate flood, but no serious damage was done. Warnings were issued whenever necessary, and they were unusually effective in the State of Ohio. The total losses north of the Ohio River were probably not over \$25,000, while the value of property saved thru the warnings of the Weather Bureau was at least ten times as much.

In the State of Kentucky, however, conditions were much more serious. The floods extended over the entire State, and all streams were out of their banks. At Louisville 5 inches of rain fell in twenty-four hours, and the property losses amounted to at least \$300,000. In the interior of the State every industry suffered, and thousands of residents in the bottoms and lowlands were made homeless for some time. It is estimated that the total losses in the State of Kentucky amounted to several millions of dollars, the heaviest of which fell upon the agricultural and lumber interests.

Heavy rains with high temperatures on the 19th caused a severe freshet in the Hudson River below the mouth of the Mohawk River, and stages from 6 to 8.5 feet above the flood stages were experienced at Troy and Albany, N. Y., on the 21st. The abnormally high stage of 22.5 feet at Troy was in part caused by back water from the ice gorge, 2½ miles below Albany. Warnings for the freshet were issued on the morning of the 20th, and little or no avoidable damage was reported. The total losses were about \$225,000, of which \$25,000 was due to enforced suspension of business. There was no damage to crops or farm lands, and the value of property saved by the warnings was about \$100,000.

There was only a moderate freshet in the upper Susquehanna and upper Delaware rivers, and owing to timely warnings the resulting damage was inconsequential.

Moderate floods also occurred in the south during the second decade of the month, and the warnings therefor were of especial value to the cattle interests. In the Ocmulgee and Altamaha rivers the tide was a distinct benefit as it permitted the resumption of navigation after a suspension of about three months. In the southern portion of the State of Mississippi there were losses amounting to about \$12,000, divided as follows: