

MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for March, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 160; West Indian service, cable and mail, 8; River and Flood service, 52, river and rainfall, 177, rainfall only 62; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2962; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José,

Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is $157^{\circ} 30'$, or $10^{\text{h}} 30^{\text{m}}$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^{\text{h}} 36^{\text{m}} 13^{\text{s}}$ slower than seventy-fifth meridian time, corresponding to $5^{\text{h}} 36^{\text{m}}$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

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

Gales of unusual winter intensity, due to persistent low barometric pressure over the British Isles, prevailed over the eastern Atlantic and the western European coasts during a great part of the month. In the United States the month was notably free from severe gales.

During the second decade of the month abnormally high temperatures prevailed east of the Rocky Mountains, and the highest temperatures on record for the season were recorded at a number of points in the northeastern districts.

The monthly precipitation was unusually heavy in the interior of the Atlantic coast States, in the west Gulf coast districts, in California, and the interior of Washington.

High water in the rivers inundated much valuable land in the lower Mississippi Valley.

The only severe storm of the month on the Atlantic coast advanced from Florida to the Canadian Maritime Provinces from the 29th to the 31st. This storm increased in intensity as it advanced northeastward, and showed central barometric pressure below 29.40 inches on the southeast coast of New England on the morning of the 31st, and a reading of 29.22 inches at Sydney, C. B. L., at the evening report of the 31st.

No general storms of marked strength were reported on the coasts of the Gulf of Mexico. On the 18th and 19th, however, strong easterly, shifting to northerly, winds occurred on the Texas coast, attending the passage of a barometric disturbance southeastward over Texas.

High winds occurred on the lower Lakes on the 7th. On the 19th and 20th a disturbance moved east-northeastward over the Lake region, causing wind velocities of 48 miles an hour at Chicago, Ill., and Buffalo, N. Y. During the 23d a barometric disturbance developed over Lake Michigan and moved thence northeastward, attended by gales over the Great Lakes.

High winds prevailed on the extreme north Pacific coast from the 6th to the 10th, with maximum velocities of 90 miles at North Head and 68 miles an hour at Tatoosh Island, Wash., on the 10th. On the 27th the wind was high on the Washington coast, and gales were reported on the 30th on the northern California, Oregon, and Washington coasts.

Timely and ample warning was given of all gales that visited the sea coasts and Great Lakes of the United States.

The cold periods of the month were neither severe nor prolonged. On the 1st the temperature was below zero in southwestern Kansas and heavy frost occurred in central and northern Texas and northwestern Louisiana. On the 6th light frost was reported in the San Joaquin Valley, Cal., and by the morning of the 7th the frost line had extended to Los Angeles, Cal. From the 18th to the 21st a cold wave of moderate intensity advanced from the British Northwest Territory over the Western and Northwestern States, attended on the 21st by heavy frost in northern Texas and northwestern Arkansas. On the 18th heavy frost occurred in the Sacramento Valley

and light frost in the San Joaquin Valley. From the 24th to the 29th low temperatures prevailed in the Southern States, with light to heavy frosts in the interior of the Gulf and South Atlantic States.

Injury to fruit buds and blooms by frost was reported in northern Texas, Oklahoma, Tennessee, and the Ohio Valley.

In the North Pacific coast States frost was frequently reported during the last half of the month.

The frosts of the month were anticipated by the regular forecasts and special warnings of the Weather Bureau.

At the close of February the rivers of the Ohio Valley and the Gulf States had risen to flood stages, and the Mississippi River had passed the danger line from the mouth of the Ohio River to the Gulf of Mexico. At Cairo, Ill., the river rose to a maximum stage of 50.6 feet on the 15th, 16th, and 17th; at Memphis, Tenn., to a stage of 40.1 feet on the 20th; at Arkansas City, Ark., to a stage of 53 feet on the 27th and 28th; at Greenville, Miss., to a stage of 49.1 feet on the 27th; at Vicksburg, Miss., to a stage of 51.8 feet on the 27th and 28th, after which dates the river began to subside. At New Orleans, La., the river rose to a stage of 20.3 feet by the 31st. At all of the points named, excepting Cairo and Vicksburg, the river stages reached were the highest on record.

Special bulletins and advices regarding the present and anticipated stages of the Ohio and Mississippi rivers were issued and telegraphed throughout the affected districts preceding the floods and during their continuance. The timeliness and accuracy of the forecasts permitted the adoption of all possible means to protect life and to guard against loss of property.

Recognizing, early in the month, the seriousness of the situation, the official in charge of the Weather Bureau office at New Orleans, La., issued on the morning of the 9th, the following warning of the unprecedented high water:

The Mississippi River is now within one and four-tenths feet of the highest water ever recorded, and the Atchafalaya within one foot of the highest water on record. These rivers will continue to rise slowly during the next three or four weeks and all interests are advised to prepare for a stage of twenty-one feet at New Orleans and a corresponding rise in the Atchafalaya if levees hold volume of water now coming.

The following comments have been made by the New Orleans daily press with regard to this and subsequent warnings issued for the lower Mississippi Valley:

The Times-Democrat, March 16, 1903:

Barely a week has passed since the above warning was issued and the river has risen 1.2 feet and is already within 1.7 feet of the stage predicted. When the warning was first issued there were those who were inclined to doubt a record-breaking flood, but previous warnings of the Weather Bureau had been so accurate that the levee boards began strengthening the levees for a 21-foot stage. Present stages of the river indicate that preparations for the stage named in the warnings were not commenced too soon, and if the water is held within the levees from Vicksburg south, the timely warnings of the Weather Bureau must come in for their share of credit along with the efficiency of the recent improvements of the levees.

The Times-Democrat, March 16, in an editorial advised the levee board as follows:

It must now be clear, however, that the board should not relax its efforts to strengthen the levees in this district. The river, which is already high, will certainly rise even higher within the next fortnight. Indications are now plentiful that the waters which touch the gage at 19.3 feet will, before April 1, go as high as 21 feet. In its official report the Weather Bureau has warned the public to prepare for such a rise. This warning can not be disregarded with impunity.

The Daily Picayune, March 30, 1903:

The conditions now in the Mississippi and its tributaries stand as a testimonial to the timely and accurate warnings issued by the United States Weather Bureau three weeks ago to-day. Too much can not be said in commendation for such efficient and valuable warnings. These warnings have added much to the already great popularity of the weather service in this section.

The Times-Democrat, March 30, 1903:

The lower Mississippi River and tributaries are practically at stages

forecasted by the United States Weather Bureau three weeks ago. Preparations which have been made by the public to meet these high waters show the great value of such timely and accurate warnings.

BOSTON FORECAST DISTRICT.

The weather was phenomenally mild, the monthly mean temperature over the district ranging from 4° to 13° above the normal. There was much cloudy weather, and the precipitation, which was chiefly in the form of rain, was considerably in excess of the monthly normal. A conspicuous feature of the weather was the absence of high winds and severe gales along the coast, which are of common occurrence in March in New England. Only four storm warnings were issued during the month and no storms occurred for which warnings were not issued.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

Taken as a whole, March was mild, and but one general storm crossed this district during the month. Cold-wave warnings were ordered for Oklahoma and the northwestern portion of east Texas the evening of the 18th and storm south-east warnings were ordered for the Texas coast. On the 19th cold-wave warnings were extended to Arkansas and storm warnings changed to northwest on the Texas coast.

The feature of greatest interest in the eastern portion of this district during the month was the river warnings. On the 7th interests were advised to prepare for a stage of 20 feet, or higher, at New Orleans. Warnings for stages of 39 feet at Melville and 37 feet at Alexandria were issued on the 12th, and for 45 feet at Monroe were issued on the 14th.

Notwithstanding there are several crevasses above here, the river had for several days been oscillating between 20.1 and 20.4 feet. The highest stage in the other rivers was as follows: Melville, La., 38.5 feet, 31st, and rising; Alexandria, 36.2 feet, 27th; Monroe, La., 44.5 feet, 26th to 28th. The above were practically the stages forecast two to four weeks in advance. Warnings were repeated by mail from day to day with such changes as conditions called for. The situation along the Mississippi at the close of March was very critical. Much valuable land was under water and fully thirty days' continuation of high water was in sight. It was impossible at that time to form any estimate as to what the damage would amount to. Eventually it was found to be considerable, and it would have been much greater had the warning for a stage of 21 feet at New Orleans been deferred another week. The warning was distributed on the morning of the 9th; that afternoon the levee boards met and arranged to have work commenced the following day raising and strengthening the levees. A close watch was kept on the levees throughout the district, and they were strengthened as much as possible. At the close of the month the temporary levees along the commercial front of New Orleans were 2 to 5 feet high, and in many places the water was 12 to 18 inches above the height of the levees on the 9th, the date the warning for 21 feet was issued. No breaks had occurred so far in the levees along the Atchafalaya, notwithstanding the water stood 1.6 feet higher than ever recorded before. Several breaks occurred along the Bayou Lafourche. Only one break had occurred in the levees of the Mississippi proper between the mouth of the Red River and New Orleans, and that one is almost 40 miles above New Orleans, known as the Hymelia crevasse. Other breaks would have occurred, however, had it not been for the prompt action taken by the levee board as a result of the timely warnings issued by the Weather Bureau. An illustration of the value of every crevasse prevented may be taken from the Hymelia crevasse, 40 miles from New Orleans, on which over \$100,000 had been spent in efforts to close the break, and ultimate success was still very doubtful, and if successfully closed at least as much more must be expended. Praises for the Weather Bureau, as a result of these warnings, were heard on all sides,