

MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for July, 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.

The storms of the month on the North Atlantic were of moderate intensity and appeared over the ocean in high latitudes. In the vicinity of the Azores high barometric pressure prevailed except from the 14th to the 16th.

In the United States the only important general storm of the month visited the Lake region and middle Atlantic and New England coasts on the 17th and 18th. This storm, in advance of which the usual warnings were displayed, was severe in the lower Lake region and on the southern New England coast, and the high wind that attended its passage flattened corn in the Ohio Valley and the Lake region.

The warm waves of the month were neither severe nor of long duration. High temperatures that prevailed generally over the country on the 1st were broken in the Eastern States by local rains on the 2d. A warm wave that appeared in the Northwest on the 6th extended over the central valleys on the 7th and reached the Atlantic coast on the 8th. High temperatures continued over the interior and eastern districts until broken by local rains and thunderstorms on the 10th, 11th, and 12th. On the 23d and 24th high temperatures again appeared in the Northwest, and the warm wave extended over the upper Mississippi and lower Ohio valleys and the western Lake region during the 25th and reached the Atlantic coast on the 26th. The temperature continued high in the Middle West during the 27th and 28th and rose, on those dates, to 100° at Fresno, Cal.

The warm wave of the 6th to 12th culminated in the Middle Atlantic States with severe local storms. At Baltimore, Md., a tornadic storm that occurred about noon on the 12th unroofed or otherwise wrecked several hundred houses. The buildings wrecked were mostly frail brick structures. On the 22d, shortly after 3 p. m., Paterson, N. J., was visited by a tornado that caused the death of three persons and destroyed property, principally in the form of small houses, valued at about \$250,000.

In the early days of the month heavy rains resulted in floods in the streams of northern Texas, and on the 5th considerable damage was caused by rain in parts of Pennsylvania and western Maryland.

During the first decade of the month frost occurred at points in the middle and northern Plateau and northern Rocky Mountain districts, and on the 2d snow was reported on the Continental Divide in Montana. On the 26th and 27th frost occurred in parts of northern New England, and snow flurries were reported in the mountain regions of New Hampshire.

BOSTON FORECAST DISTRICT.

From the 1st till the 14th the weather was of the usual mid-summer type, with the temperature generally above normal. During the remainder of the month there was much cloudiness, with local storms, which in some localities were of marked

violence, and temperatures uniformly below the normal. Frosts occurred on the 26-27th in some of the northern sections and snow flurries were reported in some of the mountain regions of New Hampshire. High winds prevailed along the coast on the 18th and 19th, for which warnings were issued. There was no damage to shipping, so far as known to this office. No storms occurred without warnings.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month of July was mild and no extensive storm occurred. The month opened with rainy weather in some parts of the district, especially over Texas, and showers continued until the 9th, after which dry weather prevailed, except for occasional scattered showers, until the 25th, when rainy weather set in over Louisiana and Texas and continued until the close of the month. The commencement of these rains, following two weeks' dry weather, was announced in the forecasts of the 24th, practically twenty-four hours before the rains set in. Excessive local rains occurred in Texas on the 29th and 30th.—*I. W. Cline, District Forecaster.*

CHICAGO FORECAST DISTRICT.

Except for squalls, which usually attend summer thunderstorms, there was but one storm of any severity which crossed the district during the month. This storm developed in the Southwest during the night of the 16th and passed across the Lakes during the 17th and 18th, causing destructive winds and doing damage. Warnings were issued well in advance and shipping interests cautioned. During the passage of this disturbance severe local storms with tornadic characteristics occurred in portions of Illinois. A severe hailstorm occurred in Chicago and vicinity on the 21st. This storm was unusual both in duration—lasting five minutes—and in the size of the hailstones, some of the stones measuring an inch in diameter, with jagged points.—*F. J. Walz, Inspector, Weather Bureau.*

SAN FRANCISCO FORECAST DISTRICT.

The month as a whole has been an uneventful one. Cooler weather than usual prevailed throughout California, permitting fruit to ripen slowly. From July 12 to 17 and again from the 20th to 24th generous rains and frequent thunderstorms occurred from the Valley of the Colorado eastward. Warnings of warmer weather with high north winds were issued for northern California on July 2, and were verified.—*A. G. McAdie, Professor of Meteorology.*

PORTLAND, OREG., FORECAST DISTRICT.

The first decade of the month in this district was unsettled and showery, and the month, as a whole, averaged from 1° to 3° cooler than usual. A light frost occurred in southwestern Idaho on the morning of the 3d, for which warnings were issued twenty-four hours in advance.

The Columbia River slowly fell during the entire month, and at Portland, Oreg., the river passed below the danger mark during the afternoon of the 14th. It was forty-one days above danger line, during fifteen days of which time it was rising; on two days it was stationary, and during the remainder of the period it was falling.—*E. A. Beals, District Forecaster.*

DENVER FORECAST DISTRICT.

No special warnings were issued. The feature of the month was the exceptionally cool weather that prevailed following the passage of a low barometer area that developed in the middle Rocky Mountain region during the afternoon of July 1. During the 3d the fall in temperature was sharp, with a general and killing frost in high agriculture districts, and light local

frosts at moderate elevations on the 3d and 4th. Cooler weather was forecast for almost the entire district on the mornings of the 2d and 3d.—*F. H. Brandenburg, District Forecaster.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

| Number. | First observed. | | | Last observed. | | | Path. | | Average velocity. | |
|------------------------|-----------------|---------|----------|----------------|---------|----------|---------|-----------|-------------------|---------|
| | Date. | Lat. N. | Long. W. | Date. | Lat. N. | Long. W. | Length. | Duration. | Daily. | Hourly. |
| High areas. | | | | | | | | | | |
| I..... | 1, a. m.. | 41 | 124 | 3, a. m.. | 47 | 122 | 525 | 2.0 | 262 | 10.9 |
| II..... | 3, p. m.. | 49 | 86 | 6, a. m.. | 32 | 65 | 1,675 | 2.5 | 670 | 28.0 |
| III..... | 3, p. m.. | 47 | 112 | 10, a. m.. | 27 | 80 | 3,800 | 6.5 | 585 | 24.4 |
| IV..... | 6, p. m.. | 41 | 124 | 8, a. m.. | 45 | 100 | 1,375 | 1.5 | 917 | 38.2 |
| V..... | 8, p. m.. | 45 | 123 | 18, a. m.. | 32 | 65 | 4,150 | 9.5 | 437 | 18.2 |
| VI..... | 16, a. m.. | 53 | 121 | 21, p. m.. | 37 | 81 | 3,600 | 5.5 | 654 | 27.2 |
| VII..... | 22, a. m.. | 47 | 92 | 25, p. m.. | 38 | 80 | 1,400 | 3.5 | 400 | 16.7 |
| VIII..... | 24, p. m.. | 53 | 105 | 28, a. m.. | 39 | 75 | 2,000 | 3.5 | 571 | 28.8 |
| IX..... | 28, a. m.. | 48 | 117 | 4, a. m.* | 45 | 64 | 3,575 | 7.0 | 511 | 21.3 |
| Sums..... | | | | | | | 22,100 | 41.5 | 5,007 | 208.7 |
| Mean of 9 paths..... | | | | | | | 2,456 | | 556 | 23.2 |
| Mean of 41.5 days..... | | | | | | | | | 532 | 22.2 |
| Low areas. | | | | | | | | | | |
| I..... | 29, p. m.† | 38 | 105 | 2, p. m.. | 46 | 60 | 2,475 | 3.0 | 825 | 34.4 |
| II..... | 30, p. m.† | 50 | 120 | 3, p. m.. | 50 | 100 | 2,225 | 3.0 | 742 | 30.9 |
| III..... | 2, p. m.. | 35 | 112 | 6, a. m.. | 44 | 70 | 2,550 | 3.5 | 723 | 30.3 |
| IV..... | 4, p. m.. | 44 | 116 | 8, a. m.. | 48 | 89 | 1,750 | 3.5 | 500 | 20.8 |
| V..... | 15, a. m.. | 35 | 112 | 19, a. m.. | 41 | 70 | 2,500 | 4.0 | 625 | 26.0 |
| VI..... | 21, a. m.. | 48 | 89 | 24, a. m.. | 46 | 60 | 1,700 | 3.0 | 567 | 23.6 |
| VII..... | 25, p. m.. | 44 | 116 | 30, p. m.. | 48 | 68 | 2,750 | 5.0 | 550 | 22.9 |
| Sums..... | | | | | | | 15,950 | 25.0 | 4,537 | 188.9 |
| Mean of 7 paths..... | | | | | | | 2,278 | | 648 | 27.0 |
| Mean of 25.0 days..... | | | | | | | | | 638 | 26.6 |

* August. † June.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*George E. Hunt, Chief Clerk, Forecast Division.*

RIVERS AND FLOODS.

Nothing of special interest transpired in the various river districts during the month. As a rule the stages were lower than during the preceding month. In the interior districts, however, they were higher than the usual summer stages, as a result both of the substantial rainfall and of the fact that the flood waters of May and June had not entirely passed out.

In the upper Red River there was a period of comparatively high water from the 4th to the 7th, with danger line stages at Arthur City, Tex., and Fulton, Ark. Warnings that were telegraphed on the morning of the 4th to all available points within the State of Arkansas were well verified by the subsequent events. Some losses to crops were reported, amounting to perhaps \$15,000 or \$20,000, while the value of property saved by removal or protection was, according to advices received, about \$200,000.

Heavy local showers over Texas during the first few days of the month also caused a sharp rise in the Trinity River. At Dallas, Tex., the water rose from 7.9 feet on the 2d to 32.7 feet on the 6th, the latter stage being 7.7 feet above the danger line. At points below the rise was not so marked. Warnings were distributed on the morning of the 4th, but four days after the establishment of the service on Trinity River. This new service is a part of the extensive additions that were made to the Texas River and Flood Service on July 1, 1903. Heretofore, service had been maintained only on the Brazos River, but on July 1 new river stations were established as follows: On the Sabine River, at Logansport, La., and Orange, Tex.; on the Neches River, at Rockland and Beaumont, Tex.; on the Trinity River, at Dallas, Riverside, and Liberty, Tex., and on the Colorado River, at Ballinger, Austin, and Colum-