

MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for March, 1902, is based on reports from about 3,100 stations furnished by employees and voluntary observers, classified as follows: Regular stations of the Weather Bureau, 162; West Indian service stations, 13; special river stations, 132; special rainfall stations, 48; voluntary observers of the Weather Bureau, 2,562; Army post hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Railway Company, 96; Hawaiian Government Survey, 200; Canadian Meteorological Service, 33; Jamaica Weather Office, 160; Mexican Telegraph Service, 20; Mexican voluntary stations, 7; Mexican Telegraph Company, 3; Costa Rican Service, 7. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

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, Meteorologist to the Hawaiian Government Survey, Honolulu; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; 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 Jose, Costa Rica; Capt. François S.

Chaves, Director of the Meteorological Observatory, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; and Rev. Josef Algué, S. J., Director, Philippine Weather Service.

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 $10^{\circ} 30''$ west of Greenwich. The Costa Rican standard of time is that of San Jose, $0^{\text{h}} 36^{\text{m}} 13^{\text{s}}$ 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 always 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.

Several storms of marked intensity moved from the United States coasts northeastward over the Canadian Maritime Provinces, and advanced thence over the Atlantic in high latitudes. During the third decade of the month a succession of areas of low barometric pressure whose centers passed north of Scotland, caused high winds, low temperature, and rain or snow over a great part of the British Isles and along the central and north coasts of western Europe. In the United States energetic storms were numerous. Some of these storms moved rapidly inland from the north Pacific coast, and others first appeared over the Rocky Mountain and Plateau regions, and, as a rule traveled rapidly north of east to the Atlantic coast. The most important storm of the month appeared over Nevada on the morning of the 13th, and moved eastward to Colorado by the morning of the 14th, where, at Denver, the barometer reduced to sea level was 29.10 inches, with one exception the lowest reading reached at that station during March in thirty years. Moving north of east with a gradual loss of strength, this storm reached Lake Superior on the 16th. The severest cold wave and snowstorm of the month followed in its wake, extending over the northern Rocky Mountain region and the middle and northern Rocky Mountain slope during the 14th, advancing over the upper Mississippi Valley and the upper

Lake region during the 15th and 16th, and reaching the lower Lake region on the 17th; the cold wave covered the Atlantic coast districts during the 17th. The snow fall was heavy and the cold intense for the season in the States of the upper Missouri Valley, and thence over the middle Rocky Mountain districts. The highest wind velocities of the month occurred in connection with a severe storm which appeared on the north Pacific coast on the 1st. On that date the wind maintained a velocity of over 100 miles an hour for several hours at Point Reyes Light, Cal. During the closing days of March the temperature continued low in the extreme southwest, and on the 25th a remarkable fall occurred in the mountain districts of Arizona, a minimum of -8° being recorded at Flagstaff. Ample warnings were issued in connection with the cold waves and storms of the month in the central and northern districts, and the occurrence of frost was successfully forecast in the Southern States.

The following report has been rendered by the Weather Bureau observer at Wilmington, N. C., relative to warnings issued in that section in advance of the cold wave of the second decade of the month:

In connection with the severe freeze of this section on the morning of the 19th instant every effort was made to get the warnings of damaging

frosts out promptly to as many truckers as possible, and railroads entering this city assisted by telegraphing the information to all their stations. An immense amount of growing stuff, strawberries, lettuce, etc., was protected, and the observer has been informed that many thousands of dollars were saved as a result of the warnings.

In California no damage by frost was reported, and at the close of the month fruit trees were in better condition than is usual at this season. In the north Pacific coast States the month was unusually cool and heavy frosts were frequent during the last of the month.

The month opened with destructive freshets in the rivers and streams of the Appalachian Mountain system, and during the last few days of the month destructive floods occurred in Mississippi, Alabama, Georgia, Tennessee, and Kentucky.

BOSTON FORECAST DISTRICT.

The weather of the month was unusually warm, with excessive precipitation, mostly in the form of rain, and a number of severe windstorms. Warnings were given of the approach of these storms.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

March was unusually stormy, and warnings for high winds were issued on a number of dates. These warnings were timely, and no windstorms occurred without warnings. The cold waves and frosts of the month were also accurately forecast.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

Advisory messages for severe storms were issued from time to time to steamboat companies at the various ports on Lake Michigan where a winter service is maintained. A cold wave crossed the district from the 13th to the 17th. Warnings were sent well in advance of this cold wave, and were completely verified. In the Northwest the cold wave was accompanied by high winds and snow. Advices for these conditions were sent to railroads and other interests.—*H. J. Cor, Professor.*

DENVER FORECAST DISTRICT.

The feature of the month was the unusual number of storms that developed in this district. For only one, however, the storm of the 14-15th, was it necessary to issue warnings. These warnings were fully justified in Colorado east of the foothills, in western, and the greater part of eastern Wyoming, and practically throughout the area specified west of the mountains.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month was one of unsettled weather, with fairly frequent rain, although the total rainfall for the month was below the average. The month opened with one of the most severe storms experienced for some time in this section. At Point Reyes Light on March 1 a wind velocity of over 100 miles was reported for several hours, with an extreme velocity of 120 miles.

Light and heavy frosts occurred generally in California on the morning of March 4. Ample warning was given and no damage was done to fruit. The month passed without the usual injurious frosts.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

The month was unseasonably cool but not unusually stormy in this district. Sharp frosts occurred frequently in the North Pacific States from the 24th to the 30th, and they were almost without exception accurately forecast.—*E. A. Beals, Forecast Official.*

HAVANA FORECAST DISTRICT.

No general advices were issued during the month. On the 5th the following was telegraphed all regular and display stations in Cuba:

Fresh to brisk and occasionally high southwest wind, shifting to cooler brisk and high northwesterly, this afternoon and to-night over western Cuba, and over eastern Cuba during Thursday.

A daily, except Sunday, wind forecast was furnished the captain of the port of Havana for the information of departing vessel masters.—*W. B. Stockman, Forecast Official.*

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.....	2, p.m.	37	123	8, a.m.	32	65	Miles. 4,625	Days. 5.5	Miles. 841	Miles. 35.0
II.....	3, p.m.	53	108	10, a.m.	47	54	3,725	4.5	828	34.5
III.....	5, p.m.	53	108	10, a.m.	47	54	2,775	4.5	617	25.7
IV.....	7, a.m.	35	120	13, a.m.	32	65	3,600	4.0	900	37.5
V.....	12, p.m.	36	106	17, a.m.	47	54	3,575	4.5	794	33.1
	15, p.m.	54	113	20, a.m.	48	86	2,675	4.5	594	24.8
Suns.....							20,975	27.5	4,574	190.6
Mean of 6 paths.....							3,496		762	31.8
Mean of 27.5 days.....									763	31.8
Low areas.										
I.....	1, p.m.	32	81	5, a.m.	47	54	2,100	3.5	600	25.0
II.....	1, p.m.	35	120	6, a.m.	45	64	4,400	4.5	978	40.8
III.....	5, p.m.	45	123	10, a.m.	45	64	3,750	4.5	833	34.7
IV.....	9, p.m.	37	105	14, a.m.	47	54	3,500	4.5	778	32.4
V.....	12, a.m.	52	122	17, a.m.	48	63	3,950	5.0	790	32.9
VI.....	14, a.m.	51	120	15, a.m.	42	113	700	1.0	700	29.2
VII.....	19, a.m.	37	114	21, p.m.	32	91	1,500	2.5	600	25.0
VIII.....	24, a.m.	37	114	27, p.m.	50	97	1,550	3.5	443	18.4
IX.....	27, a.m.	27	97	30, a.m.	45	67	2,250	3.0	750	31.2
X.....	29, a.m.	32	100	1, a.m.*	48	68	1,975	3.0	658	27.4
Suns.....							25,675	35.0	7,130	297.0
Mean of 10 paths.....							2,568		713	29.7
Mean of 35.0 days.....									731	30.5

*April.

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

RIVERS AND FLOODS.

During the early days of the month the ice in the upper Mississippi River moved out quietly, the dates at the various stations being as follows: At St. Paul, Minn., La Crosse, Wis., and Leclaire, Iowa, on the 9th; at Prairie du Chien, Wis., and Dubuque, Iowa, on the 11th; at Davenport, Iowa, on the 5th; at Keokuk, Iowa, on the 4th, and at Hannibal, Mo., on the 5th.

Navigation, however, was not generally opened as the early movement of the ice had not been anticipated. In the lower Mississippi the stages were much higher, owing to the Ohio River flood of the early days of the month and the torrential rains from the 26th to the 28th, but danger-line stages were not quite reached. The Missouri River, from the mouth of the Platte northward, opened generally from the 5th to the 12th, and the ice passed quietly down the river. For a few days, however, gorges above Yankton, S. Dak., caused conditions to assume a very threatening aspect. Moderate water stages prevailed during the remainder of the month.

In the Ohio River and the rivers of the East and South flood stages were the rule, particularly in the East, where the floods attained proportions such as, with but a single exception, had never before been recorded.