

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for February, 1904, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph, and mail, 167; West Indian Service, cable and mail, 4; River and Flood Service, regular 43, special river and rainfall, 190, special rainfall only, 56; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 3025; 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. R. C. Lydecker, Territorial Meteorologist, Honolulu, Hawaii; 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 H. M. Hodges, Hydrographer, United States Navy; H. Pitier, 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. N. Shaw, Esq., Secretary, Meteorological Office, London; Rev. José Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

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 meridian is that of San José, $5^{\text{h}} 36^{\text{m}}$ 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.

Exceptionally severe weather prevailed along the transatlantic steamer routes of the North Atlantic Ocean during the first and second decades of the month, and in a number of instances gales were experienced as far south as the Azores. From the 23d to the 28th generally high barometric pressure over the British Isles and low pressure over Spain and Portugal was attended by abnormally low temperature over western Europe.

Over the western Atlantic the month opened with a storm of marked intensity moving eastward over New England and the Canadian Maritime Provinces. The 3d, 7-8th, 15-16th, 22d-25th, and the 29th were stormy days on the middle Atlantic and New England coasts, the severest gales of the month in that region occurring on the 15th and 16th. No severe storms were reported on the Gulf of Mexico or its coasts. The principal Lake storms of the month occurred on the 2d and 6-7th, with a maximum reported wind velocity of 64 miles an hour at Buffalo, N. Y., on the 7th. Storms of less-marked severity crossed the Lake region on the 14th, 21st-22d, 23d, 24th, and 29th. On the north Pacific coast the month was usually stormy, and on a number of dates the gales that attended the passage of storms across the northern coast line extended southward over California. As a rule, the storms that appeared on the north Pacific coast crossed the United States, those that followed a northern track being attended by gales on the Great Lakes and the Atlantic seaboard. The

storms from the North Pacific that followed a southeast track dissipated or diminished greatly in intensity upon reaching the southwestern and Gulf districts. Ample warning was given to all American ports of the important windstorms of the month.

From the northeastern slope of the Rocky Mountains eastward to the Atlantic coast and southeastward over the east Gulf and South Atlantic States the month was colder than the average February, and from the Missouri Valley over the Lake region, Ohio Valley, and Middle Atlantic and New England States exceptionally low temperatures prevailed. In the Southwestern States and from the Rocky Mountains to the Pacific coast the temperature averaged above the normal. The month opened with a cold wave of marked intensity over the Atlantic seaboard, and on the morning of the 2d the lowest temperatures of the present winter were registered in the Middle Atlantic States. During the night of the 5th a cold wave swept southward over the Plateau and Rocky Mountain districts, and extended thence eastward to the Atlantic coast by the 8th. The third well-marked cold wave of the month advanced from the British Northwest Territories over the West and Northwest during the night of the 13th, covered the central valleys during the 14th, and reached the Middle Atlantic and New England States during the night of the 15th, where the temperature continued very low until the 17th. The decided falls in temperature were forecast and made the subject of special warnings.

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.....	*31, a. m.	52	105	2, a. m.	33	79	2, 100	2.0	1, 050	43.8
II.....	*31, p. m.	23	98	2, a. m.	33	79	1, 225	1.5	817	34.0
III.....	1, p. m.	50	107	3, a. m.	36	87	1, 500	1.5	1, 000	41.7
IV.....	2, p. m.	50	110	4, p. m.	35	73	2, 100	2.0	1, 050	43.8
V.....	9, a. m.	52	104	13, p. m.	46	60	2, 375	4.5	528	22.0
VI.....	12, p. m.	55	114	18, p. m.	44	74	2, 550	6.0	425	17.7
VII.....	16, p. m.	41	124	21, a. m.	41	70	3, 150	4.5	700	29.2
VIII.....	21, a. m.	33	97	24, a. m.	27	83	1, 525	3.0	508	21.2
IX.....	23, p. m.	50	107	27, p. m.	46	60	2, 575	4.0	644	26.8
X.....	27, p. m.	53	108	29, p. m.	48	68	1, 950	2.0	975	40.8
XI.....	29, a. m.	41	100	†2, a. m.	40	73	1, 575	2.0	788	32.8
Sums.....							22, 625	33.0	8, 485	353.6
Mean of 11 paths.....							2, 057		771	32.1
Mean of 33 days.....										32.1
Low areas.										
I.....	*31, a. m.	51	114	3, a. m.	45	67	2, 400	3.0	800	33.3
II.....	4, a. m.	48	125	8, a. m.	46	60	3, 650	4.0	912	38.0
III.....	7, a. m.	43	113	10, p. m.	25	82	2, 625	3.5	750	31.2
IV.....	11, p. m.	47	125	14, p. m.	29	95	2, 150	3.0	716	29.8
V.....	12, p. m.	53	103	16, a. m.	47	60	2, 650	3.5	757	31.5
VI.....	15, p. m.	47	125	19, p. m.	26	82	3, 225	4.0	806	33.6
VII.....	19, p. m.	51	104	22, p. m.	48	69	2, 300	3.0	767	32.0
VIII.....	20, p. m.	29	94	22, p. m.	27	80	950	2.0	475	19.8
IX.....	22, a. m.	42	107	25, a. m.	46	60	2, 375	3.0	792	33.0
X.....	22, a. m.	53	125	24, p. m.	30	95	2, 150	2.5	860	35.8
XI.....	23, p. m.	47	122	26, p. m.	33	92	1, 925	3.0	642	26.8
XII.....	26, a. m.	52	120	28, p. m.	48	69	2, 300	2.5	920	38.3
XIII.....	27, p. m.	38	105	†1, a. m.	46	78	1, 600	2.5	640	26.7
Sums.....							30, 300	39.5	9, 837	409.8
Mean of 13 paths.....							2, 331		757	31.5
Mean of 39.5 days.....										31.5

*January. †March.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*C. C. Cooper.*

Ice gorges and resultant floods in localities in the Middle Atlantic States and floods in California are discussed under the head Rivers and Floods.

BOSTON FORECAST DISTRICT.

The weather was notable for severe and persistent storms, during which violent gales prevailed along the coast, the wind in some instances reaching hurricane force. The severest storms were those of the 1st and 15th. During the latter storm the Boston fishing schooner *Irene and May* ran ashore near the entrance to Provincetown Harbor. The life-savers went to the assistance of the fishermen, and all were saved. The vessel was not greatly damaged. Along the northern shore of Massachusetts Bay this was considered one of the worst storms of the season. The month, so far as temperatures are concerned, is unprecedented in the records of the New England weather service. The mean for the entire district was 16.6°, and the next lowest was 18.0° in 1901. Shipping was greatly inconvenienced and delayed by the unusually low temperatures and stormy weather, although few casualties resulted. Seventeen storm warnings were issued during February and were generally fully justified.—*J. W. Smith, District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

The month was abnormally dry. Notwithstanding favorable conditions for precipitation on several dates, only one general rainstorm occurred during the month. Decided falls in temperature occurred in parts of the district on the 3d, 8th, 10th, 14th, 15th, 18th, 19th, 27th, and 29th, for all of which forecasts or warnings were issued. Storm warnings were issued for all high winds that occurred during the month. No severe storms occurred.—*I. M. Cline, District Forecaster.*

CHICAGO FORECAST DISTRICT.

The month was marked by temperature far below the nor-

mal throughout the entire district, except in the extreme western portion. The cold was persistent, although not, as a rule, very severe. There were during the month two or three temporary breaks in these conditions. The month opened cold over the eastern half of the forecast district, and a moderate cold wave appeared in the British Northwest on the same day, which was followed by another on the 6th and 7th, which lasted for several days. After a temporary moderation, another cold wave appeared in the Northwest on the 13th, and overspread the entire district on the 14th and 15th, causing the lowest temperatures of the winter at many stations. A cold wave appeared again in the extreme northwest on the 20th, and within forty-eight hours it passed eastward across the district. There was still another, which developed on the 24th, with practically the same movement as its predecessor. Warnings were sent out in advance of the movement of these cold waves, and no considerable fall in temperature occurred without the proper notification.

As the temperature continued very low in the extreme northwest during practically the entire month, the storms approaching from the North Pacific were diverted southward over the middle Rocky Mountain region. These disturbances were of frequent occurrence, and, while no individual storms caused general heavy snows, the aggregate snowfall for the month for the northern portion of the forecast district was considerable.

The transportation companies which usually maintain winter navigation endeavored to continue service, but were handicapped considerably by the large amount of ice in the lake. The car ferries and steamboats were stalled in the ice for several days at a time, and very few trips were made by boats navigating along the west shore, although the car ferries which went across from Michigan to Wisconsin met with better success.

Later developments show that Lake Michigan was not frozen over, as was supposed, for a time during January, but it is true that the ice was thicker and there was less open water than have prevailed for twenty or thirty years.

Several storms crossed Lake Michigan during the month and advices of their coming were sent to vessel masters. The managers were also fully advised as to the probable direction of the wind from day to day, as the condition of the ice in the lake depends largely upon the direction of the wind.—*H. J. Cox, Professor and District Forecaster.*

DENVER FORECAST DISTRICT.

Notwithstanding the number of low areas that crossed the Continental Divide in Wyoming and Colorado, the month was unusually mild, and for the greater part of the district exceedingly dry. Cold waves, warnings of which were timely, were notably few, moderate, and of short duration. For Colorado the month was the mildest February in sixteen years. Windstorms from westerly quadrants were frequent on the eastern slope, the gale of the 1st being very severe along the foothills of Colorado and Wyoming.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO FORECAST DISTRICT.

The month was essentially different from the preceding months of this winter. The latter were abnormally dry, and the pressure distribution of the type common to drought periods over the extreme southwestern portion of the country. During February a marked difference in pressure distribution will be found to exist. The rainfall, which had been so deficient throughout southern California as to seriously injure pasturage and cause a considerable loss of stock, fell during the month of February opportunely and in such quantities as to insure the crops. Had the dry spell continued longer, serious loss would have resulted in southern California. The month was unusually free from frost. This is not always the case with rainy seasons, although the general law holds that such

seasons have less frost than others. Storm warnings were displayed frequently. Beginning February 24 special attention was given to the river conditions in northern California. Warnings were sent in ample time to river towns on the American, Yuba, and Feather rivers, also on the upper Sacramento. Warnings of high water for the reclaimed lands between the Sacramento and San Joaquin rivers were issued with the evening forecasts and distributed by the Associated Press. The work was of direct and positive value in saving lives and property. Much stock was removed from the lowlands in time.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND FORECAST DISTRICT.

The month of February was unusually stormy in this district. Four vessels were wrecked, as follows: Three-masted schooner *Emma Utter*, loaded with 360,000 feet of lumber, abandoned off Grays Harbor, February 11, came ashore in Barclay Sound, Vancouver Island, February 16; vessel and cargo total loss; crew saved. Schooner *Gem* sailed from San Francisco February 3, reported wrecked on Nehalem Beach, Oreg., February 16; vessel and cargo total loss; crew saved. Steam schooner *Fulton*, 300 tons, with 500,000 feet of lumber, ran out of fuel oil during storm of February 12 and was beached near Port Oxford, Oreg.; 1 man was drowned; the underwriters have strong hopes of saving this vessel. The three-masted schooner *Frank W. Howe*, loaded with railroad ties, was wrecked during a storm of February 22, a few miles north of the North Head, Wash., Weather Bureau station; 2 of the crew were lost; vessel and cargo a total loss. Warnings were issued in every instance well in advance of all severe storms, and the casualties that occurred were to vessels at sea beyond the reach of warnings. The work of the Weather Bureau vessel-reporting station at North Head, Wash., during the month has been very creditable. The first intimation of the disabled condition of the schooner *Frank W. Howe* was received from that station. The observer notified the life-saving crews in the neighborhood, and they were on the ground almost by the time the vessel reached the shore, and no time was lost in rescuing the crew. This station was also the means of saving the steam schooner *Grace Dollar* which became disabled during a severe storm and was drifting helplessly about. As soon as the observer sighted her he notified the tugs at Astoria, Oreg., one of which found and towed her to a safe anchorage after a very perilous trip over the bar at the mouth of the Columbia River. The disabled condition of the *Grace Dollar* was previously reported by the British Bark *Thistle*, but at this time the helpless vessel was too far out at sea for the tugs to locate her, and it is believed that it was the definite information received from the North Head Weather Bureau station which made the rescue of the vessels possible.

No cold waves occurred, nor were any cold-wave warnings issued.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The ice situation can be summarized as follows:

At the end of January, 1904, the Missouri River was frozen to near the Iowa-Missouri line, with 24 inches of ice at Williston, 29½ inches at Bismarck, 19 inches at Sioux City, and 13 inches at Omaha. One month later the only change noticeable was an increase, ranging from 3 to 6 inches, in the thickness of the ice. The Mississippi River on January 31 was frozen as far south as the mouth of the Illinois River, the thickness of the ice ranging from 26 inches at St. Paul to 16 inches at Hannibal. By the end of February there had been an increase of 11 inches at St. Paul and 1 inch at Hannibal. The river at Hannibal was open from the 7th to 17th, inclusive, and again on the 29th. At St. Louis heavy ice was persistent until February 25, when navigation was resumed. At Memphis the heaviest ice in many years was observed February 3 and 4, suspending navigation and endangering boats along the

river. The river was clear from the 5th until the end of the month, except from the 21st to 24th, inclusive. The Ohio River was free from gorges, but ice in greater or less quantities was constantly running until the 25th. There were some attempts at navigation, but nothing was done in a general way until February 24 and 25. The Kentucky River opened on February 24.

The great gorges in the Susquehanna River continued throughout the month. The conditions gradually became more threatening and serious, and at the end of the month the situation was the most dangerous of the entire winter. The persistent cold weather had solidified the gorges, and the only hope of averting greater danger and destruction than that which had already befallen the valley lay in the possibility that slowly moderating weather would permit the ice to go out gradually, reducing the loss to a minimum. The following report on the conditions during the month was prepared by Mr. E. R. Demain, official in charge, United States Weather Bureau office, Harrisburg, Pa.:

At the close of January the river was icebound at Huntingdon, Lockhaven, and Wilkesbarre, with the great gorges of ice in the main river near Bainbridge and in the North branch from Kipps Run to Berwick still intact.

On February 5 the weather map indicated rain and decidedly warmer weather for the Susquehanna Valley, and the following bulletin was, therefore, given the widest possible publication and distribution:

"River conditions are again becoming threatening. A storm, now approaching from the west, will cause a decided rise in the temperature and probably rain over the Susquehanna Valley to-night and on Sunday. Should the rainfall be heavy, which is likely, the ice in the river will probably break up and go out on a flood that may cause great damage to property and possibly endanger human life. Persons living on lowlands near the river, or those having live stock on river bottoms, are particularly cautioned to keep a close watch, as a sudden gorging of ice might cause their lands to become submerged. No one can positively predict what the outcome will be, but the public is warned that the possibilities of a damaging flood are considered great, and all should be prepared as far as possible to meet any danger that may arise."

On February 6 the following bulletin was published on the weather map: "The conditions continue favorable for an early break-up of the ice and a flood in the river, probably within forty-eight hours. Indications are for rain over the Susquehanna Valley to-night, the rain continuing Sunday."

The first reported break in the ice occurred at Lockhaven on the night of February 7, the ice gorging near Jersey Shore. The break in the Juniata occurred at Huntingdon on February 7, the river reaching a maximum stage of 9.0 feet during the night. At Wilkesbarre the ice began to break up at 5:15 a. m., February 8, and moved past the city until February 10, when it once more became stationary, owing to the formation of a gorge at Nanticoke, about 9 miles below. The water backed up till it reached a stage of 25.7 feet at 4 p. m. on February 9. Ice from Williamsport and points below on the West branch began to pass Selinsgrove on the night of February 8, and early on the following night the breaking of the gorge at Jersey Shore caused another heavy flow to begin. All this ice passed Harrisburg and lodged on the gorges below. On the afternoon of February 9 a section of the great gorge in the North branch moved, beginning a short distance above Berwick and stopping at Millinville. The ice in its progress moved the bridges at Berwick and Millinville from their piers. At 8 a. m., February 10, the river at Bloomsburg registered 29.5 feet, and at Catawissa 28.5 feet. Some previous high-water stages at Catawissa were as follows: March 18, 1865, 28.9 feet; March 3, 1902, 27.3 feet; and January 25, 1904, 29.3 feet, the latter stage the highest known.

A cold wave on the night of February 8 caused the West branch and the Juniata to begin to fall early on February 9, and on the morning of February 10 reports showed that the waters of all the streams of the system were receding. On account of the gorges, the waters fell very slowly from the great pools, and no material relief was afforded the flooded territory for several days, the severe weather intensifying the suffering of the people whose homes had been flooded. Low-lying farm lands, as well as the lower portions of towns and cities suffered severely, and the following statement relative to a single farm, taken from the Catawissa News Item of February 18, fairly represents the conditions obtaining on many farms along the river bottom.

"His farm buildings have been badly wrecked by the ice which covers the farm, and the house shows the effect of the flood. Several hundred bushels of potatoes in the cellar are a total loss, and the corn in the crib is frozen solid. The farmer has moved everything movable, and will not return to the farm until the floods are over. If the ice goes off with high water, every building on the place will go with it."

The Juniata at Huntingdon and the West branch at Lockhaven again