from the Rio Grande Valley caused gales along the middle Atlantic and New England coasts.

Three disturbances that first appeared over the west part of the Gulf of Mexico moved northeastward to the Great Lakes, and one of these was the storm before referred to as having moved eastward over Newfoundland on the 23d.

Several vessels were lost on the Great Lakes during the third decade of the month. On the night of the 23d the steamer *Sylvanus J. Macy* sprung a leak off Point Burwell, Ontario, and sank. On the 25th the steamer *Quito* ran ashore in a northeast gale, while trying to make the harbor at Lorain, Ohio. During the night of the 29th the steamer *Charles Hebard* was wrecked at Point Mamainse, Lake Superior.

A number of barometric depressions appeared on the north Pacific coast, notable among which were those of the 8–10th, and 16–18th. The storm of the 16–17th was particularly severe, and a number of expressions of appreciation have been received regarding the value to shipping interests of the warnings issued in connection therewith.

Ample warnings were issued of all storms that visited the Atlantic, Pacific, and Gulf coasts and the Lake region.

The first important cold wave of the season swept southward and eastward from the British Northwest Territory over the interior of the country from the 26th to the 28th, carrying the line of freezing temperature almost to the coast line of the Gulf of Mexico. Timely warning was given to all interests that were subject to damage or loss by frost and cold. The following comment is made by the New Orleans press on the warnings issued for the Gulf district, the only section east of the Pacific coast States in which agricultural products were endangered by frost:

The Times-Democrat of November 28, 1902:

The warnings sent out by Dr. Cline Wednesday morning were timely for all parts of this extensive district. Freezing weather occurred over Arkansas, Oklahoma, and northwest Texas. Heavy frosts occurred over the interior of Texas, and frost occurred generally over southern Texas and all of Louisiana. Frost was in evidence in New Orleans, and on the outskirts was quite heavy. The warnings of these severe conditions were issued by the Weather Bureau well in advance, and all business interests were prepared for the frosts and freezing.

The Daily Picayune of November 29, 1902:

This season's special forecasts were inaugurated Wednesday by the forwarding of frost warnings to every station in the west Gulf district, with the result that planters and farmers, relying implicitly upon Dr. Cline's forecasts, which were so accurate in past seasons, had time to protect their crops from the low temperatures. This warning, in ample time, was a thanksgiving offering to southern industrial and agricultural interests, and its value can hardly be estimated in cold cash.

From the 25th to the 30th frost was general in California. The frosts of this period, and also the rains of the month were covered by forecasts and special warnings issued from San Francisco.

During the third decade of the month heavy rains caused destructive freshets in eastern Texas, and large areas of bottom lands along the Red River above Shreveport were inundated. The floods in the Red River continued into December, and will be referred to in the MONTHLY WEATHER REVIEW for that month.

BOSTON FORECAST DISTRICT.

The weather was remarkable for unusual mildness and light precipitation. The storms of the 8–9th and 25–26th were of marked severity, with heavy easterly gales. The latter storm was the most severe of the season. All warnings were timely, and called forth most favorable comment.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

Warnings for cooler, brisk to high northerly winds over eastern Mexico, and northwest storm warnings for the west Gulf coast were issued on the 26th, and cold, high winds followed. Warnings were issued on the 26th for freezing weather in northern part of the district and frost to the coast line, and the first general frost (killing throughout the interior) occurred on the morning of the 27th. Press comments regarding the warnings have been forwarded.—*I. M. Cline, Forecast Official.*

CHICAGO FORECAST DISTRICT.

Storm warnings were displayed on the upper Lakes at frequent intervals during the month, and evidently vessel masters took necessary precautions. No very severe storms occurred, but there were some casualties. The Canadian steamer *Bannockburn* left Port Arthur, Ont., on November 21, and no trace of her has yet been found. She undoubtedly foundered in one of the storms that followed soon after sailing. It is probable, however, that at no time the steamer came within range of the storm warning stations of this service. The other important casualties were the loss of the steamer *Hebard*, and one of her consorts, on Lake Superior the night of the 29th. During the storm the steamer had parted from her consorts, and in the high wind and snow the captain lost his bearings and found himself on the breakers near Point Mamainse. The crew were rescued the next day, but the boat went to pieces on the rocks. The *Hebard* was a wooden steamer and her business of towing barges during the stormy season was extremely hazardous. It would seem that the captain of such craft should pay particular attention to the daily forecasts and storm warnings. All vesselmen that could be reached were fully advised as to the approach of the storm in which these boats were wrecked.—*H. J. Cox, Professor.*

DENVER FORECAST DISTRICT.

Unsettled weather characterized November, but cold waves were notably few, unimportant, and local in character. A feature of the month was the heavy precipitation that occurred in Arizona, especially in connection with the low area, central in Wyoming on the morning of the 19th, which took a southwestward course to Arizona where it remained for several days. The snowfall was very heavy in northern Arizona.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

Unusually heavy rainfalls occurred in the northern portion of California on November 8 and 9. At Eureka the 24-hour rainfall was 3.16 inches, and at Red Bluff, 2.26 inches. At the latter point the rainfall in forty-eight hours amounted to 4.46 inches. The forecasts of rain throughout California were handsomely verified, and wherever fruit was injured the loss was due to causes beyond the control of the orchardists. Ample warning was given at nearly all points. A second stormy period began November 13, but did not cause unusual weather conditions south of San Francisco. Southwest storm warnings were ordered from San Francisco to Eureka at noon November 18, and a few hours later the warnings were extended southward to Santa Barbara, and advisory messages were sent to Los Angeles and San Diego. By the evening of the 19th rain had fallen as far south as San Diego. A peculiar feature of the disturbance was the excessive rainfall in southeastern California, the valley of the Colorado, and Arizona. In the latter territory rain or snow fell several days, the snowfall in the northern portion being unusually heavy. Light to heavy frosts occurred generally in California on November 25, and subsequent mornings.—*A. G. McAdie, Professor.*

PORTLAND, OREG., FORECAST DISTRICT.

Although wet and stormy the month was not unseasonably

cold. The reports from the new stations at North Head and Tatoosh Island were of great value in giving early information of approaching storms, and no storms entered the district without ample warning having been sent to marine interests. Shipping was badly hampered by gales, but no serious casualties occurred.—*E. A. Beals, 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.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	31, p. m.*	41	124	3, a. m..	37	97	1,500	2.0	750	31.2
II	4, p. m..	53	108	9, a. m..	46	60	3,150	4.5	700	29.2
III	9, p. m..	53	108	11, p. m..	41	72	1,900	2.0	950	39.6
IV	12, a. m..	53	105	13, a. m..	44	100	650	1.0	650	27.1
V	12, a. m..	45	123	13, a. m..	44	100	1,125	1.0	1,125	46.9
VI	14, p. m..	45	118	20, a. m..	42	75	3,400	5.5	618	25.8
	15, a. m..	50	100				2,875	5.0	575	24.0
VII	21, a. m..	47	123	24, a. m..	34	78	2,600	3.0	867	36.1
VIII	24, p. m..	45	123	29, p. m..	41	70	3,500	5.0	700	29.2
IX	28, p. m..	43	103	30, p. m..	39	82	1,750	2.0	875	36.5
Sums							22,450	31.0	7,810	325.6
Mean of 10 paths							2,245		781	32.6
Mean of 31.0 days									724	30.2
Low areas.										
I	1, a. m..	38	105	3, p. m..	48	68	2,000	2.5	800	33.3
II	2, a. m..	51	120	4, p. m..	46	85	1,650	2.5	660	27.5
III	3, p. m..	29	95	7, a. m..	47	65	2,200	3.5	629	26.2
IV	6, p. m..	51	120	8, p. m..	49	86	1,800	2.0	900	37.5
V	10, p. m..	41	112	15, p. m..	48	68	3,275	5.0	655	27.3
VI	12, a. m..	47	96	13, p. m..	45	80	900	1.5	600	25.0
VII	14, a. m..	35	112	18, a. m..	42	80	2,350	4.0	588	24.5
				18, p. m..	35	75	2,550	4.5	567	23.6
VIII	23, p. m..	32	107	28, p. m..	46	60	3,175	5.0	635	26.5
IX	26, p. m..	53	114	30, p. m..	46	60	2,550	4.0	638	26.6
	27, p. m..	38	105				2,450	3.0	788	32.8
Sums							24,900	37.5	7,460	310.8
Mean of 11 paths							2,264		678	28.2
Mean of 37.5 days									664	27.7

*October.

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.

The occurrences of interest in connection with the river work of the month were but three; 1, the formal opening of the New England branch of the River and Flood Service; 2, the floods in the Southwest; and 3, the moderate flood in the upper Sacramento Valley.

The New England River and Flood Service was established at the urgent request of the business interests of that section in the hope that, after a series of observations had been made, some system might be devised whereby warnings of approaching floods, ice gorges, etc., could be given a sufficient time in advance to admit of the removal of property to places of safety, and of the application of any preventive measures that might be found to be practicable. The headquarters of the new service are located at Boston, and following are the names of the stations established; they were selected after a personal inspection of the entire territory and a due consideration for all interests likely to be affected at any time.

PENOBSCOT RIVER.

River stations.	*Rainfall station.*
Mattawamkeag, Me.	Millinocket, Me.
Montague, Me.	
Bangor, Me.	

KENNEBEC RIVER.

River stations.	*Rainfall stations.*
Solon, Me.	Kineo, Me.
Winslow, Me.	Jackman, Me.

MERRIMAC RIVER.

River stations.	*Rainfall station.*
Franklin Junction, N. H.	Plymouth, N. H.
Concord, N. H.	
Manchester, N. H.	

CONNECTICUT RIVER.

River stations.	*Rainfall stations.*
Wells River, Vt.	West Stewartstown, N. H.
White River Junction, Vt.	North Stratford, N. H.
Bellows Falls, Vt.	
Holyoke, Mass.	
Hartford, Conn.	

HOUSATONIC RIVER.

River station.	*Rainfall station.*
Gaylordsville, Conn.	Pittsfield, Mass.

This service will be maintained from November to April, inclusive, of each year, with a special service during the remaining months whenever necessary.

The floods in Texas and in the Red River Valley were due to the persistent heavy rains of the latter half of the month over the territory affected. The great extent of the Texas and Indian Territory floods is not at all indicated by the stages of the water in the larger rivers. They were comparatively, though not extremely, high, the Trinity River leading, but the rains were so frequent and excessive that the whole country became saturated with water. Lakes, ponds, and small streams were entirely filled and overflowed their banks, and the ground became burdened with water. In some portions of the districts affected the rains appear to have been more of a benefit than a detriment, while in others the reverse was true. The greatest sufferers were the railroads. Culverts and bridges were washed away, and many miles of tracks settled in the soft ground, necessitating vexatious delays and frequently the entire abandonment of train service. Some late cotton was ruined and quite a number of cattle were drowned in the bottom lands.

The Red River flood was still increasing at the end of the month, and it will be the subject of a special report in the WEATHER REVIEW for December, 1902.

The flood in the upper Sacramento Valley was caused by the heavy rains of the 8th and 9th. At Red Bluff, Cal., the river was out of its banks on the 9th, and warnings were sent to the lower river points to move stock and portable property to higher ground. The maximum stage reached at Red Bluff was 24.2 feet, 1.2 feet above the danger line. The rise was not prolonged, and by the 13th the water had fallen below the 6-foot mark.

Navigation on the Tennessee River above Florence, Ala., was resumed on the 26th after a suspension of over five weeks. Over the remaining navigable rivers conditions did not materially change.

Very little ice has thus far been reported. At Moorhead, Minn., the Red River of the North was frozen over in places on the 12th, and remained so at the close of the month.

The highest and lowest water, mean stage, and monthly range at 156 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*