

RIVER STATIONS—Continued.

District.	Station.	River.
Philadelphia, Pa.	Mauchchunk, Pa.	Lehigh.
	Phillipsburg, N. J.	Delaware.
	Port Jervis, N. Y.	Delaware.
	Reading, Pa.	Schuylkill.
	Trenton, N. J.	Delaware.
St. Louis, Mo.	Arlington, Mo.	Gasconade.
San Francisco, Cal.	Colgate, Cal.	Yuba.
	Knights Landing, Cal.	Sacramento.
	Riovista, Cal.	Sacramento.
Shreveport, La.	Kiomache, Tex.	Red.
	Springbank, Ark.	Red.
	Whitecliffs, Ark.	Little.
Vicksburg, Miss.	Greenwood, Miss.	Yazoo.
	Swanlake, Miss.	Yazoo.
Portland, Oreg.	Bonners Ferry, Idaho.	Kootenai.
	Harrisburg, Oreg.	Willamette.
	Jefferson, Oreg.	Santiam.
	McMinnville, Oreg.	Yamhill.
	Newport, Wash.	Pend d' Oreille.
	Pasco, Wash.	Columbia and Snake.
	Tualitin, Oreg.	Tualitin.

RAINFALL STATIONS.

District.	Station.	Watershed.
Augusta, Ga.	Anderson, S. C.	Savannah.
Cairo, Ill.	New Athens, Ill.	Kaskaskia-Mississippi.
Charleston, S. C.	Catawba, S. C.	Catawba-Santee.
	Enoree, S. C.	Broad-Santee.
	Pelzer, S. C.	Saluda-Santee.

RAINFALL STATIONS—Continued.

District.	Station.	River.
Cincinnati, Ohio.	Ivanhoe, Va.	New-Ohio.
	Pikeville, Ky.	Big Sandy-Ohio.
Columbus, Ohio.	Lima, Ohio.	Maumee.
	Upper Sandusky, Ohio.	Sandusky.
Fort Smith, Ark.	Marion, Kans.	Neosho-Arkansas.
Grand Rapids, Mich.	Jackson, Mich.	Grand.
Keokuk, Iowa.	Mount Pleasant, Iowa.	Skunk-Mississippi.
La Crosse, Wis.	Black River Falls, Wis.	Black-Mississippi.
	Peterson, Minn.	Mississippi.
Memphis, Tenn.	Dyersburg, Tenn.	Mississippi.
Montgomery, Ala.	Dadeville, Ala.	Alabama.
Nashville, Tenn.	Walling, Tenn.	Cumberland.
Parkersburg, W. Va.	Smithfield, W. Va.	Ohio.
Philadelphia, Pa.	Griffin Corners, N. Y.	Delaware.
Raleigh, N. C.	Louisburg, N. C.	Tar.
	Randolph, Va.	Staunton-Roanoke.
	Randleman, N. C.	Cape Fear.
	Rocky Mount, N. C.	Tar.
Richmond, Va.	Covington, Va.	James.
	Glasgow, Va.	James.
	Howardsville, Va.	James.
St. Louis, Mo.	Albany, Mo.	Grand-Missouri.
	Osceola, Mo.	Osage-Missouri.
	Trenton, Mo.	Grand-Missouri.

The highest and lowest stages, together with the annual ranges at selected stations, are given in Table VII.—*H. C. Frankenfield, Professor.*

REPORT OF THE CHIEF OF THE WEATHER BUREAU FOR THE FISCAL YEAR ENDING JUNE 30, 1904.

[Reprinted from the report of the Secretary of Agriculture, October, 1904.]

I have the honor to submit a report of the operations of the Weather Bureau during the fiscal year that ended June 30, 1904.

FORECAST DIVISION.

PRACTICAL VALUE OF FORECASTS AND WARNINGS.

Weather forecasts for thirty-six and forty-eight hours in advance have been made daily throughout the year for each State and Territory, and special warnings of gales on the seacoasts, Gulf, and Great Lakes, and of cold waves, frost, heavy snows, floods, etc., have been issued when the advices were calculated to benefit commercial, agricultural, and business interests. The North Atlantic and West Indian storm-warning service was continued, and forecasts for steamers bound for European ports for the first three days out were issued daily at 8 a. m. and 8 p. m. In a number of instances European shipping interests were notified of the character and probable course of severe storms that were passing eastward from the American coast.

A WEST INDIAN HURRICANE.

The first important tropical storm of the year moved from the Windward Islands of the West Indies over the Caribbean Sea and the Gulf of Mexico from August 8 to 15, 1903. The vortex of this storm passed over or near the island of Martinique during the night of the 8th-9th, reached Jamaica on the morning of the 11th, crossed the Cayman Islands during the evening of the 11th, advanced over northern Yucatan on the 13th, and apparently dissipated on the Mexican coast of Tamaulipas during the 15th. Except during its passage over Jamaica the center of this hurricane did not come within the region of observation. Beginning with the first indications of its appearance near the Windward Islands, however, shipping interests and West Indian stations were advised daily regarding its character and probable course. At Kingston, Jamaica, the barometer fell to a minimum of 28.80 inches, and on the island the losses to owners of banana plantations were estimated at more than 500,000 pounds sterling, and the destruction to houses, property, and plantations was appalling. At Grand Cayman Island a minimum barometer reading of

28.30 inches was recorded in the harbor of Georgetown, and of 23 vessels in the harbor but one was saved. Every tree or plant on the island was either blown away or had its leaves and small branches stripped off, crops were entirely destroyed, and about 200 houses were blown down or unroofed. Reports from vessels that encountered the storm in the Gulf of Mexico show that it diminished rapidly in intensity after passing westward from the Caribbean Sea.

VESSELS SAVED FROM A BAHAMA STORM.

In September, 1903, two storms of marked intensity advanced from the subtropical region north of the West Indies to the Atlantic coast of the United States. The first of these storms appeared over the Bahamas on the morning of the 10th, advanced north of west over the southern point of Florida by the morning of the 12th, moved northwestward over the eastern part of the Gulf of Mexico during the 12th and 13th, after which it diminished in intensity and finally dissipated over the South Atlantic States. At Nassau, New Providence Island, Bahamas, the wind reached an estimated velocity of 90 miles an hour, and at Cat Bay, Bahamas, a minimum barometer reading of 28.30 inches was reported. During its progress over Florida and the Gulf, the storm destroyed property to the value of \$100,000 from West Palm Beach to Miami, Fla., and nine lives were lost by the stranding and breaking up of the British steamer *Inchulva* at Delray. The steamer and cargo were valued at \$350,000. Other marine losses amounting to about \$20,000 were reported on the eastern Florida coast. At Tampa, Fla., the barometer fell to 29.42 inches, the wind blew in squalls at a rate of 50 to 60 miles an hour, buildings were destroyed or damaged to the extent of about \$200,000, and great havoc was wrought in the orange groves of the surrounding country.

The warnings and advices issued in connection with this storm permitted all possible precautions to save exposed property, and comparatively little damage was caused to vessels.

Mr. C. E. Garner, president of the Jacksonville Board of Trade, has written as follows regarding the warnings:

I wish to express my appreciation of the timely warnings given by the Weather Bureau both at this point and at Tampa during the recent West Indian hurricane. They were especially valuable at Tampa, as I have steamers operating from that point to Manatee River and Terra Cela Bay points, and the notice we had from the Weather Bureau prevented our leaving port on Saturday, the 12th. The observer at Tampa kept us fully advised as to the situation there, and his warnings to vessels not to leave port, in my judgment, prevented serious disasters. I think it is very fortunate for the agricultural and shipping interests of this State that we have such an efficient service of the Weather Bureau, and that the service is in the hands of such capable and accommodating officials.

The Tampa Evening Herald of September 15 comments editorially regarding the storm, and says, in part:

Too much credit for the saving effected can not be given to the Weather Bureau, and it is the intention of this article to direct public attention seriously toward one of the most valuable of the Government branches in this city.

The Weather Bureau observer at Jacksonville, Fla., reports that there is no doubt that a large amount of property and a number of lives were saved by the timely display of the storm warnings. During the displays ten vessels, the approximate value of which was one-quarter of a million dollars, remained in port at Jacksonville, and three vessels, valued at \$135,000, at Fernandina. Sponge and fishing vessels, valued at nearly \$200,000, and employing hundreds of men, remained in ports along the Florida coast, and the display of warnings undoubtedly saved many of these vessels and their crews. The observers at Tampa and Pensacola gave the widest possible distribution of the warnings, and state that they were, as usual, well heeded.

On September 16 a severe storm of small area advanced from the Atlantic Ocean and moved northward along the middle Atlantic coast, causing the loss of a number of lives and some destruction of crops and seaside property. Owing to the unusual character and course of this storm its indications did not result in a display of warnings until the morning of the 16th.

WARNING OF PACIFIC COAST GALES.

The severest storm of the year on the Pacific coast occurred on the night of March 9-10, 1904, when barometric pressure was below 29 inches on the Washington and Oregon coasts. The gales that attended this storm were severe from British Columbia to San Diego, Cal., and heavy rain fell in the coast districts and heavy snow in the mountain regions of the North Pacific States.

The Humboldt Standard, Eureka, Cal., of March 10, 1904, remarks as follows regarding the work of the Weather Bureau in connection with this storm:

One of the most violent storms that ever occurred on the coast of northern California was heralded yesterday morning by the display of southeast storm warnings at the local Weather Bureau station. The warnings were ordered up by District Forecaster McAdie twelve hours before the storm struck this city. All of the shipping in the bay having ample notice from the Weather Bureau, there was no damage to vessels, all shipping being securely tied up, with no vessels at anchor.

SPECIAL FORECASTS OF SNOW.

The following are some of the special snow warnings that, in addition to the regular forecasts, were issued for the benefit of transportation interests:

January 2, 1904: Snow will be heavy in the interior of New York and New England this afternoon and to-night, with high northeast shifting to northerly winds.

January 26, 1904: Heavy snow indicated for the interior of New York and New England during the next twenty-four hours, with high southerly shifting in New York to much colder northwest winds to-night.

April 15, 1904: Heavy snow and high easterly shifting to northerly winds indicated for the lower Lake region to-night.

SAVINGS BY COLD-WAVE AND FROST WARNINGS.

The following comments have been made regarding cold-wave and frost warnings:

[The Daily Picayune, New Orleans, La., November 19, 1903.]

Sugar planters have been warned by the Weather Bureau to prepare for temperatures as low as 25°, and reports received seem to indicate that

they are acting in accordance with the warnings, and protecting the cane crop. A temperature of 25° so early in the season would damage the cane crop to the extent of millions of dollars unless protection is accomplished. Since sugar cane grows richer in sugar content with every day that it is allowed to grow, many planters cut their cane only as fast as they can manufacture sugar. In some seasons grinding is completed without a freeze, and the cane harvested at the close of the season gives much greater production than that harvested at the opening. With a feeling of certainty that he will be warned by the Weather Bureau of an approaching freeze in time to enable him to protect his crop, the planter lets his cane grow until warned by the United States Weather Service to protect his crop. The Weather Bureau has in the past saved millions of dollars to the sugar planter, for there has not been a freeze in recent years but what the lowest temperature which occurred has been announced in warnings issued twenty-four to thirty-six hours in advance of its occurrence.

[Savannah News of January 7.]

When the first intimation of the cold wave's approach was received at the Weather Bureau word was at once sent to florists and they were warned to have their fires up. These were immediately started, and when the wave reached here flowers were well protected.

[The San Francisco Call of January 20, 1904.]

Reports to-night from correspondents stationed throughout the orange districts of southern California are to the effect that the frost this morning did little damage to the citrus crop, which is now practically ready for market. Having received special warnings from the Weather Bureau, hundreds of ranchers resorted to smudging this morning, and thereby removed all danger to their crops.

[The San Francisco Chronicle of March 20, 1904.]

The farmer shares equally with the merchant the advantages of Weather Bureau warnings, and every year this service increases in efficiency and value. Many millions of dollars have already been saved by the fruit growers of California by timely warnings sent out, enabling citrus growers to protect their crops against frost, and the raisin, prune, and apricot growers to stack their trays of drying fruit before overtaken by rain.

[The Daily States, New Orleans, La., March 4, 1904.]

The warnings of the United States Weather Bureau were, as usual, timely and accurate, and they enabled the protection of berry crops and truck gardens, and have thus saved thousands of dollars to the farming interests.

[The Advertiser, Montgomery, Ala., March 5, 1904.]

The Weather Bureau's warning saved many thousand young cabbages and tomatoes which were exposed in cold frames, almost ready to transplant, and which would have been killed had warnings not been received. This item of benefit from the Bureau's warnings means \$50,000 or more to the truckers of this section. Had these young plants been killed, an entire new crop of early sets would have had to be started, which would make the vegetables too late to command lucrative prices in the Northern markets. The warning, verified to the degree, was far enough in advance to be of great benefit.

RIVER AND FLOOD SERVICE.

PROGRESS IN WORK AGAINST ICE PACKS AND FLOODS.

Happily the floods of the year did not nearly approach in character and importance the great overflows of the spring of the year immediately preceding, with their destruction of over 100 human lives and property valued approximately at over \$40,000,000. There were, nevertheless, severe floods at various times, and in the management of the work occasioned by them the river and flood service continued to demonstrate its usefulness and growing efficiency as a valuable branch of the Weather Bureau. That there has been a constant increase in the accuracy of its work is evidenced by the more specific and detailed character of the forecasts and warnings in localities where such refined work had heretofore been considered practically impossible. The service performed during the prevalence of the great winter ice gorges in the Susquehanna, Allegheny, and Ohio rivers, with their attendant floods, was especially noteworthy. These gorges were the greatest in the history of the localities, and that their great dangers were minimized is due in no small degree to the timely advices and warnings of the Weather Bureau.

There were minor floods during nearly every month of the year, but each was amply covered by timely warnings. These floods were not in any sense alarming or dangerous, but they nevertheless attained sufficient importance to endanger a large amount of property, which without the benefit of the Weather Bureau advices and warnings would have been totally lost.