

U. S. DEPARTMENT OF AGRICULTURE.

REPORT

OF THE

CHIEF OF THE WEATHER BUREAU

FOR

1893.

BY

MARK W. HARRINGTON.

FROM THE REPORT OF THE SECRETARY OF AGRICULTURE FOR 1893.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1894.

National Oceanic and Atmospheric Administration Report of the Chief of the Weather Bureau

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REPORT OF THE CHIEF OF THE WEATHER BUREAU.

SIR: I have the honor to transmit herewith a report on the work of the Weather Bureau during the year 1893.

Very respectfully,

MARK W. HARRINGTON,
Chief.

Hon. J. STEELING MORTON,
Secretary.

WORK OF THE YEAR.

During the current year the work of the Bureau has been carried on successfully and the expenditures kept well within the appropriations. The reduction in total cost of maintenance is about 10 per cent, and the estimates for the present fiscal year have been correspondingly reduced, with the confident expectation that, while more economically administered, the service will lose nothing of its value to the public nor have its efficiency impaired.

REORGANIZATION OF BUREAU FORCE—RESULTS.

A general reorganization of the Bureau, however, has been effected, with the satisfactory result of eliminating discordant elements, systematizing the work, and establishing harmonious and concerted efforts to increase the value of the service to the public. This readjustment added largely to the labors and responsibilities of certain divisions without corresponding increase of working force. In order to afford all proper guaranty of success and honesty in the disbursement of funds and care of property, important changes were made in the purchasing and disbursing divisions, the general effect of which is to have all matters relating to property and funds receive the indorsement of two independent officers.

In January, 1893, the entire force of local forecast officials and observers was brought within the classified service by Presidential order, and since that date all appointments to such force have been made through the Civil Service Commission. While 19 persons have been separated from the classified station force during the period covered by this report, but three requests have been made for certifications during the same period. This, of course, has somewhat embarrassed the service in its general station work; yet in furtherance of the policy of the Bureau to reduce the station force to the smallest possible number consistent with efficiency, every effort has been made, by a judicious placing of the present force, to maintain the high standard of station work.

The purely executive work of the Bureau, heretofore occupying the attention of a separate and distinct division of the office, has been added to the duties of the chief clerk; other work not considered executive has been subdivided and variously assigned to the proper branches of the office. This change has not only resulted in the discontinuance of the "executive division," but has also permitted a more satisfactory conduct of the business of the office.

DIVISIONAL DUTIES AT THE CENTRAL OFFICE.

The work of the central office is at present subdivided as follows:

Chief Clerk's Office.—Under the immediate supervision of the chief clerk. Herein are performed the usual duties of the chief clerk as prescribed by the statutes, and all work pertaining to the general management of stations, general correspondence, the supervision of printing and publications, and the direction of the captain of the watch and the force on duty under him.

Forecast Division.—Under the immediate supervision of the assistant chief of Bureau. Twice a day the reports received in cipher are charted on the daily weather map. This division has charge of all forecasting, exercising general supervision over the work of all local forecasters. Subdivisions of this division are river and floods section, the telegraph room, storm signal stations, and lake marine service.

Records Division.—Under the charge of a clerk of class 4. Examines and checks all meteorological forms, computes normals for use in the forecast division, and prepares the data used in the Monthly Weather Review.

Accounts Division.—In charge of a clerk of class 3, acting as assistant disbursing officer. Has in charge the disbursement of all funds appropriated for the Bureau.

Supply Division.—Is charged with the purchase of all supplies necessary for the work of the Bureau, the supervision of contracts and the issue and transportation of supplies, and the checking of property returns showing the accountability of observers for public property.

State Weather Service Division.—Has sole charge of all matters pertaining to the selection and equipment of voluntary stations and the distribution of temperature and weather signals.

Publications Division.—Is, as its name implies, concerned with the publication, issue, and distribution of all weather maps, special circulars, reviews, bulletins, and miscellaneous printed matter.

Instrument Section.—Attends to the standardizing and maintenance of the instrumental equipment of stations.

The Library.—Consists of nearly 15,000 books and nearly 5,000 pamphlets. The bibliography of meteorology comprises more than 65,000 titles.

The Monthly Weather Review.—Contains tabulated statements of meteorological conditions for the period of one month, and also serves as a means of acknowledgment of the reports of some 2,500 voluntary observers in the United States, a copy of the Review being furnished each observer.

In all, 183 persons, when the rolls are full, are employed in the Bureau at Washington. Three of this number (the inspectors) are, however, employed the greater portion of their time away from Washington. To perform the scientific and clerical duties, 107 persons are necessary; 92 of these are in the classified service.

FORECAST OFFICIALS AND OBSERVERS.

At the present date the regular (classified) observing force of the Bureau consists of 30 local forecast officials, at \$1,500 each per annum, and 269 observers, at salaries ranging from \$600 to \$1,400 per annum. In addition to this force there are employed 4 persons (telegraph operators, etc.) who are not regular observers, but whose duties involve one or more observations daily.

The number of local forecast officials is limited by law, and the present number is far below that needed. The value of these officials to the local interests of the communities in which they are serving is well known and highly appreciated, as shown by the increasing demand for such services.

In addition to the force of local forecast officials and observers a number of stations are employing messengers and special (temporary) assistance. In many cases these employees, whose monthly compensation averages about \$25, are hired for a portion of the year only—that is, for the busier season of the year. It is intended to gradually lessen the number of persons thus employed; and to this end the services of 28 have been discontinued during the present year, while a further reduction is contemplated.

It is gratifying to state that within the past year there has been a very thorough readjustment and equalization of salaries of the general observing force. The transfer of these men from the Department of War to the Department of Agriculture brought with it a complicated and unclassified pay account, incident to the military rank, station, and other conditions governing this force while it was serving as an enlisted corps. The introduction of a classification more in harmony with that of a civil branch of the public service, with a limited appropriation, was a difficult task to accomplish; but the classification, as finally agreed upon and now in operation, is, in the main, quite satisfactory and involves but 9 grades of pay, as against 42 under the old system.

Experience has demonstrated that military management and discipline are not essential to an efficient weather service, and it is gratifying to report that the present civilian management has found no difficulty in maintaining the necessary stations at the most isolated points. The employees of the Weather Bureau, with very few exceptions, have performed their duties with absolute promptness and fidelity, and to the faithful and intelligent execution of the arduous labors of the observing force must, in the largest measure, be ascribed the high standard of efficiency which has been attained by the national weather service.

OBSERVING STATIONS.

There are at present in operation 156 regular (paid) stations of the Bureau. During the current year 3 new stations were established at a moderate cost, while 14 were discontinued as useless for the purposes of the Bureau, thus effecting a material reduction in the general expenses of the service.

Of the 156 stations now in operation, 60 are located in rooms furnished free of cost to the Bureau for occupancy (47 in Government buildings and 13 in buildings owned by corporations or individuals), while 96 are located in quarters for which rent is paid from the funds of the Bureau.

The importance of the regular inspection of the observing stations of

the service can not be overestimated. These inspections involve a close scrutiny and report upon the general work of the stations of the Bureau; an examination into the exposure of the meteorological instruments; the preparation and dissemination of forecasts, maps, bulletins, etc.; the care and safety of public property; the conduct and value of services rendered by the personnel of the observing force, etc.

Seventy stations have been inspected during the present calendar year.

The meteorological work pertaining to the Pacific coast has continued to receive the attention due to this important section. Every effort has been made to increase the usefulness of the service there. It is hoped at some date in the future to have an official of high rank stationed in San Francisco in addition to the local forecast official.

This service continues to send daily cablegrams to the French meteorological bureau at Paris, containing marine data obtained from the logs of incoming vessels, the position of areas of highest and lowest pressure in the United States, and data from two selected stations in the Canadian maritime provinces.

BUREAU EXHIBIT AT WORLD'S FAIR.

The official in charge of the instrument room was assigned as special agent in charge of the Weather Bureau exhibit at the World's Columbian Exposition. The exhibit aimed to set forth all the characteristic features of the work of the Bureau. The general climatic conditions of the United States were shown in a series of 42 finely executed normal charts, compiled from the long series of observations in possession of the Bureau.

The complete work of receiving telegraphic weather reports and the preparation of daily forecasts of the weather therefrom was fully shown and illustrated by the actual preparation and printing, lithographically, of a morning weather map for distribution among the visitors.

In addition to these features there were exhibited, in continuous and actual operation, each of the instruments used by the Bureau in procuring automatic records of the weather conditions; also many other typical instruments employed by meteorologists in general.

During the time the exhibit was open to the public, experienced employees of the Bureau were always on duty to give verbal explanation to visitors respecting all the details of weather forecasting, the operation of instruments, and all other points connected with the work of the Bureau. By this personal attention to those interested it was possible to impart to a very large number of people correct ideas of the real work being done by the Bureau, and this information excited the highest appreciation on the part of visitors, many of whom expressed themselves to that effect in the most emphatic way.

INTERNATIONAL METEOROLOGICAL CONGRESSES.

The Official International Congress of Meteorologists, which it was hoped would have been held at Washington in August, had to be abandoned, owing to causes which need not be given in detail here. As a substitute therefor a congress of meteorologists was held at Chicago August 21 to 24. Many papers of great importance were presented from the leading meteorologists of the world, making a valuable contribution to the science of meteorology. The Bureau has undertaken to publish these memoirs, and copies will be duly distributed to authors and public libraries.

At the International Meteorological Congress held at Munich, August, 1891, an international meteorological committee was appointed, with a representative from each of the leading meteorological services of the world. The Chief of the Weather Bureau is one of the members of this committee. It is the prime object and purpose of this committee to make the work of the different meteorological services as uniform as practicable and to promote coöperation among the various services on all important questions. A communication from the chairman of this committee, Dr. H. Wild, of St. Petersburg, recently received, proposes a meeting of the committee at some central point in the summer of 1894. At this meeting will, in all probability, be discussed the general subject of agricultural meteorology, in accordance with the propositions of Messrs. Wild and Harrington at the Munich conference; also the matter of a more complete and uniform method of observing clouds.

SEASONAL FORECASTS.

The subject of seasonal forecasts has not heretofore been considered profitable for discussion, but an attempt which has been made within the past two or three years by the meteorological service of India in this direction indicates a path by which useful results can perhaps be reached. This matter is receiving the careful attention of the Bureau, and when it is believed that predictions of this sort can be made of value, the attention of the scientific force will be directed to the subject with the hope of improving the forecasts.

Prof. Bigelow continues his studies of magnetism with sufficient prospect of success to justify the time and labor expended.

DEATHS BY WIND AND LIGHTNING.

Statistics showing deaths by high wind and lightning have been prepared as in former years. The loss of life by wind storms has been very great as compared with other years, the number of deaths from that cause during the last four years being as follows: 273 in 1890, 108 in 1891, 190 in 1892, and 399 in 1893. The loss in March and April of the past year was especially great—96 and 174, respectively, or more than 67 per cent of the whole.

ADVISABILITY OF EXTENDING THE FIELD OF OBSERVATION.

In the Monthly Weather Review opportunity has been taken to explain how the movements of the atmosphere, with its storms, cold waves, frost, etc., illustrate the mechanical processes involved. This review contains a running series of notes and explanations intended to throw such light upon atmospheric phenomena as must eventually improve our methods of weather prediction. The conclusion, long since derived from other sources, that the area covered by our daily map is too small to allow of sufficiently comprehensive studies, is now again confirmed, and every means should be taken to extend the map so as to cover Mexico, the West Indies, and Central America on the south, and to extend as far north as possible into Alaska and the Aleutian Islands and west to the Hawaiian Islands.

YEARLY VOLUME OF METEOROLOGICAL DATA.

A very important work of the year, so far as the results affect the general public, was the preparation of the manuscript for the yearly volume

of meteorological data, authorized by the concurrent resolution of Congress, dated February 19, 1893. The volume, consisting of 528 quarto pages, has since been printed, but has not yet been received from the binder. It contains the results of meteorological observations during 1891 and 1892 from upwards of 2,000 stations, and has already proved of importance and value in the work of the office as well as to students and others seeking information as to the climatic conditions which obtain in the various sections of the country.

RECOMMENDATIONS.

Attention is invited to the necessity of a closer coöperation with the weather services of Mexico and the Bahamas. The need of full telegraphic reports from the latter was clearly shown very recently. The disastrous hurricane of August 28 emphasized unfortunately but too well the value of telegraphic communication with the stations in the West Indies.

In connection with the storm of October 2-5, 1893, there arose in the public press some comment as to the inability of this Bureau to give warning to communities on the Gulf coast. A year ago, when in Mexico, the chief made arrangements with the director of the Central Meteorological Observatory to have an international exchange of telegrams on terms similar to those in operation between the United States and Canada; the Mexican service to deliver without expense to our agent at the nearest point certain data and receive a return in kind. Negotiations have, therefore, been resumed looking to a full and free interchange of meteorological information.

The suggestion is also made that a more efficient and satisfactory distribution of railway forecasts could be made if the postal clerks on mail trains were intrusted with the display of signals and made responsible therefor. This would require very little time on the part of the clerks, and the expense to the Bureau would be reduced to a minimum.

Uniformity in publication and distribution of the reports of the State weather services is also a matter to which attention is respectfully invited. It is much to be desired that the various bulletins be uniform in appearance, and that each State should appropriate a sufficient amount to cover the cost of publication. The observer should not be compelled, as now, in some cases, to print as a private enterprise. It is possible that some plan of coöperation between this Bureau and the States in the matter of printing the reports might be adopted to secure general and uniform publication.

Attention is invited to the existing civil service regulation which permits the transfer of clerks from one Department of the Government to another. When such a transfer is made solely with reference to the work to be performed, it may be advantageous to the public interests; but such is not usually the case, and it is generally a disadvantage. By the operation of this rule it is possible for an employee of any Department to secure transfer to another branch of the departmental service, provided he may secure the consent of the head of the Department to which such transfer is to be made. Almost invariably, it is believed, such consent is obtained whenever sought, and frequently through the personal efforts of the influential friends of the employee. The result is that an employee whose services for years have been devoted to a particular class of work in a certain Department or Bureau (and whose value to that Department or Bureau is relatively great) secures a "transfer," leaving a branch wherein he is experienced and

valuable to assume untried duties in a Department or Bureau whose appropriations permit it to offer him advantages in a pecuniary sense. If the employee is worth more money he ought to be able to secure it, if anywhere, in the Bureau where he can render the most valuable service; and where his superiors can not so reward him, it is due to the inelastic system which now prevails, and which is so discouraging to legitimate ambition and individual effort.

In view of the present faulty and unsatisfactory system of filing the correspondence of the office, plans for an improvement therein have received due consideration, and in another paper suggestions have been made for simplifying this work. At present there are five or six different files of letters, and it is proposed to reduce this number to at most two files.

The present locations of inspectors (Nashville, Boston, and Detroit) not only render the movements of these officials expensive, but necessitate delays in inspection of stations at distant points. Therefore it has been suggested to the Secretary of Agriculture, with a view to economy, that the country should be divided into three inspection districts: (1) The lakes, New England, and Middle-Atlantic States; (2) including the central valley to the Rocky Mountains; and (3) to include stations west of the Rocky Mountains; placing an inspector at a central point in each of the three districts.

FORECASTS.

THE DAILY WEATHER MAP.

The daily weather map is now issued at 72 stations of the Weather Bureau outside of Washington, D. C., the issue on November 1, 1893, being 8,867 copies, or over 2,500,000 copies annually.

These maps, showing the weather conditions of to-day and the probabilities for the morrow, are given the widest possible circulation with the means at hand. As a means of disseminating forecasts and the weather conditions which obtain over a large area of country, the map is much superior to any process yet devised; there is this objection, however, viz, that in its present form it does not reach the masses. The ideal system of distributing the information collected by the Bureau is one which would place the daily weather map in the hands of the reading public at an early hour, through the daily press or other medium. It is believed that present efforts should be directed towards the reproduction of a legible map in the daily papers, which shall contain the forecasts and such other climatological data as may be of importance to the community in which the paper is printed. Efforts in this direction have been made heretofore and with great success for a limited period, but in some cases the ground thus gained has been lost through causes beyond the control of the Bureau. Rivalry has not only aided in the publication of maps in the daily papers, but in many cases it has been the cause of discontinuing them. Recent efforts to secure the publication of the maps in large dailies under a contract seem to warrant the belief that if the publication can be made exclusive it can be done for a nominal sum. The importance of the subject warrants careful consideration.

There has been but little change in the number of stations issuing maps and bulletins since last report, but it has been possible to secure the material and supplies now used in such work at greatly reduced prices as compared with those of last year, thus enabling the Bureau

to maintain its large daily issue with less expenditure of money than ever before.

Minor improvements in the mechanical details of map-making are being constantly suggested to the officials charged with this important duty.

OFFICIAL RATINGS.

While official ratings continue to be taken and are found to be guides to the chief of the forecast division and the prosecution of the work, and while the present ratings are in nowise inferior to previous ratings, yet it has become so clearly evident that these percentages are not true exponents in every respect of the success of the forecasts, and as they unquestionably limit the freedom of the forecaster in his arduous and hurried work, the policy of the office this year has been to encourage the forecasters to make their forecasts with more freedom, keeping less in mind their ratings than the satisfaction of the public. This, it is believed, has had a useful effect, in that it has rendered the forecasts more intelligible to the public, leaving the forecaster, as it necessarily does, more free to express his own estimate of the approaching weather conditions. The official ratings for 1893 are given in Tables I, II, III, IV, and V, which follow:

TABLE I.—Percentages of verifications of 8 p. m. 24-hour forecasts for the year ending December 31, 1893.

States.	January.			February.			March.			April.		
	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.
Maine	92.3	71.0	84.1	89.6	94.3	91.5	78.4	95.5	85.2	86	77.3	82.5
New Hampshire	86.1	76.5	82.3	91.1	90.4	90.3	86.5	93.9	89.5	89	84.7	87.3
Vermont	83.5	74.2	79.8	94.6	82.5	89.2	90	91.9	90.8	91	86	89
Massachusetts	85.5	84.5	85.1	92.9	92.9	92.9	85.2	83.9	84.7	83.3	90.3	86.1
Rhode Island	80	85.5	82.2	92.9	87.5	90.7	84.5	87.1	85.5	83	92.3	86.7
Connecticut	89.2	88.7	85.4	92.9	94.6	93.6	84.5	86.5	85.3	78.7	87	82
Eastern New York	90.3	87.4	89.1	89.6	96.4	92.3	89	77.7	84.5	88	81	85.2
Western New York	88.2	95.5	88.1	92.5	91.1	91.9	91	79	86.2	82.3	80	81.4
Eastern Pennsylvania	84.8	95.2	89	88.6	88.6	86.6	94.6	75.8	87.2	87.3	89.7	80.3
Western Pennsylvania	73.5	95.2	82.2	86.4	86.8	86.6	91.6	82.6	85	77.7	80.7	78.9
New Jersey	87.4	96.1	90.9	87.9	91.1	89.2	93.9	82.3	89.3	89.7	82	86.6
Delaware	84.2	94.2	88.2	86.8	92.9	89.2	97.1	86.5	92.9	80	72.7	77.1
Maryland	70.4	89.7	83.5	84.3	93.9	88.1	87.1	82.9	85.4	78.3	70.7	75.3
District of Columbia	81.6	78.4	80.3	86.8	90.4	88.2	90.3	83.9	87.7	80	66.7	74.7
Virginia	80.3	86.5	82.8	82.1	88.6	84.7	88.1	77.7	83.9	83.7	75	80.2
North Carolina	84.5	76.8	81.4	85.2	84.3	85.6	84.5	87.7	85.8	82.3	76.3	79.9
South Carolina	92.9	73.9	85.3	80.7	73.6	77.9	83.9	89.7	86.2	86.7	80.7	84.3
Georgia	95.8	76.1	87.9	80.4	78.9	79.8	87.4	92.6	89.5	82	85.3	84.5
Eastern Florida	88.4	80.6	85.3	87.9	88.2	89	89.4	90.3	89.8	80.3	93.7	85.7
Western Florida	90.4	82.6	82.7	71.4	82.1	75.7	88.7	91	88.6	86	96.7	90.3
Alabama	92.9	86.5	86.3	78.6	65	73.2	81	91	85	85.3	90.7	87.5
Mississippi	87.1	86.5	86.9	73.2	80.7	76.2	75.2	80	80.7	90	89.3	89.7
Louisiana	82.9	86.8	84.5	73.6	76.4	74.7	84.5	83.2	83	85.8	90.7	87.5
Texas	83.2	77.7	81	80	87.9	83.2	89.7	80.7	89.7	87.3	81.7	85.8
Arkansas	81.3	66.8	75.5	80.7	87.1	83.3	82.3	81	81	87.7	86.7	87.0
Tennessee	90.3	72.9	83.3	82.5	85.7	83.8	80	84.8	87.9	79	78.7	78.9
Kentucky	75.8	74.5	75.3	84.6	91.1	87.2	91.6	82.6	88	86.3	85.7	86.1
Ohio	79.7	82.3	80.7	88.2	82.9	87.1	89.4	75.8	82.4	76.3	75.3	76.1
West Virginia	67.7	87.1	75.5	82.9	92.9	86.9	85.5	81.3	83.8	75.7	84.8	80.1
Indiana	77.1	70.8	77	88.6	84.3	85.9	92.9	83.5	89.1	83.3	81	82.4
Illinois	77.1	77.7	77.3	91.4	86.1	89.3	90.3	85.5	88.4	78.7	82	80
Lower Michigan	80.3	65.8	74.5	85.7	90.4	87.7	87.1	87.1	87.1	84	93.3	87.7
Upper Michigan	78.1	81	79.3	78.2	76.8	77.6	78.2	89	79.5	82.7	91	86
Wisconsin	77.1	75.2	76.3	89.6	72.9	82.9	90	91.9	90.5	75.3	77	76
Minnesota	70	75.5	77.0	83.0	81.5	83.1	85.2	88.1	88.4	67	74.7	71.7
Iowa	79	86.5	82	91.4	80.7	87.1	87.4	86.8	87.2	79.7	82	80.6
Kansas	90.6	65.5	80.4	86.4	82.1	84.7	79.4	70.3	75.8	65.3	69.3	78.9

TABLE I.—Percentages of verifications of 8 p. m. 24-hour forecasts for the year ending December 31, 1893—Continued.

States.	January.			February.			March.			April.		
	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.
Nebraska.....	89.7	81.8	86.3	95.7	82.1	90.3	84.2	70.6	78.8	88.3	78.3	84.3
Missouri.....	80.6	80.8	80.5	92.1	83.6	88.7	83.3	81.8	80.7	78.7	76	77.6
Colorado.....	88.7	84.8	79.1	84.6	84.6	84.6	85.8	73.5	79.5	90.8	86.7	88.6
North Dakota.....	82.9	75.5	79.9	77.9	86.4	81.3	78.7	77.1	78.2	80	89	83.6
South Dakota.....	84.2	82.9	87.7	97.5	81.4	91.1	82.6	71.9	78.8	78	85	80.8
Average.....	82.8	80.8	82.7	86	85.5	85.8	86.4	84.1	85.5	82.9	82.5	82.7
States.	May.			June.			July.			August.		
	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.
Maine.....	84.8	78.7	82.4	74	61.3	69.9	81.3	71	77.2	88.7	65.8	79.5
New Hampshire.....	87.1	84.2	85.9	74.7	80	76.8	74.2	71	72.9	86.5	85.5	78.1
Vermont.....	83.9	88.7	85.8	77.7	79	78.2	67.7	75.8	70.9	84.8	86.1	77.8
Massachusetts.....	91	89.9	88.2	87	75	82.2	68.1	75.8	71.2	87.4	82.9	77.6
Rhode Island.....	87.1	84.5	86.1	77.7	75	76.6	81.9	77.7	80.2	80.7	71	82.2
Eastern New York.....	86.1	82.6	84.7	87.3	74.7	82.3	80.8	70.5	78.3	88.7	64.3	79.1
Western New York.....	89.7	83.9	91.4	85.7	82.3	84.3	82.9	75.2	79.3	81.9	87.1	78
Eastern Pennsylvania.....	84.5	80.3	82.6	87.7	79.3	84.3	80.1	74.5	81.5	82.3	79	81
Western Pennsylvania.....	90.6	92.5	91.8	91.3	81.7	88.7	81.3	78.4	80.1	73.2	80.6	68.2
Western Pennsylvania.....	78.4	84.5	80.1	88.7	75.7	83.5	73.5	68.4	71.5	73.9	79.7	76.2
New Jersey.....	88.9	88.7	91.3	95	79.3	88.7	85.2	83.2	84.4	64.2	62.9	68.7
Delaware.....	93.5	95.2	94.2	93.3	85	90	84.8	87.1	85.7	68.7	87.7	68.8
Maryland.....	93.9	92.3	93.3	92.7	81.3	88.1	81	80.3	80.7	69.4	63.5	67
District of Columbia.....	85.8	88.7	86.3	88.7	80	85.2	90	74.3	78.3	67.7	59.7	64.5
Virginia.....	85.8	89	87.1	86	80.3	82.7	86.3	81.9	84.7	75.2	64.5	68.9
North Carolina.....	92.9	85.8	90.1	78.3	88	82.2	90	76.5	84.6	67.4	80	64.4
South Carolina.....	81.9	85.5	83.3	78.7	90.3	83.3	81.3	80	86.8	68.7	66.5	67.8
Georgia.....	81	82.9	81.8	81.3	84.3	82.5	82.6	79.4	81.3	80	70	76
Eastern Florida.....	84.5	93.9	88.3	90	98	98.2	76.8	95.2	84.2	78.1	78.1	76.9
Western Florida.....	79	93.5	84.8	76.7	98.3	89.3	71.6	92.3	79.9	59.4	80	67.6
Alabama.....	86.5	85.5	86.1	79.7	84	81.4	82.3	84.8	83.2	68.1	68.4	68.3
Mississippi.....	85.2	84.8	85	79	87.3	82.3	81.7	79.9	80.2	69	71.9	70.3
Louisiana.....	88.4	88.5	80.4	83.7	88	85.4	85.2	86.8	85.6	65.3	70.3	67.2
Texas.....	90.6	83.2	87.6	88.3	90.3	89.1	86.1	85.9	96	56.5	68.4	61.3
Arkansas.....	87.7	66.7	80.1	76	83.3	78.9	82.6	83.2	82.6	68.4	70.6	68.3
Tennessee.....	77.7	83.9	80.2	77.7	80	78.6	88.7	88.4	88.6	68.4	72.3	70
Kentucky.....	85.2	85.5	85.3	83.3	79.7	81.9	83.2	82.9	83.1	71.9	71.6	71.6
Ohio.....	80.6	76.1	78.6	88.7	82.3	86.1	83.9	77.7	81.4	72.9	75.2	73.6
West Virginia.....	72.9	82.3	76.7	79.3	75.7	77.9	79.4	81	80	67.7	63.5	66
Indiana.....	87.1	83.3	85.7	85.7	80.7	83.7	83.5	82.6	82.9	83.2	71.6	78.6
Illinois.....	85.2	80.6	83.4	86.7	82.7	85.1	81.6	81	81.4	86.8	66.1	79.3
Lower Michigan.....	83.9	89.7	86.2	90.3	86.3	88.7	81.3	78.7	80.3	74.2	85.5	77.7
Upper Michigan.....	82.6	80	77.2	80	73.7	77.5	82.6	86	77.2	73.9	79.4	75.7
Wisconsin.....	85.3	73.3	80.4	81.7	84.3	82.7	80.6	79.7	80.2	71.9	70.6	71.4
Minnesota.....	89.4	78.5	83	69.7	70.3	69.9	82.6	81.3	82.1	72.6	74.5	73.4
Iowa.....	88.2	78.1	81.2	83.3	72.7	79.1	90	80.6	86.2	63.9	67.7	65.4
Kansas.....	93.2	75.8	86.2	88.7	73.7	82.7	86.1	81	84.1	70	63.9	67.2
Nebraska.....	85.8	70.8	82.2	81.3	78.7	78.3	80	77.4	79	65.5	61.6	63.9
Missouri.....	80.7	81.3	86.3	83	80.3	81.6	91	83.2	87.9	64.2	65.2	64.6
Colorado.....	87.1	59	75.9	82.7	83	86.6	91.6	78.9	84.5	75.8	59.6	65.7
North Dakota.....	87.4	74.2	82.1	77.7	82.7	79.7	85.2	73.9	79.4	77.7	70.5	70.5
South Dakota.....	85.8	73.5	80.9	82.7	81.7	82.3	79.7	66.5	74.4	77.7	69.4	74.4
Average.....	86.1	82.6	84.7	83.5	81	82.5	82	79.3	80.9	73.8	68.4	71.6

TABLE I.—Percentages of verifications of 8 p. m. 24-hour forecasts for the year ending December 31, 1893—Continued.

States.	September.			October.			November.			December.			Year.		
	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.
Maine.....	77.3	84.3	80.1	87.4	78.4	83.8	79.7	86.7	82.5	76.5	87.7	81	83	79.4	81.6
New Hampshire.....	81.8	79.3	80.5	85.5	72.6	80.3	78.3	90	83.3	82.6	94.5	87.4	83.6	81.9	82.9
Vermont.....	78	70.7	75.1	85.3	71.3	80	81.7	83.3	82.3	88.4	94.2	90.7	83.9	80.3	82.5
Massachusetts.....	82.7	82.3	82.5	85.3	87.7	92.6	77	80	82.2	88.4	89	88.0	85.4	83.2	84.5
Rhode Island.....	77	87	81	95.3	90.3	94.2	76.3	93.8	83.1	87.1	96.8	91	84.5	85.7	85
Connecticut.....	78	84	80.4	92.9	91	92.1	74.3	91.7	81.3	85.8	90.8	90.2	84.4	84	84.6
Eastern New York.....	87.3	82	85.2	91.3	78.1	86	84	93.7	87.9	88.1	89.7	88.7	87.3	83.7	85.9
Western New York.....	80.7	77.7	79.5	80.6	77.4	79.3	96	84	95.2	86.8	86.8	86.2	86	82.9	84.8
Eastern Pennsylvania.....	82.7	87.3	84.5	93.5	88.1	91.3	79.3	95.7	85.9	90	90.3	90.1	86.4	84	85.5
Western Pennsylvania.....	80	81	80.4	87.7	84.5	86.4	95.8	90.7	93.6	77.7	83.9	80.2	82	82.6	82.3
New Jersey.....	78.3	86	81.4	92.6	88.1	90.8	81.8	97.7	87.9	90.3	93.5	91.6	86.6	85.9	86.8
Delaware.....	84	88.9	85.7	89.7	90.3	89.9	82	91.7	85.9	83.2	88.7	85.4	85.6	86.7	86.9
Maryland.....	81.7	94	86.6	87.1	88.4	87.6	84.7	87.3	85.7	84.8	85.8	85.2	83.7	84.2	83.0
District of Columbia.....	71.7	98.3	80.3	89.7	83.9	86.8	85	80	83	80	80.6	80.3	82.2	80	81.9
Virginia.....	80.7	92.3	85.7	93.5	83.2	86.7	86.8	90.3	87.9	81.6	86.1	83.4	83.8	83	83.3
North Carolina.....	87.7	92.3	85.5	93.5	81.3	88.6	87.7	85	86.6	92.9	93.2	93	85.4	82.3	84.1
South Carolina.....	88	86.2	86.2	88.2	83.2	88.4	88	86.2	82.7	94.8	94.8	94.8	84.9	83.1	84.3
Georgia.....	81.2	86	83.3	88.3	79	85.2	86	87.3	86.3	88.7	89.9	89.9	85.6	83.6	84.6
Eastern Florida.....	84.7	90.3	90.5	78.7	95.8	85.5	76	97	84.4	84.5	89.3	88.3	88.1	91.6	86.8
Western Florida.....	89.3	97.7	92.6	100	95.5	98.2	93.3	91	92.4	88.1	96.8	91.6	83.6	81	88.5
Alabama.....	88	90.7	89.1	90.9	86.5	89	91.7	85	89	87.7	87.4	87.6	84.4	88.5	84.1
Mississippi.....	91	89.3	90.3	95.8	82.6	90.3	86	85.3	85.7	91.3	85.2	88.9	83.6	82.3	83.9
Louisiana.....	85.7	80	87.4	91	85.5	88	88.7	82.3	86	95.2	85.2	91.2	84.1	88.9	84
Texas.....	96.7	90.3	94.1	98.4	80.6	91.9	87.7	83	85.8	92.6	85.8	89.0	86.5	83.9	85.4
Arkansas.....	89	85	87.4	96.8	82.6	91.1	80	80.3	80	94.8	86.1	91.1	83.9	80.1	82.4
Tennessee.....	90.3	92.7	91.3	92.9	80.6	88	85	85.3	85.1	88.7	89	88.8	84.3	82.8	83.7
Kentucky.....	83.3	85	94	93.5	83.5	89.5	95.7	88.3	89.4	88.3	87.4	82.3	84.4	86	84.4
Ohio.....	86.7	83	85.2	91.9	82.6	88.2	90.3	87.3	86.1	79	90.3	83.5	84	80	83.7
West Virginia.....	83.3	84.7	83.9	88.1	74.8	82.8	82.7	91.8	86.1	83.9	80	82.3	79.1	81.6	80.2
Indiana.....	85	83	84.2	94.2	78.1	87.8	82	87.8	87.8	90.7	83.2	86.5	84.5	86.4	81.6
Illinois.....	84.3	78.3	81.9	86.5	71.9	86.7	82.8	84.8	89.1	83.2	82.3	83.4	85.2	80	83.5
Lower Michigan.....	77	72	75	85.2	80.6	83.4	78.3	83	80.2	85.6	84.2	89	82.7	83.9	83.1
Upper Michigan.....	73.3	78	75.2	76.5	78.5	75.3	86.3	87.7	86.9	81	85.3	88	79	79.8	79.2
Wisconsin.....	89	83.7	86.9	79.3	72.6	80.3	92.7	95	93.6	86.5	86.5	84.8	83.8	79.8	82.2
Minnesota.....	92	78	85.6	79.7	73.9	77.4	85.7	83.3	87.7	84.5	74.2	80.4	80.9	77.6	79.6
Iowa.....	91.7	89.3	90.8	83.3	71.3	82.7	81.7	92	85.7	82.6	82.6	79.1	83.7	80.1	83.3
Kansas.....	97.7	75.3	88.7	90.1	75.2	87.7	89	85.3	87.5	87.1	74.8	88.2	86.3	74.3	82.7
Nebraska.....	96.3	74.7	87.7	96.6	75.2	84.4	86.8	84.7	86.7	92.6	82.6	85.8	86.4	76.6	82.6
Missouri.....	82.7	82.7	87.7	90.6	82.3	87.3	86.7	82	84.8	87.4	79.7	84.3	83.9	79.8	82.3
Colorado.....	95.3	77	88	92.6	82.6	88.6	74.7	86.7	83.6	84.3	75.8	86.8	87.3	74.8	82.3
North Dakota.....	87.7	70.7	80.9	84.8	72.3	79.8	88	89.7	85.7	82.6	80.6	73.8	82.1	75.8	79.6
South Dakota.....	96	78.3	86.9	88.1	74.2	82.5	82.7	85.7	83.9	91.3	87.7	85.7	85.5	76.9	82.1
Average.....	85.6	85	85.4	90.2	81.2	86.6	85	87.9	88.2	87	86.2	86.7	84.4	82	83.4

PACIFIC COAST DIVISION.

States.	January.			February.			March.			April.		
	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.
North California.....	92	78.3	84.5	87.1	82.1	85.1	83.2	78.5	78.3	84.7	73	80
South California.....	94	66	82.8	97.9	77.1	89.6	91.6	67.7	82	97.3	67.3	85.3
Arizona.....	93.3	63.7	81.5	97.9	86.8	93.5	85.5	79.4	82.1	98.3	87.3	93.9
Nevada.....	90	65.7	80.3	83.9	72.1	79.2	84.5	66.5	77.3	88.3	65	79
Utah.....	87.7	76.7	83.3	70	73.2	71.3	86.8	82.9	85.2	78	77.3	77.7
Oregon.....	85.3	75.7	81.5	73.3	80.4	76.1	74.5	72.9	73.9	89.3	68.7	77.5
Washington.....	84.3	78.3	81.9	72.6	75.6	73.8	70	80	70.4	82.7	72.7	78.7
Average.....	89.5	71.3	82.2	83.2	78.2	81.2	83.5	74.7	80	87.5	73	81.7

TABLE I.—Percentage of verifications of 8 p. m. 24-hour forecasts for the year ending December 31, 1893—Continued.

PACIFIC COAST DIVISION—Continued.

States.	May.			June.			July.			August.		
	Weather.	Temperature.	Combined.									
North California.....	89.0	71.6	85	89.3	73.9	88.6	99.4	86.1	94.1	100	76.5	90.6
South California.....	89.4	76.8	90.4	89.7	74.8	89.5	99	74.2	89.1	100	78.7	91.6
Arizona.....	96.8	84.8	92	100	81.7	92.7	94.3	85.3	90.6	81.9	77.4	89.1
Nevada.....	91.3	86.7	82.7	99.3	63	87.2	96.4	80.3	90	97.4	70	86.4
Utah.....	92.3	86.1	89.8	96.7	71	86.4	100	78.4	91.4	91.3	73.5	81.2
Oregon.....	77.4	81	78.8	89	59.7	77.3	94.5	77.8	87.8	95.5	70	85.3
Washington.....	65.8	76.8	70.2	84	65.3	76.5	95.5	76.1	87.7	91.3	71	83.3
Average.....	88.1	78.1	84.1	95.4	70.6	85.5	97	79.7	90.1	93.9	78.9	85.9

States.	September.			October.			November.			December.			Year.		
	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.	Weather.	Temperature.	Combined.
North California.....	88.7	68.8	80.5	93.2	74.3	85.6	88.7	74.3	82.9	94.6	75.8	87.2	92.1	75.2	85.8
South California.....	100	80	92	97.7	65.5	81.8	90.7	68.3	81.7	88.7	81.0	85.0	93.3	73.1	87
Arizona.....	93.3	80.3	91.1	97.7	67.1	85.5	97	78.7	95.3	85.2	91.3	94.3	94.3	77.7	87.6
Nevada.....	96	86	85.2	95.8	69.4	85.2	88	69.3	79.3	91.5	81.2	80.0	91.7	81.2	82.7
Utah.....	90.7	88.7	87.8	98.4	64.5	81.8	91.7	68.3	82.3	88.7	88.7	80.7	89.4	78.3	81.7
Oregon.....	90.9	82.7	79.8	89	78.5	84.8	93	74.3	84.9	79	71.2	78.7	86.2	72.7	86.3
Washington.....	88.7	71.3	81.7	84.3	74.2	80.2	86.3	78.3	84.9	86.3	85.8	74.5	88.1	73.8	78.4
Average.....	92.5	76.8	83.8	93.7	70.2	84.8	90.8	72.3	80.4	88.3	78.5	82.4	93.3	73.8	83.7

TABLE II.—Percentages of justifications of wind signals for the year ending December 31, 1893.

Month.	Total number ordered.	Justified as to velocity.		Justified as to direction.	Cautionary.		Storm.		For easterly winds.		For westerly winds.		Number of winds without signals.	Number of signals ordered late.	Percentage of justifications.		
		Wholly.	Partly.		Number ordered.	Justified as to velocity.		Number ordered.	Justified as to velocity.		Ordered.	Justified.				Ordered.	Justified.
						Wholly.	Partly.		Wholly.	Partly.							
Jan.....	217	187	0	197	0	0	217	137	0	78	53	144	144	8	5	73.3	
Feb.....	191	154	2	184	0	0	191	154	2	53	47	138	137	8	18	89.2	
Mar.....	180	181	4	159	0	0	180	131	4	61	54	119	105	10	10	76.3	
Apr.....	338	287	21	335	63	46	313	275	8	143	143	105	193	21	15	83.7	
May.....	225	177	19	212	122	95	198	108	82	6	94	88	131	124	14	12	83.9
June.....	128	87	0	118	78	47	0	50	45	0	53	40	78	69	23	6	79.4
July.....	86	29	0	85	80	23	0	6	6	0	12	11	24	24	8	63.6	
Aug.....	94	75	0	88	0	0	0	78	75	0	79	18	15	7	1	82	
Sept.....	143	93	2	136	82	56	1	61	34	1	68	54	75	72	23	15	88
Oct.....	336	214	2	315	156	95	1	180	119	1	177	166	159	149	6	11	74.8
Nov.....	300	200	19	268	148	80	12	182	120	7	113	97	187	171	38	30	71.5
Dec.....	244	181	12	221	64	48	10	180	158	2	78	67	171	164	28	43	74.1
Total.	2,432	1,785	81	2,268	743	488	50	1,689	1,247	31	909	901	1,438	1,367	205	168	*76.3

* Yearly percentage.

TABLE III.—Percentages of justifications of cold-wave signals for the year ending December 31, 1893.

Month.	Number of signals ordered.	Number verified.		Number of cold waves without signals.	Percentage of justification.
		Wholly.	Three-fourths.		
January	639	300	40	3	50.2
February	295	210	17	16	73.5
March	224	180	17	11	84
April	150	75	10	0	55
May					
June					
July					
August					
September					
October	88	20	4	0	60.5
November	229	136	18	0	65.3
December	427	318	22	16	76.9
Total	2,002	1,299	128	46	*68.9

* Yearly percentage.

TABLE IV.—Percentages of verifications of forecasts by classes, for the year ending December 31, 1893.

Month.	Twenty-four hours.								Forty-eight hours.							
	Weather.				Temperature.				Weather.				Temperature.			
	Fair.		Rain or snow.		Warmer or colder.		Stationary.		Fair.		Rain or snow.		Warmer or colder.		Stationary.	
	No.	Per ct. of ver.	No.	Per ct. of ver.	No.	Per ct. of ver.	No.	Per ct. of ver.	No.	Per ct. of ver.	No.	Per ct. of ver.	No.	Per ct. of ver.	No.	Per ct. of ver.
Jan	956	89.9	346	67.2	1,049	80.4	253	83.1	8	93.8	31	68.1	31	88.1		
Feb	527	90.7	649	82.1	1,003	87.1	173	76.4	17	93.5	18	83.9	41	72.7		
Mar	598	93.7	704	80.2	1,015	85.2	287	80.5	22	91.8	26	70	42	97.9	6	66.7
Apr	703	88.4	557	76	891	84.1	369	78.6								
May	1068	88	234	77.6	635	83.3	667	81.9								
June	787	89.2	493	74.7	852	80.6	408	81.7								
July	748	89.2	554	72.4	793	82.4	509	81.6	6	88.3			19	33.2		
Aug	664	90	698	56.8	928	64.2	374	78.0	89	75.2			114	72.9		
Sept	921	90	339	73.6	891	83.7	569	89.1	43	98.8						
Oct	938	95.1	864	77.6	959	79.7	343	85.3			1	30	19	15.8		
Nov	788	93.3	472	71.1	959	88.8	301	84.9	4	100	22	58.2	51	92.9		
Dec	882	89.8	420	81.1	1,073	87.2	229	81.4	17	100						
Totals ..	9,560	*90.4	5,770	*74.1	10,848	*82	4,482	*82	206	*87	98	*68.9	817	*75.1	6	*66.7

* Yearly percentage.

TABLE V.—Percentages of verifications of 24-hour forecasts by classes, for the year ending December 31, 1893.

[Pacific Coast division.]

Month.	Weather.				Temperature.			
	Fair.		Rain or snow.		Warmer or colder.		Stationary.	
	No. of forecasts.	Per cent of verification.	No. of forecasts.	Per cent of verification.	No. of forecasts.	Per cent of verification.	No. of forecasts.	Per cent of verification.
January	168	94.9	42	69.7	140	60.7	70	92.6
February	116	91.9	78	70.6	141	75	58	87.7
March	96	92.5	121	78.5	151	70.1	68	85.2
April	126	96.2	84	74.5	124	69.5	86	78.1
May	165	94.6	52	67.5	168	77.4	49	80.6
June	189	98.4	21	69	162	68.8	48	78.6
July	201	98.7	16	76.3	114	75	103	85
August	183	98.4	34	69.7	151	68.9	66	83.8
September	164	97.5	46	74.8	164	65.7	46	88.9
October	162	98.5	55	79.6	191	66.4	26	98.1
November	129	90.1	81	82.2	179	69	81	91.6
December	130	97.6	87	74.5	156	68.2	61	86.6
Totals	1,829	*96.6	717	*74.6	1,841	*69.4	705	*85.4

* Yearly percentage.

FORECASTS, STORM WARNINGS, AND COLD WAVES.

The attention of the employees of the Bureau has been fixed still more strongly than before upon the work of forecasting—the primary duty of the Bureau in its relation to the public.

The forecasts from the 8 a. m. and 8 p. m. observations have been made as usual throughout the year, the separate States and districts for which they are made numbering 45 and covering the entire country east of the Rocky Mountains. The forecasts are made habitually for periods of twenty-eight and thirty-six hours, respectively, and for longer periods when warranted.

Storm warnings to lake and seacoast stations and to the director of the Canadian meteorological service at Toronto, warnings of frost to the sugar, fruit, cranberry, and tobacco regions, and warnings of severe local storms, cold waves, northers, and dangerous floods to the threatened districts, have been issued whenever the conditions justified them.

An unusually large number of storm warnings have been sent out during the year, and with marked success. The past summer was one of unusual frequency in the occurrence of severe local storms and tornadoes, and warnings of the conditions favorable to these were given in nearly every instance. The cyclones of August 25-27 and October 12-14 were of marked violence and followed an exceptional path, but the action taken by this Bureau to give notice of their approach was such that nearly every interest affected received ample warning, and hearty commendations were received from the people in the districts over which they passed.

The warnings of the approach of cold waves have also been unusually successful during the year, abundant testimony having been received of their increased value and the large amount of perishable products saved thereby.

On July 1, 1893, the old forecast room, telegraph division, and river and flood room were consolidated into the forecast division and placed in charge of the assistant chief of the Bureau, thus enabling the Bureau to dispense with the services of a superintendent of telegraph, at a salary of \$2,000, and a professor in charge of the river and flood room, at a salary of \$2,500. The superintendence of the wind-signal-display stations and of the lake marine section has also been assigned to this division.

The staff of forecast officials has been assigned to this division, and during the months when they are not on official forecast duty they are required to make daily, for practice, complete forecasts from the a. m. map, employing also a portion of their time in the investigation and preparation of reports upon practical meteorological problems that have been officially assigned them. It is expected that these reports, several of which have been completed, will be of great value as practical aids to forecasting.

The system of giving each of the local forecast officials in the service a two months' course of instruction at this office in the preparation of the charts in use here and in making forecasts for the whole country has been resumed, there being some of these who were recently appointed who have not yet had this valuable training.

Arrangements have been made with the Light-House Board and the Superintendent of the Life-Saving Service whereby the keepers of the light-houses and life-saving stations on the Atlantic coast will telegraph this Bureau during the hurricane season the occurrence of heavy ocean

swells or other signs of the approach of hurricanes to our coast observed by them, these officials being exceptionally well located for this purpose. An instance of the value of these reports occurred during the hurricane that struck our southern coast in the latter part of August, 1893, when a report of a heavy ocean swell off Tybee Island, forwarded by telegraph by our observer at Savannah, was among the earliest intimations that we received of its approach.

RIVER AND FLOOD SERVICE.

The river and flood service has been reorganized by putting the making of the forecasts of river stages and changes in the hands of experienced observers at the principal river stations, assigning to each one a section of the river or rivers in his vicinity to forecast for. The observers are furnished with all the available data relative to the conditions of the rivers during the previous floods, and directed to make a careful study of the same. They receive daily telegraphic reports of the stages of rivers and amount of rainfall throughout their sections. These, with their own experience and the aid of such rules as have been found to be of practical value in river forecasting will, it is thought, enable them to make more valuable predictions than have hitherto been made under the old system, and the familiarity with the local needs will enable them to specialize more intelligently and distribute the warnings more effectively.

The efficiency of the storm-warning system on the Great Lakes has been considerably increased by the establishment of 10 new display stations, and decided progress has been made in the work of ascertaining the set of, and charting, the lake currents. A large number of bottles have been floated during the season for this purpose, and a preliminary current chart, as a result of the work for 1892, has been prepared and published.

The investigation of the meteorological conditions that prevail over the Great Lakes has also been greatly extended, over 100 new voluntary observers having been secured from among the masters of lake vessels. The collection of the data in relation to the currents and meteorology of the Great Lakes has entailed very little expense to the Government, and it is expected that it will prove of great value to the lake marine.

REPAIR OF SEACOAST TELEGRAPH LINES.

Under the head of maintenance and repairs of seacoast telegraph lines the most important feature was the completion in July last of the telephone lines and cables connecting Thunder Bay and Middle Islands, in Lake Huron, with the Weather Bureau office at Alpena, Mich., thus permitting the establishment of display and vessel-reporting stations on these islands. The line to Thunder Bay Island is 17½ miles long, inclusive of 3½ miles of submarine cable; that to Middle Island, 13¼ miles, with 2¼ miles of cable. Both lines were put in operation July 14, 1893, and have worked without material interruption since that date.

Extensive general repairs were made on the Tatoosh Island, Fort Canby, and Hatteras sections, with excellent results. The work on the first-named section consisted mainly in clearing out trails through the dense forest and underbrush to facilitate the movements of repairmen,

and in changing portions of the line to prevent damage from landslides. Two additional repair stations were established along the line, which, it is hoped, will greatly lessen the frequency and duration of interruptions as compared with last year. The exceedingly rough character of the country, absence of roads, prevalence of high winds, etc., render the efficient maintenance of this line a difficult problem at all times, justified only by its great and growing importance to the shipping interests of Puget Sound and the North Pacific coast. The following extract from the report of the inspector who visited Tatoosh Island last October may be of interest in this connection:

Since September 1 all tug boats from the sound (Puget Sound) receive orders from their owners from this station by telegraph. It is a great advantage to the shipping interests. A large blackboard is in course of construction and is to be placed on the bluff, and messages to be written in large letters so that they can be read with a glass, thus saving time and expense to vessels passing in or out. Shipping reports, weather and vessels, are sent by telegraph three times a day to Port Angeles, Port Townsend, and Seattle. A record of all vessels passing in or out is prepared by the observer.

On the Hatteras section 1,169 new wooden telegraph poles were put up, and the entire line given a general overhauling. The chief operator at Cape Henry reports that this work was done in an entirely satisfactory manner, and that the line is now in excellent condition, except that (owing to the damage done by the cyclones of August and October last) 25 additional poles and 12 miles of new wire should be used to strengthen certain weak places. The south-shore end of the New Inlet (North Carolina) cable was lengthened by 122 yards, to prevent a threatened washout. The cable between Cape Henry and Cape Charles was broken during January. Efforts to recover and splice the broken ends having proved fruitless, the honorable Secretary authorized the abandonment and subsequent sale of this cable, which, at best, had been of little direct value to the public service. The following extract from the chief operator's line journal, dated Cape Henry, September 14, 1893, gives an example of some of the services rendered by the Hatteras line:

By request of the commandant of the Norfolk navy-yard, the United States cruiser *Detroit* was to-day flagged and instructed by this office to return to Hampton Roads. The vessel was bound to Rio de Janeiro, Brazil, but orders had been issued by the Navy Department deferring the cruiser's departure until after her final trial trip. When the telegraphic order reached Hampton Roads and Norfolk the vessel was beyond the reach of communication by the usual methods, but upon Admiral Brown requesting the assistance of the Bureau in his efforts to overhaul the steamer, prompt action was taken on his request, with the result that the *Detroit* was back in Hampton Roads at noon.

The line from Titusville to Jupiter was prostrated and badly damaged by the cyclone of October 13. As the northern portion of this line had already been duplicated by a railroad telegraph line now under construction between Titusville and Jupiter, with the expectation that the entire distance would be covered by the road by February next, no expense was authorized for rebuilding the Government line. Under an agreement between the Chief of the Bureau and the railroad company the latter has rebuilt the southern half of the line, with the privilege of using the same until its own wire reaches Jupiter, when the entire Government line can be put up for sale at auction.

Less extensive general repairs were also made necessary during the year on the Nantucket, Wilmington, and Point Reyes sections. At this date all lines are reported to be in good condition for the winter.

The entire mileage of telegraph lines and submarine cables is 645, of

which 166 miles, in 3 sections, are on the Pacific coast; 488 miles, in 5 sections, on the Atlantic coast, and 1 section of 31 miles on Lake Huron.

With reference to the other duties of the telegraph service, it may be mentioned that in making contracts for the present fiscal year a reduction of about 12½ per cent was obtained on telegraph rates for the Bureau.

STATE WEATHER SERVICES.

The year 1893 has been one of much activity in State weather service work. Before the close of 1892, as stated in the last Annual Report of the Secretary of Agriculture, State weather service organizations had been so extended as to cover the whole of the United States, the last service organized being that for Idaho. The entire field being thus covered, the work of the year 1893 has been in the direction of further developing and improving the services already in operation.

That the popularity and usefulness of the State weather service is becoming more fully recognized as the work of these organizations becomes more generally known is attested by the fact that during the past year the legislatures of New York, Pennsylvania, and North Dakota have made liberal provision for the support of their respective services. As New York and Pennsylvania had in former years made provision for their services, the continued aid thus given is evidence of proper recognition and appreciation of the value of the work performed. The work accomplished by the Maryland State service during the year was so effective that the governor, whose approval of the bill for the support of that service was given only upon condition that but one-half of the sum appropriated should be expended, withdrew his objections and authorized the expenditure of the full amount of the appropriation (\$2,000) in carrying on the work of the service. It is believed that during the ensuing year the legislatures of other States, recognizing the importance of the State weather services, will provide for their maintenance.

STATION OFFICERS AND TRANSFERS.

Owing to pressure of other professional duties, Prof. P. H. Mell, who organized the Alabama weather service in 1884, with headquarters at Auburn, found it impracticable to continue longer in charge of that service, and on July 1, 1893, retired from the directorship. Under Prof. Mell's management the Alabama weather service, which was among the first to begin active coöperation with the National Bureau in the distribution of weather forecasts, became one of the most efficient local weather services in the country. Upon the resignation of Prof. Mell the central station of the Alabama service was transferred from Auburn to Montgomery and placed under the charge of an official of the Weather Bureau. Montgomery being centrally located, with better facilities for communication than exist at Auburn, the future prospects of this State service are most encouraging. The central station of the Nebraska weather service has also been transferred from Crete to Omaha. This change was made in view of the superior facilities for the printing and distribution by mail and telegraph of the information collected by the State and National services. By this transfer of the central station to Omaha Prof. Goodwin D. Swezey retired from the directorship and was succeeded by the official in charge of the regular Weather Bureau station at Omaha.

The same reasons that prompted the Chief of the Weather Bureau in ordering the transfer of the central stations of the Alabama and Nebraska services—viz, to secure improved facilities for the collection of meteorological and crop data and for the distribution of the weather forecasts and other information—also caused the transfer of the central station of the Mississippi service from University to Vicksburg, and that of the Washington weather service from Olympia to Seattle. While these changes in the locations of the central stations of the Alabama, Mississippi, Nebraska, and Washington weather services will make it possible to accomplish much more efficient work in those States, this action involved the loss of the services of the directors of the Alabama, Mississippi, and Nebraska weather services, respectively; but they have been succeeded by men of experience and ability, who will earnestly endeavor to further improve and extend the work.

At the close of the year the transfer of the central station of the Virginia service from Lynchburg to Richmond is under advisement, and it is probable that the change under consideration will be made before the opening of the crop season of 1894. By the proposed transfer it is expected that a closer coöperation between the State service and the State board of agriculture will be secured to the mutual advantage of both State and National services.

WEATHER CROP BULLETINS.

The weather crop service continues to be the most valuable feature of State weather service work. All State weather services, except that of Nevada (in which State the principal work has been the collection and publication of meteorological data, owing to the limited extent to which agricultural pursuits are carried on), have issued weather-crop bulletins during the season of planting, cultivating, and harvesting of crops. These State weather crop bulletins are based upon impartial and reliable reports on the weather and crop conditions each week during the season, the report being so mailed as to reach the State service center Monday afternoon, or early Tuesday morning, and as a rule to cover as nearly as possible the week ending Monday. The correspondents are so distributed that their reports furnish the official at the State center full information as to the weather and crop conditions of the State, from which he is enabled to prepare the State bulletin containing a review of the conditions prevailing during the previous week. During the season of 1893 the number of weather crop correspondents was increased by more than 100 per cent over the number of the previous year, there being at the midst of the season more than 9,000 crop correspondents coöperating with the several services throughout the country.

The circulation of the weekly weather crop bulletins of State services has also greatly increased, the weekly editions of as many as ten services ranging from 1,000 to 11,000 copies; the others for the most part closely approximating the first-named figure. While this distribution of the bulletins insures wide publicity of the information they contain, the press of the country affords by far the most effective means of distribution, as the bulletins are printed in a large proportion of the weekly and daily papers and in many agricultural journals throughout the country. As an illustration of the extent to which the State bulletins are circulated through the public press, it may be stated that the Missouri and Arkansas bulletins are reprinted in nearly 200 patent-

sheet weeklies having an aggregate circulation of more than 150,000 copies.

As the National Weather Crop Bulletin, issued at Washington, is based upon the information received by telegraph from the various State centers, and as there has been such a general and decided extension of this work in all States, the data composing the National Bulletin has been more complete than in any previous year. The demand for this publication continues, and during the year arrangements were made for the public display of the bulletin in more than 130 cities and towns of more than 5,000 inhabitants, through the coöperation of mayors, postmasters, and other officials. From the temperature and precipitation charts accompanying the National Bulletin may be readily seen how the current weekly temperature and rainfall compare with the normals deduced from observations covering long periods. The reproduction in agricultural journals of the National Weather Crop Bulletin and special charts of temperature and rainfall, a work referred to in the last annual report, has been continued this season with the same success that attended similar work last year.

The former excellent character of the monthly reports of State weather services has been fully maintained during the year, and the general increase in the number of voluntary observers, upon whom these reports so largely depend, has afforded more than the usual amount of material for discussion and investigation. The detailed climatological data published in these reports render them of much value. During the past summer it was found that the representatives of foreign meteorological services in attendance at the Columbian Exhibition, in calling at the Weather Bureau in Washington manifested great interest in the State weather service system, and were anxious to secure specimen copies of the publications issued.

WEEKLY SNOW CHART.

During the latter part of January, 1893, the publication of a chart of the size of the daily weather map, showing the depth of snow on the ground at 8 p. m. of Monday of each week, was commenced at this office, based upon telegraphic reports made at the hour named, by the observers of the Bureau. The first issue of this snow chart was that for the week ending January 23, 1893, and it was regularly published each week thereafter until the close of the winter. The favor with which this chart was received has induced the Chief of the Bureau to make it a permanent publication during the winter season. Its publication for the winter of 1893-'94 was resumed December 5, and in addition to illustrating in graphic manner the depth of snow on the ground, the detailed reports of which are given in tabular form, provision was also made for publishing, in connection with this chart, information as to the thickness of ice in the various rivers and harbors at Weather Bureau stations. The snow charts issued during the winter of 1892-'93 were reproduced by chalk-plate process in the columns of a number of the larger newspapers in different sections of the country. When the protection afforded winter wheat by a covering of snow is considered, it will readily be seen why such interest would be taken in a publication that shows at a glance the extent and depth of snow during the winter. This snow chart is also of great importance to the lumber interests of the Northwestern States. Mr. James F. Buckner, secretary of the Louisville (Ky.) Board of Trade, in a communication addressed

to the observer at Louisville, under date of January 28, 1893, referring to this chart, states as follows:

Referring to your note of the 26th instant, inclosing copy of chart showing snow-fall up to 8 o'clock p. m. Monday, the 23d instant, I have to say that I have examined the chart carefully and have called to it the attention of a considerable number of the members of the board of trade, who are interested in such matters, and our unanimous opinion is that it is a most valuable publication, in fact one of the very best issued by your Bureau, and we sincerely hope that the Department will continue to send it. The chart is of especial interest to quite a large number of the members of this board of trade who are engaged in milling and dealing in grain (wheat) generally.

The Chief of the Bureau is also in receipt of numerous other communications commending the snow chart.

SPECIAL THUNDERSTORM OBSERVATIONS.

The collection of special thunderstorm observations, after the plan followed during the summer of 1892, was continued this year, the region of observations being extended to include the territory east of the 100th meridian, north of the 35th parallel. A large number of observations were collected during the months of June, July, and August, an investigation of which is now being conducted.

VOLUNTARY OBSERVERS.

The total number of voluntary stations established during the year ending June 30, 1893, was 540. Of these over 300 were fully or partially equipped with instruments of the Bureau. About 50 per cent of the remainder, or about 100 stations, were furnished with instruments by the several State weather services, while the personal property of the observers formed the equipment of the rest. The total number of voluntary observers is about 2,500, including Army post surgeons and agents of the Central and Southern Pacific Railroad systems.

THE COTTON REGION SERVICE.

The cotton region service, which was placed under this division in July, has been continued as in former years, the observers taking one observation daily of rainfall and extremes of temperature, and telegraphing the same to the several centers. The present organization of the cotton region service is very complete in most of the cotton-producing States, but a larger number of stations in Texas would materially improve the service in that State.

CONVENTION OF WEATHER SERVICE OFFICIALS.

The important work now being conducted by State weather services throughout the country makes it very desirable that the officials of these services should meet in convention for the purpose of exchange of views and discussion of various matters of importance in connection with their work. Such a convention was held in Rochester, N. Y., in 1892, when a permanent organization, known as the "American Association of State Weather Services," was formed. The second convention of this association was held in Chicago, August 21-25, 1893, an abstract of the proceedings of which was published in the Monthly Weather Review of August, 1893.

THE DISTRIBUTION OF FORECASTS, AND FROST, COLD-WAVE, INLAND-STORM, AND RAIN WARNINGS.

In the distribution of weather forecasts and special warnings every available means of transmission is being utilized; and while the number of stations receiving such weather information by telegraph or telephone at Government expense has been materially decreased during the year, the number of places to which forecasts, etc., are furnished at little or no cost to the Bureau has been largely augmented. The number of stations now receiving the full forecasts by telegraph or telephone at Government expense is 1,613—a reduction of 275 during the past year; and the number of places receiving the same information through gratuitous distribution is over 7,000—an increase of over 3,000 during the same period. Plans have been perfected for an extended distribution of the forecasts by mail, and the total number of places receiving such information will be largely increased in the near future, as it is expected that, through the voluntary coöperation of the interested persons, this Bureau will, during the coming year, be enabled to have its forecasts posted in many thousands of post-offices within agricultural sections which have not heretofore received the benefit of such information.

COÖPERATION OF RAILROAD COMPANIES.

A large number of railroad companies are coöperating with this Bureau in the work of distributing the forecasts by telegraphing the same over their lines (in some cases twice daily), and as a rule require prompt and proper attention on the part of their employees concerning the receipt and posting of the weather telegrams. Other railroad companies are performing this service gratuitously through the medium of train baggage masters, who distribute the bulletins to station agents, and they in turn post the information for the benefit of the public. Weather symbols are displayed on the baggage cars of the following railroads: Chicago and Grand Trunk; Chicago and West Michigan; Grand Rapids and Indiana; Pontiac, Oxford and Port Austin; Chicago and Rock Island.

Over 400 full sets and nearly 100 partial sets of weather signal flags were furnished to displaymen by this Bureau during the past year.

The whistle signals are used to a considerable extent in some States. In the State of Ohio alone the use of the stationary engine as a means of disseminating weather forecasts has constantly increased in favor, and over 50 towns in that State are now sounding the weather forecasts daily. These points alone represent over 200,000 farmers within the limits of hearing of the signals. The usefulness of this method of service is beyond expectation, as is also its appreciation.

FORECASTS AND WARNINGS DISTRIBUTED.

The following tabulated statement shows the number of places supplied with forecasts and special warnings by paid service and without expense, and is arranged with a view to comparison of the work of distribution in each State and Territory:

Distribution of forecasts, cold-waves, and frost warnings.

States and Territories.	By telegraph or telephone, at Government expense.			Without expense to the United States, by—			
	Forecasts and warnings.	Cold wave warnings only.	Frost warnings only.	Mail.	Telegraph or telephone.	Railroad telegraph.	Railroad train service.
Alabama.....	19			218	1	4	53
Arizona.....	1						
Arkansas.....	21	1	8		17	2	
California.....	55		4	16	24	26	
Colorado.....	15	5	7	2		4	7
Connecticut.....	12	4	4		47	83	4
Delaware.....	5					1	
District of Columbia.....	1						
Florida.....	18	1	18	183	9	13	
Georgia.....	44		89	60		56	63
Idaho.....	1						
Illinois.....	80	11	5	151	10	183	
Indiana.....	76	4		111		83	80
Indian Territory.....	5						
Iowa.....	72	11		100			
Kansas.....	49	8		100	23	91	8
Kentucky.....	30	0	47	1	8		
Louisiana.....	25	4	27	32	17		16
Maine.....	29	2	1	83	4	10	77
Maryland.....	18	1	8	4	7	70	
Massachusetts.....	15	5	16	13			303
Michigan.....	64	7		7	11	161	5
Minnesota.....	51	2	12	18	3		
Mississippi.....	35	5	10	47	50	67	14
Missouri.....	53	6	1	233	53		60
Montana.....	5					1	
Nebraska.....	40	4		140		11	
Nevada.....	2						
New Hampshire.....	20	1		113	8	3	81
New Jersey.....	23	5	23	55	14	159	
New Mexico.....							
New York.....	97	27	15	267	115	236	155
North Carolina.....	55	2	24	246	8		10
North Dakota.....	16	8	14		1		
Ohio.....	104	4	94	437	57	53	
Oklahoma Territory.....	3	1					
Oregon.....	27			4			167
Pennsylvania.....	65	15	1	136	85	700	7
Rhode Island.....	3	1		3			27
South Carolina.....	50	7		52	11	20	
South Dakota.....	44	0	14	5			
Tennessee.....	20	1	24	39	19	20	62
Texas.....	40	3	14	15		4	
Utah.....					6	4	
Vermont.....	12			106	8	12	4
Virginia.....	25	3	11	8		54	33
Washington.....	19		3				81
West Virginia.....	18	1	11		1	49	
Wisconsin.....	103		18	57	7		
Wyoming.....		0					
Total.....	1,613	174	453	3,065	620	2,129	1,264

Grand total, 9,323.

INSTRUMENTS.

The work inaugurated a few years since of improving very much the instrumental equipment of stations by providing them with instruments furnishing continuous and automatic records, and the development and improvement of the instruments themselves, have been prosecuted throughout the year with very gratifying results.

There are now in use at the stations the following special instruments: 69 registers, recording wind direction, velocity, and, in some cases, rainfall and sunshine; 90 registers, recording wind velocity; 70 barographs, 88 thermographs, recording pressure and temperature, respectively; 19 photographic sunshine recorders, to which have been recently added 24 electrical recorders of sunshine, and 10 recording rain and snow gauges.

Among the instruments specified above special improvements in respect to various details of construction have been made in the devices for securing registration of wind direction and velocity. The instruments for recording rain and snowfall and for securing an electrical registration of sunshine were devised during 1892, and greatly developed and rendered practically applicable to station work during the current year.

The correspondence growing out of the supervision of the instrumental equipment of stations and the routine duty of inspection of records from recording instruments has been promptly disposed of without increase in the number of employees, notwithstanding the very great increase in the volume of the work incident to the enlarged and elaborated equipment of stations.

The introduction of continuously recording instruments at our stations marks an important step in advance, not only in accumulating data of great climatic value, but in supplying the needs of great business and commercial interests by having complete automatic records of storms and general meteorological conditions at all hours, day and night. Without such instruments, and with eye observations in the morning and evening only, it was never possible to give accurate reports of special meteorological conditions of great importance to engineers, builders, shippers, etc., or to courts of justice.

By means of the improved devices we are using with great success at many stations we are able to obtain continuous records hour after hour, showing at each moment of time the direction of the wind, its velocity, the duration, moment by moment, of sunshine or cloudiness, the temperature of the air, the pressure of the air, the time of beginning and ending of rainfall or snowfall, and not only the total quantity of precipitation, but also whether the fall was rapid and in torrents or gentle and prolonged. Applications indorsed by boards of trade, engineers, and others are repeatedly received from many of the stations not yet equipped with these recording instruments, urging that this improvement of the service furnishing such valuable and important data be extended in their direction and developed to its greatest utility.

REPAIR OF DAMAGED INSTRUMENTS.

The great and increasing volume of work devolving upon the instrument room taxes to the utmost the present force available for its prompt performance. This is particularly the case in respect to the work of repairing damaged and unserviceable instruments. The nature of the work is such that it is impossible to accomplish it successfully outside the office, from the fact that the work is of the greatest diversity, requiring special provision for each particular case, and the best results can be obtained only under the immediate supervision of the official in charge of instruments. We now have on hand many old instruments, more or less damaged by use, that can be made serviceable by various repairs and modifications, and this work is being done in the machine shop. Only two workmen, however, are available, and the progress of repairs is very slow and tedious. Additional assistance is very greatly needed.

THE LIBRARY.

During the year ending June 30, 1893, there were added to the library 1,170 books and 653 pamphlets, or a total of accessions of 1,823 numbers, the largest number of meteorological books and pamphlets added in any one year since the organization of the Weather Bureau in 1870.

The books in the library now number 14,301 and the pamphlets 4,640. Only such books and pamphlets are added as bear upon the legitimate work of the Bureau. More than one-half of these are acquired by a system of exchange with home and foreign weather services, or by gift.

A valuable collection of patent specifications and drawings relating to meteorological instruments was obtained for the library from the Commissioner of Patents. This collection comprises over 400 numbers, and includes practically all patents of this class issued in the United States up to 1893.

As opportunity offered during the year titles were added to the general bibliography of meteorology, mostly from books and periodicals in the library of the Weather Bureau. The collection now comprises over 65,000 titles. The usefulness of this catalogue would be greatly increased by the publication of, at least, the portions relating to those branches of meteorology to which the Bureau is at present devoting special attention, i. e., weather forecasting and climatology.

RECORDS.

In any comprehensive system of meteorological observations a number of checks upon the accuracy of the work of each individual observer is necessary. The scheme of checking the accuracy of the observations made by Weather Bureau observers begins with the reports received twice daily by the translator. The entire mass of data charted on the daily weather map is subjected to his scrutiny, and steps are immediately taken to correct improbable entries and apparent inaccuracies. Later, when the manuscript observations are received, they are subjected to a further examination with a view of correcting the errors that naturally occur in reductions and compilations. It is especially gratifying to report that with but few exceptions the work in this respect is highly creditable.

Several hundred transcripts of records of meteorological observations have been made during the year for use as evidence in courts of law, and the records of outlying stations have been taken into court in a large number of additional cases. Many of these transcripts have been used in actions involving large sums of money, and it frequently happens that the turning point of the case hinges upon the state of the weather. Especially is this so in the case of transportation companies carrying perishable goods.

The twenty-third year of continuous meteorological observations under the auspices of the General Government was completed on November 1, 1893. In the beginning there was naturally more or less uncertainty as to the amount and character of meteorologic and climatic data that should be placed on record. Succeeding years, however, developed a tendency towards expansion, both as to the phenomena investigated and the details of observation. The maximum period of observations and record was reached in 1884, when direct observations of the weather alone were made and recorded 8 times each day. That number gradually decreased until at present the needs of the service are fully met with regular observations twice daily, supplemented by

such special observations as may be deemed necessary by the forecast official at the central office. The volume of records of direct observations is not so great, therefore, as at a previous period in the history of the meteorological service; but what is lacking in direct observation is fully compensated for in the number and character of automatic records now maintained. The latter serve a double purpose. They enable observers at outlying stations to keep themselves constantly informed of the atmospheric changes that are taking place hourly, and also to supply a growing demand for climatic data as affecting the varied interests of commerce and agriculture.

Continuous records of wind velocity have been maintained from 1871-1872 to date, and of late years an automatic record of the direction—a most important feature—has been added. A continuous record of velocity and direction is made at 69 stations and of velocity only at 90 stations.

The continuous climatic records, next in order as to number maintained, are those of temperature, 88 of which are now being made.

Thermographs were supplied to 38 stations in 1888, and additional instruments have been put into use from time to time until the present number has been reached.

Continuous records of rainfall were begun at 10 stations in 1889 and are now being made at 45 stations. Continuous records of pressure were begun at 5 stations in 1888; the number now being maintained is 70. Continuous records of sunshine began in 1891 at 20 stations; the number of such records now being maintained is 43.

The numerical results derived from the foregoing-named records as well as the results of direct observations are closely scrutinized in the records division and tabulated for publication in the Monthly Weather Review and other climatic reports.

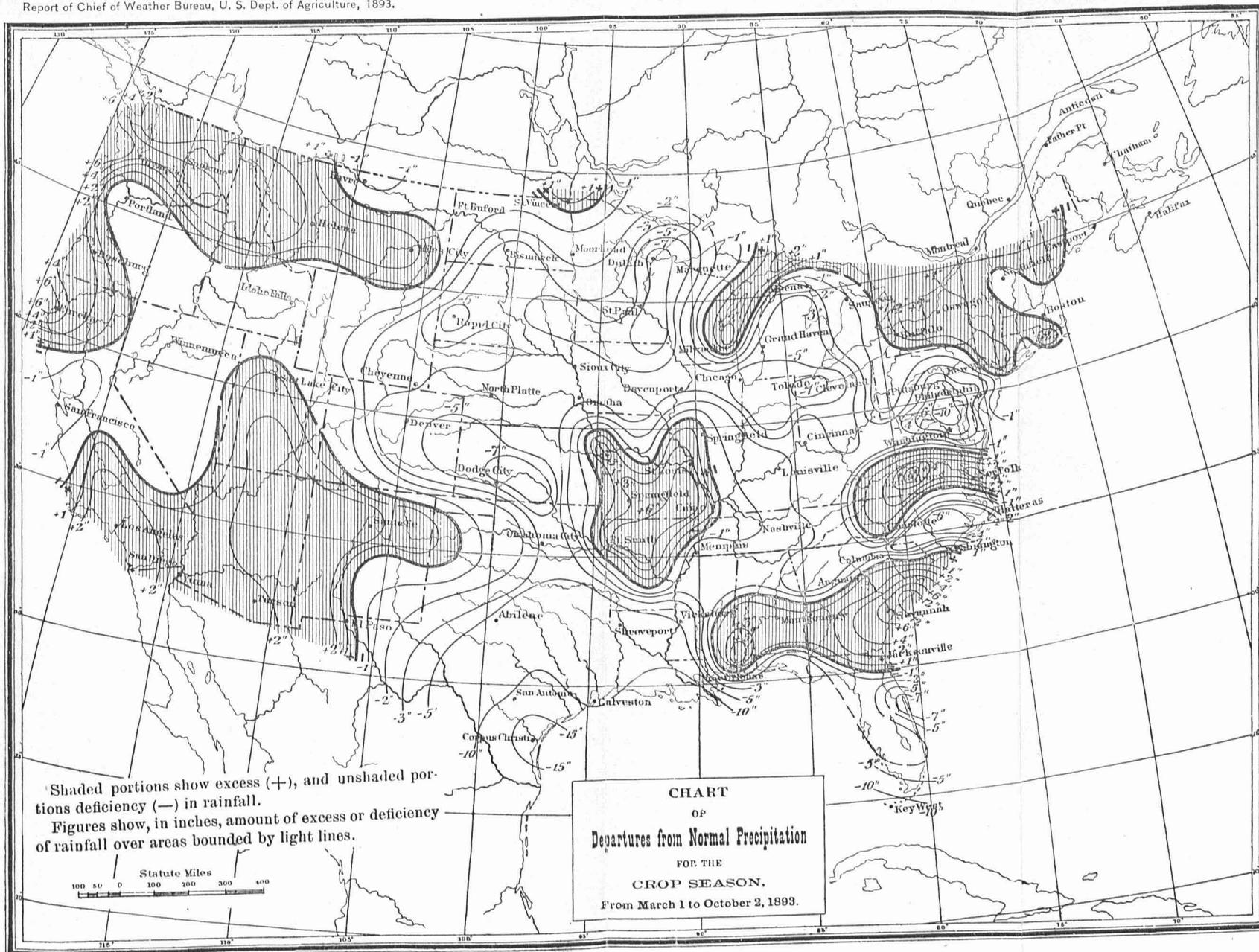
PUBLICATIONS.

The character of the work of this division does not materially change from year to year, except in volume. During the present year the increase has been very marked, and the result has been that it has required careful attention and a large amount of labor in handling the enormous quantity of maps, bulletins, reviews, forms, and other publications issued from time to time for distribution to the general public, and to do the work in a business-like manner.

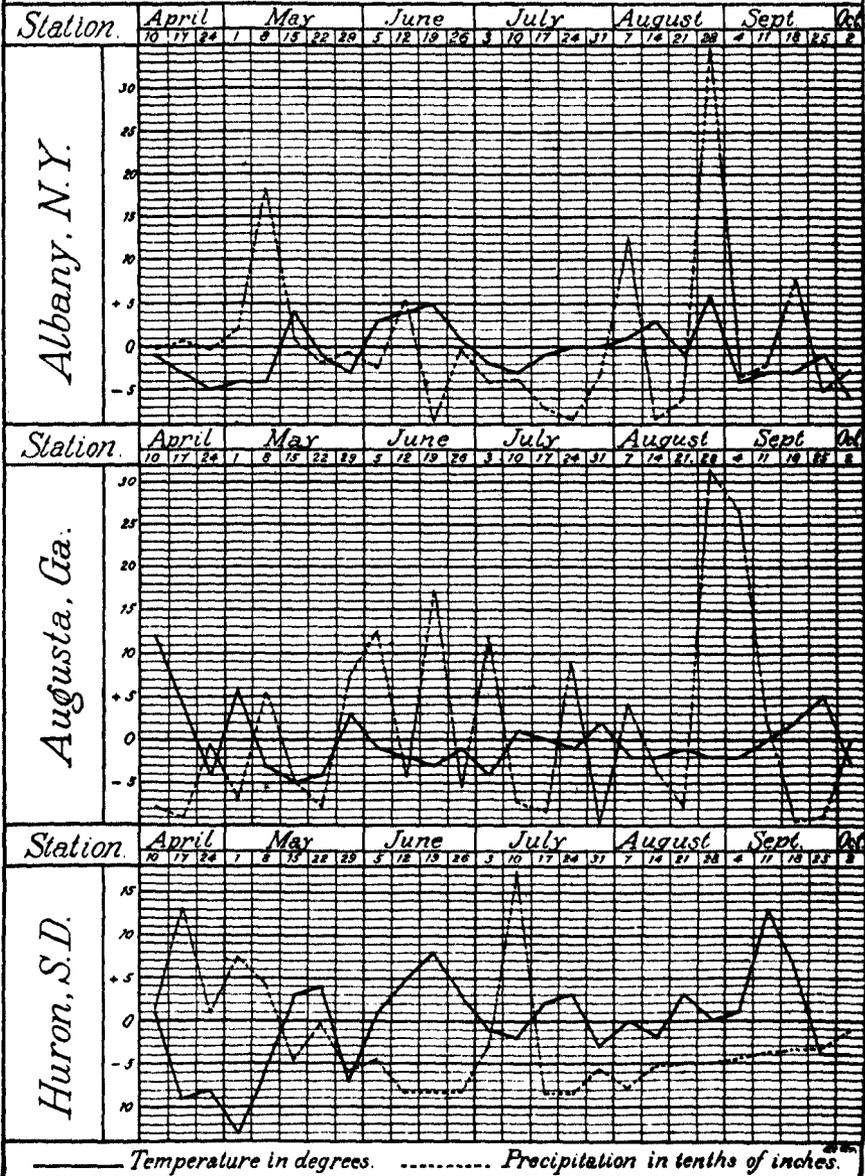
In the composing room are set up and printed the bulletins, monthly weather reviews, instructions, circulars, wrappers, letters and letter-heads, envelopes, many of the forms, and the miscellaneous matter of the Bureau. The volume of the work may be judged by the fact that 2,548,157 copies were made in the press-room. The number of lithographic impressions taken was 1,287,565, and during the year the number of forms issued to stations and the central office was 4,978,000, of which 830,550 were printed by the Bureau, the remainder by the Government Printing Office.

The Monthly Weather Review has varied in size from 28 to 46 pages, and in editions from 3,455 copies to 4,188.

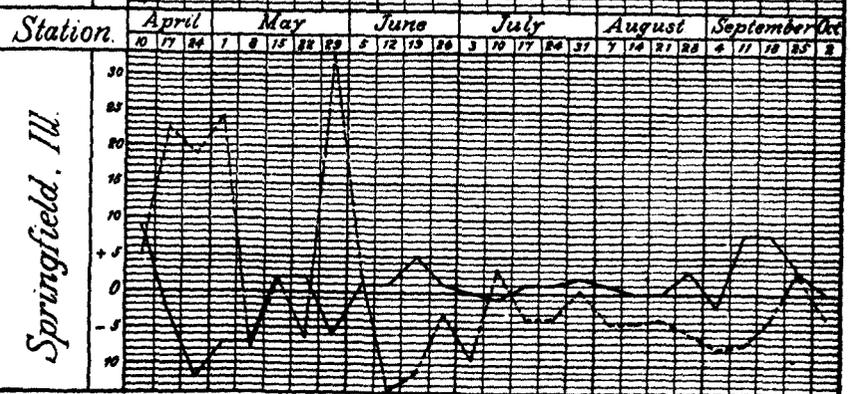
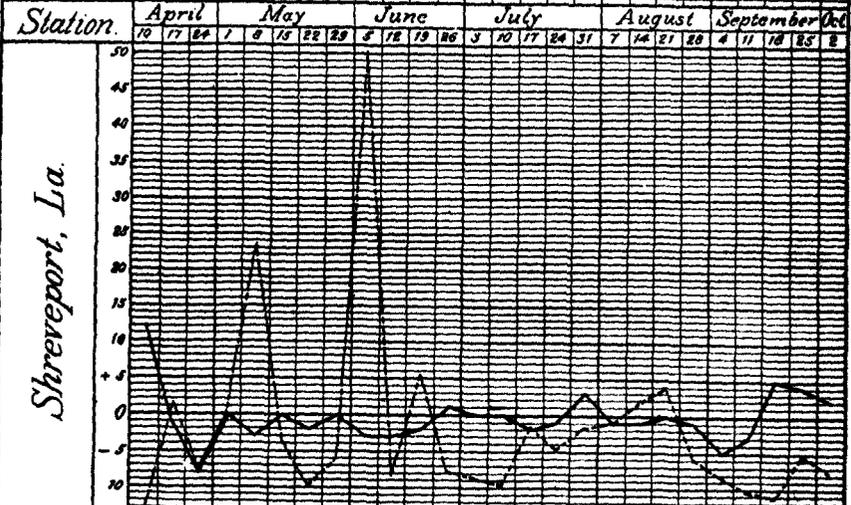
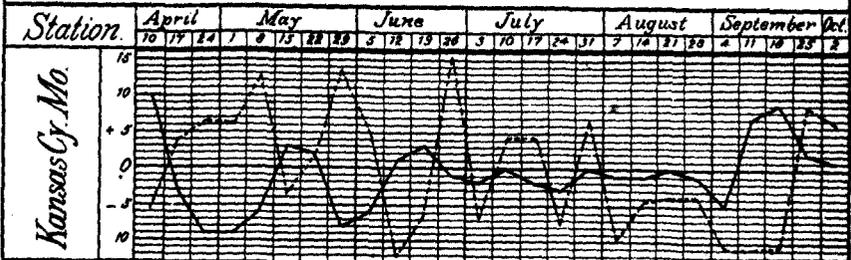
In July, 1893, an edition of 5,000 copies of the Current Chart of the Great Lakes, in four colors, was issued. This work was performed in the lithograph room and was considered to be a first-class job in every respect, and was done at a small expense to this Bureau. This has only recently been rendered possible by our outfit. Lake Storm Bulletins Nos. 1, 2, 3, and 4 have also been printed, showing the storms



*Average daily Departures from Normal Temperature,
and weekly Departures from Normal Precipitation,
from April 10th to October 2nd 1893.*



*Average daily Departures from Normal Temperature,
and weekly Departures from Normal Precipitation,
from April 10th to October 2nd 1893.*



————— Temperature in degrees. - - - - - Precipitation in tenths of inches. du.R.

of October 4 and October 5 to 14, 1893; also the storm of November 16 and 17, and the storms of November 20 to 23, 1893. The edition of these bulletins was 600 copies at first, but there being such a demand for them the edition had to be increased to 1,000 copies. They will be printed and distributed in the future whenever a noteworthy storm passes over the Lake region.

Five Weather Bureau bulletins were printed during the year, as follows:

	Copies.
Bulletin A. Summary of International Meteorological Observations, by Maj. H. H. C. Dunwoody. 10 pages of text and 61 charts	500
Bulletin No. 7. Report of the First Annual Meeting of the American Association of State Weather Services. 49 pages	6,500
Bulletin No. 8. Report on the Climatology of the Cotton Plant, by P. H. Mell, Ph. D. 68 pages with charts	7,500
Bulletin No. 9. Report on the Forecasting of Thunderstorms during the Summer of 1892, by N. B. Conger. 54 pages with charts	7,500
Bulletin No. 10. Report on the Climate of Chicago, by Prof. Henry A. Hazen. 137 pages with charts	5,000

WEATHER CONDITIONS OF THE CROP OF 1893.

(Prepared by H. H. C. DUNWOODY, Major, Signal Corps, U. S. Army, assigned as Assistant Chief of Weather Bureau.)

The tabular statements (Tables VI and VII) show the temperature and rainfall from January 1, 1893, to April 3, compared with the normal for many years, and similar comparisons are made for these elements for each week ending with Monday from April 3 to October 2, 1893.

Plate I shows the seasonal conditions of rainfall from March 1 to October 2 throughout the United States. The shaded portion of this chart covers areas where the precipitation was in excess, and the unshaded portion shows the region of country that received less than the usual rainfall for the same period. The lines show the amount of excess or deficiency in inches, as indicated by the figures. It will be seen from this chart that the season of 1893 was dry over the greater portion of the agricultural districts, the only regions in the United States east of the Rocky Mountains showing an excess being a portion of the cotton region east of the Mississippi, southern Virginia, and portions of Arkansas, Missouri, New York, and Wisconsin. There was a deficiency in the rainfall in the States of the Ohio Valley ranging from 4 to 7 inches, and this deficiency occurred at such times as to have the most injurious effect upon growing crops, especially corn. The excess of rainfall in Missouri occurred early in the season, while August and September were unusually dry, the absence of rain reducing somewhat the yield of crops. The reverse conditions will be found in Iowa, the State immediately north, where the seasonal rainfall was deficient, but where timely rains occurred when the growing crops were most in need of moisture. The distribution of rainfall throughout the season from week to week may be found for any section by reference to the accompanying table.

The drought conditions which existed in Texas are indicated on Plate I by lines showing deficiency in seasonal rainfall ranging from 5 to 15 inches. The abundant rains which occurred over the southern plateau region were attended by a most favorable season in Arizona, and a report furnished by the director of the Arizona weather service states that the cattle ranges in that section are in the best possible condition and that the hay crop is sufficient for two years' demand. The Pacific

coast was favored with but slight departures from the normal conditions, but in the States on the North Pacific considerable grain was lost by the late rains occurring when grain was exposed in the fields. The spring wheat region of Minnesota and the Dakotas received less than the usual amount of rain, although the departures were not marked except in southern Minnesota, where the deficiency ranged from 5 to 7 inches. In the wheat region of the Dakotas the actual rainfall for the season ranged from 13½ to 18 inches. All stations in the Missouri Valley from Yankton, S. Dak., to Helena, Mont., received more than 10 inches of rain.

The drought in western Kansas and eastern Colorado, where the seasonal rainfall ranged from 6 to 9 inches, or a little more than one-half the usual amount, resulted in almost a complete loss of crops in that section.

Although the chart showing seasonal departures from the normal rainfall indicates an excess in New England and New York, this excess was due to the heavy rains that occurred in early May and late in August, and the latter rains were preceded by drought conditions during the growing season which resulted in some injury to crops.

Plate II exhibits the thermal conditions for the growing season of 1893, the shaded portion of the chart defining the regions over which an excess of seasonal temperature prevailed. The season was slightly warmer than usual over the greater portion of the cotton region, although the variation from the normal was very slight, except in Texas, where it amounted to from 1 to 2 degrees per day in the interior. In the States of the Ohio Valley and Lake region the average temperature was slightly in excess, but in all other districts the season was cooler than usual. Along the Atlantic coast the departures from the normal were very slight, but to the westward, over the Rocky Mountain districts and on the Pacific coast, the deficiency apparently increased with the longitude to the westward, and over the Pacific coast States it ranged from 2 to 4 degrees per day below the normal. The cool weather on the Pacific coast was not, however, unfavorable to the staple crops, and while some fruits were injured others were favored by the abnormally cool season.

Plates III and IV show the conditions of temperature and rainfall by weeks at selected stations so distributed as to give the approximate conditions which prevailed in the principal agricultural districts to the east of the Rocky Mountains. The data from which the diagrams were constructed may be found in the accompanying tables, containing data from the regular meteorological stations of the Weather Bureau, from which similar diagrams may be constructed which will show graphically the rainfall and temperature conditions which existed during the growing season over the entire country.

As in the previous year, the diagram illustrating the temperature and rainfall conditions at Springfield, Ill., is taken as an example. The heavy horizontal line marked 0 indicates the normal and the figures to the left indicate inches when referring to rainfall and degrees Fahrenheit when referring to temperature. The solid line indicates the weekly departure from the normal temperature, while the dotted line shows the weekly departure from the normal rainfall. From this diagram it will be seen that in the vicinity of Springfield, Ill., the early portion of spring was wet and cold, and also that heavy rains occurred in the last week of May, attended by about normal temperature, after which time it was relatively dry, there being but one week from June 1 to the close of September when the normal rainfall was exceeded.

This absence of rain resulted in a considerable reduction in the yield of the staple crops in that section, while it is probable that the heavy rains of early spring caused a reduction in the acreage.

It will be of interest to compare this diagram with that of Springfield for the previous years 1891 and 1892, tracing the rainfall and temperature conditions which attended the unusual corn crop of 1891 with those attending the reduced yields of 1892 and 1893 for that particular section. The drought conditions of 1893 in that section are clearly indicated by the diagram for that year, and the tabular statement shows that the drought region extended over the greater portion of the corn belt and thence eastward to the Atlantic States. The data contained in the table referred to show the departures from the normal of both temperature and rainfall for each week of the growing season, and will furnish a ready means of comparing the meteorological conditions attending the development of the several crops with the actual yields as published elsewhere in this report. With additional years of record these statements can not fail to give the probable effect of the weather conditions upon the staple crops considerably in advance of the time of ripening and securing the crop.

The following tables show the departures from normal temperature and rainfall from January 1 to and including April 3, 1893, and for each subsequent week ending with Monday to October 2, 1893:

TABLE VI.—Temperature departures for the season of 1893 from the normal of many years.

Stations.	From Jan. 1 to Apr. 3, inclusive.	For weeks ending—											
		April—			May—					June—			
		10.	17.	24.	1.	8.	15.	22.	29.	5.	12.	19.	26.
<i>New England.</i>													
Eastport, Me.....	-2.7	-2	-1	-3	0	-2	+2	+3	+1	0	+1	+1	+1
Portland, Me.....	-3.2	-2	-1	-4	-3	-5	+3	0	-2	-2	+1	-2	-3
Boston, Mass.....	-2.0	0	-1	-4	-1	-5	+3	+2	0	+2	+7	-3	-6
<i>Middle Atlantic States.</i>													
Albany, N. Y.....	-4.3	-1	-3	-5	-4	-4	+4	-1	-3	+3	+4	+5	+1
New York, N. Y.....	-3.5	+1	-1	-4	-4	-3	+2	+1	0	+1	+5	0	+1
Philadelphia, Pa.....	-3.2	+5	0	-4	-3	-5	+1	0	-1	+3	+4	+1	+1
Washington, D. C.....	-2.8	+6	-1	-5	-1	-4	-2	-1	-1	+3	+3	0	+3
Lynchburg, Va.....	-3.9	+7	-3	-4	+3	-2	-4	-1	+1	+2	+1	-1	-1
Norfolk, Va.....	-4.0	+9	-1	0	+4	+1	-2	+1	+2	+3	+1	-1	+2
<i>South Atlantic States.</i>													
Charlotte, N. C.....	-3.3	+13	-4	-3	+6	-3	-5	-2	+2	0	-1	-3	-3
Wilmington, N. C.....	-2.1	+10	+1	-1	+7	0	-3	0	+2	-1	-1	-2	+1
Charleston, S. C.....	-1.7	+9	+3	-1	+5	+1	-3	-2	+3	-2	-2	-2	0
Augusta, Ga.....	-3.6	+12	+4	-4	+6	-3	-5	-4	+3	-1	-2	-3	-1
Savannah, Ga.....	-2.5	+9	-2	-1	+7	0	-4	-2	+3	0	-1	0	+1
Jacksonville, Fla.....	-1.8	+7	+5	-2	+6	+1	-2	-2	+3	0	-1	0	+2
<i>Gulf States.</i>													
Atlanta, Ga.....	-2.8	+12	-1	-7	+5	-3	-2	-3	+2	-1	-1	-2	-2
Mobile, Ala.....	-1.4	+7	0	-4	+4	-2	0	-3	+3	0	-2	-1	+1
Montgomery, Ala.....	-1.8	+10	+2	-6	+5	-2	-2	-3	+2	0	-3	-1	0
Vicksburg, Miss.....	-0.4	+12	0	-5	+4	-3	+1	-2	0	-1	-2	-1	+1
New Orleans, La.....	-0.9	+7	0	-4	+5	+1	0	-2	+3	+1	-4	-1	+3
Shreveport, La.....	+0.5	+12	-1	-3	0	-3	0	-2	0	-3	-3	-2	+1
Fort Smith, Ark.....	-1.2	+15	-1	-9	-3	-3	0	0	-4	-3	-2	0	+1
Little Rock, Ark.....	-2.1	+15	-2	-7	0	-4	0	0	-3	-3	-1	0	+1
Palestine, Tex.....	+0.9	+13	-1	-3	+1	-1	+2	-1	+2	+2	-1	-1	+2
Galveston, Tex.....	+0.3	+5	0	-2	0	-1	0	-1	+1	+1	-3	-3	-1
San Antonio, Tex.....	+0.5	+11	+1	+1	+2	0	-1	-1	+3	+2	-1	-2	+3

TABLE VI.—Temperature departures for the season of 1893, etc.—Continued.

Stations.	From Jan. 1 to Apr. 3, inclusive.	For weeks ending—											
		April—			May—					June—			
		10.	17.	24.	1.	8.	15.	22.	29.	5.	12.	19.	26.
<i>Ohio Valley and Tennessee.</i>													
Memphis, Tenn.....	-0.3	+16	-3	-6	+1	-2	+3	0	-3	-3	-1	+1	-1
Nashville, Tenn.....	-1.8	+15	-1	-7	+3	-2	+1	-3	-4	0	-1	0	-2
Chattanooga, Tenn.....	-2.4	+14	-1	-7	+4	-3	0	-3	0	-1	-1	-1	-2
Louisville, Ky.....	-3.4	+12	-3	-11	+2	-5	0	-2	-5	+2	+1	+2	-2
Indianapolis, Ind.....	-3.3	+11	-2	-11	-1	0	0	-2	-0	+2	0	+2	+1
Cincinnati, Ohio.....	-4.4	+11	-3	-10	+1	-5	-1	-3	-0	+2	0	+2	-2
Columbus, Ohio.....	-2.9	+9	-2	-8	-1	-6	0	-3	-3	+4	+1	+3	0
Pittsburg, Pa.....	-2.8	+10	-2	-8	0	-5	0	-5	-3	+0	+1	+3	0
<i>Lake region.</i>													
Owego, N. Y.....	-4.0	+1	-2	-6	-3	-5	+5	-3	-3	+7	0	+6	+3
Buffalo, N. Y.....	-2.9	+3	0	-5	-2	-4	+5	-2	-3	+6	0	+6	+4
Cleveland, Ohio.....	-2.4	+7	+2	-5	-2	-6	+3	-2	-4	+8	+1	+2	+5
Detroit, Mich.....	-5.0	+6	-1	-9	-6	-7	-2	-1	-5	+5	0	+4	+5
Alpena, Mich.....	-1.3	+3	+1	-4	-5	-1	+3	+2	-0	+3	+5	+8	+7
Grand Haven, Mich.....	-2.9	+4	-3	-7	-7	-6	0	0	-7	+1	-1	+8	+3
Milwaukee, Wis.....	-4.2	+6	-3	-8	-8	-6	+1	+1	-5	+2	+2	+4	+6
Chicago, Ill.....	-6.0	+6	-1	-9	-7	-9	+1	0	-8	+2	-1	+2	+4
Duluth, Minn.....	-8.1	+1	-5	-7	-7	-3	0	+1	-1	-3	+3	+8	+5
<i>Upper Mississippi Valley.</i>													
St. Paul, Minn.....	-5.8	+1	-11	-13	-13	-6	0	+1	-10	+2	+2	+9	+3
La Crosse, Wis.....	-4.4	+5	-5	-11	-11	-6	+1	+2	-5	+2	+4	+8	+2
Davenport, Iowa.....	-5.3	+8	-4	-10	-10	-9	+2	+3	-7	0	+1	+7	+2
Des Moines, Iowa.....	-4.0	+6	-7	-12	-13	-10	+2	+1	-8	-2	0	+5	+1
Springfield, Ill.....	-4.2	+9	-3	-12	-7	-7	-2	+2	-0	+1	+1	+5	+1
Carro, Ill.....	-1.8	+12	-2	-7	+1	-4	+1	0	-5	-2	+1	+3	-1
St. Louis, Mo.....	-2.3	+11	-2	-11	-3	-5	+2	+3	-6	-1	+1	+4	-1
<i>Missouri Valley.</i>													
Springfield, Mo.....	-1.3	+11	-3	-9	-2	-5	-1	-2	-0	-4	-1	+1	-1
Kansas City, Mo.....	-3.1	+10	-3	-9	-9	-6	+3	+2	-8	-6	+1	+3	-1
Concordia, Kans.....	-1.7	+10	0	-6	-10	-6	+5	+3	-7	-3	+4	+3	+4
Omaha, Nebr.....	-2.3	+7	-4	-10	-14	-9	+3	+2	-0	-2	+2	+3	+2
Valentine, Nebr.....	-0.6	+5	-6	-7	-18	-8	+2	+4	-9	-4	+7	+7	+1
Huron, S. Dak.....	-1.6	+1	-9	-8	-13	-6	+3	+4	-7	+1	+5	+8	+3
<i>Extremes Northwest.</i>													
Moorehead, Minn.....	-5.3	-3	-9	-10	-11	-2	0	+3	-5	+2	+7	+11	+2
Bismarck, N. Dak.....	-2.6	-1	-11	-8	-10	-4	+2	0	-3	-4	+4	+6	+1
Fort Buford, N. Dak.....	-3.4	-3	-8	-9	-11	0	+3	0	-8	-3	+2	0	0
<i>Rocky Mountain slope.</i>													
Havre, Mont.....	-2.6	-4	-8	-10	-13	0	+5	+4	-4	-3	+1	-6	-2
Helena, Mont.....	-2.0	-2	-5	-8	-10	-2	+5	0	-8	-7	+2	-5	-4
Spokane, Wash.....	-1.2	-5	-8	-5	-4	-3	+1	-5	-4	-4	-2	-10	-6
Winnemucca, Nev.....	-3.7	-0	-8	-5	-0	-3	+9	-6	-7	0	+3	0	-3
Salt Lake City, Utah.....	-2.2	-3	-9	-0	-13	-7	+6	-3	-11	-7	+6	0	-3
Cheyenne, Wyo.....	+0.4	+3	-7	-7	-13	-8	+5	+3	-0	-7	+5	+3	+1
North Platte, Nebr.....	+1.4	+4	-6	-7	-15	-7	+5	+2	-8	-7	+5	+4	+2
Denver, Colo.....	+3.0	+5	-6	-5	-12	-7	+5	+4	-9	-7	+7	+5	+2
Dodge City, Kans.....	+3.0	+9	-1	-4	-13	-7	+2	+3	-7	-2	+0	+1	+4
Abilene, Tex.....	+0.8	+16	+2	0	0	-1	-2	+4	+1	+5	0	-2	+7
Santa Fe, N. Mex.....	+1.8	+6	-5	-2	-4	-4	+1	0	0	0	+5	+2	+4
El Paso, Tex.....	+0.5	+7	-1	0	-4	-3	-4	-1	-2	0	+2	-1	+2
Tucson, Ariz.....	-0.2	+1	-5	-1	-7	-3	-3	-2	-3	0	+3	-1	+1
<i>Pacific coast.</i>													
Olympia, Wash.....	-2.2	-5	-7	-3	-2	-2	0	-4	-2	+1	-4	-8	-5
Portland, Oreg.....	-4.0	-9	-10	-5	-6	-5	-1	-8	-5	-2	-6	-9	-6
Roseburg, Oreg.....	-3.0	-8	-8	-2	-5	-2	+1	-7	-3	+1	-3	-0	-6
Red Bluff, Cal.....	-3.3	-10	-6	-2	-7	-2	+4	-11	-2	+8	-1	-2	-0
Sacramento, Cal.....	-3.2	-6	-4	-1	-5	-1	+3	-7	0	+5	-3	-1	-5
San Francisco, Cal.....	-2.5	-5	-4	-2	-5	-2	-1	-2	-3	-1	-5	-3	-5
Los Angeles, Cal.....	0	-7	-2	+2	-4	-2	0	-1	-2	-1	-1	0	-2
San Diego, Cal.....	+0.2	-3	-3	+2	-3	-1	0	0	-2	-2	-1	-2	-1

TABLE VI.—Temperature departures for the season of 1893, etc.—Continued.

Stations.	For weeks ending—													
	July—					August—				September—				October
	3.	10.	17.	24.	31.	7.	14.	21.	28.	4.	11.	18.	25.	
<i>New England.</i>														
Eastport, Me.....	-4	+2	+4	+3	-2	-1	+4	-2	+5	-1	-3	+2	0	-3
Portland, Me.....	-4	+1	-2	+1	+1	+1	+4	-5	+6	0	-2	0	+1	-4
Boston, Mass.....	-7	-1	-1	+1	+1	0	+2	-5	+6	-1	-2	0	+1	-6
<i>Middle Atlantic States.</i>														
Albany, N. Y.....	-2	-3	-1	0	0	+1	+3	-1	+6	-4	-3	-3	-1	-6
New York, N. Y.....	-3	+1	+1	+1	+2	0	+4	+1	+5	-2	-1	-1	+3	-7
Philadelphia, Pa.....	-6	-1	0	+1	+2	-1	+2	+2	+6	-4	0	-1	+5	-5
Washington, D. C.....	-6	0	-1	-2	+1	-1	0	0	+6	-5	+1	0	+6	-9
Lynchburg, Va.....	-6	+2	+1	+2	+2	-2	-2	-1	+1	-5	-1	-1	+8	-10
Norfolk, Va.....	-6	+1	-1	0	+1	0	+1	0	+4	-2	+2	0	+5	-8
<i>South Atlantic States.</i>														
Charlotte, N. C.....	-4	0	+2	0	+2	-2	-2	-1	-1	-3	0	+3	+3	-7
Wilmington, N. C.....	-3	+2	0	0	+1	-2	0	-2	+1	0	+2	+2	+7	-5
Charleston, S. C.....	-2	+1	0	0	+2	-2	0	-1	-1	+1	+1	+3	+8	-1
Augusta, Ga.....	-4	+1	0	-1	+2	-2	-2	-1	-2	-2	0	+2	+5	-3
Savannah, Ga.....	-2	0	-2	+1	+2	-1	0	-1	-1	+1	+1	+4	+3	0
Jacksonville, Fla.....	-2	+1	0	+2	+2	0	0	0	-1	0	-2	+4	+5	0
<i>Gulf States.</i>														
Atlanta, Ga.....	-1	+3	0	0	+3	-1	0	+1	+4	+1	-1	+3	+7	0
Mobile, Ala.....	0	+1	-1	0	+2	0	-1	+1	-2	+1	-2	+3	+3	+1
Montgomery, Ala.....	0	+2	0	0	+3	-1	-1	+1	+2	+2	-1	+3	+5	0
Vicksburg, Miss.....	-3	0	-2	-2	+1	-1	-1	+3	0	-3	+7	+3	+4	0
New Orleans, La.....	+2	0	-1	0	+3	-2	-1	+2	+2	+3	-3	+2	+4	+2
Shreveport, La.....	0	0	-2	-1	+3	-1	-1	0	-1	-5	-3	+5	+4	+2
Fort Smith, Ark.....	-4	-1	-2	-4	+3	-2	-2	+1	-2	-5	0	+7	+4	-1
Little Rock, Ark.....	-3	+1	-1	-3	+2	-1	-1	0	-2	-4	-2	+5	+5	0
Palestine, Tex.....	+2	0	0	0	+3	-1	-1	+1	+1	-4	-1	+3	+7	+4
Galveston, Tex.....	0	-1	-3	0	+1	-3	-1	0	+1	-2	0	+4	+5	+3
San Antonio, Tex.....	+3	+2	+2	+1	+2	+2	+2	+2	+2	-3	+5	+7	+7	+5
<i>Ohio Valley and Tennessee.</i>														
Memphis, Tenn.....	0	+1	0	-1	+4	+1	+1	+2	0	-3	-3	+4	+5	+1
Nashville, Tenn.....	+2	+2	0	-1	+4	0	0	0	+3	-2	+1	+4	+4	-2
Chattanooga, Tenn.....	0	+2	+2	+1	+3	-1	0	0	+3	+1	+1	+3	+3	-2
Louisville, Ky.....	-1	+1	+3	+2	+4	+1	+1	+1	+3	-3	+6	+5	+5	-4
Indianapolis, Ind.....	0	+2	+3	+1	+6	+2	+2	0	+5	-3	+10	+7	+4	-3
Cincinnati, Ohio.....	0	+1	+1	0	+3	0	0	0	-3	-4	+7	+7	+5	-6
Columbus, Ohio.....	-2	0	+1	-2	+4	-1	+1	-1	-4	-3	+7	+4	+5	+3
Pittsburg, Pa.....	-6	-3	+1	-2	0	-3	0	-1	+5	-6	+3	+1	+3	-9
<i>Lake region.</i>														
Oswego, N. Y.....	0	-2	-1	-2	+1	-1	+2	-2	+5	-5	-5	0	-1	-7
Buffalo, N. Y.....	+2	-1	+1	-1	+2	0	+2	0	+6	-4	0	+3	+1	-6
Cleveland, Ohio.....	-1	0	+3	-2	+4	-1	+1	0	+5	-4	+4	+4	+2	-7
Detroit, Mich.....	-1	-2	+3	-1	+3	0	+1	0	+5	-2	+1	+3	+1	-7
Albion, Mich.....	+2	-1	+2	+1	+3	+1	0	0	+6	-1	-2	+4	+1	-4
Grand Haven, Mich.....	+2	-4	0	-1	+2	-1	+1	-2	+5	-5	+5	+6	+1	-5
Milwaukee, Wis.....	-1	-4	+4	+3	+2	+1	+1	-2	+3	-4	+1	+7	+3	-5
Chicago, Ill.....	-2	-1	+4	+3	+2	-1	+1	-3	+2	-4	+1	+8	+3	-4
Duluth, Minn.....	-2	-5	-4	+2	+4	+1	+1	+1	+2	+3	+2	+3	-3	-5
<i>Upper Mississippi Valley.</i>														
St. Paul, Minn.....	+2	-2	+3	+5	+1	+2	+1	+1	0	-2	+11	+5	0	-6
La Crosse, Wis.....	+2	-1	+2	+2	+2	+1	+2	+1	+3	-2	+3	+3	0	-5
Davenport, Iowa.....	+1	0	+2	+1	+2	+2	+2	0	+2	-2	+3	+7	0	-3
Des Moines, Iowa.....	-1	0	+2	0	-1	-1	-1	-3	-2	-4	+9	+7	0	-3
Springfield, Ill.....	0	-1	+1	+1	+2	+1	0	0	+3	-2	+3	+3	+3	0
Calro, Ill.....	0	+2	0	-2	+3	+1	0	0	0	-3	+1	+5	+5	0
St. Louis, Mo.....	-1	+1	+1	-1	+2	0	-1	0	+1	-2	+7	+7	+4	0
<i>Missouri Valley.</i>														
Springfield, Mo.....	-3	+1	-3	-4	+3	-1	-1	-1	-1	-5	+4	+11	+3	+1
Kansas City, Mo.....	-2	0	-2	-3	0	-1	-1	0	-1	-5	+7	+9	+3	+1
Concordia, Kans.....	-1	+4	+4	-2	+1	0	0	+2	0	-3	+7	+5	+3	-2
Omaha, Nebr.....	-1	0	+1	-1	-1	0	0	-1	-2	-3	+9	+3	+3	-2
Valentine, Nebr.....	-2	-1	+1	+4	+2	+3	0	0	0	+4	+11	+5	+5	-5
Huron, S. D.....	-1	-2	+2	+3	-2	0	-2	+3	0	+1	+13	+3	+4	-4

TABLE VI.—Temperature departures for the season of 1893, etc.—Continued.

Stations.	For weeks ending—													
	July—					August—				September—				October
	3.	10.	17.	24.	31.	7.	14.	21.	28.	4.	11.	18.	25.	
<i>Extreme Northwest.</i>														
Moorehead, Minn.....	+2	-2	+2	+5	-1	+4	-1	+1	0	+1	+12	+5	-7	-6
Bismarck, N. Dak.....	-3	-3	+1	+7	-3	+5	-2	+2	-1	+5	+14	+5	-8	-4
Fort Buford, N. Dak.....	-4	-4	-1	+8	-1	+8	-8	0	-1	+4	+13	+1	-8	-5
<i>Rocky Mountain slope.</i>														
Havre, Mont.....	-4	-2	-2	+7	0	+5	-6	+4	+1	+8	+8	-3	-10	-1
Helena, Mont.....	-3	-1	-2	+12	+5	+6	-5	0	+1	+7	+3	-7	-7	-6
Spokane, Wash.....	-4	-6	-4	+2	0	0	-7	+2	+2	+10	+2	0	-4	+2
Winnemucca, Nev.....	0	-3	-6	+2	+1	+3	-3	-2	+4	+5	-5	-7	-4	-4
Salt Lake City, Utah.....	0	-1	-3	+2	-3	0	-5	0	-2	+1	+1	-4	-3	-3
Cheyenne, Wyo.....	+1	+2	-2	0	-1	0	0	0	-3	+1	+6	+4	-3	-7
North Platte, Nebr.....	+1	-2	-1	+2	0	-1	-4	0	-2	0	+9	+6	-4	-6
Denver, Colo.....	+2	+2	0	0	-2	-1	+1	+2	+1	0	+5	+5	-1	-6
Dodge City, Kans.....	0	+3	-2	-3	+2	-3	-1	+1	0	-2	+5	+6	+4	-4
Ablene, Tex.....	+6	+4	+3	-1	+5	-4	+1	+4	+3	-4	+5	+12	+8	0
Santa Fe, N. Mex.....	+4	0	-1	-3	-1	-4	+2	-1	0	-6	+2	+1	+3	-5
El Paso, Tex.....	+2	-1	-2	-7	-2	-9	-1	+1	0	-6	0	+3	+4	-2
Tucson, Ariz.....	+2	-2	-2	-6	0	-4	-1	-3	-2	-1	-3	-1	+3	-2
<i>Pacific coast.</i>														
Olympia, Wash.....	-2	-2	-1	-3	0	-1	-2	-1	+2	+3	-1	-3	+3	-2
Portland, Oreg.....	-4	-5	-5	-4	0	-2	-3	-1	+2	+3	-6	-3	-2	-4
Roseburg, Oreg.....	-4	-3	-3	-2	0	-4	-3	-2	+3	+2	-4	-4	-3	-3
Red Bluff, Cal.....	+4	-4	0	+2	-1	+2	-3	-5	+2	0	-13	-6	-5	+2
Sacramento, Cal.....	+3	-3	+2	+2	0	+4	0	+4	+2	-3	-8	-5	+4	0
San Francisco, Cal.....	-3	-3	-2	-3	-5	-3	-5	-3	-3	-3	-1	-2	-4	0
Los Angeles, Cal.....	-1	-2	-2	+2	-2	+1	+3	-4	-3	0	-5	-5	-3	-5
San Diego, Cal.....	-2	-1	0	+1	-1	0	+1	0	+1	-1	-5	-5	-3	-1

TABLE VII.—Precipitation departures for the season of 1893 from the normal of many years.

Stations.	From Jan. 1 to Apr. 3, inclusive.	For weeks ending—							
		April—			May—				
		10.	17.	24.	1.	8.	15.	22.	29.
<i>New England.</i>									
Eastport, Me.....	-6.76	+ .05	- .41	- .21	- .87	- .73	- .16	- .31	- .73
Portland, Me.....	- .54	+ .33	+ .15	+ .78	- .32	+1.69	+2.43	+1.18	- .78
Boston, Mass.....	- .98	+ .29	+ .05	+ .03	- .27	+2.29	- .38	+ .33	- .44
<i>Middle Atlantic States.</i>									
Albany, N. Y.....	- .63	- .03	+ .07	- .02	+ .20	+1.84	+ .09	- .19	- .06
New York, N. Y.....	+3.73	+ .33	+1.00	+1.66	+ .77	+2.93	- .60	- .07	- .49
Philadelphia, Pa.....	- .05	+ .51	+ .53	+ .33	+ .46	+1.12	- .63	+ .01	- .25
Washington, D. C.....	-3.30	- .16	- .09	+ .32	+ .32	+2.01	- .24	+ .08	+ .06
Lynchburg, Va.....	-2.78	- .68	- .12	+ .46	+ .90	+2.42	- .29	- .25	+ .01
Norfolk, Va.....	-2.65	- .97	- .89	- .77	+ .85	+ .52	- .11	+ .18	+2.51
<i>South Atlantic States.</i>									
Charlotte, N. C.....	-3.25	- .88	+ .22	- .54	- .56	+1.76	- .71	- .83	- .10
Wilmington, N. C.....	-4.18	- .67	- .43	- .28	- .52	+1.38	+ .33	- .60	- .01
Charleston, S. C.....	-2.70	- .98	- .79	+ .03	- .86	+ .21	- .08	- .84	+ .40
Augusta, Ga.....	-2.90	- .78	- .90	- .04	- .68	+ .55	- .49	- .70	+ .74
Savannah, Ga.....	+ .18	- .98	- .12	+ .50	- .72	+ .18	- .36	- .27	+ .20
Jacksonville, Fla.....	+0.53	- .70	- .57	+1.78	- .78	+ .25	- .72	- .50	+1.30
<i>Gulf States.</i>									
Atlanta, Ga.....	-6.94	- .44	- .74	+ .45	- .13	+ .44	- .38	- .87	+1.52
Mobile, Ala.....	-6.87	-1.40	- .57	+1.67	+ .01	+2.37	+ .94	- .46	-1.07
Montgomery, Ala.....	-6.02	- .85	-1.09	+1.36	+ .98	+2.89	- .32	- .86	- .16
Vicksburg, Miss.....	-6.71	-1.54	+ .87	-1.42	- .07	+4.52	- .13	-1.04	+1.07
New Orleans, La.....	-5.01	-1.26	- .44	+1.62	-1.23	- .17	+ .30	- .94	-1.33
Shreveport, La.....	-9.50	-1.32	+ .16	- .76	- .08	+2.36	- .36	- .98	- .61
Fort Smith, Ark.....	-2.56	-1.17	- .40	-1.11	+5.51	+1.72	+ .16	- .88	+1.66
Little Rock, Ark.....	-5.70	-1.12	+ .54	- .68	+4.27	+1.02	- .57	-1.26	+4.41
Palestine, Tex.....	-7.87	- .91	- .53	- .93	+1.63	+ .65	+ .73	-1.45	- .79
Galveston, Tex.....	-7.02	- .70	- .81	+3.60	+ .61	+ .19	.00	- .99	- .75
San Antonio, Tex.....	-2.90	- .77	+ .17	- .68	+ .32	- .77	+2.56	- .76	- .70

TABLE VII.—Precipitation departures for the season of 1893, etc.—Continued.

Stations.	From Jan. 1 to Apr. 3, inclusive.	For weeks ending—							
		April—			May—				
		10.	17.	24.	1.	8.	15.	22.	29.
<i>Ohio Valley and Tennessee.</i>									
Memphis, Tenn.	-7.95	-1.21	+1.54	-1.00	+2.50	-.32	+ .52	-.85	+6.47
Nashville, Tenn.	-0.76	-1.16	+1.68	-.91	+ .33	-.04	+ .75	-.47	+1.49
Chattanooga, Tenn.	-6.35	-.59	+2.02	-.03	+ .24	+3.89	-.23	-.82	+1.33
Louisville, Ky.	-3.57	-.42	+1.56	+ .84	+2.87	-.15	+ .10	-.84	-.03
Indianapolis, Ind.	+1.27	-.28	+1.67	+ .66	+3.20	-.87	+ .44	-.58	-.24
Cincinnati, Ohio	-1.25	+ .02	+1.22	+ .26	+4.48	-.69	+1.05	+ .09	-.36
Columbus, Ohio.	+1.35	+ .58	+ .46	+ .11	+5.57	-.45	+1.05	-.42	-.75
Pittsburg, Pa.	-.74	+ .42	+ .58	+ .48	+1.35	-.20	-.42	+1.84	-.46
<i>Lake region.</i>									
Oswego, N. Y.	-2.74	+ .25	-.31	+ .55	+ .66	+ .80	-.23	+1.01	-.39
Buffalo, N. Y.	+ .74	+ .49	+ .45	+1.36	+ .86	-.09	-.43	+2.28	-.50
Cleveland, Ohio.	-.06	-.30	+ .21	-.15	+1.84	-.70	+ .05	+2.67	-.41
Detroit, Mich.	+ .36	+ .44	+ .27	-.05	+1.00	-.67	-.19	-.67	-.38
Alpena, Mich.	-1.29	+ .76	.00	+ .20	+ .19	-.44	+ .06	-.83	+1.03
Grand Haven, Mich.	+2.29	+ .87	+ .05	+ .59	+ .25	-.37	+ .00	-.79	+ .63
Milwaukee, Wis.	-.06	+1.35	+ .09	+1.05	+ .48	-.25	-.27	-.77	-.18
Chicago, Ill.	-1.19	-.61	+ .02	+ .35	+1.87	-.02	-.42	-.85	+ .08
Duluth, Minn.	+1.25	-.09	+1.46	-.05	+ .21	-.50	-.07	+ .31	-.84
<i>Upper Mississippi Valley.</i>									
St. Paul, Minn.	+1.07	-.22	+ .77	+1.88	+ .91	-.47	-.46	+ .13	+ .22
Lacrosse, Wis.	+ .46	-.29	+ .47	+ .80	+1.46	+ .10	-.32	+ .42	-.52
Davenport, Iowa.	-.72	-.56	+1.64	+1.01	-.11	-.64	-.30	-.68	-.24
Des Moines, Iowa.	-1.27	-.43	-.15	+1.85	+1.81	-.47	+ .02	-.90	-.70
Springfield, Ill.	-.25	+ .50	+2.25	+1.90	+2.42	-.78	+ .16	-.64	+3.29
Cairo, Ill.	-5.20	+ .38	+1.24	-.13	+3.77	+ .36	+ .13	-.86	+1.45
St. Louis, Mo.	-.10	+ .75	+1.42	+1.57	+3.73	-.45	+ .10	-.92	+2.65
<i>Missouri Valley.</i>									
Springfield, Mo.	-3.55	+ .61	+ .07	+ .67	+2.83	+ .14	+ .18	-1.32	-1.35
Kansas City, Mo.	-.37	-.66	+ .39	+ .65	+ .61	+1.26	-.35	+ .15	+1.36
Concordia, Kans.	-2.83	-.70	-.76	-.13	-.87	-.77	+ .21	-.86	-.45
Omaha, Nebr.	-.64	-.08	-.08	+ .98	-.03	-.21	+ .66	-.09	-1.04
Valentine, Nebr.	+1.31	-.41	-.31	-.13	+1.45	+ .16	-.05	-.73	-.84
Huron, S. Dak.	+1.25	+ .13	+1.52	+ .08	+ .75	+ .44	-.46	-.03	-.60
<i>Extreme Northwest.</i>									
Moorhead, Minn.	+1.40	-.14	+1.85	+ .65	-.16	-.39	+ .14	-.45	-.60
Bismarck, N. Dak.	-.01	-.46	-.18	-.50	-.31	-.55	-.51	+ .21	-.54
Fort Buford, N. Dak.	+ .98	-.07	-.15	-.31	-.26	-.32	-.29	+4.14	-.43
<i>Rocky Mountain slope.</i>									
Havre, Mont.	-.28	+ .18	-.01	+ .38	-.21	+ .54	-.17	-.09	+ .23
Helena, Mont.	-.23	-.02	-.23	+ .64	+ .85	+ .35	-.08	+1.30	+ .08
Spokane, Wash.	+ .64	+1.05	+ .12	+ .91	+ .44	+ .59	-.22	+ .83	-.16
Winnemucca, Nev.	+ .98	+ .09	-.15	+ .41	-.09	+ .10	-.14	-.08	-.14
Salt Lake City, Utah.	+ .08	+ .10	-.26	+ .02	+ .01	+ .29	-.43	-.16	+ .49
Cheyenne, Wyo.	-.03	-.27	-.10	+ .17	+ .18	+ .03	-.47	-.02	+ .10
North Platte, Nebr.	+ .39	-.40	-.55	-.58	-.49	-.27	-.93	-.70	-.61
Denver, Colo.	-1.02	-.42	-.06	-.17	-.46	+ .85	-.74	-.07	+ .49
Dodge City, Kans.	-1.52	-.22	-.85	-.51	-.59	-.60	-.01	-.71	-.83
Arlene, Tex.	-2.48	-.97	-1.07	-1.11	-.79	-.95	+4.08	-.98	-.91
Santa Fe, N. Mex.	-.08	-.21	-.21	-.21	-.12	+ .05	+ .62	-.21	-.21
El Paso, Tex.	-.66	-.07	-.07	-.03	-.00	-.06	+2.21	-.07	-.07
Tucson, Ariz.	-.42	-.07	-.07	-.06	-.00	.00	+ .71	-.05	-.00
<i>Pacific coast.</i>									
Olympia, Wash.	-.77	-.11	+ .72	+2.76	-.46	+ .78	-.26	+1.10	-.36
Portland, Oreg.	-8.24	+ .32	-.28	+ .54	-.16	+ .56	-.52	+ .34	-.41
Roseburg, Oreg.	-2.18	+1.05	-.18	-.10	-.06	+ .22	-.41	+1.27	-.34
Red Bluff, Cal.	+1.49	+ .35	-.57	-.24	-.34	-.07	-.30	+ .08	-.21
Sacramento, Cal.	-1.01	+ .10	-.65	-.39	-.47	+ .47	-.19	+ .09	-.09
San Francisco, Cal.	-2.37	+ .28	-.16	-.34	-.36	-.24	-.14	+ .01	-.10
Los Angeles, Cal.	+7.67	-.29	-.42	-.39	-.28	-.13	-.01	-.07	-.07
San Diego, Cal.	+ .87	+ .01	-.21	-.36	-.17	-.11	+ .32	-.07	-.07

TABLE VII.—Precipitation departures for the season of 1893, etc.—Continued.

Stations.	For week ending—								
	June—				July—				
	5.	12.	19.	26.	3.	10.	17.	24.	31.
<i>New England.</i>									
Eastport, Me.....	-.62	-.85	-.32	+ .12	-.94	-.08	-.81	-.42	+ .07
Portland, Me.....	-.77	+1 .03	+ .04	+ .13	-.84	-.72	-.80	-.54	-.34
Boston, Mass.....	-.74	-.68	-.27	+ .79	-.77	-.63	-.73	+ .50	-.68
<i>Middle Atlantic States.</i>									
Albany, N. Y.....	-.24	+ .54	-.86	-.02	-.41	-.39	-.71	-.84	-.30
New York, N. Y.....	-.70	+ .30	-.50	+ .29	-.71	-.73	-.84	-1 .05	-.33
Philadelphia, Pa.....	-.74	-.32	-.72	+1 .77	-.43	-.42	-.30	-.97	-.81
Washington, D. C.....	-.25	-.73	-.87	-.32	-.98	-.49	-.48	-1 .03	-.82
Lynchburg, Va.....	-.22	-.01	+ .15	+ .13	+2 .43	-.70	-.59	-.76	+ .68
Norfolk, Va.....	-.59	+ .65	+5 .00	-.83	+3 .39	-1 .07	+ .04	-1 .30	-1 .00
<i>South Atlantic States.</i>									
Charlotte, N. C.....	+ .90	-.69	+ .78	-.43	-.50	-.73	-1 .39	+ .92	-.24
Wilmington, N. C.....	-.99	+ .49	+1 .51	-.93	-1 .38	-1 .38	+ .29	-.98	-.52
Charleston, S. C.....	+ .41	+4 .66	+7 .17	-.85	-1 .03	+1 .23	-1 .55	-.66	-1 .16
Augusta, Ga.....	+1 .26	-.42	+1 .72	-.55	+1 .18	-.72	-.82	+ .90	-.97
Savannah, Ga.....	-1 .40	+ .06	+2 .33	-.32	-.39	-.92	+1 .52	-.41	-.63
Jacksonville, Fla.....	-.77	-.85	+ .44	-.85	+ .11	-.11	-1 .46	-.86	+1 .00
<i>Gulf States.</i>									
Atlanta, Ga.....	+1 .09	+ .29	-.19	-.59	-1 .05	-1 .05	-.26	-.40	-.36
Mobile, Ala.....	-.36	+2 .83	-1 .16	-1 .42	+ .04	-.31	-1 .08	-.55	-1 .32
Montgomery, Ala.....	-.38	+1 .46	-.81	-1 .09	-.39	-.88	-.95	+2 .30	+1 .23
Vicksburg, Miss.....	+1 .82	-1 .04	+ .26	-.96	+ .68	-.98	+ .80	+ .36	-.15
New Orleans, La.....	+1 .37	-.72	-1 .37	-1 .61	-.17	-1 .07	+ .41	-.53	-.88
Shreveport, La.....	+5 .93	-.84	+ .56	-.79	-.87	-.98	-.16	-.47	-.16
Fort Smith, Ark.....	+ .73	-1 .05	+ .23	-.34	+2 .33	-1 .15	-.61	-.58	-.84
Little Rock, Ark.....	+4 .02	-1 .12	-1 .02	+ .34	+ .22	-.79	-.17	+ .90	-.82
Palestine, Tex.....	+2 .19	-.69	+1 .07	-.78	-.70	-.70	-.54	-.62	-.56
Galveston, Tex.....	+ .14	+ .98	+2 .81	-1 .15	-.99	-.75	+1 .17	+ .78	-.77
San Antonio, Tex.....	+ .72	-.86	-.37	-.63	-.63	-.63	-.63	-.63	+ .26
<i>Ohio Valley and Tennessee.</i>									
Memphis, Tenn.....	+2 .46	-1 .26	-.31	-.87	-.67	-.52	-.51	-.52	-.77
Nashville, Tenn.....	+4 .39	-.94	-1 .05	+ .15	-.46	-.50	-.72	-.85	-.23
Chattanooga, Tenn.....	+2 .53	+ .28	-.84	+ .21	-.86	-.42	-.76	-.67	-.29
Louisville, Ky.....	+2 .12	-1 .03	-1 .10	+ .19	-.19	-.47	-.69	-.84	+ .07
Indianapolis, Ind.....	-.22	-1 .04	-1 .25	+ .85	-.91	-1 .12	-.94	-1 .10	-.55
Cincinnati, Ohio.....	+1 .92	-1 .07	-.75	+1 .02	-.09	-.30	-.16	-.63	+1 .36
Columbus, Ohio.....	+ .63	-.73	-.71	+ .30	-.71	-.66	+ .19	-.77	-.68
Pittsburg, Pa.....	+ .11	-.50	-.59	+ .69	-.80	-.91	+1 .10	-1 .00	+1 .27
<i>Lake region.</i>									
Oswego, N. Y.....	-.70	+ .28	-.82	+ .21	-.36	-.66	-.61	-.70	-.19
Buffalo, N. Y.....	-.04	-.61	-.56	-.43	-.67	-.46	-.41	-.77	-.04
Cleveland, Ohio.....	+ .74	-.87	-.98	-.76	-.71	-.37	-.34	-.85	-.71
Detroit, Mich.....	+2 .34	+ .50	-.76	-.76	-.63	+ .49	+ .06	-.77	-.58
Alpena, Mich.....	+ .44	-.85	-.84	+ .54	-.71	-.21	+ .13	-.63	-.35
Grand Haven, Mich.....	+ .28	+ .87	-.92	-.74	-.73	+ .34	+1 .24	-.63	-.54
Milwaukee, Wis.....	+ .43	+1 .20	-.86	+ .98	-.72	+1 .39	+ .41	-.74	-.46
Chicago, Ill.....	-.27	+ .52	-.80	+ .63	-.90	+ .75	+ .50	-.84	-.78
Duluth, Minn.....	-.83	-1 .12	-1 .17	-.18	-.70	+ .81	+ .74	-.59	-.83
<i>Upper Mississippi Valley.</i>									
St. Paul, Minn.....	+ .05	-.90	-1 .13	-.17	-.81	+ .37	-.01	-.74	-.34
Lacrosse, Wis.....	-.85	-.93	-.32	-.20	-.56	+1 .04	-.59	-1 .02	-.30
Davenport, Iowa.....	+ .89	-.29	-.54	-.44	-.53	+ .70	-.85	-.84	-.70
Des Moines, Iowa.....	-.60	+1 .24	-.97	-.40	-.94	+1 .28	+ .11	-.70	-.17
Springfield, Ill.....	+ .19	-1 .39	-1 .13	-.39	-.91	+ .33	-.37	-.37	+ .05
Cairo, Ill.....	+6 .55	-1 .11	-.63	-.65	-.86	+ .04	-.83	-.59	-.63
St. Louis, Mo.....	-.31	-.82	-.98	+ .77	-.02	-.65	+ .39	-.72	+ .39
<i>Missouri Valley.</i>									
Springfield, Mo.....	+2 .27	-1 .38	-.75	+1 .16	-.92	+ .42	+ .25	+1 .70	-.80
Kansas City, Mo.....	+ .48	-1 .21	-.63	+1 .54	-.68	+ .46	+ .45	-.74	+ .68
Concordia, Kans.....	+2 .53	-.91	-.91	+ .30	+3 .29	-.70	+ .71	-.78	+1 .12
Omaha, Nebr.....	+3 .27	+ .01	-1 .39	-.64	-.53	+ .01	-1 .06	-.98	-.20
Valentine, Nebr.....	+ .29	-.79	+ .81	-.69	+1 .58	+ .24	-.58	-.70	-.52
Huron, S. Dak.....	-.47	-.84	-.84	-.84	-.50	+1 .77	-.83	-.84	-.56

TABLE VII.—Precipitation departures for the season of 1893, etc.—Continued.

Stations.	For week ending—								
	June—				July—				
	5.	12.	19.	26.	5.	10.	17.	24.	31.
<i>Extreme Northwest.</i>									
Moorhead, Minn	-.86	-.98	-.36	+ .83	+ .19	+ .02	+ .61	-.82	-.73
Bismarck, N. Dak	+ .48	-.73	-.10	-.44	+1.55	+ .05	-.16	-.48	-.28
Fort Buford, N. Dak	-.40	-.12	-.32	-.62	-.34	-.28	+ .98	-.24	-.40
<i>Rocky Mountain slope.</i>									
Havre, Mont	-.14	-.61	-.38	-.51	-.48	-.24	+ .89	-.42	-.49
Helena, Mont	-.36	-.56	-.29	-.43	.00	+ .48	-.04	-.21	-.19
Spokane, Wash	-.14	-.29	-.35	-.35	-.39	+ .08	-.14	-.09	-.07
Winnemucca, Nev	-.21	-.21	-.12	-.14	-.11	-.07	-.08	+ .08	+ .08
Salt Lake City, Utah	-.19	-.21	-.17	-.14	-.14	-.14	-.14	+ .66	+ .35
Cheyenne, Wyo	+ .06	-.40	+ .52	-.29	-.27	-.41	-.36	-.34	+ .13
North Platte, Nebr	+1.95	-.70	-.15	-.77	+ .98	-.55	-.43	-.63	+ .12
Denver, Colo	-.24	-.32	-.28	-.83	-.38	-.38	-.37	-.27	+ .67
Dodge City, Kans	-.72	-.68	-.73	-.20	-.48	-.61	+ .09	+1.85	-.46
Abilene, Tex	-.57	-.68	+ .13	-.59	-.46	-.36	-.35	+ .17	-.33
Santa Fe, N. Mex	-.21	-.19	-.21	-.23	-.37	+ .40	+ .03	-.85	+ .28
El Paso, Tex	-.07	-.07	-.07	-.16	-.30	+ .57	-.18	-.49	-.08
Tucson, Ariz00	.00	.00	-.06	-.49	-.78	+ .78	+ .41	-.71
<i>Pacific coast.</i>									
Olympia, Wash	-.28	+ .98	+ .71	-.32	-.28	-.06	+ .17	-.14	-.14
Portland, Oreg	-.43	-.15	+ .20	-.40	-.26	-.02	-.12	-.14	-.17
Roseburg, Oreg	-.35	-.06	-.28	+ .12	-.25	-.18	-.06	-.07	-.04
Red Bluff, Cal	-.84	-.14	-.14	-.11	-.06	.00	+ .89	.00	.00
Sacramento, Cal	-.07	-.07	-.07	-.01	.00	.00	.00	.00	.00
San Francisco, Cal	-.07	-.07	-.07	-.04	-.01	.00	.00	.00	.00
Los Angeles, Cal	-.07	-.04	-.01	.00	.00	.00	.00	.00	-.08
San Diego, Cal	-.07	-.01	.00	.00	.00	.00	.00	.00	-.91

Stations.	For weeks ending—								
	August—				September—				Octo- ber—
	7.	14.	21.	28.	4.	11.	18.	25.	2.
<i>New England.</i>									
Eastport, Me	-.70	+ .11	+ .88	+ .41	-.34	-.55	+ .10	-.70	+ .09
Portland, Me	-.57	-.77	+ .62	-.30	-.30	+ .12	+ .16	-.43	-.58
Boston, Mass	+3.16	-1.04	+ .76	-.74	-.25	-.88	-.13	-.46	-.76
<i>Middle Atlantic States.</i>									
Albany, N. Y.	+1.27	-.83	-.61	+3.47	-.82	-.21	+ .78	-.52	-.37
New York, N. Y.	-.76	-.97	+1.50	+2.80	-.51	-.80	+ .20	-.61	-.81
Philadelphia, Pa	-.78	-1.10	-.97	+ .31	-.11	-.87	+1.81	+ .10	-.65
Washington, D. C	-.67	-.83	-.77	-.64	+1.23	-.34	+ .83	-.70	-.53
Lynchburg, Va	+2.06	-.89	+ .06	+3.07	+1.84	+ .22	+3.20	-.57	+ .54
Norfolk, Va	+1.31	-1.36	+ .23	-1.32	+ .74	+1.80	-.21	-.92	+ .81
<i>South Atlantic States.</i>									
Charlotte, N. C	+ .84	-.69	+ .24	+3.98	+2.46	+1.11	+ .22	-.75	+ .42
Wilmington, N. C	+3.52	-1.00	-1.36	-.90	+ .08	-.91	-.26	-1.19	-.78
Charleston, S. C	+3.56	+ .82	-.88	+3.84	+1.86	+2.46	-.18	-1.39	-1.36
Augusta, Ga	+ .43	-.33	-.76	+3.16	+2.66	+ .24	-.93	-.89	-.01
Savannah, Ga	+ .38	+1.09	-.20	+4.01	-.23	+3.89	+ .50	-1.28	-1.05
Jacksonville, Fla	+1.61	+ .83	-.90	+2.20	+ .13	+1.93	-1.00	-1.89	-1.58
<i>Gulf States.</i>									
Atlanta, Ga	+ .87	-.11	-.98	-1.05	+ .82	+ .58	-.60	-.08	-.67
Mobile, Ala	+1.72	+1.44	-1.42	-.90	-1.09	+3.20	-.78	-1.07	+3.80
Montgomery, Ala	+1.83	+1.19	-.04	-.84	-.70	+1.73	+ .35	-.71	-.32
Vicksburg, Miss	+ .87	-.19	-.09	-.93	-1.02	-.52	-1.00	-.86	-.07
New Orleans, La	+ .74	+ .55	-1.08	-1.40	-.99	+2.18	-.94	-.87	+2.24
Shreveport, La	-.10	+ .18	+ .40	-.58	-.82	-1.04	-1.12	-.51	-.77
Fort Smith, Ark	+ .35	+1.50	-.77	-.72	-.80	-.47	-.77	+2.93	+1.42
Little Rock, Ark	-.81	-.12	-.71	+ .82	-.91	-.27	-.80	+ .63	-.28
Palestine, Tex	+1.75	+ .52	-.22	-.61	-.74	-.77	-.77	+ .49	-.78
Galveston, Tex	+ .59	+ .80	-.58	-.84	-1.61	-.72	-1.83	-1.54	-.63
San Antonio, Tex	-.42	-.52	-.70	-.67	-1.02	-1.11	-1.02	-.81	-.73

TABLE VII.—Precipitation departure for the season of 1893, etc.—Continued.

Stations.	For week ending—								
	August—				September—				October—
	7.	14.	21.	28.	4.	11.	18.	25.	2.
<i>Ohio Valley and Tennessee.</i>									
Memphis, Tenn.....	-.91	-.55	-.84	-.57	-.87	+2.84	-.79	+.94	-.68
Nashville, Tenn.....	+.19	-.34	-.66	-.58	-1.02	+1.93	-.18	+1.54	-.39
Chattanooga, Tenn.....	+1.05	+.16	-.73	-.98	-.09	+.46	-.65	-.92	-.56
Louisville, Ky.....	-.84	+.66	-.83	-.87	-.80	+.04	+.94	+.10	+.28
Indianapolis, Ind.....	-.91	-.53	-.49	-.69	-.70	-.59	+1.07	+.09	+.51
Cincinnati, Ohio.....	-.94	-.75	-.79	-.41	-.66	-.53	+.88	+.21	+1.64
Columbus, Ohio.....	-.02	-.47	-.49	-.54	-.64	-.65	-.15	-.17	-.46
Pittsburg, Pa.....	-.58	-.55	-.56	-.13	-1.00	-.63	-.37	+.96	-.51
<i>Lake region.</i>									
Oswego, N. Y.....	+.30	-.50	-.17	+.88	+3.25	+.16	+.09	+.30	-.60
Buffalo, N. Y.....	-.68	-.38	-.36	+.14	+2.97	+.18	+.01	+.20	-.84
Cleveland, Ohio.....	-.59	+.07	-.44	+.16	+.32	-.86	-.88	-.55	-.73
Detroit, Mich.....	-.70	+.12	-.04	-.27	-.63	-.63	+.29	-.31	-.37
Alpena, Mich.....	-.77	-.69	+.46	-.19	-.59	-.70	+1.17	+.05	-.96
Grand Haven, Mich.....	-.63	-.60	-.28	-.58	-.77	-.84	+.09	+.28	+.69
Milwaukee, Wis.....	-.70	-.42	-.08	-.43	-.63	-.68	-.65	+.05	+2.32
Chicago, Ill.....	-.70	-.68	-.54	-.64	-.63	-.64	-.32	+.38	+.57
Duluth, Minn.....	-.77	+.05	-.79	-.18	-.92	-1.02	-.91	-.86	+.23
<i>Upper Mississippi Valley.</i>									
St. Paul, Minn.....	-.84	-.21	-.73	+1.01	-.77	-.77	+.01	+.86	+.20
Lacrosse, Wis.....	-.81	-.43	+.01	-.77	-1.09	-1.22	-1.11	-.19	-.43
Davenport, Iowa.....	-.91	-.10	-.50	-.77	-.77	-.77	-.67	+.63	+1.62
Des Moines, Iowa.....	-.77	-.14	+.06	-.65	-.84	-.84	-.63	-.63	+.36
Springfield, Ill.....	-.42	-.43	-.37	-.55	-.77	-.71	-.38	+.28	-.33
Cairo, Ill.....	-.69	-.02	-.18	-.05	-.63	+4.09	-.30	+.20	+.94
St. Louis, Mo.....	-.56	-.10	-.39	-.43	-.74	-.29	-.41	+.99	+.32
<i>Missouri Valley.</i>									
Springfield, Mo.....	-1.05	-.84	-.76	-.79	-.94	-.85	-.84	+3.78	+1.12
Kansas City, Mo.....	-.98	-.43	-.39	-.37	-1.09	-1.10	-1.05	+.89	+.64
Concordia, Kans.....	-.93	-.90	-.21	+.01	-.79	-1.06	-.53	-.56	+1.57
Omaha, Nebr.....	-.77	+.62	+.58	-.18	-.77	-.77	-.77	-.70	+.99
Valentine, Nebr.....	-.45	-.07	+.66	-.23	-.25	-.28	-.94	-.85	-.11
Huron, S. Dak.....	-.78	-.54	-.50	-.50	-.45	-.38	-.35	-.35	-.11
<i>Extreme Northwest.</i>									
Moorhead, Minn.....	-.62	+.75	-.63	+.85	-.41	-.56	+.12	-.54	+.40
Bismarck, N. Dak.....	-.56	-.54	-.45	+.16	-.88	-.28	-.20	-.23	+.61
Fort Buford, N. Dak.....	-.35	-.27	-.09	-.17	-.24	-.21	+.24	-.17	+.78
<i>Rocky Mountain slope.</i>									
Havre, Mont.....	-.34	+.65	-.35	-.27	-.35	-.30	+.92	+.19	-.14
Helena, Mont.....	-.14	-.14	+.32	-.19	-.25	+.02	+.20	-.13	+1.57
Spokane, Wash.....	+.01	-.07	-.07	-.10	-.18	+.06	-.18	+.39	+.03
Winnemucca, Nev.....	.00	.00	.00	.06	+.11	+.10	+.03	-.05	+.19
Salt Lake City, Utah.....	-.10	+.20	-.11	-.21	+.05	+.14	-.17	-.24	+1.02
Cheyenne, Wyo.....	-.04	-.28	+.22	-.28	-.20	-.26	-.21	-.15	+.19
North Platte, Nebr.....	-.96	-.25	+.71	+1.25	-.44	-.41	-.35	-.38	+.98
Denver, Colo.....	-.35	-.30	-.10	-.35	-.24	-.24	-.17	-.14	+.40
Dodge City, Kansas.....	-.64	-.79	+.34	-.01	-.37	-.28	-.20	-.25	+1.63
Ablene, Tex.....	+2.72	-.25	-.34	-.17	-.53	-.65	-.70	+1.60	-.67
Santa Fe, N. Mex.....	+.68	-.43	+2.10	-.14	+.07	-.38	+.21	-.18	+2.11
El Paso, Tex.....	+2.45	-.46	-.37	-.33	-.38	-.33	-.14	-.08	+1.46
Tucson, Ariz.....	+1.80	+.39	+.15	+.16	-.28	-.39	-.34	+.09	+.21
<i>Pacific coast.</i>									
Olympia, Wash.....	+.20	-.12	-.14	-.06	-.33	+1.01	-.61	-.54	-.48
Portland, Oreg.....	-.14	-.14	-.14	-.14	-.19	+.68	-.29	+.26	+.12
Roseburg, Oreg.....	-.67	-.06	-.63	-.07	-.07	+1.22	+.54	+.87	+.40
Red Bluff, Cal.....	.00	.00	.00	.00	-.07	+.68	-.08	-.14	-.16
Sacramento, Cal.....	.00	.00	.00	.00	-.03	+.15	-.07	-.07	-.09
San Francisco, Cal.....	-.01	.00	.00	.00	.00	+.20	-.07	-.07	-.09
Los Angeles, Cal.....	-.05	.00	.00	.00	.00	.00	.00	-.01	-.09
San Diego, Cal.....	-.07	-.07	-.01	.00	.00	.00	.00	+.02	-.07