casions. For the September equinox the agreement was 181 out of 360. The southeast and northwest winds in this region of the continent are by far the most frequent of all that occur, but the preceding figures show that the equinox does not appreciably control the wind.—ED.

CLIMATE AND CROP SERVICE PUBLICATIONS.

By JAMES BERRY, Chief of Climate and Crop Division.

Soon after the present Chief of the Weather Bureau assumed charge of the service he set about to accomplish what had long been considered most desirable and important in connection with the publication of the climatological data collected through the various State weather services in cooperation with the National Weather Bureau, viz, the issue of the monthly reports in a uniform style after an approved pattern. The monthly reports of the various State weather services up to 1896 were printed by the stencil plate and milliograph process. They were inelegant in appearance, of various forms and sizes, lacked agreement in arrangement and character of the data, and in only one or two cases contained graphic illustrations of meteorological conditions.

In January, 1896, the Chief of Bureau, desiring to emphasize the distinction between the terms climate and weather, as also the fact that the Weather Bureau and not the respective States was responsible for the work, announced in official instructions that the division formerly entitled State Weather Service, having charge of the local services, should be designated the Climate and Crop Division, and that each local service should be known as a State Section of the Climate and Crop Service of the Weather Bureau. Careful attention was devoted to the matter of designing a model form of publication for all sections, and the one adopted was of the size of the general MONTHLY WEATHER REVIEW. It provided for tables containing current means and normals of temperature and precipitation, extremes of temperature, altitude of stations, daily readings of maximum and minimum thermometers and daily precipitation for all stations, charts of temperature and precipitation, and several pages devoted to a general discussion of the various meteorological elements and miscellaneous weather phenomena.

The first report according to the new model was that for February, 1896, for the New England section, issued at Boston. Pennsylvania followed in the succeeding month, and as quickly as possible other section reports were issued after the adopted standard. Many difficulties lay in the way of making the section reports uniform, even where the necessary means for printing were available, as several States had by legislative enactment provided for the printing of the reports of State Weather Services, and the State directors were not all disposed to depart from the form in which their previous reports had been issued. By the close of 1897, however, nearly one-half of the sections had adopted the new model, and by October, 1898, all were issuing reports uniform in size, while the arrangement of data was identical in all but two, these exceptions being New York and Iowa, the reports of which, although differing slightly in minor details, contained the same information.

At the present time the Climate and Crop Service of the Weather Bureau is divided into 42 sections, independent of those for Porto Rico and Cuba. Therefore, 42 quarto publications are issued every month, containing accurate and detailed reports of observations made daily throughout the year at more than 3,000 voluntary stations. Not only has the form of the publication been standardized, but the instrumental equipment of the voluntary observers and the exposure of the instruments have received most careful attention. Nearly all voluntary observers are now supplied with instruments of the most approved pattern, and during the past two years a large proportion have been supplied with approved thermometer shelters.

The monthly editions of the section reports for the various States range from 300 to 3,000 copies. These are distributed to cooperating observers, scientific institutions, libraries and newspapers, each section center receiving and carefully preserving the reports for all other sections.

A file of these reports supplies a vast fund of meteorological information for the purposes of study and investigation.

The work of establishing Climate and Crop Sections in Porto Rico and Cuba is well advanced, an ample number of instruments to equip a complete system of stations having been sent into these islands. About 30 stations have already been established in Porto Rico, where the issue of weekly Climate and Crop Bulletins was begun in January of this year. At an early date the monthly report of the Porto Rico section in the standard form is expected. In Cuba the conditions have been less favorable for this work, but much progress has been made, and no doubt before the close of the year both weekly and monthly reports after the standard type will be issued for that island also.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

Meteorologische Zeitschrift, Wien, Band 16.

Satke, L. Fünfjährige Beobachtungen der Temperatur der Schneedecke in Tarnopol. P. 97.

Westman, J. Täglicher Gang der resultirenden Luftströmung an der Erdoberfläche zu Upsala 1891–1895. P. 107.

Maurer, J. Einige Ergebnisse der sechsten internationalen Ballonfahrt am 3 Oktober, 1898. P. 110.

Bezold, W. v. Bemerkungen zu der Abhandlung des Herrn. "Ueber Spät- und Frühfröste." P. 114.

Supper, K. Resultat der meteorologischen Beobachtungen in der Republik Guatemala im Jahre 1897. P. 117.

Tippenhauer, G. Ueber die Ursache der doppelten täglichen Oscillation des Barometers. P. 120.

———Ergebnisse der meteorologischen Beobachtungen auf dem Mont Ventoux im Jahre 1897. P. 123.

———Resultate der meteorologischen Beobachtungen in Buëa am Kamerun-Gebirge. P. 123.

Davis, W. M. "Helm Wind" Beobachtet in den Cevennen. P. 124.

Madsen, C. L. Ein Beitrag zur Erklärung von abnormalen Temperaturverhältnissen im nördlichen Europa. P. 125.

———Blitzschäden im Jahr 1897 in Steiermark, Kärnthen und Oberkrain. P. 128.

Prohaska, K. Ueber die Fortpflanzungsgeschwindigkeit der Gewitter in Steiermark, Kärthen und Oberkrain. P. 129.

Hegyfoky, J. Bemerkung zu dem Referate "Hegyfoky, J., Wasserstand der Flüsse und Niederschlag in Ungarn." P. 130.

Hann, J. Der Charakter der Winter der letzten 70 Jahre in Wien. P. 132.

———Temperatur und Luftdruck-Mittel für Tokio. P. 134.

———Täglicher Gang des Barometers zu Sao Paulo. P. 136.

Harrington, M. W. Mittlerer Regenfall in San Juan de Porto Rico. P. 135.

———Meteorologisches aus Bolivien. P. 136.

Fischer, F. Erwiderung. P. 131.

Sitzungsberichte der k. p. Akad. der Wiss. zu Berlin. 1899.

Ludeling, G. Ueber den täglichen Gang der erdmagnetischen Störungen an Polarstation. P. 236.

La Nature, Paris, 27 *année.*
Dupont G. Brulot auto-allumeur pour la protection des récoltes. P. 319.
Leotard, Jacques. L'Observatoire de Zi-Ka-Wei. P. 342.

Scientific American Supplement, New York.
Peckman, W. C. Liquid air and its Phenomena. P. 19504.

Proceedings the Royal Society. London. Vol. 64.
Fitzgerald, M. F. On Flapping Flight of Aeroplanes. P. 420.

Symons Meteorological Journal. London. Vol. 34.
Winter Minima [Temperature] on British Mountain Tops. P. 33.
Negretti and Zambra's Self-recording Rain Gauge. P. 36.

Appleton's Popular Science Monthly, New York. Vol. 55.
Remsen, Ira. Liquid Air. P. 35.

Engineering Magazine, New York. Vol. 17.
Thomson, Elihu. Possibilities of Liquid Air. P. 197.

National Geographic Magazine, Washington. Vol. 10.
Leiberg, J. B. Is Climatic Aridity Impending on the Pacific Slope? Testimony of the Forest. P. 160.

Nature, London, Vol. 59.
MacDowell, A. B. Sunspots and Rainfall. P. 583.
———Wireless Telegraphy. P. 606.
Fitzgerald, F. Flight of Birds. P. 609.
H. B. Theory of the Rainbow. P. 616.

Ciel et Terre, Bruxelles. 20 *année.*
Spring, W. Sur l'unité d'origine du bleu de l'eau. P. 81.
Zenger, Ch. V. Climat de la Belgique en 1897 et la période solaire. P. 108.
———Dépression au centre du continent asiatique. P. 119.

Sitzungberichte der Akad. Wiss. zu Berlin. Band 16, 1899.
Bezold, W. v. Ueber die Zunahame der Blitzgefahr während der letzten 60 Jahre. P. 291.

Aeronautical Journal. London. Vol. 3.
Bacon, J. M. The Balloon as an Instrument of Scientific Research. P. 29.
Biddle, D. Method of Steering Balloons during Ascent and Descent. P. 37.
Hugo, T. N. How Birds Fly. P. 38.
Mossman, R. C. Wind Averages. P. 42. (From J. Roy. Met. Soc.)

Quarterly Journal Roy. Met. Soc. Vol. 25. 1899.
———Wind Force Committee. Exposure of Anemometers at Different Elevations. P. 1.
Wilson-Barker, D. Comparison of Estimated Wind Force with that given by Instruments. P. 13.
Marriott, W. Tornado at Camberwell, October 29, 1898. P. 19.
Carpenter, A. West Indian Hurricane, September, 1898. P. 23.
Dines, W. H. Connection between the Winter Temperature and height of the Barometer in northwestern Europe. P. 32.
Hann, J. Theory of the Daily Barometric Oscillation. P. 40.

Geographical Journal. London. Vol. 13. 1899.
Thoroddsen, Th. Explorations in Iceland during the years 1881–1898 (conclusion). P. 480. [Meteorological data. P. 495.]
———Bulletin of the American Geographical Society. New York. Vol. 31. 1899.
Gannett, H. The timber line. P. 118.
Ward, R. DeC. Notes on climatology. P. 160.
Libbey, W. Notes on oceanography. P. 163.

Naturwissenchaftliche Rundschau. Braunschweig. April, 1899. *Vol.* 14.
Bacon, J. M. Ueber den Werth von Beobachtungen, die man vom freien Ballon ausmachen Kann. P. 213.

Zeitschrift für Luftschiffart und Physik der Atmosphäre. Berlin. Vol. 18.
Loessel, F. R. von. Aërodynamische Schwebezustand einer dünnen Platte und deren Sinkgeschwindigkeit nach der Formel

$$V = \sqrt{\frac{gs}{r\,(F + bv)}}$$ (Fortsetzung). P. 25.

Steffen, K. Zur Spannungs-Theorie. P. 31.
Dientsbach, Karl. Ueber Luftwiderstand. P. 38.
Trabert, W. Was erwartet die Meteorologie vom Registrierdrachen? P. 50.

Zeitschrift für Instrumentenkunde. April, 1899. *Vol.* 9.
Sprung, A. Ueber den photogrammetrischen Wolkenautomaten und seine Justirung. P. 111.

Physical Review. New York. Vol. 8.
Waidner, C. W. and Mallory, F. Comparison of Thermometers. P. 193.

Himmel und Erde. Berlin. 11 *Jahrg.*
Scheiner, J. Nachtrag zu die Temperatur der Sonne. P. 323.

Archives des Sciences Physiques et Naturelles. Genève. 4me série. Vol. 7.
Spring, W. Sur l'origine du bleu du ciel. P. 225.

NORMAL PRECIPITATION IN THE REGION OF THE GREAT LAKES.[1]

By ALFRED J. HENRY, Chief of Division.

We present elsewhere a chart[2] of normal annual precipitation of rain and snow in the drainage basins of the Great Lakes. The outlines of the different drainage basins were drawn from the excellent map published in Report of the United States Deep Waterways Commission, House Doc. No. 192, 54th Congress, 2d Session. The precipitation data were obtained from the files of the United States Weather Bureau and the Meteorological Service of the Dominion of Canada.

The distribution of precipitation and its relation to the fluctuations of the surface level of the lakes are subjects of much importance. While we are able to present a fairly accurate chart of the normal distribution of precipitation, and to give figures which show the amount of rain and snow that has fallen in the several drainage basins during the last six months, we should not be too hasty in drawing conclusions therefrom.

The rain that falls on the ground may be disposed of in several ways. A considerable portion, say from 33 to 50 per cent, may run into small streams and rivers, and thence into the Lakes, and it is this portion, called for convenience the runoff, with which hydrographers are chiefly concerned.

The allied questions of rainfall and runoff, in their bearing upon the design and construction of sewerage systems, have received a good deal of attention of recent years from civil and municipal engineers. The National Government, also, in dealing with the reclamation of arid and subarid lands, has investigated to some extent, the amount of runoff in various parts of the country, and a preliminary map of the results has been prepared by Messrs. Gannett and Newell of the U. S. Geological Survey. This map shows the runoff in the Lake region to be rather large, approximating 50 per cent of the total rainfall in the lower peninsula of Michigan. For the entire region, however, it is somewhat less. It does not seem possible with our present knowledge of the surface conditions to estimate the runoff for each basin separately.

The normal annual precipitation of the several basins, giving equal weight to all of the available records, is about as follows:

	Inches.
Lake Superior	28
Lake Michigan	33
Lake Huron	32
Lake St. Clair	35
Lake Erie	36
Lake Ontario	33

These figures agree closely with those used by Professor Abbe, MONTHLY WEATHER REVIEW, April, 1898, except in the case of Lake Superior, for which he uses a value of 31.2 The records, whence my figures were obtained, especially for the Canadian side, are more complete than those consulted by Professor Abbe.

The lakes themselves, with the possible exception of Lake Superior, do not seem to have a very marked influence on the precipitation of moisture on adjacent land areas. Precipitation is greater on the south than on the north side of Superior, Erie, and Ontario—lakes whose longer axes run approximately east and west. The difference in the case of Superior is about 8 inches, the average annual precipitation on the American side being that much greater than on the Canadian side. The average precipitation on the south shores of Lakes Erie and Ontario is about 3 inches greater than on the north shores. Precipitation is greater on the eastern

[1] Reprinted from Meteorological Chart of the Great Lakes, June 3, 1899.
[2] Not reproduced.