THE SEASONAL VARIATIONS IN THE CLIMATE OF ANTIGUA, W. I.

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The very interesting meteorological data for St. Johns, Antigua, W. I., embracing the observations of Mr. Francis Watts, chemist and government analyst for the Leeward Islands, and communicated by Mr. W. H. Alexander in Table 1 of his article entitled "Climatology of Antigua, W. I.,"[1] have been rearranged in the following 21 smaller tables so as to show in addition to the annual means, which in most cases were worked out by Mr. Alexander, the monthly and annual averages which have been computed by myself. In the case of a tropical oceanic climate like that of Antigua, where the variations from year to year, unlike those of the higher latitudes, are extremely small, excepting perhaps the variations in the rainfall, the changes from month to month, or from season to season, are of the greater interest.

For a description of instruments and exposures see Mr. Alexander's article above referred to. Apparently the correction to be applied to the readings of the barometer to reduce them to the readings of a standard instrument is unknown, but a comparison of the mean readings for 1899 and 1900 with those for Basseterre, St. Kitts, for the same years, after reducing the St. Johns readings to standard gravity, indicates that this correction is within the probable error[2] of the data for Basseterre, and is quite likely to be between ± 0.00 and $+0.01$ inch.

The observations appear to have been taken at 9 a. m. and 3 p. m., local time, corresponding to 8:07 a. m. and 2:07 p. m. seventy-fifth meridian time, or just previous to the principal maximum and minimum in the diurnal pressure curve. The mean of these two observations is only .002 or .003 higher than the mean of the hourly readings[3]. The barometric data were given by Mr. Alexander to thousandths of inches, and the means were computed from the data as so given, but only inches and hundredths have been retained in the printed tables.

The monthly averages of pressure show a maximum in February and again in June and July, with a decided minimum in October and November; the summer maximum is much more pronounced than at other West Indian stations. The winter maximum is easily explained by the southward movement at this season of the belt of high pressure encircling the globe north of the equator; the summer maximum may be attributed to the building up of the area of high pressure over the Atlantic which reaches a maximum in July.[4] The principal minimum of the year occurs a month later than in Havana, and is attributable to the combined effect of the northward movement of the high pressure belt, and the contraction of the Atlantic high pressure area.

It is interesting to notice that the average daily wind movement follows much the same law as the average monthly pressure, showing a decided maximum in June and July and a decided minimum in October. The wind direction data is not of a character that enables us to study changes of direction from season to season, since the prevailing direction only is given, that is, the direction observed the greatest number of times during the month, and this is almost always from the east. We notice, however, that northeasterly winds prevail less frequently in summer than in winter, and therefore infer that the prevailing easterlies, in a latitude where we would naturally expect northeasterlies, are due to the anticyclonic circulation about the Atlantic high to the east of Antigua. While the full observations of wind direction for Antigua would no doubt show the same strong northeasterly component that is observed at other West Indian stations, it must be admitted that the influence of the Atlantic high pressure area on both the atmospheric pressure and the winds of Antigua is very marked.

The table of lowest temperatures shows very clearly the effect upon the minimum thermometer of the change in the exposure of the instruments in November, 1895, referred to by Mr. Alexander, and the annual mean of the minimum temperatures after this date averages nearly 3° higher than before. The annual mean of the maximum temperatures is slightly lower after the removal than before, so that on the whole we may say that since November, 1895, the temperatures recorded have averaged too high, and the diurnal range of temperature has been too small.

The monthly averages of temperature vary less than 3° from the annual average. February is the coldest month and August the warmest, but the highest temperatures do not occur until September and October. Similarly, the minimum monthly rainfall for the whole island occurs in February, and the maximum in September.

The convectional origin of much of the rainfall is apparent, since besides the coincidence in the time of the occurrence of the maximums of temperature and rainfall already noted, there is also a marked decrease in the wind movement during September as compared with the summer months; moreover thunderstorms, which are unknown in February, average 2.5 per month during the summer, 2.6 in September, and reach a maximum of 3.2 per month in October. In this connection, however, Mr. Alexander has referred to an interesting relation between the rainfall at St. Johns and the average rainfall for the whole island, as shown by his tables 2 and 5. In general, the rainfall at St. Johns, on the leeward side of the island, is greater than the average for the whole island, the only exceptions to this rule occurring in September and November, or at a season of the year when, as we have seen, the winds are comparatively light and the convectional action comparatively strong. It therefore appears that in the case of Antigua either the crest of the atmospheric wave,[5] caused by the air being blown against the sides of the mountains on the island, occurs at some little distance after the tops of the mountains are passed, or else the forward drift of the clouds formed on the upward slope of this wave is very appreciable. Under the average conditions of pressure, temperature, and humidity that prevail during the summer at 3 p. m., the air at sea level would have to rise to a height of about 2,600 feet, or 400 feet above the tops of the highest mountains on the island, before it would be cooled adiabatically to the saturation point. It is, therefore, not impossible that in this case the heaviest rain may occur on the leeward side of the island, but it is very much to be desired that the rainfall data may be rearranged so as to leave no doubt as to this point. As is well known, but little rain falls in the trade wind belts except where the winds are deflected upward by mountains.

Mr. Alexander has referred to the dryness of the climate of Antigua, and I have, therefore, computed the relative humidity from the monthly means of the dry and wet bulb thermometer readings, using Marvin's Psychrometric Tables (W. B. No. 235, 1900), which are based on readings of the whirled psychrometer, and therefore would not apply to the readings of a stationary hygrometer unless the wind was sufficient to thoroughly ventilate the shelter at all times. While this seems to have generally been the case at Antigua, we suspect the relative humidities here given are a little too high, although the average of the two observations, 69.5, is considerably less than the average given by Prof. M. W. Davis for the mean relative humidity of the trade winds over the oceans, namely, 77 per cent.[6] Ravenstein's charts, British Associa-

[1] See page 165.
[2] See page 24, Report of the Chief of the Weather Bureau, 1899–1900.
[3] See hourly readings for Basseterre, Report of the Chief of Weather Bureau, 1899–1900, pp. 314–315.
[4] See Bartholomew's atlas of meteorology, London, 1899, plate 12.
[5] See the memoir by Dr. F. Pockels, p. 152 of this REVIEW.
[6] Elementary Meteorology, Davis, Boston, 1894, p. 152.

tion for the Advancement of Sciences, 1870, p. 812, would seem to make the humidity less than 80 per cent.

The mean dew-point computed by the use of Glaisher's factors gives an average annual vapor tension of 0.732, and an average relative humidity of 68.4 at 9 a. m., and 63.7 at 3 p. m., which is considerably less than the humidity given by the psychrometric formula. It may therefore be that Glaisher's factors are the more accurate for determining dew-points and humidities from readings of a stationary hygrometer, under conditions such as prevail at Antigua.

These tables emphasize the importance of proper exposure of instruments, if records of value in the study of the climatology of a place are to be obtained. The increase of nearly 3° in the annual mean minimum thermometer reading, due to a change of exposure in November, 1895, is as great as the differences in the average annual mean minimum temperatures for the different islands of the Windward group. Any error in recording the temperature also enters into the relative humidity data, and a comparison between the climates of the different islands is thus made difficult.

Meteorological data for St. Johns, Antigua, W. I.

TABLE 1.—BAROMETRIC PRESSURE, 9 A. M.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1890	.....	.....	.....	30.16	30.17	30.20	30.08	29.99	30.03	30.02	30.00	30.06	.....
1891	30.10	30.14	30.07	30.08	30.06	30.09	30.11	30.09	30.04	30.00	30.03	30.08	30.08
1892	30.11	30.10	30.12	30.13	30.12	30.16	30.15	30.01	30.09	30.05	30.03	30.10	30.10
1893	30.07	30.11	30.10	30.09	30.05	30.08	30.04	30.01	30.00	29.94	30.02	30.05	30.05
1894	30.10	30.16	30.12	30.06	30.03	30.11	30.12	30.07	30.04	30.03	30.04	30.04	30.08
1895	30.10	30.10	30.11	30.10	30.09	30.13	30.12	30.03	30.02	29.99	30.03	30.08[a]	30.07
1896	30.10	30.14	30.10	30.08	30.06	30.12	30.14	30.10	30.03	30.04	30.03	30.11	30.09
1897	30.11	30.17[b]	30.11	30.11	30.07	30.14[a]	30.12	30.10	30.09	30.06	30.04	30.08	30.10
1898	30.13	30.09	30.05	30.10[a]	30.06	30.09	30.07	30.05	30.00	30.02	30.00	30.10	30.06
1899	30.13	30.15	30.12	30.08	30.10	30.09	30.06	30.02	30.03	29.98	30.00	30.02	30.06
1900	30.08	30.13	30.11	30.07	30.07	30.06[f]	30.06	30.06	30.04	30.02	30.00	30.09	30.06
Means	30.10	30.13	30.10	30.09	30.07	30.11	30.10	30.05	30.04	30.01	30.02	30.07	30.08

TABLE 2.—BAROMETRIC PRESSURE, 3 P. M.

1890	.....	.....	.....	30.13[e]	30.15[e]	30.18[d]	30.06[d]	30.00[e]	29.97[d]	29.95[d]	29.94[e]	29.99[f]	.....
1891	30.04[e]	30.08[d]	30.03[e]	30.04[d]	30.04[e]	30.05[e]	30.07[d]	30.05[f]	30.00[d]	29.93[d]	29.93[e]	30.02[f]	30.02
1892	30.02[e]	30.02[d]	30.03[d]	30.06[f]	30.06[f]	30.11[e]	30.12[e]	30.03[d]	30.02[d]	29.97[e]	29.95[e]	30.02[e]	30.04
1893	30.00[f]	30.02[d]	30.02[e]	30.01[f]	30.00[e]	30.03[e]	30.00[e]	29.93[e]	29.96[d]	29.86[e]	29.94[e]	29.98[g]	29.98
1894	30.02[f]	30 08[d]	30.05[f]	30.01[e]	29.97[f]	30.07[d]	30.08[e]	30.02[f]	29.96[e]	29.93[d]	29.96[e]	29.95[g]	30.01
1895	30.02[e]	30.02[d]	30.04[e]	30.02[e]	30.03[e]	30.09[f]	30.08[d]	29.98[e]	29.96[e]	29.92[e]	29.94[e]	29.94[g]	30.00
1896	30.02[e]	30.06[d]	29.96[e]	30.01[f]	30.01[g]	30.08[d]	30.11[d]	30.05[f]	29.97[d]	29.95[d]	29.95[f]	30.02[f]	30.02
1897	30.04[f]	30.10[d]	30.03[d]	30.04[f]	30.01[f]	30.09[g]	30.07[d]	30 04[f]	30.03[d]	29.98[e]	29.96[e]	30.00[f]	30.03
1898	30.05[f]	30.01[d]	29.99[d]	30.03[f]	30.00[g]	30.04[e]	30.03[f]	30.00[e]	29.94[e]	29.95[e]	29.93[e]	30.02[e]	30.00
1899	30.05[f]	30.08[d]	30.04[e]	30.01[f]	30.03[f]	30.04[d]	30.02[e]	29.96[d]	29.96[d]	29.91[e]	29.88[e]	29.94[g]	29.99
1900	30.00[e]	30.05[d]	30.04[d]	29.99[g]	30.01[e]	30.04[f]	30.03[e]	30.01[e]	29.99[e]	29.94[d]	29.92[e]	30.01[f]	30.00
Means	30.03	30.06	30.03	30.02	30 02	30.06	30.06	30.01	29.98	29.93	29.94	29.99	30.01
Means of the 9 a. m. and 3 p. m. pressure.	30.06	30.09	30.06	30.06	30.04	30.08	30.08	30.04	30.01	29.97	29.98	30.03	30.04

NOTE.—Data for 1890 not included in the means. The instrumental error of the barometer is unknown. The readings have been reduced to sea level, but not to standard gravity.

TABLE 3.—DRY THERMOMETER, 9 A. M.

	°	°	°	°	°	°	°	°	°	°	°	°	°
1890	.....	.....	.....	79.0	83.0	82.0	83.0	82.0	82.0	83.0	80.0	80.0	80.9
1891	77.5	77.0	79.0	81.0	83.0	83.0	82.0	83.0	84.0	84.0	79.0	78.0	80.9
1892	78.0	77.0	83.5	80.5	81.0	83.0	83.0	84.0	83.8	83.8	80.5	79.0	81.4
1893	77.8	78.0	78.0	79.8	82.3	82.5	82.7	84.0	83.0	82.5	82.3	78.9	81.0
1894	77.7	76.8	77.4	79.8	82.1	83.4	83.4	84.1	83.9	81.4	80.8	78.4	80.8
1895	76.7	77.0	79.0	81.2	80.7	83.7	82.8	83.3	83.1	82.8	81.3	80.8	80.1
1896	78.8	78.1	79.0	79.8	81.7	83.3	83.3	83.5	84.6	83.9	80.5	80.4	81.4
1897	78.8	78.5[b]	78.7	80.8	82.3	83.6[a]	83.3	84.2	84.3	84.4	82.8	81.3	81.8
1898	79.3	78.7	79.2	80.8[a]	83.0	84.4	83.3	84.0	83.5	83.6	81.0	80.5	81.8
1899	78.6	78.1	78.3	80.8	82.8	83.4	83.4	84.0	83.5	83.6	82.8	80.3	81.6
1900	79.8	78.3	79.2	81.4	83.0	83.6	83.4	86.3	84.7	83.7	82.5	80.2	82.2
Means	78.3	77.8	79.1	80.4	82.3	83.1	83.1	83.9	83.7	83.3	81.4	79.8	81,3

TABLE 4.—DRY THERMOMETER, 3 P. M.

1890	.....	.....	.....	80.0[e]	81.0[e]	84.0[e]	82.8[d]	84.0[e]	84.0[d]	83.5[d]	82.5[e]	82.0[f]	82.4
1891	80.0[e]	79.0[d]	82.0[g]	83.0[d]	84.0[e]	84.0[e]	84.0[d]	85.0[f]	85.0[d]	84.0[d]	82.0[e]	82.0[f]	82.9
1892	80.8[g]	81.0[d]	82.8[d]	82.0[f]	83 0[f]	84.5[e]	85.5[e]	86.0[d]	85.0[d]	85.0[e]	83.5[e]	81.0[e]	83.2
1893	80.7[f]	80.8[d]	81.5[e]	81.5[f]	83.6[e]	85.0[e]	85.0[e]	86.8[e]	85.3[d]	83.7[e]	83.7[e]	80.0[g]	83.1
1894	79.7[f]	80.2[d]	80.6[f]	81.5[e]	83.6[f]	85.4[d]	85.8[e]	86.9[f]	85.9[e]	83.6[d]	82.4[e]	81.7[g]	83,1
1895	81.3[e]	82.0[d]	82.6[e]	83.8[e]	83.0[e]	84.8[f]	85.2[d]	85.2[e]	84.8[e]	82.8[e]	82.3[e]	83.7[g]	83.4
1896	82.0[e]	81.7[d]	82.5[e]	82.7[f]	84.2[g]	84.6[d]	85.2[d]	86.2[f]	88.0[d]	86.2[d]	83.4[f]	83.8[f]	84.2
1897	82.8[f]	82.5[d]	82.2[d]	84.0[f]	83.6[f]	84.3[g]	85.4[d]	86.9[f]	86.7[d]	86.7[e]	84.9[e]	83.6[f]	84.5
1898	83.6[f]	82.8[d]	83.5[d]	83.5[f]	84.9[g]	86.4[e]	84.5[f]	85.8[e]	85.2[e]	85.7[e]	83.8[e]	83.9[e]	84.4
1899	82.4[f]	82.0[d]	81.9[e]	83.5[f]	85.2[f]	85.5[d]	86.1[e]	85.1[d]	85.8[d]	86.8[e]	85.9[e]	85.1[g]	84.6
1900	84.3[e]	82.6[d]	82.3[d]	83.2[g]	85.0[e]	84.1[d]	87.6[e]	85.2[e]	85.3[e]	84.2[d]	83.3[e]	81.3[f]	84.3
Means	81.8	81.5	82.1	82.6	83.6	84.8	85.2	85.7	85.5	84.7	83.3	82.6	83.6

TABLE 5.—MEAN MAXIMUM TEMPERATURE

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1890	.....	.....	.....	84.0	85.0	87.0	87.0	87.0	88.0	87.5	86.0	85.5	85.7
1891	82.5	82.5	84.0	86.0	87.0	87.5	87.0	87.8	89.0	88.5	86.5	84.0	86.0
1892	84.0	84.8	86.5	86.0	85.5	87.0	88.0	89.0	88.8	88.8	85.0	84.5	86.5
1893	83.3	83.0	84.0	85.0	86.5	87.6	88.6	89.8	88.6	87.7	87.0	83.3	86.2
1894	82.5	82.9	83.4	85.0	87.0	87.9	88.6	90.2	88.9	86.5	85.2	84.2	86.0
1895	83.6	84.5	85.8	86.9	85.9	87.5	88.2	88.9	88.0	86.7	85.6	85.9*	86.4
1896	.....	82.7	83.3	83.7	84.6	86.0	86.0	87.3	88.8	88.1	85.0	84.8	85.3
1897	84.6	83.5	82.9	85.0	85.2	85.5	86.4	87.7	87.7	88.2	86.8	85.6	85.8
1898	84.7	83.9	83.6	84.4	85.7	87.0	86.2	87.0	86.9	87.4	85.4	85.1	85.6
1899	83.4	82.6	82.5	84.3	86.2	86.5	86.9	87.0	87.6	87.8	87.1	86.7	85.7
1900	85.1	83.9	83.6	85.2	86.1	86.6	86.7	87.4	88.0	87.1	85.1	84.9	85.8
Means	83.7	83.4	84.0	85.0	85.9	86.9	87.2	88.1	88.2	87.7	85.9	85.0	85.9

*Mean for the first seventeen days of the month.

TABLE 6.—MEAN MINIMUM TEMPERATURE.

1890	.....	.....	.....	68.0	71.0	73.0	73.0	74.0	72.0	72.0	73.0	70.0	71.4
1891	68.5	69.5	67.0	72.0	73.0	74.5	75.0	74.5	73.5	73.0	72.0	69.2	71.8
1892	68.5	67.0	69.5	71.0	74.0	74.5	74.8	74.8	73.0	73.0	71.0	70.0	71.8
1893	67.7	68.7	71.0	70.0	72.7	74.0	74.0	74.7	72.8	72.4	70.6	70.3	71.6
1894	68.2	68.0	67.4	70.6	71.8	74.5	74.3	75.7	73.8	73.8	72.2	69.6	71.6
1895	68.4	69.5	70.8	71.8	72.7	74.3	74.7	75.6	74.7	73.5	73.0	72.2	72.5
1896	70.8	71.8	72.2	73.8	72.2	76.8	77.1	77.5	77.2	76.0	74.1	74.1	74.5
1897	72.0	71.7	71.5	73.7	75.6	76.4	77.0	78.1	77.1	76.8	75.2	73.8	74.9
1898	72.3	71.2	71.5	73.5	76.0	77.3	76.2	77.1	76.7	76.2	73.3	73.2	74.5
1899	72.2	71.7	71.4	73.3	75.3	76.5	77.5	77.8	76.8	76.1	75.7	71.9	74.7
1900	73.0	72.0	73.2	74.0	76.0	75.0	75.4	75.6	75.5	74.3	72.6	72.2	74.1
Means	70.2	70.1	70.5	72.0	73.7	75.2	75.4	75.9	74.8	74.2	73.0	71.5	73.0

TABLE 7.—MEAN TEMPERATURE (MAX. + MIN.) ÷ 2.

1890	.....	.....	.....	76.0	78.0	80.0	80.0	80.5	80.0	79.8	79.5	77.8	78.6
1891	75.5	76.0	75.5	79.0	80.0	81.0	81.0	81.2	81.2	80.6	79.2	76.6	78.9
1892	76.2	75.9	78.0	78.5	79.8	80.8	81.4	81.9	80.9	80.9	78.0	77.2	79.1
1893	75.5	75.8	77.5	77.5	79.6	80.8	81.3	82.2	80.7	80.0	78.8	76.8	78 9
1894	75.4	75.4	75.4	77.8	79.4	81.2	81.4	83.0	81.4	79.6	78.7	76 9	78.8
1895	76.0	77.0	78.0	79.4	79.3	80.9	81.4	82.2	81.4	80.1	79.3	79.0	79.5
1896	.....	77.2	77.8	78.8	78.4	81.4	81.6	82.4	83.0	82.0	79.6	79.4	79.9
1897	78.3	77.6	77.2	79.4	80.4	81.0	81.7	82.9	82.4	82.5	81.0	79.7	80.3
1898	78.5	77.6	77.6	78.0	80.8	82.2	81.2	82.0	81.8	81.8	79.4	79.2	80.0
1899	77.8	77.2	77.0	78.8	80 8	81.5	82.2	82.4	82.2	82.0	81.4	79.3	80.2
1900	79.0	78.0	78.4	79.6	81.0	80.8	81.0	81.5	81.8	80.7	78.9	78.6	79.9
Means	76.9	76.8	77.2	78.4	79.8	81.1	81.3	82.0	81.5	80.9	79.4	78.2	79.5

TABLE 8.—HIGHEST TEMPERATURE.

1890	.....	.....	.....	88	90	91	90	90	90	90	88	88	91
1891	85	84	89	89	90	90	90	91	92	93	92	86	93
1892	86	89	90	89	89	89	90	91	91	92	88	88	92
1893	86	85	87	88	89	90	91	92	92	92	90	86	92
1894	85	84	85	88	90	90	90	92	93	89	87	87	93
1895	86	87	88	92	89	90	92	92	90	89	89	90[n]	92
1896	.....	85	86	86	87	88	88	89	92	92	89	87	92
1897	88	86	86	87	88	88	88	90	90	91	89	90	91
1898	88	86	86	86[a]	89	89	88	88	90	90	89	87	90
1899	86	86	85	86	87	88	89	90	90	92	90	90	92
1900	88	86	86	88	88	89	89	90	91	91	90	89	91
Absolute maximum	88	89	90	92	90	91	92	92	93	93	92	90	93

TABLE 9.—LOWEST TEMPERATURE.

1890	.....	.....	.....	62	68	69	69	72	70	67	65	63	.....
1891	61	67	60	68	66	72	72	71	70[a]	69	65	63	60
1892	61	61	63	60	72	71	71	70	71	68	68	66	60
1893	63	60	61	62	68	72	72	71	70	67	65	65	60
1894	61	67	60	67	67	73	71	73	69	70	68	63	60
1895	61	63	68	68	70	71	71	72	72	69	67	67	61
1896	65	69	67	72	73	73	74	75	75	71	69	71	65
1897	68	66[b]	67	71	72	74	73	74	72	75	71	70	66
1898	68	67	68	71[a]	73	75	72	74	73	72	68	69	67
1899	70	70	69	70	72	74	73	72	73	73	73	65	65
1900	69	70	71	72	75	72	72	73	73	71	70	70	69
Absolute minimum	61	60	60	60	66	69	69	70	69	67	65	63	60

TABLE 10.—WET THERMOMETER, 9 A. M.

Year	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1890				72.5	74.2	75.1	76.0	76.6	77.2	76.7	75.0	73.3	74.1
1891	71.0	69.0	70.5	73.8	74.0	76.0	76.8	77.0	77.8	77.5	76.0	72.8	74.4
1892	72.5	70.0	71.8	71.0	74.5	75.5	72.5	77.0	76.0	76.5	75.5	72.5	73.8
1893	71.5	71.0	70.5	72.4	74.7	76.6	77.0	77.3	77.4	77.0	74.7	72.0	74.3
1894	70.8	69.6	70.5	73.1	75.7	75.7	75.6	76.0	76.8	75.8	74.8	72.6	73.9
1895	70.7	70.1	71.2	73.5	74.5	77.2	77.3	77.2	77.7	77.0	75.2	74.8	74.7
1896	72.3	71.3	71.4	71.9	74.8	76.6	76.8	77.2	77.6	77.0	74.1	74.4	74.6
1897	72 6	71.5[b]	72.3	73.5	75.5	75.5[a]	76.5	76.9	77.1	76.8	75.9	75.0	74.9
1898	72.3	70.3	70.0	71.8[a]	75.1	75.9	76.6	77.2	77.2	76.6	74.3	73.9	74.3
1899	71.3	70.7	70.2	72.0	74.5	75.7	76.5	77.2	77.3	77.0	76.8	72.5	74.3
1900	72.5	71.2	70.7	73.6	75.3	76.2	76.4	76.7	77.1	76.7	75.1	74.2	74.6
Means	71.7	70.5	70.9	72.6	74.8	76.0	76.2	76.9	77.2	76.8	75.2	73.5	74.4

TABLE 11.—WET THERMOMETER, 3 P. M.

1890				73.5[f]	74.7[e]	75.8[e]	76.7[d]	77.6[e]	77.0[d]	76.5[d]	75.0[e]	73.5[f]	74.7
1891	73.0[e]	69.5[d]	71.5[g]	74.5[d]	75.5[e]	76.0[e]	77.0[d]	78.0[f]	78.5[d]	74.0[d]	76.0[e]	74.0[f]	74.7
1892	73.0[g]	71.2[d]	72.8[d]	72.0[f]	75.0[f]	72.0[e]	77.0[e]	76.8[d]	76.0[d]	77.0[e]	76.0[e]	73.0[e]	74.3
1893	72.4[f]	71.8[d]	71.4[e]	73.0[f]	75.0[e]	77.3[e]	77.7[e]	78.2[e]	77.7[d]	76.7[e]	75.0[e]	72.5[g]	74.9
1894	71.6[f]	70.6[d]	71.4[f]	74.0[e]	76.4[f]	76.5[d]	76.3[e]	76.8[f]	77.3[e]	75.8[d]	75.4[e]	73.8[g]	74.7
1895	72.7[e]	72.0[d]	72.4[e]	74.8[e]	75.1[e]	78.2[f]	77.7[d]	77.9[e]	78.3[e]	77.2[e]	75.9[e]	75.4[g]	75.6
1896	73.9[e]	72.4[d]	72.7[e]	72.7[f]	75.5[g]	76.6[d]	77.4[d]	77.9[f]	78.5[d]	77.7[d]	75.2[f]	75.9[f]	75.5
1897	73.9[f]	72.4[d]	73.3[d]	74.2[f]	75.7[f]	76.1[g]	77.3[d]	77.9[f]	77.6[d]	77.5[e]	76.5[e]	75.8[f]	75.7
1898	73.2[f]	71.3[d]	71.4[d]	72.9[f]	75.5[g]	76.6[e]	76.9[f]	77.7[e]	77.3[e]	77.5[e]	75.3[e]	75.0[e]	75.0
1899	72.6[f]	71.6[d]	71.4[e]	72.8[f]	74.8[f]	76.1[d]	77.6[e]	77.8[d]	77.8[d]	78.2[e]	77.6[e]	74.3[g]	75.2
1900	70.9[e]	72.6[d]	72.1[d]	74.2[e]	76.0[e]	75.8[d]	76.7[e]	77.2[e]	77.4[e]	75.7[d]	75.8[e]	75.0[f]	74.9
Means	72.6	71.5	72.0	73.5	75.4	76.1	77.1	77.6	77.6	76.7	75 8	74.4	75.0

TABLE 12.—DEW-POINT, 9 A. M.

1890				67[a]	69	70	70	72	72	74	70	69	69
1891	67	64	65	70	69	72	73	74	74	74	73	70	70
1892	68	64	66	65	70	70	71	72	70	72	72	68	69
1893	67	66	65	67	70	72	74	73	74	73	70	67	70
1894	66	65	66	69	72	71	70	71	72	72	71	69	70
1895	66	65	66	68	70	74	74	73	74	73	71	71	70
1896	67	67	66	66	70	72	72	73	73	72	70	70	70
1897	68	67[b]	68	69	71	71[a]	72	72	72	72	71	70	70
1898	67	64	64	66[a]	70	70	72	73	73	72	70	69	69
1899	66	66	65	66	69	71	73	73	73	73	73	67	70
1900	67	66	65	69	71	72	72	72	73	72	71	70	70
Means	67	65	66	67	70	71	72	73	73	73	71	69	70

TABLE 13.—DEW-POINT, 3 P. M.

1890				64[f]	69[e]	70[e]	71[d]	72[e]	72[d]	71[d]	70[e]	68[f]	70
1891	68[e]	65[d]	65[g]	69[d]	69[e]	72[e]	73[d]	74[f]	74[d]	73[d]	72[e]	69[f]	70
1892	67[g]	65[d]	65[d]	64[f]	70[f]	70[e]	71[e]	70[d]	72[d]	72[e]	72[e]	68[e]	69
1893	66[f]	66[d]	65[e]	67[f]	69[e]	72[e]	73[e]	73[e]	73[d]	71[e]	69[e]	68[g]	69
1894	66[f]	64[d]	65[f]	69[e]	72[f]	71[d]	70[e]	71[f]	72[e]	71[d]	71[e]	69[g]	69
1895	67[e]	65[d]	66[e]	68[e]	70[e]	74[f]	73[d]	73[e]	74[e]	74[e]	72[e]	70[g]	70
1896	68[e]	66[d]	66[e]	66[f]	70[g]	72[d]	72[d]	73[f]	72[d]	72[d]	70[f]	71[f]	70
1897	68[f]	66[d]	68[d]	68[f]	70[f]	71[g]	72[d]	72[f]	72[d]	72[e]	71[e]	70[f]	70
1898	66[f]	64[d]	64[d]	66[f]	70[g]	70[e]	72[f]	72[e]	72[e]	72[e]	70[e]	69[e]	69
1899	66[f]	65[d]	64[e]	66[f]	68[f]	70[d]	72[e]	72[d]	73[d]	73[e]	72[e]	67[g]	69
1900	67[e]	66[d]	65[d]	68[g]	70[e]	70[d]	72[e]	72[e]	72[e]	73[d]	72[e]	70[f]	70
Means	67	65	65	67	70	71	72	72	73	72	71	69	70

TABLE 14.—RELATIVE HUMIDITY, 9 A M.

	%	%	%	%	%	%	%	%	%	%	%	%	%
1890				73	66	72	72	78	81	75	72	73	73
1891	72	67	66	71	66	72	79	76	75	74	87	78	74
1892	77	71	57	64	74	71	59	73	70	72	79	73	70
1893	74	71	69	70	70	76	77	74	73	73	70	71	73
1894	71	69	71	73	74	70	70	69	73	73	75	76	72
1895	74	71	69	70	74	73	73	76	73	77	76	75	75
1896	73	71	69	68	72	74	74	76	73	73	73	75	73
1897	74	71	73	71	73	72	74	72	72	71	72	75	72
1898	71	66	63	64	69	68	74	74	74	73	73	73	70
1899	70	69	67	65	68	70	73	74	75	74	76	69	71
1900	71	71	66	70	70	71	73	64	71	73	70	75	70
Means	73	70	67	69	71	72	73	73	75	74	75	74	72

TABLE 15.—RELATIVE HUMIDITY, 8 P. M.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	%	%	%	%	%	%	%	%	%	%	%	%	%
1890				74	74	68	76	75	73	73	71	67	70
1891	68	62	60	67	68	69	73	73	75	62	76	69	68
1892	69	62	61	61	72	54	68	65	66	70	74	68	66
1893	67	64	61	67	67	71	72	68	71	73	67	70	68
1894	68	62	63	70	72	66	64	63	68	70	72	69	67
1895	67	61	61	64	69	74	71	71	75	78	74	68	69
1896	69	64	62	61	67	69	71	69	66	68	68	69	67
1897	65	61	65	70	69	68	69	66	66	65	68	70	67
1898	61	57	58	60	64	64	71	70	70	69	67	66	65
1899	62	60	60	57	61	65	68	72	70	68	69	61	64
1900	51	61	60	66	66	68	61	70	70	68	71	75	66
Means	65	61	61	65	68	67	69	69	70	69	71	68	67

TABLE 16.—PREVAILING WIND DIRECTION, 9 A. M.

1890				e.	e.	e.	e.	e.	e.	e.	e.	e.	e.
1891	e	e.	e.	e.	e.	e.	e.	e.	e.	e.[a]	e.	e.	e.
1892	e.	ne.	e.	e.	e.	e.	e.	e.	e.	e.	e.	ene.	e.
1893	e.	ene.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.
1894	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	ne., e.	e.
1895	e.	e.	e.	e	e.	e.	e.	e.	e.	e.	e.	ene., e.	e.
1896	e.	e.	e.	ene., e.	e.	ene.	e.	e.	e.	e.	ene.	e.	e.
1897	e.	ene.	ene.	e.	ese.	e.[a]	ene.	e.	e.	e.	e.	e.	e.
1898	ne.	e.	ene.	e.	e.	e.	e.	e.	ene.	e.	e.	e.	e.
1899	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	ne	e.
1900	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.
Prevailing direction	e.	e.	e.	e.	e.	e.	e.	e.	e.	e	e.	e.	e.

TABLE 17.—PREVAILING WIND DIRECTION, 8 P. M.

1890				e.[f]	e.[a]	e.[a]	e.	e.	e.	e.	e.	e.[b]	e.
1891	e.[c]	e.[b]	e.[g]	e.[d]	e.[h]	e.[e]	e.[f]	e.[i]	e.[d]	e.[e]	e.[e]	e.[f]	e.
1892	e.[g]	ne.[d]	e.[d]	e.[f]	e.[e]	e.[e]	ene.[e]	e.[e]	e.[d]	e.[e]	e.[e]	ene.[e]	e.
1893	e.[f]	e.[d]	ene.[e]	e.[f]	e.[e]	e.[e]	e.[e]	e.[e]	e.[d]	ene.[e]	e.[e]	e.[g]	e.
1894	e.[f]	e.[d]	e.[e]	e.[e]	ese.[e]	e.[d]	e.[e]	e.[e]	e.[e]	se.[d]	ene.[e]	ene.[g]	e.
1895	e.[e]	e.[d]	e.[e]	e.[f]	e.[e]	e.[f]	e.[d]	e.[e]	e.[e]	e.[e]	e.[e]	e.[g]	e.
1896	e.[e]	ene.[d]	ene.[e]	ene.[f]	e.[g]	ene.[d]	e.[d]	ene.[f]	e.[d]	ene.[d]	ene.[f]	e.[f]	ene.
1897	ene.[f]	ene., e.[d]	ene.[d]	e.[f]	e.[f]	e.[g]	e.[d]	e.[f]	e.[d]	e., ese.[e]	ene.[e]	e.[f]	e.
1898	ne.[f]	ene.[d]	ene.[d]	e.[f]	e.[g]	e.[e]	e.[e]	e.[e]	e.[e]	ene.[e]	e.[e]	e.[e]	e.
1899	e.[f]	e.[d]	e.[e]	e.[f]	e.[f]	e.[d]	e.[e]	e.[d]	e.[d]	e.[e]	e.[e]	ne.[g]	e.
1900	e.[e]	e.[d]	e.[d]	e.[g]	e.[e]	e.[e]	e.[e]	ene.[a]	ese.[e]	ene.[d]	e.[e]	e.[f]	e.
Prevailing direction	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.	e.

TABLE 18.—AVERAGE DAILY WIND MOVEMENT.

	Miles.	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*
1894	233.5	273.5	217.9	202.5	128.2	252.3	271.7				169.8	138.7	198.4
1895	194.8	185.5	234.2	241.2	264.3	219.0	250.3	235.0	192.5	156.4	199.0	110.5	206.9
1896	166.1	194.0	229.5	212.6	222.7	248.8	238.5	187.0	138.2	111.8	239.3	167.9	196.4
1897	160.0	220.4	160.5	143.2	240.2[c]	266.7	222.1	230.4[d]	164.8	143.4	152.0	171.0	189.6
1898	195.0	167.0	197.0	245.0	186.0	268.5	209.0	199.5	146.0	117.0	138.0	169.0	186.4
1899	219.0	228.6	198.0	176.5	207.6	240.0	273.4	236.2*	184.3	93.6	106.2	92.0	188.0
1900	191.1	183.6	226.4	216.8	218.3	166.1	241.8	200.5	124.8	96.7	68.3	109.4	170.3
Means	194.2	207.5	209.1	205.4	209.6	237.3	243.8	214.8	158.4	119.8	153.2	136.9	190.9

*Anemometer out of order from August 7 to 21.

TABLE 19.—NUMBER OF DAYS WITH .01 INCH OR MORE RAINFALL.

1890				19	18	21	25	25	23	21	29	26	263
1891	28	22	9	13	18	23	25	23	25	25	29	27	267
1892	29	20	18	12	22	25	21	21	19	24	27	23	261
1893	19	19	21	17	16	22	27	22	26	21	17	29	256
1894	19	22	18	17	17	17	21	19	26	24	27	20	247
1895	19	10	20	15	22	19	26	26	27	27	22	19	252
1896	25	17	17	13	14	25	26	24	15	20	21	22	239
1897	18	16	17	12	20	22	21	23	20	18	24	25	236
1898	23	18	18	12	14	16	26	23	20	18	21	25	229
1899	28	21	14	8	11	23	23	20	20	19	22	12	221
1900	20	15	9	15	15	14	20	21	10	20	16	19	194
Average	23.8	17.5	16.1	13.9	17.0	20.1	23.7	22.5	21.0	21.5	23.2	22.5	242

TABLE 20.—NUMBER OF THUNDERSTORMS.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November	December.	Annual.
1890	.....	.....	.....	.....	.....	2	2	2	3	6	1	0	.....
1891	0	0	0	1	1	4	4	5	1	4	1	0	21
1892	0	0	0	0	0	3	0	1	3	2	2	0	11
1893	0	0	0	0	1	3	6	3	5	4	0	0	22
1894	0	0	0	0	2	3	0	0	3	4	0	1	13
1895	0	0	0	0	2	2	4	4	1	5	1	0	19
1896	0	0	0	0	2	2	3	3	4	2	1	0	17
1897	0	0	1	0	0	2	3	2	2	0	0	1	11
1898	0	0	0	0	0	1	2	5	5	1	0	0	14
1899	2	0	1	0	0	3	3	1	2	4	1	0	17
1900	0	0	0	1	0	1	2	1	0	3	0	0	8
Average	0.2	0	0.2	0.2	0.8	2.4	2.6	2.5	2.6	3.2	0.6	0.2	15.3

TABLE 21.—NUMBER OF EARTHQUAKES.

1890	.....	.....	.....	.....	.....	0	0	0	2	1	2	2	.....
1891	0	0	2	0	0	0	2	2	0	1	1	1	9
1892	0	0	0	0	1	1	0	1	1	1	0	0	5
1893	0	0	0	0	0	0	1	0	1	1	0	0	3
1894	0	2	0	0	2	3	1	2	0	0	0	0	10
1895	0	0	1	0	2	0	1	1	1	1	0	1	8
1896	1	0	2	0	0	1	0	0	1	0	0	0	5
1897	0	1	2	1	0	0	1	1	2	0	0	0	8
1898	2	1	2	1	0	0	0	0	1	0	0	0	7
1899	0	0	3	0	0	1	0	0	0	2	0	2	8
1900	0	0	1	1	0	0	1	1	1	3	2	1	11
Average	0.3	0.4	1.3	0.3	0.5	0.5	0.6	0.7	0.9	0.9	0.5	0.6	7.4

NOTE.—When the data for any month is missing, the average for that month has been used in obtaining the annual mean. The letters in the figure columns indicate the number of days missing from the record; for instance, "e" denotes five days missing.

NOTES BY THE EDITOR.

MR. ALEXANDER ASHLEY.

When the Editor came to the weather service in January, 1871, as civilian assistant to the Chief Signal Officer of the Army, his first acquaintance was Mr. Alexander Ashley, who was usually spoken of as Chief Clerk, although, strictly speaking, he was Chief of the Division of Correspondence and Records; and now, after more than thirty years of public service together, the Editor regrets to have to announce the death of his colleague. Mr. Ashley's official record is as follows:

Born at Pittsburg, Pa., May 31, 1831. Served as an enlisted man in the United States Army from May 10, 1861, to March 31, 1863. (Private Company I, Tenth Regiment, Pennsylvania Reserve Corps, May 10, 1861; Corporal August 12, 1862; detailed from the Army for signal duty August, 1861; assigned to Office of Chief Signal Officer March 19, 1862; discharged from Army March 31, 1863.) Appointed civilian clerk April 1, 1863. Died April 11, 1901.

Mr. Ashley was graduated from Allegheny College, at Meadville, Pa., which conferred upon him the degrees of A. B. and A. M. He enlisted and was ordered to Washington, D. C., at the outbreak of the war; was detailed for duty under Gen. A. J. Myer, and later assisted him in the formation of the meteorological service of the Signal Corps. All scientific papers passed through his hands; for several years he prepared and had printed lists of the principal scientific documents preserved in his files, which lists were a great convenience for reference in the daily work of the office. He was also the recorder and historian of the Veteran Signal Corps Association. On June 30, 1887, on account of his advancing age, he vacated the position then regarded as that of chief clerk and was assigned to less exacting work. From July, 1897, until his death, he was on duty as examiner with the United States Civil Service Commission, by detail from the Weather Bureau.

Animated by the highest ideals of duty, Mr. Ashley's life was one of great official activity and personal influence. Both in official and private life he adhered to the right without a trace of compromise. Often a great amount of work was suddenly imposed upon him and his assistants, and he never failed to hold himself to duty as strictly as he held his subordinates; withal he was as kind and considerate of the rights and feelings of others as any comrade or brother could be. Although essentially a business man, a soldier, and a churchman, yet, he knew also how to further the scientific interests of the meteorological service in minor details and in many ways the Weather Bureau has been benefited by his long and faithful career.

MR. CHARLES DAVIS.

Mr. Charles Davis died at Charlotte, N. C., April 26, 1901, after a brief illness. He was born in Wilmington, N. C., on April 24, 1870, and educated in the graded schools of Chatham, Va., being graduated from the Chatham High School. He entered the meteorological service of the Government on August 21, 1889, and served as an assistant at Vicksburg and Meridian, Miss., Pensacola, Fla., Galveston, Tex., New Orleans, La., and Memphis, Tenn. In June, 1894, while but 24 years of age, he was promoted to the important position of observer in charge and assigned to duty at Shreveport, La. Four years later he was placed in charge of the Charlotte station, where he continued on duty until his death. His record in the Bureau is an enviable one. In his meteorological work he attained a high degree of accuracy, for which he was several times officially commended. A few months ago his station was rigidly inspected and found to be in splendid condition. In the death of Mr. Davis the Weather Bureau sustains a distinct loss. His good work as an observer and his excellent qualities as a man will be long remembered.