## MOISTURE.

The *quantity of moisture* in the atmosphere at any time may be expressed by the weight of the vapor coexisting with the air contained in a cubic foot of space, or by the tension or pressure of the vapor, or by the temperature of the dew-point. The mean dew-points for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, are given in Table I.

The *rate of evaporation* from a special surface of water on muslin at any moment determines the temperature of the wet-bulb thermometer, but a properly constructed evaporometer may be made to give the *quantity* of water evaporated from a similar surface during any interval of time. Such an evaporometer, therefore, would sum up or integrate the effect of those influences that determine the temperature as given by the wet bulb; from this quantity the *average humidity of the air* during any given interval of time may be deduced.

Measurements of evaporation within the thermometer shelters are difficult to make so as to be comparable at temperatures above and below freezing, and may be replaced by computations based on the wet-bulb temperatures. The absolute amount of evaporation from natural surfaces not protected from wind, rain, sunshine, and radiation, are being made at a few experimental stations and will be discussed in special contributions.

*Sensible temperatures.*—The sensation of temperature experienced by the human body and ordinarily attributed to the condition of the atmosphere depends not merely on the temperature of the air, but also on its dryness, on the velocity of the wind, and on the suddenness of atmospheric changes, all combined with the physiological condition of the observer. A complete expression for the relation between atmospheric conditions and nervous sensations has not yet been obtained.

## PRECIPITATION.

[In inches and hundredths.]

The *distribution of precipitation* for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, III, and IV. The total precipitation for the current month was heaviest (over 12 inches) in the northwest corners of Oregon and Washington, respectively; it was least (trace or zero) in southern California and Idaho, and western Arizona and Utah, and New Mexico. The largest values were: Neahbay, 17.5, and Glenora, 19.3.

*The diurnal variation*, as shown by tables of hourly means of the total precipitation, deduced from self-registering gauges kept at the regular stations of the Weather Bureau, is not now tabulated.

The *current departures* from the normal precipitation are given in Table I, which shows that precipitation was in excess on the coasts of Washington and Oregon, the lower Lake Region, New England, Middle States, and the Carolinas; it was deficient throughout the interior valleys, the Rocky Mountain Plateau, and California. The large excesses were: Neahbay, 6.4; Tatoosh Island, 4.8; Columbia, S. C., 4.2; Philadelphia, 3.5; Baltimore and Cape Henry, 3.4; Kittyhawk and Raleigh, 3.2. The large deficits were: San Francisco, 3.6; Portland, Oreg., and Los Angeles, 3.5; Point Reyes Light and Redbluff, 3.3; Eureka, 3.0.

The *average departure* for each district is also given in Table I. By dividing these by the respective normals the following corresponding percentages are obtained (precipitation is in excess when the percentages of the normals exceed 100):

Above the normal: New England, 110; middle Atlantic, 161; south Atlantic, 139; lower Lake, 130; north Pacific, 119; Florida Peninsula, 108; east Gulf, 106.

Below the normal: west Gulf, 90; North Dakota, 85; southern Slope (Abilene), 66; northern Slope, 64; upper Mississippi, 62; Missouri Valley, 55; upper Lake, 48; northern Plateau, 42; middle Slope, 28; middle Pacific, 28; southern Plateau, 23.

*The years of greatest and least precipitation* for February are given in the REVIEW for February, 1890. The precipitation for the current month was the greatest on record at: Northfield, 4.45; Oswego, 4.90; Harrisburg, 5.48; Philadelphia, 6.87; Baltimore, 7.07; Kittyhawk, 7.16; Raleigh, 6.73; Columbia, S. C., 8.00; Vicksburg, 10.13; Palestine, 7.05; Tatoosh Island, 13.63. It was the least on record at: Greenbay, 0.26; Carson City, 0.02; Sacramento, 0.09; Fresno, 0.06; San Diego, 0.02; Dodge City, T.; Los Angeles, T.; Yuma, 0.00.

*The total accumulated monthly departures* from normal precipitation from January 1 to the end of the current month are given in the second column of the following table; the third column gives the ratio of the current accumulated precipitation to its normal value.

| Districts. | Accumulated departures. | Accumulated precipitation. | Districts. | Accumulated departures. | Accumulated precipitation. |
|---|---|---|---|---|---|
| | *Inches.* | *Per ct.* | | *Inches.* | *Per ct.* |
| Middle Atlantic | + 0.20 | 103 | New England | − 2.00 | 75 |
| South Atlantic | + 0.40 | 105 | East Gulf | − 1.40 | 86 |
| Florida Peninsula | + 0.40 | 107 | Ohio Valley and Tenn. | − 3.80 | 57 |
| West Gulf | + 0.10 | 101 | Upper Lakes | − 1.10 | 74 |
| North Dakota | + 0.50 | 138 | Upper Mississippi | − 1.60 | 59 |
| Abilene (southern Slope) | + 0.10 | 105 | Missouri Valley | − 1.20 | 56 |
| North Pacific | + 4.90 | 125 | Northern Slope | − 0.30 | 76 |
| | | | Middle Slope | − 1.10 | 39 |
| | | | Southern Plateau | − 0.20 | 81 |
| | | | Middle Plateau | − 0.10 | 97 |
| | | | Northern Plateau | − 1.40 | 67 |
| | | | Middle Pacific | − 0.70 | 93 |
| | | | South Pacific | − 2.00 | 56 |

Details as to *excessive precipitation* are given in Tables XII and XIII.

The *total monthly snowfall* at each station is given in Table II. Its geographical distribution is shown on Chart VI. The southern limit of freezing temperatures and possible snow is shown on this chart by the isotherm of minimum 32°. The isotherm of minimum 40°, namely, the air temperature within the thermometer shelter, is also given on this chart, and shows approximately the southern limit of frost on exposed surfaces.

The depth of snow on the ground at the close of the month is shown on Chart VII. The condition of the snow on the ground on Monday of each week is also shown on the weekly charts published by the Weather Bureau during December–March, inclusive.

### HAIL.

The following are the dates on which hail occurred in the respective States:

Alabama, 5. Arizona, 4, 22. Arkansas, 5, 28. California, 18, 29. Florida, 28, 29. Idaho, 27. Louisiana, 4 to 7, 28. Mississippi, 1, 4, 5, 24, 28. North Carolina, 5, 6. Oregon, 28, 29. South Carolina, 5, 6, 7. Tennessee, 28. Texas, 27. Utah, 28. Virginia, 5, 6. Washington, 1, 26, 28, 29.

### SLEET.

The following are the dates on which sleet occurred in the respective States:

Arkansas, 7, 8. California, 29. Colorado, 27, 28, 29. Connecticut, 1, 3, 4, 8, 9, 13. Delaware, 3, 4, 8, 9, 13. District of Columbia, 3, 4, 16. Idaho, 4, 5, 26, 28, 29. Illinois, 2, 3, 5, 10, 12, 28, 29. Indiana, 2, 3, 12, 28, 29. Indian Territory, 2. Iowa, 4, 6, 11. Kansas, 2, 11, 12, 29. Kentucky, 8. Maine, 1, 6, 13, 20, 23. Maryland, 2, 3, 5, 8, 9, 13. Massachusetts, 1, 3, 6, 9, 13. Michigan, 1 to 4, 15, 18, 23. Minnesota, 8, 27, 28. Missouri, 2, 5, 7, 9, 11, 12, 13, 28, 29. Montana, 5, 7, 9, 14, 26, 28. Nebraska, 3, 9, 10, 12, 17, 28, 29. Nevada, 2, 3, 26, 29. New Hampshire, 13, 23. New Jersey, 1, 3, 4, 6, 8, 9, 13, 24, 28. New Mexico, 1, 4, 12, 13, 14. New York, 1, 3, 4,

6, 13, 24, 29. North Carolina, 5 to 8. North Dakota, 27. Ohio, 2, 3, 4, 6, 8, 10, 12, 13, 15, 16, 23, 24, 29. Oklahoma, 6, 9. Oregon, 1, 9, 28, 29. Pennsylvania, 1, 3, 4, 6, 8, 9, 13, 23, 28. Rhode Island, 5. South Carolina, 5, 17, 24, 25. Tennessee, 5 to 8, 28. Texas, 12, 24, 25. Utah, 4, 5, 29. Vermont, 6. Virginia, 3, 6, 8, 16, 19. Washington, 2, 4, 9, 21, 28, 29. West Virginia, 2, 3, 4, 6, 8, 11, 14.

## WIND.

The *prevailing winds* for February, 1896, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table IX. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

### HIGH WINDS.

*Maximum wind velocities* of 50 miles or more per hour were reported at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

| Stations. | Date. | Velocity. | Direction. | Stations. | Date. | Velocity. | Direction. |
|---|---|---|---|---|---|---|---|
| | | *Miles* | | | | *Miles* | |
| Amarillo, Tex | 27 | 66 | n. | Hatteras, N. C | 19 | 50 | n. |
| Block Island, R. I | 3 | 51 | ne. | Kittyhawk, N. C | 6 | 66 | sw. |
| Do | 6 | 55 | e. | Do | 17 | 58 | ne. |
| Do | 7 | 54 | w. | Do | 18 | 60 | n. |
| Do | 11 | 50 | w. | New Haven, Conn | 6 | 54 | e. |
| Do | 29 | 50 | se. | New York, N. Y | 2 | 53 | nw. |
| Boston, Mass | 6 | 58 | se. | Do | 6 | 64 | e. |
| Buffalo, N. Y | 10 | 54 | w. | Do | 7 | 65 | w. |
| Do | 11 | 64 | w. | Do | 11 | 60 | w. |
| Do | 19 | 60 | nw. | Do | 14 | 64 | nw. |
| Cheyenne, Wyo | 28 | 58 | nw. | Do | 19 | 52 | w. |
| Cleveland, Ohio | 11 | 61 | w. | Do | 29 | 52 | se |
| Denver, Colo | 28 | 54 | nw. | Norfolk, Va | 6 | 56 | sw. |
| Eastport, Me | 6 | 60 | e. | Tatoosh Island, Wash | 5 | 54 | w. |
| Do | 7 | 54 | e. | Do | 13 | 54 | s. |
| Do | 9 | 52 | e. | Do | 18 | 50 | e. |
| Fort Canby, Wash | 13 | 66 | s. | Do | 25 | 58 | s. |
| Do | 21 | 67 | s. | Do | 27 | 50 | w. |
| Do | 25 | 54 | s. | Do | 28 | 68 | w. |
| Grand Haven, Mich | 10 | 51 | w. | Williston, N. Dak | 27 | 52 | n. |
| Do | 11 | 52 | nw. | Winnemucca, Nev | 28 | 58 | w. |
| Hatteras, N. C | 6 | 54 | sw. | Woods Hole, Mass | 7 | 56 | sw. |
| Do | 18 | 60 | n. | Do | 9 | 50 | sw. |

## SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 17 regular stations of the Weather Bureau by its photographic, and at 21 by its thermal effects. At one station records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric sheets show seventy-fifth meridian time; for convenience the results are all given in Table XI for each hour of local mean time.

Photographic and thermometric registers give the duration of that intensity of sunshine which suffices to make a record, and, therefore, they generally fail to record for a short time after sunrise and before sunset, because, even in a cloudless sky, the solar rays are then too feeble to affect the self-registers. If, therefore, such records are to be used for determining the amount of cloudiness, they must be supplemented by special observations of the sky near the sun at these times. The duration of clear sky thus specially determined constitutes the so-called twilight correction (more properly a low-sun correction), and when this has been applied, as has been done in preparing Table XI, there results a complete record of the clearness of the sky from sunrise to sunset in the neighborhood of the sun. The twilight correction is not needed when the self-registers are used for ascertaining the duration of a special intensity of sunshine, but is necessary when the duration of cloudiness is alone desired, as is usually the case.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

*Difference between instrumental and personal observations of sunshine.*

| Stations. | Apparatus. | Total possible duration. | Personal estimated area of clear sky. | Instrumental record of sunshine. | | | |
|---|---|---|---|---|---|---|---|
| | | | | Photographic. | Difference. | Thermometric. | Difference. |
| | | *H'rs.* | % | % | % | % | % |
| Galveston, Tex | P. | 324.7 | 57 | 56 | — 1 | ..... | ..... |
| New Orleans, La | T. | 323.6 | 57 | ..... | ..... | 58 | + 1 |
| Savannah, Ga | P. | 321.3 | 53 | 67 | +14 | ..... | ..... |
| Vicksburg, Miss | T. | 321.3 | 52 | ..... | ..... | 56 | + 4 |
| Phœnix, Ariz | P. | 319.8 | 70 | 87 | +17 | ..... | ..... |
| San Diego, Cal | P. | 319.8 | 71 | 78 | + 7 | ..... | ..... |
| Atlanta, Ga | T. | 318.5 | 57 | ..... | ..... | 63 | + 6 |
| Wilmington, N. C | T. | 318.5 | 55 | ..... | ..... | 62 | + 7 |
| Little Rock, Ark | T. | 317.2 | 51 | ..... | ..... | 66 | +15 |
| Santa Fe, N. Mex | P. | 316.4 | 62 | 73 | +11 | ..... | ..... |
| Independence, Cal | T. | 314.8 | 79 | ..... | ..... | 92 | +13 |
| Dodge City, Kans | P. | 313.7 | 68 | 75 | + 7 | ..... | ..... |
| Louisville, Ky | T. | 313.7 | 41 | ..... | ..... | 46 | + 5 |
| San Francisco, Cal | T. | 313.7 | 75 | ..... | ..... | 74 | — 1 |
| Baltimore, Md | T. | 312.1 | 40 | ..... | ..... | 45 | + 5 |
| Cincinnati, Ohio | T. | 312.1 | 39 | ..... | ..... | 47 | + 8 |
| Kansas City, Mo | P. | 312.1 | 48 | 49 | + 1 | ..... | ..... |
| St. Louis, Mo | T. | 312.1 | 39 | ..... | ..... | 50 | +11 |
| Washington, D. C | P. | 312.1 | 55 | 48 | — 7 | ..... | ..... |
| Columbus, Ohio | T. | 311.0 | 28 | ..... | ..... | 37 | + 9 |
| Denver, Colo | P. | 311.0 | 57 | 74 | +17 | ..... | ..... |
| Philadelphia, Pa | T. | 311.0 | 43 | ..... | ..... | 56 | +13 |
| Eureka, Cal | P. | 309.7 | 52 | 59 | + 7 | ..... | ..... |
| New York, N. Y | T. | 309.7 | 40 | ..... | ..... | 50 | +10 |
| Salt Lake City, Utah | P. | 309.7 | 43 | 63 | +20 | ....1 | ..... |
| Boston, Mass | T. | 307.7 | 48 | ..... | ..... | 54 | + 6 |
| Chicago, Ill | T. | 307.7 | 47 | ..... | ..... | 55 | + 8 |
| Cleveland, Ohio | P. | 307.7 | 27 | 27 | 0 | ..... | ..... |
| Des Moines, Iowa | T. | 307.7 | 44 | ..... | ..... | 62 | +18 |
| Detroit, Mich | T. | 307.7 | 33 | ..... | ..... | 40 | + 7 |
| Buffalo, N. Y | T. | 306.6 | 19 | ..... | ..... | 35 | +16 |
| Rochester, N. Y | T. | 306.6 | 33 | ..... | ..... | 53 | +20 |
| Northfield, Vt | P. | 305.0 | 34 | 35 | + 1 | ..... | ..... |
| Portland, Me | T. | 305.0 | 43 | ..... | ..... | 53 | +10 |
| Eastport, Me | P. | 303.0 | 33 | 37 | + 4 | ..... | ..... |
| Portland, Oreg | T. | 301.5 | 37 | ..... | ..... | 30 | — 7 |
| | P. | 301.5 | 37 | 29 | — 8 | ..... | ..... |
| Bismarck, N. Dak | P. | 299.8 | 49 | 45 | — 4 | ..... | .. |
| Helena, Mont | P. | 299.8 | 47 | 47 | 0 | ..... | ..... |

### COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the percentage of duration relative to possible sunshine is derived; the observer's personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental durations of sunshine are almost always larger than the personal estimates of area of clear sky; the average excess for February is 5 per cent for photographic and 8 per cent for thermometric records. The details are shown in the above table in which the stations are arranged according to the greatest possible duration of sunshine, and not according to the *observed* duration as heretofore.