ATMOSPHERIC HUMIDITY

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THE amount of moisture in the atmosphere is usually determined by simultaneous readings of dry and wet bulb thermometers, when the relative humidity, absolute humidity, and dew-point can be obtained from tables. Although this method is not of the highest degree of accuracy, the reading of the wet-bulb thermometer depending to an appreciable extent on the ventilation to which it is exposed, its convenience has brought it into general use.

The tables generally supplied are intended for use when the thermometers are exposed to a light breeze. The error due to incorrect ventilation is much greater, if the instruments are sheltered from all ventilation, than if they are exposed to a wind considerably greater than that for which the tables were computed.

There is a limit to the amount of moisture that can be contained in a unit of volume, this amount depending on the temperature only and increasing very rapidly as the temperature rises. For example, a rise of 18° F., from 32° F. to 50° F. will double the maximum amount of moisture per unit volume. It is redoubled at 69·5° F., and doubled again at 90·7° F. Over ordinary atmospheric temperatures, it is nearly correct to say that the maximum amount of moisture increases in geometric progression as the temperature increases in arithmetical progression.

Relative, or percentage, humidity is the proportion, expressed as a percentage, which the actual quantity of moisture in any volume of air bears to the amount which could be contained in the same volume, if the air were saturated at the same temperature. When the actual moisture content of the air is unchanged, the relative humidity varies rapidly with the temperature. A moisture content that will give a relative humidity of 100 at 70° F. will only give 72 at 80° F., and 52 at 90° F.

The pressure exerted by water vapour in the air is approximately proportional to the actual water content per unit volume. This water content is therefore usually expressed by the pressure it exerts, in inches of mercury or millibars, and is known as the vapour pressure, or absolute humidity. The actual mass of water vapour per unit volume, at various temperatures and relative humidities, can be obtained from special tables, but approximate values in grains per cubic foot, or grammes per cubic metre, can be obtained by multiplying the vapour pressure, in inches of mercury, by 11 or 25, respectively, *e.g.*, a vapour pressure of 1·000 inch is roughly equivalent to 11 grains of water vapour per cubic foot, or 25 grammes per cubic metre. At ordinary shade temperatures in Ceylon, both in the low-country and among the hills, this approximation should be correct within 5%.

A third method of expressing the humidity of the air is to give the dew-point, or the temperature at which the moisture actually present in the air would be just sufficient to saturate it. It is the temperature at which, if the air were cooled, dew would just begin to form, hence the name. The dew-point is obviously a function of the absolute humidity alone.

A fourth method of expressing atmospheric humidity, which as yet has not been very much used, is to give the saturation deficit. This is the amount of water-vapour per unit volume, generally expressed as a pressure, in inches of mercury or millibars, which would be required to saturate the air at the particular temperature at which it happens to be.

An example will perhaps make these various definitions clearer.

At sea-level the dry bulb temperature is observed to be, say, 86·2° F., and the wet bulb temperature 73·8° F. (It is necessary to specify the level at which the observations are taken, or the approximate barometric pressure, as, for given values of the dry and wet bulb temperatures, the values computed for these various humidity factors, depend to some extent, on the barometric pressures. However, tables at intervals of 2 inches of pressure, or 2,000 feet of altitude, are sufficient to allow for this variation).

We have a difference of 12·4° F. between the dry and wet bulb readings. From the tables, the moisture in the air exerts a pressure of ·665 inch of mercury, which is therefore the absolute humidity. This amount of moisture would be sufficient to saturate the air if the temperature were reduced to 67·2° F. This latter temperature is therefore the dew-point. The amount of vapour that would be required to saturate the air at 86·2° F. would exert a pressure of 1·249 inch. The relative humidity is therefore (·665 × 100)/1·249, or 53. The saturation deficit is 1·249 − ·665, or ·584 inch of mercury.

The rapidity of evaporation bears a much closer relation to the saturation deficit than to the relative humidity. In the low and mid-country of Ceylon, saturation deficit is usually high in the day-time, and may be an important climatological factor in the variations of agricultural, medical, or other biological phenomena. It is, of course, true that the rapidity of evaporation depends also on the wind, a factor which varies so much with small changes in locality that it is difficult to take it into account in this connection.

Saturation deficit, at any rate in Ceylon, shows much greater variations in the monthly means than either relative humidity or vapour pressure, and attempts to correlate it with other agricultural or medical factors may prove fruitful. In a paper now in course of publication,[1] monthly mean values of the saturation deficit have been given for the 16 principal meteorological stations of Ceylon, for each month over periods of a few years. Average monthly values are also given, for certain hours of the day. It is hoped that these tables may prove useful to investigators.

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(1) Jameson, H. : Tables of Saturation Deficit for Ceylon. *Ceylon, J. of Sc.* (E) Vol. II, pt.2