LETTERS TO THE EDITORS

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Vertical Distribution of Atmospheric Humidity near the Ground

PARTLY as an investigation in pure meteorology and partly as a study of the effects of air temperature and humidity on the propagation of very short-wave radio transmissions, autographic records of the temperature and humidity of the air at heights of 1, 15, 47 and 107 m. have been maintained at Rye (Sussex) during the three years July 1945 to June 1948. The station is located on flat marshland, and is about 5 km. from the sea. The temperature and humidity measuring elements were continuously aspirated.

The main features of the temperature records resemble those found elsewhere, for example, at Porton[1] and Leafield[2].

The humidity records are believed to provide information of a kind not hitherto available concerning the vertical distribution of water vapour in the lowest 100 m. of the atmosphere, and its variation with time. The data, though not necessarily representative in detail of other localities, may be of interest for purposes other than those which gave rise to the investigation.

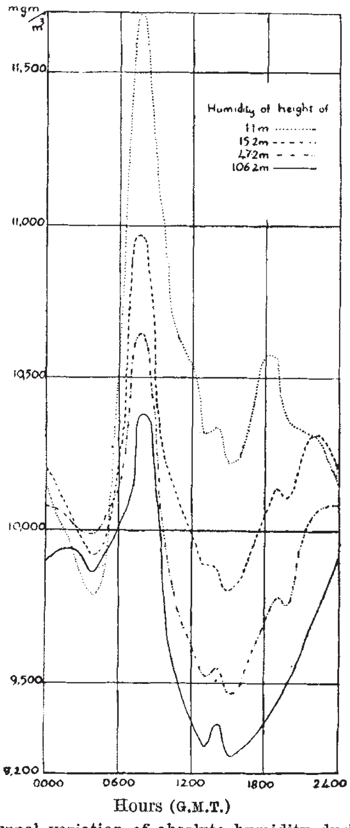

Fig. 1. Diurnal variation of absolute humidity during August at four heights

During the winter, the absolute humidity usually follows a diurnal variation with a maximum around noon at all heights, as might be expected.

In summer, however, the regime is quite different. Fig. 1 shows the average variation of absolute humidity throughout the day in August at each of the four levels. The prominent peak maximum at about 0800 G.M.T., decreasing in magnitude with height, indicates the upward diffusion—by restricted atmospheric turbulence in the hours following sunrise—of surface-evaporated moisture. As the convective turbulence increases, moisture is diffused through a much deeper layer of air, and the absolute humidity in the lowest levels consequently decreases to a minimum in the afternoon. This morning maximum and afternoon minimum are characteristic of the summer months—April to September.

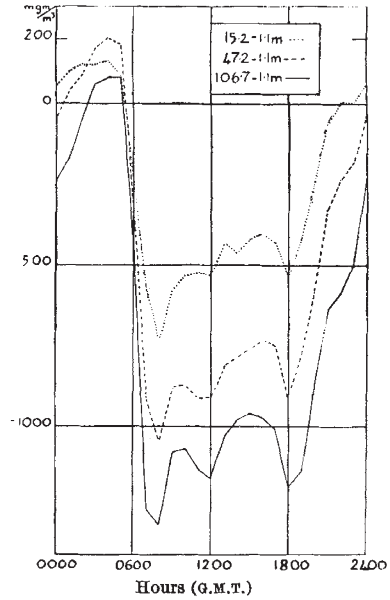

Fig. 2. Diurnal variation of absolute humidity differences during August

The effect of cloud upon the diurnal variation of absolute humidity is pronounced. On cloudy days in summer the amplitude of the diurnal variation is reduced to about half its value on clear days, and the time of occurrence of the maximum is delayed until late afternoon or early evening, instead of taking place in the early forenoon as on sunny days.

The mean differences between the absolute humidity at each of the three upper levels and the lowest level are illustrated in Fig. 2 for the month of August. The outstanding feature is the large decrease of absolute humidity upwards during the day. At night the difference in humidity becomes smaller and of opposite sign. This form of variation is broadly typical of that for other months.

The diurnal range of humidity gradient in winter is naturally much smaller, the value for February being about one-fifth of that for August. In nearly all months the nocturnal inversion of the day-time gradient extends to a height between 15 and 47 m., and in some months to beyond 107 m. The inversion is more pronounced on clear nights and less pronounced or non-existent on overcast nights.

It is proposed to publish shortly the detailed results of the investigation, and also the mean values of the 'modified refractive index' (as used in radio propagation work) computed from the temperature and humidity records.

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Meteorological Office, London. Oct. 11.

[1] Johnson, N. K., Geophys. Mem. No. 46 (London, 1929).

[2] Johnson, N. K., and Heywood, G. S. P., Geophys. Mem. No. 77 (London, 1938).