LETTERS TO THE EDITORS

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Wind and Temperature Measurements up to 30 Km.

In a letter in *Nature* in 1946 Sir Nelson Johnson[1] reported some results of direct measurements of winds at 30 km. by means of observations of shell bursts. Exploration to this height by means of sounding balloons has recently become possible through the development of balloons of large size. Measurements of wind structure are made by radar tracking, and temperature observations are given by *radio sonde* technique. Seven successful ascents have been made at stations in the south and east of England; five of them were made in midsummer and at night, thus avoiding possible temperature errors due to solar radiation. The other two were day-time ascents in spring, and were confined to wind measurements only. The results of two of the soundings are illustrated in the accompanying diagram.

Between 15 km. and 20 km., all the soundings showed a veer of more than 100° in wind direction and also a minimum in wind speed. From these heights up to 30 km., easterly winds prevailed in all the summer ascents and also in the April one, whereas in the March sounding the upper wind was from a westerly quarter. Good confirmation is thus provided for the 'monsoon wind' theory of the late Dr. F. J. W. Whipple[2] who, from the anomalous propagation of the sound of explosions, deduced that the wind at high levels changes from west to east at the end of March and back again to west in the middle of September.

The chief feature of the temperature soundings is the steady rise with height in the stratosphere from a mean of −54° C. at 18 km. to −40° C. at 30 km., that is, a gradient of about 1° C. per km. These temperatures are about 16° C. lower than the day-time temperatures at the same levels in England calculated by Gowan[3] from the effect of absorption of radiation in the ozonosphere under radiative equilibrium conditions. The large difference can scarcely be due to the fact that the soundings were made at night, for Gowan also calculated that the cooling of the ozonosphere during the night should not amount to more than about 3° C. at 30 km.

Three of the five temperature soundings showed double minima, the lower one being at the normal tropopause height of 12 km. and the other at about 17 km. These features can be interpreted as a discontinuity in the tropopause of the type first suggested by Bjerknes and Palmen[4,5]. According to Hess[6], the discontinuity between an upper, tropic tropopause and a lower, arctic one occurs between latitudes 50° and 52° in North America in summer. It could, therefore, be expected to show up frequently in high soundings in England. Moreover, since the discontinuity is associated with the occurrence of a narrow zone of fast-moving air, which has recently come to be known as a jet stream, some evidence of this in the shape of a sharp maximum in wind speed near the lower level tropopause could also be expected. Some of the soundings did, in fact, show such sharp maxima.

Further details of the recent observations are being published in the *Meteorological Magazine* of October 1949. The work forms part of the research programme of the Meteorological Office, and this note is published with the permission of the Director.

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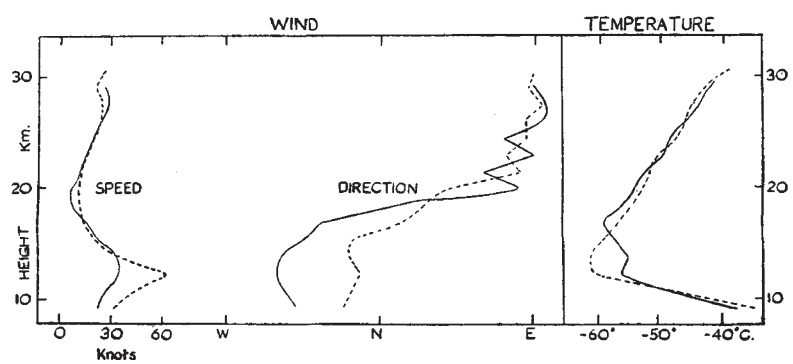
Sept. 2.

[1] Johnson, N. K., *Nature*, **157**, 24 (1946).
[2] Whipple, F. J. W., *Quart. J. Roy. Met. Soc.*, **61**, 285 (1935).
[3] Gowan, E. H., *Proc. Roy. Soc.*, A, **190**, 219 and 227 (1947).
[4] Bjerknes, J., and Palmen, E., *Geofys. Pub. Oslo*, **12**, No. 2 (1937).
[5] Palmen, E., *J. Met.*, **5**, 20 (1948).
[6] Hess, S. L., *J. Met.*, **5**, 293 (1948). See also *Met. Mag.*, **78**, 102 (Fig. 2) (1949).



Crystal Size and Fluorescence Intensity

Anthracene crystals usually take the form of thin plates, and in ultra-violet light their fluorescence seems concentrated at the edges. This is because much of the fluorescence is unable to escape through the large flat surfaces, and undergoes numerous reflexions within the thin layer, emerging at the narrow faces. A part of the fluorescence light, therefore, travels very much farther through the material than it would if it could escape equally in all directions, and the effect of overlap of absorption and fluorescence bands is thereby greatly exaggerated. The shorter-wave side of the fluorescence band is weakened by re-absorption and energy degradation.

The effect was investigated by measuring the fluorescence band contours of anthracene with a high-aperture spectrograph having an electron multiplier at the exit slit. The readings were corrected for variations of the instrument sensitivity with wave-length by calibration against a tungsten band lamp of known temperature.

The accompanying table gives the measured intensities at the maxima of the vibrational band structure of the fluorescence band of anthracene, taking the 0–2 band as standard. Illumination by 3650 or by 2537 A. light gave identical results. Crystals of 1 mm. and 0·1 mm. diameter were obtained by sieving, those about 0·02 mm. by pouring a saturated solution in acetone into warm 15 per cent gelatine solution, 0·003 mm. by adding water to an acetone solution, and less than 0·0003 mm. by pouring an acetone solution into hot water. It will be seen that