The latter wave has been examined and has little effect in the tropics. It has therefore been neglected. All amplitudes have been adjusted linearly to a standard pressure of 1013·3 mb. and to the equator by dividing by the cube of the cosine of the latitude. The adjusted amplitudes appear in the last column of the table and are plotted on the accompanying chart. A cursory inspection of the chart indicates that the amplitudes are distributed with extraordinary regularity, the magnitude increasing with distance from the coast.

It is considered that this regularity can be made to serve two purposes. First, to check the accuracy of the instruments, *e.g.* Chirundu (for which only one one year's indifferent records are available) appears to be too high and, second, to obtain the amplitude for stations not equipped with barographs.

REFERENCE

G. C. Simpson 1918 Quart. J. R. Met. Soc., London, **44**, p. 1.

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Atmospheric Radiation.

I was unable to be present at the reading of the valuable paper by G. D. Robinson, pages 127-150 of the *Journal* for January, 1947, on atmospheric radiation, and it is only recently that I have been able to examine it properly. If it is not too late I should like to take this opportunity of commenting on a few of the many interesting points which it contains.

Regarding the emission by water vapour alone, I feel that some confusion might be caused by the description of Figs. 11 and 12 as the "Emissivity of water vapour (without CO_2)" and suggest it would be somewhat more correct to call this, "Emissivity of water vapour (in the presence of CO_2)". Water vapour has appreciable emissivity in the same region of the spectrum as CO_2, and therefore the elimination of all the radiation in this region gives too low a total for water vapour alone. This, doubtless well known to the author, is not clearly stated in the text.

Estimates of the absorption by water vapour at 15μ, in the middle of the CO_2 band, range from about 56 per cent by 1 cm. equivalent liquid (Cowling, *Rep. Proc. Phys.*, **9**, 1942-3, p. 39) to 30 per cent for the same amount (Elsasser, *Q.J.*, **66**, Suppl., p. 41).

"Additional" atmospheric radiation: This extra radiation found on many occasions, and discussed in section 13 of the paper, raises some interesting points. Here only the possible extent to which it could be due to CO_2 will be considered.

In an article on variations of CO_2 in different air currents (*Q.J.* **66**, p. 395), I showed that these variations are significant if large numbers of reliable observations are used. As, however, they only amounted to about 4 per cent on the mean values, it would not be possible to attribute anything more than a small fraction of the observed additional radiations to this cause.

At Kew the local variations of CO_2 are considerably larger than this owing to its being close to such a large centre of population. Using the observations of Brown and Escombe (*Proc. Roy. Soc.*, B, p. 118), **76**, on the amount of CO_2 in the air at Kew, it was shown (*loc. cit.*) that the average was 10 per cent greater on days with winds between NE. and SE. than on those having westerly winds. On some days this excess was as much as 20 per cent.

Since the time of these observations the output of CO_2 from London has greatly increased (to over 100 million cubic metres per day) and it would be reasonable to expect an excess of around 25 per cent in the lower air at Kew on some days with easterly winds. For an atmospheric path length of 1 km., this figure is equal to an increase of CO_2 "depth" from 32 to 40 cm.-atm., and the available data (Callendar, *Q.J.*, **67**, p. 263) indicates that the increase of emission for this would be approximately 0·6 per cent of the full temperature radiation, say 0·2 mw. cm.$^{-2}$. This may be compared with the average of about 1 mw. cm.$^{-2}$ found for the additional component of radiation. From this it seems that only a small part of the additional radiation could be attributed to variations of CO_2, although on many of the occasions when it was pronounced the conditions suggest that CO_2 may have been present in excess at Kew.

My own view is that the additional radiation observed at Kew is caused mainly by a local excess of combustion products, such as smoke particles, carbon dioxide, polyatomic gases and vapours which always arise from large centres of population. However that may be, the additional radiation observed on January 17, 1947, in very clear weather with south-westerly wind, could scarcely be accounted for on the above basis, and one can only suggest the possibility of a small low-level temperature inversion. In this connection it is clear from the text that the observers at Kew are well aware of the havoc which temperature inversions can play with the consistency of these radiation measurements, and were at pains to avoid such conditions.

The observations by J. Strong, which are referred to in the paper as showing additional absorption in the transparent part of the atmospheric spectrum, are even more difficult to account for. They were made under conditions where none of the above factors could have appreciable influence, and, until they have been confirmed by others of a similar nature, no useful comment seems possible beyond the suggestion that someone may have been "blowing down" gas wells in the vicinity. (The C_2 and heavier vapours absorb strongly in this part of the spectrum.)

It would be of great interest if some of these radiation measurements could be made in a locality far from large towns, where the air is much purer, for comparison with those at Kew. Data on the effect of temperature inversions would be valuable also, although such observations might be too laborious to be worth while.

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