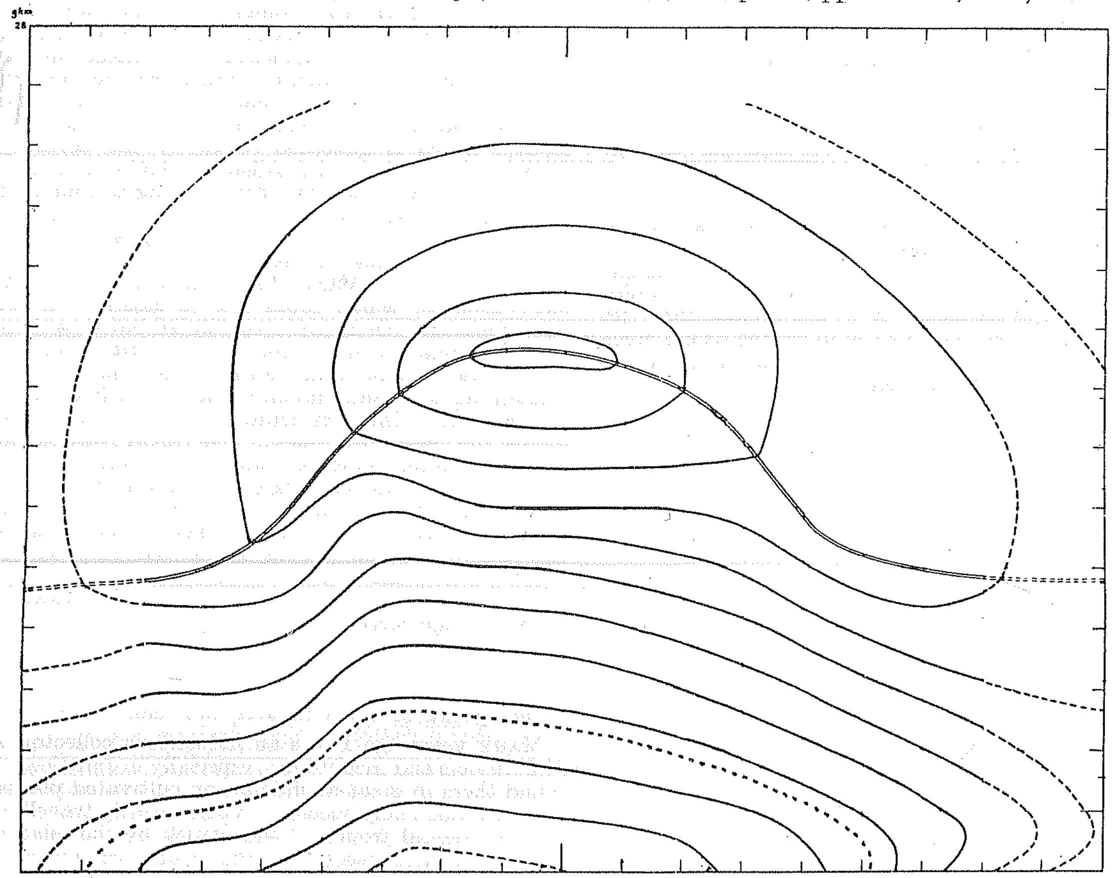
Distribution of Temperature in the First 25 Kilometres over the Earth.

SIR NAPIER SHAW, in his "Manual of Meteorology", gives on p. 100 of vol. 2 a very interesting diagram showing the distribution of temperatures in the upper air over the globe. As pointed out by Dr. C. W. B. Normand in his review of the book in the *Quarterly Journal of the Royal Meteorological Society* (vol. 54, p. 275; 1928), the diagram does not represent exactly the peculiarities of the distribution of temperature in the stratosphere over the tropical and subtropical regions. An attempt has therefore been made to prepare a modified diagram, using all the data now available. It shows (Fig. 1) the probable distribution of isotherms in the atmosphere up to 25 km. in summer and winter over the northern hemisphere. The dotted lines are based on very few observations and are therefore mainly conjectural. The principal features of the diagram may be briefly summarised.

(1) The stratosphere is not isothermal over any particular place, but above a certain level there is a tendency for the temperature to increase with height.



(2) The coldest air over the earth, of temperature about 185° A., lies at a height of some 17 gkm. over the equator in the form of a flat ring surrounded by rings of warmer air.

(3) The surface of the tropopause has a relatively steep slope towards the pole between latitudes 30° and 50° in summer and between 25° and 45° in winter.

(4) The ring of lowest temperature at the tropopause is displaced towards the summer hemisphere.

(5) There is a ridge of high temperature in the tropopause between latitudes 20° and 40° N. in summer corresponding to the ridge of high pressure at 8 km. over those latitudes (see Sir Napier Shaw's chart of 8 km. isobars in July, *loc. cit.* p. 262).

The evidence for (1) and (2) comes from the results of sounding balloon ascents at Batavia, Agra, and in the United States of America (Blair, *Bull. Mt. Weather Obs.*, vol. 4, part 4, pp. 183-304; 1912). The rise of temperature with height in the stratosphere over these places cannot be considered to be due to insolation, as most of the Agra ascents and many of the American ascents began late in the day when the sun was low. Bemmelen has given strong reasons for believing that the rise of temperature in the stratosphere which he observed over Batavia could not have been due to insolation. The Agra and Batavia results indicate a temperature of about 220° A. at a height of 24 km., and the American results show about 230° A. at 25 km.

The seasonal variation of temperature of the tropopause at Batavia and Agra is illustrated in Fig. 2 and shows (4) clearly. The height of the tropopause over

Nature, 123, 834-835, 1929.

Batavia does not show such well-marked variation as that of temperature, but the following figures taken from Bemmelen (*Proc. Roy. Acad.*, Amsterdam,

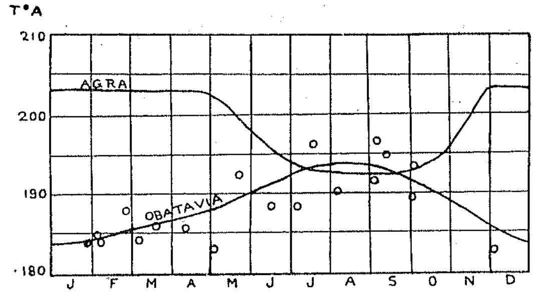


FIG. 2.—The points marked in the figure refer to Batavia temperatures.

vol. 20, p. 1313) show that the variation is similar to that which occurs over Agra but displaced by about six months.

HEIGHTS OF TROPOPAUSE OVER BATAVIA (KM.).

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
17·8	17·6	17·3	17·0	16·5	16·2	16·0	16·5	17·0	17·4	17·6	17·7

The lower temperatures and greater heights of the tropopause in summer are presumably due to the stronger convection in the troposphere in that season.

The persistent increase of temperature with height for at least 5 km. above the tropopause in the tropics finds a natural explanation if we assume that the tropopause marks the lower limit of the ozone layer in the atmosphere.

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his speed 231·44 miles per hour (or if we give the arithmetical residues, 231·43683 . . . m.p.h.).

3. He may take precisely the same time to the half hundredth of a second as Sir Henry Segrave (15·56 sec.) with a speed of 231·36 miles per hour.

4. He may take one-half hundredth of a second longer, when his speed will be 231·29 miles per hour.

5. He may fail to obtain the record by a substantial margin.

Now in cases 2 and 4, to determine whether the claimant has obtained the record or not, it is amply sufficient to record the speed to 1/100th of a mile per hour. The difference from the standing record in each case amounts to 0·07 or 0·08 mile per hour. In case 3 no addition to the number of significant figures will serve to distinguish between the new record and the old. It is difficult to find any support for 8 significant figures from these facts.

Col. O'Gorman next points out that the speed published is not the true mean of the speeds obtained on the two runs over the measured distance, but the sum of the two distances divided by the sum of the two times. It is not clear how this fact affects the question of the permissible number of significant figures, which is governed solely by the accuracy with which the time and the distance can be measured. One may further ask why, if it is wrong to round off to two decimal figures, it is right to stop at five figures? Why not publish a whole page of decimals ?

It would perhaps be presumption on my part to suggest a line of defence which Col. O'Gorman might have adopted, which could not be assailed on the scientific side. He might have pointed out that these speeds to be accepted internationally must be worked out in the manner laid down by the international controlling body, and that any country which attempts a record and wishes its claim to be recognised must follow the prescribed rules. The Royal Automobile Club, therefore, would be under an obligation to give the prescribed number of figures whatever this number might be. It may publish a foolish statement, but no alternative is open except that of not claiming the record, and few people would wish to push the claim for scientific honesty to this length.

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The Spread of Scale Insects and their Parasites.

MANY years ago I was an industrious collector of scale insects and mealy-bugs, especially in Jamaica. I found them in great abundance on cultivated plants, and obtained many species. When recently travelling in the Oriental tropics, I was struck by the relative scarcity of these insects, and the occurrence of various well-known injurious forms only in small patches or isolated individuals. Perhaps the difference was partly due to the relative poorness of my eyesight, but I could not help speculating on the causes which might lead to a diminution of scale insects on cultivated plants, aside from the operations of economic entomologists. World-wide commerce has spread the injurious Coccidæ over the earth, as they are so easily carried with plants. In their native countries they are efficiently controlled by parasitic and predatory enemies. In several well-known cases a plague has been abated by going to these countries and obtaining the natural enemies, which had failed to arrive with the first (accidental) importation of the coccids. Thus, following the modern expansion of trade and rapid transit, there has been in many regions a great increase in the damage done by scale insects, at times reaching the magnitude of a calamity. But by the same process,