Distribution of Potential Temperature in the First 25 Kilometres over the Northern Hemisphere.

IN his communication in NATURE of June 15, p. 906, Sir Napier Shaw has emphasised the fundamental importance of a knowledge of the distribution of entropy in the atmosphere for an understanding of the physics of the general circulation.

In Fig. 1 is drawn a smoothed diagram (similar to Sir Napier Shaw's diagram on p. 116 of his "Manual of Meteorology", vol. 2) showing the latitudinal distribution of potential temperature in summer and winter of the northern hemisphere. The potential temperatures plotted (in degrees absolute) are

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temperatures which the air at any place would assume if compressed or expanded adiabatically to 1000 mb. The temperature data used in the calculation are the same as those employed in preparing the diagram of temperature distribution over the earth (see NATURE, June 1, p. 834), and the monthly mean surface pressure data at the places of sounding balloon observations are taken from the isobaric maps given in pp. 218-241 of the book quoted above. The values obtained from the results of a few sounding balloon ascents over Poona (lat. 18° N.) during the winter of 1928–29 have also been used. As is well known, lines of equal potential temperature are also lines of equal entropy.

It is possible that potential temperatures over north India during the summer are exceptionally high and that the trough near Lat. 25° N. will be less marked if more data from similar latitudes in other parts of the world are available.

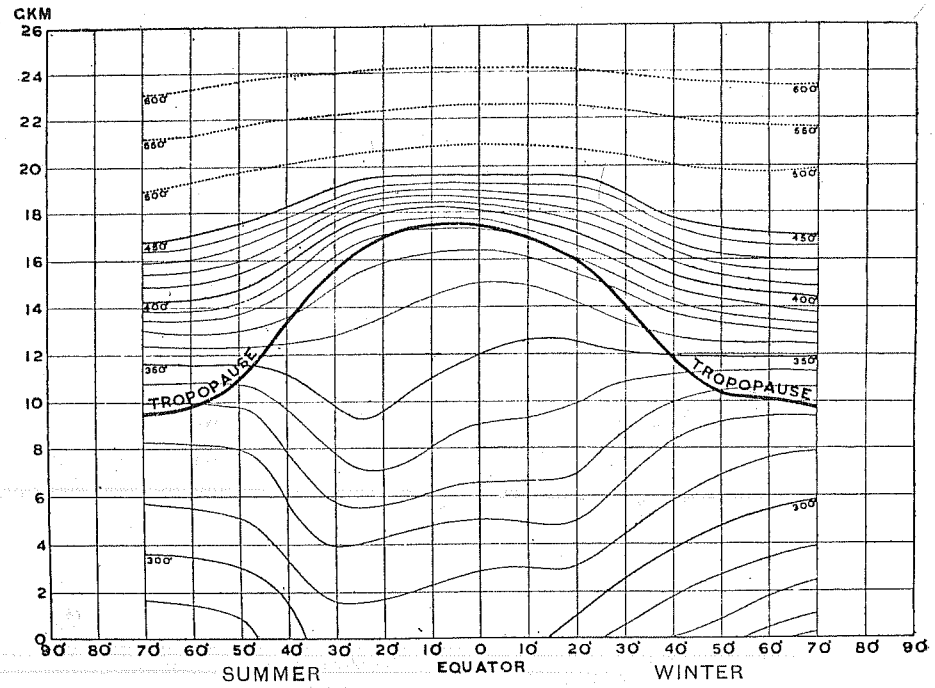

FIG. 1.—Upper air potential temperatures over the northern hemisphere.

Two interesting features (also partially shown in Sir Napier Shaw's diagram) may be pointed out:

1. The dip in the isentropics over the tropics and sub-tropics below about 12 gkm., their elevation between 12 gkm. and 20 gkm., and their pronounced concentration between 17 gkm. and 20 gkm., especially during the summer, suggest that these features are causally connected.

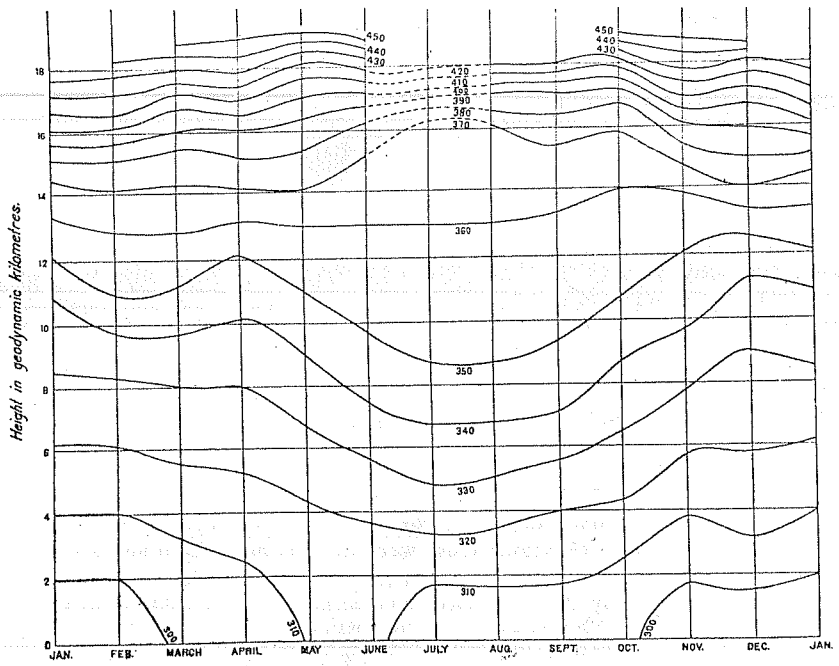

FIG. 2.—Annual variation of potential temperature with height at Agra.

2. Within the tropics during summer the isentropic lines have a downward slope towards the north practically throughout the troposphere, while between 30° N. and 50° N. they have an upward slope to about 12 gkm. Tropical storms and depressions occur mostly in the neighbourhood of this V-shaped trough in the isentropics and move from an easterly direction in the region where the isentropics fall towards the north and from a westerly direction in the region where they rise.

In connexion with Fig. 1, it may be interesting to point out the close analogy which the distribution of potential temperature in Fig. 1 bears to the seasonal variation of its distribution over Agra (Fig. 2). The influence of the high value of entropy below 12 gkm. in raising the tropopause and increasing the inversion above it is clear in both cases.

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