The Stratosphere over North India.

ASCENTS of sounding balloons carrying Dines meteorographs carried out from the Upper Air Observatory, Agra, during the last two and a half years have yielded interesting information regarding the height and temperature of the base of the stratosphere over northern India and their remarkable seasonal variations. A brief summary of the results may be of interest to readers of NATURE.

All the three types of transition from the troposphere to stratosphere classified by W. H. Dines, namely—

Type I—When the stratosphere commences with an inversion;

Type II—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° C. per kilometre without inversion; and

Type III—When the decrease of lapse-rate takes place gradually;

are met with. In addition, a fourth composite type with I above II or III is common between the months November to April.

During the period April 1926 to March 1928, 46 records of ascents going up to the stratosphere are available. The mean height of the tropopause (H_c) is 15·9 geodynamic or 16·3 ordinary kilometres and the mean temperature (T_c) 199° A.

In Fig. 1 are plotted the heights and temperatures of

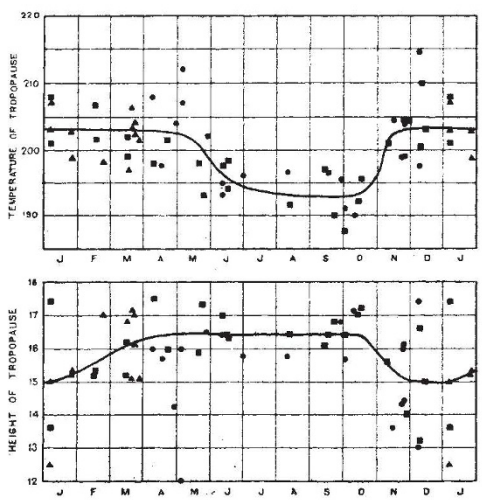

FIG. 1.—Variation of the height and temperature of the tropopause over Agra during the year.
●, Observations in 1926.
■, ,, ,, 1927.
▲, ,, ,, 1928.
Total Number of Observations, 46.

the tropopause obtained from the records of these ascents. When the transition is of the composite type, both positions of rapid changes of lapse-rate are plotted. The sudden jump of temperature and height of tropopause between October and November is specially noteworthy, as it occurs more than a month and a half later than the time of withdrawal of the monsoon from north India. From the point of view of seasonal variation, we may divide the year broadly into two parts :—

(1) *Middle of May to end of October.*—During this period, the type of tropopause is either I or II; if II, the initial sudden change of lapse-rate is followed by an inversion soon after, so that there is always an inversion of temperature in the stratosphere. The mean value of the height of the tropopause is 16·5 geodynamic kilometres, and its mean temperature 194·5° A. The period of activity of the monsoon in northern India is July to September.

(2) *November to middle of May.*—In this period, types III and IV are more frequent. Even here there is almost always an inversion of temperature above 17 geodynamic kilometres. The mean values of H_c and T_c during this period are 16·2 gkm. and 201° A. if we take the values corresponding to the higher value of H_c on occasions when the transitions were of type IV, and 14·9 gkm. and 203·5° A. if we take values corresponding to the lower values of H_c.

A significant feature shown by the results of the monsoon period is the comparatively high temperature

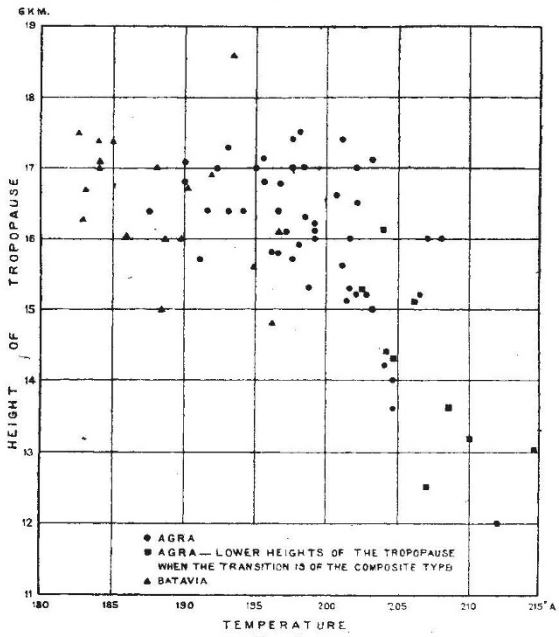

FIG. 2.

between 4 and 13 gkm. and the close agreement of the height-temperature lines between these limits with those of saturation adiabatics.

In Fig. 2 are shown the values of T_c plotted against the corresponding values of H_c. The values obtained by Bemmelen from ascents at Batavia are also plotted for comparison. The general tendency of H_c to approach a limiting value of about 17·5 gkm. with decreasing T_c is very suggestive.

K. R. RAMANATHAN.

Meteorological Office,
Poona, Oct. 12.

The Velocity Coefficient of a Homogeneous Bimolecular Gas Reaction.

THE theory of kinetic activation has been shown by Hinshelwood to lead to a simple explanation of homogeneous bimolecular reactions ("Kinetics of Chemical Change in Gaseous Systems," Oxf. Univ. Press). According to this view, two molecules react on collision when their joint kinetic energy at impact exceeds a certain limiting value E, termed the critical increment for the reaction. The number of binary impacts of this kind per second in a gas can be calculated by means of the kinetic theory as

$$\sqrt{2}\pi\sigma^2\bar{u}n^2e^{-E/RT},$$

where σ is the molecular diameter, $\bar{u}$ the root mean square velocity, and n the number of particles per cubic centimetre. By comparing this expression with