551.510.528

TROPOPAUSE OVER DIBRUGARH

The study of tropopause is of interest to aviators and atmospheric physists. Clear air turbulance occurs in the vicinity of tropopause. The cruising altitudes for SST aircrafts is around the altitudes of tropopause. The increase or decrease of atmospheric ozone amount is linked with the variation in the heights of tropopause. Further the seasonal variation of tropospheric thickness and the temperature lapse rates can be derived from such a study and these things are useful for different tropospheric investigations.

Under the Monex scheme radiosonde receiver has been installed at Mohanbari Meteorological Office near Dibrugarh. Daily balloon ascents are taken since then at 00 and 12 GMT and temperature data are being received. From the upper air data so collected during 1980-1983, a study of tropopause was made and the results are presented here. Dibrugarh, being the northeasternmost point in India in the Himalayan belt, the study has an added significance to get an idea of tropopause behaviour over a till now data sparse region beyond Gauhati.

Mean height of tropopause was calculated for every month of each year and then the average for the month was arrived at from the values for the month in different years. Same procedure was adopted for arriving at the average tropopause temperature also for each month. From the monthly mean surface temperature, tropopause height and temperatures, the average tropospheric lapse rate of temperature was computed.

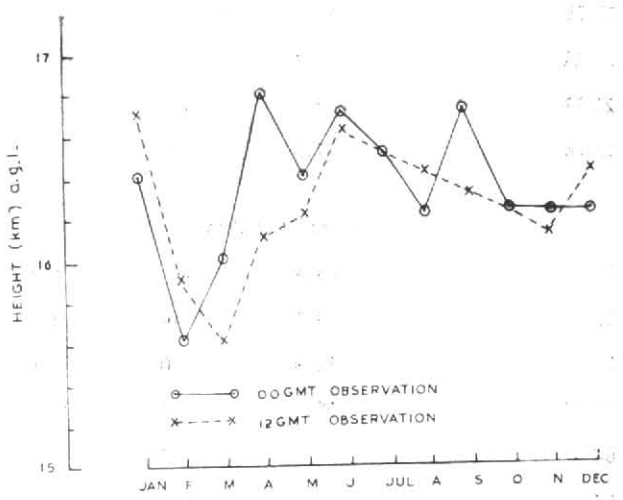

Fig. 1. Monthly mean heights of tropopause

On certain days, the flight could not reach the tropopause levels and on certain other days, the temp data was not reliable due to recorder trouble. Those data were not included for analysis. By this method on about three months the available days of observations reduced to less than 15. Those months data were not taken into consideration. The analysis was conducted separately for 00 GMT and 12 GMT measurements. Finally an attempt was made to see whether there exists any relations between convective activity at ground level and tropopause height.

Fig. 1 gives the monthly mean heights of the tropopause. It is seen that there is not much difference

TABLE 1

Frequency of occurrence of double tropopause and the mean heights

	Frequency (per cent)	Level 1 Extra tropical tropopause (km asl)	Level 2 Tropical tropopause (km asl)
November	05	11.7	16.3
December	06	12.0	16.4
January	15	11.6	16.7
February	14	11.3	15.8
March	19	11.7	15.8
April	13	12.4	16.4

between the 00 GMT and 12 GMT values. It is 16 ± 1 km in any part of the year. The highest level observed was 19.3 km in May and the lowest was 13.8 km in February, on any day. Another feature noticed was the occurrence of a second tropopause at a lower height during November to April. It was seen around 11 to 12 km a.s.l. The lower is the 'extra tropical tropopause' while the upper one is the 'tropical tropopause'. Dibrugarh is situated at about Lat. 27 deg. N which is in the boundry region of tropics. Hence winter is the season when the extra tropical tropopause intrudes over this region. The average height and the frequency of occurrence of this phenomenon is shown in Table 1. January to April has got a considerable frequency while the phenomenon can be present in November/December also.

The upper wind pattern over higher latitudes shows jet winds (speed greater than 50 kt). This is called the sub-tropical jet stream. The maximum winds reported on several occasions during the months November to April by radar wind observations at Mohanbari were 55 kt and above, going upto 100 kt. The mean level of this maximum wind valid for the month, November to April, has been computed. It is 12.0, 12.1, 11.6, 11.5, 12.2 and 12.4 km a.s.l. respectively. It is observed that these levels are just above the level of extra tropical tropopause as can be seen from column 3 of Table 1.

TABLE 2

Mean tropopause temperatures and lapse rate

	00 GMT		12 GMT	
	Temp. (°C)	Lapse rate (°C/km)	Temp. (°C)	Lapse rate (°C/km)
Jan	—69.0	5.1	—69.2	5.2
Feb	—68.2	5.5	—69.2	5.5
Mar	—67.5	5.5	—67.3	5.8
Apr	—72.0	5.7	—73.3	6.1
May	—71.6	5.9	—72.5	6.1
Jun	—75.8	6.1	—77.8	6.4
Jul	—76.0	6.3	—77.9	6.5
Aug	—76.8	6.4	—78.7	6.6
Sep	—77.1	6.2	—78.3	6.5
Oct	—77.1	6.3	—78.3	6.4
Nov	—75.3	5.9	—76.7	6.1
Dec	—70.8	5.4	—70.0	5.4

Table 2 presents the mean temperatures at tropopause monthwise. The first point to note is that the tropopause is having higher temperatures during winter (December to March) and colder temperature during the monsoon months and October. The switch over in temperature value from March (winter) to April (nor'wester season) as well as to winter (November-December) are rather sharp. From the difference in temperature values of May and June, setting in of monsoon season can also be identified.

Taking the mean surface temperature also into consideration the lapse rate of temperature valid for the full troposphere was computed and the same is also shown in Table 2 monthwise. High lapse rates are noticeable in monsoon months (June-September) and the lowest rate is seen in February. October, though is not a monsoon month climatologically, can be grouped with monsoon months as far as the temperature lapse rate is concerned.

Greaves (1951) has suggested that with strong convective activity tropopause level has a tendency to come down. In order to see the presence of any relation between tropopause height and convective activity, if any, days of strong convective activity were picked up from the current weather registers of 1981 to 1983. Tropopause heights were scrutinised on an observation before and after the convective activity.

During the nor'wester season, that is, April/May out of the 16 occasions analysed, tropopause level came down by more than one km on 14 occasions and on the rest occasions it was more or less maintained. However, during the thunder days of monsoon season (June-September) out of the 15 occasions only on 5 occasions the tropopause level came down. Thus it was seen that while Greave's concept was applicable during the nor'wester season, the same was not true during monsoon months. Hence it is not preferable to take the tropopause height as a parameter in getting any clue for local forecast of thunder activity. Perhaps a study with more data which may be available in the years to come may be required to investigate this aspect in detail.

Reference

Greaves, M.E., 1951, *Bull. Am. Met. Sec.*, **32**, 2, pp. 54-60.

T. R. SIVARAMAKRISHNAN

Meteorological Office, Dibrugarh, Assam

23 *August* 1984