551.557 : 551.507.362.1 (548)

SEASONAL VARIATIONS OF THE EQUATORIAL MESOSPHERIC CIRCULATIONS INDICES AT THUMBA

1. As part of the Indo-Sorviet collaborative meteorological rocket sounding programme, regular weekly M-100 rocket soundings are being conducted from Thumba (08°32′N, 76°52′E) since December 1970. From November 1972 onwards piggy back chaff payloads (fibre glass and copper) were incorporated with the routine M-100 rocket soundings monthly once each corresponding to the middle of the month to obtain the upper winds in the equatorial mesospheric region upto 80 km. The winds and the diffusion coefficient measurements obtained from these chaff cloud experiments have been reported earlier (Narayanan & Fedynski 1973, Narayanan *et al.* 1976 and Narayanan & Sivadasan 1976). The present study deals with the mesospheric circulation indices for the layers 60-70 km centred at 65 km called M_L CI and 70-80 km centred at 75 km called MuCI and their seasonal variations in relation to SCI-Stratospheric Circulation Index (Average wind in the layer 40-50 km). The results thus obtained are also compared with CIRA Model 1972 for 10°N. (*see Ref.*),

2. Average monthly wind, zonal and meridional for the layers 60-70 km and 70-80 km were computed and designated M_LCI and MuCI respectively and plotted to study the seasonal variations in a manner reported by Cisneros (1973). As the Thumba mesopause was found to be at a lower altitude by 5 km, the definition of MCI is modified slightly from the usual conventional type explained by Webb (1966).

3 (a). *Zonal circulation index* — Figs. 1, 2(a) & 2(b) present the average annual zonal stratospheric circulation index SCI, M_LCI and MuCI respectively. Figs. 3 (a) & 3 (b) present Thumba monthly zonal and meridional SCI, M_LCI and MuCI. The zonal M_LCI are predominantly westerlies (positive) and maximum 40-45 mps during the equinox period April and October. The zonal MuCI are predominantly easterlies (negative). Two maxima 40 mps are seen during February and May but no regular seasonal variation is noticed in MuCI as in the case of M_LCI and SCI. The early winter experiences the extreme positive (westerlies) MuCI values 30-35 mps. The seasonal easterly reversal of SCI is seen reflected in MCI also. When SCI and M_LCI show the same phase, the reversal of MuCI takes place much earlier about 2 months in 1973 and 3 months in 1974. The M_LCI values

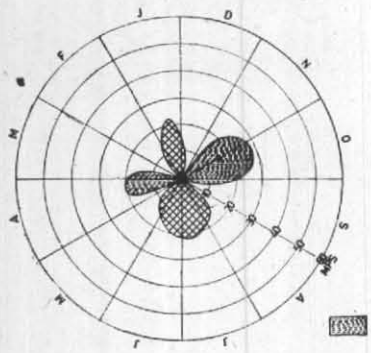

Fig. 1. Annual average (December 1970–December 1972) of Stratospheric zonal circulation index (SCI) in mps from weekly data

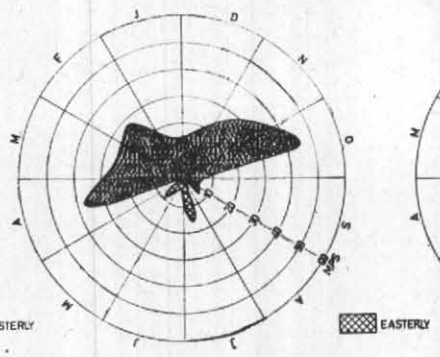

Fig. 2(a). Annual average (November 1972– November 1974) of Lower Mesospheric zonal Circulation Index (M_LCI) in mps from monthly data

Fig. 2(b). Annual average (November 1972– June 1974) of upper Mesospheric zonal Circulation Index (MuCI) in mps from monthly data

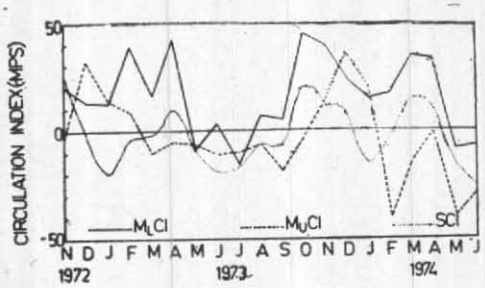

Fig. 3(a). Monthly data of mesospheric zonal circulation indices —M_LCI and MuCI from November 1972 to June 1974. SCI represents the monthly averages. Easterly winds are —ve and westerly +ve.

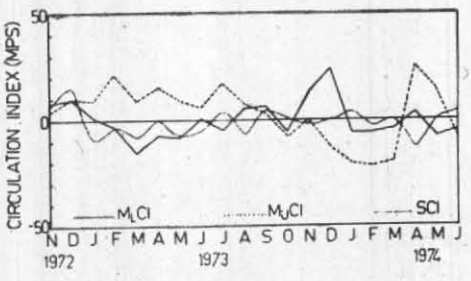

Fig. 3(b). Monthly data of mesospheric meridional circulation indices—M_LCI and MuCI—from November 1972 to June 1974. SCI represents the monthly averages. Northerly winds are —ve and Southerly +ve.

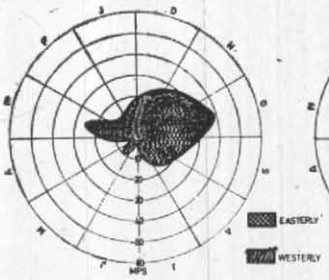

Fig. 4(a). Lower mesospheric zonal circulation index (M_LCI) in mps of CIRA Model 1972 for 10°N

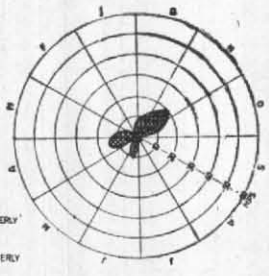

Fig. 4(b). Upper mesospheric zonal circulation index (MuCI) in mps of CIRA Model 1972 for 10°N

are usually higher than SCI in magnitude except during summer.

3 (b). *Correlation* — The SCI and M_LCI show good positive correlation of 0·85. The correlation between SCI and MuCI is very poor 0·14. This result is found consistant with CIRA Model 1972 for 10°N which give corresponding correlation values 0·55 and 0·29 respectively. Figs. 4 (a) and 4(b) present M_LCI and MuCI of CIRA Model 1972 for 10°N.

3 (c). *Meridional circulation index* — The meridional MCI are found weak less than 20 mps for both M_LCI and MuCI (Fig. 3b). The M_LCI meridional winds are northerly 10 mps on an average while MuCI meridional flow is mainly southerly 15 m/s. Sharp MuCI meridional flow reported in Antarctica region (Sehra 1976) are not generally found during May-June. However, such sharp meridional flow in SCI is noticed over the equatorial region. Whether meridional disturbances in the polar regions are contributing to the stratospheric meridional flow near the equatorial stratopause region and associated monsoon disturbances are yet to be investigated in detail. The extreme value of the meridional flow is 25 m/s and no significant seasonal variation is noticed.

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