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16. Summary/Notes

Meridional local eddy transport of sensible heat is calculated over four Southern Hemisphere rocket sonde stations. It has been found that the transport is small over all the stations in Summer. In winter the transport is large over high latitude stations and is towards the South pole.

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ABSTRACT

Meridional local eddy transport of sensible heat is calculated over four Southern Hemisphere rocket sonde stations. It has been found that the transport is small over all the stations in Summer. In Winter the transport is large over high latitude stations and is towards the South pole.

I. INTRODUCTION

The general circulation of the atmosphere is normally studied in terms of balance of energy and angular momentum. This balance, as verified first by Starr (1954, 1960), is maintained by the quasi horizontal eddies both in the troposphere and lower stratosphere. Further, indirect inferences by trace substances such as water vapor, ozone and radioactive substances confirmed the importance of quasi horizontal disturbances.

The discovery of quasi biennial oscillation in the zonal wind of equatorial lower stratosphere and the stratospheric sudden warmings of winter polar stratosphere stimulated interest in the study of stratospheric circulation.In spite of several studies a number of questions still remains un-answered. The situation in the Southern Hemisphere is relatively less studied because of lack of data.

One of the important processes in the general circulation of the upper atmosphere is the transport of sensible heat by the transient disturbances. In the present note we use rocket data of four Southern Hemispheric rocket stations to calculate the meridional local eddy transport of sensible heat.

II. CALCULATION PROCEDURE

The rocket stations used in the present study are Ascension Islands (7^0 59'S, 14^0 25'W), Natal (5^0 55'S, 35^0 10'W), Mar Chiquita (37^0 45'S, 57^0 25'W) and Moledzhanja (67^0 40'S, 45^0 51' E).

Rocket data for the whole year is divided into two parts, Summer (15 April to 15 October) and inter (16 October to 16 April). Sensible heat transport is calculated separately for each station from 20 to 56 Km at intervals of 4 Km using data of 1969 - 71. The mathematical expression used to calculate the transport is

$$\overline{VT} = \overline{V}\,\overline{T} + \overline{V'T'}$$

where V and T are the meridional wind and temperature respectively. A bar denotes the time average (Summer or Winter) and prime denotes the instantaneous deviation from the average. The first term on the right hand side of the above expression represents the meridional sensible heat transport by the mean motion and the second term represents meridional transport of sensible heat by the transient eddies. In this note we calculate the later term using the formula

$$S = \frac{\sum_{i=1}^{N} V_i' T_i'}{N}$$

where N is the number of observations in time for each level.

It should be mentioned here that the compatibility of temperature data between the stations is good only up to 45 Km (Finger and Gelman 1974). No attempt is made to correct the data at higher levels.

III. RESULTS

The results of the calculations are shown in figures (1-6). In figure 1 mean zonal wind is plotted for the four stations for the Winter. It could be seen in Winter the zonal wind is predominantly over Mar Chiquita (Ma) and Moledzhanja (Mo). It is weak easterly over Natal (Na) and Ascension Islands (A). Figure 2 shows the mean temperature over the stations for winter. It could be seen that at 20 Km maximum temperature are found over Mar Chiquita indicating temperature is maximum in middle latitudes and it decreases both towards South pole and equator. At higher levels however, temperature decreased continuously from the equator towards pole.

The sensible heat transport shown in figure 3 is small over low latitude stations and the direction is not clearly defined. Over Mar Chiquita and Moledzhanja it is directed towards pole and the values are relatively large.

The zonal wind in Summer (Figure 4) is generally easterly over all the stations. Over Moledzhanja it changed from strong westerly of the order of 70 m sec^{-1} at 44 Km in Winter to a few $m.sec^{-1}$ at 44 Km in Summer. Over Mar Chiquita the change of zonal wind from Winter to Summer is more at higher levels than that over Moledzhanja.

Comparing figures 2 and 5 it could be seen that the temperature gradient reversed from Winter to Summer in accordance with the thermal wind equation such that the high latitudes are generally warmer than the low latitude regions in Summer. Further, the temperature gradient appears to be smaller in Summer than in Winter. The sensible heat transport over all the stations is small and the direction is highly variable. (Figure 6).

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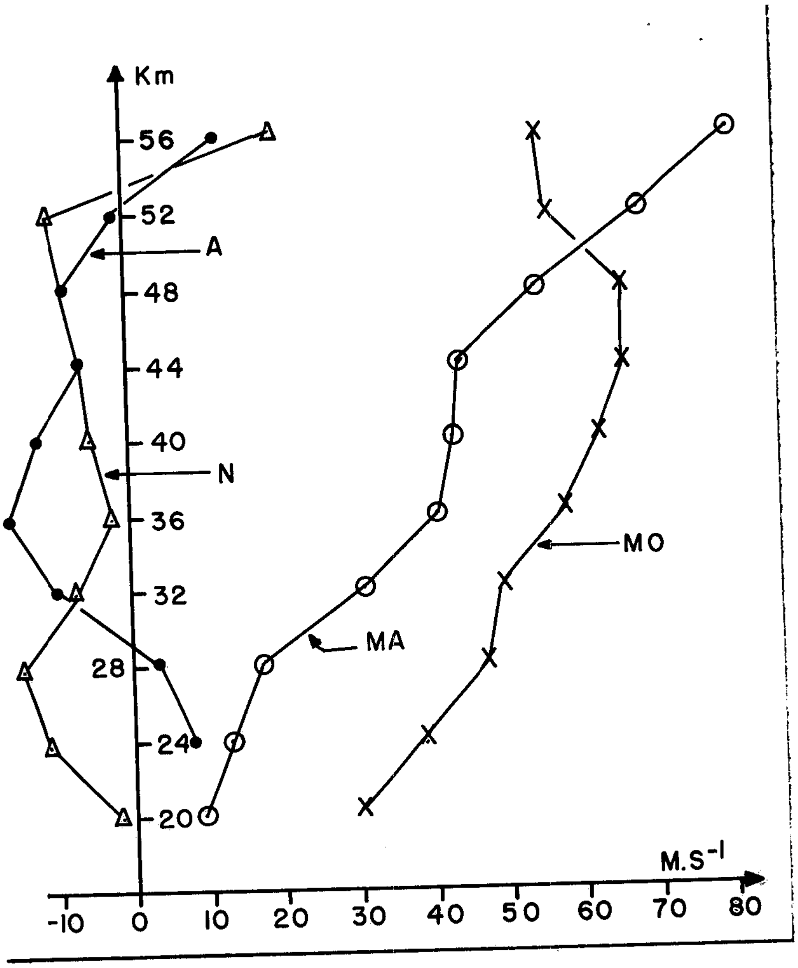

Figure 1: Mean zonal for the Winter regime. A, N. MA and MO means Ascension Islands, Natal, Mar Chiquita and Moledzhanaja rocket sonde stations, respectively.

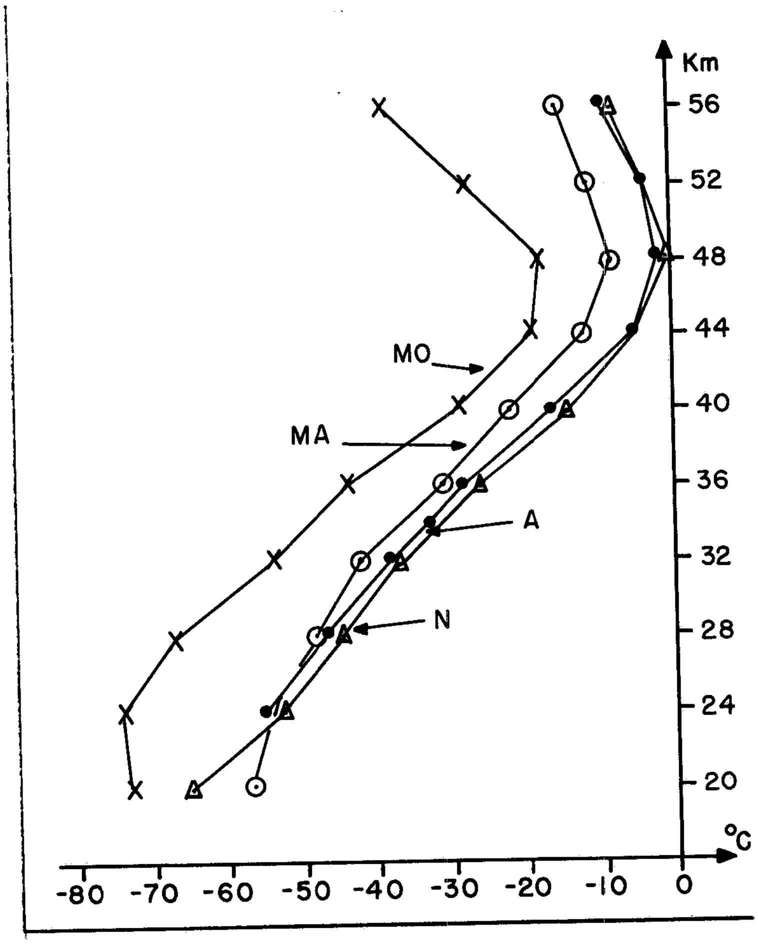

Figure 2: Mean temperature over the stations for the Winter regime.

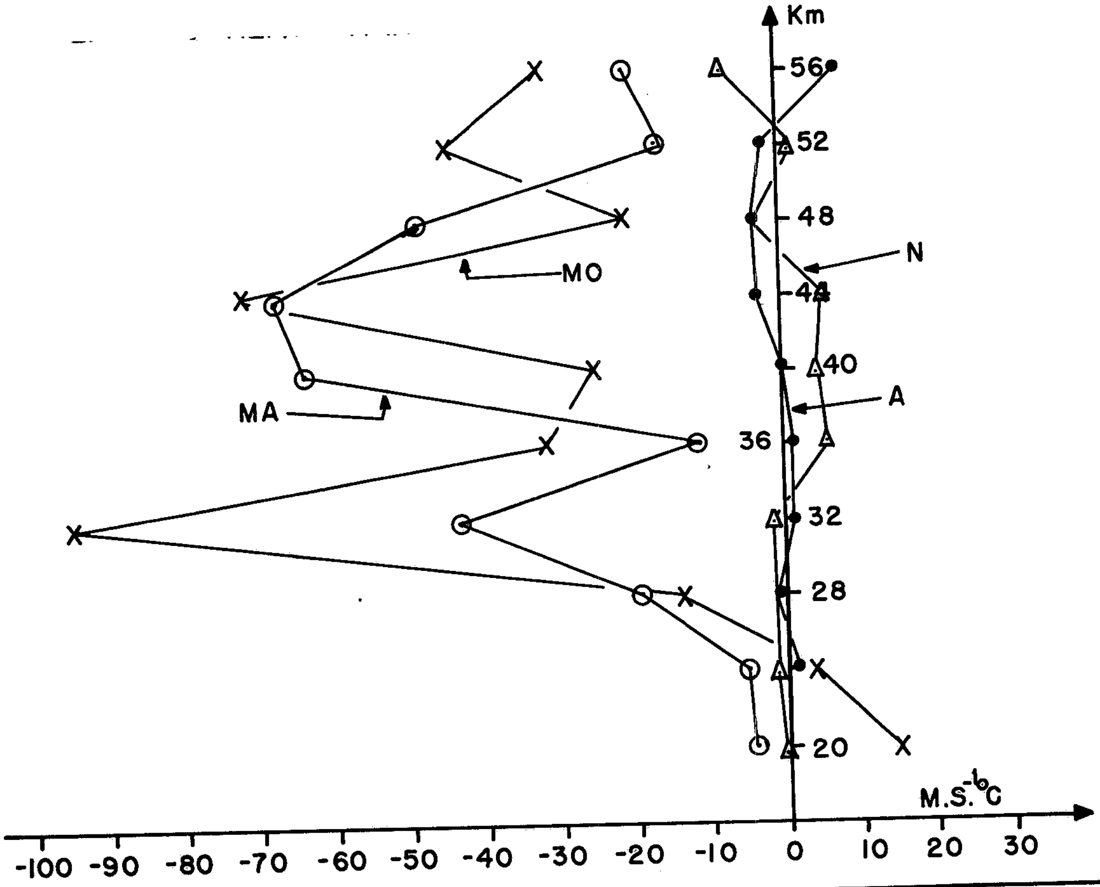

Figure 3: Meridional local eddy transport of heat for the Winter regime.

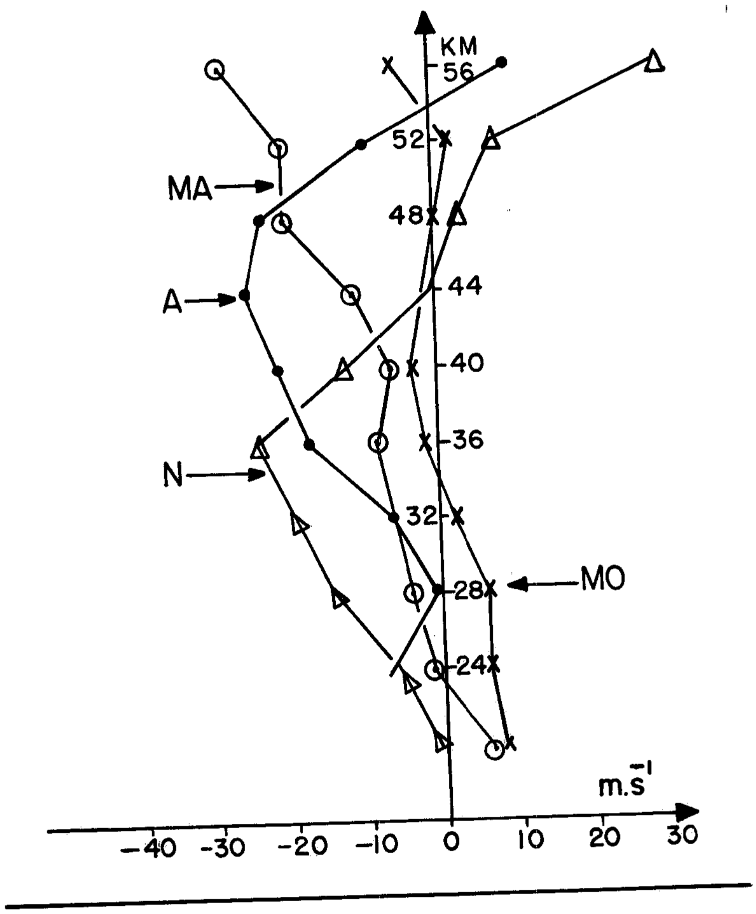

Figure 4: Mean zonal wind for the Summer regime .

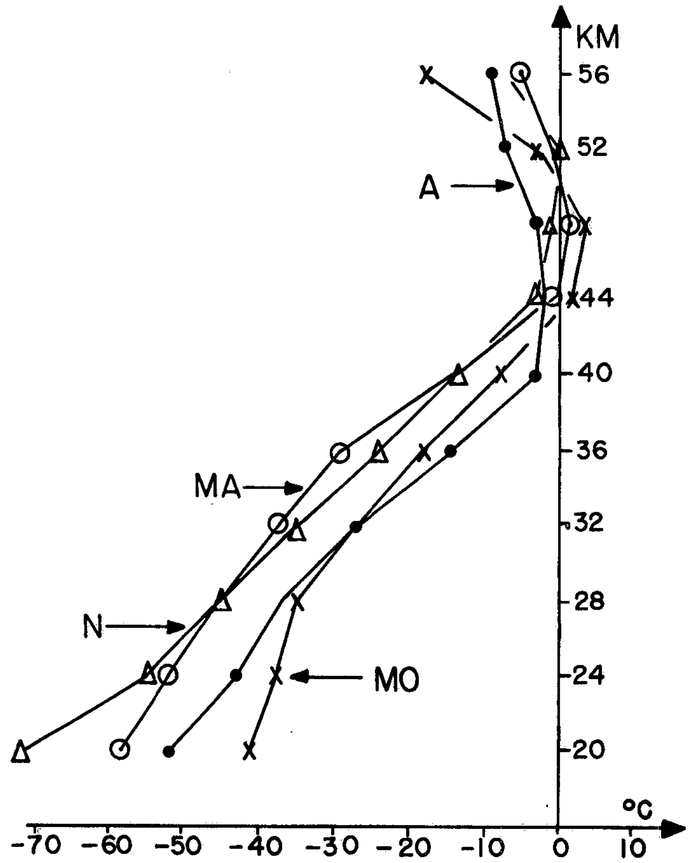

Figure 5: Mean temperature over the stations for the Summer regime.

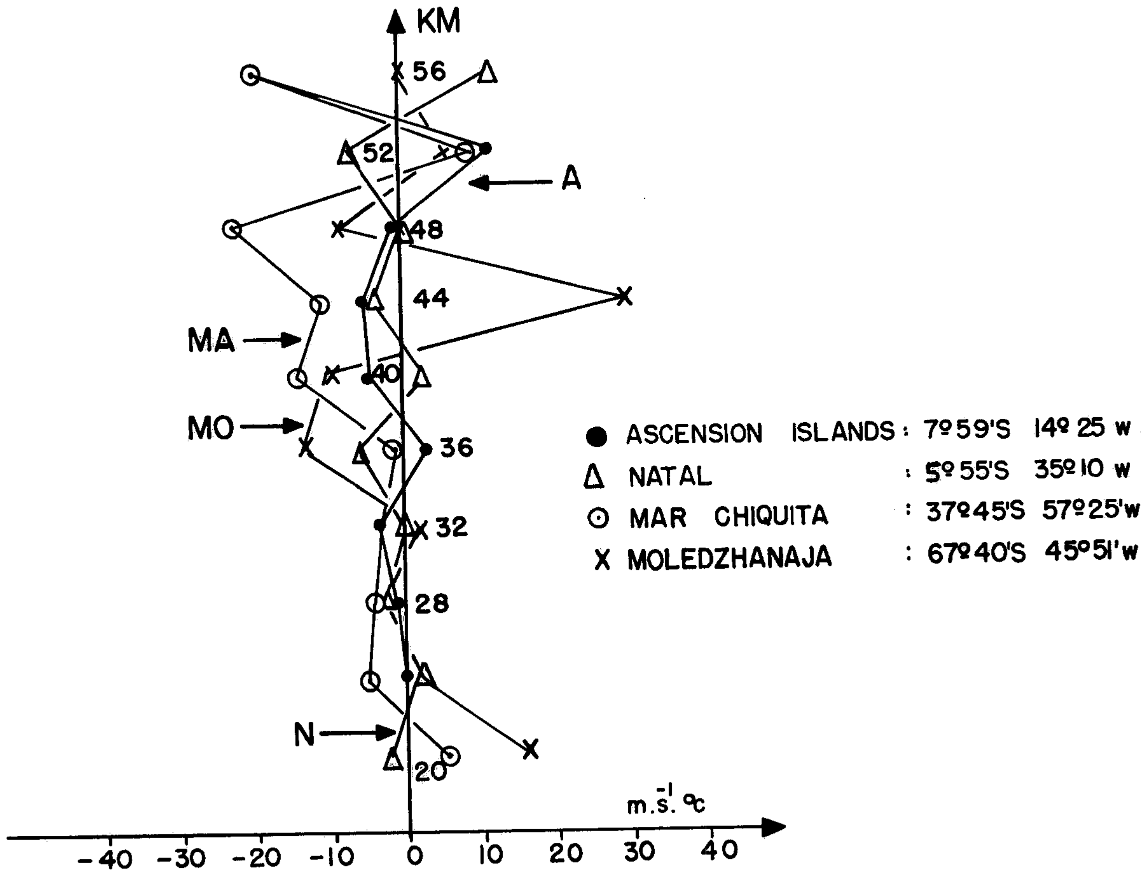

Figure 6: Meridional local eddy transport of heat for the Summer regime.

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