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16. Summary/Notes  <i>The monthly median <math>f_0F_2</math> characteristics at Cachoeira Paulista (geographic latitude <math>23^\circ S</math>, longitude <math>45^\circ W</math>, magnetic dip angle <math>-27^\circ</math>) and Tucuman (geographic latitude <math>27^\circ S</math>, longitude <math>65^\circ W</math>, magnetic dip angle <math>-23^\circ</math>) were compared for 4 selected months in 4 different seasons (March, June, September and December, 1978). Considerable differences were observed. The implication of this for the fountain effect at the two locations is examined.</i>			
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COMPARISON OF THE IONOSPHERIC  $f_0F_2$  CHARACTERISTICS AT CACHOEIRA  
PAULISTA AND TUCUMAN, IN THE SOUTH-AMERICAN REGION

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ABSTRACT

The monthly median  $f_0F_2$  characteristics at Cachoeira Paulista (geographic latitude  $23^\circ\text{S}$ , longitude  $45^\circ\text{W}$ , magnetic dip angle  $-27^\circ$ ) and Tucuman (geographic latitude  $27^\circ\text{S}$ , longitude  $65^\circ\text{W}$ , magnetic dip angle  $-23^\circ$ ) were compared for 4 selected months in 4 different seasons (March, June, September and December, 1978). Considerable differences were observed. The implication of this for the fountain effect at the two locations is examined.

In an earlier communication (Kane, 1980), the ionospheric  $f_0F_2$  characteristics at São Paulo (23.6°S, 46.6°W, geomagnetic latitude -12.9°, dip -22°) and Tucuman (26.9°S, 65.4°W, geomagnetic latitude -15.3°, dip -22°) were compared for the period 1957-1963 and, in spite of their similar dip angles (-22° in IGY period), considerable differences were observed. The  $f_0F_2$  values at Tucuman were generally higher than those at São Paulo. The distance between these two locations (mainly east-west) is about 2000 km.

The geomagnetic field in the Brazilian region is anomalous. Specially, near the east coast, there is a considerable secular variation. As a result, whereas the dip angle at Tucuman has changed only slightly from -22° to about -23°, the dip angle at São Paulo is now about -27°. At low latitudes, the ionospheric  $f_0F_2$  is minimum at about dawn and rises rapidly, reaching a maximum value in the afternoon, falling slowly thereafter until midnight and faster still until dawn. However, the afternoon maximum value of  $f_0F_2$  has a peculiar latitude dependence. It is not maximum at the equator, where the average solar zenith angle is least. Instead, because of the large vertical Hall field developed in the equatorial electrojet region, ionization is lifted up, and later diffuses down along the magnetic field lines. This "fountain effect" causes the Appleton anomaly (Appleton, 1946), where the  $f_0F_2$  maxima (crests) occur at about  $\pm 30^\circ$  dip angles on either side of the equator. If the fountain effects are similar at all longitudes, locations at the same dip angle should have the same value of  $f_0F_2$ . The larger value of  $f_0F_2$  at Tucuman could, therefore, indicate a stronger fountain effect in the Tucuman longitude. From IGY up to the present period, the dip angle at São Paulo changed from -22° to about -27°. Thus, São Paulo is now farther away from the dip equator and nearer to the crest (-30° dip); hence the  $f_0F_2$  at São Paulo is expected to have increased and either approached the value at Tucuman or surpassed the same. The recordings at São Paulo stopped in 1963. However, since 1973 an ionospheric recorder has been operative at Cachoeira Paulista (22.7°S, 45.0°W, geomagnetic latitude -14.0°, dip about -27°), a location only about 200 km to the east of São Paulo. We present here the comparison of  $f_0F_2$  characteristics at Cachoeira Paulista

and Tucuman.

Fig. 1(a) shows the monthly median daily variation of  $f_0F_2$  for Cachoeira Paulista (full lines) and Tucuman (dashed lines with crosses) for the four selected months: March, June, September and December, 1978, in four different seasons. In June and September, the  $f_0F_2$  at Tucuman is larger than at Cachoeira Paulista during the afternoon. In contrast, after about 2000 LT,  $f_0F_2$  at Tucuman becomes smaller than at Cachoeira Paulista, in March, September and December, but not in June.

Fig. 1(b) shows similar plots for the height parameter  $hmF_2$  obtained by using the relation (Shimazaki, 1955)

$$hmF_2 = \frac{1490}{M(3000)F_2} - 176$$

Considerable differences are noticed. In particular, the  $hmF_2$  at Tucuman is generally higher than at Cachoeira Paulista.

In the absence of simultaneous data from several other locations, it is difficult to ascertain the exact profile of the latitude dependence of  $f_0F_2$  in this area. However, we consider the present results as a possible indication that the fountain effect is probably considerably stronger in the Tucuman longitude, as compared to the region to its east. An alternative possibility would be a differential particle precipitation from the magnetosphere in the Tucuman region.

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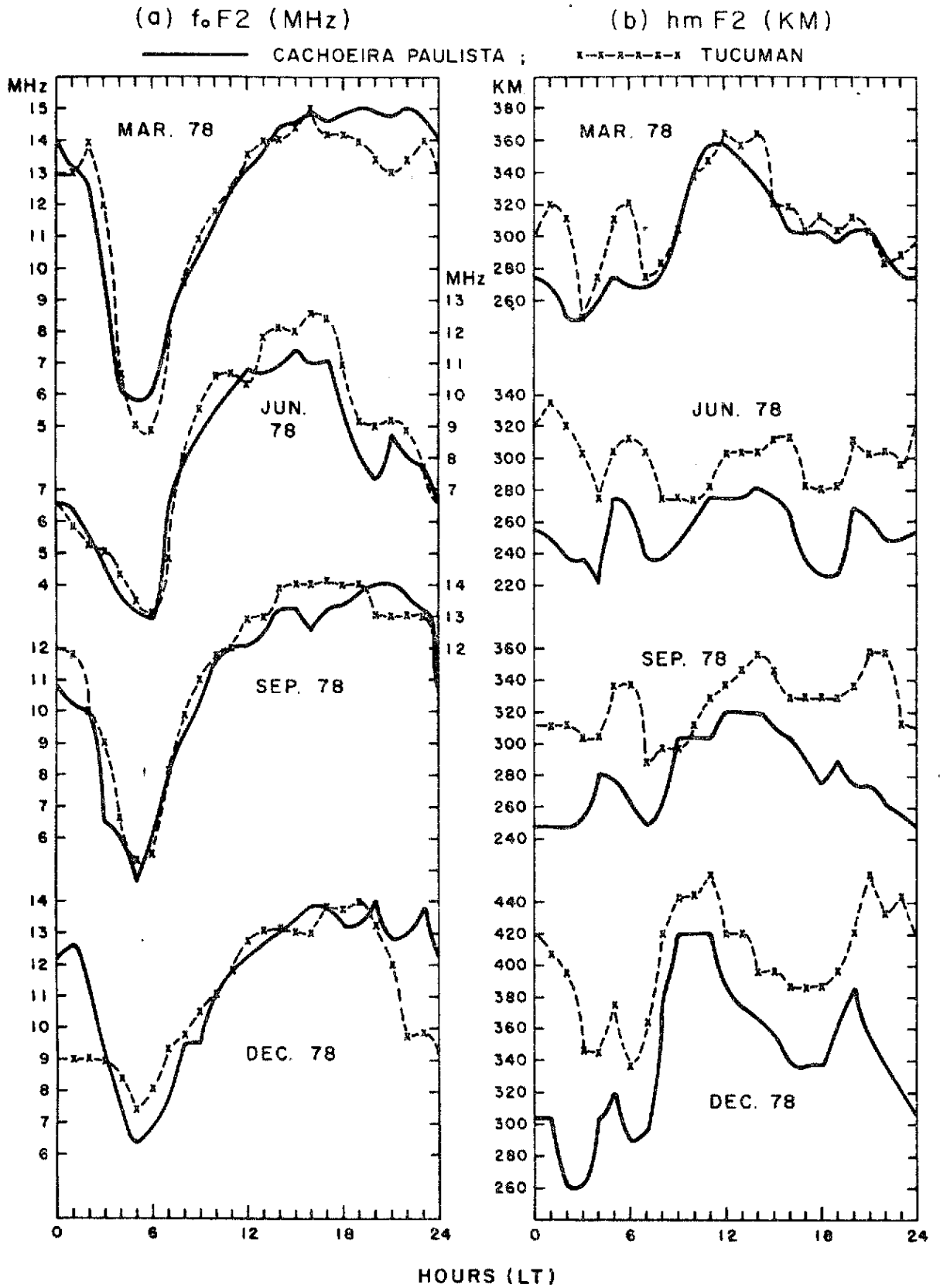


Fig. 1 - The monthly median daily variation plots for March, June, September and December, 1978, for Cachoeira Paulista (full lines) and Tucuman (dashed lines with crosses) for (a)  $f_oF_2$  and (b)  $h_mF_2$ .

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