MEASUREMENTS OF THE EARTH'S TOTAL MAGNETIC FIELD AT HEIGHTS OF 1000 KM IN THE BRAZILIAN ANOMALY

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J. L. R. Muzzio

P. Ramirez Pardo

F. de Mendonça

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Comissão Nacional de Atividades Espaciais
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São Paulo — Brasil

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This research note is the result of preliminary measurements of magnetic field in the Brazilian Magnetic Anomaly utilizing the top - side sounder satellite Alouette (Molozzi, 1964) from October 31 to December 4, 1964.

The commands that actuated the satellite's transmitter were initiated at Santiago and South Atlantic Stations. Due to this reason, only the west part of the anomaly (from 45º to 75º west longitude) was co - vered in this set of measurements. In order to get a more extensive mapping of the field, we have made use also of data obtained from Ariel I (Baumann, 1963) and from Vanguard III (Cain, et all., 1962).

On account of the variation in height of the satellites, we have selected the data which was acquired while the satellites were in heights between 980 and 1060 km. These data of the magnetic field were reduced by means of the inverse cube law to the height of 1020 km. From this reduction process, about 170 points were chosen to draw the isodynamics of 0.165, 0.170, 0.175 and 0.180 (± 0.001) gauss, shown in Fig. 1 .

The values of the field obtained from Alouette's data were reached using the resonances or spikes at the electron gyrofrequency and its multiplies (Lockwood, 1963; Calvert and Goe, 1963 ; Johnston and Nuttal, 1964 ; Wallis, 1965).

In Fig. 2 we see one of the ionograms obtained showing the various spikes, up to the eight harmonic.

For each passage of the satellite we plotted the frequency-latitude diagram (Calvert and Goe, 1963) as displayed on Fig. 3 and from the smoothed curves corresponding to the various spikes seen on the iono - grams we computed the magnetic field. Finally, the values thus obtained were reduced to 1020 km height using the inverse cube law. This process, combined with the reading accuracy of the ionograms resulted in the final accuracy of $\pm$ .001 gauss.

The data from Ariel I and Vanguard III were rounded off to three significant figures to be in accord with the above points. In doing so we may disregard the diurnal variation of the magnetic field and also the effects of magnetic storms.

The most interesting feature of the curves shown in Fig. 1   is the appearance of two centers of minimum total field intensity instead of one as has been reported and calculated with spherical harmonics   until now.   This suggests the desirability of a more extensive experiment   to improve the shape of the curves.   In fact, some parts of the isodynamics are shown by dashed lines because at these areas the number of   points was not considered sufficient to permit one to reliably draw a   deffinite contour.   On the other hand, the general aspect of the curves   indicates the closing of the contours of 0. 165 gauss as shown.

We have included in Fig. 4 the computed isodynamics   of 0. 170 gauss at 1000 km level (Dudziak et all, 1963) to show the   discrepancy of the shape of the center of the anomaly between the calculated and mea-sured values.

From the above we can conclude the importance of a more com-plete program of evaluation of magnetic field at various heights   in   the anomaly, for instance, with the help of future swept-frequency top- side sounders or other satellites taking direct measurements. The ideal would be the instalation, in Brazil, of a commanding station to actuate the   sa-tellites and get a broader coverage of this region.
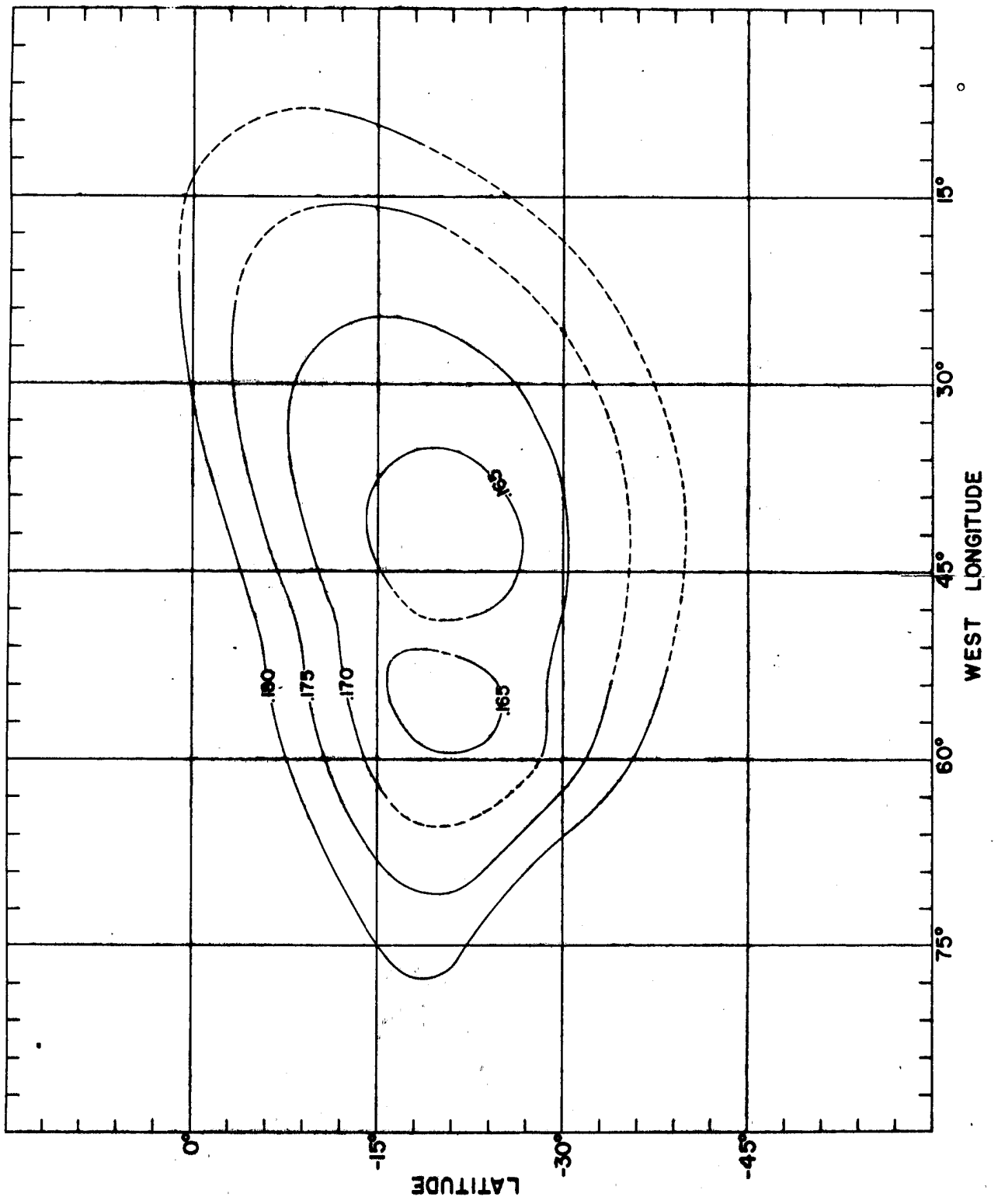
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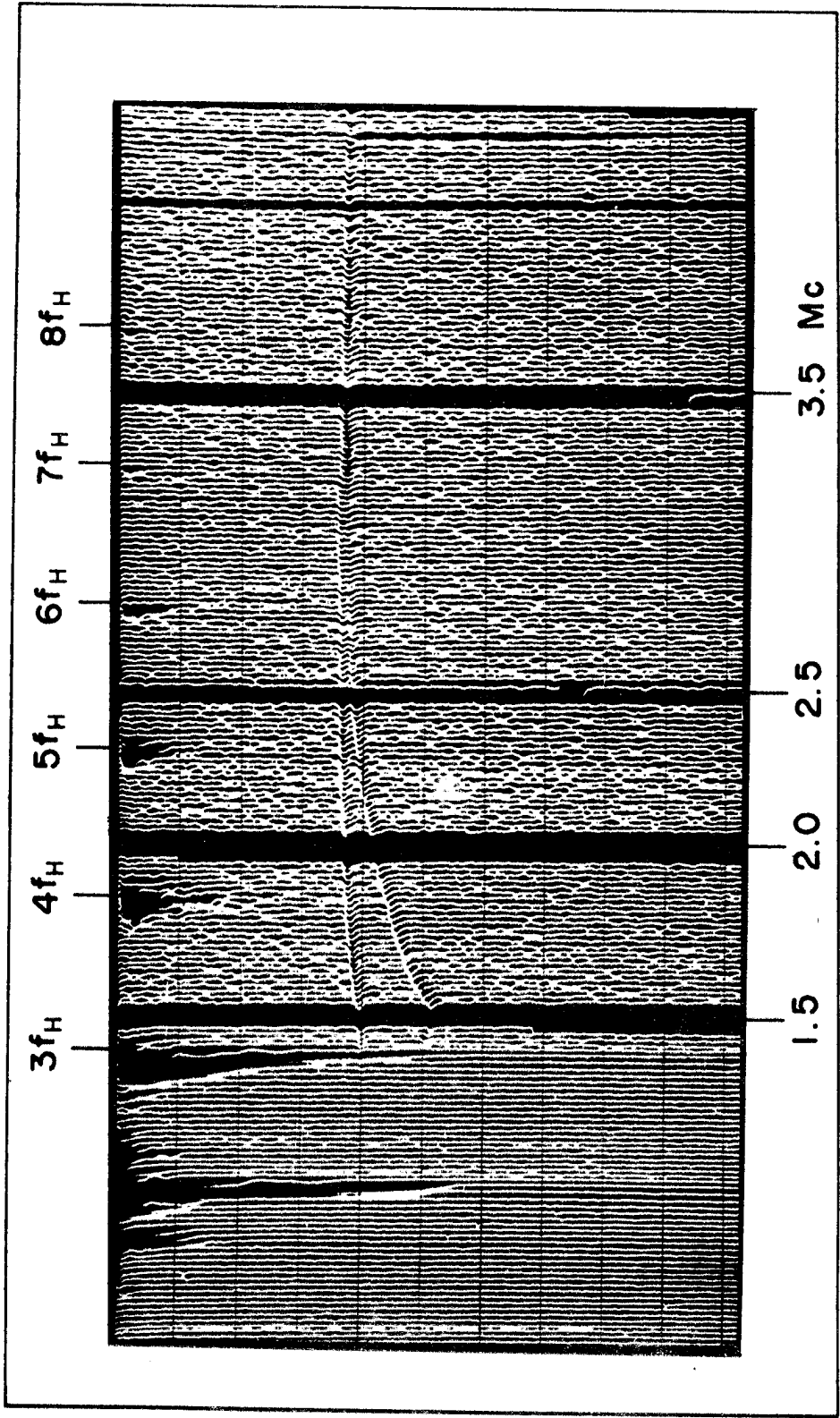
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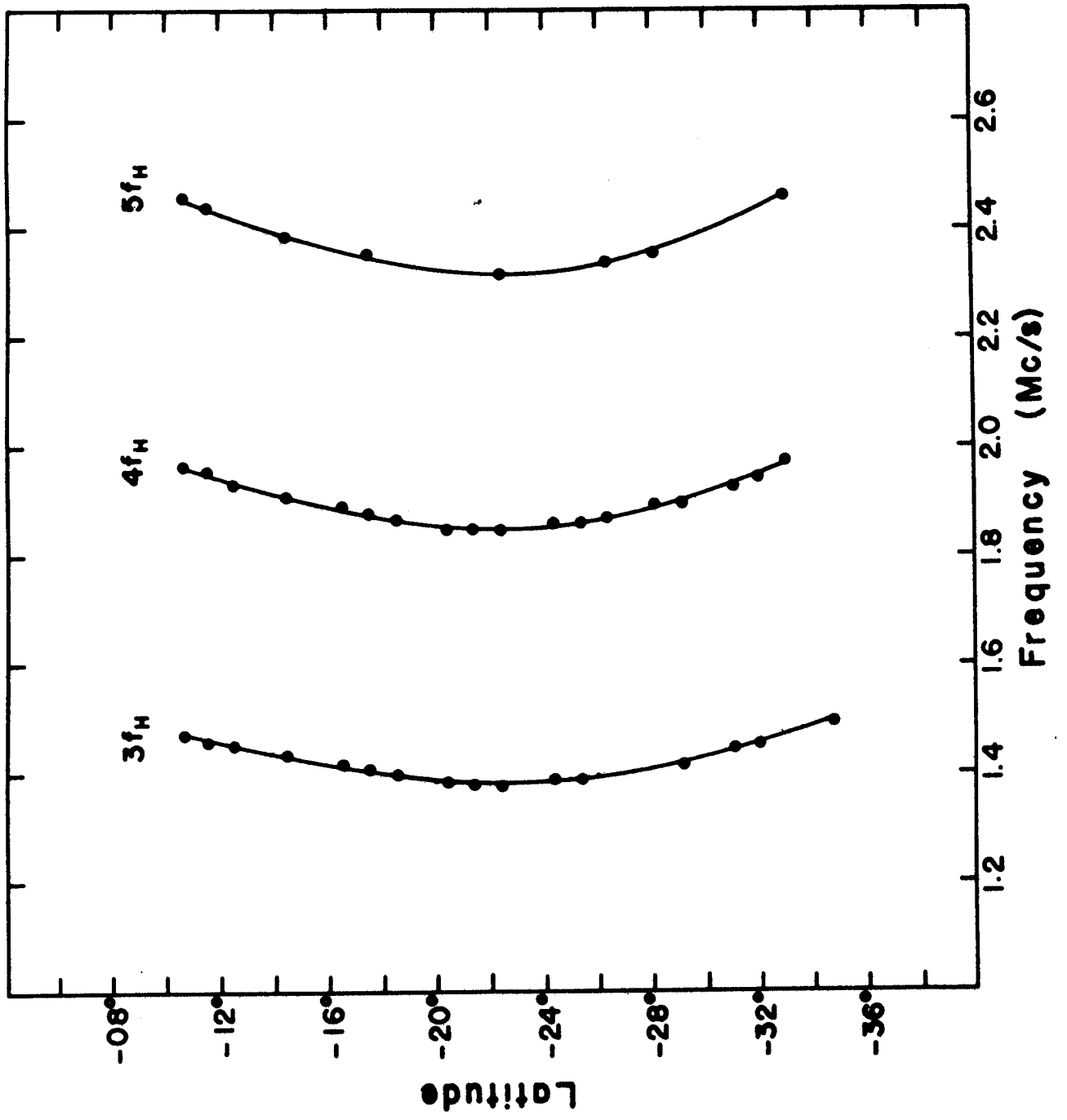
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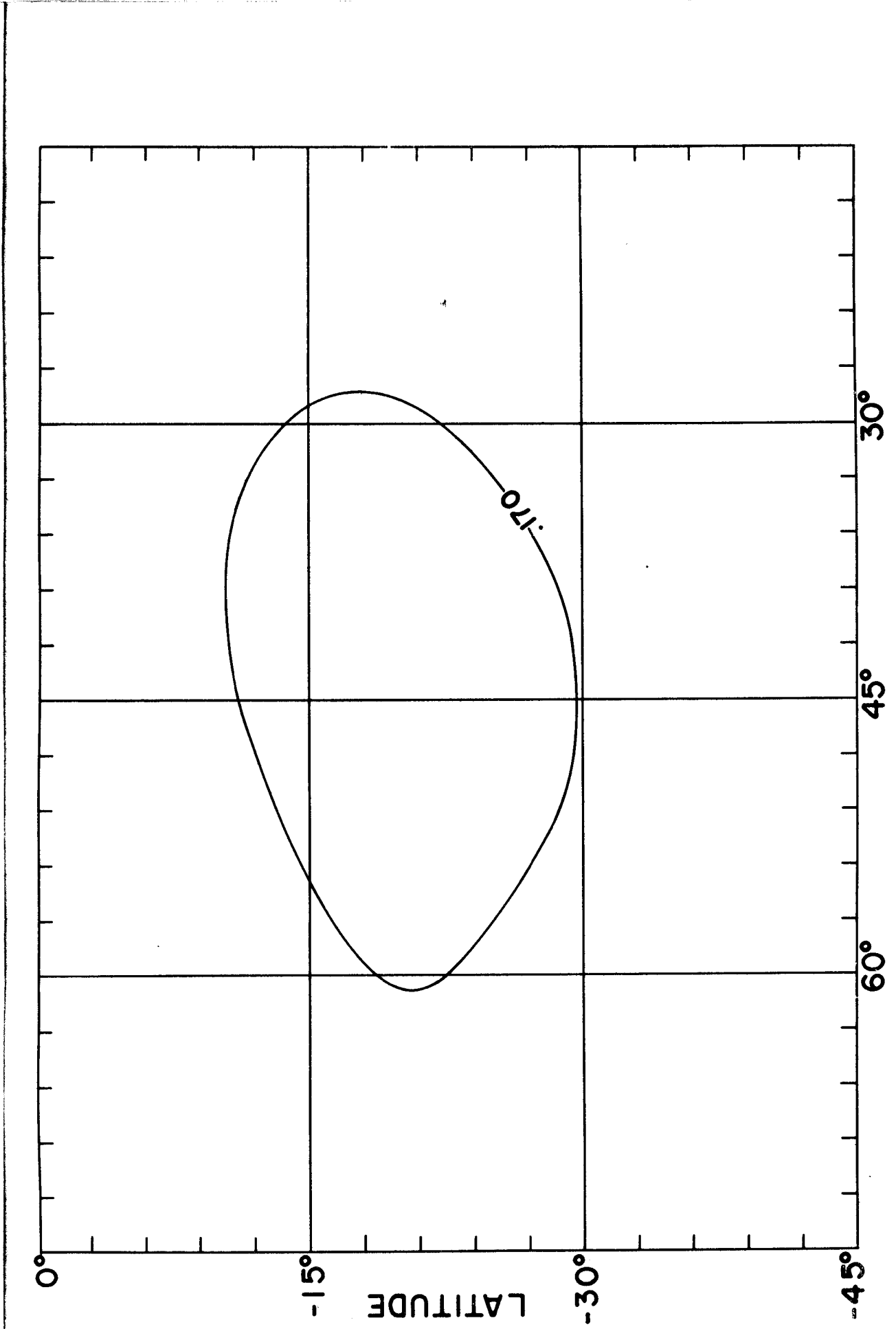
FIGURE   CAPTIONS

Fig. 1 - Isodynamics of 0.165, 0.170, 0.175 and 0.180 gauss at the height of 1020 Km. In the dashed regions the number of points was not considered sufficient to reliably close the contours .

Fig. 2 - Ionogram taken at October 31, 1964 at 22:17:17 G. M. T. .   The spikes can be seen at gyrofrequency multi ;les up   to the   eight harmonic .

Fig. 3 - Frequency - latitude diagram corresponding to the passage of No vember 11, 1964 at about 08 G. M. T.   The smoothed curves cor respond to 3 f_H, 4 f_H and 5 f_H . The dots corresponds to the observed spikes.

Fig. 4 - Isodinamic of (·.170 gauss at 1000 Km height computed by spher ical harmonics development. (Dudziak et all, 1963)

3f_H 4f_H 5f_H 6f_H 7f_H 8f_H

1.5 2.0 2.5 3.5 Mc

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