SHAPE AND SIZE OF F_2 LAYER IONOSPHERIC IRREGULARITIES AT IBADAN

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INTRODUCTION

Ionospheric irregularities in the equatorial and low latitude stations are observed to drift horizontally. They are also observed to be highly elongated along the magnectic north (Chandra and Rastogi, 1972, Bamgboye, 1969).

Elongation of irregularities is the case when the irregular amplitude pattern produced on the ground by the effect of the irregularities on the down coming radio wave is statistically anisotropic. In this case the contours of constant correlation are elliptical. The axial ratios of the ground characteristic ellipses give a measure of elongation of ionospheric irregularities. The size of the irregularity is related to the North-South extent of the ground characteristic ellipse.

METHOD

Fading records at 3 closely spaced aerials obtained by past workers at the ionospheric observatory at Ibadan (magnetic dip 3°S) during IGY and IQSY and whose fading rates fall within modal range were reduced. These are the records chosen in order to exclude records with extreme fading rates. The modal range of fading rates of records is discussed in details in an earlier article by Somoye (2002).

The size and elongation of irregularities are deduced using the full correlation method of analysis as modified by Phillips and Spencer (1955).

RESULTS

Table 1 shows the results of analysis.

TABLE 1: Axial Ratio (Elongation) And (N-S) Extent (size)

Parameter Year	Axial ratio (Elongation)	NS extent (size)
1958	11.0 ± 1.6	350 ± 50 m
1964	5.2 ± 0.9	250 ± 50m

During 1966 to 1967, Bamgboye obtained an overall mean of $7.8 + 0.5$ for axial ratio and an average (North South) extent or size of 300 metres at the same station for which these results are obtained. The present result and Bamgboye's indicate the variation of both axial ratio or elongation and (N-S) extent or size with the epochs of solar cycle.

These results are in fair of agreement with those of Chandra and Rastogi during 1967 who obtained a median value of 7 for axial ratio and the values of 6.6 for axial ratio and 300 m for irregularity size obtained by Koster and Katsriku (1966) at Tamale (dip 0.6S)

DISCUSSION

The size and elongation of ionospheric irregularities are found to show high correlation with the Zurich sunspot number, Rz, the correlation being 0.998 for irregularity size and 0.994 for shape or elongation.

The correlation of irregularity size and shape with sunspot numbers is consistent with Martyn's (1959) suggestion that there is automatic enhancement of irregularities of ionization on the other side of a layer if the layer moves up. The upward movement of the F_2 layer is the case at maximum sunspot (Olatunji, 1966). Dagg (1957) has pointed out that it is possible for neutral turbulent cells to form irregularities in the density of gas which may then be ionized by a steady ionizing radiation resulting in the production of electron density irregularities. F region ionization is greatly enhanced as solar activity increases.

The enhancement of the elongation of F region irregularities in the equatorial electrojet zone reported by Koster and Katsriku (1966) and Bamgboye (1969) suggests an influence of the electrojet on the elongation of F region irregularities. The electrojet, which is closely related to the magnetic Sq variation (Rishbeth and Garriot, 1969) is known to increase in intensity with solar activity (Adeniyi, 1980). The variation of the elongation of F region irregularities may be as a result of the variation of the electrojet with sunspot activity.

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