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OBSERVED RELATIONSHIPS AMONG SOME IONOSPHERIC F_2 LAYER PARAMETERS IN AN EQUATORIAL STATION.

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ABSTRACT

Relationships among some F_2 parameters is studied. The parameters are the fading rates of echoes from F_2 layer, the height of maximum F_2 layer, hm, critical frequency, foF_2 and the maximum useable frequency factor for a distance of 3000km, M (3000) F_2. (M3000) F2 is also known as propagation factor. While a fair inverse relationship is observed between M(3000)F_2 and hm F_2; between hmF_2 and foF_2 and and between foF_2 and fading rates, a small direct or no relationship is observed (M3000)F_2 and foF_2 and between hmF_2 and fading rates.

1.0 INTRODUCTION

It is desireable to know the kind of relationship that exists among F_2 layer parameters. This is because the data of some of these parameters are difficult to generate owing to lack of equipments. If the relationships between parameters whose data are not difficult to generate and those whose data are difficult to generate is known, prediction of data of parameters difficult to generate may be possible.

The data of parameters such as foF_2, hmF_2, M(3000) F_2 are readily obtainable in ionospheric bulletins. This is not the case with those of fading rates in which the fading records from which they can be obtained require expensive and unavailable equipments.

ANALYSIS

Fading records used to obtain fading rates and ionospheric bulletin from which M(3000) F_2, hmF_2 and f_oF_2 median values are obtained, were collected from the ionospheric observatory at Ibadan. 1200 (LMT) median values of 1958 (a year of high sunspot number) months for the four parameters are used. Median values are used, being readily available in the bulletins and having been found to show no significant difference from mean values (Somoye, 1984).

Scatter diagrams of M(3000)F_2 and fading rates; M(3000) F_2 and hm F_2; M(3000) F_2 and foF_2; foF_2 and hmF_2; foF_2 and fading rates and foF_2 and fading rates are shown in Figures 1(a) – (f). The pairs are also correlated.

3.0 RESULTS AND DISCUSSION

The scatter diagrams in Figures 1(a) – 1(f) show that there seems to be

i. A small direct relationship between M(3000) F_2 and fading rate

ii. A fairly high inverse relationship between M(3000) F_2 and hm F_2.

iii. A small direct relationship between M(3000) F_2 and fo F_2.

iv. An average inverse relationship between foF_2 and hm F_2.

v. An average inverse relationship between foF_2 and fading rate

vi. A very small direct relationship between hmF_2 and fading rate

Correlation coefficients corresponding to the pairs of (i) M(3000) F_2/fading rate is 0.17;

(ii) M(3000) F_2 /hm F_2 is – 0.65; (iii) M(3000) F_2 / fo F_2 is 0.23; (iv) fo F_2 / hm F_2 is – 0.45 (v) fo F_2 / fading rate is – 0.4 and (vi) hm F_2 / fading rate is 0.04

Explanation for the inverse relationship between fo F_2 and fading rate may be sought from the relation

$$\frac{\Delta f}{foF_2} \approx \frac{\Delta N}{N}$$

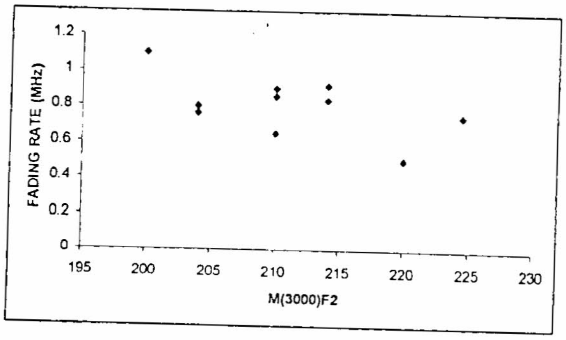

FIG. 1a: Scatter diagram of M(3000)F2 against Fading Rate

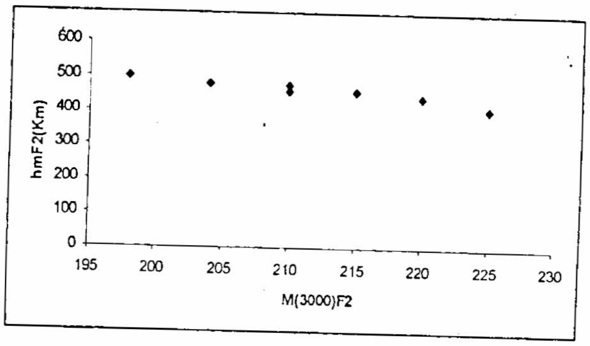

FIG. 1b: Scatter diagram of M(3000)F2 against hmF2

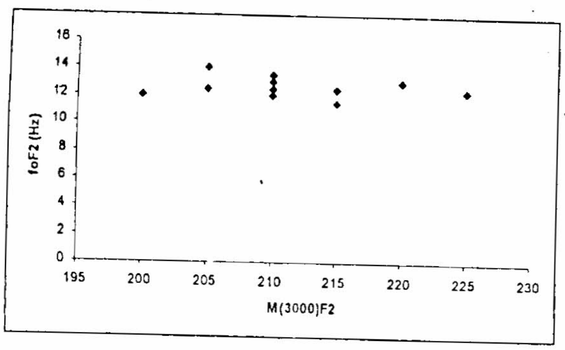

FIG. 1c: Scatter diagram of M(3000)F2 against foF2

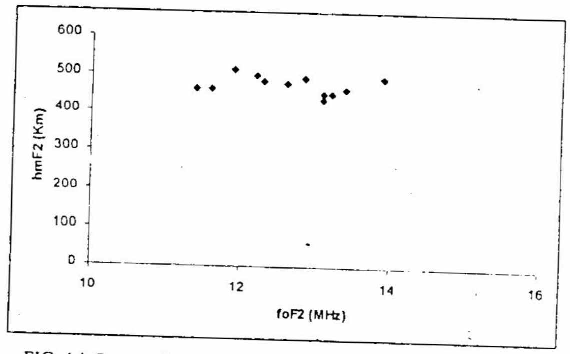

FIG. 1d: Scatter diagram of hmF2 against foF2

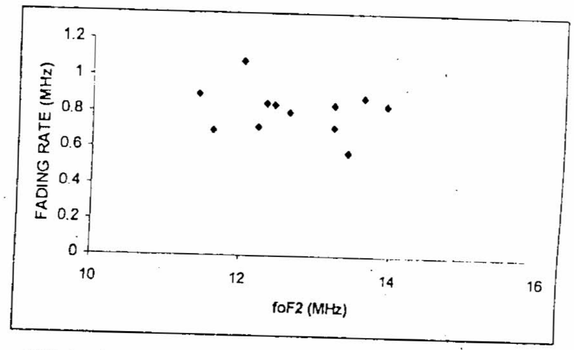

FIG. 1e: Scatter diagram of foF2 against Fading Rate

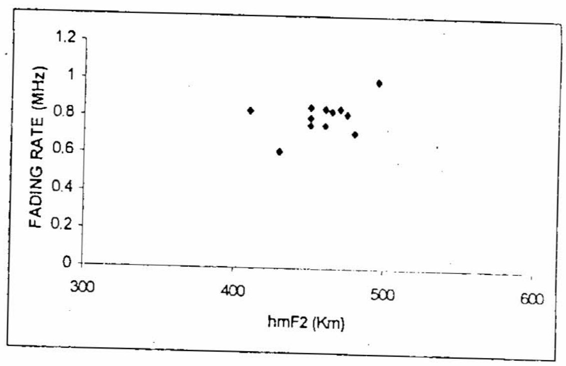

FIG. 1f: Scatter diagram of hmF2 against Fading Rate

Where Δif is the range of frequency in the spreading of f region echoes caused by spread f irregularities. ΔN is the deviation in N or electron concentration also called irregularities. The drift and changing in form of irregularities cause fading of echoes (Somoye , 1996; ; Bamgboye, 1969; Onolaja, 1977; Morriss and Lyon, 1966 and Skinner et. al., 1966). That an inverse relationship is observed to exist between foF_2 and hm F_2 follows from the fact that when hmF_2 is raised irregularities are enhanced (Martyn, 1959) and fading rate should be high

M(3000) F_2 is expected to show an inverse relationship with foF_2 since

$$M(3000)\,F_2 = \frac{MUF}{foF_2}$$

(MUF) being maximumuseable frequency. Their correlation coefficient is 0.23.

The average inverse relationship between M(3000) F_2 and hmF_2 shows that as the height of maximum F_2 layer is raised, M(3000) F_2 decreases and MUF is enhanced.

The relationship between M(3000) F_2 and fading rate, though direct is small.

As hmF_2 increases, which is the case during a period of high sunspot number fading rate is expected to be high since irregularities whose drift and changing in form cause fading is enhanced. The scatter diagram (see Figure 1(f)) and the correlation coefficient of 0.04 show nothing but a very small direct relationship between them.

4.0 CONCLUSION

A fairly high inverse relationship is observed between M(3000) F_2 and hmF_2. Average inverse relationships are also observe between the pair of foF_2 and hmF_2 and between the pair of foF_2 and fading rate. The other pairs show little direct relationship or no relationship at all

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