

VARIATION OF FADING RATES OF ECHOES WITH HEIGHT
DURING MAXIMUM SOLAR ACTIVITY AT IBADAN, NIGERIA

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ABSTRACT The variation of the rate of fading of E and F₂ echoes with height at Ibadan, an equatorial station, was investigated during a period of maximum solar activity in 1958. Fading rate was observed to be highest at the peak of electron densities of both regions. Irregularities causing the fading are found to be situated at the same heights as those of peak electron densities.

1. INTRODUCTION: An irregular distribution of the amplitude of radio signals is recorded as a result of scattering of signals by ionospheric irregularities. Usually, the amplitude waxes and wanes with a quasi-period which depends on the rate at which the changes take place in the diffraction pattern formed on the ground.

Radio signals are reflected from different heights in the ionosphere, depending on the strength of the signals. The study herein reported investigated the effects of different heights of reflection of radio signals on the fading rates of E and F₂ echoes at Ibadan, Nigeria.

2. METHODS: Analysis was performed for the determination of fading speeds of signals reflected from E and F₂ regions during 1958 and 1964 by the counting of maxima. Over a hundred fading records obtained at the ionospheric observatory at Ibadan during each year covering five to ten days of each month were used for the E region while over two hundred records during each year covering five to ten days of each month were used for the F₂ region.

Variation of fading rates (speeds) of signals with apparent height of reflection was investigated for signals reflected from E and F₂ regions during 1958. This investigation could not be made for signals reflected from both regions during 1964 as apparent heights of reflection of signals were not recorded in the log book. Figures 1 and 2 show the mass plot of fading rates with apparent height, while the plots of mean fading rates with apparent height are illustrated in Figures 3 and 4.

3. RESULTS AND DISCUSSION: Investigation of fading rates with apparent height of reflection of radio signals, carried out for 1958 fading records and illustrated in Figures 1 and 2, reveals that fading

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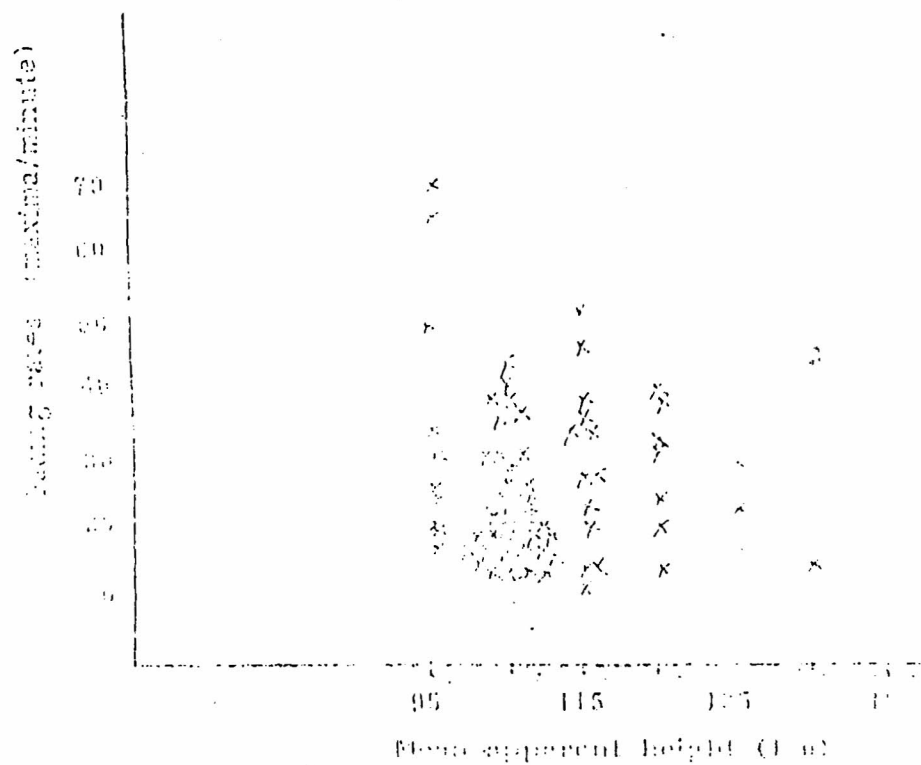


Fig. 1 Scatter plots of variation of E region Colaptes apparent height during 1998

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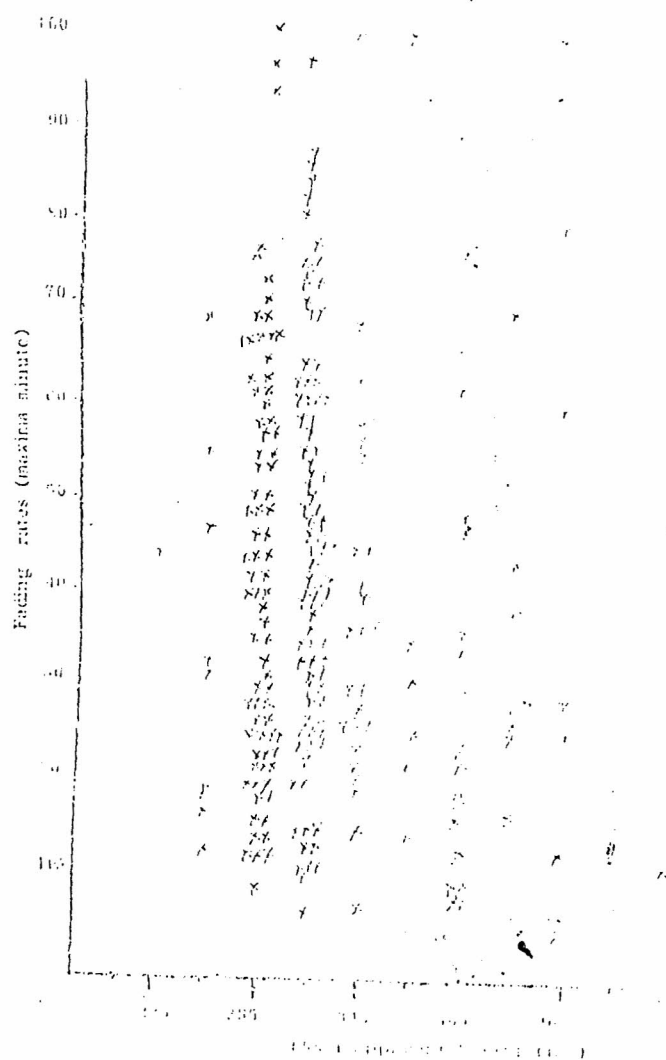


FIG. 2 Scatter plots of fading rates with day number during 1958.

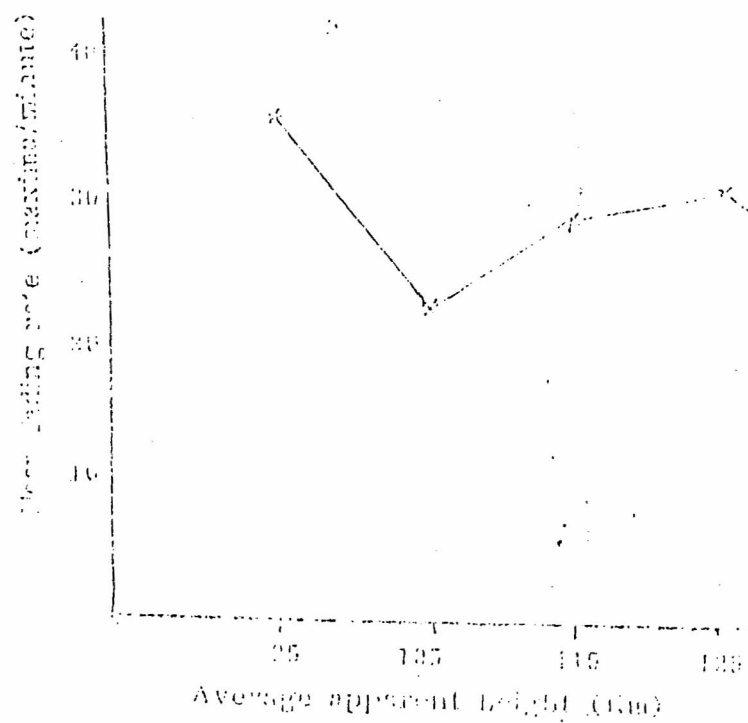


FIG. 3 Variation of E-scan mean fading rate with average apparent height during 1958.

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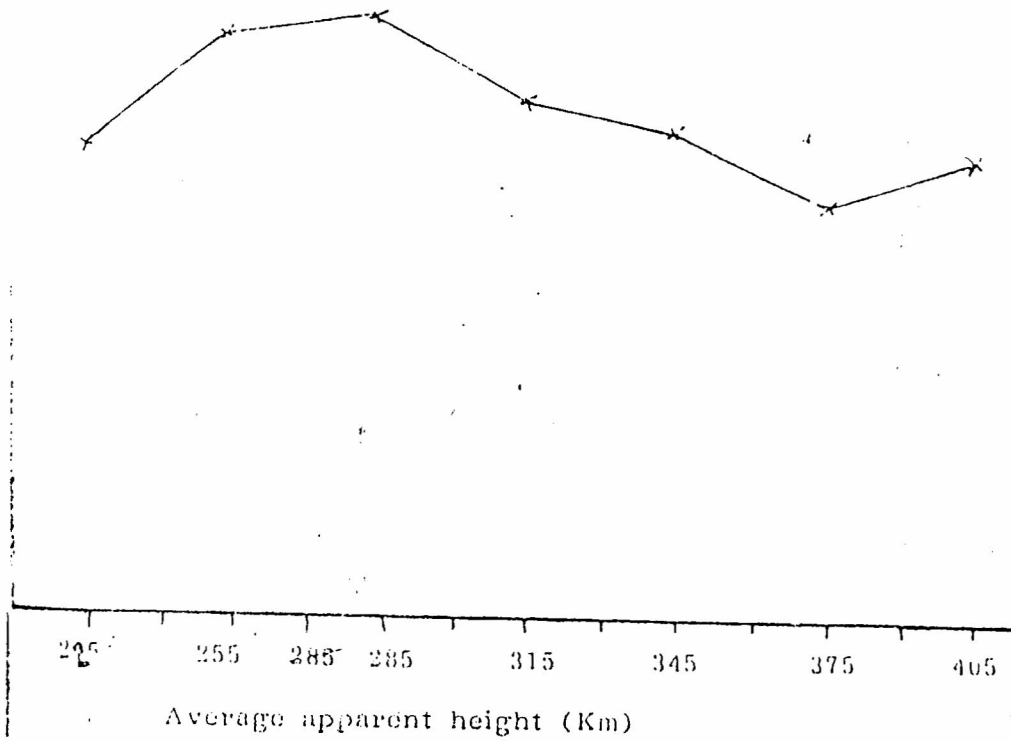


FIG. 4 Variation of F region mean fading rate with apparent height during 1958.

rate was maximum at a mean apparent height of $95 \pm 5\text{km}$ for E region echoes. It then decreased to a minimum at $105 \pm 5\text{km}$, after which it increased to a lower maximum at a mean apparent height of $125 \pm 5\text{km}$ (Fig. 2).

Figure 3, the mass plot of fading rate with apparent height, shows that the reflection of radio signals from the F_2 region of the ionosphere was concentrated in the apparent height range of 240km to 300km. In the plot of mean fading rates with average apparent height (Figure 4), the fading rate was observed to reach a peak in this same height range above which it fell

The present results confirm the cause-and-effect relationship between irregularities and fading of echoes, as the heights of peak fading rates more or less coincide with the heights at which the irregularities causing the fading occur (Somoye, 2002).

Rishbeth and Garriot (1969) reported that below the turbopause at around 100km, turbulent air motions might produce irregularities. These irregularities probably account for the fading of echoes in the E region. Irregularities causing the fading of radio signals in the F region which are also responsible for radiostar scintillations are situated at heights of 250km and above (Rishbeth and Garriot, 1969).

The peak of electron concentration of the E region is known to be at about 100km while that of F_2 region is said to be at about 250km (Ratcliffe, 1970). The present results show that the fading of radio signals returned from the heights of peak concentration of E and F_2 regions is heavier than the fading at other heights.

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