LETTERS TO THE EDITOR

TRAVELLING IONOSPHERIC DISTURBANCES IN THE LOWER F-REGION

THE characteristics of travelling ionospheric disturbances (TID's) have been extensively studied during the last three decades using a variety of experimental techniques[1–10]. It is now generally accepted that TID's observed in the ionospheric F-region correspond to the disturbances of neutral gas associated with the passage of internal atmospheric gravity waves[11–14].

Most of the results of the characteristics of TID's reported so far in the literature correspond to the F2-region, *i.e.*, altitudes around 300 Km. Heisler[15] has pointed out that many of Munro's fixed frequency observations of TID's could be observations of TID's below 200 Km. In this brief communication we present the characteristics of TID's at F1-region heights obtained from a few observations using phase path technique. The phase path technique being a very sensitive method of measuring variations in height, it was possible to deduce perturbations causing even small distortions in the isoionic surfaces. The changing distortions in the isoionic surfaces due to TID's could be observed as increases and decreases of phase path of pulsed radio waves reflected at normal incidence from these distorted isoionic surfaces. The details of the experimental technique and the evaluation of TID's parameters have been given elsewhere[9,16].

The data for the present study were taken at Waltair (17° 48′ N, 83° 18′ E) during the period, November 1970–March 1972, on a frequency of 5·6 MHz. The observations were taken mostly during the daylight hours, between 0700–1800 hr. (I.S.T.), and at the operating frequency of 5·6 MHz the observations were mostly confined to F2-region of the ionosphere, *i.e.*, altitudes between 250-350 Km. However on a few occasions we have noticed reflections from an altitude around 170 Km which is much above the normally observed E and Es region reflections. Also, since the critical frequency of E-region never exceeded 4·2 MHz at Waltair, the observed reflections around 170 Km were attributed to the reflections coming from F1-region. Typical phase path variations of F1-region reflections are shown in Fig. 1. The observed phase path variations of the reflected echoes can be interpreted as due to a contribution of a linear variation of phase path due to normal diurnal variation and due to TID's. The diurnal variation in phase path arises as the phase height on a given frequency and at a given instant of time depends on the two parameters, (i) the height of reflection level and (ii) the integrated electron density below the level, both of which vary with the solar zenith angle. The mean straight lines in Fig. 1 represent this diurnal variation in phase path. The quasiperiodic oscillations of phase path superposed on the steady component can be interpreted as due to TID's. If the contribution due to TID is approximated to be sinusoidal, then the observed phase path A, as a function of time, can be represented as

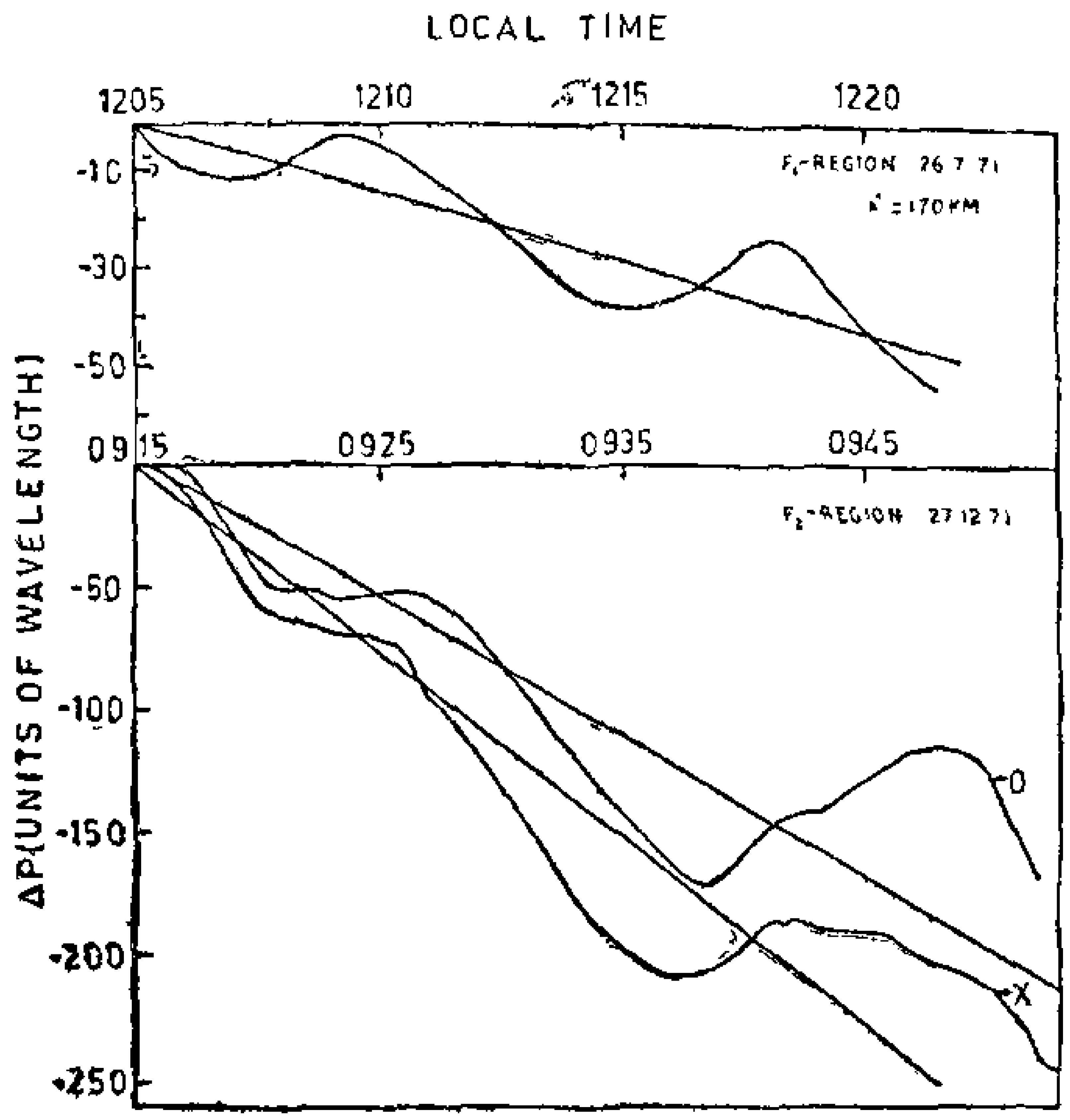

FIG. 1. Typical phase path variations of the F-region echoes (Operating frequency—5·6 MHz. O and X represent the ordinary and the extraordinary components of the reflected signal).

$$A = (C + A_L t) + A_v \sin\left(\frac{2\pi t}{T}\right)$$

where A_L is the rate of change of phase path of the linearly varying part, A_v is the vertical amplitude of the sinusoidal disturbances, T is its time period and C is a constant. From the observed phase path variations it was possible to obtain the time period and vertical amplitude of TID's.

From the available records we have calculated the time periods, and vertical amplitudes of TID's at F1-region altitudes. The time periods were found to be in the range of 4-8 min and the vertical amplitudes in the range 2-4λ (λ is the wavelength corresponding to the operating frequency of 5·6 MHz). The direction of propagation of TID, calculated from a single spaced aerial F1-region phase path record, was found to be 138° E of N. But there was an ambiguity of 180° in this direction because of the absence of the ordinary and extraordinary components[16]. The characteristics of F2-region TID's observed at Waltair have been reported in an earlier communication[17]. The results of F1-region TID's are too few to make any statistical comparison with the characteristics of F2-region TID's.

Theoretical studies have revealed that dynamical processes control TID production at F2-region levels whereas photoionization and chemical loss processes are the two important mechanisms for TID production at F1-region levels[18,19]. It is also shown theoretically, that ducting, reflection of gravity waves due to temperature variations and the background winds play important role in the selection of propagating periods of internal atmospheric gravity waves from the ground to F-region heights[20–22]. It would be very interesting if simultaneous observations of TID's at F1- and F2-region heights are made in view of the different mechanisms that control TID production and propagation of internal atmospheric gravity waves. Phase path technique, because of its sensitivity to the changes in the reflection height, promises to be a useful tool for such a study.

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FLUORESCENCE POLARIZATION SPECTRUM OF MERCURIDIBROMOSODIUM-FLUORESCEIN

In a previous note the fluorescence polarization spectrum of rhodamine 6 G was reported[1]. In continuation of this work, the fluorescence polarization spectrum of mercuridibromosodium-fluorescein is measured. This compound belongs to the same Xanthene group as rhodamine 6 G and its fluorescence polarization has not been investigated in detail so far. The experimental procedure adopted is the same as in the earlier work[1]. The polarization of fluorescence was measured for two excitation wavelengths, 306 nm and 512 nm, at 25° C, for the concentration $1 \cdot 1 \times 10^{-5}$ g/cc in glycerol. The results obtained are given in Table I and shown in Fig. 1.

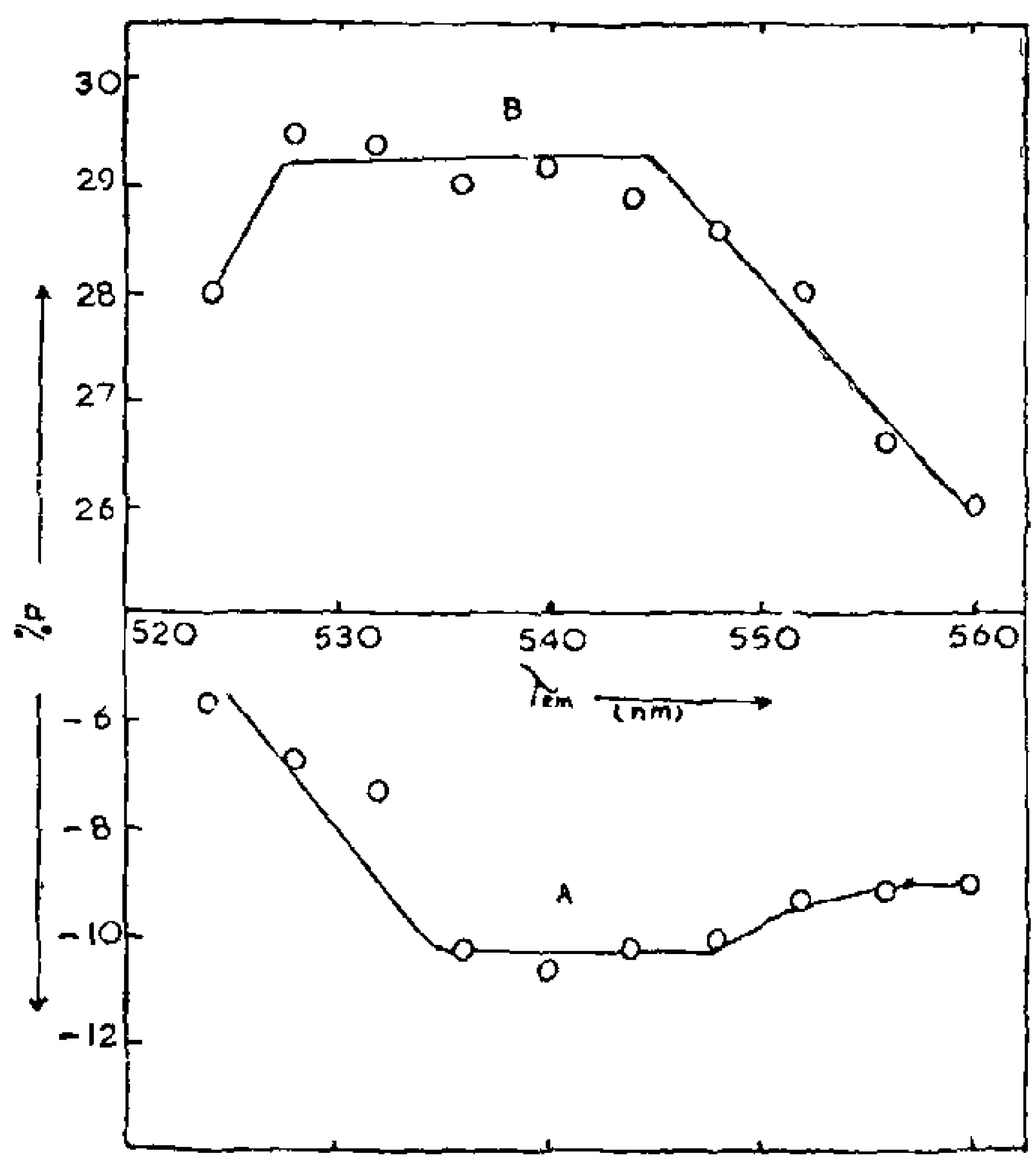

FIG. 1. Percentage polarization *versus* emission wavelength for (A) $\lambda_{ex} = 306$ nm; (B) $\lambda_{ex} = 512$ nm.

From Table I, it is seen that the polarization is positive for the longer excitation wavelength (512 nm) and negative for the other (305 nm). The excitation