Neglecting the squares and higher powers of δ^*, it was shown[4] that $\delta^* = (\gamma\sigma)^{-1}$. With this value of δ^*, the eqns. (1) and (2) determine a transcendental equation in Δ^*. Under the same approximation for Δ^*, we obtain

$$\Delta^* = \frac{\sigma C_3}{\beta C_1}. \tag{3}$$

with Pr. = 0·025, E = 0·01, α = 0·1 as in ref. 2, 4 Δ^* is computed in Table 1 for different values of σ and β (Biot-number). It is found to be in fact much smaller than δ^*.

TABLE I

Computed Values of the thermal boundary layer thickness Δ^*

σ	δ^*	Δ^* $\beta = 1$	Δ^* $\beta = 2$
100	0·1	0·01012	0·00550
500	0·02	0·00212	0·00150
1000	0·01	0·00112	0 00100
5000	0·002	0·00032	0·00060
10000	0 001	0·00022	0·00055

Again δ^* is chosen to be unity in their numerical discussion[2,4]. This appears to be a rather large value and is inconsistent with the assumption made. δ^* can at most be 0·1. In the presence of the buoyancy[2,4], Δ^* is further expected to be dependent on the parameter N_0.

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DIURNAL VARIATION OF f_0F_2 AT EQUATORIAL LATITUDES AND COUNTER ELECTROJET

ONE well documented feature of the diurnal variation of f_0F_2 at equatorial latitudes is the occurrence of two maxima, one in the morning and the other in the evening with a prominent trougeh around midday, termed as noon 'bite-out'[1-6]. The asymmetry of the bite-out, *i.e.*, the relative amplitudes of the morning and evening maxima exhibit a significant dependence on the phase of the sunspot cycle. During the periods of low sunspot activity, the ampltude of the evening maximum is prominent while during periods of high sunspot activity the morning maximum gains prominence[6,7]. The physical mechanisms responsible for this long term behaviour of the asymmetry of the bite-out are yet to be established.

It is well known that the intense band of *eastward* ionospheric currents at E-region altitudes, over and in the vicinity of the dip equator, referred to as electrojet, gives rise to the pronounced enhancement in the diurnal range of the H-component of the earth's geomagnetic field monitored on ground. The electric field (east-west) at E-region levels associated with the electrojet is transferred along the highly conducting magnetic lines of force to higher altitudes where it interacts with the horizontal geomagnetic field to set up an upward directed (during daytime) E × B drift of plasma. Thus the electrojet current strength, on which the E × B drift depends, governs to a large extent the behaviour of the equatorial F-region[8-11]. It is well established now that on occasions, designated as 'Counterelectrojet' (CEJ) events[12], the electrojet current gets reversed for a while during daytime, *i.e.*, *current is wastward*, resulting in a depression of the H-component below the mean midnight level[13]. These CEJ events are closely associated with several phenomena in the lower and upper equatorial ionosphere, the most prominent among them being the disapperance of E_{sq} traces on bottomside ionograms and reversal of the E-region horizontal drift velocitties, clearly indicating a reversal in the electrojet direction[14-16]. The probable effect of the CEJ events is to reverse or reduce the E × B vertical drift (due to a reversal of the E-region electric field) and hence to increase the F-region electron densities at and close to the dip equator[11]. The occurrence of CEJ events is noticed to be more frequent during afternoon hours under conditions of low geomagnetic and solar activity[17]. It is thus quite possible that the pronounced evening maximum in the diurnal variation of f_0F_2 at equatorial latitudes, observable during low sunspot activity, might be due to the frequent occurrence of afternoon CEJ events. In fact, such an explanation has already been put forward[18] although systematic studies have not been made. It is therefore felt worthwhile to examine this possibility.

The present study is based on the ionogram and magnetogram data at Kodaikanal (77·5° E, 10·2° N, dip 3·5°), situated well within the electrojet region, for the period Jan ary 1963 to December 1964 corresponding to low sunspot activity (mean sunspot number = 19). The analysis is mainly confined to geomagnetically quiet days (AP$\lesssim$ 6) as the occurrence of CEJ is more frequent during quiet periods. The objective is to study in comparison the mean di rnal variation of f_0F_2 on normal quiet days and CEJ days. If the frequent occurrence of afternoon CEJ events is indeed responsible for the prominent evening maximum in f_0F_2, then one would expect a significant increase in f_0F_2 values during CEJ days compared to normal quiet days. Careful examination of the quarter-hourly ionogram and magnetogram data revealed that out of the 310 quiet days that occurred during the 24 month period considered, CEJ manifested on 73 days. Following current practice[19], the presence of CEJ is inferred if, at any particular time, there is a negative fluctuation in the value of Δ H at Kodaikanal (within the electrojet) *minus* Δ H at Alibag (outside the electrojet), the reference value being the mean midnight level, coincident with disappearance of E_{sq} on ionograms. Occasions wherein there is only an obvious reduction in the value of H at Kodaikanal but not large enough to give a negative value of Δ H at Kodaikanal *minus* Δ H at Alibag, but associated with the disappearance of E_{sq}, referred to as 'partial counter-electrojet' events[20], have also been taken into consideration.

In Fig. 1 is shown the mean diurnal variation of f_0F_2 corresponding to the 237 normal quiet days (solid curve). The presence of noon 'bite-out' with a prominent evening peak is quite evident. In Fig. 1 is also shown the mean diurnal variation of f_0F_2 corresponding to the 73 CEJ days. A perusal of Fig. 1 shows that there is an apparent increase in f_0F_2 values in the evening period during CEJ days compared to normal quiet days. The difference in f_0F_2 values is however not statistically significant as may be seen from the standard deviations of the mean values. It has been reported earlier that increases in f_0F_2 occur during period of CEJ[11,21]. Examination of f_0F_2 behaviour during selected days of strong CEJ by the authors also showed an increase in f_0F_2 values during the evening period but only on some of th days. It is thus quite evident that the prominent evening peak in the diurnal variation of f_0F_2 at equatorial latitudes during low sunspot activity conditions is not entirely due to the frequent occurrence of afternoon CEJ events. Further work is therefore required to assess the other physical mechanisms involved.

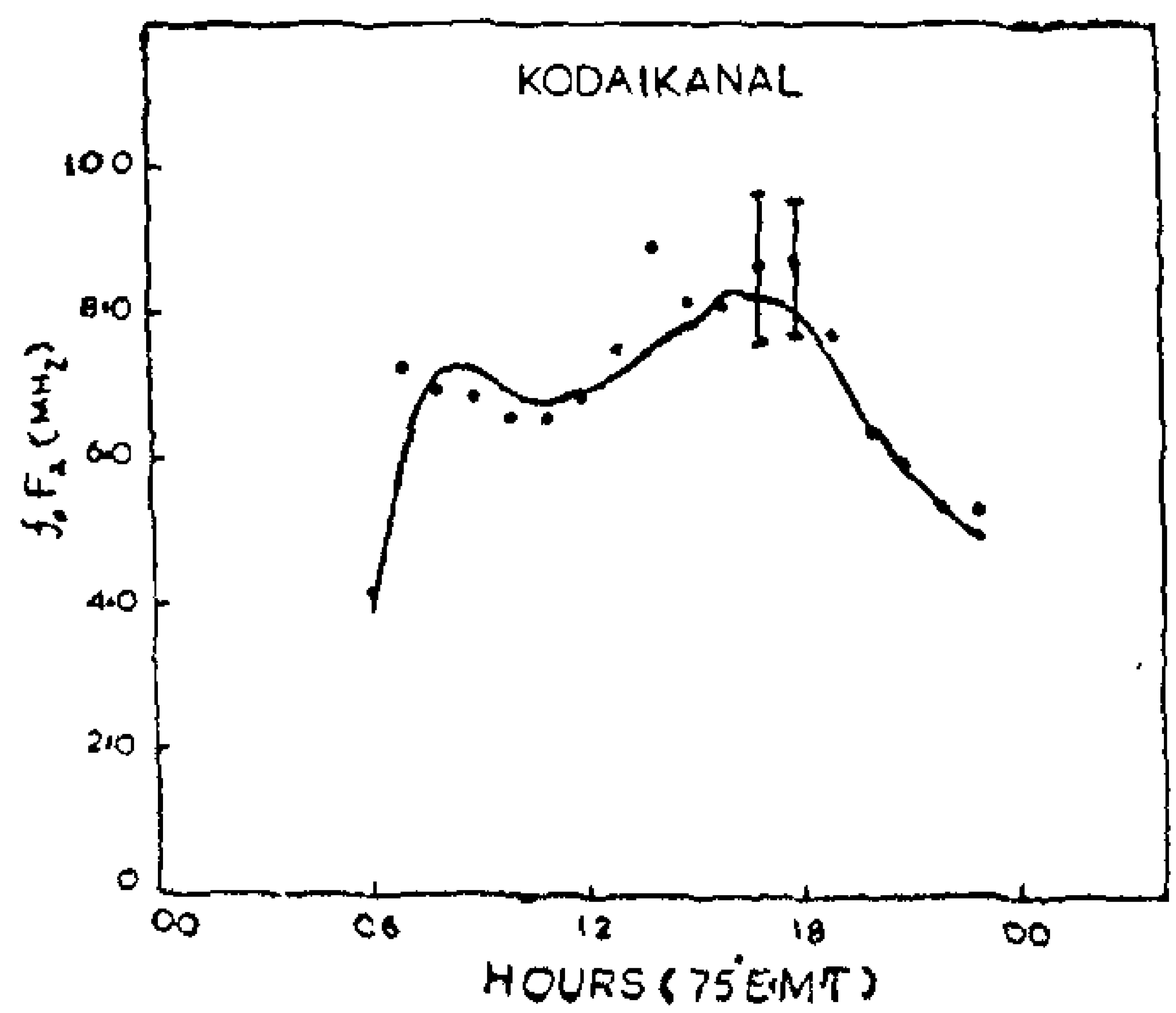

FIG. 1. Mean diurnal variation of f_0F_2 at Kodai kanal corresponding to normal quiet days (solid curve) and CEJ days (solid circles) during the period January 1963 to December 1964. The vertical bars represent the standard deviations of the mean valu es of f_0F_2 for the CEJ days.

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