wavelength has proved to be a more practical index because of its lower day-to-day variability in comparison to the daily sunspot number. The daily solar reports help to establish the phase of the solar activity in the 27-day cycle that is to follow during the forecast week and then an appropriate average solar index (10.7-cm flux) is predicted for that particular phase of the cycle. Several statistical studies have been made to examine the distribution of daily 10.7-cm flux values around the smoothed 12-monthly mean, 90-day mean and monthly mean values of 10.7-cm flux. The weekly average solar index (10.7-cm flux) prediction is based on these statistical distribution studies. The RSD also predicts, on monthly basis, long-term solar activity (12-monthly means) variation six months in advance and daily 10.7-cm flux measured at Ottawa is made available to the RSD on daily basis by World Warning Agency, Boulder, through IUWDS (International Ursigram and World Day Service) GEOALERT messages. A comparison of the most recently measured values of 10.7-cm flux with the predicted values for the same period also helps in predicting the solar index for the forecast period.

Fig. 1 shows predicted average 10.7-cm flux values plotted along with observed average flux values for the period Mar.-Sep. 1979. The dotted line shows the predicted values and the continuous line the observed values. The excellent agreement between the predicted trends of high or low solar activity with those of actual observation can be appreciated from Fig. 1. A comparison of predicted and observed values shows that the predicted values are within 5% for 70% of the time and within 10% for 80% of the time.

The incidence of a considerable prediction error is essentially restricted to those periods when solar activity plunged to very low values. It is rather uncharacteristic of the increasing phase of the solar cycle. It should, however, be mentioned that a certain amount of subjectivity is involved both in interpreting the changes observed on the solar disk and also in quantifying these changes. Since some very recent ideas are used in making the forecasts, it is not possible to use statistically significant data for an absolutely objective estimate.

The success of such a prediction system, of course, critically depends upon timely transmission of solar data from around the world; the World Warning Agency of Boulder (USA), the Regional Warning Centres at Moscow, Paris and Sydney and the Indian Institute of Astrophysics (Kodaikanal) provide most of the data used in this forecast. Contributions from our colleagues Mrs S Aggarwal, Mrs S Shastri and Mr P L Malhotra are gratefully acknowledged.

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On the Growth & Decay of Blanketing Sporadic-E Layers

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Evidence is presented from 1-min interval ionogram data to show that strong blanketing-layer-type ionization irregularities at E-region altitudes can occasionally decay, in a span of about 4 min, at stations in the vicinity of the geomagnetic dip equator.

Substantial evidence exists in the literature to show that thin layers of enhanced ionization at E-region altitudes which manifest as extended E-region traces on ionograms known as “blanketing sporadic-E” layers, do occur at and close to the magnetic dip equator. As the effectiveness of the vertical ion convergence mechanism, which is widely considered responsible for the formation of blanketing sporadic-E layers at temperate latitudes, reduces sharply close to the dip equator, alternative mechanisms have been proposed to account for the occurrence of blanketing sporadic-E layers at and close to the dip equator. One of them is ion convergence by horizontal shears of horizontal neutral winds induced by short period internal
gravity waves\(^6\) and another is physical transport of ionization of long-lived metallic ions from tropical latitudes towards the dip equator by neutral winds.\(^7\)

The morphological behaviour of blanketing sporadic-E layers at and in the vicinity of the dip equator has been well documented in the recent times. It is now known that (i) blanketing sporadic-E layers occur most frequently during local summer months of low sunspot activity periods and with a characteristic diurnal variation with a prominent peak around 1700 hrs LT and (ii) they occur mostly in a narrow height range 95-105 km and under conditions of weak equatorial electrojet.\(^6\)\(^+8\) Although the usually available quarter-hourly ionogram data do indicate the growth and decay of blanketing sporadic-E layers at and close to the dip equator to be rather rapid\(^8\) (< 15 min), there is a dearth of observations on this aspect of blanketing sporadic-E layers with a time resolution better than 15 min. With a view to fill in this gap, a preliminary study is attempted and the results are presented in this communication.

Vertical incidence ionospheric soundings with a C-3 ionosonde have been carried out at Kodaikanal (dip 3.5°N) at 1-min intervals on a number of days during the period Oct. 1974 - Jan. 1975, with a view to monitor the small-scale fluctuations in the F-region critical frequency. These ionogram sequences with a high-time resolution have been used in the present study. Careful scrutiny of the available ionogram data showed the occurrence of blanketing sporadic-E layers during daytime conditions on five occasions. The blanketing frequency \((f_b\text{Es})\) which represents the peak electron density of the sporadic-E (Es) layer, is scaled at 1-min interval on these five occasions to infer the growth and decay times of the Es layers.

It is found that on four occasions, the blanketing Es-layers showed a smooth development and decay with growth times ranging from 6 to 12 min and decay times from 8 to 19 min. The layers on these occasions were of moderate to strong blanketing type with intensity factors (ratio of peak electron density in the Es-layer to that of the ambient) ranging from about 1.5 to 4. The blanketing Es-layer on the fifth occasion, however, showed a different and interesting behaviour. This event occurred during the time interval 1030-1120 hrs IST on 17 Nov. 1974. Fig.1 shows the time evolution of \(f_b\text{Es}\) for this day. The development of the blanketing Es-layer seems to have occurred in two stages on this day as can be seen from Fig.1.

**Fig. 1—Variation of \(f_b\text{Es}\) at Kodaikanal on 17 Nov. 1974 during the time interval 1000-1130 hrs IST**

The value of \(f_b\text{Es}\) started to increase from 4.0 MHz at 1030 hrs IST and reached 5.0 MHz at 1047 hrs IST where it remained constant for 12 min. It then rose sharply to reach a maximum value of 8.4 MHz at 1108 hrs IST. The critical frequency of the E-layer \((f_0\text{E})\) will usually be about 4.0 MHz around this time of the day. The \(f_b\text{Es}\) value of 8.4 MHz indicates a strong blanketing Es-layer with an intensity factor of 4 or more on this occasion. It may be noted that blanketing Es-layers during daytime typically exhibit intensity factors in the range 1.5-2.5 (Ref.6). The decay of this strong blanketing Es-layer, in contrast to its growth, was remarkably rapid as can be clearly seen from Fig.1. The value of \(f_b\text{Es}\) dropped from 8.4 MHz at 1113 hrs IST to 4.1 MHz at 1117 hrs IST, i.e. the peak electron density of the Es-layer returned to more or less its usual value within a span of 4 min. The other interesting features of the blanketing Es-layer on this occasion are (i) its occurrence around midday—a rarity and (ii) its occurrence at a height of 120 km well above the usually observed narrow range of 95-105 km.

Further 1-min interval ionospheric soundings are in progress at this station to obtain a comprehensive picture of the growth and decay characteristics of blanketing sporadic-E layers.

**References**

Ionospheric Drift Measurements at Tiruchirapalli—
2. Results of Cross-spectral Analysis

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About 600 spaced-fading records obtained from ionospheric E- and F-region reflections over Tiruchirapalli, during the period 1973-75 have been subjected to the cross-spectrum analysis for Jones and Maude [Nature, Lond., 206 (1965), 177] to examine for the dispersive motions. Majority of the records showed no evidence of dispersion. In all, 30% of the records showed dispersion and that too mainly positive dispersion (about 25% of cases).

Drift velocities of the ionization irregularities in the ionosphere are usually measured by the spaced-receiver experiment. There are basically two approaches which have been extensively employed to compute the drift velocities from the spaced-fading records. The similar-fade method gives the apparent drift velocity \(V_a\) and the full-correlation method gives both the apparent and the steady or true drift velocity \(V\). A new approach was adopted by Jones and Maude where the fading records are Fourier analyzed and from the phases in the three cross-spectra of the fading records one obtains the apparent drift velocities at different fading frequencies. The method has been applied for fading as well as scintillation records and the results have been reviewed by Jones and Maude. An increase of the velocity with fading frequency is generally reported by different authors. In the equatorial region, the cross-spectrum method had been applied to a few records at Thumba and at Ibadan; however, at both the locations the number of records analyzed was not sufficiently large. About 600 spaced-fading records obtained from E- and F-region echoes at Tiruchirapalli were subjected to cross-spectrum analysis along with the full-correlation analysis. The features of the cross-spectrum analysis results are discussed in this communication.

On the average about 25% of records for the E-region and about 23% of records for the F-region showed the velocity to be independent of the fading frequency [examples in Fig. 1(a)]. Mean power spectrum and cross-correlation functions for E-W pair are also shown in Fig. 1(a) along with the markings of the velocities \(V_a\), \(V\) and \(V_e\) as determined by the full-correlation analysis. In all these examples [Fig. 1(a)] values of \(V\) are close to \(V_a\), and \(V\) has comparatively low values. However, the value of \(V_a\) is not necessarily related to the velocities obtained by the cross-spectrum method.

The phenomenon of velocity increasing with fading frequency is known as positive dispersion and this thing is found to occur in about 24% of cases for E-region records and in about 27% of cases for F-region records. Such cases show large variation of the velocity with fading frequency and comparatively large values of the velocity \(V_e\) are also [Fig. 1(b)] noticed.

When velocity decreases with fading frequency we have what is known as negative dispersion and this is rarely observed and, in all, were noticed in about 10% of cases for E-region and in about 13% of cases for F-region. Large variations in the velocity with fading frequency are accompanied by large values of velocity \(V_e\) [Fig. 1(c)].

About 41% of records for E-region and about 37% of records for F-region showed no consistent variation of the velocity with fading frequency. The large random fluctuations in the velocity with fading frequency seem to be related to the large values of the characteristic velocity [Fig. 1(d)]. The relationship between the velocities \(V_a\) and \(V\) deduced from correlation analysis and the velocities deduced from the cross-spectrum analysis is not very obvious as shown in the examples presented here. Further, the correlation functions are not showing any marked asymmetry.

It is thus clear that dispersion is found to occur for about 30% of cases only and that too mainly in a positive dispersion. These results are close to the findings of Bamgboye for another equatorial station Ibadan where about one-third of the records showed a positive dispersion. Bamgboye observed that the apparent drift velocity \(V_a\) corresponds to the drift velocity at mid-frequency and the true drift speed \(V\) corresponds to the velocity at the lowest fading frequency, while Briggs and Golley and Rastogi et al. observed that the apparent drift velocity corresponds to the drift velocity at the highest fading frequency. The results at Tiruchirapalli do not support any of these earerli