

LETTERS TO THE EDITOR

RADIOWAVE FADING AT WALT AIR
DURING I.G.Y.

FADING analysis of the ionospheric drift records taken during the International Geophysical Year (I.G.Y.) at Waltair ($17^{\circ} 43' N$; $83^{\circ} 18' E$; Geo. Mag. Lat. $7.4^{\circ} N$.) was carried out and the results have been reported earlier (Rao and Rao).¹ Further results obtained are presented in this communication. Following the method given by Rice² the fading frequency is calculated in cycles per minute by counting the number of peaks per minute in a fading record. About 350 records taken on 2.3 Mc./sec. in the E region and 300 records taken on 5.6 Mc./sec. in the F_2 region during magnetically quiet days were analysed.

With a view to study the difference in fading frequency during daytime and night time, all the fading frequency data taken on 2.3 Mc./sec. was separated into daytime (0700–1800 hours) and night time (1900–0600 hours) data. Night time records were taken on E_s reflections. The average fading frequency in the E region during daytime and night time was found to be 10.96 and 14.02 cycles/minute respectively. The observed increase in the fading frequency during night time is in conformity with the result of Millman,³ who arrived at a similar conclusion from a study of fading data taken on a frequency of 150 Kc./sec. The observed increase in the fading frequency during night time may partly be due to the ionisation produced by meteors in the upper layers of earth's atmosphere. It would be worthwhile here to quote Rao and Rao⁴ who reported positive correlation between meteor activity and E region fading. It has already been reported that at Waltair drift speed is greater during night compared to daytime (Rao and Rao).⁵ Part of the increase in fading frequency can therefore be attributed to the larger drift speeds observed during night time. A similar analysis in the case of F_2 region reflections taken on 5.6 Mc./sec. was carried out and the average fading frequency during night time and daytime came out to be 11.22 and 8.37 cycles/minute respectively. The observed increase in the night time value of the fading frequency may be due to the presence of spread echoes at night time in the F region levels, which is more frequent at Waltair during I.G.Y.

Rao and Rao¹ from a study of the diurnal

variation curves of fading frequency and drift speed in the E region at Waltair and Yamagawa concluded that the diurnal variation of fading frequency may be used as a fairly good index of the diurnal variation of drift speed. In order to test whether this is true in the case of F_2 region, the values of fading frequency available at intervals of one hour are averaged and these values are plotted against local mean time (LMT) (Fig. 1). The values of drift speed

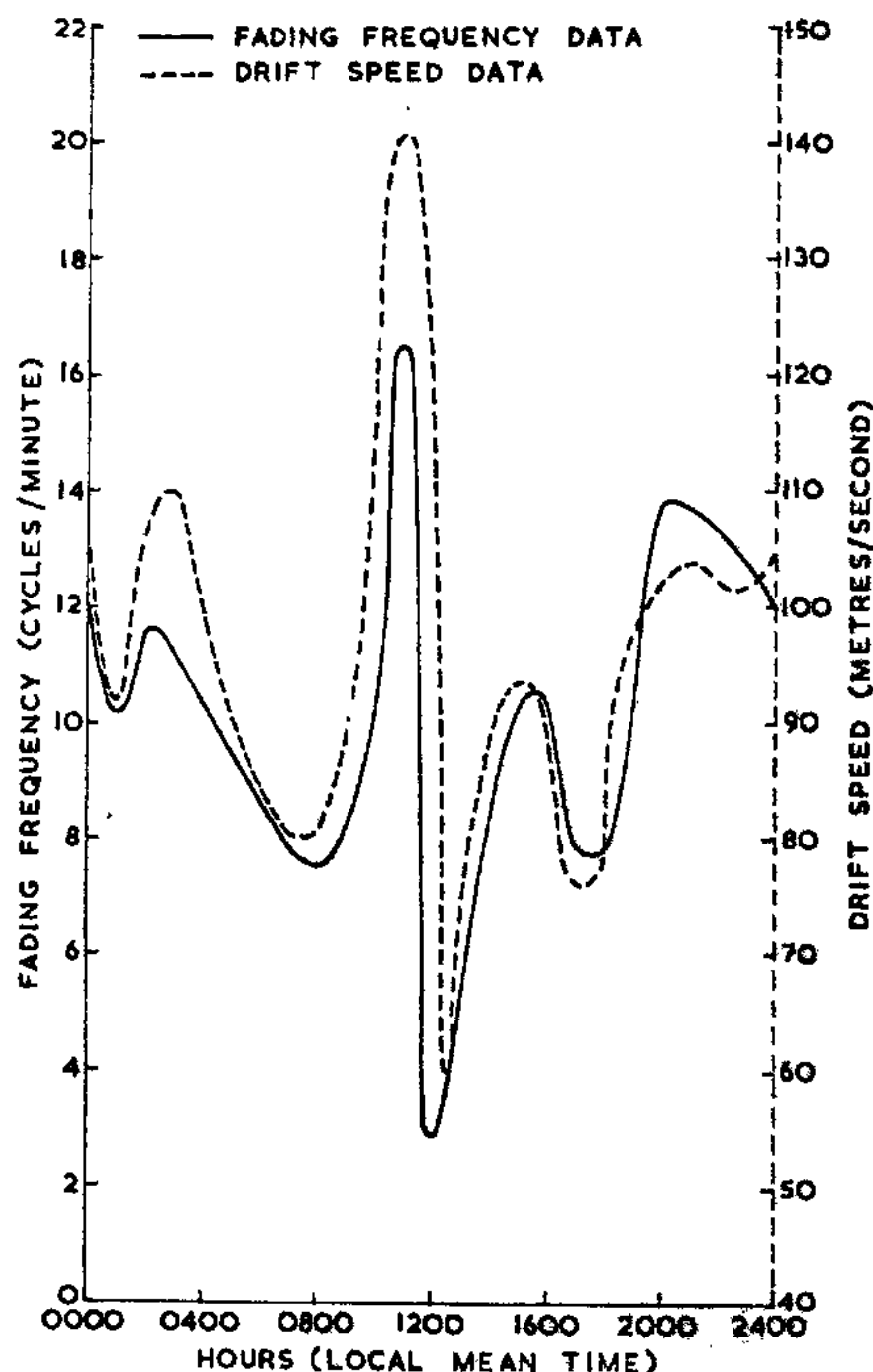


FIG. 1. Diurnal variation of fading frequency and drift speed in the F_2 region.

(calculated by the 'Similar fades method' due to Mitra)⁶ available at interval of one hour are averaged and the average values are plotted against local mean time in the same figure. It will be interesting to note that these two diurnal variation curves are remarkably similar. In order to establish the extent of similarity statistically, standard statistical methods were used and the correlation coefficient

came out to be 0.84 ($P = 0.01$ level). From this highly significant correlation, we can definitely conclude that the diurnal variation of fading frequency can be taken as a fairly good index of the diurnal variation of drift speed. As the fading frequency measurement can be made by a very simple technique, this offers a possible method of studying the mean diurnal variation of drift speed without having recourse to elaborate experimental techniques required for drift measurements.

One of the authors (P. S. K. Rao) is grateful to the University Grants Commission, New Delhi, for the award of a Junior Research Fellowship.

Ionosphere Research P. S. KESAVA RAO.
Laboratories, B. RAMACHANDRA RAO.
Physics Department,
Andhra University, Waltair, January 27, 1967.

1. Rao, P. S. K. and Rao, B. R., *J. Atmosph. Terr. Phys.*, 1964, 26, 841.
2. Rice, S. O., *Bell. Syst. Tech. J.*, 1945, 23, 282.
3. Millman, G. H., *Penn. State Univ. Report*, No. 37, 1952.
4. Rao, P. S. K. and Rao, B. R., *J. Atmosph. Terr. Phys.* 1966, 28, 457.
5. Rao, R. R. and Rao, B. R., *Ibid.*, 1961, 22, 81.
6. Mitra, S. N., *Proc. Inst. Elect. Engrs.*, 1949, Pt. III, p. 441.

AMMONIUM THIOCYANATE AS A GRAVIMETRIC REAGENT FOR COPPER: A NEW PROCEDURE

AMMONIUM thiocyanate precipitates copper quantitatively as cuprous thiocyanate from acid solution in the presence of sulphurous acid. The copper solution should be slightly acidic with respect to hydrochloric or sulphuric acid. Sulphurous acid reduces cupric ions to cuprous state and maintains it in that state. Based on this, Kolthoff and Van Der Meene¹ described a procedure for the gravimetric determination of copper. Belcher and West² used ferrous salt for the reduction of copper II to copper I and obtained results as satisfactory as those with the method employing sulphurous acid as the reductant. The indicator properties of the ferric thiocyanate complex served the purpose of estimating the correct amount of thiocyanate to be added to the copper solution. Stathis³ recommended reduction with ascorbic acid to avoid the interference of lead, bismuth and cadmium.

We have now found that ammonium thiocyanate could function both as a reductant and precipitant, in the quantitative precipitation of copper as cuprous thiocyanate, provided

the reaction is carried out in acetic acid medium instead of mineral acid. Thus there is no need at all to employ any reducing agents such as sulphurous acid, ferrous ammonium sulphate or ascorbic acid in the gravimetric estimation of copper as cuprous thiocyanate.

All chemicals employed in our investigation were of analytical reagent quality. A stock solution was prepared by dissolving a weighed amount of A.R. (B. D. H.) copper sulphate in water and then diluting to a known volume. Its strength was further determined iodometrically.

Recommended Procedure.—A known volume of the standard copper sulphate solution was pipetted out into a clean beaker (400 ml.), about 45 ml. of glacial acetic acid were next added and diluted to ca. 150 ml. The solution was then kept on a boiling water-bath for 30 minutes and a freshly prepared 10% ammonium thiocyanate solution was added dropwise with constant stirring till the formation of the precipitate was observed. About 5 ml. of water was added and the precipitation was complete. The heating was continued till the supernatant liquid became colourless. The contents of the beaker were allowed to cool to room temperature and after 2–3 hours, the precipitate was filtered through a weighed No. 4 sintered glass crucible. The precipitate was washed 4–5 times with a cold 0.1% solution of ammonium thiocyanate and finally with 20% ethanol till the precipitate was free from ammonium thiocyanate. The precipitate was dried to constant weight at 110–120° C. and weighed as cuprous thiocyanate.

The results of determination of copper by this method using varying amounts of the metal and in presence of different concentrations of the acid recorded in Tables 1 and 2 respectively show that copper could be determined accurately by this method and the acid concentration is not critical.

TABLE I
Determination of copper as cuprous thiocyanate

Copper, mg.		Error %
Taken	Found	
63.70	63.55	-0.235
95.55	95.45	-0.104
126.80	126.70	+0.089
191.10	190.90	-0.104
254.80	254.40	-0.157
318.50	318.30	-0.063

Belcher and Nutten⁴ drew attention to the fact that the main source of error in solutions