LETTERS TO THE EDITOR

FADING OF C.W. SIGNALS AS A MEANS OF SPREAD-F STUDY

CONSIDERABLE evidence has accumulated in recent years[1-3] pointing out the identity of the Ionospheric irregularities causing Radio Star scintillations and spread-F phenomena, and their occurrence in extensive patches of considerable horizontal extent (up to 750 km.). In view of these facts it is to be naturally expected that these irregularities should affect C.W. transmissions through the disturbed F-region. It is interesting to know how far these effects can be utilized for the study of spread-F irregularities. With this end in view C.W. Signals on 11·717 Mc./s. from a regular commercial station Colombo (Ceylon) situated at about 1,300 km. south of this station (Waltair 17° 43′ N., 83° 18′ E.) were recorded at night using one Hallicrafters receiver type Sx-42 in combination with a conventional D.C. amplifier and Esterline-Angus pen recorder. These recordings were coupled with simultaneous observations of overhead Ionospheric condition by vertical pulse sounding equipment.

An index number in the range 0 to 10, as defined in an earlier communication[4] depending on the spread-F echo height range could be assigned for each of the overhead observations as a measure of the intensity of the irregularity. Pulse soundings were made on 6·4 Mc./s. which is found to be nearly the equivalent vertical incidence frequency corresponding to the single hop F reflection which is expected to be predominant for the C.W. transmission used. An exact evaluation of this equivalent frequency does not seem to be necessary as the sprread-F character (equatorial) does not vary much with 1 or 2 Mc./s. change. About 100 C.W. records were taken during the months of January to February 1959 at different times between 18·00 hrs. and 23·00 hrs. I.S.T. Of these some 46 are associated with calm local conditions ('O' index) and rest with different spread-F indices.

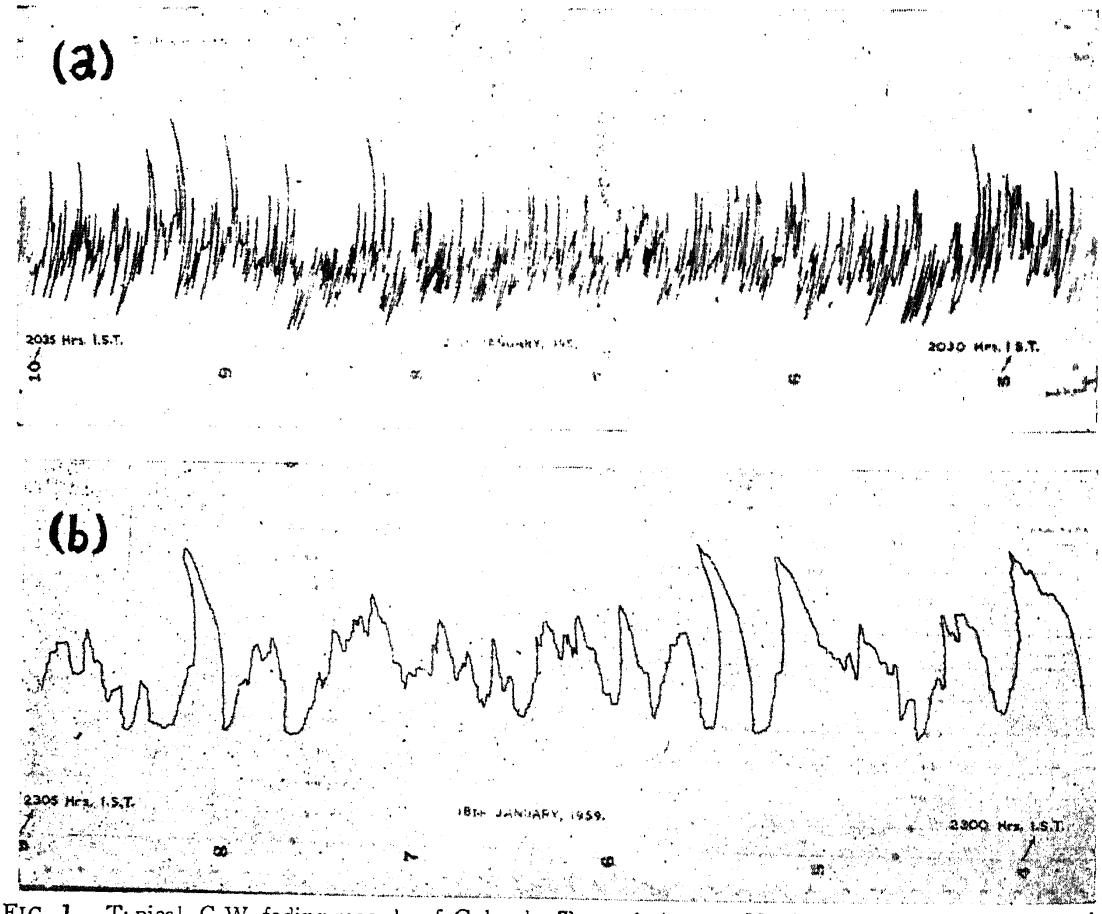

FIG. 1. Typical C.W. fading records of Colombo Transmissions on 11·717 Mc./s. received at Waltair. (*a*) Affected by spread-F; (*b*) Unaffected by spread-F.

A striking feature in all these records is a consistent increase in the fading rate whenever spread-F is observed locally. Fig. 1 (*a*) and (*b*) show typical fading records affected and unaffected by spread-F conditions. But there are at least 8 occassions in which fading rate remained high in spite of calm local conditions. This can be reconciled with the fact that spread-F occurs more frequently at points, south of this station, approaching geomagnetic equator. Fading rate for each C.W. record is obtained by counting the number of maxima occurring per minute. To keep consistency only fluctuations greater than 10% of the average fading amplitude were considered, an approach similar to that of Dagg[5] in connection with star scintillation analysis. As a preliminary study, all the overhead observations were classified into 5 groups with 0-2, 2-4, etc., spread-F indices. C.W. fading rates associated with these class ranges are averaged and shown in Table I. Peculiarly, this table does not indicate any systematic dependence of the fading rate on the spread-F index except that there is a three to four-fold increase during spread-F conditions as against calm conditions.

TABLE I

Sl. No.	Spread-F index range	Average rate of fading, peaks/min.
1	0– 2	13·9
2	2– 4	34·7
3	4– 6	44·8
4	6– 8	32·8
5	8–10	42·3

This result, as such, does not encourage the use of C.W. fading rate as a measure of the intensity of the irregularity, but suggests a possible time shift in the occurrences, of a certain intensity, at the overhead point and the effective region of the Ionosphere involved in the C.W. transmissions used. In order to verify this possibility continuous C.W. recording together with overhead pulse observations at closer intervals are being considered. One of the obvious causes of this time shift is the movement of the irregularities. If due account is taken of this time shift it seems likely that a fairly linear increase of the fading rate with increased spread-F activity may be obtained. Early results have already indicated this time shift. A complete investigation into this and other aspects of fading will be published elsewhere shortly.

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