GEOMAGNETIC DISTURBANCE EFFECT ON EQUATORIAL RADIO WAVE SCINTILLATIONS

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ABSTRACT

The effect of geomagnetic disturbance on the scintillations of radio beacons radiated from geostationary satellite ATS-6 at the equatorial stations Huancayo during 1974–75 and at Ootacamund during 75–76 is discussed. In western sector (Huancayo), with the increase of geomagnetic activity the scintillations on 140 as well as 360 MHz are decreased during the premidnight hours and increased during the post midnight and daytime hours. In the Indian sector (Ooty) the effect of geomagnetic activity during the winter months caused a decrease for most part of the night hours for any of the frequencies, *i.e.* 40 MHz, 140 MHz or 360 MHz. During the summer months the average night-time scintillations are small and hence the geomagnetic storm effects are small.

INTRODUCTION

EQUATORIAL radio scintillations were initially observed only during night-time and were considered due to the spread F[1]. It has been shown by Rastogi[2] that it is the range type of spread F showing absence of group retardation effects which are responsible for equatorial radio wave scintillations. Koster and Wright[3] showed that during low solar activity, scintillations showed little dependence on magnetic activity while during high sun spot activity there was marked negative correlation between the occurrences of scintillations and the degree of magnetic disturbances during any period of night.

Later Koster[4] showed that the day-time scintillations were relatively rare and mild at Legon and were not significantly related to magnetic activity.

In the American sector Mullen[5] found that the magnetic activity tends to increase scintillations during the June solstice and decrease the seasonal variations of scintillations in general.

In a detailed study on scintillations in different sectors by Aarons *et al*[6] indicated that in general (except for May, June and July in the 0–70° W sectors and in November, December and January in the 135–180° E sectors) premidnight scintillation is inhibited by magnetic activity. Post midnight increased magnetic activity increases scintillation activity under moderate solar flux conditions. Using a large set of data of scintillations of ATS-3 beacons at Huancayo Rastogi *et al*[7] had shown that during disturbed days the night-time scintillations were decreased during the premidnight hours and increased during post midnight hours for E and D months. During the J months, scintillations at Huancayo were very small and were basically disturbed time phenomena.

The provision of radio beacons 40 MHz, 140 MHz and 360 MHz from ATS-6 provided simultaneous

ATS-6 AT HUANCAYO

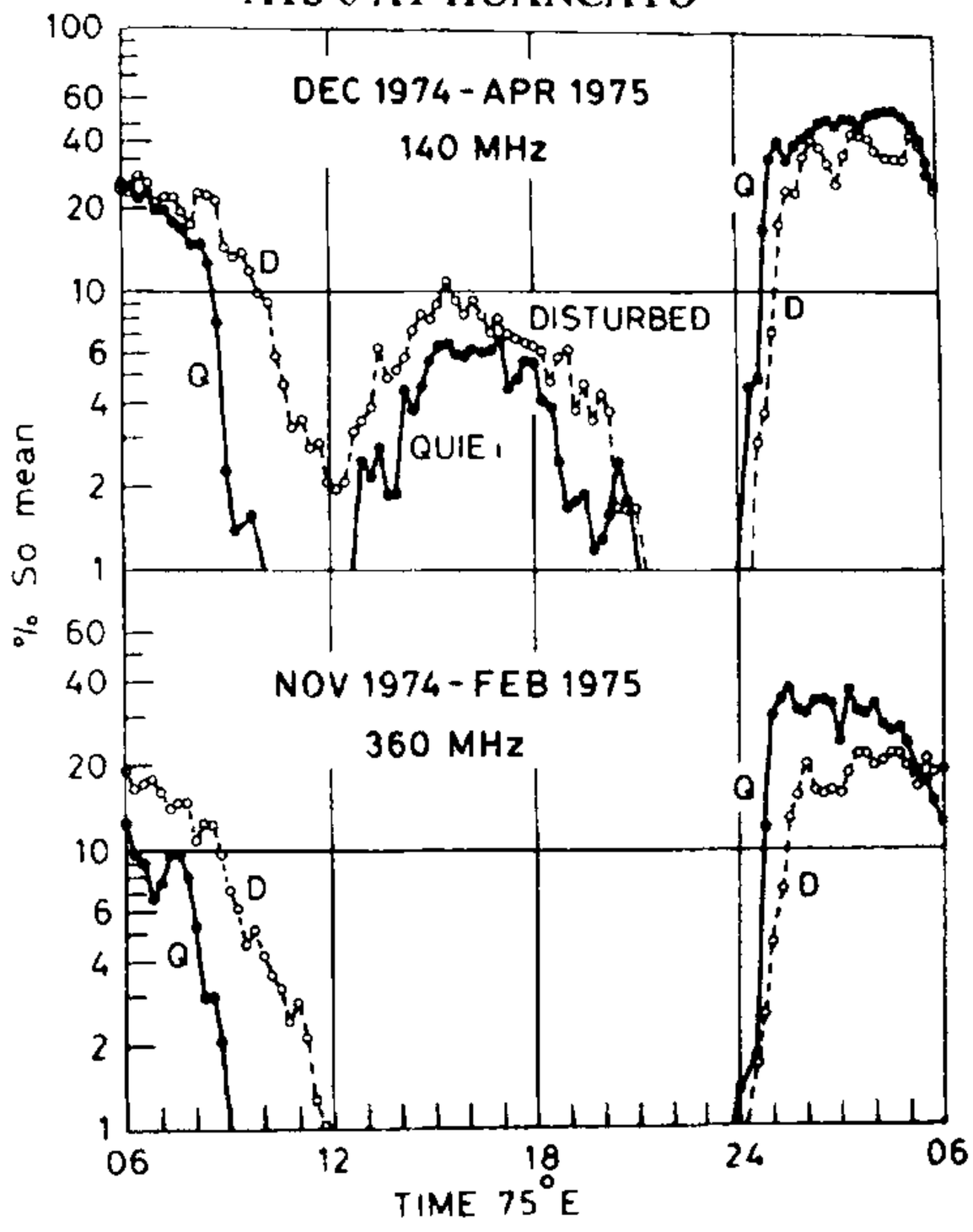

Figure 1. Average daily variations of scintillation index on 140 and 360 MHz from ATS-6 at Huancayo for quiet and disturbed days during 1974–75.

recording of equatorial multi-frequency scintillations at Huancayo during the first phase of the satellite operation and at Ootacamund during the second phase of its operation. The average characteristics of scintillations have been reported for Huancayo by Rastogi[8] and for Ootacamund by Rastogi *et al*[9]. The most significant differences at the two latitudes were the absence of 360 MHz scintillations at Huancayo and significantly large scintillations at Ootacamund during the day-time hours. The observations at Ootacamund covered a period of about ten months and it was felt necessary to examine the effect of geomagnetic disturbances on scintillations of these HF, VHF and UHF radio waves. Average scintillations were computed on 5 quietest and 5 most disturbed days of each month and the average diurnal variations were obtained, for the summer and winter months separately. The data for Huancayo were too small to make any seasonal grouping.

In figure 1 are plotted the average daily variations of scintillations on 140 and 360 MHz on disturbed and quiet days. The data on 40 MHz scintillations were too small for such analysis. It is seen that the mean scintillation index (So mean) for 140 MHz was about 40% (about 4 dB peak to peak) during night-time and less than 10% (1 dB peak to peak) during day-time. The mean scintillation index was lower on D than on Q days for the pre midnight hours, but was higher on D than on Q days for the post midnight and daytime hours. The scintillations on 360 MHz were present only during night time hours. The premidnight value of So(360 MHz) were lower on D than on Q days, while for post midnight hours So was larger on D than on Q days.

In figure 2 are plotted the average daily variation of So on different frequencies at Ootacamund averaged for Q and D days separately for the period October 75–January 76 and May 76 to August 76.

During the winter months (Oct 75–Jan 76) scintillations on any frequencies were higher at night time than during daytime and the proportionate change was higher for higher frequencies. During night-time, the disturbance seems to reduce scintillations on any of the frequencies. Unlike Huancayo, there is no increase of

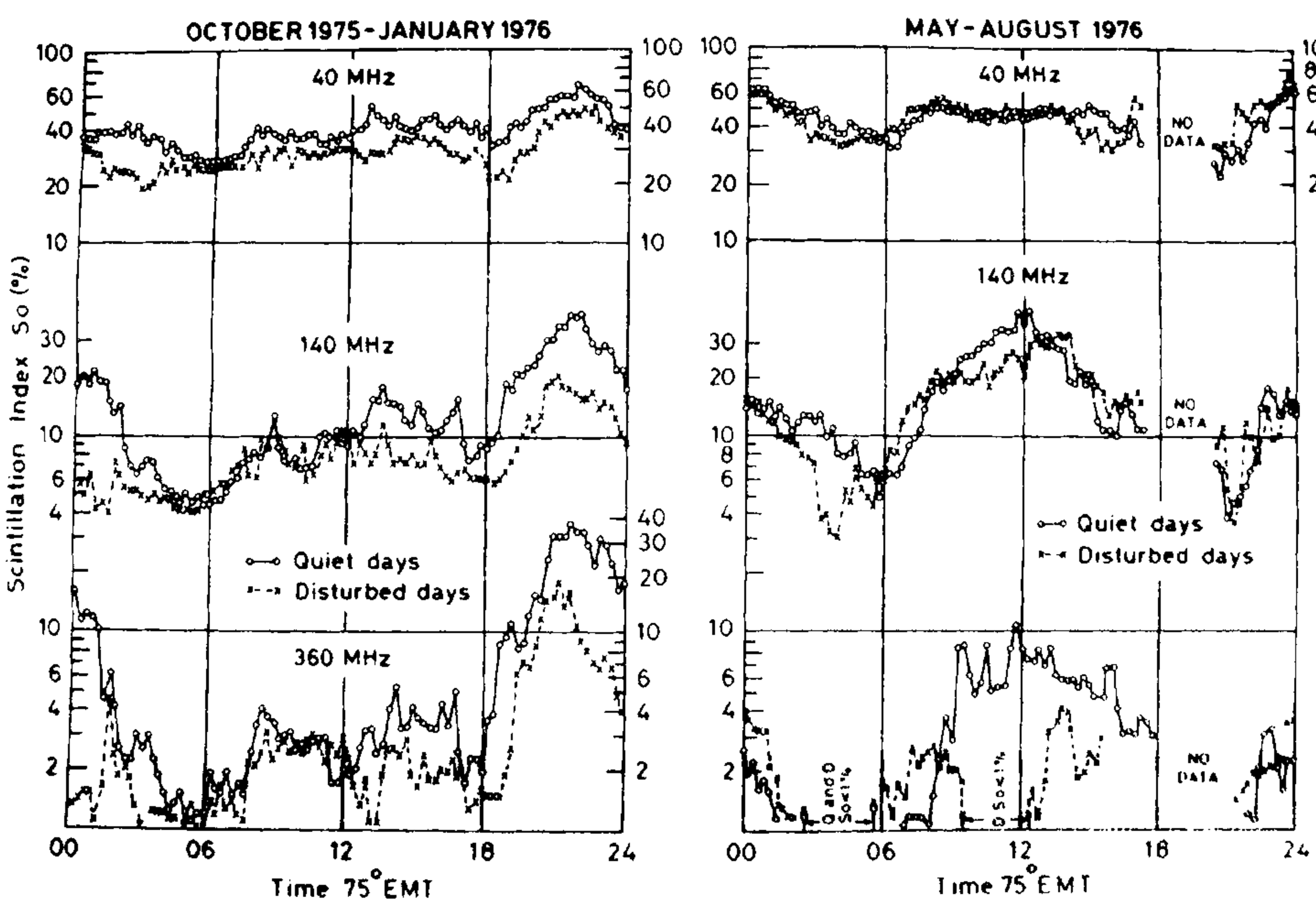

Figure 2. Average daily variations of scintillation index on 140 and 360 MHz from ATS-6 at Ootacamund for quiet and disturbed days during 1975—76.

scintillations in post midnight hours on disturbed days. Regarding the day-time hours, the scintillations on 40 MHz seem to be consistently lower on D than on Q days. The mean day-time scintillations on 140 and 360 MHz were small and there were no significant differences between scintillations on Q and D days for the prenoon hours, while during the postnoon hours, scintillations were lower on D than on Q days.

During May to Aug 1976, no significant differences were noticed between Q and D days average curves for 40 MHz. On 140 MHz too no significant effect of disturbance could be noticed except for noon hours when scintillations were smaller on D than Q days. On 360 MHz, scintillations were smaller on D than Q days during the day times and no significant effect during the night was observed.

In conclusion, the scintillations of radio waves in the equatorial region are generally suppressed on disturbed days except in the American longitudes during the post midnight hours when scintillations seem to increase on disturbed periods. The explanation should be sought in the different storm time effects on the equatorial spread *F* in the American and Indian sectors. This in turn could be due to different coupling processes of the polar substorms with equatorial ionosphere in the two longitude zones.

ACKNOWLEDGEMENTS

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NEWS

NEW TEA LEAF COLD TREATMENT TECHNOLOGY

The new technology worked out by Soviet specialists helps reduce the cycle of tea leaf treatment from 10–12 hours to one–two hours. It is based on freezing the tea leaf. Water in the cells freezes and the intracellular ice crystals, thus formed, destroy them easily.

During rapid thawing in special conditions, all the fermentation processes are started simultaneously and become controllable. Due to little time, undesirable reactions ruining the tea do not take place and, as a result, a fine beverage of better quality than the ordinary one is obtained. In order to impart tea-leaves their traditional sickle-shape form, characteristic of the good varieties, the defrosted tea is subjected to brief rolling. All the processes are conducted for a strictly fixed time and under special temperature.

The use of new technology fully rules out the stage of sun-curing (drying of green leaves to remove surplus water). The newly picked leaf is put straight into the refrigerator.

Experts have calculated that the introduction of new technology will produce a major economic effect. Besides, this method will, possibly, solve the problems of seasonal work for tea-packing plants—frozen green leaves can be preserved without fearing to ruin them and processed evenly. (*Soviet Features*, Vol. XXIV, No. 136, September 10, 1985).