J. Ind. Geophys. Union (July 2010)
Vol.14, No.3, pp.195-

Solar and geomagnetic activity control on equatorial VHF Scintillations in the Indian region

S.Banola, R.N.Maurya[1] and H.Chandra[1]
Indian Institute of Geomagnetism, Navi Mumbai- 410 218
Physical Research Laboratory, Ahmedabad- 380 009
E.mail :sbanola@iigs.iigm.res.in

ABSTRACT
A network of stations was operated monitoring amplitude scintillations of 244/251 MHz signal from FLEETSAT (73° E) in India for over a solar cycle. Latitudinal width of the equatorial belt of scintillation is higher during D-months and E-months compared to J-months. There is a positive correlation between the width of the belt and solar activity. Width of the belt decreases with magnetic activity. Equatorial scintillations are inhibited during magnetic disturbances with seasonal and solar cycle dependence. An analysis covering more than 200 geomagnetic storm events show scintillations at low latitudes can be either inhibited or triggered during storms depending on the phase of the storm and local time of occurrence.

INTRODUCTION

Radio waves traversing through the ionosphere suffer phase modulations due to the presence of ionization irregularities. The phase fluctuations give rise to the intensity fluctuations as the waves propagate to ground thereby forming a diffraction pattern. Temporal phase and intensity fluctuations are observed by a receiver at ground as the diffraction pattern formed moves past the receiver. This process is known as Scintillation. With the advent of satellites, radio beacon technique has been used extensively to study ionospheric irregularities through the scintillation effect (Koster 1966). The studies using signals from low orbiting as well as geostationary satellites have indicated that the equatorial scintillations are basically a nighttime phenomenon with maximum occurrence before midnight at all longitudes and are mainly associated with Spread-F irregularities (Mullen, 1973; Chandra and Rastogi, 1974, Chandra et al., 1979 **REFERENCE NOT SEEN IN THE LIST**) of the ionosphere. Aarons (1982) and Basu & Basu (1985) have reviewed scintillations at low latitudes.

India provides a unique geographical feature of covering latitudes right from magnetic equator to well beyond the anomaly crest region. A chain of about 20 stations monitoring amplitude scintillations on 244/251 MHz signal from the geostationary satellite FLEETSAT (73° E) was set up under the All India Coordinated Programme on Ionospheric and Thermospheric Studies (AICPITS) to study the features of scintillations at low latitudes. Three campaigns with joint data analysis workshops were conducted during March-April 1991, September-October 1991 and February-March 1993 (Chandra, Vyas & Rao 1993; Sushil Kumar, Singh & Chauhan 2000, Vijaykumar et al.,. 2007). In general scintillations were found to occur in a continuous patch lasting few hours or patches of longer time duration near the magnetic equator, while away from the magnetic equator the patches were of smaller duration. There was a systematic delay in the onset time of scintillation at stations away from the magnetic equator and based on this vertical rise velocity of plasma depletions was estimated. The half width of the belt of equatorial scintillations was estimated to be 15° in the pre-midnight and 6° in the post-midnight period during first campaign and 10° and 8.5° during the second campaign.

OBSERVATIONS AND DATA

Indian Institute of Geomagnetism operated a ground network of 14 stations monitoring amplitude scintillations on 244/ 251 MHz signal, transmitted by geostationary satellite FLEETSAT (73° E long.) in low-latitudinal region in Indian longitudinal sector for more than a solar cycle. The receiving system consists of a Yagi-Uda antenna, a super-heterodyne VHF receiver, an analog chart recorder and a PC based multi-channel digital data logger (deployed in later years at selected stations). To examine solar cycle and magnetic activity dependence, scintillation data at Trivandrum, Tirunelveli, Pondicherry, Karur, Mumbai and Ujjain for the period 1989-2000 are analyzed.