On the Equinoctial Asymmetry of Equatorial Spread F (ESF) Irregularities Over Indian Region Using Multi-instrument Observations in the Descending Phase of Solar Cycle-23

S. Sripathi[1], B. Kakad[1], A. K. Patra[2] and A. Bhattacharyya[1]
[1.] *Indian Institute of Geomagnetism, Navi Mumbai, India (Email: sripathi@iigs.iigm.res.in)*
[2.] *National Atmospheric Research Laboratory, Tirupati, India*

In this paper, we address the issue of equinoctial asymmetry in the equatorial spread F (ESF) irregularities over Indian region in the descending phase of solar cycle-23 using multi-instrument observations like (a) amplitude scintillations on GPS L-band signal obtained using network of GPS receivers under GAGAN project, (b) amplitude scintillation observations on VHF signal using spaced receivers at Tirunelveli (8.7^0N, 77.8^0E, Dip latitude: 0.6^0N) and (c) MST radar located at Tirupati/Gadanki (13.5^0N, 79.2^0E, Dip latitude: 6.3^0N). Occurrence of amplitude scintillations on the GPS L1 (1.575 GHz) signal recorded at several stations over India has been investigated using the strength of L-band scintillations. The latitudinal, longitudinal and temporal evolution of L-band scintillations suggests that scintillations occur predominantly during 20-23 LT over equatorial ionization anomaly (EIA) region. Further, the observations show that while L-band scintillations are more during both equinoxes than the solstices, as expected, importantly, the observations also reveal that there is an asymmetry in the occurrence of scintillations for these two equinox periods. We find that occurrence of L band scintillations is greater in the vernal equinox than in the autumn equinox. Further, the occurrence of scintillations is found to extend to higher latitudes in the vernal equinox than for the autumn equinox. The observations also indicate that occurrence of L-band scintillations is greater for 2004 than for 2005 with average annual mean sunspot number varying from 40 in 2004 to 30 in 2005. The new observation is that occurrence of L-band scintillations extending to the hours beyond 23:00 IST only for a narrow band of 70-90 days in the vernal equinox. In order to understand this aspect, we have analyzed the occurrence characteristics of maximum cross-correlation of intensity fluctuations ($\mathbf{C_I}$) obtained from the VHF spaced receivers observations. The observations suggest that the occurrence of $\mathbf{C_I}$ less than 0.5 during 19:00-22:00 IST is more dominant in the vernal equinox than in the autumn equinox period. It may be noted that rise in the height of plasma irregularities is found to be higher when $\mathbf{C_I}$ falls to less than 0.5. TIMED GUVI satellite retrieved peak electron density in the low latitude over Indian region during the same period also indicates that background electron density is higher during vernal equinox than autumn equinox period suggesting the role of background electron density in the equinoctial asymmetry in the occurrence of L-band scintillations. So, the results suggest that

background electron density and height of the F layer play a vital role in creating the equinoctial asymmetry in the occurrence of scintillations in addition to the meridional winds. Apart from this, attempts have also been made to study the scale size dependence of ESF irregularities on the scintillation activity.