A STUDY ON THE OCCOURANCE OF STRONG LATE NIGHT IONOSPHERIC SCINTILLATIONS AT LOWER ALTITUDES

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Abstract

The L-band scintillations are one of the important manifestations of plasma density irregularities in the post sunset equatorial F-region, commonly known as Equatorial Spread-F (ESF). It has gained its importance mainly because of its effect on the satellite to ground communication links. The occurrence of ESF depends primarily on Rayleigh–Taylor instability mechanism aided by seed perturbations and a verity of other favorable ionospheric background conditions. After sunset, ionospheric F-region will be raised to higher altitudes due to pre-reversal enhancement and the ESF is found to occur any time after the layer reaches sufficient heights of low collision frequency. This means that high altitudes are favorable for the occurrence of plasma irregularities. However, observations show that scintillations can occur even if the base height of ionosphere is as low as ~225 km, if the plasma density scale heights are favorable. Perhaps, strong scintillations are present at all heights from 225-300 km, for plasma density scale heights ranging from 20-30 km, in the current period of analysis. The present study investigates the reason behind the presence of such strong scintillations even at altitudes as low as ~225 km.

The data presented in this study is from a dip equatorial station Trivandrum (8.5^0 N, 77^0 E, 0.5^0 dip lat), India. Since the GPS satellites are moving, scintillation data is taken from Geostationary Satellites situated at 55° E and 83° E longitudes respectively. The data from equinoxial months of 2012 and 2013 are used for the current analysis. The base height (h'F), critical frequency of the F layer (foF_2) and ionospheric scale heights (L) are obtained from the Digisonde at Trivandrum. Our analysis shows that, strong scintillations are present just before midnight. This is partly due to modification of ionospheric scale height and due to the presence of higher electron densities during this period. The mechanism behind this increased electron densities are discussed in this study. It can be shown that this high electron density is not from any other source, but due to the compression of ionosphere as the layer descends in altitude after the pre-reversal enhancement. Further, the increase in critical frequency of F-region is not seen in GPS Total electron content (TEC) measurements, which corroborates with the argument. It can be also shown from the data that, the change in base height of F-region is proportional to the increase in foF_2. The study is important, as it give some information on how modification of background conditions can lead to strong ionospheric scintillations.