URSI-RCRS 2024, ARIES/GEHU, Bhimtal, India, 22 - 25 October, 2024

Long-term aspects of Satellite traces (STs) over an equatorial station using ionosonde observations

Gayathri B [(1)*], S Sripathi [(1)]
(1) Equatorial Geophysical Research Laboratory, Indian Institute of Geomagnetism, Tirunelveli, India
email: balamurugangayathri135@gmail.com/ ssripathi.iig@gmail.com

The equatorial plasma bubble (EPB) clusters or Equatorial spread F (ESF) patches can disrupt trans-ionospheric propagation. While several studies have been conducted to understand these EPBs, their short-term/day-to-day variability is still not well understood. The theoretical aspects of developing EPBs and associated irregularities have been studied over decades. It is commonly accepted that the generalized Rayleigh-Taylor (RT) instability is responsible for their generation, but the parameters that seed the RT instability are not yet well discussed. This instability depends on various factors, one of which is density seed perturbation at the bottom side of the F layer. This perturbation is due to multiple causes, one such observational evidence is Satellite traces (STs) in the equatorial ionograms. STs signify the formation of oblique echoes from the upwelling walls of the crests of large-scale wave structures (LSWS). Generally, a prominent precursor that affects plasma irregularities is the post-sunset vertical ExB drift, but that alone cannot drive the EPBs without the upwelling growth. In this paper, we examined the occurrence characteristics of STs with the evolution of EPBs during the descending phase of solar activity over Tirunelveli (8.7°N; 77.7°E; 1.7°N Dip Lat), which is located at the magnetic equator. STs are found to precede ESF development in most cases, where as in few cases, they occurred along with ESF and without ESF. We also examined the role of STs in ESF occurrence, considering yearly, seasonal, and local time variations. In addition to the ST signature, the effect of bottomside h'F in ESF occurrence for different seasons are discussed.These studies allow us to interpret ESF activity before its onset and highlight the importance of STs in the evolution of ESF, providing newer insights into the current understanding of the short-term prediction of EPBs.