VHF & L-band scintillation characteristics over an Indian Low latitude Station, Waltair (17.7°N, 83.3°E)

PVS Rama Rao*, K Niranjan, DSVVD Prasad, S Tulasi Ram and S Gopi Krishna
Space Physics Laboratories, Department of Physics, Andhra University, Visakhapatnam 530 003, India

Amplitude scintillation measurements made at VHF (FLEETSAT 73°E) and L-band (INMARSAT 65°E) frequencies using online digital data acquisition system during the year 2004 are used to study the characteristics of the low latitude ionospheric irregularities. The fading rates and the power spectral characteristics at the VHF (244 MHz) suggest that amplitude scintillations are due to two distinct types of irregularities, namely the Plasma Bubble Induced (PBI) irregularities with maximum occurrence during the pre-midnight hours of equinoctial and winter months and the Bottom Side Sinusoidal (BSS) type of irregularities which occur in the midnight to post-midnight sector with most probable occurrence during summer months. At the L-band (1.5 GHz), the scintillations are mostly confined to the pre-midnight hours due to PBI type of irregularities, with practically no occurrence during the post-midnight hours.

During the pre-midnight hours the amplitudes as well as the fading rates at the VHF are higher (S4 ≈ 0.6 – 0.8; fading rate ≈ 0.8 cycles/sec) than those at the L-band (S4 ≈ 0.3 – 0.5; fading rate ≈ 0.3 cycles/sec). Further, the Fresnel break frequency (f_B) and the slope (p) of the roll-off portion in the VHF scintillation power spectra are higher (f_B ≈ 1 – 3 Hz and p ≈ -4 to –7) indicating presence of various scale size irregularities within the Fresnel outer scale whereas at the L-band frequency although the spectra show similar characteristics, the break frequency as well as the slope are relatively lower (f_B ≈ 0.1 – 0.3 Hz and p ≈ -2.5 to -4).

The amplitude scintillations due to BSS type of irregularities, which are mostly observed during post-midnight hours of the summer months at the VHF signal show much reduced fading rates (< 0.1 cycles/sec) and power spectral slopes (p ≈ -2.5 to –3.5) with a shift in the break frequency towards the lower frequency end (f_B ≈ 0.06 – 0.1) of the spectrum. The presence of Fresnel oscillations on the linear roll-off portion in the power spectra suggests a reduced thickness in the size of the irregularity layer. The East-West zonal drifts of the irregularity patches indicate a consistent decrease in the drift velocities from pre-midnight to post-midnight hours.

The diurnal and seasonal occurrence patterns of the scintillations at the two frequencies show similar features with those of the Spread-F on Ionograms from a co-located digital Ionosonde and the GPS L-band scintillation data.

* Corresponding Author: palurirao@yahoo.com