Low latitude ionospheric scintillation and zonal plasma bubble drifts observation from a GPS scintillation monitoring system and closely spaced VHF receivers in Kenya.

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Abstract

In this study we have used VHF and a GPS monitoring receivers located in Kenya, to investigate the ionospheric scintillation and zonal drift irregularities of a few hundred meter-scale irregularities associated with equatorial plasma density bubbles. From simultaneous observations of amplitude scintillation at VHF and L-band frequencies, it is evident that the scintillation activity is higher during the post sunset hours of the equinoctial months than at the solstice. While it is noted that there is practically no signatures of the L-band scintillation in solstice months (June, July, December, January) and after midnight, VHF scintillation does occur in the solstice months and show post midnight activity through all the seasons. VHF scintillation is characterized by long duration of activity and slow fading that lasts till early morning hours (05:00 LT). Equinoctial asymmetry in scintillation occurs with higher occurrence in March-April than in September-October. The occurrence of post midnight VHF scintillation in this region is unusual and suggests some mechanisms for the formation of scintillation structure that might not be clearly understood. Zonal drift velocities of irregularities were measured using cross-correlation analysis with time series of the VHF scintillation structure from two closely spaced antennas. Statistical analyses of the distribution of zonal drift velocities after sunset hours indicate that the range of the velocities is 30 to 160 m/s. This is the first analysis of the zonal plasma drift velocity over this region. Based on these results we suggest that the east-west component of the plasma drift velocity may be related to the evolution of plasma bubble irregularities caused by the prereversal enhancement of the eastward electric fields. The equinoctial asymmetry of the drift velocities and scintillation could be attributed to the asymmetry of neutral winds in the thermosphere that drives the eastward electric fields.