L-BAND AND VHF RESPONSE TO SCINTILLATION ACTIVITY DURING THE ASCENDING PHASE OF SUNSPOT CYCLE 24 IN THE EQUATORIAL REGION OF EAST AFRICAN

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ABSTRACT

Ionospheric scintillation is the rapid change in the phase and or the amplitude of a radio signal as it passes through small scale plasma density irregularities in the ionosphere. These scintillations, not only can they reduce the accuracy of GPS/Satellite Based Augmentation System (SBAS) receiver pseudo-range and carrier phase measurement, but can also result in a complete loss of lock on a satellite. Most scintillations occur for a few hours after sunset during the ascending and peak years of the solar cycle. VHF and GPS-SCINDA receivers located both at Nairobi (36.8^{o} E, 1.3^{o} S) in Kenya and at Kampala (32.57^{o} E, 0.335^{o} N) in Uganda were used to investigate ionospheric scintillation and forecast scintillation of both kilometer scale and a few hundred meter-scale irregularities associated with equatorial ionospheric irregularities for the period 2011 and 2012. From simultaneous observations of amplitude scintillation at VHF and L-band frequencies, it was observed that the scintillation activity was higher during the hours of the equinoctial months than at the solstice. It was noted that there was practically some little signatures of the L-band scintillation in solstice months (June, July, December, January) before midnight. VHF scintillations occurred in the solstice months and show post-midnight activity in all the seasons. VHF scintillation was characterized by long duration of activity and slow fading that lasted till early morning hours (05:00 LT). The occurrence of post-midnight VHF scintillation in these regions was unusual and suggested some mechanisms for the formation of scintillation structure that might not be clearly understood. Furthermore, different percentage occurrence of scintillation in some months were observed, but found that weak scintillation ($(0.2 < S_4 \leq 0.4)$ was more dominant throughout the period. It was observed that the geomagnetic storms that occurred after midnight (0:00 LT) to the early morning hours in both 2011 and 2012 showed scintillation inhibition during the storm time while the intense scintillations were observed during nights before the storm and during the recovery periods of the storm. The occurrence of scintillations was more dominant in the equinox season than in the solstice season which had the same trend as the sunspot number. The suppression or enhancement of pre-midnight scintillations during magnetically disturbed and quiet periods was also observed and found to be seasonal and local time dependent. An attempt was made to develop a model of percentage occurrence of scintillations for the ascending phase of solar cycle using neural network and the modeled data for the occurrence of scintillations was found to match well with original data.