SCINDA-GPS derived TEC depletions and amplitude scintillations over Kisumu, Kenya during selected quiet and storm days of 2013 and 2014

Abstract.

Total Electron Content (TEC) depletion and amplitude scintillation (S4) can be derived from, SCINDA-GPS receivers situated in various parts of the equatorial region. In this paper we present results of characterization of TEC depletions and amplitude scintillations over Kisumu, Kenya (Geomagnetic coordinates: 9.64o S, 108.59o E; Geographic coordinates: 0.02o S, 34.6o E) for both selected geomagnetically quiet and geomagnetically disturbed conditions between 1st January 2013 and 31st December 2014 using data derived from the Kisumu NovAtel GSV4004B SCINDA-GPS receiver situated at Maseno University. TEC depletions and amplitude scintillations affect Global Positioning System (GPS) signals in the ionosphere as they propagate from the satellite to the receiver. This study aims to investigate day to day variability of TEC depletions and amplitude scintillations over Kisumu, Kenya during both geomagnetically quiet and geomagnetically disturbed days of 2013 and 2014 which was a high solar activity period for Solar Cycle 24. Seasonal variability of TEC depletions and S4 index is also presented. The Receiver Independent Exchange (RINEX) data for the years 2013 and 2014 was retrieved from the Kisumu SCINDA-GPS receiver, processed to obtain Vertical Total Electron Content (VTEC), S4 and Universal Time (UT) and fed into MATLAB to generate VTEC and S4 plots against UT for each selected quiet and storm day within the 2013 and 2014 period. The obtained results showed a diurnal variation of TEC where TEC was minimum at pre-sunrise, maximum during daytime and minimum during nighttime. The minimum TEC during pre-sunrise and nighttime was attributed to reduced solar intensity while maximum TEC during daytime is attributed to increased solar intensity. Most of the selected quiet and storm days of the years 2013 and 2014 showed TEC depletions and TEC enhancements corresponding with enhanced amplitude scintillations between 1800UT and 20:00UT. This might be attributed to the rapid rise of the F-layer and the increase in the vertical E x B plasma drift due to the Pre-reversal Enhancement (PRE) of the eastward electric field. Post-midnight TEC depletions and amplitude scintillations were observed for some days and this was attributed to the effect of zonal winds which brought post-midnight enhancement of the E x B drift. The percentage occurrence of amplitude scintillations for the selected quiet and storm days exhibited a seasonal dependence with equinoctial months having higher occurrences than the solstitial months. The higher average S4 index during equinoctial months might be attributed to increased solar intensity resulting from the close alignment of the solar terminator and the geomagnetic meridian.

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