

Quiet Time Correlation Between Geomagnetic Field Variations and the Dynamics of the East African Equatorial Ionosphere.(2017).

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Abstract

The equatorial ionosphere is highly dynamic and consequently poses serious threats to communication and navigation systems. As a result, proper understanding of ionospheric dynamics is important. The present paper presents the results of an investigation of the correlation between quiet time vertical total electron content (VTEC) and solar quiet variation in the horizontal component of geomagnetic field (Sq(H)) from low solar activity year (2009) to the high solar activity year (2014) within the equatorial East African sector using statistical analysis method. Values of Sq(H) were observed to increase steadily from around 0700LT attaining maximum values around 1100-1200LT, then descending towards zero level and beyond. The magnitudes of (VTEC) increase uniformly from around 0600-1000LT, then gradually, attaining maximum values around 1300-1500LT. The time instants of occurrence of these peaks are mainly controlled by drifts and photo-ionization. The correlation coefficients (ccs) between (VTEC) and Sq(H) were found to be strongest during the ascending phase (0600-1200LT), ranging from 0.69 to 0.98 at Addis Ababa and 0.61 to 0.97 at Nairobi. During the descending phase (1300-1800LT), ccs range from -0.28 to 0.89 at Addis Ababa and -0.06 to 0.76 at Nairobi. A high level of significance (99.98%) of ccs was obtained. The good linear relationship is attributed to the independent increase of the eastward electric field and photo-ionization on (VTEC) while poor relationship is possibly due to domination of photo-ionization over equatorial ionization anomaly (EIA) development. The annual ccs between (VTEC) and Sq(H) exhibit a general dependence on solar activity at Addis Ababa, closer to the dip equator, rather than at Nairobi during the ascending phase of the daytime. This observation suggests that the EEJ changes linearly with change in solar activity, thus streamlining the variations in TEC, through drifts, and Sq(H) by intensifying the eastward equatorial electric field.

Keywords Equatorial Electrojet, Equatorial Ionization Anomaly, Solar Quiet, Total Electron Content, Correlation

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12