

First observations of poleward large scale travelling ionospheric disturbances over the African sector during geomagnetic storm conditions

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This paper presents first observations of poleward travelling ionospheric disturbances (TIDs) during strong geomagnetic conditions over the African sector. By analysing different datasets we have observed both positive and negative ionospheric responses during the storm period of 08-10 March 2012. Considering the African region as a whole, three longitudinal sectors were strategically selected to establish the entire regional response. On both sides of the geomagnetic equator, results show poleward shift in peak TEC enhancements/depletions at different times which are associated to large scale TIDs. The observed phenomena are linked to the global ionospheric response and electrodynamics. The understanding has been established with the usage of global TEC maps, radio occultation electron density profile data, derived $E \times B$ drift measurements from magnetometer observations and regional ground-based and satellite data. Contrary to other related studies, generated regional TEC perturbation maps were not enough to show obvious directions of the large scale TIDs due to insufficient data over the northern hemispheric part of the African sector. There appears to be a switch between positive and negative storm phases during the same storm period, which when analysed in detail revealed that the positive storm phase corresponded to the expansion of the equatorial ionisation anomaly (EIA) towards some parts of mid-latitude regions, while the other part recorded a negative storm phase. Our results show that short-lived large scale TIDs are possibly launched by the equatorial electrojet (EEJ) while the EIA expansion contributes (through modulation) to the poleward propagation of the disturbances. Temporal variation of TEC perturbations on a storm day over the entire African sector showed the existence of large scale TIDs during the main and recovery phases which can travel poleward up to 20° latitude. The amplitudes of the TIDs have range ± 2 TECU, period of 2 hours and velocities of 250-990 m/s.