Abstract

In this paper we present characteristics of the ionosphere over eastern Africa region in response to two geomagnetic storms of March 2013 and March 2015 that occurred at the same date and time but with different intensities. Ionospheric TEC was derived from the IGS network of ground based dual-frequency GPS receivers from four stations, namely Eldoret (0.29^{o}N, 35.29^{o}E), Dodoma (6.19^{o}S, 35.75^{o}E), Malindi (2.99^{o}S, 40.19^{o}E) and Mtwara (10.26^{o}S, 40.17^{o}E) within the Eastern Africa region. GPS data were obtained from the UNAVCO website (http://www.unavco.org/). The GPS data were processed into TEC using the GPS-TEC processing software developed at Institute for Scientific Research, Boston College, U.S.A. by Gopi Krishna Seemala (http://seemala.blogspot.com). This software reads raw data, processes cycle slips in phase data, reads satellite biases, calculates receiver bias, and calculates the interchannel biases for different satellites in the receiver. In order to eliminate the effect that might be caused by multipath; elevation angle > 20° was used. The interplanetary magnetic field (IMF) Bz and corresponding Dst index, solar wind speed (Vsw) and density (Np) were used to represent the evolution of the storm events. Our results showed that, the behavior of the ionosphere over eastern Africa region during the two geomagnetic storms was similar. During both storms the main phases occurred on 17th of March. However, the main phase of the storm in 2015 had more intensity than that of 2013 but the same duration, and they were followed by a long-duration slow recovery with values that did not return to levels prior to the onset of the storm. The enhancement and reduction of TECv were observed at almost all stations at different times. Prompt penetration electric field (PPEF) is the main cause of the enhancement of TECv. This PPEF cause the upward stormtime drifts on the dayside and downward drifts on the nightside which results into the maximal uplift of the ionosphere around noon. Also, TECv reductions observed are caused by variations in the composition of the neutral atmosphere due to heating and upsurge of the lower atmosphere with its molecular-rich composition. The results from both storms also show that, there was a pre-reversal enhancement especially at stations that lie close to the equatorial region compared to the stations far from the equatorial region. This effect is an outcome of the interaction of the E and F region dynamos which results into an enhancement of the eastward electric field before it turns westward at dusk. The pre-reversal enhancement increases the vertical drift which makes the ionosphere to be lifted to higher altitude where the ratio of production to loss of electrons is greater and the transport of ions is dominant. The observations from the results also showed that, for both storms presented, the main phases were mostly intensified in the beginning of the day hours and continued during the daytime. This tendency might have been due to continuous feeding of energy into the ionosphere during the daytime when production is still predominant, leading to the elongated disturbances.