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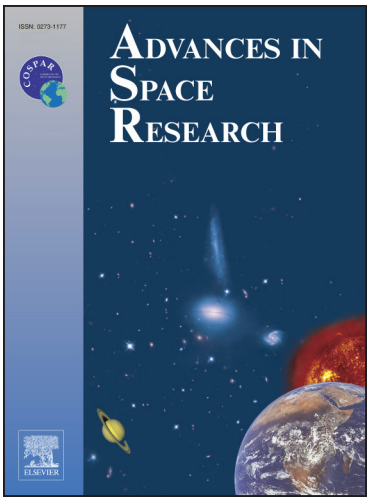

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Comparison of GPS-TEC measurements with NeQuick2 and IRI model predictions in the low latitude East African region during varying solar activity period (1998 and 2008-2015)

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Abstract: This paper examines the performances of NeQuick2, the latest available IRI-2016, IRI-2012 and IRI-2007 models in describing the monthly and seasonal mean total electron content (TEC) over the East African region. This is to gain insight into the success of the various model types and versions at characterizing the ionosphere within the equatorial ionization anomaly. TEC derived from five Global Positioning System (GPS) receivers installed at Addis Ababa (ADD, 5.33°N, 111.99°E Geog.), Asab (ASAB, 8.67°N, 116.44°E Geog.), Ambo (ABOO, 5.43°N, 111.05°E Geog.), Nairobi (RCMN, -4.48°N, 108.46°E Geog.) and Nazret (NAZR, 4.78°N, 112.43°E Geog.), are compared with the corresponding values computed using those models during varying solar activity period (1998 and 2008-2015). We found that different models describe the equatorial and anomaly region ionosphere best depending on solar cycle, season and geomagnetic activity levels. Our results show that IRI-2016 is the best model (compared to others in terms of discrepancy range) in estimating the monthly mean GPS-TEC at NAZR, ADD and RCMN stations except at ADD during 2008 and 2012. It is also found that IRI-2012 is the best model in estimating the monthly mean TEC at ABOO station in 2014. IRI show better agreement with observations during June solstice for all the years studied at ADD except in 2012 where NeQuick2 better performs. At NAZR, NeQuick2 better performs in estimating seasonal mean GPS-TEC during 2011, while IRI models are best during 2008-2009. Both NeQuick2 and IRI models underestimate measured TEC for all the seasons at ADD in 2010 but overestimate at NAZR in 2009 and RCMN in 2008. The periodic variations of experimental and modeled TEC have been compared with solar and geomagnetic indices at ABOO and ASAB in 2014 and results indicate that the F10.7 and sunspot number as indices of solar activity seriously affects the TEC variations with periods of 16-32 days followed by the geomagnetic activity on shorter timescales (roughly periods of less than 16 days). In this case, NeQuick2 derived TEC shows better agreement with a long term period variations of GPS-TEC, while IRI-2016 and IRI-2007 show better agreement with observations during short term periodic variations. This indicates that the dependence of NeQuick2 derived TEC on F10.7 is seasonal. Hence, we suggest that representation of geomagnetic activity indices is required for better performance over the low latitude region.

Keywords: Ionosphere, Total electron content (TEC), GPS-TEC, NeQuick2, IRI model, Solar and geomagnetic activity

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