

Comparison of GNSS-TEC and IRI-2012 TEC in different regions of Pakistan during the years (2015–2016)

This paper investigates the performance of International Reference Ionosphere (IRI-2012) model in estimating the variations of Vertical Total Electron Content (VTEC) in different regions of Pakistan during the descending phase of solar cycle 24 (2015–2016). The study has been accomplished by comparing the IRI-2012 model and measured VTEC deriving from permanent dual frequency Global Network Satellite System (GNSS) receivers at Islamabad (geographic latitude 33.74°N, longitude 73.16°E), Multan (geographic latitude 30.26°N, longitude 71.50°E) and Quetta (geographic latitude 30.20°N, longitude 67.02°E). We have analyzed the diurnal, monthly and seasonal variability in the measured VTEC and compared with IRI-2012 model VTEC. The highest peaks of the measured and model VTEC are observed during the April equinoctial month, whereas the lowest values are registered in December solstice month at each station. The diurnal variability of measured VTEC is found to be maximum at 06:00 – 12:00 UT and minimum nearly at 21:00 – 24:00 UT (02:00 – 05:00 LT). Moreover, maximal and minimal monthly mean measured VTEC for each station have also been observed in April and December, respectively. For equinoxes and winter solstices the highest and lowest seasonal mean measured VTEC are found, respectively. The model predictions generally follow the diurnal variability of the measured VTEC with minimum at predawn hours and maximum at noontime hours (06:00 – 09:00 UT). The measured and model monthly mean VTEC from each station are in good agreement during the equinoctial and winter solstice months. In the summer solstice months at Islamabad station, the measured monthly and seasonal VTEC are larger than the corresponding model VTEC by about 34% and 30%, respectively. Similarly, at Multan and Quetta stations, the summer solstice months have a difference in values between the measured and model VTEC about 27% and 25%, respectively. The large discrepancies are observed in diurnal model and measured VTEC during the equinoctial months for Islamabad station at the time interval 05:00 – 16:00 UT. The outcomes of this study might be helpful to understand the ionospheric dynamics and its effects on radio propagation on different regions of Pakistan.

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