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Ionospheric Plasma Anomaly Using GPS TEC Measurements Over Nepal

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Ionospheric concentration can be measured as the total electron content (TEC) i.e. the total number of electrons present per square meter along a path between a radio transmitter from a satellite and a receiver. The TEC data for this study are acquired from the UNAVCO GPS network, which is widely distributed across Nepal. The ionospheric TEC fluctuation is primarily influenced by terrestrial, geomagnetic, and solar activities. This talk covers such ionospheric variabilities using the GPS TEC measurements over Nepal [1]. The TEC data from 53 GPS stations from Nepal are extracted for the long period (19 years) from 2000 to 2019 to study the trend of the ionospheric variability over Nepal with the comparison study with other ionospheric models. We have also developed Artificial Neural Network (ANN) models to predict ionospheric behaviour over Nepal. We compared the ANN model with existing models IRI-2016 and NeQuick- 2 models and found good agreements with the IRI-2016 model than the NeQuick-2 model as illustrated in Figure 1.

Moreover, the ionospheric anomalies using the TEC data during solar eclipse as well as before and after the great Gorkha Earthquake in Nepal (28.23°N, 84.73°E) with a magnitude of 7.8 on April 25, 2015 have been analyzed. The eclipse-triggered consequences on TEC and hence metrological parameters in response to the solar eclipse in different eclipses have been investigated at different solar eclipse events [2]. Similarly, diurnal VTEC variations (blue solid line) from a station nearby earthquake epicentre, upper bound, (UB) (dot-dash blue line), Lower bound (LB) (dot-dash red line), and the vertical pink dashed line as earthquake day (o day) are shown in Figure 2. The arrows represent the anomalous TEC variation. A significant positive anomaly penetrating the upper boundary layer was seen on April 16th, 23rd, and 24th, which correspond to the ninth, second, and first days before the earthquake, respectively [3].

Keywords: Total electron content, Ionospheric anomaly, Superstorms, Earthquake.

References

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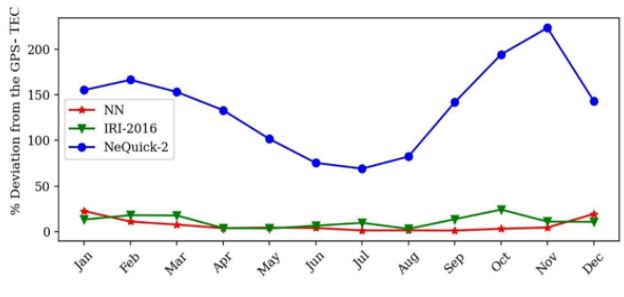

Figure 1. Percentage deviation of NeQuick, IRI-2016 and NN from GPS-TEC.

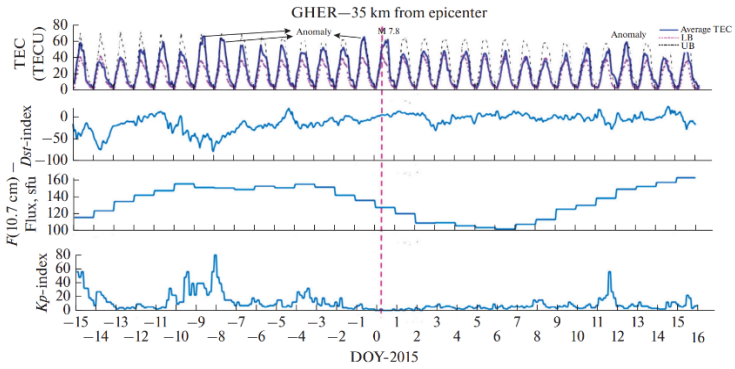

Figure 2. VTEC observed for the period of one month April 10 (-15) to May 11 (16),) 2015 from a station nearby epicenter of Gorkha Earthquake.