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Ionospheric Plasma Anomaly Using GPS TEC Measurements from Nepal

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Ionosphere is a part of upper atmosphere, where there are enough electrons and ions (plasma), which effectively interact with terrestrial and extra-terrestrial events [1]. The 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 satellite and receiver. The satellite signal delay recorded at GPS stations provides a means of estimating TEC of ionosphere.

In this work, TEC data are acquired from the UNAVCO, widely distributed GPS network over different places of Nepal. The ionospheric TEC fluctuation is primarily influenced by the terrestrial, geomagnetic and solar activities and this presentation covers such ionospheric variability using GPS TEC measurements [2]. To investigate the ionospheric responses with geomagnetic activities, the TEC will be correlated to various geomagnetic indices such as interplanetary magnetic field (Bz), disturbance storm time index (Dst), and auroral electrojet index (AE) during the superstorms events.

In order to examine the eclipse-triggered consequences on TEC in response to the annular solar eclipse, the different solar eclipse events are analyzed [3]. Figure 1 shows depletion of diurnal TEC at the four GPS stations from Nepal during the solar eclipse of 22 July 2009 and its comparison with mean TEC of top five quietest days of the month, July 2009. The Left panel shows the variation of vTEC for the whole eclipse day and the right panel shows the variation during between 00:00 to 02:00 UT, highlighting eclipse period. The region between the solid blue lines represents the eclipse hour, and the bold black solid line represents the maximum phase of the eclipse.

Likewise, the presentation also will effort to analyze ionospheric anomalies using TEC data prior to and after the great Gorkha Earthquake in Nepal (28.23°N, 84.73°E) with magnitude 7.8 on 25th April 2015. Figure 2 shows the 30 days TEC time-series observations with associated upper and lower bounds prior to and after to earthquake. TEC variations preceding Nepal earthquake started almost a few days before the event. A prominent positive (high) anomaly crossing upper boundary layer was observed on 2nd, 3rd, 14th, 16th, 17th and 24th prior to main shock (25th April 2015) and low TEC value was observed on 11th April prior to and on 29th April 2015 after to mainshock at CHLM GPS station located at 57.1 km distance from the epicentre.

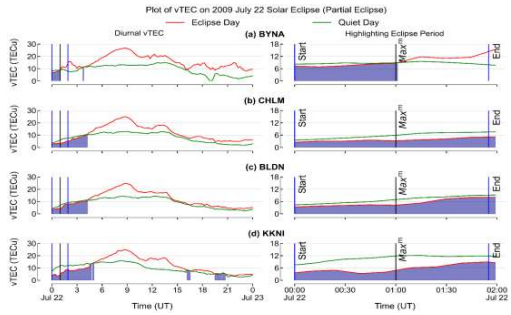

Figure 1: Depletion of diurnal TEC at the four GPS stations from Nepal during the solar eclipse of 22 July 2009 and its comparison with mean TEC of top five quietest days.

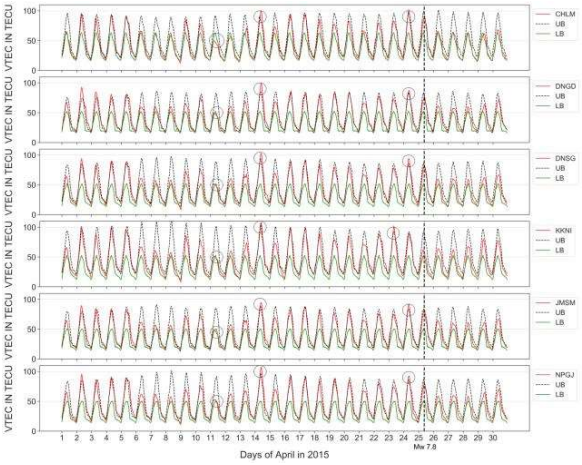

Figure. 2. VTEC values observed in the TEC unit for the period of one month computed from six stations from Nepal on April 2015. The circles represent the anomalous TEC variation. Anomalies are marked when TEC crosses upper and lower bounds.

References

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