Day-to-Day Variability and Spatio-Temporal Variation of GPS-Measured Total Electron Content its over Nigeria within Equatorial Ionospheric Anomaly Region

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We examined the day-to-day variability and spatial variations of the ionospheric Total Electron Content (TEC) over Nigeria, a country within the equatorial ionospheric anomaly region, using the GPS data obtained from 11 stations of the Nigeria GNSS Network (NIGNET) in the year 2012 during the ascending phase of solar activity (Eyelade et al., 2017). However, the day-to-day variability was investigated using data from only 5 stations and on selected quiet days only. At sunrise at about 07:00 LT, TEC decreases westwards across all the latitudes. Meanwhile, at about sunset (around 17:00 LT), TEC decreases eastward across all latitudes (Figure 1). This variability pattern is attributed to the time-related depreciation in the ionization due to the relative motion of the earth with respect to the position of the Sun. Daytime TEC value is found to be consistently weakest at sunrise and maximized in daytime at about local noon across all latitudes. Generally, daytime values of TEC are observed to be greater than the nighttime values.

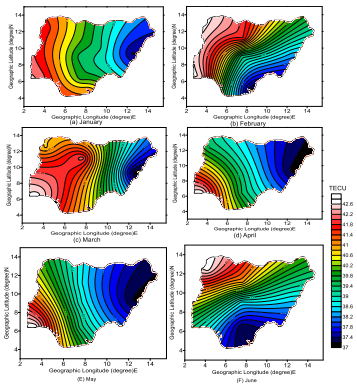

Figure 1: Spatial variation of TEC at 17:00LT (Sunset) in January to June as a function of Geographic latitude and Longitude.

Ayorinde at el., (2016) showed that day-to-day variability which is also called the inter hour variability is equivalent to the standard deviation of the TEC at a particular time t within the batch under consideration. Thus, the monthly day-to-day variability was quantified by taking the standard deviation of the minute values of the TEC at every month as follows:

$$Standard\ deviation \quad \sigma_t = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\{TEC_{t(i)} - \mu\}^2}\ ; \text{Where} \quad \mu = \frac{1}{n}\sum_{i=1}^{n}\Delta TEC_{t(i)} \qquad \ldots\ldots (1)$$

where i = 1, 2, 3 ……n and n is the number of quiet days in a month, $TEC_{t(i)}$ is the TEC values in the quiet days at every minute in a month, and μ is the mean of TEC values at a particular time "t".

The results of the day-to-day variability depicts the dynamism expected of a region within the equatorial ionospheric anomaly even on quiet days.

References

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