



An Estimation of Ionospheric Scintillation in S band using IGS stations

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The ionospheric disturbances affect the GNSS signals and may even cause loss of lock in the receiver in presence of strong storms. Due to powerful solar storm in early hours of 11th May 2024, severe ionospheric irregularities were observed on the ground.

ISRO has established two NavIC S band enabled IGS stations namely LCK4 (Lucknow) and PBR4 (Port Blair). Measurement data of IRNSS-1C (83°E) from these IGS stations is used here for the estimation of amplitude scintillation (S4) and vertical total electron count (VTEC). The amplitude scintillation (S4 index) is given as [1]:

$$S4 = \sqrt{\frac{\langle s_i^2 \rangle - \langle s_i \rangle^2}{\langle s_i \rangle^2}} \quad (1)$$

where, $\langle \rangle$ denotes average and s_i is the linear C/No of i th satellite.

The VTEC is mentioned as below [1,2]:

$$VTEC = \left(\frac{P_2 - P_1}{40.3} \right) \left(\frac{f_1^2 f_2^2}{f_1^2 - f_2^2} \right) (\cos \theta) \quad (2)$$

where, f_1 and f_2 are the frequencies of two GNSS signals (here, L5 and S band), P_1 and P_2 are the pseudoranges on these frequencies and θ is the zenith angle of the satellite.

The results are shown in the following plots.

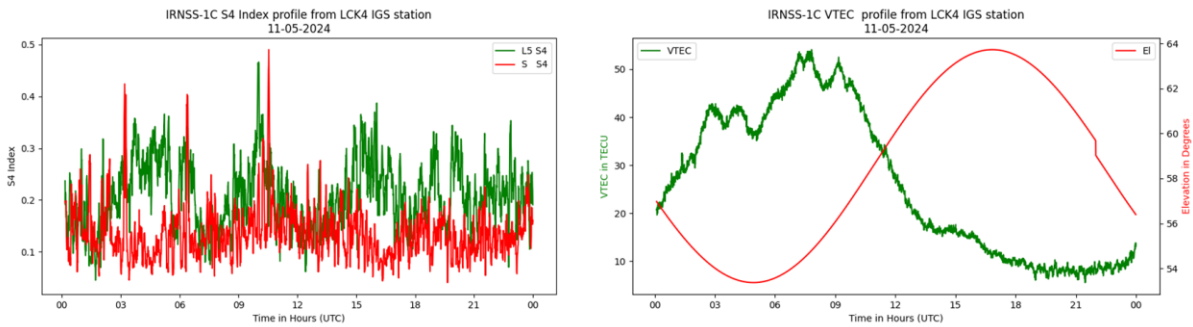


Figure 1. S4 index and VTEC count for LCK4 IGS station in NavIC L5 and S bands

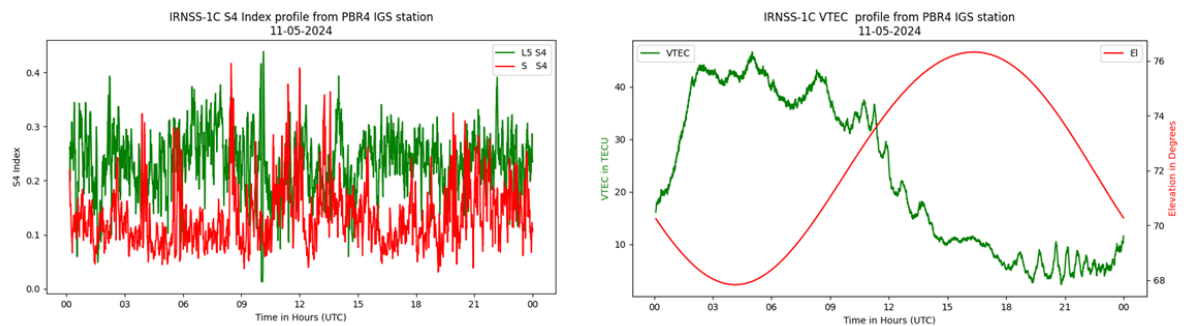


Figure 2. S4 index and VTEC count for PBR4 IGS station in NavIC L5 and S bands

Higher VTEC was observed in first half of the day due to impact of the solar storm. Long term analysis over ionospheric observations will be presented.

1. Norsuzila Ya'acob et al 2019 J. Phys.: Conf. Ser. 1152 012020, "Observation of Ionosphere Scintillation and Total Electron Content (TEC) Characteristic at Equatorial Region."
2. Jiuhou Lei et al 2007 AN AGU Journal, "Comparison of COSMIC ionospheric measurements with ground-based observations and model predictions: Preliminary results".