HAPEE, a statistical approach for scintillation prediction in the polar region

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Abstract: Through several studies, CNES, ONERA, NSC and NMA have sought to define a prediction model for ionospheric variations that can disturb e.g. GNSS-based systems. The studies have focused on the high-latitude region, with a particular focus on the auroral oval. A first model was proposed in 2014. The model was a simple empirical model driven by the Kp geomagnetic index, and where the main output was the instantaneous mean Rate-of-TEC Index (ROTI) value. The model was found to not be sufficiently reliable to be used as an operational prediction model. In 2019, an updated model is proposed, where the main inputs are now the solar wind parameters pressure (the solar wind pressure p) and B_z (the z component of the solar wind magnetic field). Moreover, a distribution of predicted ROTI or σ_φ index is provided instead of a mean value. Thus, the model allows estimating the percentage of time of occurrence for a level of ROTI (or σ_φ) to be exceeded in the next 5 minutes or 1 hour, or the exceeded ROTI (or σ_φ) for a corresponding percentage of time. This empirical approach is based on 10 years of GNSS/scintillation data collected by more than 15 GNSS stations in Norway.

Keywords: ionospheric scintillation, GNSS, L band, polar region, solar wind pressure, IMF B_z, ROTI, σ_φ