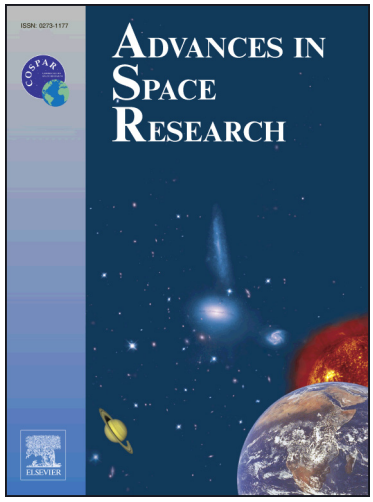

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A Fast Algorithm For Automatic Detection of Ionospheric Disturbances: DROT

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Abstract

Solar, geomagnetic, gravitational and seismic activities cause disturbances in the ionospheric region of upper atmosphere that may disrupt or lower the quality of space based communication, navigation and positioning system signals. These disturbances can be categorized with respect to their amplitude, duration and frequency. Typically in the literature, ionospheric disturbances are investigated with gradient based methods on Total Electron Content (TEC) data estimated from ground based dual frequency Global Positioning System (GPS) receivers. In this study, a fast algorithm is developed for the automatic detection of the variability in Slant TEC (STEC) data. STEC is defined as the total number of electrons on the ray path between the ground based receiver and GPS satellite in the orbital height of 20,000 km. The developed method, namely, Differential Rate Of TEC (DROT), is based on Rate of Tec (ROT) method. ROT is widely used in the literature and it is usually applied to Vertical TEC (VTEC) that corresponds to the projection of STEC to the vertical direction along the ray path at the Ionospheric Pierce Point (IPP) using a mapping function. The developed DROT method can be defined as the normalized metric norm between the ROT and its baseband trend structure. In this study, the performance of DROT is determined using synthetic data with variable bounds on the parameter set of amplitude, frequency and duration of disturbance. It is observed that DROT method can detect disturbances in three categories. For DROT values less than 50%, there is no significant disturbance in STEC data. For DROT values between

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