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Monitoring and forecasting Regional Ionospheric perturbations over Australia based on GNSS techniques.

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Ionospheric storms have the capability to cause serious propagation errors in modern radio systems such as Global Navigation Satellite Systems (GNSS). Thus near real time detection and forecasting of ionospheric storms is helpful to estimate potential degradation of the performance of these systems.
In this paper, a new Australian Regional Ionospheric Disturbance Index (AusRDI) is introduced based on a regional dynamic approach. The Spherical Cap Harmonic Analysis (SCHA) method was firstly used to estimate Total Electron Content (TEC) at evenly distributed grid points from GPS data collected from the Australian Regional GPS Network (ARGN). The SCHA model is based on longitudinal expansion in Fourier series and fractional Legendre co-latitudinal functions over a spherical cap-like region including the Australian continent. This harmonic expansion requires fewer coefficients to represent the fine structure of regional ionospheric features and may be adapted to take advantage of regions of densely distributed observations in order to observe and model ionospheric dynamics over Australia on a range of spatial scales. Principal Component Analysis (PCA) was then used to decompose the TEC dataset into a series of orthogonal Eigenfunctions (EOF base functions) and associated coefficients. PCA is non parametric and as such does not utilize deviation from a previously described average to determine perturbations.
The new disturbance index provides an objective measure of ionospheric perturbation processes. Furthermore the index is predictable using early space weather information.
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