Spatial Fluctuation of TEC Index: A new index of ionospheric irregularities

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This study presents a new spatial fluctuation of total electron content (TEC) index (SFTI) to identify and analyze ionospheric irregularities. SFTI is defined as the dispersion of vertical TEC (VTEC) within a specific area at a given time. With the data from the Global Navigation Satellite System (GNSS) Earth Observation Network of Japan (GEONET), the size of the specific area for SFTI calculation can be chosen as 0.8˚× 0.8˚ in longitude and latitude. An SFTI map generated by sliding window shows the spatial variation of the ionospheric irregularities in two dimensions. It can be used to obtain the size, shape, orientation and intensity distribution of the irregularity structures. With a series of SFTI maps, we analyzed three strong irregularity events on 12 February 2000, 20 March 2001 and 10 November 2004. The irregularities are found to consist of branching structures, which are anisotropic and elongate along longitudinal direction when first seen at low latitudes. The structures can drift and eventually move perpendicular to their orientations. It is concluded that SFTI will provide an unprecedented view of irregularity development and help to understand the process of irregularity generation.

Keywords: ionospheric irregularities, GNSS observation, SFTI

