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Isolated ionospheric disturbances as deduced from global GPS network

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Abstract

We investigate an unusual class of medium-scale traveling ionospheric disturbances (MS TIDs) of the nonwave type, isolated ionospheric disturbances (IIDs) that manifest themselves in total electron content (TEC) variations in the form of single aperiodic negative TEC disturbances of a duration of about 10 min (the total electron content spikes, TECS). For the first time, we present the TECS morphology for 170 days with a different level of geomagnetic activity and with the number of stations of the global GPS network ranging from 4 to 240. A total number of the TEC series (radio paths) used in the analysis, corresponding to the observation along a single receiver-satellite Line-of-Sight (LOS), with a duration of each series of about 2.3 hours, exceeded 850000. The data were obtained using the technology of global detection and monitoring of ionospheric disturbances (GLOBDET, developed at the ISTP SB RAS) of a natural and technogenic origin using measurements of TEC variations from a global network of receivers of the GPS. It was found that TECS are observed in no more than 1-2% of the total number of radio paths. We present the results derived from analyzing the dependence of TECS parameters on the local time, and on the level of geomagnetic activity. The TECS amplitude exceeds at least one order of magnitude the TEC fluctuation intensity under "background" conditions. The IID-induced TEC variations are similar in their amplitude, form and duration to the TEC response to shock-acoustic waves (SAW) generated during rocket launchings and earthquakes. However, the IID propagation velocity is less than the SAW velocity (800-1000 m/s) and are most likely to correspond to the velocity of background medium-scale acoustic-gravity waves (AGW), on the order of 100-200 m/s.