

Monitoring global ionospheric structures using a near real-time Global Ionospheric Map

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To efficiently monitor the fast changing ionospheric weather events, such as magnetic storms, solar flares, solar eclipses, earthquake precursors, etc., a near real-time (4-hour delay) Taiwan Global Ionospheric Map (TGIM) is constructed from global vertical total electron content (TEC) observations using a spherical harmonics expansion. The TEC is measured by about 120 ground-based GPS stations and FORMOSAT-3/COSMIC. The high correlation (correlation coefficients > 0.95) of the TGIM and the CODE and JPL GIMs suggests that the TGIM show global scale ionospheric structures as well as the other two GIMs. The high temporal resolution of the TGIM (5 to 15 minutes) reveals that it is capable of showing the variation in ionospheric density structures in more detail. Here we also examine a severe geomagnetic storm, which is the largest during the weak solar cycle 24, occurred on 17 March 2015 at 0445 UT, using the GIMs. The results show the positive storm is pronounced at mid- and low-latitudes in the first day after the storm onset. The negative storm remains present in the equatorial ionization anomaly crest regions more than one week. The sudden change in TEC at middle and low latitudes during the main phase period maybe associated with the equatorward disturbance wind and the prompt penetration electric field.

Keywords: Ionospheric weather, Global ionospheric map, FORMOSAT-3/COSMIC, GPS TEC