

Ionospheric disturbances after the 2011 off the Pacific coast of Tohoku Earthquake studied with 1-Hz sampling GPS data

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Ionospheric disturbances after the 2011 off the Pacific coast of Tohoku Earthquake were studied in detail with 1-Hz sampling GPS-TEC data. The post-seismic ionospheric disturbances have been observed by GPS-TEC, HF Doppler Radar, and ionosondes. Tsugawa et al. [2011] analyzed 30-sec sampling TEC data and found concentric waves which propagated in the radial direction with a velocity of 100m/s - 3.5 km/s. The wave with the velocity of 3.5 km/s had a period of around five minutes. Ogawa et al. [2012] analyzed data of the HF Doppler radar in Hokkaido. They found an ionospheric disturbance which propagated with a velocity of 6.7 km/s. The period of the disturbance was about 2 minutes. Maruyama et al. [2011] investigated ionosonde data in Japan and suggested that the disturbance propagated around 7 km/s. The ionospheric disturbance with a large velocity (e.g., 6 - 7 km/s) has not found in GPS-TEC data. One of the reasons that the high-velocity disturbances with a short period was not detected by GPS-TEC data would be its sampling rate, that is, 30 second sampling. In this study, we utilized 1-Hz sampling TEC data in order to study the short-period disturbances. We used about 1200 stations data which are operated by the Geospatial Information Authority of Japan. We applied high-pass filters with a window of 2 - 10 minutes and detected short period waves. Comparing the data of HF Doppler radar and ionosonde, we found that the short period disturbance was not observed in the high-pass TEC data. This suggests that the fast waves could not propagated to the F-peak altitude because of its large damping rate. Only HF Doppler Radar and ionosonde, which observe bottom-side of F-layer could observe the short period waves.

Keywords: post-seismic ionospheric disturbance, total electron content, 1 second sampling, GEONET