Spatial and Temporal Characteristics of the Pre-Seismic Ionospheric Anomaly over Japan: Case study for the 2011 Off the Pacific Coast of Tohoku Earthquake (Mw9.0) and statistical study

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The ionospheric anomalies possibly associated with large earthquakes have been reported by many researchers. In this paper, Total Electron Content (TEC), Ionosonde, and tomography analyses have been applied to investigate the spatial and temporal anomalies of ionospheric electron density prior to the 2011 Off the Pacific Coast of Tohoku earthquake (Mw9.0). Results show significant TEC enhancements and an interesting three dimensional structure prior to the main shock. As for temporal TEC changes, the TEC value increases 3-4 days before the earthquake remarkably, when the geomagnetic condition was relatively quiet. In addition, the abnormal TEC enhancement area in space was stalled above Japan during the period. Tomographic results show that three dimensional distribution of electron density decreases around 250 km altitude above the epicenter (peak is located just the east-region of the epicenter) and increases the mostly entire region between 300 and 400 km. Details and statistical tendency will be also shown in our presentation. In this research, we have investigated the positive and negative Ionospheric anomalies before and after large earthquakes and around geomagnetic storm days. First of all, we have done some statistical analysis that covers of 53 earthquakes with M≥6 during 2000 and 2013. The results indicate that 28/53 had presented anomalous behaviour and of 8/28 have been observed with 10 hours continuous TEC anomaly. Then, we have performed tomographic analysis to discriminate differences in space and time between for earthquake-related anomalies and for disturbances due to geomagnetic storms.

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