

3-D tomographic approach to investigate the ionospheric disturbance prior to the 2011 Tohoku Earthquake

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In this paper, neural network based tomography using GEONET data has been performed to investigate the fine structure possibly associated with the 2011 off the Pacific coast of Tohoku Earthquake (Mw9.0). Although the possible ionospheric anomalies preceding large earthquakes have been reported by many researchers, a physical mechanism of the anomalies has not been clarified yet. To understand the mechanism, monitoring of three-dimensional distributions of ionospheric electron density is considered to be effective.

At first, the Total Electron Content (TEC) anomaly associated with the earthquake using the Global Ionosphere Maps (GIM) published by the Center for Orbit Determination in Europe (CODE) has been investigated. To detect the anomalous TEC changes, the normalized GIM-TEC (GIM-TEC*), which is computed based on 15 days backward running mean of GIM-TEC, have been investigated. As for the 2011 off the Pacific coast of Tohoku Earthquake, the significant enhancements are found in GIM-TEC investigation, 1, 3-4 days prior to the earthquake. Especially, TEC increase of 3 days prior to the earthquake was remarkable. Then the tomography has been performed. As a result, the reconstructed distribution of electron density was enhanced around F-region in comparison with 15 days backward median distribution, the region was found to be located over the epicenter and extended farther southward. Additionally, we found the enhanced region at lower ionosphere over the Japan Sea and it seems to be developed toward the upper ionosphere along with magnetic field lines. In our presentation, the difference in the character of pre-seismic disturbance and other periods will be shown.