

Neural Network based tomographic analysis of ionospheric disturbance associated with Tohoku earthquake

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The ionospheric anomalies possibly associated with large earthquakes have been reported by many researchers. However a physical mechanism of pre-seismic ionospheric anomalies has not been clarified. To understand the mechanism, monitoring of three-dimensional structures of pre-seismic ionospheric disturbance is considered to be effective. In this paper, neural network based tomography [1] using GEONET and ionosonde data has been performed to investigate the fine structure possibly associated with the 2011 off the pacific coast of Tohoku Earthquake (Mw9.0).

At first, we investigate the Total Electron Content (TEC) anomaly associated with the earthquake using GEONET data. To detect the anomalous TEC change, the normalized TEC (TEC*), which is computed based on 15 days backward running mean of TEC data, have been investigated. As for the 2011 off the Pacific coast of Tohoku Earthquake, the significant enhancements are found in 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 in sub-ionosphere to over F-region in comparison with 15 days backward median distribution. Moreover the enhanced area is seems to be developed to upper ionosphere from sub-ionosphere with time. The tomographic results suggest the existence of some energy influx from the surface associated with seismic activity. Details will be shown in our presentation.

References

- [1.] Hirooka, S., Hattori, K., and Takeda, T., Numerical Validations of Neural-Network-based Ionospheric Tomography for Disturbed Ionospheric Conditions and Sparse Data, RADIO SCIENCE, VOL. 46, RS0F05, 13 PP., 2011