

Three-dimensional structure analysis of ionospheric anomalies associated with large 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 distributions of ionospheric electron density is considered to be effective.

In this study, to investigate the three-dimensional structure of ionospheric electron density prior to large earthquake, the Neural Network based tomographic approach is adapted to GEONET and ionosonde data.

In the case of the 2011 Off the Pacific Coast of Tohoku Earthquake (Mw9.0), the significant enhancements are found in Total Electron Content (TEC) investigation, 1, 3-4 days prior to the earthquake. Especially, TEC increase of 3 days prior to the earthquake was remarkable. As a result of tomographic analysis, 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 was seems to be developed to upper ionosphere from sub-ionosphere with time. The rise velocity along magnetic field line was approximately 70 m/s. The tomographic results suggest the existence of some energy influx from the surface associated with seismic activity. Then, in order to understand the relationship of detected phenomenon and earthquake, we performed the tomographic analysis for other earthquakes occurred in Japan. Details will be shown in the presentation.

Keywords: Pre-seismic ionospheric anomaly, Ionospheric tomography, GPS