3D analysis of Ionospheric anomalies preceding large earthquakes in Japan: tomographic approach

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Many anomalous electromagnetic phenomena possibly associated with large earthquakes have been reported. TEC (Total Electron Contents) anomaly is one of the most promising phenomena preceding large earthquakes. We investigated statistically TEC anomalies before large earthquakes around Japan region during 1998-2010 the 2011 off the Pacific coast of Tohoku Earthquake. We found that that positive anomalies significantly appear 1-5 days before M>=6.0 earthquakes in Japan area.

To understand the mechanism, monitoring of 3D 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 for the 2011 Off the Pacific Coast of Tohoku Earthquake (Mw9.0) and other earthquake which investigated in above statistical analysis. As for the M9 Tohoku earthquake, the reconstructed distribution of electron density decreases just below the F-region and was enhanced over F-region in comparison with 15 days backward median distribution. Moreover the enhanced area seems to be developed to upper ionosphere from sub-ionosphere with time. Similar precursor tendency is found for the earthquake with longer duration of GIM-TEC anomalies. These tomographic results suggest the existence of additive horizontal electric field of eastward, which is possibly related to the seismic activity. The details will be shown in the presentation.