

Variations of ionospheric total electron content associated with large earthquakes

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Many anomalous electromagnetic phenomena possibly associated with large earthquakes have been reported. One of the most frequent studies among them is to investigate the relationship between ionospheric disturbances and earthquake activity. Recent researchers found apparent reductions in the ionospheric total electron content (TEC) within 1 - 5 days prior to M 5.0- earthquakes in Taiwan, as exemplified by the 1999 Chi-Chi earthquake (Mw7.6) and Chia-Yi earthquake (ML6.4). However, these studies did not consider the simultaneous data sets from other sites outside of Taiwan. In this study, we investigate whether the anomalies observed during these earthquakes were local or global phenomena using TEC data observed by ground-based GPS receivers and NmF2 data obtained from ionosondes in Taiwan and Japan. We also used the global ionosphere maps (GIM) published by the Center for Orbit Determination in Europe (CODE) in order to detect anomalies in various locations throughout the globe. In this result, we have found that the anomaly four days before the Chi-Chi earthquake was global phenomenon induced by the geomagnetic disturbance. However, we have recognized three anomalies to be local phenomena. They occurred (1) three days before the Chi-Chi earthquake, (2) one day before the Chia-Yi earthquake, and (3) three days before the Chia-Yi earthquake. For all of these three anomalies, the ionospheric-disturbed areas were localized around Taiwan, and did not spread all the way to Tokyo. The disturbed areas were within a 2200 km radius and seem to be much smaller. These results suggest that possible ionospheric disturbances preceding large earthquakes exist after removing global changes. We have applied the constructed algorithm to the 2004 - 2007 Sumatra earthquakes and the 2007 off-shore mid-Niigata Earthquake. We will show the result in the presentation.