

Early warning system with GPS-TEC observation

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Traveling ionospheric disturbances generated by an epicentral ground/sea surface motion, ionospheric disturbances associated with Rayleigh-waves as well as post-seismic 4-minute monophasic atmospheric resonances and other-period atmospheric oscillations have been observed in large earthquakes. In addition, a giant tsunami after the subduction earthquake produces an ionospheric hole which is widely a sudden depletion of ionospheric total electron content (TEC) in the hundred kilometer scale and lasts for a few tens of minutes. The tsunamigenic ionospheric hole detected by the TEC measurement with Global Position System (GPS) was found only in huge subduction earthquakes. This occurs because plasma is descending at the lower thermosphere where the recombination of ions and electrons is high through the meter-scale downwelling of sea surface at the tsunami source area, and is highly depleted due to the chemical processes. The results imply that magnitude of the tsunamigenic ionospheric hole is related to that of the tsunami. It means that we can directly observe the tsunami several minutes after the subduction earthquake occurs.

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