

## Is an ionospheric electron enhancement preceding the earthquakes a precursor?

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Heki [2011] reported that the TEC gradually enhanced from 40 minutes before the 2011 M9.0 off the Pacific coast of Tohoku earthquake (Tohoku EQ) to the time when the co-seismic acoustic wave reached the ionosphere and the TEC immediately recovered at the normal state. This paper shows an alternative interpretation of total electron content (TEC) variation in the ionosphere associated with the Tohoku EQ. Our interpretation is that a tsunamigenic ionospheric hole, a wide depletion of the TEC, occurred after the co-seismic acoustic wave reached the ionosphere and gradually recovered at the normal state with several tens of minutes [Kakinami et al., 2012]. The difference between Heki [2011] and Kakinami et al. [2012] is attributed to the reference curves of the TEC to extract the ionospheric variations. The former is given by the least-squares fitting curve of the EQ day data excluding an expected precursor period, while the latter is given by the data of the similar orbit of global positioning system (GPS) satellite on another day. The results strongly suggest that variation of slant TEC is explained by the depletion of TEC due to tsunami rather than the precursory enhancement.

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