

Excitation of 3.9 mHz periodic ionospheric variations by acoustic wave following the large earthquakes

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We report the excitation of the ionospheric variations by the large earthquakes. Using ground-based GPS TEC measurements we detected that three large earthquakes, the Mw 9.3 on December 26, 2004 off the west coast of northern Sumatra, the Mw 8.6 on March 28, 2005 northern Sumatra, and the Mw 8.5 on September 12, 2007 southern Sumatra, induced the variations of ionosphere. The observational results for these three earthquake events showed that the intense TEC variations occur after the large earthquakes and the four-minute TEC variation follows them and continues for more than one hour. The periodicity of the four-minute TEC variations has a peak around 3.9 mHz. The four-minute TEC variation could be generated by the earthquake-induced acoustic waves that propagated upward to the ionosphere. We propose that the uplift along the fault zone in the trench line plays an important role to generate the acoustic resonances in the atmosphere, and then the acoustic resonance controls the four-minute TEC variation for long time. The long durations for more than one hour of the four-minute TEC variation could be induced by the acoustic resonances between the ground surface and the bottom thermosphere. The four-minute periodic TEC variation was observed in a limited area whose size was less than 1,200 km around the epicenter. This is consistent with the limitation of acoustic wave propagation in the atmosphere. The detail of mechanism of the earthquake-generated periodic TEC variation will be discussed on the presentation.