Observation and simulation of propagation of coseismic infrasound to the ionosphere

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Vertical motion of the ground surface caused by seismic waves generates acoustic waves that propagate nearly vertically upward owing to supersonic speed of seismic waves. As the air density decreases with height, the amplitude of acoustic waves increases to conserve the energy flux up to the altitudes where the air is so rarefied that it cannot sustain the propagation and the waves start dissipating. For distances up to about 1500 km from the epicenter of the strong earthquakes (M>7), the amplitude (oscillation velocity) of infrasound waves reaches significant values in the upper atmosphere. Consequently, the nonlinear phenomena start to play an important role. Spectral content of the wave packet is changed and the energy is transferred to lower frequencies, which can cause the formation of roughly bipolar N-shaped pulse. The simulation results are compared with observation for selected examples. It is also shown that only infrasound with periods larger than about 10 s (generated by long period seismic waves) can reach the ionospheric heights, namely the F layer where it can be easily detected.

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