



Vertical structure of ionosphere and lower atmosphere perturbed by the 11 March 2011 Mw9.0 Tohoku earthquake and tsunami

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The FORMOSAT-3/COSMIC (F3/C) radio occultation (RO) technique vertically scans the atmosphere from 0 to 800 km altitude over eastern Asia and the Pacific Ocean during the 2011 Mw9.0 Tohoku earthquake and tsunami. The mean wavelet spectra derived from dozens of atmospheric and ionospheric RO sounding profiles within ten hours after the earthquake illustrate that the atmospheric oscillations with a vertical wavelength ranging from 0.5 to 8 km and from 10 to 40 km, respectively, appear in the stratosphere and ionosphere within 6 hours after the earthquake initial rupture. The vertical wavelength estimated from the atmospheric gravity wave dispersion relation is compared with the observed vertical wavelength. The small-scale gravity waves may not be easy to reach the upper ionosphere. These RO-observed long-lasting atmospheric and ionospheric oscillations may consist of the earthquake/tsunami wavefront and its residual oscillatory tail. The results suggest that the RO technique is a powerful tool which is suitable for probing earthquake/tsunami-induced oscillations in the atmosphere, and allow a more comprehensive understanding of the excitation, propagation, and dissipation of earthquake/tsunami-induced gravity waves in the entire atmosphere.