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Interpretation of deformed ionograms induced by vertical ground motion of seismic Rayleigh waves and infrasound in the thermosphere

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Abstract

© 2016 Author(s).The vertical ground motion of seismic surface waves launches acoustic waves into the atmosphere and induces ionospheric disturbances. Disturbances due to Rayleigh waves near the short-period Airy phase appear as wavy fluctuations in the virtual height of an ionogram and have a multiple-cusp signature (MCS) when the fluctuation amplitude is increased. An extremely developed MCS was observed at Kazan, Russia, after the 2010 M 8.8 Chile earthquake. The ionogram exhibited steep satellite traces for which the virtual heights increased rapidly with frequency starting near the top of cusps and continuing for 0.1-0.2 MHz. This complicated ionogram was analyzed by applying a ray tracing technique to the radio wave propagation in the ionosphere that was perturbed by acoustic waves. Acoustic wavefronts were inclined by the effects of finite Rayleigh wave velocity and sound speed in the thermosphere. The satellite echo traces were reproduced by oblique returns from the inclined wavefronts, in addition to the nearly vertical returns that are responsible for the main trace.

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