Dynamics of ionosphere disturbances excited by large earthquakes

Elvira Astafyeva[1]; Kosuke Heki[2]

[1] Dept.Natural History Sci., Hokkaido Univ.; [2] Dept. Natural History Sci., Hokkaido Univ.

Earthquakes are known to produce infrasonic pressure waves in the atmosphere. Because of the coupling between neutral particles and electrons at ionospheric altitudes, these acoustic waves induce variations of the ionosphere electron density. GPS provides a way of direct measure the total electron content in the ionosphere and, therefore, of detecting such perturbations in the upper atmosphere.

Using data of Japanese dense network of GPS receivers (GEONET) we observed ionosphere response to large earthquakes (coseismic ionosphere disturbance, CID) at distance more than 1800 km from the epicenter. We managed to analyze the dynamics and evolution of the disturbances while propagating from the source. This can provide us more information about the process of a wave transformation from the ground to the ionosphere (i.e., transformation of acoustic waves to shock-acoustic waves) and then to ionosphere disturbance: the amplitude and the shape of variations were found to change with distance from the source as well as the velocity of the CID propagation. In the records of the GPS receivers located within ˜500 km from the epicenter the TEC response had a form of N-wave and the CID propagated with velocity ˜1.3 km/s. Starting from ˜500-600 km the negative phase of the N-wave seemed to separate from the 'main' wave and those splitted waves further propagated with velocities that differ essentially in value: the positive phase of the N-wave propagates with the velocity about 1.7 km/s, while negative phase of the N-wave propagates with velocity about ˜600 m/s and changes its shape considerably.