Observations of ionospheric variations following the 13 January 2007 earthquake using GPS and SuperDARN Hokkaido radar: 1. GPS

Yuichi Otsuka[1]; Yu Yamaya[2]; Nozomu Nishitani[1]; Tadahiko Ogawa[1]

[1] STELAB, Nagoya Univ.; [2] STELab,Nagoya Univ.

http://stdb2.stelab.nagoya-u.ac.jp/member/otsuka/index.html

An earthquake occurred at the east of the Kuril islands at 0423 UT on January 13, 2007. SuperDARN Hokkaido radar at Rikubetsu (43.5^{o}N,143.6^{o}E), Japan detected altitude variations of the bottomside ionosphere 7-15 minutes after the earthquake. These ionospheric variations moved westward. Global Positioning System (GPS) data obtained by a GPS network in Japan were also analyzed to investigate effects of the earthquake on the ionosphere. The dual frequency radio signals of the GPS allow measurements of the total number of electrons, called total electron content (TEC), along a ray path from GPS satellite to receiver. Approximately 30 minutes after the earthquake, TEC perturbation with an amplitude of approximately 0.03 TECU was observed to propagate southwestward (azimuth of 220^o from the north) at a phase velocity of 970 m/s within an area of 38^o-42^{o}N and 143^o-145^{o}E. The observed TEC perturbations could be caused by acoustic waves generated by the earthquake propagated into the ionosphere. Due to the acoustic waves, the neutral particles oscillate in the direction parallel to the wave propagation direction. In the F region, the neutral particles move ions along the geomagnetic field lines through neutral-ion collisions. The ion motion across the magnetic field line is restricted because the ion gyro-frequency is much higher than ion-neutral collision frequency.This directivity of the ion mobility cause anisotropy in response of the electron density variations. Further, neutral particle motions across the magnetic field line experiences an anisotropic frictional ion drag force. These effects are expected to cause the observed directivity of the TEC perturbations.