Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

PEM36-P18 Room:Poster Time:April 28 18:15-19:30

Detection of ionospheric disturbances caused by the earthquake using HFD

TAKABOSHI, Kazuto[1*] ; NAKATA, Hiroyuki[1] ; TAKANO, Toshiaki[1] ; TOMIZAWA, Ichiro[2]

[1]Graduate shool of Engineering, Chiba University, [2]Center for Space Science and Radio Engineering,Univ. Electro-Comm

Many studies have reported that ionospheric disturbances occur after giant earthquakes. This is because the acoustic wave and/or atmospheric gravity wave are excited by the ground perturbations or tsunami. The HF Doppler observation is suitable for detection of ionospheric disturbances since this can observe ionospheric vertical drift from Doppler shift of radiowaves (5006 and 8006 kHz) transmitted from the Chofu campus of UEC. In this study, usng Doppler shift data of 5006 kHz, ionospheric disturbances associated with earthquakes are ditected. When Doppler shift is fluctuated intensely after propagation time of Rayleigh wave from the seismic center to the observation points, the fluctuation is determined as a disturbance associated with the earthquakes.

In 55 events of earthquakes (M≥6.0) occurred around Japan since 2003, fluctuations by earthquakes are detected in 14 events and the smallest magnitude is 6.4. No fluctuation is detected in some larger earthquakes than M6.4. Since the ionosphere is unstable at night, received frequency is disturbed and it is hard to determine the fluctuations caused by earthquake. In addition, the observation points are not always located near the seismic centers. When earthquakes occur near observation points at the daytime, it is expected that the fluctuations caused by earthquakes are observed even if the magnitudes of the earthquakes is smaller than M6.4.

We also examined the relationship between direction of fault and fluctuations of HFD data. Most of the earthquakes in Japan are reverse fault type. Because a hanging wall slides up in this type of an earthquake, it is expected that initial perturbation of a sound wave excided by the hanging wall is upward. Actually, in most of the events Doppler shifts are negative, which means that the ionosphere moves upward. Next we examined a normal-fault-type earthquake (Fukushima hama-dori earthquake, 2011/4/11), in which a hanging wall slips down. In this event, the epicenter is located at the east of Fukushima prefecture. Doppler data of three observation points (Iitate, Sugadaira, Kiso) are examined. In Iitate observatory, which is the closest to the epicenter, Doppler data shows that ionosphere moved only upward. On the contrary, in the other two points, Doppler data shows that ionosphere moved downward first and then upward, or upward first and then downward. Therefore, fluctuations of ionosphere can not be determined only by a type of fault. More detailed analysis using the seismometer is necessary.

Keywords: ionosphere, HFD, earthquake, acoustic wave, atmospheric gravity wave, fault