

## Ionospheric disturbances associated with Mt. Asama eruption observed by GPS-TEC and HF Doppler sounding

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Due to the strong atmospheric disturbances excited by natural hazard, such as earthquakes, volcanic eruptions, typhoons, and so on, the ionospheric disturbances are excited.

Among these hazards, the earthquake and the volcanic eruptions seem to excite similar atmospheric waves because the ground moves vertically in the earthquakes and plumes explode upward from the volcanos.

Using GPS-TEC observation, Heki [GRL, 2006] reported the ionospheric disturbances in association with the eruption of Mt. Asama.

These disturbances were very similar to the coseismic disturbances, namely "N-Shape" variations. However, those frequencies were about 7 mHz, which is higher than those of the coseismic disturbances. In order to examine the difference between the coseismic disturbances and those associated with the eruptions, in this study, we have examined ionospheric disturbances associated with volcanic eruptions using GPS-TEC and HF Doppler sounding (HFD).

In this study, we have examined the eruption of Mt. Asama, which occurred at 11:02 UT on Sep. 1st, 2004. In HFD sounding observation, the spiky disturbances whose frequency is about 1-2 minutes was observed firstly.

Following this disturbances, longer-frequency disturbance was appeared, whose frequency is about 3-5 minutes.

The former disturbance was also observed by GNSS measurements, whose ionospheric pierce points were located near the Mt. Asama.

From the ray-tracing calculation of the propagation time of the acoustic wave, it is confirmed that the spiky disturbances observed by HFD and the TEC disturbances are due to the acoustic wave generated by the eruption.

We will also present the results of the comparisons between HFD and GPS-TEC data in the presentation.

Keywords: Ionospheric disturbance, Volcanic eruption, Atmospheric gravity wave