Low-latitude HF Doppler observations of magnetospheric electric fields during space weather disturbances

*Kumiko K. Hashimoto[1], Takashi Kikuchi[2], Ichiro Tomizawa[3], Keisuke Hosokawa[3], Jaroslav Chum[4]

1. Kibi International University, 2. Nagoya University, 3. University of Electro-Commnunications, 4. Institute of Atmospheric Physics, Prague

Ionospheric electric fields penetrated from the magnetosphere to the low latitude ionosphere have been observed as geomagnetic disturbances caused by ionospheric currents, such as the equatorial electrojet (EEJ) at the dayside equator. The ionospheric currents are too weak to be a detector of the electric field at low latitudes on the dayside and even at the equator on the nightside. The HF Doppler (HFD) sounder is another powerful tool for observations of the electric filed at low latitudes on both the day- and night-sides. We have shown that the electric fields of the geomagnetic sudden commencements (SC) are composed of the preliminary impulse followed by the main impulse, of which directions are opposite to each other and both electric fields are opposite on the day- to night-sides (Kikuchi et al. 2016 JGR). We have also shown that the substorm electric fields are composed of the growth phase followed by expansion phase overshielding electric fields, of which directions are opposite to each other (Hashimoto et al., 2017). In this paper, we show that the HFD sounder is capable of detecting stormtime electric fields and that the electric fields are found to decay rather rapidly over one hour during the main phase with the time scale of a few hours. Combining with the equatorial magnetometer data, we would be able to estimate the decaying rate of the HFD electric fields, which helps obtain the stormtime electric fields quantitatively from the HFD data. We discuss advantages of widely separated HFD sounder operations and cooperations with SuperDARN as well as with magnetometer networks.

Keywords: HF Doppler observation, ionosphere electric field, magnetospheric electric field, geomagnetic storm, equatorial electrojet

