Propagation of electric fields during Pi2 pulsations based on multi-point observations

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Pi2 pulsations are irregular oscillations in the period range from 40 s to 150 s, and their source lies in the nightside magnetosphere. Electromagnetic disturbances associated with Pi2 pulsations propagate through the magnetosphere by magnetohydrodynamic waves. The compressional fast mode waves are launched by localized plasma sheet fast flows and propagate into the inner magnetosphere [e.g., *Lee*, 1996; *Lee and Kim*, 1999]. On the other hand, the velocity shears at the edge of these flows excite shear Alfven waves, which transport magnetic shear and carry field-aligned currents along magnetic field lines [e.g., *Keiling et al.*, 2006, 2008]. These propagation processes have been proposed based on several previous studies using magnetic field observations and numerical simulations. However, there have been few results by electric field observations although the electric field is an important quantity for detecting Pi2 pulsations than magnetic field. In addition, Pi2 pulsations are known to be associated with substorms. *Nishimura et al.* [2012] shows evolution of auroral streamers at the substorm onset time followed by Pi2 pulsations after a few minutes, using ground-based observations. It suggests that Pi2 pulsations are driven by multiple plasma sheet flow bursts to earthward. However, the propagation mechanism of Pi2 pulsations and associated phenomena such as auroral streamers are not only governed by plasma sheet flow bursts. In the mid-low latitude, Pi2 pulsations are known to be driven by cavity mode resonance that a fast mode impulse associated with substorm onset propagates into the plasmasphere and trapped between the plasmapause and ionosphere. Since there are several propagation processes of electromagnetic energy that can explain the relationship between the substorm onset, auroral streamers, and Pi2 pulsations, further validations by multi-point observations in the magnetosphere-ionosphere coupled system are required.

Motivated by these issues, we investigate the evolution and propagation of the electric field during Pi2 pulsations using multiple observations. We use the magnetospheric electric and magnetic fields obtained by THEMIS (5 probes), Van Allen Probes (VAPs; 2 probes). Magnetospheric magnetic field data from GOES 13 and 15 are also used. The ionospheric electric field data are obtained from SuperDARN (high latitude) and HF Doppler (mid latitude) radars. Pi2 events are identified by the low-latitude geomagnetic field detected at Kakioka and AL index.

We will investigate several events when satellites and radars cover the entire region of the inner magnetosphere, and evaluate the possible propagation process of the electromagnetic energy associated with Pi2 pulsations.