Poleward boundary intensificationに伴うPi2型地磁気脈動の地上-衛星連携観測

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Satellite-ground coordinated observations of Pi2 pulsations associated with poleward boundary intensification

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Pi2 pulsations are irregular geomagnetic oscillations that occur with various auroral phenomena, such as substorms, pseudo breakups, and poleward boundary intensifications (PBI). Pi2s are believed to be generated by plasmaspheric resonances and/or oscillations of bursty bulk flows that involve oscillating substorm current wedge (SCW). SCW oscillations are often associated with middle-latitude and auroral region Pi2, but it is not clear whether the substorm current system (DC current component) is necessary for the generation of the oscillating current system. The purpose of this study is to determine if a Pi2-related oscillating current system associated with PBI can occur in an absence of a significant CD component current system. We examined spatial and temporal relations between PBI aurora, which corresponds to an upward field-aligned current, observed by the THEMIS all-sky imagers and Pi2 magnetic oscillations observed globally by ground-based magnetometers and satellites.

We found several cases where east-west elongated auroral arcs quasi-periodically intensified near the brightest region of PBI, and each emission propagated both eastward and westward, corresponding to each Pi2 pulse. We focus on two consecutive Pi2 events associated with quasiperiodic PBI auroras around 2013-02-06 07:00 UT. In these events, Z-component magnetic field oscillations reversed with respect to the PBI latitude (GMLat. ~72 degrees), indicating that oscillating auroral electrojet drives Pi2s near the PBI. Spatial distribution of horizontal magnetic field in the nightside region lower latitude than PBI latitude is consistent with ground magnetic field produced by oscillating upward and downward FACs located near the PBI location, and the magnetic field did not show substantial positive or negative bays. These observations suggest that a wedge-shaped oscillating current system was generated by PBI-related phenomena without a substorm DC current system. Dayside Pi2s showed a very similar waveform to nightside Pi2 and an amplitude enhancement at the magnetic equator, indicating that dayside ionospheric current was driven by electric field transmitted from the oscillating FAC almost instantaneously. The RBSP-B satellite at ~3Re radial distance observed Pi2s with a similar waveform to ground Pi2 with no significant time delay. On the other hand, RBSP-A at ~6Re radial distance observed a Pi2 that preceded ground Pi2 onset by ~45 s, and its waveform was somewhat different from ground Pi2. The delay time is almost of the same order as the travel time of fast mode waves from the satellite to the ground, and the reason for a different waveform may be some resonance process or a localized disturbance.

Ground-based observations suggest that PBI-related phenomena without a substorm DC current system can be a cause of a wedge-shaped oscillating current system. We will investigate whether the resonance features of Pi2s in the magnetosphere can be coexistent with such an oscillating current system or not, using relation of electric and magnetic fields observed by the THEMIS satellites.