地上-衛星同時観測による大規模擾乱に伴う電場の発達・伝搬過程

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Evolution and propagation of electric fields during magnetospheric disturbances based on ground-based and spacecraft observations

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Magnetospheric disturbances triggered by the input from the solar wind lead to the variation of the particle and electromagnetic field. Among these processes, there is evolution of convection electric fields, which involve energy transmission from the solar wind and development of large-scale convection and current systems. It is believed that Poynting fluxes associated with the onset of convection electric fields provides a key to understand the energy transmission [*Nishimura et al.*, 2010]. However, the interaction between magnetosphere and ionosphere, such as the electric field propagation and energy transport process in the magnetosphere-ionosphere (M-I) coupled system, is still an open issue. Motivated by this issue, we focused on sudden commencements (SCs) known as one of the distinct magnetospheric disturbance phenomena triggered by the compression of the magnetosphere due to solar wind disturbances, and investigated the evolution and propagation of electric fields during SCs using in-situ electric field data by THEMIS and Van Allen Probes. We also identified the transport process of the electromagnetic energy by multi-spacecraft, SuperDARN radar, and ground magnetometer data coordinated in a wide region of the M-I coupled system. In order to judge whether SCs occurred or not, we referred the SYM-H index provided by OMNI database and low-latitude geomagnetic field (KNY). Event criteria were set as follows; (1) Low-latitude magnetometer (KNY) locates at 0-7 h UT, (2) The amplitude of SYM-H is more than 10 nT, and (3) The rise time of SYM-H is less than 5 min.

We found 21 SC events in 2013 under these conditions, and all events showed enhancements of the dusk-dawn electric field associated with SCs detected by both THEMIS and Van Allen Probes. There is little time difference between in-situ electric and magnetic field (within 5 sec), which is consistent with fast mode waves propagating across the magnetosphere. We also found that the in-situ electric field detected by THEMIS corresponds to that by Van Allen Probes, but these SC onset and peak time varied with their configuration. Moreover, the ionospheric electric field associated with SCs detected by radar observations was seen corresponding to the magnetospheric electric field.

Now we are trying to evaluate the time lag of SC onset time and peak time between the magnetospheric and ionospheric electric fields, and estimate Poynting fluxes from in-situ electromagnetic field data. These validations could verify the energy transport channel from dayside magnetosphere toward nightside magnetosphere via ionosphere that was suggested by model estimation and the single point observation.