RESPONSE OF ELECTRIC FIELDS AND REGION 2 FACS IN THE INNER MAGNETOSPHERE ASSOCIATED WITH SUBSTORM ONSET

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This talk presents the quick response of large-scale electric fields and region-2 field-aligned currents in the premidnight inner magnetosphere associated with substorm onset using THEMIS spacecraft and all-sky camera data. During the February 11, 2008 substorm, the THEMIS spacecraft covered a wide region in the nightside magnetosphere between XGSM = -19 and -2 RE. The innermost spacecraft (TH-C) was located in the premidnight inner magnetosphere, where subauroral polarization streams (SAPS) were frequently observed. The footprints of the three spacecraft located around XGSM ~ -10 RE (TH-A, D and E) were located in the field-of-view of the all-sky camera at Sanikiluaq and close to Gillam.
TH-D located at 11.7 RE measured a dipolarization at 10:15:20 UT. It was simultaneous with the auroral intensification measured at Fort Yukon within the time resolution of the auroral observation (3 sec). Dawn-dusk electric fields increased concurrently with the dipolarization.
The electric field in the inner magnetosphere earthward of the electron plasma sheet measured by TH-C started to increase 1 min after the dipolarization and auroral intensification. It abruptly decreased when the spacecraft encountered the inner edge of the electron plasma sheet. The electric field can thus be regarded as SAPS electric field. Ion energy flux and eastward perturbation of the magnetic field started to increase simultaneously with the electric field. It indicates that the electric field and the region 2 current system quickly respond to substorm onset.
The Poynting flux associated with the electric field is calculated in order to identify the energy source of the electric field. The Poynting flux was directed toward the ionosphere at the TH-A and E locations (~10 RE); the energy is propagating from the magnetosphere toward the ionosphere. The Poynting flux in the inner magnetosphere started to increase 1 min later, and it was directed from the ionosphere. It suggests a quick transmission of electric fields via the ionosphere right after the substorm onset, which leads build-up of the ion pressure and region-2 current system.

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