Characteristics of the electric-field disturbance above the polar ionosphere associated with the storm sudden commencement

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In this study, the magnetic data from the 210 deg magnetic meridian and the electric-field data obtained by AKEBONO satellite were studied to investigate the characteristics of the electric-field disturbance above the polar ionosphere and to understand the propagating process of the storm sudden commencement in the magnetosphere.

As the result, the two-type electric-field disturbances were successfully detected by AKEBONO satellite.

It is well known that the passage of the interplanetary shock or discontinuity causes the sudden compression of the magnetosphere, and intensifies the magnetospheric convection. In this process, two-type electric fields are considered to be generated and to penetrate into the polar ionosphere. One is generated on the dayside magnetopause by the enhanced Chapman-Ferraro current (DPpi-field), and the other is intensified electric field of the magnetospheric convection which is like DP2 (DPmi-field).

In this study, the magnetic data from the 210 deg magnetic meridian and the electric-field data obtained by AKEBONO satellite were studied to investigate the characteristics of the electric-field disturbance above the polar ionosphere and to understand the propagating process of the ssc in the magnetosphere.

As the result, the two-type electric-field disturbances were successfully detected by AKEBONO satellite. On an ssc event which occurred on Feb 17, 1993, the perpendicular component of the electric field suddenly rose from 5 to 35 mV/m, then recovered toward the previous level. At that time, the footprint of the magnetic field running through the satellite was located at 67.2 degree and near 17:00 MLT in the geomagnetic coordinate system. The duration of the electric-field disturbance was similar to that of the Main Impulse component of the magnetic variations observed on the ground (TIX: Geomag.Lat. = 65.67, 11:00 MLT). On the other hand, the ssc event which occurred on Mar 11, 1993, the small depression (10mV/m) on the perpendicular component of the electric field was detected by AKEBONO satellite. The footprint of the field line was located at 71.4 degree and near 22:00 MLT. On this event, the magnetic variation on the ground (TIX) showed a clear PRI (Preliminary Reverse Impulse) component which was produced by the DPpi-field just before the Main Impulse. The duration and amplitude of the electric-field disturbance at AKEBONO were much shorter and smaller than the former event. Neverthless, the duration of the electric-field disturbance at AKEBONO satellite was similar to that of the PRI component of the magnetic field variation on the ground.

The observations mentioned above indicate that the electric-field variation associated with the DPmi-field penetrated into the auroral latitude and was not observed at higher latitude. On the other hand, the electric-field by the DPpi-field was not observed at auroral latitude but at higher latitude. These characteristics are basically consistent with the general model of ssc which was summarized by Araki (1994). The difference of the electric-field disturbance between these two events can be considered to depend on the propagating path of the electric field of the DPpi- and DPmi-field.