# Response of convection electric field in the inner magnetosphere-plasmasphere region during a major magnetic storm

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Knowledge of large-scale electric field and magnetic field perturbations associated with magnetic disturbances such as sudden commencements (SCs), substorm and geomagnetic storms is essential for understanding of the physics of plasma dynamics and energy transport in the inner magnetosphere-plasmasphere region. However, because majority of previous studies on the in-situ electric and magnetic field phenomena during a magnetic storm in the inner magnetosphere has been based on the satellite observations with the equatorial orbit and orbital period of more than 10 hours [e.g., Maynard et al., 1980; Wygant et al., 1998], the electric and magnetic field signatures of the inner magnetosphere and the response of the plasma distribution have not been fully understood at the point of the high time variations and meridional spatial distribution in almost the same magnetic local time sector. In this study, in order to clarify the response of a large-scale convection electric field and structure of cold plasma density in the inner magnetosphere-plasmasphere region during two major geomagnetic storms which occurred on March 13-15, and November 17-19, 1989, respectively, we analyzed the observation data of the Akebono satellite which has been carried out for more than 15 yeas since March, 1989. In each geomagnetic storm, the signature of the electric field associated with SC showed a bipolar waveform with the amplitude of order of 10 mV.m due to the passage of hydromagnetic fast-mode waves through the inner magnetosphere. After the electric field phenomena, the DC component of the Ey field indicated a gradual increase of 0.8-3.0 mV/m, which persisted for 5-30 minutes. The electric field signature suggested that the dawn-to-dusk convection electric field appears in the inner magnetosphere-plasmasphere region due to the compression of the magnetosphere by solar wind shock. During the main phase of the magnetic storm, the strong convection electric field with a spatially inhomogeneous structure appears in the inner magnetosphere between L=2.0 and 7.0 both in the dawnside and duskside sectors. The averaged intensity of the electric field was in a range of about 2.5-9.2 mV/m. The spatial distribution in the magnetic equatorial region indicates that the magnitude within an L-value range of 2.2-7.0 is much larger than that observed at L=7.0-10.0. Moreover, the spatial width of the localized electric field showed a dawn-to-dusk asymmetry, which indicates that the enhanced region was much wider in the dawnside sector near 18-20 MLT than that in the duskside sector near 05-07 MLT. Associated with the appearance of the strong convection electric field, the cold plasma density near the trough region around L=3.0-6.0 was enhanced with one or two order magnitude, compared with that in the magnetically quiet condition. This implies that a mount of the ionospheric plasma is supplied from the topside ionosphere into the trough and plasmasphere regions by the frictional heating due to the fast plasma convection in the ionosphere. During the recovery phase of the magnetic storm, the convection electric field observed in the inner magnetosphere-plasmasphere region recovers within 3-4 days almost up to the level of the magnetically quiet condition.