Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PEM027-07 Room:ファンクションルームB Time: May 24 15:30-15:45

Large electric fields observed inside the storm-time ring current and their association with ion energization

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The storm-time ring current intensification is often addressed in terms of transport of energetic ions from the plasma sheet. The associated electric field may be static as expected from enhanced global convection or it may be inductive as expected from the substorm-related change of the local magnetic configuration, dipolarization. Ohtani et al. [2007], however, suggested that ions can also be accelerated locally by a substorm-like process inside the ring current. In an event they reported, the Cluster constellation observed dipolarization and dispersionless injection at r = 4.6 RE, deep inside the ring current, and the IMAGE/HENA instrument simultaneously observed a sharp increase of the ENA flux, especially the energetic oxygen flux, from the ring current. Cluster also observed large-amplitude (a few tens of mV/m) fluctuations of electric field, which we found well correlated with magnetic variations. In the present study we seek to extend this study by examining in detail the characteristics of such large electric fields. The result of a preliminary study shows that large electric fields are observed more often near the magnetic equator than in the boundary region and that the local magnetic field tends to become more dipolar at the same time. It is therefore suggested that those large electric fields are caused by a substorm-like process inside the ring current. We will also address the occurrence frequency of large electric fields in the storm-time ring current.

Ref: Ohtani et al. (2007), Cluster observations in the inner magnetosphere during the 18 April 200 2 sawtooth event: Dipolarization and injection at r = 4.6 RE, J. Geophys. Res., 112, A08213, doi:1 0.1029/2007JA012357.

Keywords: magnetospheric storms, ring current, substorms, electric fields, dipolarization