Modeling the variations of magnetic field and relativistic electrons at geosynchronous orbit

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We have examined the characteristics of magnetic field variations at geosynchronous orbit (GEO) and its relations to the relativistic electron dynamics using magnetic field and particle data from GOES satellites located at different geomagnetic latitudes, and solar wind data from Wind and ACE satellites.

The results of our data analysis suggest that the magnetic field variations at GEO strongly depend on the dynamic pressure of solar wind and pressure corrected Dst index (Dst*). Dst* dependence shows some difference between the cases of IMF Bz positive and negative. The Dst* dependences of magnetic field variations derived from two different magnetic latitudes suggest that these magnetic field variations can be explained by the existence of equivalent westward current beyond the GEO. This means that magnetic field structure during storm time is highly stretched. Enhancement of the dynamic pressure also stretches magnetic field structure in the tail region.

The flux of relativistic electrons at GEO drops off under the highly stretched magnetic field configuration. The timing of this drop off sometimes differ between the two GOES satellites. This difference indicates that the flux drop off start from the distant L-shells. The signature of the rapid drop off is often seen in the dusk sector. These suggest that the non-adiabatic loss mechanism is significant for the relativistic electron dynamics at GEO.