Statistical analysis of the inner edge of the electron plasma sheet based on THEMIS observations

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The plasma sheet is the primary reservoir of hot plasma in the magnetosphere and believed to be the source region of ring current particles and precipitating particles which generate aurorae. The plasma sheet is closely related to the configuration of particle distributions in the inner magnetosphere. However, previous studies on the configuration of the plasma sheet have been limited in the radial coverage in the equatorial plane (e.g. Korth et al. 1999 and Friedel et al. 2001).

The purpose of the present study is to statistically examine the plasma sheet particles access to the inner magnetosphere and the dependence on geomagnetic activities by using data directly observed near the magnetic equator. We analyzed data measured by the Electrostatic Analyzer (ESA) on board the THEMIS satellite. An advantage of THEMIS is the orbit that covers the wide area in the equatorial magnetosphere and the large database from the five spacecraft. This database provides us a global view of the inner edge of the plasma sheet. We used the ESA electron data from 2007/12/15 to 2008/12/15, and the Kp index as an indicator of the geomagnetic activity. We determined the inner boundary for plasma sheet electrons in the first adiabatic invariant range of 2 to 100 eV/nT and compared them with predicted Alfven boundaries which were calculated from dipole magnetic field and sum of simple corotation and convection electric fields as a function of the Kp index.

The results show that electrons penetrate deeper into the inner magnetosphere as first adiabatic invariant decreases and the value of Kp increases. It is consistent with particles drift paradigm. Compared the results with calculated Alfven boundaries, the Alfven boundary are globally (especially night side) consistent with the averaged data in the inner magnetosphere, which is consistent with the results shown by Korth et al. [1999] and Friedel et al. [2001]. In the dawn sector, there seem to be flux decreases probably due to precipitation loss by some wave-particle interaction in all values of the Kp index. It is also consistent with the previous studies. The loss has the first invariant dependence, which may reflect the energy dependence of loss rate due to the wave-particle interaction.

We plan to extend period for analysis in order to add samples to the statistics in disturbed periods and the radial distance range over 10 earth radii. Besides, we will analyze the loss late of the electron and its energy and Kp dependences in the dawn sector quantitatively.