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

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The plasma sheet is a primary reservoir of hot plasma within the magnetosphere and is believed to be the source regions of ring current particles as well as precipitating particles which generate aurorae. The plasma sheet is closely related to the configuration of particle distributions in the inner magnetosphere. Korth et al. [1999] showed that plasma sheet particles have access to the geosynchronous orbit for high values of the Kp index. This indicates that the radial distance of the inner edge of the plasma sheet depends on the geomagnetic activity. Elphic et al. [1999] proposed a Kp-dependent model of the inner edge, using geosynchronous electron observations and midnight boundary index (MBI) measured by the DMSP satellites. However, the model is based only on the observations at the geosynchronous orbit. It cannot describe the inner edge of the electron plasma sheet for the low geomagnetic activities, since the boundary moves above the geosynchronous altitude. Kerns et al. [1994] also proposed an inner edge model, and compared the model with the position of the inner edge of the electron plasma sheet observed by the CRRES satellite. In their study, the observed inner edges are consistent with their model only for 40 to 50 % of their events. In these circumstances, there are now no models which can determine the location of the inner edge of the plasma sheet precisely.

The purpose of the present study is to quantify the relation between the shape of the inner edge of the plasma sheet and the geomagnetic activity. We analyzed statistically the particle data obtained by ESA on board the THEMIS satellites. An advantage of THEMIS is the orbit that covers a wide area of the magnetosphere. It allows us to determine the position of the inner edge of the electron plasma sheet in a wide range of the geomagnetic activity. We used the ESA data from 20h to 4h Magnetic Local Time (MLT), and the Kp index as an indicator of the geomagnetic activity. We extracted the data in the case of that Kp is 0 to 2+, and classified the positions of the inner edge of the electron plasma sheet depending on Kp.

The result reveals that the inner edge of the electron plasma sheet is located closer to the Earth for higher Kp values regardless of MLT. The boundary on the dawn side is located closer to the Earth for all Kp index, compared to the boundary on dusk. This tendency is consistent with the models proposed by Kerns et al. [1994] and Elphic et al. [1999]. The inner edge of the electron plasma sheet is placed above the geosynchronous orbit for low values of the Kp index.

We plan to extend the MLT range in order to cover a wider MLT range, and to quantify the relation between the position and the geomagnetic activity. Besides, we will statistically analyze the relation between the position and other indicators of the geomagnetic activity such as interplanetary magnetic field (IMF), solar wind pressure, Dst and AL indices.