Magnetic field dipolarization in the deep inner magnetosphere: Simultaneous observations by Arase and Michibiki satellites

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Recent satellite observations by MDS-1 and Van Allen Probes statistically revealed that magnetic field dipolarization can be detected over a wide range of L in the deep inner magnetosphere (i.e., L = 3.5-6.5, which is far inside the geosynchronous altitude). It is accompanied by magnetic field fluctuations having a characteristic timescale of a few to 10 s, which is comparable to the local gyroperiod of O^+ ions. These magnetic field fluctuations are considered to cause nonadiabatic local acceleration of ions.

In this study, we intend to confirm the above-mentioned characteristics of magnetic field dipolarization in the inner magnetosphere, using the magnetic field data and the energetic ion flux data measured by the Exploration of energization and Radiation in Geospace (ERG) “Arase” satellite. The Arase satellite was launched on December 20, 2016 into an elliptical orbit having an apogee of 6.0 Re, a perigee of 440 km altitude, an orbital period of ˜9.5 h, and an orbital inclination of ˜32 degrees. During the first magnetic storm of March 27, 2017 after Arase started scientific operation, Arase observes clear dipolarization signatures around 1500 UT at L˜4.6 and MLT˜5.7 hr. Strong magnetic field fluctuations are embedded in the magnetic field dipolarization and their characteristic frequency is close to the local gyrofrequency of O^+ ions. Both H^+ and O^+ flux enhancements are observed in accordance with the dipolarization. These results are consistent with the previous results. In this event, the Quasi-Zenith Satellite (QZS)-1 “Michibiki” satellite was located at L˜7.0 and MLT˜23.8 hr, and observes similar dipolarization signatures with a few minute time difference. Simultaneous observations by both Arase and Michibiki provides us a unique opportunity to investigate how fast and wide the dipolarization propagates in the inner magnetosphere. In the presentation, we will show detailed analysis results of the dipolarization event on March 27, 2017 as well as similar events.