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Magnetic fluctuations embedded in dipolarization inside geosynchronous orbit and their possible role in selective accele

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Magnetic field dipolarization is a distinct phenomenon observed in the magnetosphere at substorm onset. According to previous studies, magnetic field dipolarization can be mostly seen at the geosynchronous altitude or farther down the tail (i.e., radial distance of >=6.6 R_E), and is accompanied by strong magnetic fluctuations. The characteristic time scale (T_C) of the magnetic fluctuations is reported to be a few seconds to a few tens of seconds, that is, T_C=0.3-30 s at *r*=7-9 R_E by AMPTE/CCE [Lui et al., 1992; Ohtani et al., 1995], T_C=8-28 s at *r*˜8 R_E by SCATHA [Ohtani et al., 1998], T_C˜5 s at *X*=-8 to -11 R_E by Geotail [Shiokawa et al., 2005], T_C˜10 s at *X*=-8.3 R_E by THEMIS [Lui et al., 2008], and T_C=10-50 s at *X*=-17.5 R_E by Cluster [Huang et al., 2012]. These time scales are longer than local gyroperiods of H^+ by a factor of 2-20, and rather close to those of He^+ and O^+ ions. A recent study employing the MDS-1 satellite revealed that magnetic field dipolarization can be observed in the deep inner magnetosphere (L=3.5-6.0) and is accompanied by the magnetic fluctuations that have a period range between the local gyroperiods of He^+ and O^+ ions [Nose et al., 2010]. To our knowledge, there are few studies reporting T_C just inside geosynchronous orbit (L=5.0-6.6).

In this study, we analyze magnetic fluctuations embedded in dipolarization events at the geosynchronous altitude, using the ETS (Engineering Test Satellite)-VIII satellite. From the period of 2010-2012, we select 6 dipolarization events that showed an increase of the northward magnetic field more than 60 nT. It is found that all of the events are accompanied by strong magnetic fluctuations with T_C close to the local O^+ gyroperiods. We also study a dipolarization event in the inner magnetosphere (L˜4.9) observed by the AMPTE/CCE satellite on December 10, 1987. This event is found with magnetic fluctuations that have a period range between the local gyroperiods of He^+ and O^+ ions. When the fluctuations appear, the O^+ flux is enhanced in the energy range of < 10 keV.

These results suggest that magnetic fluctuations associated with dipolarization have generally T_C close to the local gyroperiod of heavy ions, and may play an important role in selective acceleration of O^+ ions.