



Sudden appearance of sub-keV structured ions in the inner magnetosphere within one hour: drift simulation

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Energy-latitude dispersed structured sub-keV ions in the inner magnetosphere drifts very slowly in the noon-to-afternoon sectors because the eastward corotation and the westward magnetic drift balances to each other there. However, majority of Cluster ion observation by the Cluster Ion Spectrometry (CIS) COmposition DIstribution Function (CODIF) instrument during 2001-2006 showed significant development or intensification (by more than factor of 3) within 1-2 h in that sector during the Cluster perigee traversals that quickly scans latitudinal structure at a fixed local time (Yamauchi et al., 2013). The frequent observations of significant inbound-outbound differences in the wedge-like dispersed ions by Cluster indicates either new injections or high eastward drift velocity even in the afternoon sector.

To examine the former possibility, i.e. whether such sudden appearances in the dayside can be explained by the drift motion of ions that are formed during substorm-related injections, we numerically simulated two such examples, one at noon (8 September 2002) and the other in the afternoon (9 July 2001), based on the same ion drift simulation model that has successfully reproduced the ion pattern of an inbound-outbound symmetric event at 5 MLT observed by the Cluster CIS/CODIF instrument. The model uses backward phase-space mapping to a boundary at the nightside 8 Earth radii and forward numerical simulation using re-constructed distribution function at that boundary.

For both examples, the ion drift model with finite duration (limited to 1-2 hours) of proton source in the nightside can explain the observed large inbound-outbound differences in the sub-keV proton population without any new sources. Ion drift motion is thus able to cause rapid changes of complicated ion populations, at remote places from the source long time after the substorm activities, although this result does not eliminate the possibility of having independent ionospheric sources.

References: Yamauchi, M. et al.: Cluster observation of few-hour-scale evolution of structured plasma in the inner magnetosphere, *Ann. Geophys.*, 31, 1569-1578, doi:10.5194/angeo-31-1569-2013, 2013.