Sudden auroral brightenings and the near-Earth tail (X ˜-10 Re) dipolarizations: The timing issue

Miho Saito[1]; Yukinaga Miyashita[2]; Kan Liou[3]; Masaki Fujimoto[4]; Yoshifumi Saito[5]

[1] Earth and Planetary Sci,Tokyo Univ; [2] ISAS/JAXA; [3] JHU/APL; [4] ISAS, JAXA; [5] ISAS

In the Geotail data set we have found observations of dipolarizations in the vicinity of the magnetic equator of the near-Earth tail (X˜- 10 R_E) that have concurrent aurora imagery data from POLAR UVI and VIS cameras. These events (six in total over the ten years) allow us to compare the dipolarization onset times and the auroral brightening times. Detailed inspection of the imagery data in the course of this study have led us to recognize that, in five of them where large-scale auroral activities are obtained, activities develop in a two-staged manner. This two-stage aspect has been suggested by *Lui* [1991] and others, but not necessarily and widely accepted by the community. 2˜11 min after the emergence of the first spot (auroral brightening), the second spot appears and large-scale development are obtained subsequently. The second spots are recognized as discrete spots in the images and describing their emergence in terms of expansion of the first spot is not considered to be appropriate. All the second spots are located westward of the first one, suggesting systematic sequence of the auroral brightening process. When these two brightening times are compared with the time series data obtained by GEOTAIL, we have found the followings: The first auroral brightening was not observed with the fast earthward plasma flow in the near-Earth tail, except for one case in which the brightening dimmed before the second brightening. The second auroral brightening was associated either with the fast earthward flow or with the small amplitude flow reversal, depending on the spacecraft location. Our observations suggest that two discrete timings exist, corresponding to the substorm initiation trigger and the substorm expansion trigger, respectively.