Statistical study of Geosynchronous Magnetopause Crossings

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The earth's magnetopause is located at X = 10 earth radii (Re) on average at the subsolar point, and its size and shape is mainly controlled by the solar wind dynamic pressure (Pd) and interplanetary magnetic field (IMF). Sometimes it moves earthward across the geosynchronous orbit when Pd is extremely enhanced (Pd type) or/and the erosion is highly developed due to the continuous intense southward IMF (Bz type). These events are called Geosynchronous Magnetopause Crossings (GMCs).

Three authors have studied GMCs statistically [Rufenach et al.,1989; McComas et al.,1994; Itoh,1997]. All of them focused on a dawn-dusk asymmetrical occurrences of the GMC events. Rufenach et al.[1989] analyzed 64 GMC events observed by GOES magnetometers, and mentioned that the local time distribution of the occurrences had dawn-dusk asymmetry. However McComas et al.[1994] analyzed 39 magnetosheath observations by the magnetospheric plasma analyzer (MPA) on board the LANL geosynchronous satellites, and reported no significant dawn-dusk asymmetry in the occurrence rate, except for a small offset effected by the solar wind aberration. Itoh[1997] analyzed 206 events observed by GOES satellites and reported that the dawnward shift of the distributions was found when the Dst index developed lower than -100 nT.

To examine the dependence of the GMC occurrence on the solar wind conditions, we analyzed GOES magnetometer data from 1996 to 2001, and detected 102 intervals of GMC events on 29 days. Local time distribution of the GOES satellites during all the 102 magnetosheath intervals were checked. Its averaged local time (mean) is about 12.0 h, but the distribution is a little shifted to the prenoon sector.

All events were classified by the SYM index in H component (SYM-H) into 2 groups; SYM-H was more than -100 nT or not. The averaged local times were also 12.0 h in both groups. The local time distribution of the latter group (SYM-H was less than -100 nT) had a secondary peak from 8 to 10h LT. These features are consistent with the results by Itoh[1997].

Then we checked the solar wind conditions observed by ACE during the intervals. Relative locations of the satellites to the solar wind flow direction were calculated, and also classified into 2 groups by SYM-H (-100 nT). The local time distributions were both symmetric to the solar wind flow direction, and no secondary peak was found.

We also sorted events by IMF clock angle. When the IMF Bz was negative, By dependence of local time distribution was not so apparent.