Properties of the plasma mantle in the near-earth magnetosphere : Rapid mantle flow

Satoshi Taguchi[1], Toshifumi Mukai[2], Yoshifumi Saito[2]

[1] Univ. of Electro-Communications, [2] ISAS

Geotail observes sharp enhancements superposed on the gradual speed variations in the near-Earth plasma mantle. This study places emphasis on this sort of sharp enhancement events, and clarifies the characteristics. Typical enhancement is about a factor of 1.3 only for 1 min. During the rapid flow the plasma speed and density well correlate as the usual plasma mantle, but its correlative relation is different from the ones for the mantle before and after the rapid flow. Most of the rapid mantle flow events appear to be associated with the southward tilting of the IMF. Even very small Bz decrease, for example, only -1 nT decrease corresponds to the rapid mantle flow. Their association with dayside reconnection will be discussed.

The plasma mantle is a region having properties between the magnetosheath and lobe, and has graded transitions of the plasma speed and density from magnetosheath to lobe values. The plasma speed is higher in the outer region of the plasma mantle, and hence gradual increase/decrease in the speed can be observed by spacecraft in the mantle when the magnetopause is shifted inward and outward for some reasons. In the near-Earth orbits Geotail sometimes observes the plasma mantle at low-latitudes, and such a gradual speed variation can be clearly identified.

Geotail also observes sharp speed enhancements superposed on the gradual variations in the near-Earth mantle. This study places emphasis on this sort of sharp enhancement events, and clarifies the characteristics. First, we examined events around X = -5 RE in detail. For most of the events, the solar wind dynamic pressure at WIND does not show any sharp enhancement. Such a sharp enhancement compresses the magnetosphere, so that Geotail may be engulfed briefly in the outer mantle where the plasma speed is relatively high. Our data show that the plasma speed in the mantle can be rapid without the solar wind density enhancement. Typically, the speed increases by about 30% only for 1 min. During the rapid flow the plasma speed and density well correlate as the usual plasma mantle, but its correlative relation is different from the ones for the mantle before and after the rapid flow. In the density-versus-speed diagram, the plasmas during the event form a separate group from the ones for the plasmas before and after the event. This suggests that the rapid mantle flow is due to the temporal change of the mantle plasma injection. The rapid flow also occurs with the change of the flow direction as well as the speed enhancement. For some of the events, we estimated accurately the propagation time from WIND in the solar wind to Geotail in the mantle. It was found from this that most of the rapid mantle flow events are associated with the southward tilting of the IMF. Even very small Bz decrease, for example, only -1 nT decrease appears to cause the rapid mantle flow. Detailed properties will be presented, and their association with dayside reconnection will be discussed.