Magnetic Field and Plasma Structures within the Dayside Magnetopause Current Layer during Flux Transfer Events

Motoharu Nowada[1], Toshifumi Mukai[2] and Tohru Sakurai[3]

1: Institute of Space Science, National Central University

2. Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency

3. Department of Aeronautics and Astronautics, Tokai University

Abstract

In order to examine how the magnetosheath plasma distribution varied within the dayside MagnetoPause Current Layer (MPCL) during Flux Transfer Events (FTEs), which is local and transient magnetic reconnection, The dayside MPCL ion and electron distribution functions when FTEs were observed and were not observed were compared with those in the magnetosheath. As a result, when FTEs were observed on the MPCL, low-energy ions originating from the magnetosheath were accelerated perpendicular to the magnetic field lines threading in the MPCL. However, low-energy electrons originating from the magnetosheath were accelerated in the field-aligned direction. On the other hand, when FTEs were not observed on the MPCL, accelerations both ions and electrons originating from the magnetosheath cannot be seen within the MPCL, and there was no difference between the magnetosheath plasma and the plasma observed within the MPCL.

These accelerated and non-accelerated magnetosheath plasmas were observed within the MPCL irregularly during the satellite multiple MPCL crossings. On the basis of this result, it is suggested strongly that FTEs occurred randomly on the dayside MPCL.

Introduction

Structure and dynamics of the MPCL are of great interest because they are important factors in determining the transport of the mass, momentum, and energy of plasma from the magnetosheath (or solar wind) into the magnetosphere. One of the important mechanisms of their transport into the magnetosphere is magnetic reconnection on the dayside MPCL. Therefore, by examining the magnetic field and the plasma structures within the dayside MPCL, it is expected that detailed plasma transport mechanism from the solar wind to the magnetosphere can be clarified.

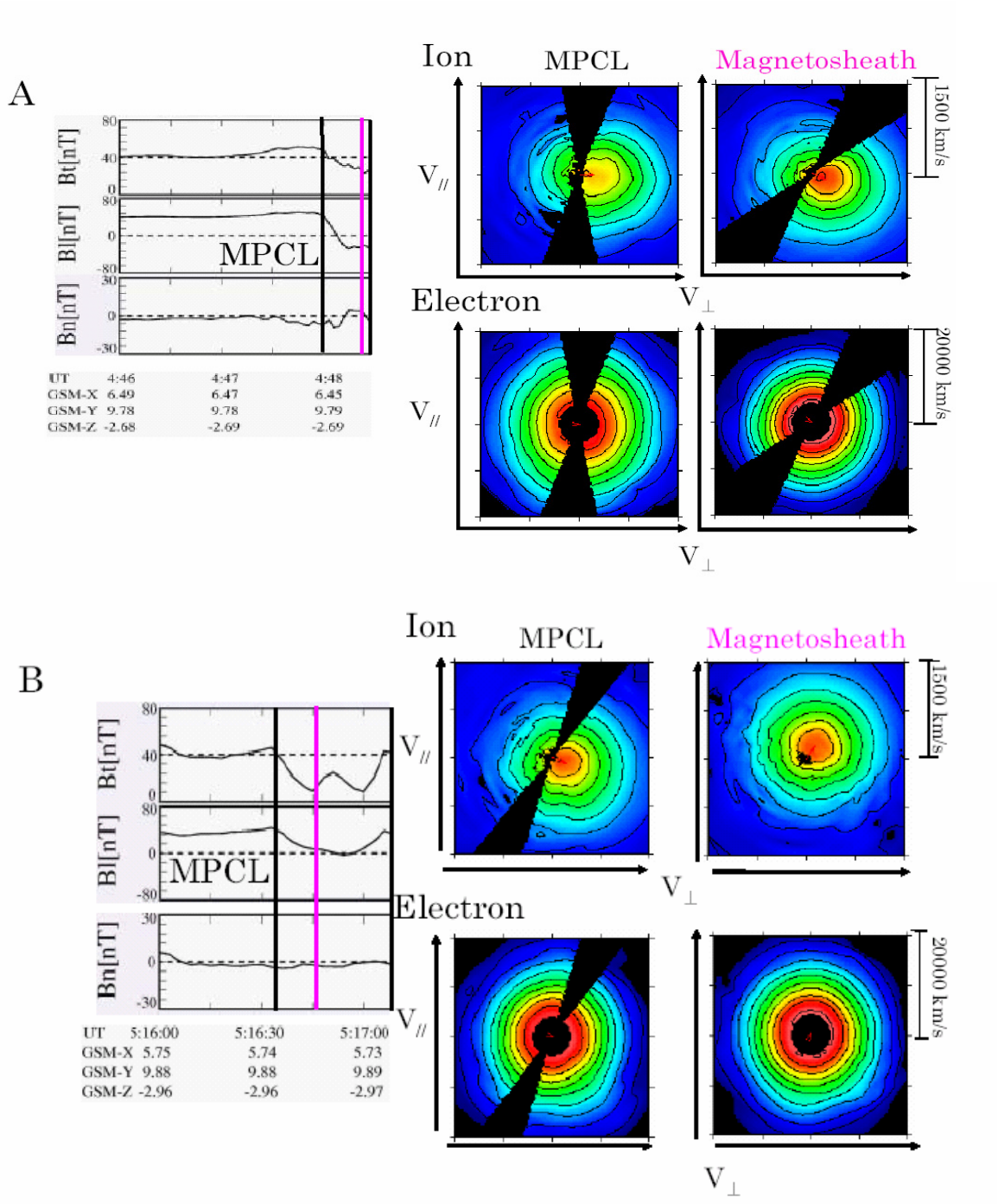

Figure 1. Left upper and lower panels show the magnetic field data when FTEs occurred (A), and when FTEs did not occur (B) on the dayside MPCL. From top to bottom, the magnetic field intensity (Bt), the magnetic field components tangential (Bl) and normal (Bn) to the MPCL are shown respectively. The observation time (UT) and the satellite locations (GSM-X, -Y and -Z) are also shown in the bottom of the figures. Right upper and lower panels show the three-dimensional ion and electron distribution functions taken in the MPCL during FTEs (A) and without FTEs (B), and the magnetosheath, marked by black and pink solid lines on the magnetic field data. Horizontal and vertical axes show the ion and the electron velocities perpendicular and parallel to the local magnetic field line, respectively. The color code is assigned according to the logarithm of the distribution function (phase space density).