

Fast Earthward Flows in the Magnetotail and Ionospheric Convection during Weak Substorms: Geotail and SuperDARN Observations

Y. Miyashita,¹ K. Hosokawa,² T. Hori,³ M. Fujimoto,¹ I. Shinohara,¹
S. Machida,⁴ T. Mukai,¹ Y. Saito,¹ A. S. Yukimatu,⁵ and N. Sato⁵

¹Institute of Space and Astronautical Science, JAXA, Sagami-hara, Japan

²The University of Electro-Communications, Tokyo, Japan

³National Institute of Information and Communications Technology, Tokyo, Japan

⁴Department of Geophysics, Kyoto University, Kyoto, Japan

⁵National Institute of Polar Research, Tokyo, Japan

Abstract

We have studied the response of the ionospheric flow to fast earthward flows in the magnetotail for two substorms on 1 May 2001. Auroral and geomagnetic field data indicate that these substorms were very weak in terms of the spatial scale and the westward auroral electrojet. The Geotail spacecraft was located in the postmidnight plasma sheet at $X \sim -14$ Re. While it did not observe fast earthward flows during the first substorm, it observed successive fast earthward flows just after the second substorm onset, accompanied by a clear dipolarization. SuperDARN observations show that the Geotail footprint was located in the equatorward part of the dawn cell of the two-cell ionospheric convection pattern. The entire dawn cell was enhanced during the expansion phases of both substorms. These results suggest that the ionospheric convection is enhanced during the substorm expansion phase not only near the footprint of the fast earthward flows in the magnetotail but also in the entire cell.