Relationship Between the Generation of Substorm-FAC and Slow Mode Processes in the Near-Earth Plasma Sheet

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The magnetospheric substorm is the fundamental but the unsolved problem in the solar-terrestrial physics. In particular, the generation process of substorm-FAC, the heart of the substorm dynamics, is not fully discussed and understood in the context of the momentum/energy balance in the Magnetosphere-Ionosphere coupling system.

In our previous studies, by using the GEOTAIL/MGF, LEP and EPIC data, we have presented the fundamental structure of convection and characteristics of magnetotail disturbances associated with substorms. Observational facts obtained from these studies are summarized as follows: (1) The stress balance is primarily achieved by –grad P and **J** x **B**. This basic condition remains unchanged even in the magnetotail disturbances. (2) As for the interval of magnetotail disturbances, the intensity of energy flux is greater parallel to the magnetic field than transverse to it. (3) During the growth phase, the plasma pressure is intensified in the near-earth plasma sheet and additional earthward pressure gradient is superimposed to the background gradient. The plasma pressure peak is formed in the region less than the radial distance of 8 R_E. (4) After the onset, enhanced pressure gradient is reduced in accordance with the development of disturbances. Consequentially, the plasma stress and the Maxwell stress are reduced in the near-earth tail where they have been intensified during the growth phase.

Based on these observational facts, we have suggested a substorm scenario based on the slow mode interpretation. However, we have not fully explained details In this study, we refine the data analysis and examined in detail some substorm events. By comparing the satellite observations and MHD simulations, we will discuss the mechanism of the generation of substorm-FAC, including the momentum/energy conversion at the site of plasma sheet and the stress/energy matching between the magnetosphere and ionosphere.

Keywords: substom; slow mode, FACs; plasma sheet;