Theoretical Model for the Generation of Bursty Bulk Flows (III)

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In this paper, we report on the result of our study of the theoretical model for the generation of burst bulk flows. We first assume that the duskward electric field is generated in association with the magnetic reconnection, and subsequent generation of the fast plasma flows. The front of this fast plasma flow divides the magnetotail, i.e., there are electric field variations in the foreside of the front, but there are large electric fields in the rearside of this front. The electric field can propagate along the magnetic field down to the ionosphere, and some of its energy is dissipated due to the Joule heating, but the other part is reflected back to the magnetosphere. Thus the superposed electric fields in the central plasma sheet show oscillatory time variations, which causes the time variations in the plasma flow velocity as well.

The whole processes can be studied with the use of the equivalent electrical circuit, assuming an inductance along the earth magnetic field and a capacitance in the direction across the magnetic field. In our previous study, we obtained the plasma flow velocity, number density and the magnetic filed intensity by solving the equation for the equivalent electrical circuit and then plugging its solution to the equation that describes the motion of the magnetic flux tube of BBF. However, we neglected the effect of the pressure gradient in the previous study, so that, we included that term in the present study.

We found that the steepening of the BBF train was quenched by the effect of the plasma pressure as we expected. Also, several important parameters are found to be expressed by analytical forms using ionospheric and magnetospheric parameters.