Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

PEM26-17 会場:302 時間:5 月 24 日 14:45-15:00

Hybrid simulation of an ion scale magnetosphere: Structure of the magnetopause boundary

Hybrid simulation of an ion scale magnetosphere: Structure of the magnetopause boundary

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An ion scale magnetosphere is studied by performing a three-dimensional hybrid simulation. The hybrid simulation treats the ions as kinetic super particles via a particle-in-cell method and the electrons as a massless fluid. In this study, the ion scale magnetosphere has a dayside stand-off distance which is several to a hundred times larger than the ion Larmor radius of the solar wind proton in the magnetic field strength which magnetic pressure equals to the solar wind dynamic pressure. The dayside magnetopause boundary has a double- or triple-layer flow structure due to the finite Larmor radius effect in the interaction between the solar wind and the magnetosphere. The flow structure is controlled by the interplanetary magnetic field. For the small ion scale magnetosphere, the bow shock cannot well steepen because the dayside sheath thickness is an order of the ion Larmor radius and the shock transition region overlaps with the boundary flow structure. We will discuss the plasma convections, current flows, and field structures in various solar wind conditions.

キーワード: イオンスケール磁気圏, ハイブリッドシミュレーション
Keywords: Ion scale magnetosphere, hybrid simulation