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Global MHD simulations of magnetosphere and 3-dimensional visualization

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A study on perpendicular and parallel current generation mechanism in the magnetosphere is important problems in interaction between the solar wind and earth's magnetosphere-ionosphere. Moreover, classification to fundamental MHD quantities and MHD modes is also essential for understandings of the mechanism. Thus we have executed a high resolution global 3D MHD simulation and a 3D graphic diagnostics.

As the solar wind and IMF becomes abnormal conditions, plasma turbulence are strongly excited near boundary layers in the magnetosphere. In the plasma sheet magnetic reconnection occurs in patchy and intermittent manner to produce streamer-like structure. At the magnetopause, more regular vortex train in association with current generation is formed for northward IMF.

Dayside reconnection occurs in patchy and intermittent manner to give seeds of plasma turbulence. As the results, complicated and strong vortex turbulence appears in flank magnetopause. We will demonstrate those phenomena from 3-dimensional visualization method of simulation results to discuss relationship between the currents and vortices in boundary layers. In particularly we will stress relationship among parallel and perpendicular components of vorticity and current, and also compressibility in order to understand the fundamental picture of magnetospheric dynamics. Moreover we will separate the fundamental MHD quantities to various MHD modes in the whole volume, which can make clear their roles on the vorticity and current generation mechanisms.

Keywords: global MHD simulation, current generation mechanism, vorticity and compressibility, roles of MHD modes, magnetic reconnection, magnetospheric dynamics