Key Parameter of Planetary Magnetospheric Configuration

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It has long been recognized that the rapidly rotating magnetospheres of Jupiter and Saturn differ greatly from that of the Earth where rotational effects are largely confined to the plasmasphere. In addition to rapid rotation Jupiter and Saturn both have sources of plasma within the magnetosphere: the volcanos on Io and the ice geysers on Enceladus while the main sources of plasma at the Earth are the solar wind and ionosphere. The magnetic moments of the two rotating gas giants are much larger than that at Earth although the surface field at Saturn is about the same as the Earth's because of its larger radius. At the Earth magnetospheric dynamics are largely controlled by the interplanetary magnetic field and reconnection while at Jupiter and Saturn the solar wind dynamic pressure is more important. Internal processes are also more important at Jupiter and Saturn than at the Earth.

We have performed the MHD simulation of Earth, Jupiter and Saturn then found the each magnetosphere has a unique character. In particular, we have obtained the vortex configuration in magnetospheric convection from Saturn's results and it seems that the formation of vortex may be related to the cushion region where is the space between plasma corotation region and magnetopause. From the simple calculation, the cushion region is controlled by the planetary rotation speed and intrinsic magnetic field. Thus in this study we perform the MHD simulation of magnetosphere with changing the speed of rotation and magnitude of magnetic field to see how the magnetospheric configuration varies.

As the results of simulations, we have obtained the various configuration of magnetosphere. In the simulation the vortex and disturbed convection are appeared as the rotation speed decreases which means that the cushion region rate increases. From these results we think the cushion region is the one of key parameter to determine the configuration of magnetosphere.