

Formation of vortices on the Kronian magnetosphere with the high temporal and spatial resolution for MHD simulation

Keiichiro Fukazawa[1]; Tatsuki Ogino[2]; Raymond J. Walker[3]; Kiyohumi Yumoto[4]
[1] EPS, Kyushu Univ.; [2] STEL, Nagoya Univ.; [3] IGPP/UCLA; [4] SERC, Kyushu Univ.

The configuration and dynamics of the Earth's magnetosphere are largely controlled by the solar wind while Jupiter's magnetosphere is dominated by its massive rotating equatorial current sheet and plasma source at Io. Saturn has a rapid rotation equivalent to Jupiter and has the comparable strength of the magnetic field with Earth. Thus Saturn is often called that the planet has the intermediate character of Jupiter and Earth. In our previous simulation study, we show that the Kronian magnetosphere always has vortices and turbulent convection which are the result from the interaction of the solar wind and corotation or the solar wind and magnetospheric convection for no IMF, southward and northward IMF by the global magnetohydrodynamics (MHD) simulation. This suggested that the Kronian magnetosphere can be quite different from both Jovian and Earth's magnetospheres. Recently we have compared the simulation results with the observation by Cassini and obtained the very similar magnetic variation which indicated the vortices among them.

From the study of Kelvin Helmholtz (KH) vortex on the Earth's magnetosphere, the formation of vortex is greatly changed and the secondary variation is occurred in its vortex depending on the grid spacing size by the localized simulations. However these simulations cannot include the magnetic curvature which affects the occurrence of KH instability because of not treating the global configuration so that they may not represent the realistic magnetosphere. On the other hand, it is hard to simulate the global magnetosphere with such a tiny grid interval due to the limit of computer resources.

Recently thanks to the developments of computer and numerical calculation techniques, we can perform the global simulation of magnetosphere with the relatively small grid spacing. As the results of this simulation of Kronian magnetosphere, we found that the formation process and configuration of vortex were different from the previous low resolution simulations.

In this study we will show you the results of high resolution global simulation of the Kronian magnetosphere, analysis of the vortex, configuration of magnetic field line related to vortex and effects of aurora at Saturn.