

カッシーニ探査機の太陽風データを利用したMHDシミュレーションによる磁気圏対流、オーロラ発光の関係
Relation between Kronian magnetospheric convection and auroral emission from MHD simulation with solar wind data observe

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In a series of our simulation studies we have reported that vortices formed at Saturn's dawn magnetopause in simulations when IMF was northward. We interpreted these vortices as resulting from the Kelvin Helmholtz (K-H) instability. In addition, thanks to the recent developments of computer performance, we have been able to perform the high resolution global MHD simulations of the Kronian magnetosphere. In these simulations we obtained the signature of the field-aligned currents from the K-H vortices in Saturn's auroral ionosphere and found small patchy regions of upward field-aligned current which may be related to auroral emissions. These patchy aurorae resembling our results have been reported from Cassini observations.

In our previous simulations we used the constant and simple solar wind conditions to understand the basic behavior of Kronian magnetosphere. In this study we have used Cassini observations of the solar wind upstream of Saturn to drive a simulation. Using these solar wind data we simulated the Kronian magnetosphere from 2008-02-12/14:00:31 to 2008-02-13/01:59:31 when the Hubble Space Telescope (HST) observed the Kronian UV auroral emissions. In these solar wind conditions there are several enhancement of the solar wind dynamic pressure (shock) and polarity reversal in the IMF components.

From these simulation the shape and convection of Kronian magnetosphere dynamically changed according to the variation of dynamic pressure and IMF directions. As the results, layered convection formed between the corotation region and magnetopause. Furthermore these convection interacted each other, then the large vortex configurations appeared. The calculated configuration of field aligned currents from the simulation also showed the layered and patchy distributions. In addition the upward field aligned current appeared in the dawn side mainly which resembles the configuration of auroral emission by HST.