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MHD simulation of Kronian magnetosphere with the high resolution solar wind data

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In a series of 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. Recently thanks to the developments of in computer performance and numerical calculation techniques, we have been able to perform the global magnetospheric simulations of the magnetosphere with much higher resolution than was previously possible. In these simulations we had sufficient resolution to model 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. Recently, patchy aurorae resembling our results have been reported from Cassini observations.

As a follow on 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. This simulation required about 1500 hours from 768 processor cores on a 10 TFlops supercomputer system with 1TB memory. Thus in this paper we will show the initial simulation results from the solar wind driven simulation and the configurations of vortices and aurorae at Saturn.