Geophysical Research Abstracts
Vol. 13, EGU2011-3175, 2011
EGU General Assembly 2011

Spatial dependence of magnetopause energy transfer: Cluster measurements verifying global simulations

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We investigate the spatial variation of magnetopause energy conversion and transfer using Cluster spacecraft observations of two magnetopause crossing events as well as a global magnetohydrodynamic (MHD) simulation GUMICS-4. These two events, (Jan 16, 2001, and Jan 26, 2001) are similar in all other aspects except for the sign of the interplanetary magnetic field (IMF) y component that has earlier been found to control the spatial dependence of energy transfer. In simulations of the two events using observed solar wind parameters as input, we find that the GUMICS-4 energy transfer agrees with the Cluster estimate both spatially and in magnitude, suggesting that the GUMICS-4 simulation gives an accurate average description of the magnetopause energy transfer. According to the simulation, most of the the energy transfer takes place in the plane of the IMF (as previous modelling results have suggested), and the locations of the load and generator regions on the magnetopause are controlled by the IMF orientation. Assuming that the model results are as well in accordance with the *in situ* observations also on other parts of the magnetopause, we are able to pin down the total energy transfer during the two Cluster magnetopause crossings. Here, we estimate that the instantaneous total power transferring through the magnetopause during the two events is at least 1500-2000 GW, three times the value of ϵ