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Magnetopause energy transfer dependence on the interplanetary magnetic field and the Earth's magnetic dipole axis orientation

M. Palmroth (1), R. C. Fear (2), and I Honkonen (1)

(1) Finnish Meteorological Institute, Earth Observation, Helsinki, Finland (minna.palmroth@fmi.fi), (2) Uniersity of Leicester, Leicester, UK (rcf11@ion.le.ac.uk)

We examine the spatial variation of the magnetospheric energy transfer using both a global magnetohydrodynamic (MHD) simulation GUMICS-4 as well as using a large data set of flux transfer events (FTE's) inferred from Cluster spacecraft data. Our main purpose is to investigate whether it is possible to validate previous results on the spatial energy transfer variation from the GUMICS-4 simulation by the statistical occurrence of the FTE events, which are regarded as manifestations of magnetospheric energy transfer. Previous simulation results have suggested that the energy transfer pattern at the magnetopause rotates according to the interplanetary magnetic field (IMF) orientation, and here we investigate whether a similar rotation is seen in the locations of the FTE events. We find that the question is well-posed only during negative IMF y component, when a previously-predicted seasonal bias combines with the orbital bias of the spacecraft to make FTE observation more likely. During dawnward IMF, the FTE locations support the previous simulation results and confirm the earlier prediction that the energy transfers in the plane of the IMF. In addition, we investigate the energy transfer spatial variation due to dipole tilt angle and orientation with respect of the solar wind flow. We find that during northern (southern) winter conditions, the energy transfer occurs mainly in the southern (northern) hemisphere, and that the dayside reconnection region is located asymmetrically about the subsolar position. Finally, we find that the energy transfer is 10% larger at equinox conditions than towards solstices, contributing to the discussion concerning the semiannual variation of magnetospheric dynamics (known as 'the Russell-McPherron effect').