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Global simulations of the response of the cusp to solar wind discontinuities

J. Berchem (1), R. Richard (1), C.P. Escoubet (2), M. G. G. T. Taylor (2), H. Laakso (2), A. Masson (2), I. Dandouras (3), H. Reme (3), F. Pitout (4), and M. Dunlop (5)

(1) UCLA, IGPP, Los Angeles, California, United States (jberchem@igpp.ucla.edu), (2) ESTEC, ESA, Noordwijk, Netherlands, (3) CESR, CNRS, Toulouse, France, (4) LPG, CNRS, Grenoble, France, (5) RAL, Didcot, United Kingdom

We present the results of three-dimensional magnetohydrodynamic (MHD) and large-scale particle (LSK) simulations of the response of the cusp to an abrupt rotation of the interplanetary magnetic field (IMF). The study is based on Cluster measurements on 23 September 2004. During the event the four satellites crossed the polar cusp within 2-16 minutes from each other while the IMF rotated from a southward to a northward direction. The first two spacecraft observed typical IMF-southward ion dispersions, while the last one observed both an IMF-southward-like dispersion in the boundary layer and an IMF-northward dispersion in the cusp. First, we use the global MHD simulation to determine the global topology of the magnetic field at different times during the event. We then investigate the topology predicted by the global MHD simulation by computing ion dispersions from a large sample of ion trajectories determined from the time-dependent MHD electric and magnetic fields. We conclude by comparing the results of the simulations with Cluster ion measurements and discussing the consequences of the IMF rotation on the large-scale topology of the high-latitude cusp and particle entry into the dayside magnetosphere.