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Cusp signatures of ion entry and acceleration at the magnetospheric boundary: Large-scale modeling of Cluster observations

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Multi-point observations by the Cluster spacecraft have revealed the complexity of ion entry and acceleration at the magnetopause. In particular, successive measurements made by the spacecraft during periods of predominantly southward interplanetary magnetic field (IMF) often show the occurrence of large-scale structures in the energy-latitude dispersions of ions in the cusps. To determine the origins of these structures we have carried out large-scale simulations of the entry of ions at the magnetospheric boundary for southward IMF. Our study is based on using the time-dependent electric and magnetic fields predicted by three-dimensional global MHD simulations to compute the trajectories of large samples of solar wind ions launched upstream of the bow shock. Particle information collected in the simulations is then used to reproduce ion dispersions along spacecraft trajectories and determine the origins of the structures. We discuss the results of the study in the context of injection sources and reconnection processes at the dayside magnetopause. In particular, we investigate whether structures form during periods of quasi-steady reconnection.