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Large-scale topology of magnetic reconnection at the dayside magnetopause: Results from global simulations

Jean Berchem and Robert Richard

Institute of Geophysics and Planetary Physics, UCLA, Los Angeles, California, USA

Measurements from multi-spacecraft mission offer a unique opportunity to investigate the large-scale topology and dynamics of magnetic reconnection at the dayside magnetosphere. Recent three-dimensional global magnetohydrodynamic (MHD) simulations and observations from the DOUBLE STAR (TC1) and CLUSTER spacecraft indicate that antiparallel merging at high latitudes and component merging in the subsolar region can occur simultaneously when the IMF has a strong east-west component. The locations of the high-latitude merging sites are generally consistent with the antiparallel merging model. Analysis of the parallel electric field indicates that the extent of the component reconnection region depends on the resistivity model used in the simulations. To assess the relative contribution of each mechanism in the transfer of solar wind energy and mass to the magnetosphere, we use large-scale kinetic (LSK) calculations to compute a large sample of ion trajectories in the time-dependent MHD electric and magnetic fields. We determine the locations on the dayside magnetopause where ions gain significant amount of energy and compare them with the different merging regions identified from the global MHD simulations. The maps of energization are then used to determine to what extent the accelerated particles subsequently populate the magnetospheric boundary layers and the plasma sheet.