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Tracing Mass and Energy Within the Magnetotail: GUMICS-4 Global MHD Simulation Results

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The magnetotail energy, magnetic flux, and plasma transport are ultimately driven by reconnection at the frontside magnetopause. During southward IMF reconnection occurs near the subsolar regions, while during northward IMF the reconnection locations move to high latitudes and the reconnection efficiency becomes much smaller. In the plasma sheet, reconnection in the magnetotail is one of the key factors in determining the transport properties and tail energy state. Here we use the GUMICS-4 global MHD simulation to trace mass and energy flow trajectories within the magnetosphere and examine how the plasma sheet characteristics are determined by the mass and energy transfer routes. We show that the energy and mass entry are sensitive functions of the IMF as well as the solar wind pressure. Further, we introduce quantitative proxies of reconnection efficiency in the magnetotail. Using these criteria, we examine the relationship between the tail reconnection efficiency and plasma and magnetic flux transport both Earthward and tailward of the reconnection region, and the relationship of these processes with the driving solar wind as well as energy and mass flux entering the magnetosphere.