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Reconnection in Saturn's magnetotail and its effects on global dynamics

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Both the external solar wind and the internal plasma loading play an important role in driving global dynamics of Saturn's magnetosphere. We have carried out three-dimensional global MHD simulations to investigate the solar wind interaction with the mass-loaded Kronian magnetosphere by using an idealized solar wind input with features typical of Corotating Interaction Regions (CIRs) observed at Saturn's orbit. In this presentation, we will focus on reconnection in Saturn's magnetotail under different external conditions and its effects on global dynamics. In our simulation, we have identified two types of reconnection processes in the magnetotail. One is reconnection on closed field lines, which occurs independent of the solar wind and IMF conditions, and the other is reconnection between open field lines in the two tail lobes, which occurs only under certain IMF conditions that facilitate dayside magnetopause reconnection (such as during northward IMF). It is found that lobe-lobe field line reconnection produces fast plasma flows moving both tailward and planetward. The subsequent motion of the planetward fast flows, as they move from the nightside reconnection site to the dayside magnetosphere, produces strong field-aligned currents intensification in the ionosphere, especially on the dawn side. In contrast, for the case of close field line reconnection, flow enhancements and the associated field-aligned currents signatures are relatively weak. We have also evaluated the importance of the two reconnection processes in removing plasma from Saturn's magnetosphere. Our results indicate that a large fraction of magnetospheric plasma is lost via plasmoids resulting from closed field line reconnection.