Magnetopause reconnection in the Gumics-4 global MHD simulation

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Global MHD simulation models are the present-day standard choice for modelling the entire magnetosphere and solar wind-magnetosphere-ionosphere coupling self-consistently. They are particularly useful in estimating integrated quantities, such as the total flux of e.g. mass or energy through the magnetopause. In this study we use the Gumics-4 simulation code to investigate the features and the global role of reconnection on the magnetopause. We find that magnetic merging in the simulation, measured by divergence of the Poynting vector, is concentrated around the subsolar point for most IMF orientations. A three-dimensional topological definition for the magnetopause x-line is presented, and the x-line is shown cross the subsolar region for all but almost exactly northward orientations of the IMF. This aspect thus seems consistent with the prediction of the component reconnection model. We then analyze quantitatively the effect of solar wind conditions on the reconnection efficiency and the magnetospheric convection associated with the opening of field lines at the magnetopause and their closure in the tail.