Using multi-spacecraft observations and simulations to determine the large-scale topology of the dayside magnetospheric boundary

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Multi-spacecraft observations offer a unique opportunity to evaluate global models in simulating the complex topology and dynamics of the dayside magnetosphere. The principle of these studies consists of using interplanetary magnetic field (IMF) and plasma parameters measured by solar wind monitors upstream of the bow shock as input to the simulations. The validity of the large-scale topological features deduced from the simulations is then tested by comparing local data streams from the simulations with spacecraft time series. In this paper, we review recent progress in using three-dimensional global magnetohydrodynamic (MHD) simulations to model the large-scale topology and dynamics of magnetic reconnection at the dayside magnetosphere by comparing their predictions with observations from the DOUBLE STAR (TC1) and CLUSTER spacecraft. Results of these studies emphasize the importance of the locations where discontinuities embedded in the solar wind impact the magnetosphere as well as the effects of the time evolution of the draping of the magnetosheath field in the global merging process, and hence the invaluable insight provided by global simulations.