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Dynamic pressure enhancement effects on the nightside magnetotail: Global MHD simulation and observations

Dogacan Ozturk, Shasha Zou, James Slavin, and Aaron Ridley
Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, USA (dcsoztrk@umich.edu)

Enhanced solar wind dynamic pressure results in compression of the Earth's magnetosphere and reconfiguration of the global current systems. We study the effects of the dynamic pressure enhancements on the evolution of the magnetotail configuration, flow channel formation and subsequent pressure buildup in the inner magnetosphere. Using the University of Michigan Block Adaptive Tree Solarwind Roe Upwind Scheme (BATS'R'US) coupled with the Ridley Ionosphere Model (RIM), we studied dynamic pressure enhancements on June 11, 2017 between 14:40 UT – 17:40 UT. The dynamic pressure was constant around 2 nPa in the beginning of the interval and the IMF Bz turned southward at 15:04 UT, followed by two pressure enhancements at 16:10 UT and 16:46 UT. After the enhanced pressure front reaching the midtail, high speed earthward flow channels formed in the tail current sheet with velocities exceeding 750 km/s. In the ionosphere, this flow channel is associated with a pair of upward and downward FACs, similar to the FAC profiles derived from Active Magnetosphere and Polar Electrodynamics Response Experiment (AMPERE). In the inner magnetosphere region, plasma pressure increased after the arrival of the flow channel. About the same time, MMS spacecraft [X=-22 Re, Y=-11 Re, Z=4.1 Re] observed 1000 km/s tailward flow with a bipolar Bz signature. Both observations and simulation results suggest that a tail reconnection event was triggered by the solar wind dynamic pressure enhancement.