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Comprehensive Case Study of Magnetosheath Pressure Pulses and Rapid Magnetopause/Bow Shock Motion

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We present multi-point observations of dayside transient events and their impact on the Earth's magnetosphere. The Magnetospheric Multiscale (MMS) spacecraft observed a series of pulsed density enhancements and a rapid transition from the magnetosphere to the region upstream from the bow shock within just 2 min on 10 December 2016. Strong antisunward, and sometimes sunward, flows are observed in conjunction with the pulses, which are bathed in energetic particles that appear to have escaped from the outer magnetosphere rather than energization of solar wind particles within the foreshock. The selectively escaping ion species provide information concerning distance from the magnetopause to the bow shock. The transient magnetosheath density and (corresponding dynamic pressure) enhancements may result from solar wind discontinuities interacting with the bow shock and/or ripples generated on the bow shock surface. Observed magnetospheric responses to these transient phenomena include patchy, sporadic magnetopause reconnection, magnetopause surface waves, transient magnetic field variations in ground magnetograms and ionospheric flow enhancements. We inspect the strikingly different observations seen by multipoint solar wind monitors at different locations and the transient response seen by high-latitude ground magnetometers and radars.

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