Energetics of the terrestrial bow shock

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The solar wind is the primary energy source for the magnetospheric energy budget. Energy can enter through the magnetopause both as kinetic energy (plasma entering via e.g. magnetic reconnection and impulsive penetration) and as electromagnetic energy (e.g. by the conversion of solar wind kinetic energy into electromagnetic energy in magnetopause generators). However, energy is extracted from the solar wind already at the bow shock, before it encounters the terrestrial magnetopause. At the bow shock the supersonic solar wind is slowed down and heated, and the region near the bow shock is known to host many complex processes, including the accelerating of particles and the generation of waves. The processes at and near the bow shock can be discussed in terms of energetics: In a generator (load) process kinetic energy is converted to (from) electromagnetic energy. Bow shock regions where the solar wind is decelerated correspond to generators, while regions where particles are energized (accelerated and heated) correspond to loads. Recently, it has been suggested that currents from the bow shock generator should flow across the magnetosheath and connect to the magnetospause current systems [Siebert and Siscoe, 2002; Lopez et al., 2011]. In this study we use data from the Magnetospheric MultiScale (MMS) mission to investigate the energetics of the bow shock and the current closure, and we compare with the MHD simulations of Lopez et al., 2011.