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Magnetopause-foreshock interactions induced by dayside reconnection

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We investigate the effects of dayside reconnection events on the bow shock in global hybrid-Vlasov simulations of the terrestrial magnetosphere. Using the Finnish Meteorological Institute's hybrid-Vlasov model Vlasiator (http://vlasiator.fmi.fi), which couples kinetic ions through Vlasov's equation with charge-neutralising fluid electrons, the solar wind-magnetosphere interaction is modelled self-consistently in two spatial and three velocity dimensions. Recent polar plane simulations with southward IMF cover both the dayside and nightside reconnection sites, in a volume ranging from about 40 Earth radii (RE) upstream to about one hundred RE downstream.

Dayside reconnection at the magnetopause results in the formation of the two-dimensional equivalents of flux transfer events. These magnetic islands are accelerated and move from the subsolar region towards the cusps and beyond. In doing so, they generate fast-mode waves ahead and behind, which propagate throughout the magnetosheath and can lead to significant perturbations in the bow shock shape and position. We investigate such simulated events and their signatures in the magnetosheath, at the bow shock and in the foreshock. We also analyse observational data to find similar signatures in spacecraft measurements and discuss the requirements for THOR instruments if they were to be able to fully characterise such an event.