



Solar wind beam deceleration upstream the Earth bow shock: THEMIS case and statistical studies

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It was suggested that the solar wind deceleration within the Earth's foreshock results from momentum transfer between the backstreaming and solar wind ions through wave-particle interaction. This phenomenon was studied by many authors but the results are affected by computations of plasma moments when using electrostatic analyzers with different working modes and methods of moment calculations. Using the closely-separated THEMIS spacecraft, we present a few examples showing the deceleration of the solar wind beam itself with a negligible influence caused by the gyrating reflected populations. The case study is supported with a large statistics of Wind and THEMIS-ARTEMIS simultaneous measurements with motivation to demonstrate which way is the solar wind speed modified at different distances from the bow shock. We quantify the effects of a systematic deceleration of the average plasma bulk speed with a decreasing distance to the bow shock. We show that the reflected and accelerated particles not only excite the waves of large amplitudes but also modify mean values of plasma bulk parameters within a broad range of Mach numbers.