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Artificial spacecraft in hybrid simulations of the quasi-parallel Earth's bow shock: analysis of time series versus spatial profiles and a separation strategy for Cluster

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Abstract. We construct artificial "software" spacecraft consisting of magnetometers and 3D thermal and energetic ion detectors. Four such spacecraft are "flown" through a 1D simulation of a quasi-parallel shock. We analyze the resulting time series from the spacecraft, and then use the more complete simulational information to evaluate our interpretations based on the limited times series information. The separation strategy used, with two closely spaced spacecraft pairs separated by a large distance, was helpful in the interpretation, since a variety of important processes operate over several different scale lengths. This work highlights the ability to draw inferences about spatially and temporally varying phenomena based on multiple-spacecraft time series data, and suggests that many spacecraft configurations which bear little resemblance to the classic Cluster tetrahedron may be necessary when multiple scale lengths are present.

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