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Interaction of the interplanetary shocks with the Earth's bow shock: INTERBALL observations and modeling

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Interplanetary shock waves (IS) belong to those solar wind structures relatively often observed by the spacecraft located at various distances from the Earth. The strongest ones are usually a part of greater solar wind structures such as coronal mass ejections or corotating interaction regions although weaker shocks and discontinuities are not necessarily companions of such global solar wind phenomena. Large pressure changes are maintained across the interplanetary shocks. They are highly geoeffective when they encounter the Earth's magnetosphere affecting in particular its outer regions. Such processes have been a subject of recent theoretical, experimental and computer simulation studies, but not all problems are yet well understood.

One of these topics is the interaction and transport of interplanetary shocks through the bow shock. In our contribution, we aim to discuss several INTERBALL-1 observations of interplanetary shocks in the magnetosheath. The shock passage is often followed by the crossing of the satellite through the Earth's bow shock with a delay of a couple of minutes. In this interval, we encountered increased and less deflected antisunward plasma flux, compressed magnetic field and hot electron population. The interval is probably further structured, usually a two-step plasma flux increase is registered. Depending on the satellite position in the magnetosheath, a return to the magnetosheath could be observed few minutes later because of a wave traveling tailward along the bow shock front. For a comparison we have used a numerical non-stationary

3-D MHD model incorporating an interaction of the supersonic plasma flow with a solid body to study the interaction of the fast forward shocks with the magnetosheath and the related bow shock movement. The results are in a good agreement with in-situ INTERBALL observations.