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Cavitons and spontaneous hot flow anomalies in a hybrid-Vlasov global simulation

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We present the first study of foreshock cavitons and spontaneous hot flow anomalies (SHFA) employing the Vlasiator global hybrid-Vlasov simulation code. Consistent with previous findings we show that cavitons evolve into SHFAs as they approach Earth's bow shock. Some SHFAs survive their interactions with the shock and cross into the downstream magnetosheath, where they can result in the formation of magnetosheath cavities previously identified in observations and simulations. We identify a region where a large scale magnetosheath cavity develops and leads to local weakening and erosion of the shock, altering shock-foreshock dynamics and upstream proton velocity distribution functions. We then present a statistical study of global caviton and SHFA size distributions. Vlasiator facilitates a global simulation view while maintaining correct length scales. The virtual spacecraft observations that we present agree well with results from observational studies.