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Towards a global hybrid Vlasov magnetospheric model: A test particle simulation

Ilja Honkonen, Arto Sandroos, and Minna Palmroth
Finnish Meteorological Institute, Earth Observation, Helsinki, Finland (firstname.lastname@fmi.fi)

We are developing a global hybrid Vlasov model and as a first step towards that goal we use our parallel 6-dimensional Vlasov solver to drive a global test particle simulation using the electric and magnetic fields from the state-of-the-art 3-dimensional global MHD simulation GUMICS-4. In this test a Maxwellian distribution of protons with the average properties of the measured solar wind is constantly inserted into the sunward edge of the test particle simulation located at 16 Re upstream from the Earth. The protons are propagated by a 6 dimensional (3 space + 3 velocity dimensions) Vlasov solver using the method of Kurganov and Tadmor (2000) for solving advection equations. The computations are carried out for a multiple substorm event that occurred on 18 Feb 2004 and has previously been analysed with the GUMICS-4 simulation. We present our approach to developing a new massively parallel hybrid Vlasov simulation with inhomogeneous spatial and velocity grids. We compare the results from the global test particle simulation to the results from the global MHD simulation and discuss the capabilities of the final fully coupled model.

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