EGU22-6378, updated on 18 Aug 2022
https://doi.org/10.5194/egusphere-egu22-6378
EGU General Assembly 2022

Kinetic signatures of magnetic reconnection in the global hybrid-Vlasov and local particle-in-cell simulations.

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Magnetic reconnection is the energy converter in space plasma that releases magnetic energy into the kinetic energy of particles. We study the magnetotail reconnection in the first 3D global magnetospheric hybrid-Vlasov simulation performed with Vlasiator code. We also performed a simulation of symmetric magnetic reconnection in particle-in-cell technique with the iPIC3D code to compare ion kinetic signatures of reconnection for both hybrid-Vlasov and fully-kinetic approaches. Despite the relatively coarse spatial resolution in the global 3D hybrid-Vlasov model, we are able to recognize the most distinguished reconnection features: ion demagnetization, non-gyrotropic ion acceleration and energy dissipation. Using the well-known signatures of the different subregions of symmetric magnetic reconnection we are able to identify ion diffusion regions, separatrices and reconnection jet fronts in the global simulation. Guided by the measure of the ion perpendicular slippage, we identify ion diffusion regions where ion non-gyrotropic crescent-type distributions are formed. These distinguishable features are nicely visible in the PIC simulation data as well. Separatrix regions are visible as the layers containing the potential Hall electric field at the boundaries of accelerated outflow. Reconnection jet fronts in the global simulation are highlighted at the positions where the energy dissipation peaks. Three-dimensional effects affecting the extending of the reconnection characteristics in the equatorial plane are discussed.