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Structures in the Hermean magnetosphere day side for MESSENGER high latitude polar orbits

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The aim of this research is to simulate the interaction of the solar wind with the magnetic field of Mercury and study the magnetosphere structures in the day side of the planet. We reproduce the magnetosphere structures for two MESSENGER orbits with the satellite closest approach located at high latitudes using the open source MHD code AMRVAC in spherical geometry and a multipolar expansion of the Hermean magnetic field (Anderson, B. J. et al, 2012). We made two simulations with realistic solar wind parameters that show different magnetosphere configurations but in both cases there is a plasma stream that links the back of the bow shock with the North Hemisphere of Mercury. The satellite crosses this structure along the trajectory between the magnetopause and the closest approach to the planet. In the simulation the plasma precipitates from the back of the bow shock region where the interplanetary and the Hermean magnetic field reconnect, following the open magnetic lines to the planet surface showing a fast expansion and cooling. The plasma reaches the surrounding of the planet North pole in a region of strong inflow where the density, temperature and plasma pressure rise. If we measure the magnetic field along the satellite trajectory in the simulation, the position of the magnetospheric structure is correlated with a perturbation of the magnetic field that is observed by MESSENGER at almost the same location.

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