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Three-dimensional, ten-moment multifluid simulation of the solar wind interaction with Mercury CHUANFEI DONG, AMMAR HAKIM, PPPL, LIANG WANG, UNH, AMITAVA BHATTACHARJEE, PPPL, KAI GERMASCHEWSKI, UNH, GINA DIBRACCIO, NASA GSFC — We investigate Mercury's magnetosphere by using Gkeyll ten-moment multifluid code that solves the continuity, momentum and pressure tensor equations of both protons and electrons, as well as the full Maxwell equations. Non-ideal effects like the Hall effect, inertia, and tensorial pressures are self-consistently embedded without the need to explicitly solve a generalized Ohm's law. Previously, we have benchmarked this approach in classical test problems like the Orszag-Tang vortex and GEM reconnection challenge problem. We first validate the model by using MESSENGER magnetic field data through data-model comparisons. Both day- and night-side magnetic reconnection are studied in detail. In addition, we include a mantle layer (with a resistivity profile) and a perfect conducting core inside the planet body to accurately represent Mercury's interior. The intrinsic dipole magnetic fields may be modified inside the planetary body due to the weak magnetic moment of Mercury. By including the planetary interior, we can capture the correct plasma boundary locations (e.g., bow shock and magnetopause), especially during a space weather event.

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