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THREE-DIMENSIONAL MHD MODELING OF THE INTERACTION OF THE SOLAR WIND WITH THE MAGNETOSPHERE OF MERCURY AT THE TIME OF THE FIRST MESSENGER FLYBY.

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We report the first results of the magnetohydodynamics (MHD) modeling of the magnetosphere of Mercury and its interaction with the solar wind using the data collected by the MESSENGER spacecraft during its first flyby of the planet in January 2008. This study is based on solving the MHD equations over an adaptive Cartesian grid that is refined or relaxed as needed. For this calculation, only solar wind protons are taken into consideration, and the effect of mass loading due to pick-up ions of magnetospheric origin is neglected. The internal magnetic field of Mercury is modeled as an eccentric tilted dipole. Our model shows that an intrinsic dipole combined with the prevailing solar wind conditions observed before and after the flyby yield a magnetic field profile and magnetospheric boundary crossings along the MESSENGER trajectory that are consistent with the observations by the Magnetometer. Moreover, our model confirms the presence of several brief northward-southward interplanetary magnetic field inversion events while the spacecrafts was in the magntosheath of the planet. The model results will be compared with the observations of Mariner 10 in 1974-75, and predictions will be made for the subsequent two MESSENGER flybys of the planet.