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# Studying non-linearity of Mercury magnetosphere and solar wind interaction features using the combined hybrid model

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The main focus of this work is to investigate non-linearity of Mercury's magnetospheric features. We use the paraboloid magnetospheric model (PMM) to calculate the initial magnetospheric field which we then use in hybrid simulations. We show that the initial total magnetospheric field can be considered a linear combination of the planetary dipole field, magnetospheric current system fields, and a penetrating portion of the interplanetary magnetic field (IMF).

We use two sets of modelling runs with IMF values of identical magnitudes and anti-parallel directions. We then compute semi-sums and semi-differences of final magnetic field maps generated by hybrid plasma simulations, and use semi-sums to cancel out IMF contributions and semi-differences to cancel out PMM contributions. The remnant fields outside and inside the magnetosphere (for semi-sum and semi-difference fields, accordingly) are used to improve our ability to determine the position of the bow shock and magnetopause, as well as calculate the IMF penetration coefficient that results into best matches of this model to observational MESSENGER data. We compare Mercury's magnetosheath magnetic field predicted by our model with MESSENGER data in the appropriate orbit sections.