Solar Wind Simulations along the Parker Solar Probe Trajectory

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Solar wind (SW) modeling is a crucial component of space weather forecasting. It describes the propagation of solar coronal disturbances towards Earth orbit, such as coronal mass ejections (CMEs) and energetic particles. Forecasting space weather requires a better understanding of the physical processes that occur in the SW plasma. At the same time, Parker Solar Probe (PSP), which was launched on August 12, 2018, provides us with a unique set of in situ SW measurements at distances as close as the Sun's critical surface. This could help in the validation of solar corona and inner heliosphere numerical models. We use the photospheric magnetograms as input to perform simulations of the 3D global heliosphere using an empirically driven MHD model developed within the frameworks of the Multi-Scale Fluid-Kinetic Simulation Suite (MS-FLUKSS). For the completed orbits, we compare our SW simulations in the inner heliosphere with in situ measurements along the PSP trajectory. We also compare our simulations with the near-Earth SW properties which are closely monitored and stored at the OMNI database. This study helps us understand the SW acceleration and provides better constraints for our semi-empirical data-driven MHD model.

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