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Comparative empirical approaches for solar wind predictions from white light coronal observations

We present a comparison of three empirical methods for defining the boundary conditions and MHD properties of the solar wind at 0.1 AU (velocity, density, and temperature). These boundary conditions are then used by the PLUTO/HelioCast MHD code to determine the 3D profile of the solar wind up to 1 AU. The first method relies on synoptic maps from the ADAPT model, based on the distance to the neutral line (NL). We propose an improvement to this approach by varying the source surface radius to better capture the geometry of the separation line. The second method is based on white light observations of the solar corona (LASCO), using the distance to the stream maximum brightness (SMB). Finally, the last method is an enhancement of these white light observations, adding corrections related to fine coronal structures. The models obtained from these three approaches are evaluated over the solar cycle (from the minimum in 2018 to a period of high activity in 2024) by comparison with in-situ data near Earth, in order to determine which model performs best during each phase of the solar cycle.