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How changing of source surface height parameter in EUHFORIA affect solar wind simulations

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A large discrepancy between modelling results and in-situ observations by Parker Solar Probe (PSP) was observed while modelling of solar wind using the 3D MHD model EUHFORIA (Pomoell & Poedts, 2018) at near the Sun distances. The default coronal model used in EUHFORIA consists of potential field source surface extrapolation (PFSS), Schatten current sheet (SCS) model and semi-empirical WSA model, which simulate plasma and magnetic conditions at inner boundary (0.1 AU). The outer boundary of PFSS model, known as source surface height parameter (RSS), and the inner boundary of SCS model are among the free parameters in the coronal model that determine the area of modelled coronal holes, which in turn influences the area of open flux. A default value of $RSS = 2.6 R_{\odot}$ as suggested by McGregor et al. (2008) is used in solar wind modelling at short radial distances. It is reported that lower RSS value in coronal models better captures the area of coronal holes (Asvestari et al., 2019), reconstructs small-scale features (Badman et. al., 2020), and represents coronal magnetic field topologies during different phases of solar cycles (Lee et al. 2011; Arden et al. 2014).

In this study, we change RSS value and inner boundary of SCS model, while keeping default values for other parameters. We then compare the solar wind modelling results with modified RSS parameter to those obtained using all default parameters in the coronal model, by evaluating their agreement with the in situ observations from PSP for its first ten perihelion encounters.

Primary author: Dr VALLIAPPAN, Senthamizh Pavai (Royal Observatory of Belgium)

Co-author: MAGDALENIC, Jasmina (Royal Observatory of Belgium)

Presenter: Dr VALLIAPPAN, Senthamizh Pavai (Royal Observatory of Belgium)

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