Can we forecast the arrival of ICMEs for the whole Solar Systems?

Dario Del Moro, Gianluca Napoletano, Francesco Berrilli, Luca Giovannelli, Ermanno Pietropaolo, and Raffaello Foldes

1 Universita di Roma Tor Vergata, Italy
2 University of L'Aquila, Italy

Solar wind transients, i.e. interplanetary coronal mass ejections (ICMEs) drive Space Weather throughout the heliosphere and the prediction of their impact on different solar system bodies is one of the primary goals of the Planetary Space Weather forecasting. We realized a procedure based on the Drag-Based Model (Vrsnak et al., 2013, Napoletano et al. 2018) which uses probability distributions for the input parameters, and allows the evaluation of the uncertainty on the forecast. This approach has been tested against a set of ICMEs whose transit times are known, obtaining extremely promising results.

We apply this model to propagate a sample of ICMEs from their sources on the solar surface into the heliosphere. We made use of the seminal works by Prise et al. (2015), Winslow et al. (2015) and Witasse et al. (2017) who tracked the ICMEs through their journeys using data from several spacecraft.

Considering the extremely short computation time needed by the model to propagate ICMEs, this approach is a promising candidate to forecast ICME arrival to planetary bodies and spacecraft in the whole heliosphere, with relevant application to space-mission short-term planning.