CME arrival prediction and its dependency on input data and model parameters

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During the last years, we focused on developing a prediction tool that utilizes the wide-angle observations of STEREO’s heliospheric imagers. The unsurpassable advantage of these imagers is the possibility to observe the evolution and propagation of a coronal mass ejection (CME) from close to the Sun up to 1 AU and beyond. We believe that using this advantage instead of relying on coronagraph observations that are limited to observe only 14% of the Sun-Earth line, it is possible to improve today’s CME arrival time predictions.

The ELlipse Evolution model based on HI observations (ELEvoHI) assumes an elliptic frontal shape within the ecliptic plane and allows the CME to adjust to the ambient solar wind speed, i.e. it is drag-based. ELEvoHI is used as an ensemble simulation by varying the CME frontal shape within given boundary values. The results include a frequency distribution of predicted arrival time and arrival speed and an estimation of the arrival probability. ELEvoHI can be operated using several kinds of inputs. In this study we investigate 15 well-defined single CMEs when STEREO was around L4/5 between the end of 2009 and the beginning of 2011. Three different sources of input propagation directions (and shapes) are used together with three different sources of ambient solar wind speed and two different ways of defining the most appropriate fit to the HI data. The combination of these different approaches and inputs leads to 18 different model set-ups used to predict each of the 15 events in our list leading to 270 ELEvoHI ensemble predictions and all in all to almost 60000 runs. To identify the most suitable and most accurate model set-up to run ELEvoHI, we compare the predictions to the actual in situ arrival of the CMEs.

This model is specified for using data from future space weather missions carrying HIs located at L5 or L1 and can also directly be used together with STEREO-A near real-time HI beacon data to provide real-time CME arrival predictions during the next 7 years when STEREO-A is observing the Sun-Earth space.
