

Drag-Based Ensemble Model (DBEM): probabilistic model for heliospheric propagation of ICMEs

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Abstract

Drag-based Model (DBM) is a simple empirical model for heliospheric propagation of Interplanetary Coronal Mass Ejections (ICMEs) based on the equation of motion where the drag acceleration has a quadratic dependence on the ICME relative speed. It predicts the ICME arrival time and speed at Earth or other targets in the solar system. However, the main drawback of empirical and numerical models (eg. ENLIL) is the lack of reliable observations that are needed for the model input. Comparison of observations and the DBM forecasts revealed that the error in the ICME arrival time is quite large and usually varies for different events from 0 to 24 hours. The advantage of DBM is very fast computational time ($\ll 1s$) compared to numerical models (ENLIL) and allows applying the ensemble modeling approach to provide a probabilistic forecasting of ICME arrival time and speed. Ensemble modeling takes into account the variability of model input parameters by making an ensemble of n different input parameters to calculate a distribution and significance of DBM results. Using such approach DBEM can determine most likely ICME arrival times and speeds, quantify the prediction uncertainties and calculate the forecast confidence intervals.