Predicting the Arrival of ICME Signatures at L1 with Stereoscopic Measurement and Physics-Constrained Drag-Based Modeling

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We present a new technique for predicting the arrival of Interplanetary Coronal Mass Ejection (ICME) signatures, including the sheath front and the magnetic cloud, at the L1 point using arrival times obtained from the ACE satellite. The method is based on obtaining accurate height measurements of the CME based on observations from multiple observing points and fitting these measurements into a drag-based model. Unlike previous work with the drag-based model, our technique does not fit the data assuming static model parameters and instead varies the characteristics of aerodynamic drag as a function of distance into the Heliosphere, using physical assumptions to simplify the model terms. This correction, as well as a geometric correction based on the propagation direction of the eruption and flux rope geometry allow for an improved prediction at L1. The method is currently dependent on white-light images from the STEREO spacecraft, but demonstrates the great benefit to space weather forecasting that could be derived from a mission to the L5 point. Combining coronagraph and heliospheric imager observations from L5 with SOHO data to allow for stereoscopic imaging of all Earth directed CMEs could greatly improve our forecasting capabilities.