Ensemble CME Forecasting

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Abstract:

Since Oct 2011, the Space Weather Prediction Center (SWPC) has used Enlil, a well-documented magnetohydrodynamic model of the heliosphere, to make numerical space weather forecasts of the arrival of coronal mass ejections (CMEs) at Earth. Earth-directed CMEs are characterized using the SWPC CME Analysis Tool, which uses three views of a CME provided by SOHO and the two STEREO spacecraft to parameterize the CME speed, width, and direction of propagation. Because of the nature of the observations, all CME and solar wind inputs used at the inner boundary of Enlil have inherent uncertainty. We have conducted a retrospective ensemble study of six events from 2012 and early 2013. We compare ensemble output against in-situ WIND data to ascertain which model inputs most strongly affect the error in the CME arrival time. As part of the outcome of this study, we suggest a simple process that can be used in near-real-time to improve CME forecasts.