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Forecasting coronal mass ejections at 1 AU using Heliospheric Imagers

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We study the feasibility of using a Heliospheric Imager (HI) instrument, such as STEREO/HI, for operational space weather forecasting of interplanetary coronal mass ejections (ICMEs) at 1 AU. We compare the predictions for speed and arrival time for about 20 ICME events, each observed remotely by one STEREO spacecraft, to the speed and arrival time observed at various in situ observatories. We use geometrical modeling, which means we approximate the ICME fronts with various shapes (Fixed-Phi, Harmonic Mean, Self-Similar Expansion). These models are applied to the time-elongation functions extracted from STEREO/SECCHI images with the SolarSoft SATPLOT package. We use these techniques for a single-spacecraft HI observer, and consequently assume constant ICME speed and direction. Partly, the configuration mimics the situation of a single HI observatory parked at the L4 or L5 point in the Sun-Earth system. For assessing the accuracy of these predictions we look at plasma and magnetic field in situ data by Wind (MFI, SWE instruments) and STEREO-A/B (IMPACT, PLASTIC) around 1 AU. Wherever possible we include ICME arrivals in the inner heliosphere (< 1 AU), from the magnetic field data by Venus Express and MESSENGER. We also look at the ratio of prediction lead time to its accuracy, and see if there is a preferred value for the ICME width.