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A potential near real-time algorithm for CME propagation utilizing heliospheric imaging observations

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The estimation of the Coronal Mass Ejection (CME) arrival at Earth is an open issue in the field of Space Weather. We present a new near real-time algorithm based on heliospheric imaging (HI) observations of the CME front as a function of time. First, we transform the front elongation angle into radial distance using basic stereoscopic techniques (i.e. fixed-phi, harmonic mean and self-similar expansion). Then we adopt the assumptions that (1) CME accelerate (or decelerate) from the Sun up to some distance and (2) they move with a constant speed past that distance. This "two-phase kinematics" behavior forms the core of our algorithm. The resulting kinematic profiles provide estimates of the CME Time-of-Arrival (ToA) and Speed-on-Arrival (SoA) at 1 AU. This new tool is tested on a sample of CMEs where stereoscopic views were possible, from the STEREO-A and -B HIs were available. The algorithm is promising with predictions for the ToA of CMEs of the order of ±1 hour and for SoA of ±100 km/s. Our approach is in preparation for a possible future combination of HI data from missions at L5. We will test our method further for cases beyond the 1 AU studying ICMEs which has been spotted also on Mars (1.52 AUs).