



Evolution of ICMEs observed by radially aligned spacecraft

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We present a preliminary analysis of 19 flux rope ICMEs observed in situ by radially aligned pairs of spacecraft in the inner heliosphere. Such observations allow the characteristics of individual ICMEs to be determined at different stages in their propagation. These ICMEs were first identified by Good & Forsyth (Solar Phys. 291, 239, 2016), and are listed in the suite of products now made available by the HELCATS project. Data from MESSENGER, Venus Express, the STEREOs and ACE have been used in this study. Kinematic analysis indicates that the ICMEs propagated at roughly constant speeds between the observing spacecraft, with ICMEs travelling at speeds above 500 km/s tending to show some weak deceleration, and ICMEs travelling below 500 km/s showing some weak acceleration; a simple application of minimum variance analysis suggests a mean rotation in the flux rope axis of 35° for the ICMEs studied, over a mean propagation distance of 0.36 AU; the expansion rates for the subset of ICMEs largely unperturbed by solar wind interactions remained approximately constant, supporting the conclusions of Gulisano et al. (Astron. Astrophys. 540, A39, 2010). The initial findings presented here suggest that ICMEs tend to evolve in a relatively uniform and predictable manner during propagation.