Forecasting the arrival of Coronal Mass Ejections: The Drag-Based Model

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THE MODEL

AIM: Prediction of ICME arrival

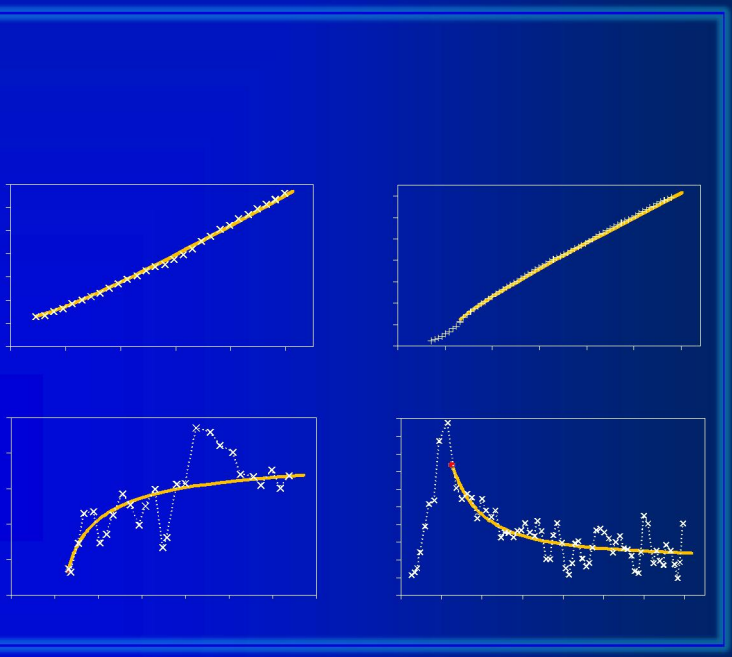
BASIC ASSUMPTION: Beyond ~20 solar radii the MHD "aerodynamic" drag caused by the interaction of ICME with solar wind, becomes the dominant force, so the equation of motion becomes:

$$\ddot{r} = -\gamma\,(\dot{r} - w)\,|\dot{r} - w|\ .$$

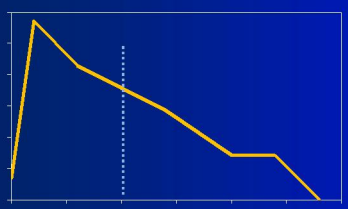
CONSEQUENCE: fast ICMEs are decelerated, slow are accelerated ($\dot{r} \longrightarrow w$).

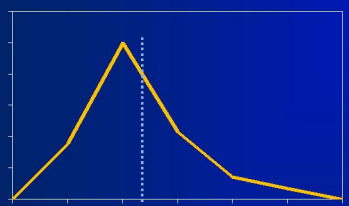
PARAMETERS: In the simplest form , we assume γ, w = **const**. The drag parameter γ depends on characteristics of both ICME and solar wind – the drag is stronger for broader, low-mass ICMEs in a high-density (slow) solar wind.

Running-difference images of the ICME take-off (LASCO/SoHO), providing the model input values $v_0(R_0,t_0)$.

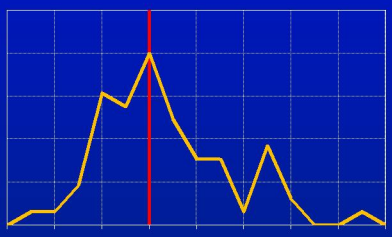


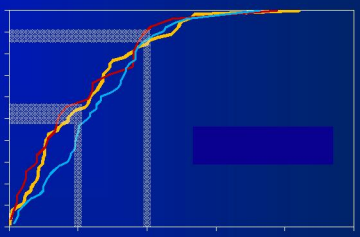
Measurements taken from: Liu et al. 2010, ApJ 722, 1762





Samples used: Schwenn et al., 2005, AnnGeo. 26, 1033 Manoharan, 2006 , SPh 235, 345

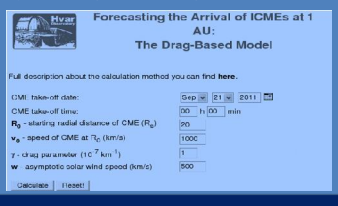




ONLINE FORCAST TOOL

http://oh.geof.unizg.hr/CADBM/cadbm.php

Input page:



CONCLUSION

DBM offers predictions of the ICME arrival for >90% of events with an accuracy better than 24 h, and for >50% of events better than 12h.

ACKNOWLEDGMENT

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