



HELCATS

WP 3

Deriving/cataloguing the kinematic properties of STEREO/HI CMEs based on geometrical and forward modelling

Overview

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WP 3 - Objectives

- To obtain the **kinematic properties** for the **STEREO/HI CMEs** in the catalogue established in WP2, through application of **geometrical and forward-modelling** techniques to the HI data
- To augment the **STEREO/HI CME catalogue** with the **model results**, and supply those results as input for **comparisons with coronal source and in-situ observations** in the validation of WP4
- To **update the STEREO/SECCHI/COR2 CME catalogue**, initiated under the SOTERIA FP7 project, until the **end of 2011** (including the application of forward modelling to the appropriate CMEs)
- To **compare the results** from the **geometrical and forward modelling** of **HI CMEs** with the modelling results for **COR2**
- To prototype the use of **inverse modelling** to derive typical HI CME parameters (**speed, size, mass**), for **photospheric and low coronal source regions** typically associated with CMEs





WP 3 – Task Summary (PMs: UGOE 21, TCD 15, STFC 9, UNIGRAZ 6)

- **Task 3.1: Geometrical modelling of STEREO/HI CMEs (Task leader: STFC; Additional participant: UNIGRAZ)**
Instruments used: STEREO/HI
Role of participants: STFC: J-map provision/CME extraction; STFC and UNIGRAZ: geometrical modelling application and development
Presentation by P. Barnes (STFC)
- **Task 3.2: Forward modelling of STEREO/HI CMEs (Task leader: UGOE)**
Instruments used: STEREO/SECCHI/HI, COR2
Role of participants: This task will be undertaken by UGOE.
Presentation by A. Pluta (UGOE)
- **Task 3.3: Inverse modelling of STEREO/HI CMEs (Task leader: UGOE; Additional participant: TCD)**
Instruments used: STEREO/SECCHI/HI, COR2
Role of participants: UGOE: modelling; TCD: source region input expertise.
Presentation by P. Gallagher (STFC)
- **Task 3.4: Comparison of modelling results (Task leaders: RAL, UGOE; Additional participant: TCD)**
Instruments used: STEREO/SECCHI, SOHO/MDI, SDO/HMI
Role of participants: RAL will collate, with input from all participants.





WP 3 – Deliverables

- D3.1: Provision of time-elongation (j) maps for the CMEs in the STEREO/HI catalogue (from WP2), and incorporation of the results of the geometrical fitting into the catalogue (first release in M12, updates to follow, type: O, lead: STFC)
- D3.2: Incorporation of the results of the forward-modelling techniques into the CME catalogue established in WP2 (M 12, updates to follow, type: O, lead: UGOE)
- D3.3: Report on modelling results (M 36, type: R, lead: RAL)
- D3.4: Report on prototype inverse model based on photospheric and low coronal source region characteristics for 3-D HI CME structure (M 36, type: R, lead: UGOE)





Update Task 3.1 - Geometrical modelling of STEREO/HI CMEs

Task leader: STFC; Additional participant: UNIGRAZ

- Geometrical modelling of the STEREO/HI CMEs identified and catalogued in WP2
- Creation of J-maps for backward (to source regions) and forward extrapolations (for solar system applications)
- Derivation of CME kinematic properties (propagation speed, direction and potentially size, launch time, source region location) and augmentation of the CME catalogue with these results (for comparisons with WP4 tasks 4.1 SR and 4.2 in-situ)
- Compilation of a catalogue of CME arrival time estimates at Mercury, Venus, Earth, Mars and Saturn as support to European-funded space missions around these planets.
- Integration of the catalogues in AMDA, offering access to the catalogues to the community of planetary scientists that use the European Research infrastructure (EUROPLANET)

Deliverable in PY 1

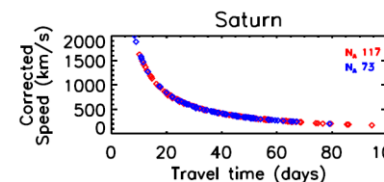
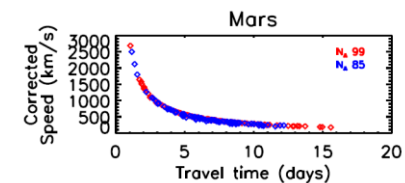
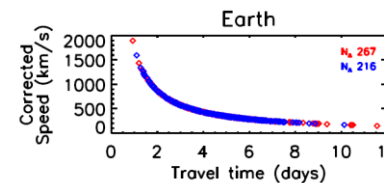
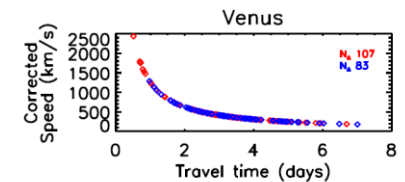
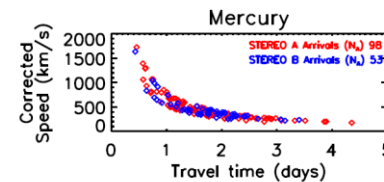
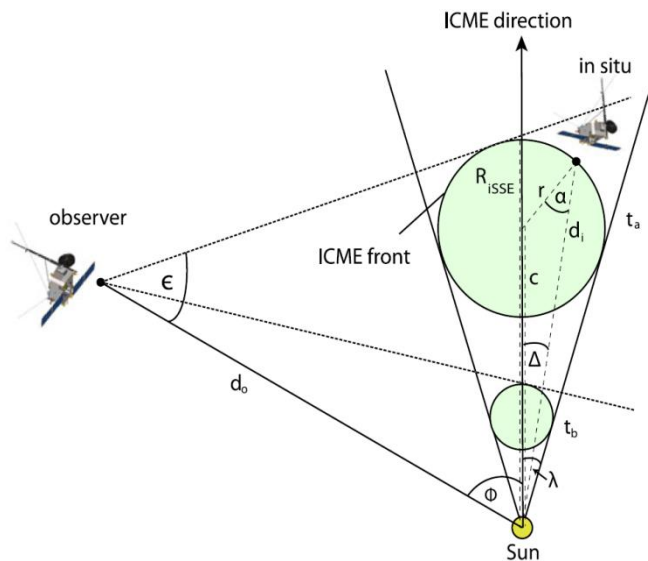
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WP 3 – Predicting In Situ Arrival Times using Geometrical Modelling

- The catalogue of geometrically-modelled CME speeds/trajectories are also used to generate a catalogue of in situ CME arrival time estimates at Mercury, Venus, Earth, Mars, and Saturn, thereby providing support to European-funded space missions around these planets
- Using state of the art SSEF geometric model
- A user friendly package in the IDL programming language has been created to read in the geometrically modelled CME catalogue files and output the predicted arrival time files for any of the in situ locations.





WP 3 – Predicting In Situ Arrival Times using Geometrical Modelling

STEREO-A_EARTH_ARRIVALS_SSEF30_V01.txt - Notepad

File Edit Format View Help

VARIABLES:
1: id-Unique CME identifier
2: delta of CME apex to target (which is difference in longitudes between central CME direction and target location)
3: ICME corrected speed at target location
4: ICME arrival time at target location
5: target distance from Sun in AU
6: target latitude in degrees HEEQ
7: target longitude in degrees HEEQ

HCME_A_20071220_01	20.0	260	2007-12-26T15:10Z	0.98381397	-1.49703	-0.00000
HCME_A_20080213_01	23.0	271	2008-02-19T22:16Z	0.98730455	-6.74196	-0.00000
HCME_A_20080409_01	25.0	214	2008-04-17T14:31Z	1.00178489	-5.99623	0.00000
HCME_A_20080521_01	20.0	266	2008-05-28T09:35Z	1.01229287	-1.84155	0.00000
HCME_A_20080602_01	28.0	261	2008-06-08T22:02Z	1.01429036	-0.48398	0.00000
HCME_A_20080607_01	24.0	277	2008-06-14T05:50Z	1.01505733	0.20600	-0.00000
HCME_A_20080721_01	4.0	363	2008-07-26T08:32Z	1.01602762	4.95954	-0.00000
HCME_A_20080807_01	29.0	194	2008-08-16T15:02Z	1.01405248	6.24936	-0.00000
HCME_A_20080820_01	27.0	194	2008-08-28T15:08Z	1.01189079	6.85920	0.00000
HCME_A_20080913_01	21.0	282	2008-09-19T23:37Z	1.00592248	7.21837	0.00000
HCME_A_20081004_01	26.0	221	2008-10-12T15:21Z	1.00007217	6.51011	0.00000
HCME_A_20081010_01	15.0	301	2008-10-16T01:45Z	0.99845856	6.17808	-0.00000
HCME_A_20081013_01	13.0	242	2008-10-19T23:40Z	0.99772329	6.00601	0.00000
HCME_A_20081103_01	21.0	383	2008-11-07T14:54Z	0.99195488	4.13042	-0.00000
HCME_A_20081202_01	17.0	240	2008-12-08T15:15Z	0.98597380	0.77709	-0.00000
HCME_A_20081212_01	29.0	312	2008-12-17T23:52Z	0.98444476	-0.63029	-0.00000

- The initial catalogue contains over 400 predicted arrivals at Earth, and over 100 for Mercury-, Venus-, Mars- and Saturn-directed CMEs.
- Catalogue includes unique id linked to the original CME catalogue.
- The arrival times will be compared to other model results and in situ data in WP4.

