Drafting findings for the CME Arrival Time and Impact Working Team
Status report: 8 March 2017
Any remarks and/or suggestions can be send to: *Christine.verbeke@kuleuven.be, m.leila.mays@nasa.gov, aleksandre.taktakishvili-1@nasa.gov*
See https://ccmc.gsfc.nasa.gov/assessment/topics/helio-cme-arrival.php for more information.

Working Team Goals
This team focuses on a community-agreed selection of metrics and set of events regarding CME arrival time and impact. Current and future models will be tested for their CME arrival time and impact forecasting capabilities, based on the metrics and the selected set of events.

Working Team Deliverables
Focus will be on a catalogue of metrics and how those relate to user needs and science validation needs. Once a set of metrics are agreed upon by the community, the participating models will be tested for a selected set of events. An online database of the model inputs, outputs and observations will be created. The final product will be to publish the results describing the model assessment results, summarizing where we stand with CME arrival time and impact prediction.

We aim to deliver the metrics and preliminary validation for a set of selected events by the International CCMC-LWS Working Meeting in April 2017. We will then work closely together with the Information Architecture for Interactive Archives (IAIA) working team to start on the online database.

Current list of models
-   DBM (Vrsnak, Zic)
-   ElEvo (Ellipse Evolution) (Moestl)
-   ElEvoHI (Ellipse Evolution based on HI)
-   Enhanced drag-based model (Hess, Zhang)
-   EUHFORIA (Pomoell, Verbeke)
-   WSA-ENLIL+Cone (Arge, Odstrcil)

First set of events: a small core selection
We have decided upon a small core-event set of 4 events that we would like to have modelled by the working meeting in April 2017. For each event, we will release a set of CME model parameters. Users are free to use those **or** their own parameters for this set of events. The modeled runs will be used for the first tests of our metrics before moving to a larger set of events.

Of the four events, two will be hits, one false alarm, and one "problem" event. The two hits will likely overlap with the IMF Bz working team's event list to reduce the overall modeling burden (for those models that predict both arrival and Bz). Within a week, more information will be send out about proposed model parameters, for those who would like to use those as input.

Events (CME start date/time)
A) 3 April 2010 10:33 UT (hit)
B) 15 March 2013 07:12 UT (hit)
C) 15 March 2015 01:48 UT (hit; problematic, many models predict a late arrival)
D) 7 January 2014 18:24 UT (false alarm; only a weak discontinuity arrives)

Next discussion items – March 2017
The next 3 weeks we will focus on the following three discussion points:
1. Which baseline/climatology model will we use to quantify the performance of the models?
2. A) Do we want to fix the CME input parameters and input magnetograms (if applicable) for all models?
    B) If so, is the team comfortable to giving the responsibility of determining the CME parameters by an expert that is not a modeler on the CME Arrival Time Working team to remove bias?
3. How can we quantify the effects of background solar wind?

Each topic will be discussed one at a time. Team members and observers that are not part of the team's Slack channel are encouraged to send any feedback and/or remarks to the team leads.

We appreciate any feedback from forecasters regarding which parameters are most important for **end users** and should be taking into consideration during this process.

_____

Summary of slack group team discussions January 27th – February 3rd

- Event selection
- Working team goals and deliverables

Event selection
The team is in favor of three sets:
a. A small core event selection which consists of clear, well-studied events. ~4 events to be assessed by the working meeting in April 2017.
b. A full representative set of realistic events that cover the full domain of observable CMEs. (Amount: to be discussed)
c. A set of hidden events which will only become available to the modelers once their model has passed sets a and b. This set of events should cover the full domain of observable CMEs as best as possible. It will test the forecasting capabilities of the models in a virtual real-time setting.

NOTE: Some events will be overlapping with the IMF Bz at L1working team.

The following lists have been identified by the team as a starting point for **event selection**:
- ISEST master CME list
- Lan Jian: Level 3 Results of Wind and ACE - ICMEs, SIRs
- Table of ICMEs at multiple spacecraft
- Richardson/Cane Near-Earth Interplanetary Coronal Mass Ejections Since January 1996

Criteria for the selection of events:
- Events where the CME-ICME association is well established
- Beneficial if the event list includes multipoint arrivals

Current events that the group has proposed:
1. 2010 April 3
2. 2012 March 7
3. 2012 July 12
4. 2013 March 15
5. 2013 April 11
6. 2013 September 29
7. 2013 October 6
8. 2014 February 4
9. 2014 June 4

Notes on event selection:
- For a first test set the events on 2012 July 12 and 2013 March 15 both have the advantage of a multipoint arrival, at L1 and MESSENGER

Working Team Goals

This team will evaluate how well different models/techniques can predict CME arrival time and impact for a set of historical events, with open communication with the community. The work is complementary to the CME Scoreboard activity whose goal is collect and display real-time CME predictions and facilitate the validation of real-time predictions.

✳ Evaluate where we stand with CME arrival time and impact prediction
✳ Establish metrics agreed upon by the community
✳ Provide a benchmark against which future models can be assessed against

Working Team Deliverables

✳ Catalog of metrics and how they relate to user needs and validation needs.
✳ Model assessments with selected metrics for selected time intervals.
✳ Online database of model inputs, outputs, and observations.
✳ Publication describing model assessment results summarizing where we stand with CME arrival time and impact prediction.

By April 2017: Deliver the first two items for at least two time intervals and a handful of models, and make a start on the third item through collaboration with the Information Architecture for Interactive Archives (IAIA) working team. Collaborate with the working team: Assessment of Understanding and Quantifying Progress Toward Science Understanding and Operational Readiness.