Topical Discussion Meeting report

Name of the meeting: CME ARRIVAL TIME AND IMPACT: WORKING TEAM
TDM webpage: http://www.stce.be/esww15/program/tdm.php?nr=15
Team webpage: https://ccmc.gsfc.nasa.gov/assessment/topics/helio-cme-arrival.php
Link to download TDM presentations: https://ccmc.gsfc.nasa.gov/assessment/topics/CME/esww15/
Conveners: Christine Verbeke (KU Leuven); M. Leila Mays (NASA GSFC); Aleksandre Taktakishvili (CUA)
Data – Time – Room: Wednesday 7/11, 14:00-15:15, MTC 01.03
Nr of participants: 25 people

Objective of the TDM

- How can we quantify the **influence of the solar background wind** on the CME arrival time?
- How to compare **CME arrival impact quantities** (v, N, T, B time series) to observations?
- Is there a way to propagate the errors of the **model input** parameters and model settings into the model outputs?
- Which **metrics** do we want to use to quantify the impact of CME arrival?
- What visualisation **diagrams** can we use to better interpret the **metrics** and validation of models?

Some discussion highlights

The conveners used one short presentation to present the current status of the CME arrival time and impact working team (presentation is also linked on the website). The rest of the time was spent discussing the topics.

A paper on the team's progress and plans is currently accepted (Space Weather Journal).

Main conclusion of the meeting

- How to compare CME arrival impact quantities (v, N, T, B) to observations?
  - Smooth that data first?
  - Derive max, mean, median, min, delta, values to compare? Sheath/MC?
  - Compare entire time-series (profile)?
  - Compare everything for now and then decide
  - Some quantities more important that others for different science/user goals
- How to quantify the effects of the background solar wind prediction on the CME arrival?
  - Compare error for subsets of ICME arrival types (e.g. ICMEs followed by SIRs, etc)
  - Parametric runs, start with less expensive models
  - Solar cycle effects on arrival time error due to background model errors?
  - Check arrival time errors for backgrounds models that have quantified errors (e.g. from EUV, coronagraphs and in-situ)
- Model inputs
  - Make sure provided CME inputs will work for all models (Need all model metadata)
  - Fix the magnetogram observatory and type
  - Careful when comparing with IPS driven results (no CME input parameters)
  - We should have set that has 1 viewpoint data to determine CME inputs to compare our capabilities.

Annexes: Minutes

- McKenna-Lawlor : HAFv2 - JGR reference- divided up event types
- Christina Kay: Science : Get numbers for all parameters at once - so that you are not updating your model to do well for just one
- David Jackson: User: Different users focus on different parameters, so separation is needed (not one number to represent all)
- Bojan Vrsnak: For single quantities: onset- and end time and peak values
                   Change so that data and simulation have similar noise
- Christine Kay: Single quantity seems easier but can lead to questions such as what is peak value (if noisy)?
- Christine Verbeke: Difference between background wind value and peak value?
- We need to be sure to differentiate between only hydrodynamic CME simulations and those with magnetic field included (shock/cloud/…).

- Christina Kay: GCS fitting is tricky and has significant errors, but is the best we can do.

- Bojan Vrsnak: DBM model gives arrival speed and time, but could be used for shock and cloud by f.e. changing solar wind parameter gamma -> doing statistical studies to figure this out.

- Vrsnak/Kay: Variation of model success throughout solar cycle (maximum vs minimum).
- Jasmina Magdalenic: High activity- back solar wind modelling in EUHFORIA, but low activity we do better

- David Jackson: NWP index -> need one number to decide if one model is better than other (for transition to operations)

- Christina Kay: Arrival time from her model -> +-6h arrival error from +-10deg total change in lat+lon
                Possible to do quick statistical study (together with DBM?) to check for sensitivity of arrival
                We should also compute just all numbers and then figure out what we want to use/need, since the metrics itself is not
                computationally expensive.

- Mario Bisi: Preceding CMEs can influence a lot the background wind
- Christine Verbeke: Having a time period instead of a set of events, gives the opportunity to model different CMEs together without problems, based on what the modeller/user wants to do.
- Mario Bisi:: IPS driven CMEs : Ok to compare if CME is definitely observed, otherwise someone would have to put in work to figure out what is what in IPS data
NOTE: The above should be done if they want to submit to team, because otherwise it is not comparable with other models. In forecasting setting, this would also have to be done, so in that sense it is not different.
---> How would we compare manual CM inputs vs IPS data driven CME detection?
- McKenna-Lawlor : Correlation to flares? West turned events better, higher type II speeds -> better hit

- KD Leka: What question is being answered by forcing models to use the same set of inputs? Aka what if a model needs different input, or the input is not ideal for a model?

- Rob Steenburgh: NOAA: Possible to do fix background wind speed in ENLIL instead of what magnetogram produces
                 Testing to see if this helps, also doing low resolution runs on their work stations
                 Tricky when you have coronal hole - CME interaction

- Del Moro/Kay: Have a set with only SOHO data for CME measurements;
               Using GCS implies STA/B era, may not be so in future
               Maybe same events just only using SOHO data?

- Bojan Vrsnak: Same magnetogram inputs as well, apart from CME inputs.
- Christine Verbeke: Yes, but what if models want to use a specific magnetogram f.e. specific amount of time before the CME they want to model? If they pick the magnetogram in a consistent way, then this should also be okay. But force to use realtime GONG inputs.
Conclusion: We can pick same type of magnetogram (and observatory), but timestamp is up to model user.
Q: zero-point corrected or not?
- Bojan Vrsnak: Model caveats should be mentioned so that shortcomings are known.

After TDM discussion/suggestions:
- include 50 events @ mercury?