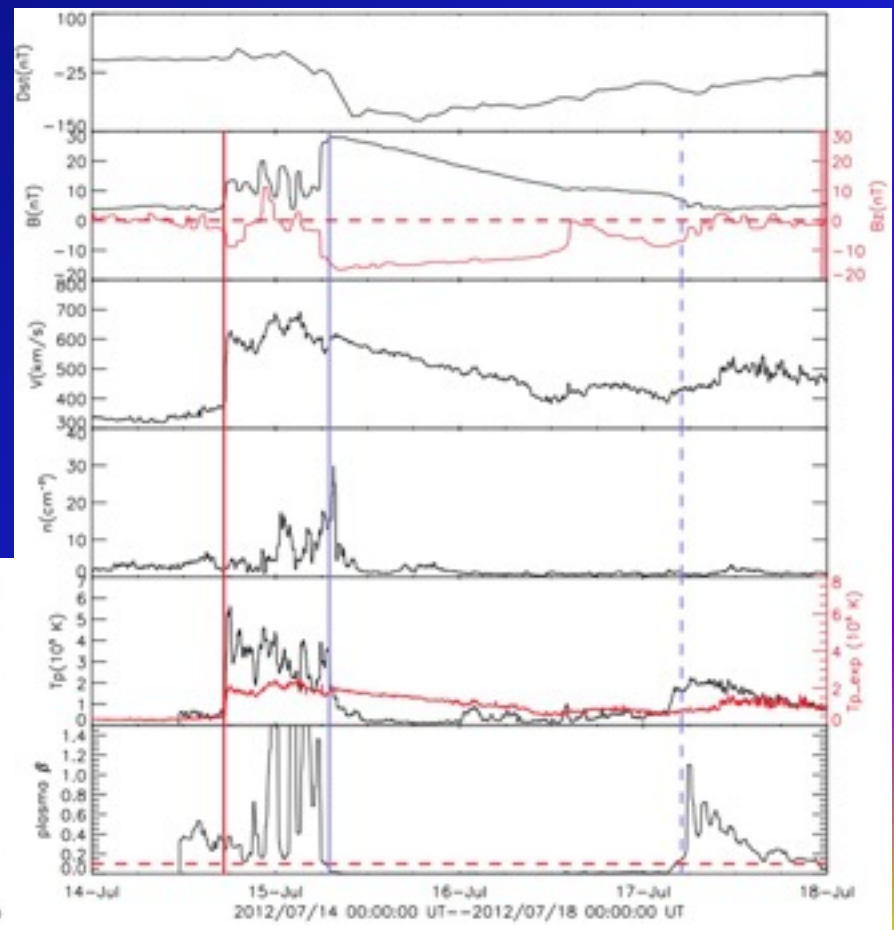
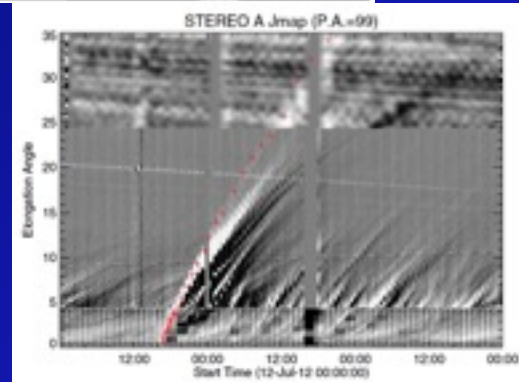
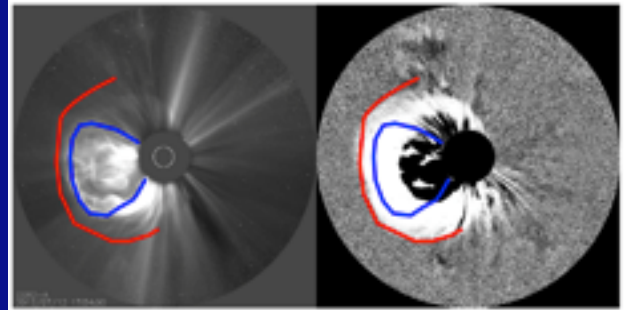
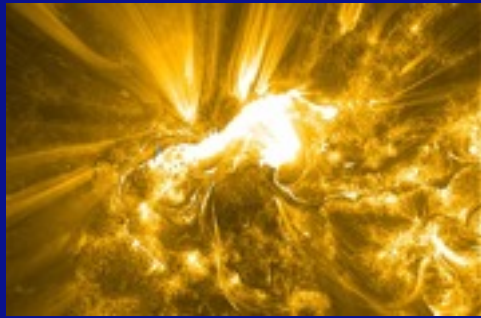


ISEST WG1 Report: Data Group (Jie Zhang)



Content

- **Scientific Tasks**
- **Action Items on these tasks**
- **Technique Question (1)**
- **Scientific Questions (3)**
- **Some items for this workshop**

Scientific Tasks

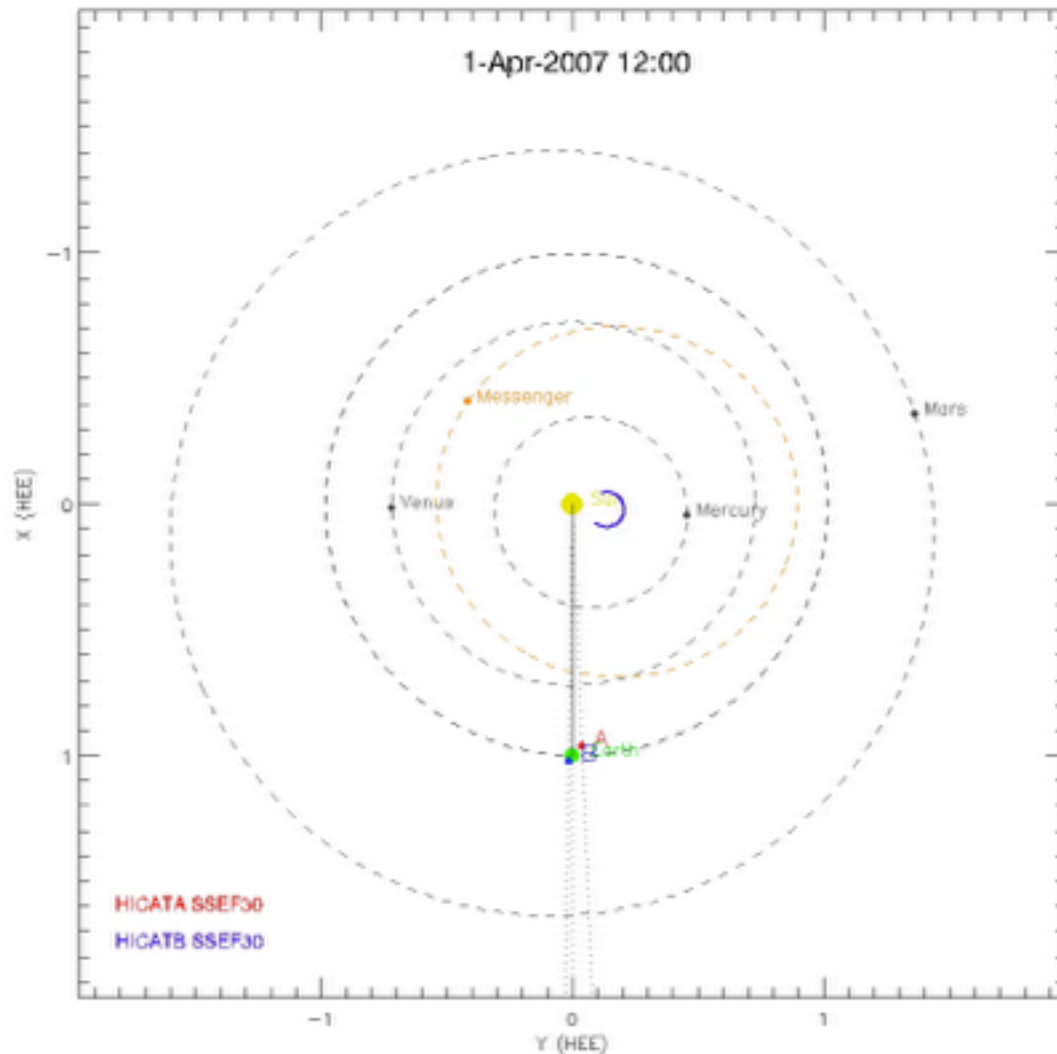
- (1) **Identify** all Earth-Affecting solar transient events, mainly CMEs, during the STEREO era (2007- up to date)
- (2) **Track** these events from the Sun to the Earth, and fully measure, **characterize** and quantify their evolutionary properties from the Sun to the Earth
- Provide a comprehensive event **database** for statistical study, for creating empirical evolution and thus prediction models, for theoretical understanding, and for comparing with and validating numerical models — **a legacy data asset for the community**
- CIRs
- SEPs

Existing Event Catalogs

- **Hess & Zhang ICME catalog**
 - Available at http://solar.gmu.edu/heliophysics/index.php/The_ISEST_Event_List
 - 64 ICMEs from 2007 to 2014 based on ACE
 - Tracking in 3D for about 10 events
- **Richardson & Cane ICME Catalog**
 - Available at <http://www.srl.caltech.edu/ACE/ASC/DATA/level3/icmetable2.htm>
 - 139 ICMEs from 2007 to 2014 based on ACE and WIND
- **Jian ICME Catalog**
 - Available at http://ww-ssc.igpp.ucla.edu/forms/stereo/stereo_level_3.html
 - 145 ICMEs from 2007 to 2013 from STA
 - 123 ICMEs from 2007 to 2013 from STB
- **USTC (China) List**
 - 147 events from 2007 to 2014 based on WIND and ACE
- **Mostl ICME List**
 - Available at http://www.uni-graz.at/~moestlc/events/chris_list_v1.htm
 - 24 events from 2008 to 2012-Jul
- **Y.-Liu List (NSSC, China) for highly selected events**

HI Events from HELCATS

HELCASTS visualization of CME fronts



Plotted CMEs extend over PAs 90/270 and SSEF was successful. C. Moestl & P. Boakes (Graz) and Jackie Davies (RAL)

All events from
STEREO HI from
2007 to mid 2013

Modeled by SSEF
technique

Provided by C. Moestl

Event Catalogs – Action Items

- Merge and clean the catalogs to make a unified ISEST ICME/CME catalog
 - ICME events at the Earth
 - ICMEs versus Solar Wind Transients
 - ICMEs: true CME events with identifiable counterpart near the Sun as seen in SOHO and STEREO
 - Solar Wind Transients: some might not originate from solar CMEs
 - Solar sources of these ICMEs
- 41 events from 2007 to Feb. 2013 so far
- Need to populate till Dec. 2014 and up to date

Tracking – Action Items

- Track the evolution in 3D for as many events as possible (will be a small number)
 - Kinematic evolution in 3D (free of projection effect): height-time profile, velocity-time profile
 - Morphological evolution in 3D: angular width, shape
 - Separation between wave/shock front and the ejecta front: the standoff distance
- A proposal: **benchmark for cross-comparison between different observers**
 - **Time and Velocity at 5 Rs, 10 Rs, 20 Rs, 40 Rs, 80 Rs, 160 Rs, 1 AU and Earth**

Technique Question

What are the best ways of measuring ICMEs in 3D at different distances from the Sun with STEREO observations?

- GCS model (Thernisien et al. 2006)
- GCS + spherical model (Hess et al. 2014)
- J-map: fixed- ϕ (Rouillard et al. 2008)
- J-map: fixed- ϕ and triangulation (Liu et al. 2010)
- J-map: harmonic mean (Lugaz et al. 2010)
- J-map: Self-similar expansion (SSE) (Davies et al. 2012)

Scientific Question - 1

1. What kind of CMEs would reach the Earth and be geo-effective? (from solar observations alone)?

- Source location distribution on the solar disk?
- Why so many halo CMEs missed the Earth?
- What is the true nature of halo CMEs? Is merely a projection effect?
- How significant is the CME deflection?
- What are the causes of CME deflection?
- What about the effect of CME rotation?
- Stealth CMEs?
- Problem ICMEs?

Scientific Question - 2

2. How do CMEs propagate in the interplanetary space? (mainly on interplanetary observations)

- How do CMEs accelerate or decelerate in the interplanetary space through interaction with the ambient solar wind?
- How does the CME morphology change, e.g., pancaking?
- How does the shock front separate from the ejecta front, i.e., the evolution of the standoff distance with time?
- Effects of CME interaction with preceding CME?
- Effects of CME interaction with preceding and trailing CIRs?
- CME erosion due to magnetic reconnection

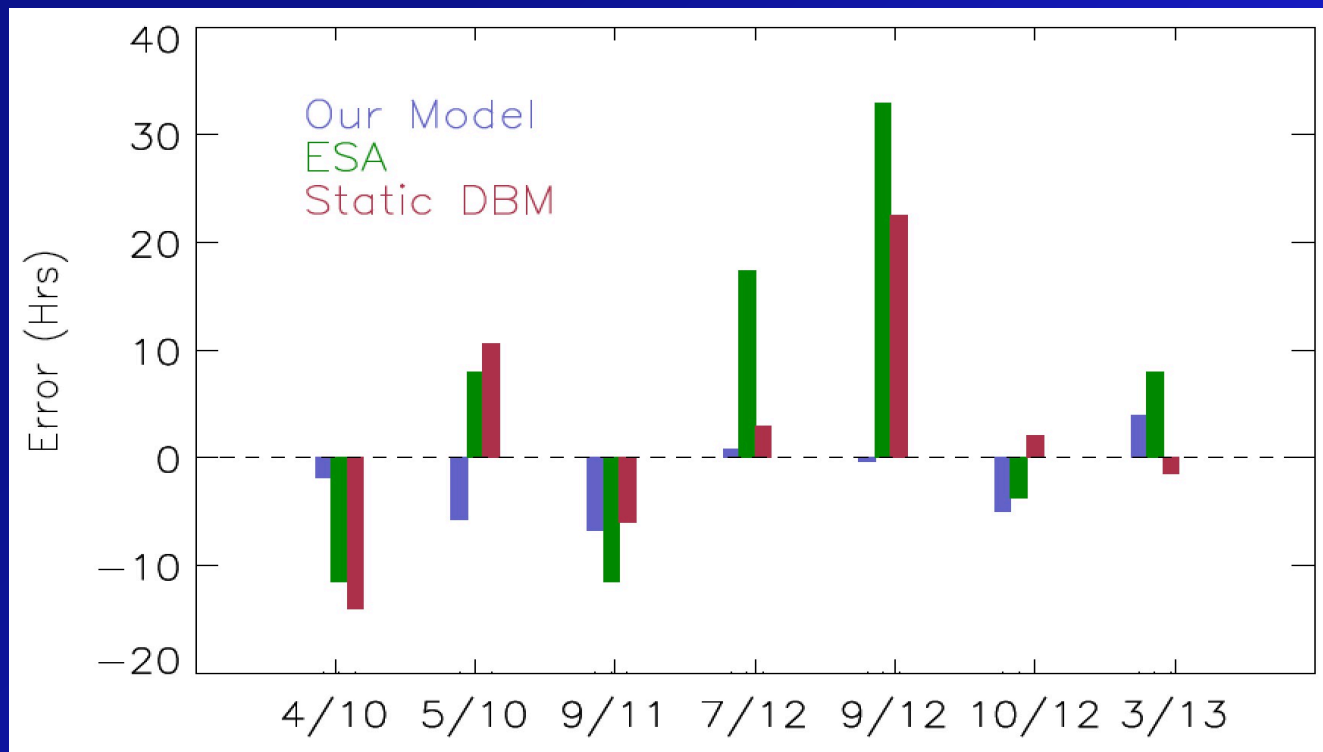
Scientific Question - 3

3. Can we predict the (1) time of arrival (TOA), (2) hit or miss (H/M) and (3) geo-effectiveness (PDST, predicted DST index)?

- **How accurately do we predict the TOA of an ICME?**
- **How accurately do we predict the TOA for both shocks and ejecta separately ?**
- **How can we improve the prediction of TOA?**
- **How to predict the hit or miss (H/M)?**
- **How to predict the geo-effectiveness of CMEs from solar observation, e.g., Bz?**

TOA prediction

- **ESA (Empirical Shock Arrival Model) (Gopalswamy et al. 2013)**
- **DBM (Drag-based Model) (Vrsnak et al. 2014)**
- **ADBM (Advanced Drag-based Model (Hess & Zhang 2015))**



Use the ISEST WiKi

<http://solar.gmu.edu/heliophysics/>

Access data/information and provide your contribution

The screenshot shows a web browser window displaying the 'The ISEST Event List' page. The browser's address bar shows the URL 'solar.gmu.edu/heliophysics/index.php/The_ISEST_Event_List'. The page features the George Mason University logo on the left and a navigation menu with options like 'Page', 'Discussion', 'Read', 'View source', and 'View history'. The main content area is titled 'The ISEST Event List' and includes a description: 'This is a list of ICMEs arranged by year. The ICMEs are cataloged by the first appearance of a signature in-situ. To add an event that is not present in the list, follow the how to guide at [Creating A New Event Page](#).' Below this is a 'Contents (hide)' table of contents listing years from 2007 to 2014. The page also displays a list of ICME events for the years 2007, 2008, and 2009, including their dates and times in UTC.

Year	Event
2007	05/21/2007 21:00:00 UTC (ICME+CIR)
2007	11/19/2007 17:00:00 UTC (published)
2008	09/17/2008 04:20:00 UTC (published)
2008	12/17/2008 03:30:00 UTC (published)
2009	01/26/2009 05:00:00 UTC (ICME like, Kilpua et al. definition)
2009	02/03/2009 22:00:00 UTC (ICME like)
2009	06/30/2009 00:16:00 UTC (ICME, published)
2009	09/30/2009 06:00:00 UTC (ICME like)

Without your input,
it won't work

Items in this workshop

- **Create ISEST event (CME/ICME) catalog?**
-
- **Create an agreeable measurement benchmark?**
- **Compare and validate difference measurement methods?**
- **Compare the results of difference TOA predictions?**
- **What else???**

Thanks