

--- VarSITI / ISEST ---

***International Study of Earth-
Affecting Solar Transients***

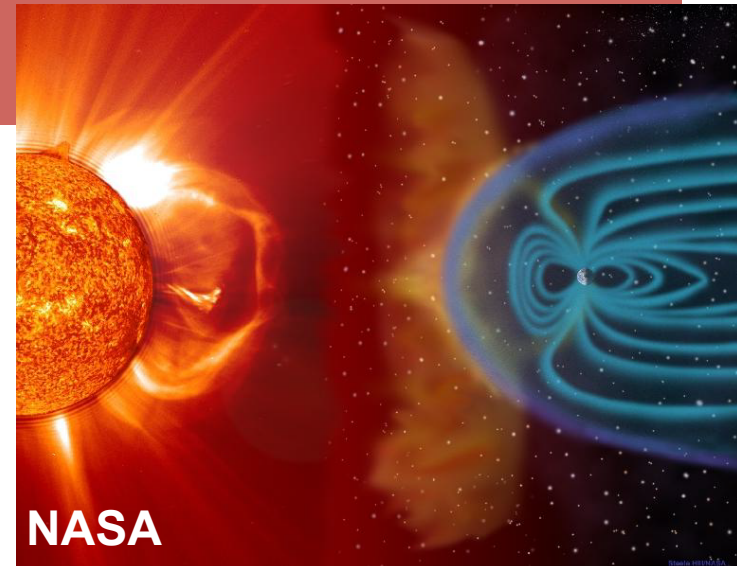


**Jie Zhang (George Mason University, USA)
Manuela Temmer (University of Graz, Austria)
Nat Gopalswamy (NASA/GSFC, USA)**

Presented by Christian Möstl

Our Goal

Understand the origin, propagation and evolution of solar transients through the space between the Sun and the Earth, and develop the prediction capability of space weather.

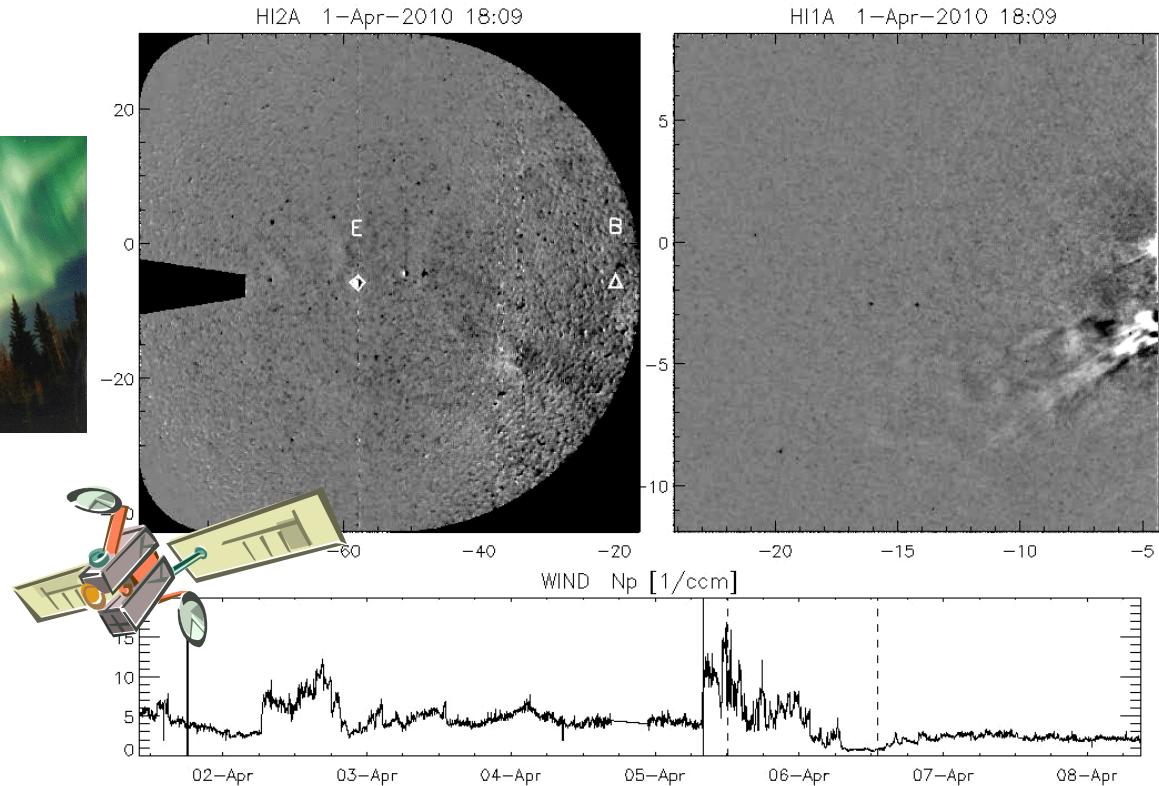


Interdisciplinary!

Geospace

Interplanetary Space

Sun



Enabled by
(1) Advanced “continuous” Observations
(2) Advanced “global” numerical simulations

Möstl, et al. 2009, 2010

Projects and Working Groups



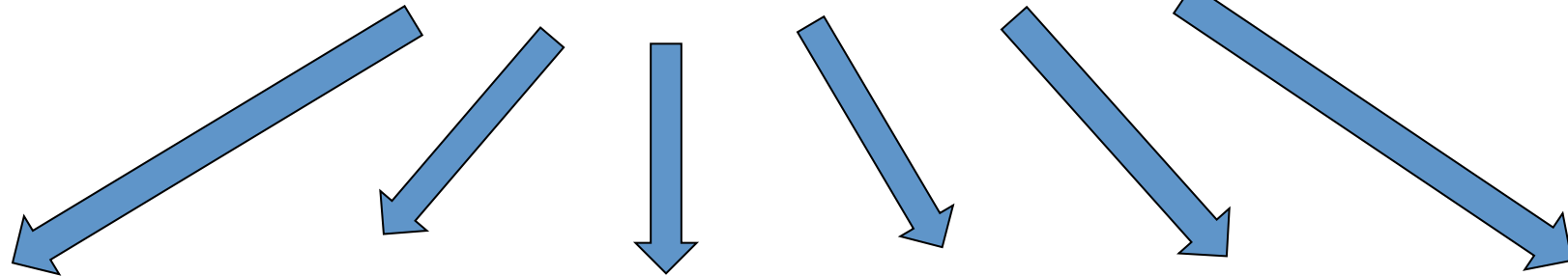
VarSITI (varsiti.org)

SEE

SPeCIMEN

ROSMIC

ISEST/MiniMax24



**WG1:
Data**

**WG2:
Theory**

**WG3:
Simula-
tion**

**WG4:
Campaign
Event**

**WG5:
Bs
Chall
enge**

**MiniMax
Camp
aign**



WG1: Data Group

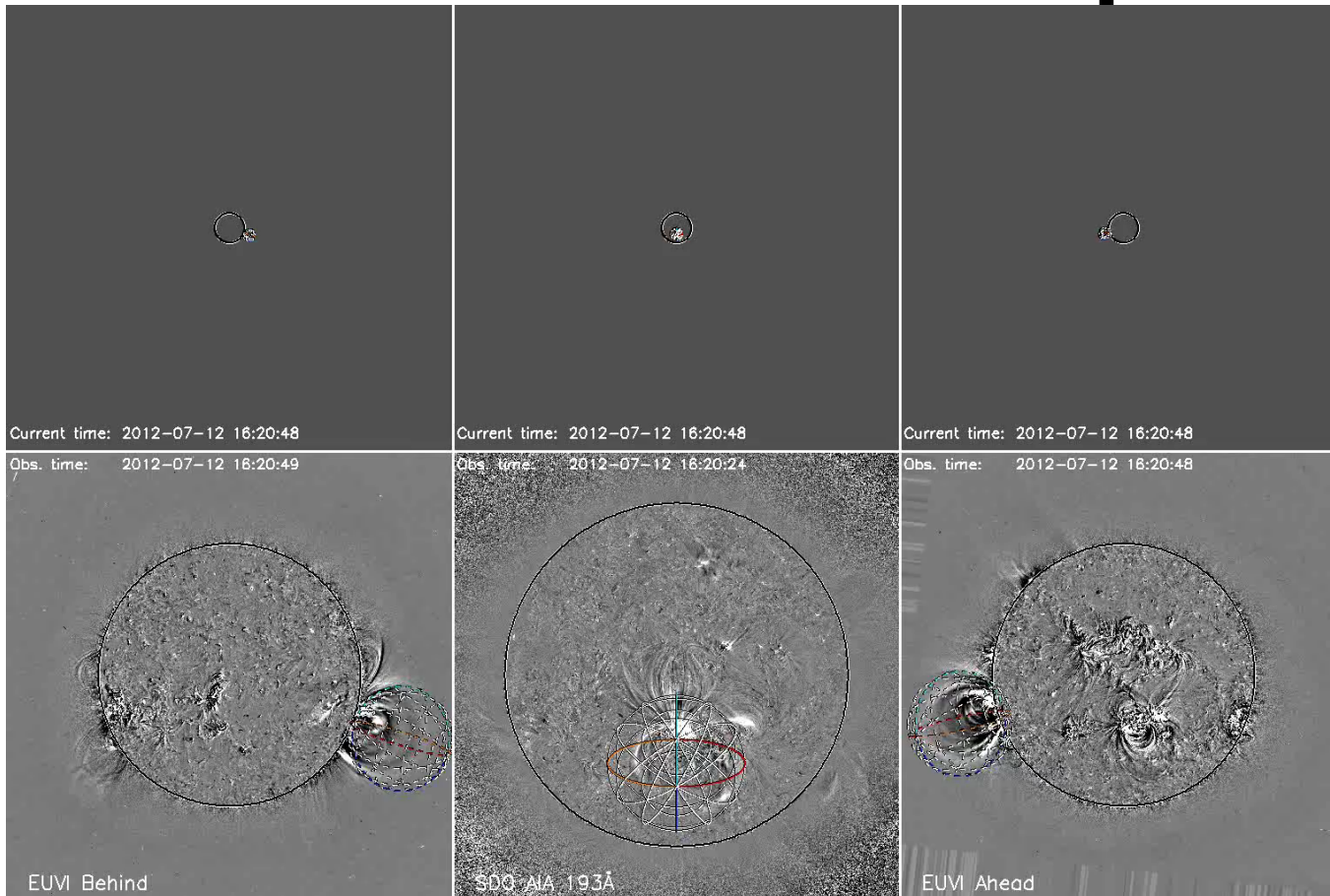
Scientific Objectives

- **Identify all Earth-Affecting ICMEs during the STEREO era (2007– to – date) and their solar sources**
- **Track these events from the Sun to the Earth, and fully measure, characterize and quantify their properties and evolution from the Sun to the Earth**
- **Provide a comprehensive event database for statistical study, for creating empirical evolution and prediction models, for theoretical understanding, and for comparing and validating numerical models**
- **Identify and characterize other Earth-affecting transients, including solar flares, SEPs and CIRs.**

WG1: Example



CME
July 12, 2012
Stereoscopic
Tracking



SB-EUVI
SB-COR1
SB-COR2

SDO-AIA
SOHO-C2
SOHO-C3

SB-EUVI
SB-COR1
SB-COR2

Colorado
July 15, 2012
(credit: Robert Arn)



WG2: Theory Group

Scientific Objectives

- **Understand the dynamics of CMEs**
 - How long the Lorentz force dominates over the aerodynamic drag force?
 - How to estimate the drag parameter and/or the dimensionless drag coefficient?
- **Understand the evolution of CMEs**
 - How are ICMEs deflected?
 - How much do variable ambient conditions affect CMEs?
- **Comparison of results produced by different models (DBM, flux-rope, ENLIL, COIN), e.g., 1AU transit time, impact speed, kinematical curves, B_z , etc.**



WG3: Simulation Group

Scientific Objectives

- Provide global context for all CME events investigated by the ISEST WG1
- Investigate processes of CME initiation, heliospheric propagation, and CME interaction
- Develop tools to assist collaboration of numerical modelers, theoreticians, and observers
- Models: ENLIL, COIN-TVD, H3DMHD, SWMF

WG3: Example

2012-07-12T00:00

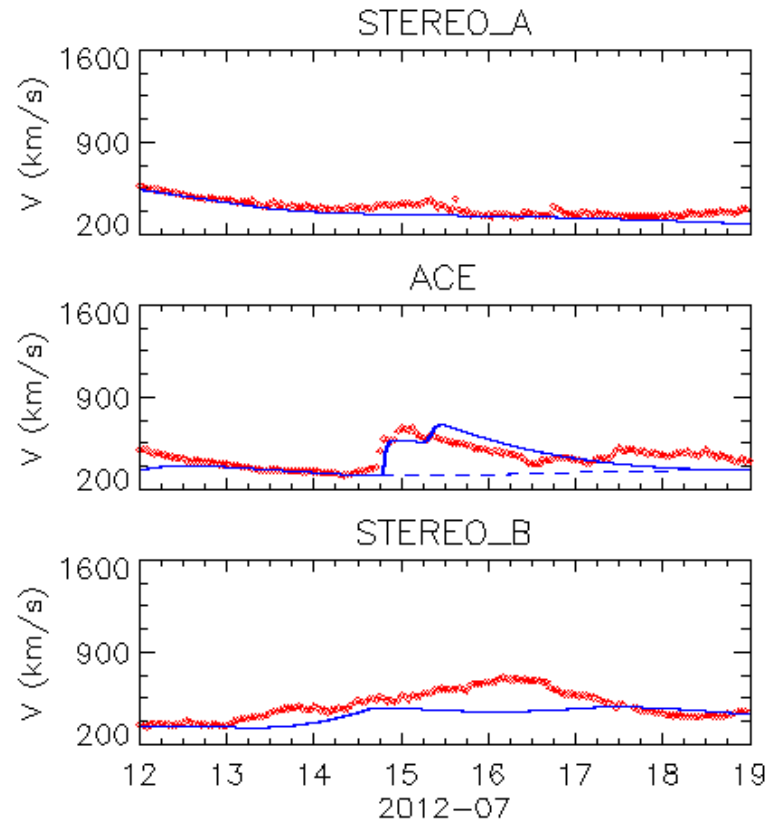
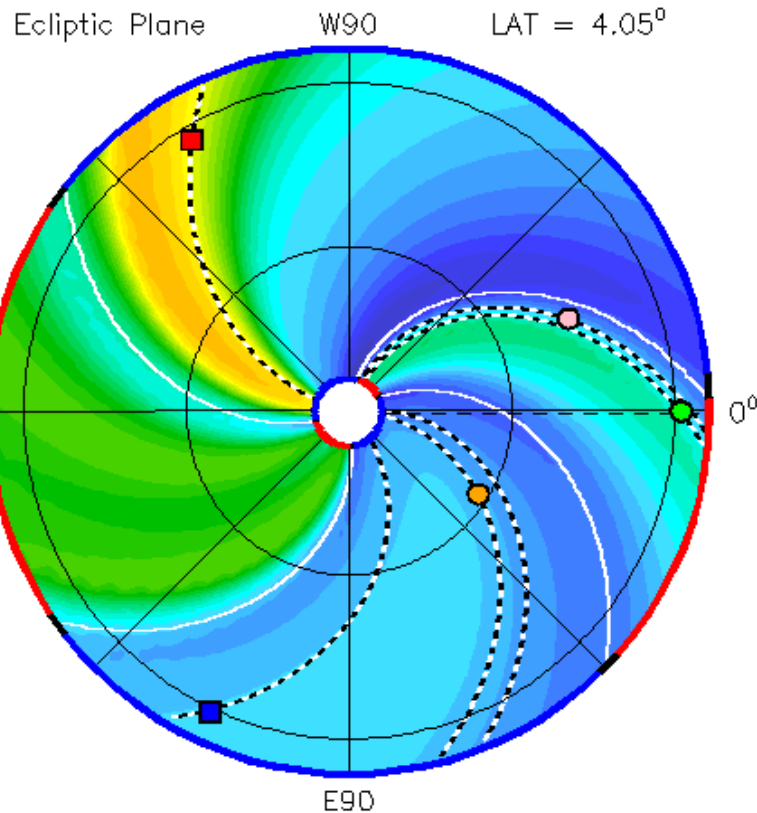
2012-07-12T00 +0.00 day

Mercury
Cassini

Venus
Helios-1

Earth
Helios-2

Mars
Messenger



Vr (km/s) 200 550 900 1250 1600

IMF polarity
- +

Current sheath

3D IMF line

ENLIL-2.8 lowres-a5b1-r2v24t04 WSA_V2.2 GONG2-2125_091 jle/264x30x90x2.a5b1-r2v24t04.22-mcp1var2cd-1.g53q5.gong2-2012-07-12T00 2013-05-20

ENLIL Model



WG4: Campaign Events Group

Scientific Objectives

- **Integrate theory, simulations and observations in order to get a complete view of the chain of events from the Sun to the Earth**
- **Provide textbook-style standard CME-ICME chain events from the Sun to the Earth: happy stories**
- **Examine controversial Earth-Affecting CME/ICME pairs: surprising stories**



WG5: Bs challenge group

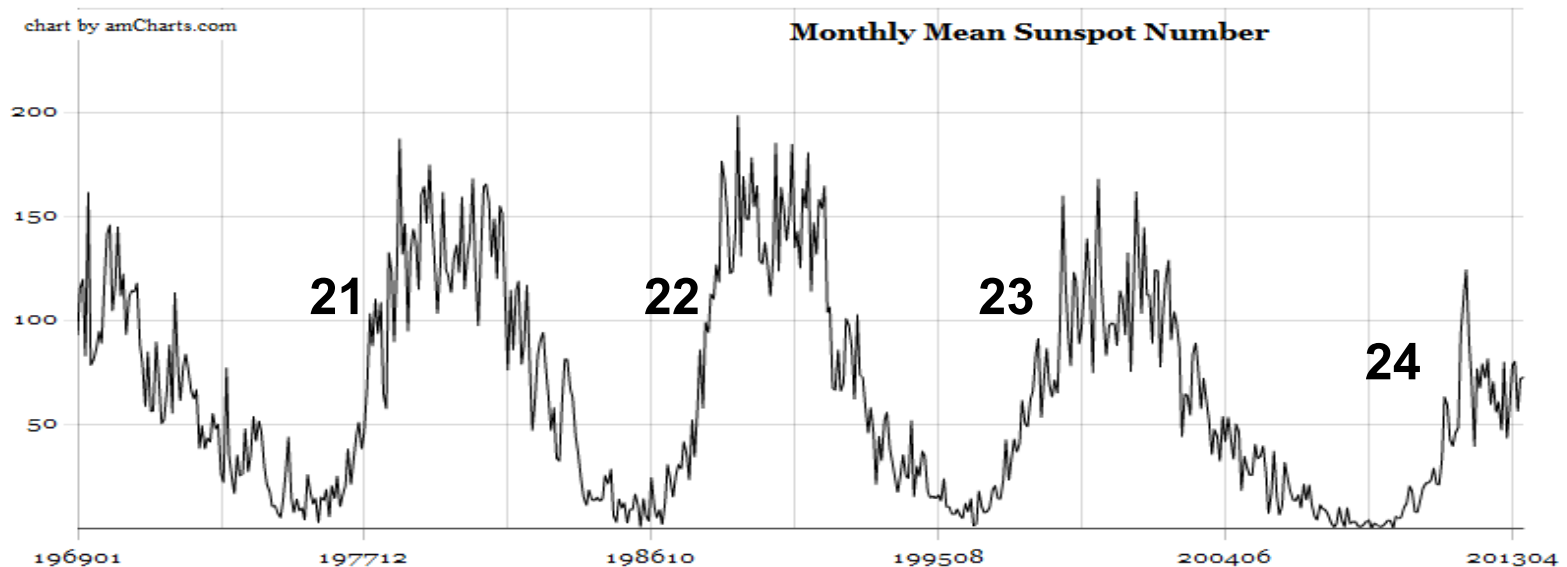
Scientific Objectives

- **Challenge in determining Bs component – the decisive factor in producing geomagnetic storms.**
- **Currently possible only for the Sun in the photosphere/ chromosphere and by in-situ observations at 1 AU.**
- **A better understanding of the magnetic field is needed to reconstruct flux rope structures of CMEs/ICMEs from observations and models.**
- **Ultimate goal is to predict the intensity and the duration of the Bs in ICMEs upon arriving at the Earth.**

MiniMax24

Scientific Objectives

- Long-term campaign providing daily updates on solar and geospace events through a network of international participants
- Currently, the campaign covers more than 170 interested colleagues from 35 different countries, actually a huge platform of expertise for exchange!



✓ Monthly Mean Number:

(data from Kanzelhöhe Observatory, UNI Graz)

Activities

Organize Workshops

- **First successful ISEST 2013: June 17-20 at Hvar, Croatia**
- **Mini ISEST Workshop 2014 at USTC, China (April 18-19)**



Upcoming 2014:

- **Special session at SHINE (June 23-27, USA)**
- **ESPM-14 (September 8-12, Ireland)**
- **ISEST 2014: Oct.12- 18 at Xi'an, China; together with the SCOSTEP's 13th Quadrennial Symposium. Use of 2013 MiniMax24 campaign data**
- **ISEST/MiniMax24 workshops in 2015 – 2018: TBD**
- **Sessions at established international meetings, e.g., COSPAR, AGU**

Activities

**Create two community portals:
wiki-based websites allowing data
uploading, data sharing and discussion**

**1. ISEST Portal: user registration, data repository
from observations, simulations, analysis and
discussions**

**<http://solar.gmu.edu/heliophysics/index.php/>
Main Page**

**2. MiniMax24 Campaign Portal: a platform for joint
analyses of interesting events from participants (self-
organized) <https://igam07ws.uni-graz.at/mediawiki/>**

The Leaders



The SOC

Jie Zhang (Chair, USA)

Bojan Vršnak (Croatia)

Ayumi Asai (Japan)

Peter Gallagher (Ireland)

Alejandro Lara (Mexico)

Noé Lugaz (USA)

Mario M. Bisi (UK)

Manolis K. Georgoulis (Greece)

Manuela Temmer (Co-Chair, Austria)

Alexis Rouillard (France)

Nandita Srivastava (India)

Yu-Ming Wang (China)

Yuri Yermolaev (Russia)

David Webb (USA)

Nat Gopalswamy (Co-Chair, USA)

Kyungsuk Cho (South Korea)

WG Leaders

Working Group 1: Jie Zhang (USA)

Working Group 2: Bojan Vrsnak (Croatia)

Working Group 3: Fang Shen (China)

Working Group 4: David Webb (USA)

Working Group 5: Manolis Georgoulis (Greece)

MiniMax24: Manuela Temmer (Austria)



Capacity Building and Outreach

- The data repository to be tailored in a way for students to use it for learning and training
- Create “text-book-style” Sun-to-Earth events to illustrate what we do for the general public
- Participate in summer schools and other varSITI activities for the outreach purposes



Anticipated Outcome

- A comprehensive database of Earth-affecting solar transient events from observations and simulations**
- Improved understanding of the origin, propagation and Earth impact of solar transient events**
- Collaboration with other VaSITI groups to enhance the understanding**
- A significant improvement of space weather prediction to predict CME arrival with a lead time 24+ hours and an accuracy of a few hours.**
- Understand the difficulty is predicting the strength and orientation of CME magnetic field**



Web Resources

- **VarSITI:** <http://www.varsiti.org/>
- **ISEST/MiniMax24 Event and Data repository:**
http://solar.gmu.edu/heliophysics/index.php/Main_Page
- **MiniMax24 Campaign webpage:**
http://igam07ws.uni-graz.at/mediawiki/index.php/Main_Page
- **ISEST 2013 Workshop Webpage:**
<http://spaceweather.gmu.edu/meetings/ISEST/>

ISEST/MiniMax24
Initiate joint event studies!
varsiti.org