



--- VarSITI / ISEST ---
**International Study of Earth-
Affecting Solar Transients**

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Outline

- **The Goal**
- **The objectives**
 - **Organized in multiple working groups**
- **Activities**
- **Capacity Building and Outreach**
- **Anticipated Outcomes**

The Goal

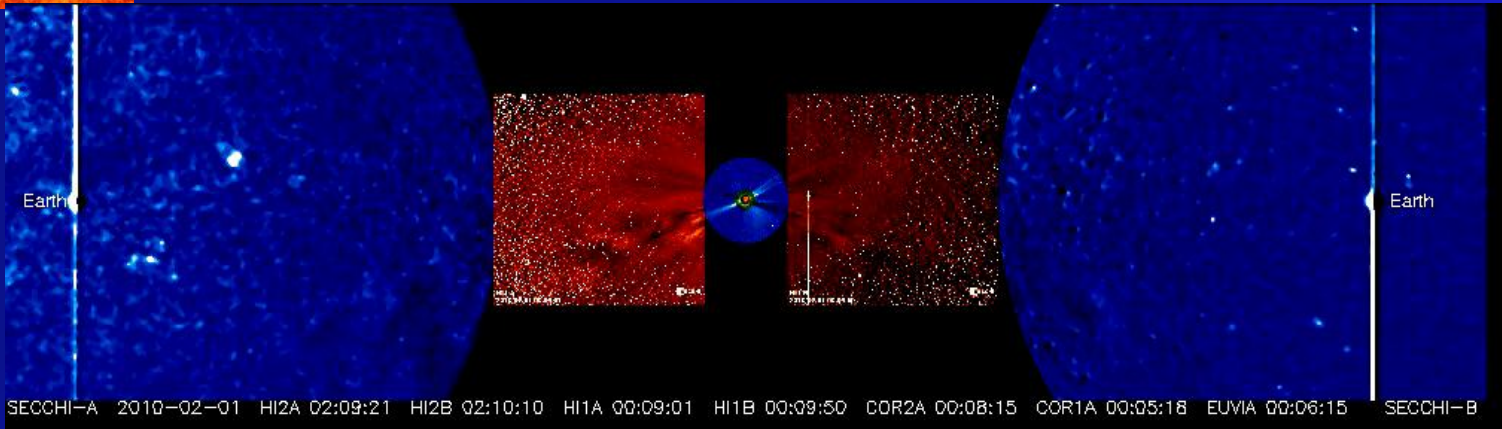
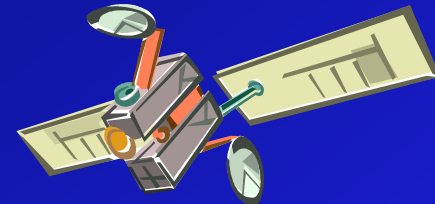
**Understand the origin,
propagation and evolution of
solar transients through the
space between the Sun and
the Earth, and develop the
prediction capability of space
weather**

Justification

Sun

Interplanetary Space

In-situ

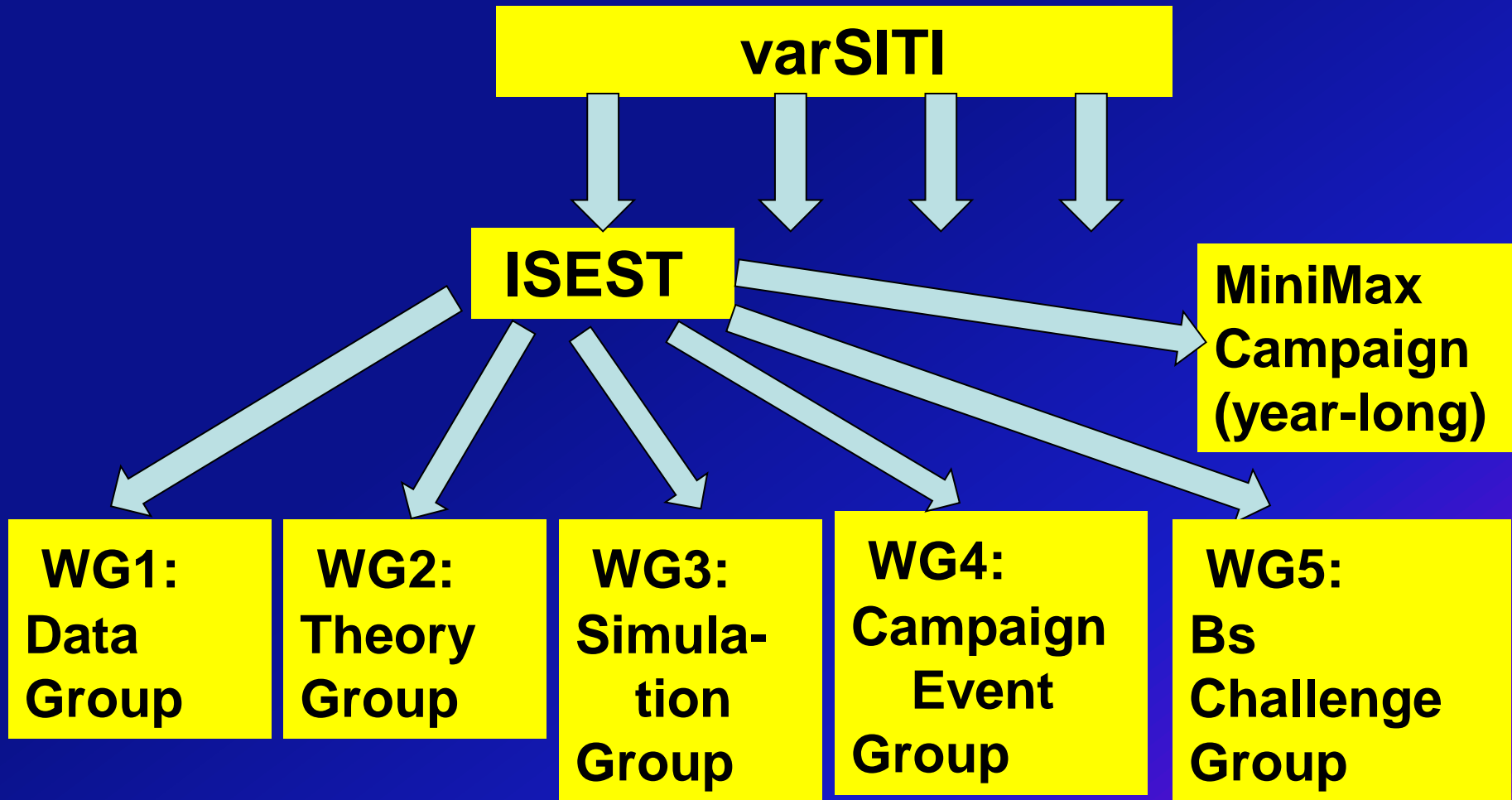


Enabled by

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



Working Groups



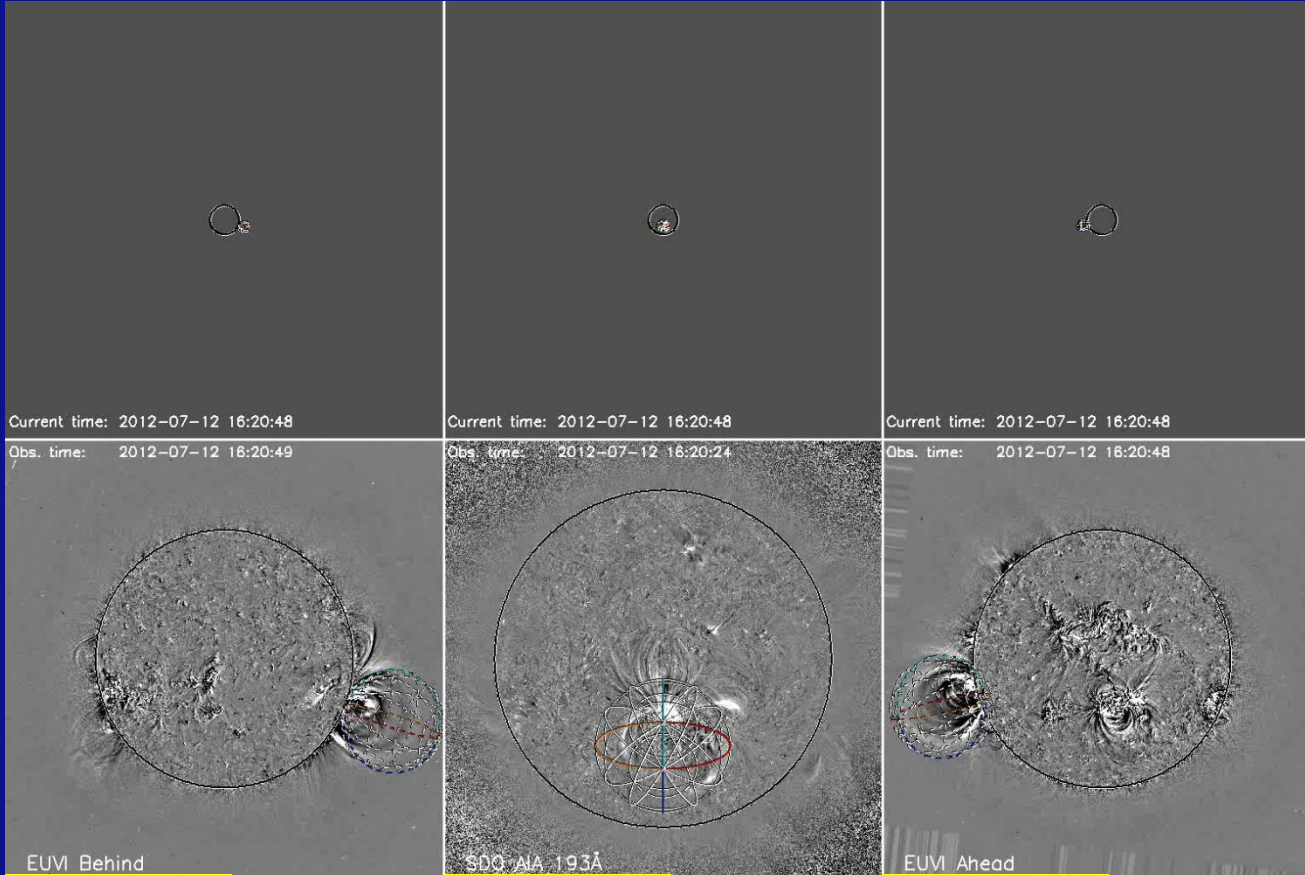
WG1: Data Group

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 other working groups, other projects, and the entire community
- 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

SA-EUVI
SA-COR1
SA-COR2

Aurora in Colorado
July 15, 2012
(credit: Robert Arn)

WG2: Theory Group

Scientific Objectives

- Understand the structure and evolution of CMEs
 - The origin of CMEs and magnetic rope structure
 - The cause and the model of **Bs**?
 - How CMEs deflected?
 - How much ambient conditions affect CMEs?
- 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?
- Comparison of results produced by different analytic and numerical models, e.g., 1AU transit time, kinematical curves, impact speed and impact magnetic field 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 among modelers, theoreticians, and observers
- Existing Models: ENLIL, COIN-TVD, H3DMHD, SWMF

WG3: Example

2012-07-12T00:00

2012-07-12T00 +0.00 day

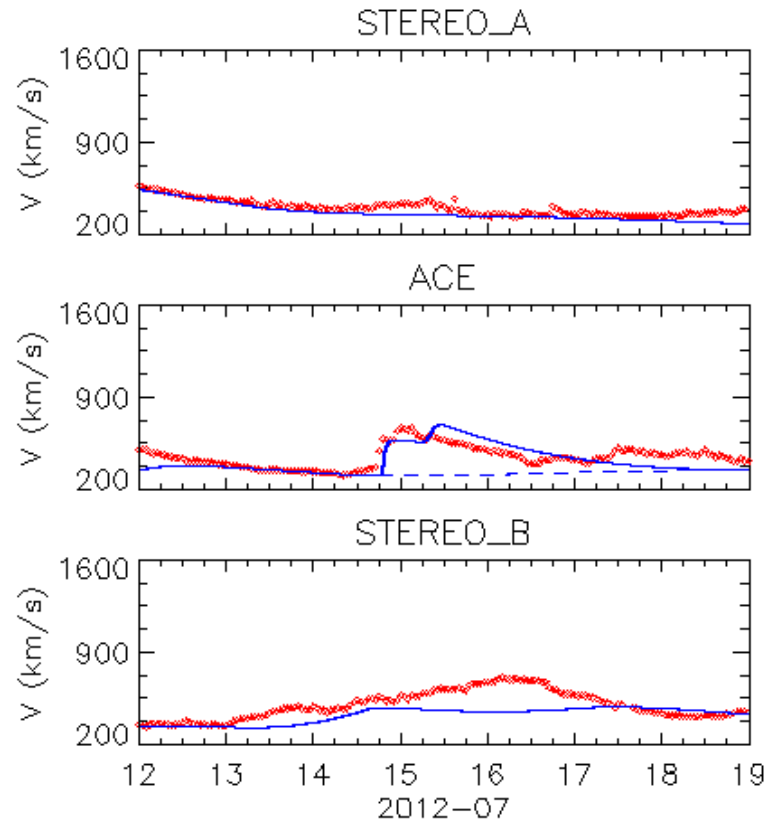
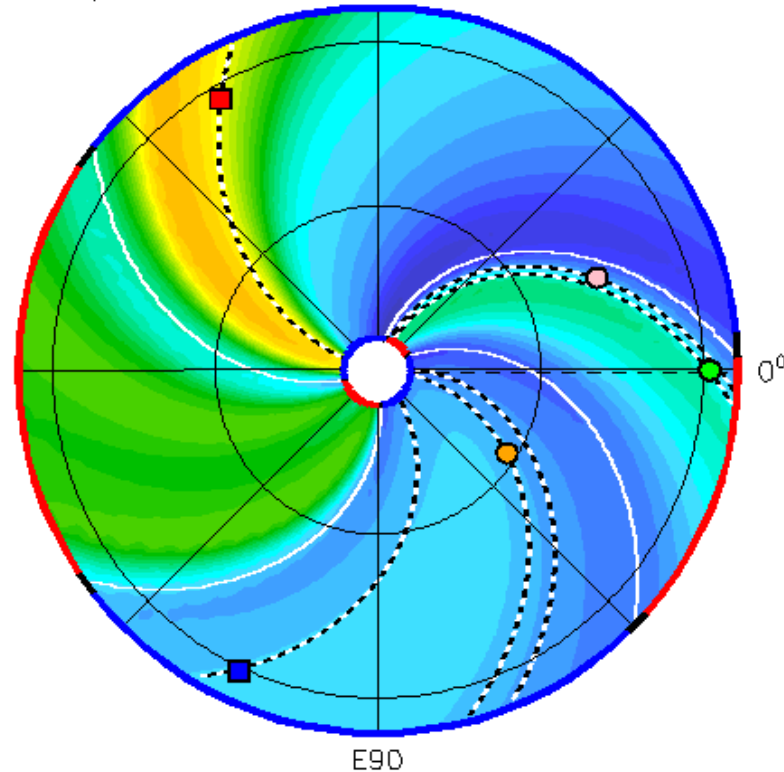
● Mercury
■ Cassini

○ Venus
■ Helios-1

● Earth
■ Helios-2

● Mars
■ Messenger

Ecliptic Plane W90 LAT = 4.05°



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

ENLIL Model

WG4: Campaign Event Group

Scientific Objectives

- Integrate theory, simulations and observations in order to get a complete view and understand of the chain of cause-effect activities from the Sun to the Earth for a small number of carefully selected events
- Provide textbook-style standard events from the Sun to the Earth (the happy stories) to the community.
- Examine controversial event such as stealth CMEs and problem ICMEs (the surprising stories)
- Interact with other projects for varSITI-wide campaign studies

WG5: Bs Challenge Group

Scientific Objectives

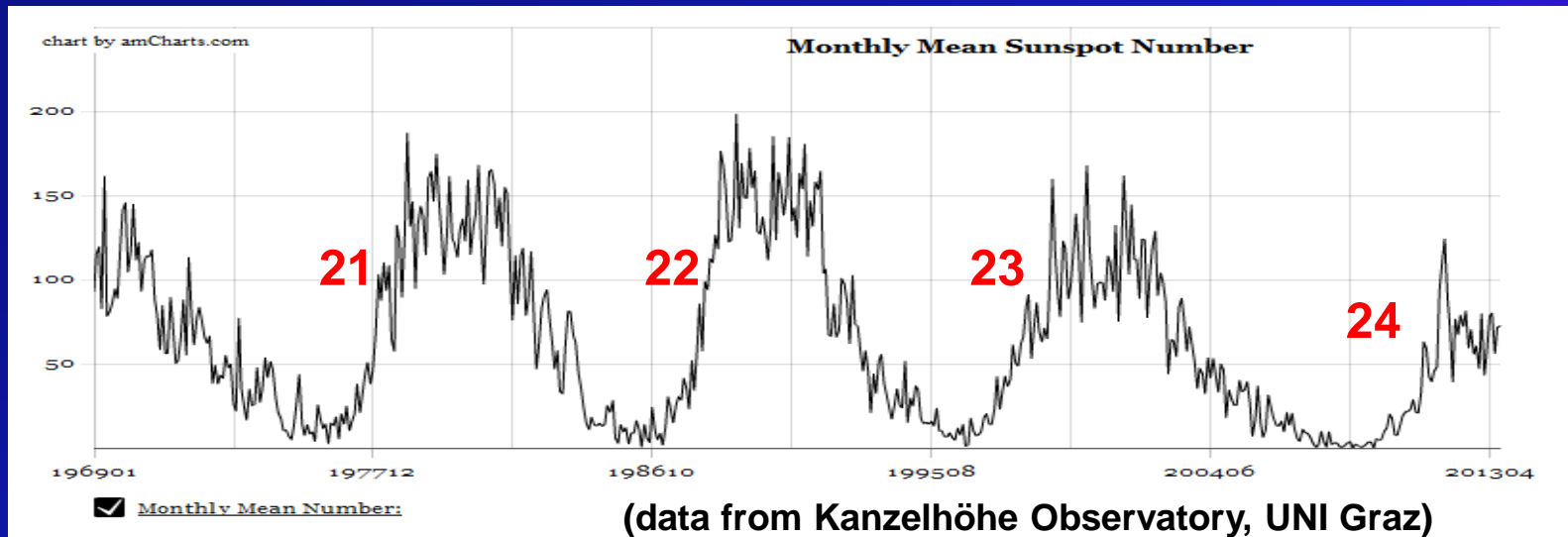
- Understand and reconstruct of the possible flux rope magnetic structure of CMEs/ICMEs from observations and models.
- Predict the intensity and the duration of the Bs in ICMEs upon arriving at the Earth

But this is challenging: direct observations of magnetic fields are extremely limited, occurring only on the photosphere of the Sun at one end and at in-situ at the other end.

MiniMax24

Scientific Objectives

- Long-term campaign providing daily updates on solar and geo-space events through a network of international participants
 - 35 observatories/institutes from 17 countries are currently in the campaign
- Act as a "come-into-contact platform" with a broad range of experts.



Activity

Organize Workshops

- **ISEST 2013: June 17-20 at Hvar, Croatia**



- **ISEST 2014: Oct.12- 17 at Xi'an, China; together with the SCOSTEP's 13th Quadrennial Symposium. Use 2013 MiniMax24 campaign data**
- **ISEST 2015: USA**
- **ISEST 2017: Mexico**
- **Organize sessions in well-attended international meetings, e.g., AGU, COSPAR**

Activity

**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 for the ISEST events**

(http://solar.gmu.edu/heliophysics/index.php/Main_Page)

**2. MiniMax Campaign Portal: daily updates of any
interesting events from participants**

(<https://igam02ws.uni-graz.at/mediawiki/>)

The Leaders

The SOC

Jie Zhang (Chair) (USA)

Bojan Vršnak (Co-Chair) (Croatia)

Ayumi Asai (Japan)

Peter Gallagher (Ireland)

Alejandro Lara (Mexico)

Noé Lugaz (USA)

Christian Mostl (Austria)

Alexis Rouillard (France)

Nandita Srivastava (India)

Yu-Ming Wang (China)

Yuri Yermolaev (Russia)

David Webb (USA)

WG Leaders

Working Group 1: Jie Zhang (USA); Christian Mostl (Austria)

Working Group 2: Bojan Vrsnak (Croatia); Yuming Wang (China)

Working Group 3: Dusan Odstrcil (USA); Fang Shen (China)

Working Group 4: Nariaki Nitta (USA); Luciano Rodriguez (Belgium)

Working Group 5: TBD

MiniMax: Manuela Temmer (Astria); Nat Gopalswamy (USA)

Based on 2013 workshop.

An update might be needed.

Capacity Building and Outreach

- The data repository will be tailored in a way for students learning and educators training
- Create “text-book-style” Sun-to-Earth events for general public
- Showcase the extreme events for the public
- Participate in summer schools and other SCOSTEP activities for the outreach purpose

Anticipated Outcomes

- A comprehensive database of Earth-affecting solar transients contributed by both observers and modelers.
- Improved understanding of the origin, propagation and Earth impact of solar transient events
- A significant improvement of space weather prediction to predict CME arrival with a lead time 24+ hours and an accuracy of a few hours
- Develop ways to predict B_z strength and duration, thus the intensity of expected space storms.
- Collaborate with other VarSITI groups to improve the global understanding of the Sun-Earth system

The End