Variability of the Sun and Its Terrestrial Impact (VarSITI)

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SEE summary slide

Name: Solar Evolution and Extrema (SEE)

Goals and Objectives: 1) Reproduce magnetic activity as observed in the Sunspot and cosmogenic records in dynamo simulations, 2) Amalgamate the best current models and observations for solar spectral and wind output over the Earth's history, and 3) Determine the size and expected frequency of extreme solar events such as flares and coronal mass ejections (CMEs).

Questions: 1) Are we at the verge of a new grand minimum? If not, what is the expectation for cycle 25? 2) Does our current best understanding of the evolution of solar irradiance and mass loss resolve the "Faint Young Sun" problem? What are the alternative solutions? 3) For the next few decades, what can we expect in terms of extreme solar flares and storms, and also absence of activity? Another Carrington event? What is the largest solar eruption/flare possible? What is the expectation for periods with absence of activity?

Data/Theory Model: Dynamo models, stellar evolution calculations including mass loss and rotation, early solar wind simulations, observations of solar-type stars, observations of very large events on stars, statistical analysis of event distributions.

Anticipated Outcome: 1) Dynamo Models for the near future, including a prediction for cycle 25, or for an upcoming grand minimum, 2) A timeline of solar activity -- spectral radiation, wind, CMEs -- from the Earth's formation up to the present, 3) A frequency distribution and near term likelihood prediction of extreme events.

Key Members: Piet Martens, Vladimir Obridko, Dibyendu Nandi

ROSMIC summary slide

Name: Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate

Goals and objectives: To understand the impact of the Sun on the terrestrial middle atmosphere/lower thermosphere/ionosphere (MALTI) and Earth's climate and its importance relative to anthropenic forcing over various time scales from minutes to centuries.

Scientific questions:

(a) What is impact of solar forcing of the entire atmosphere? What is the relative importance of solar irradiance versus energetic particles?

(b) How is the solar signal transfered from the thermosphere to the troposphere?

(c) How does the coupling take place within the terrestrial atmosphere?

(d) What is the impact of anthropogenic activities on MALTI ?

(e) What are the signatures causes of long term MALTI variations?

(f) What are the characteristics of reconstructions and predictions of TSI and SSI?

(g) What are the implications of trends in the ionosphere/thermosphere for satellites and space debris?

Data/theory/modeling: Use existing data records plus new measurements from a wide range of ground based, in-situ, and space-based instruments. use/develop dedicated models for a better understanding of specific processes (e.g. gravity wave breaking, ice formation). Modify and apply global-scale models from the ocean to the thermosphere.

Anticipated outcome: Better understanding of the impact of solar activity on the entire atmosphere, relative to anthrogenic forcing and natural long term variability

Key members: F.-J. Luebken, Stan Soloman, Annika Seppala, W. Ward

SPeCIMEN summary slide

Name: Specification and Prediction of the Coupled Inner-Magnetospheric Environment (SPeCIMEN).

Goals and objectives: The quantitative prediction and specification of the Earth's inner magnetospheric environment based on Sun/solar wind driving inputs.

Questions: How does the inner magnetosphere respond as a coupled system to Sun/solar-wind driving?

Data/theory/modeling: A combination of physical and statistical (machine learning) modeling, theory, and observations from various platforms.

Anticipated outcome: A better understanding of the physical processes leading to a series of coupled, related models that quantitatively predict the dynamical evolution of the inner magnetospheric state.

Key members: Jacob Bortnik (USA), Craig Rodger (NZ), Richard Thorne (USA), Mark Clilverd (UK), Richard Horne (UK), Yoshi Miyoshi (Japan), David Shklyar (Russia), Ian Mann (Canada), Eric Donovan (Canada), Ioannis Daglis (Greece), Mark Lester (UK) [will be updated with representatives].

ISEST / MiniMax24 summary slide

Name: International Study of Earth-Affecting Solar Transients (ISEST)

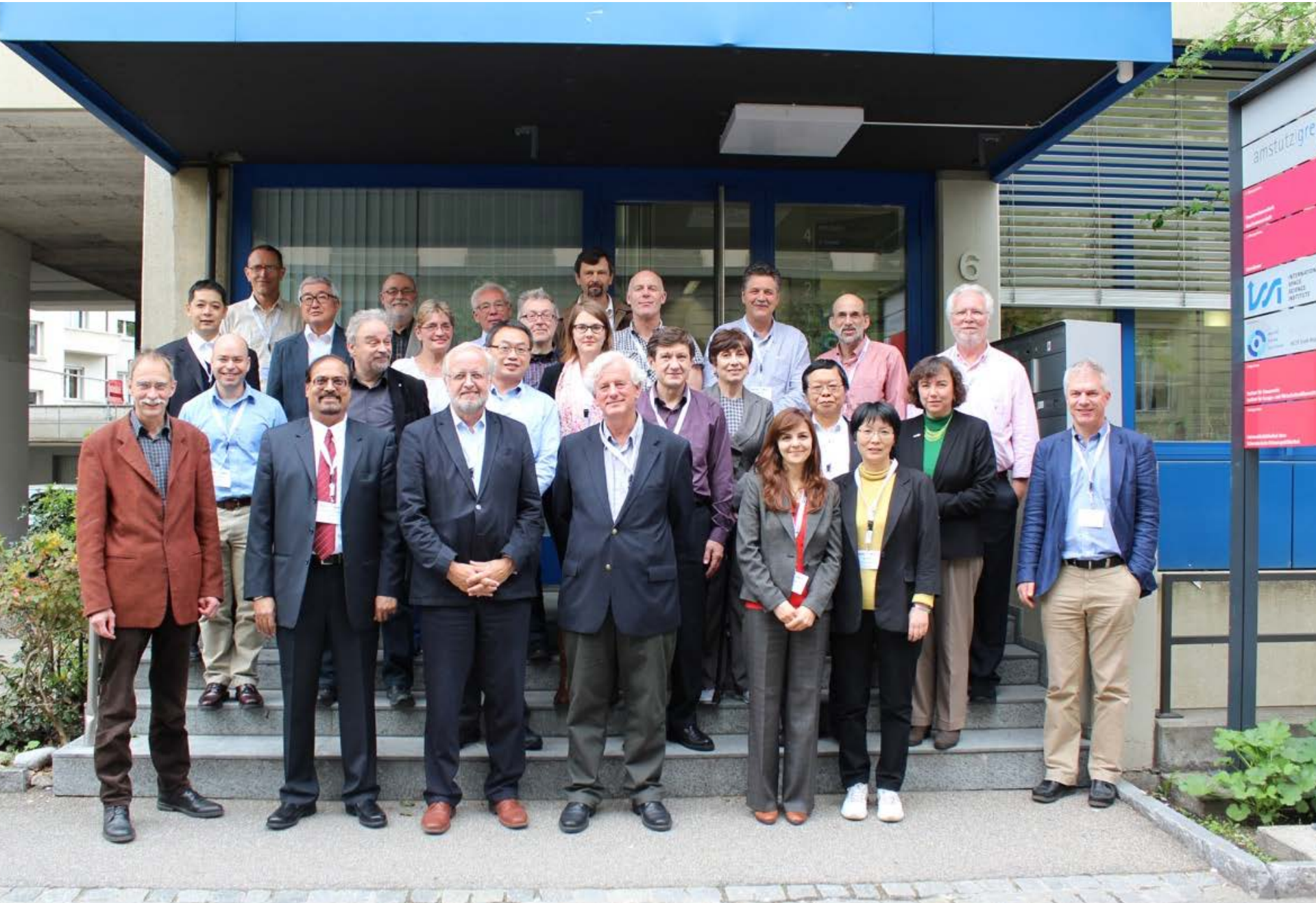
Goals and objectives: Understand the propagation of solar transients through the space between the Sun and the Earth, and develop space weather prediction capability.

Questions: How do coronal mass ejections (CMEs) and corotating interaction regions (CIRs) propagate and evolve, drive shocks and accelerate energetic particles in the heliosphere?

Data/theory/modeling: Establish a database of Earth-affecting solar transient events including CMEs, CIRs, flares, and energetic particle events based on remote sensing and in-situ observations from an array of spacecraft, run observation campaigns such as MiniMax24, develop empirical, theoretical, and numerical models of CME propagation and prediction, validate models using observations

Anticipated outcome: A comprehensive database of Earth-affecting solar transients will be created, and space weather prediction capability will be significantly improved.

Key members: Jie Zhang (USA), Bojan Vrsnak (Croatia), Manuela Temmer (Austria), Nat Gopalswamy (USA)



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