

ISEST Program - Introduction and Plan

Jie Zhang (GMU)

On behalf of the SOC

Chartered by SCOSTEP



- **SCOSTEP is one of the 17 Interdisciplinary bodies of ICSU**
 - **Other bodies with overlapping interests :COSPAR, CODATA, SCAR, WDS)**
- **Runs long-term (~4 years) international interdisciplinary scientific programs since 1966**
- **Seeks opportunities for interaction with national and international programs involving solar terrestrial physics elements**



ICSU

International Council for Science

Interdisciplinary Bodies

Name of the Interdisciplinary Body	Acronym
An International Programme of Biodiversity Science	DIVERSITAS
Committee On SPace Research	COSPAR
Committee on DATA for Science and Technology	CODATA
Global Climate Observing System	GCOS
Global Ocean Observing System	GOOS
Global Terrestrial Observing System	GTOS
Integrated Research on Disaster Risk	IRDR
International Geosphere-Biosphere Programme	IGBP
International Human Dimensions Programme on Global Environmental Change	IHDP
International Network for the Availability of Scientific Publications	INASP
Programme on Ecosystem Change and Society	PECS
Scientific Com.on Frequency Allocations for Radio Astronomy and Space Science	IUCAF
Scientific Committee On Solar-TERrestrial Physics	SCOSTEP
Scientific Committee on Antarctic Research	SCAR
Scientific Committee on Oceanic Research	SCOR
WMO-ICSU-IOC World Climate Research Programme	WCRP
World Data System	WDS

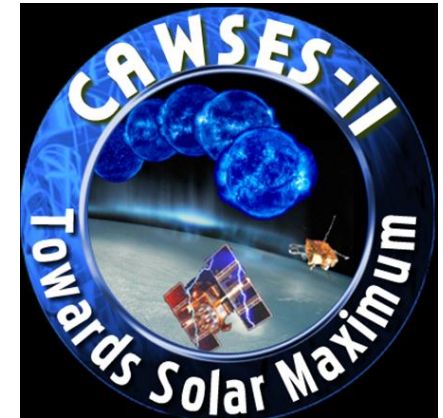
“Strengthening international science for the benefit of society”

SCOSTEP - CAWSES-II (2009-2013)

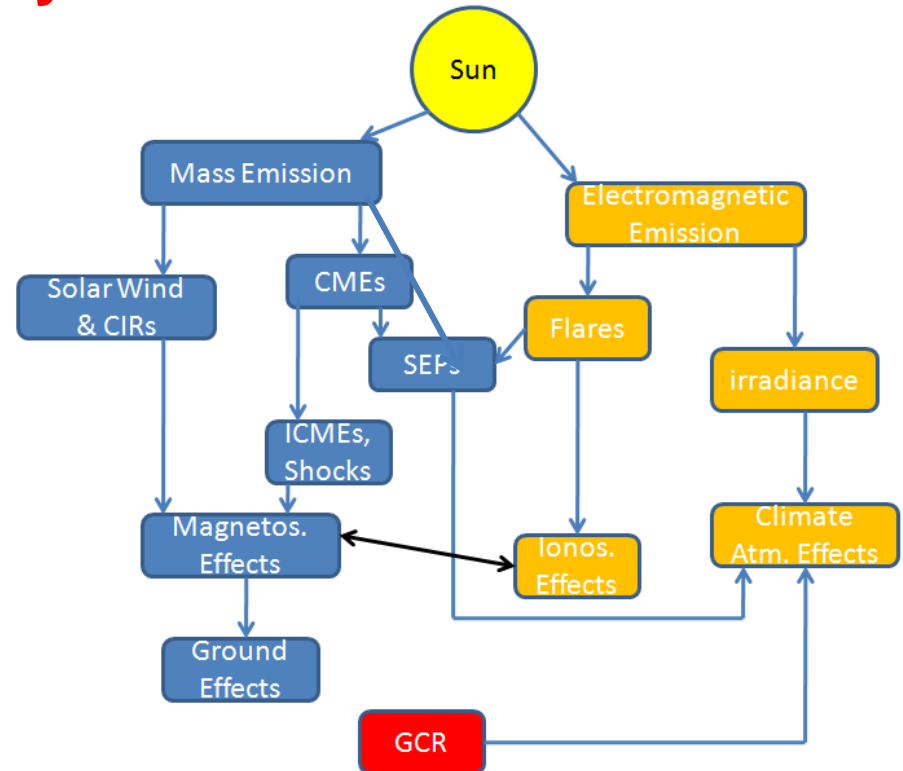
- **Current Scientific Program (ends in 2013)**

Climate and Weather of the Sun-Earth System (CAWSES-II)

New president: Nat Gopalwamy



SCOSTEP runs international interdisciplinary programs that can be completed over a period of about 4 years



The Creation of ISEST

- Currently, it is a program within CAWSES-II Task Group 3 (How does short-term solar variability affect the geospace environment?)
- Discussion started in CDAW Flux Rope workshop at Madrid, Spain, September 2011
- Formerly approved in August 2012
- The program was announced in the SCOSTEP News Letter in the August 2012 issue
- 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)

Overarching Goals

- **Improve the scientific understanding of the origin and propagation of solar transients**
- **Develop the prediction capacity of these transients' arrival and potential impacts on the Earth**
- **Education and public outreach**

1st ISEST Workshop

- **June 17 – 20, 2013, Hvar, Croatia**
(<http://spaceweather.gmu.edu/meetings/ISEST/Home.html>)
- **35 people registered for the onsite workshop**
- **53 people signed up for online participation**
- **ISEST Wiki is created for data repository, discussion forum and education**
(http://solar.gmu.edu/heliophysics/index.php/Main_Page)

Forum and Platform

Future Plan

A program in SCOSTEP (2014-2018)

1. Merge current ISEST (Jie Zhang, Bojan Vrsnak) and MiniMax (Nat Gopalswamy, Manuela Temmer)
2. In SCOSTEP Forum (ISSI, Bern, Switzerland, May 6 – 8, 2013)
 - ISEST program was presented by Jie Zhang
 - MiniMax was presented by Nat Gopalswamy
3. SCOSTEP approved the ISEST/MiniMax program as one of the four SCOSTEP programs for the next four year
4. So, think big and plan wise

Forum and Platform



Variability of the Sun and Its Terrestrial Impact (VarSTI)

SCOSTEP Scientific Program

for 2014-2018

ISSI Forum, May 7-8, 2013, Bern

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)

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

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].

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 (MALTl) and Earth's climate and its importance relative to anthropogenic 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 transferred 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 MALTl ?
- (e) What are the signatures causes of long term MALTl 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 anthropogenic forcing and natural long term variability

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