VarSITI – Variability of the Sun and Its Terrestrial Impacts

the SCOSTEP's scientific program

Scientific Committee on Solar-Terrestrial Physics

2014-2018

Katya Georgieva and Kazuo Shiokawa – VarSITI co-chairs

SCOSTEP
Scientific Committee on Solar-Terrestrial Physics

VarSITI

International interdisciplinary programs in solar-terrestrial physics operated by SCOSTEP

1976-1979: IMS (International Magnetosphere Study)

1979-1981: SMY (Solar Maximum Year)

1982-1985: MAP (Middle Atmosphere Program)

1990-1997: STEP (Solar-Terrestrial Energy Program)

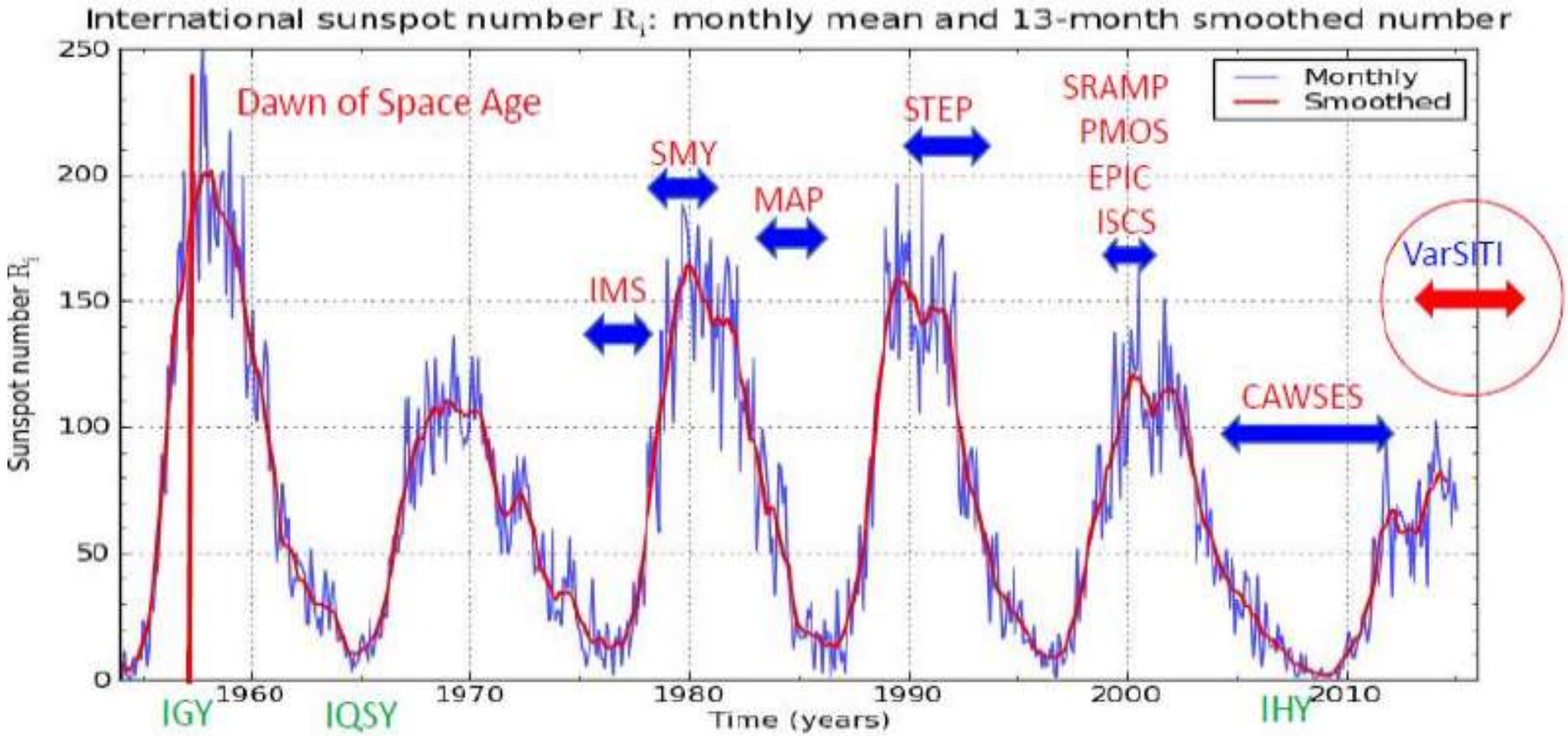
1998-2002: Post-STEP（S-RAMP, PSMOS, EPIC, and ISCS)

2004-2008: CAWSES (Climate and Weather of the Sun-Earth System）

2009-2013: CAWSES-II (Climate and Weather of the Sun-Earth System-II）

2014-2018: VarSITI (Variability of the Sun and Its Terrestrial Impact)

Solar Variability and SCOSTEP Scientific Programs



VarSITI has 4 scientific projects

Four Projects of VarSITI and their science questions

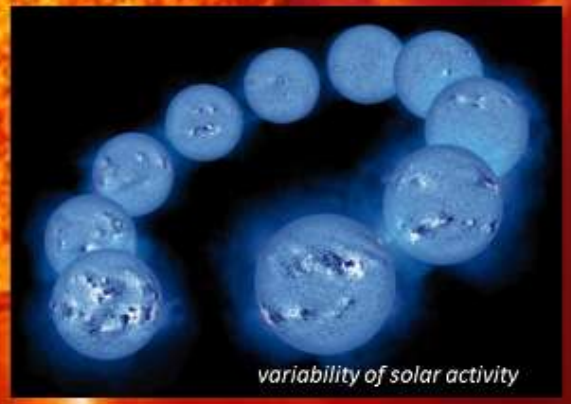
International Study of Earth-Affecting Solar Transients (ISEST)/MiniMax24

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

ionospheric plasma bubble

Solar Evolution and Extrema (SEE)

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) What is the largest solar eruption/flare possible? What is the expectation for periods with absence of activity?


variability of solar activity

Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate (ROSMIC)

1) What is impact of solar forcing of the entire atmosphere? What is the relative importance of solar irradiance versus energetic particles?
2) How is the solar signal transferred from the thermosphere to the troposphere?
3) How does coupling within the terrestrial atmosphere function (e.g. gravity waves and turbulence).
4) What is the impact of anthropogenic activities on the Middle Atmosphere, Lower Thermosphere, Ionosphere (MALTI)?
5) What are the characteristics of reconstructions and predictions of TSI and SSI?
6) What are the implications of trends in the ionosphere/ thermosphere for technical systems such as satellites.

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

Can the state of the Earth's inner magnetosphere be specified and predicted to high accuracy, based on inputs from the Sun and solar wind?


solar influence on climate


space safety


polar aurora

futurehumanevolution.com

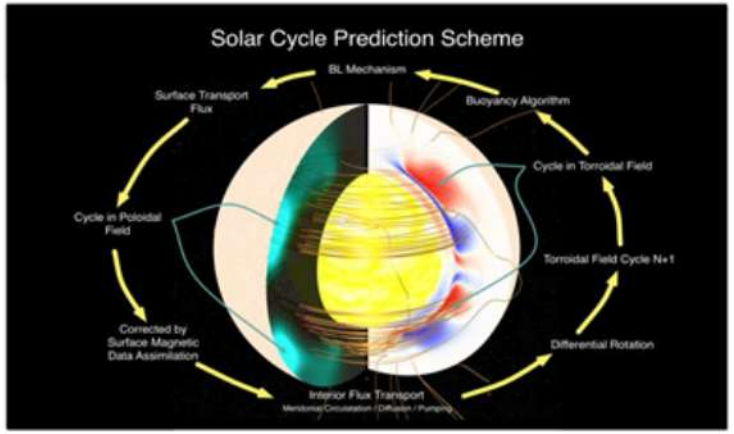
Solar Evolution and Extrema (SEE)

Dibyendu Nandy (India)
Piet Martens (USA)
Vladimir Obridko (Russia)

Members: 635
Countries: 63

VarSITI

Science Questions: the SUN



1) Are we at the verge of a **new grand minimum of solar activity?**

2) For the next few decades, what can we expect in terms of **extreme solar flares and storms**? What is the largest solar eruption/flare possible?

3) 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?

Project ISEST/MiniMax24

International Study of Earth-affecting Solar Transients

744 members
from 76 countries

J. Zhang[1], M. Temmer[2], and N. Gopalswamy[3]
[1]School of Physics, Astronomy and Computational Sciences, George Mason University, Fairfax, VA, USA
[2]Institute of Physics, University of Graz, Styria, Austria
[3]NASA Goddard Space Flight Center, Greenbelt, MD, USA


Jie Zhang


Manuela Temmer


Nat Gopalswamy

Goal of ISEST

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

Working Group 1 (Data Group): identify all Earth-affecting ICMEs during the STEREO era (2007 to present) and their solar sources. For selected events, fully measure, characterize and quantify their properties and evolution from the Sun to the Earth. Provide a comprehensive event database

Working Group 2 (Theory Group): understand the structure and evolution of CMEs as well as their origin and their magnetic rope structure.

Working Group 3 (Simulation Group): investigate processes of CME initiation, heliospheric propagation, and interaction. Use existing 3D MHD models including ENLIL, COIN-TVD, H3DMHD and SWMF.

Working Group 4 (Campaign Group): integrate theory, simulations and observations in order to understand the chain of cause-effect activities from the Sun to Earth for a small number of carefully selected events

Working group 5: (Bs challenge) develop predictive capabilities to estimate the southward component of CMEs

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

Specification and Prediction of the Coupled Inner-Magnetospheric Environment
SPeCIMEN

Jacob Bortnik,
(Dept. of Atmospheric and Oceanic Sciences
UCLA, USA)

Craig Rodger,
(University of Otago,
New Zealand)

Yoshi Miyoshi,
(ISEE, Nagoya University, Japan)

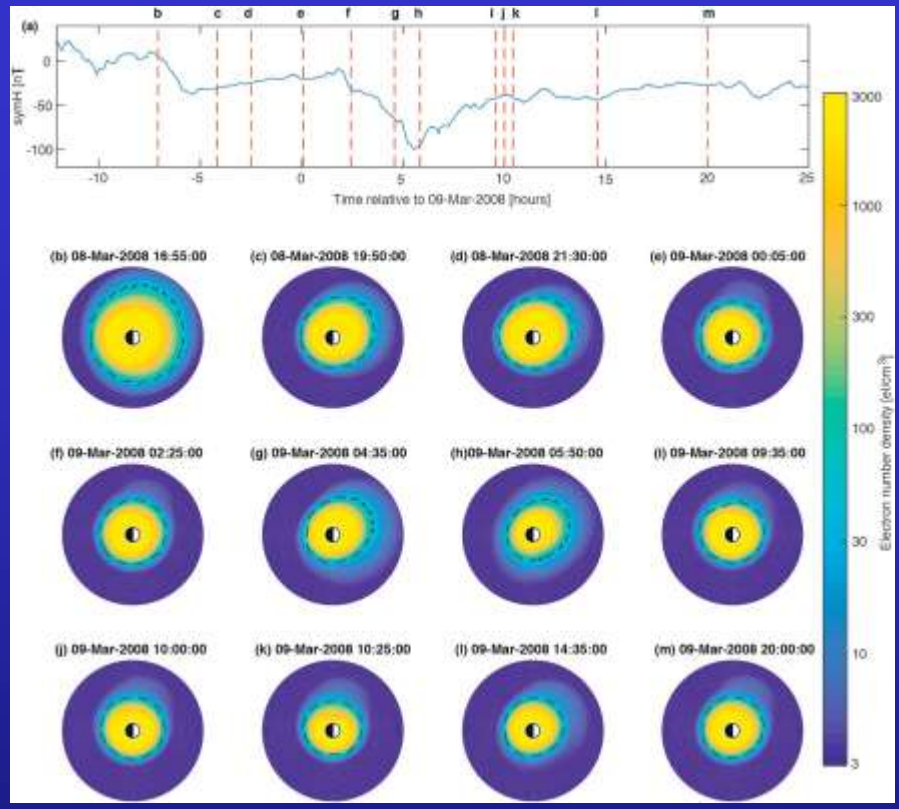
Shri Kanekal,
(NASA/GSFC, Greenbelt, USA)

620 members
from 60 countries

GOAL of SPeCIMEN:

to specify and predict the state of the Earth's inner magnetosphere:

1. To high accuracy,
2. Based on inputs from the Sun and solar wind,
3. Employing a combination of physical and statistical predictive modeling.



A focus on space weather driven specification and prediction

Role **O**f the **S**un and the **M**iddle atmosphere/thermosphere/ionosphere **I**n **C**limate

ROSMIC

F.–J. Lübken,
(Leibniz-Institut für Atmosphärenphysik, Germany)

Annika Seppälä,
(Finnish Meteorological Institute, Finland)

William Ward,
(University of New Brunswick, Canada)

824 members from 67 countries

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 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 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?

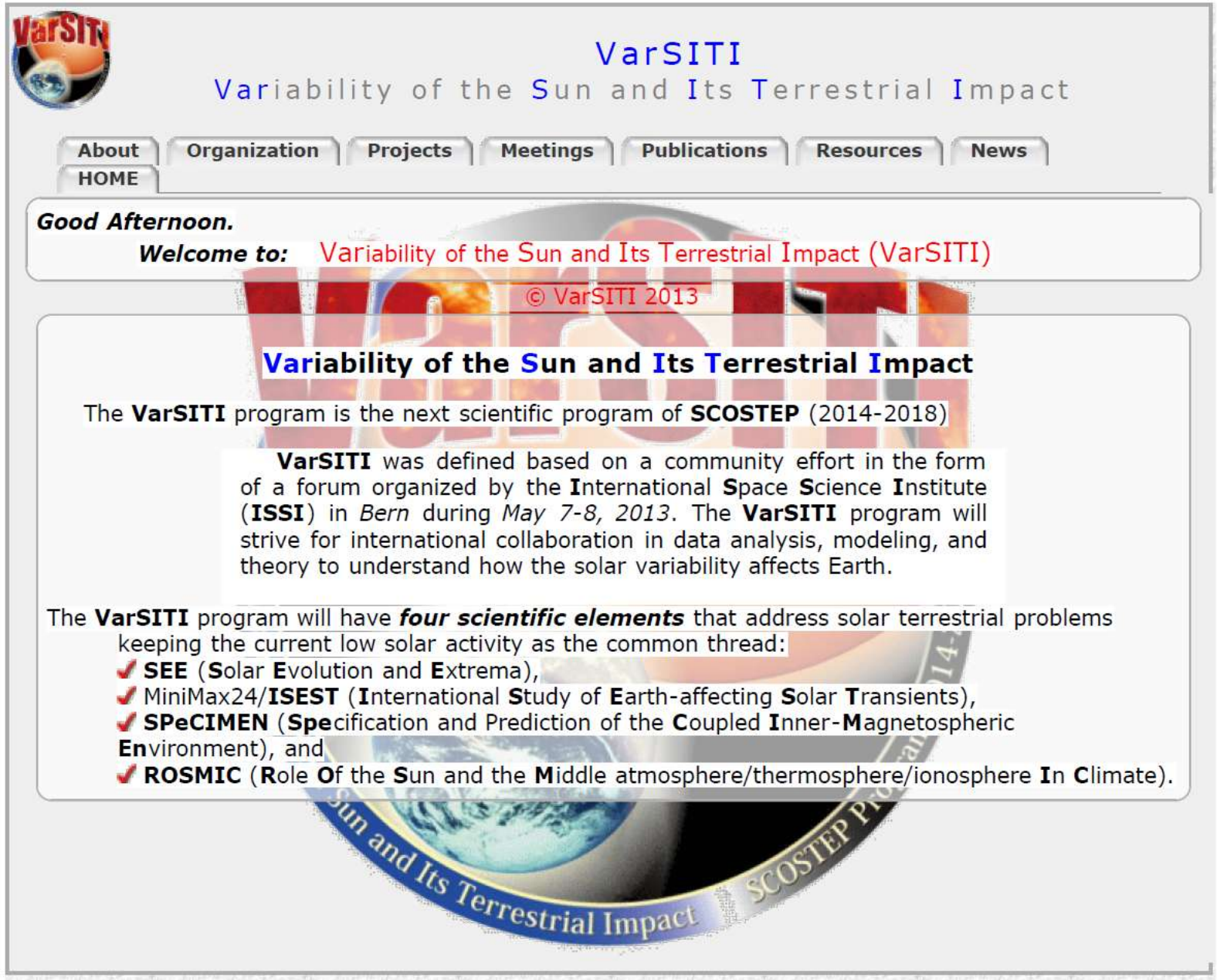
Our approach:

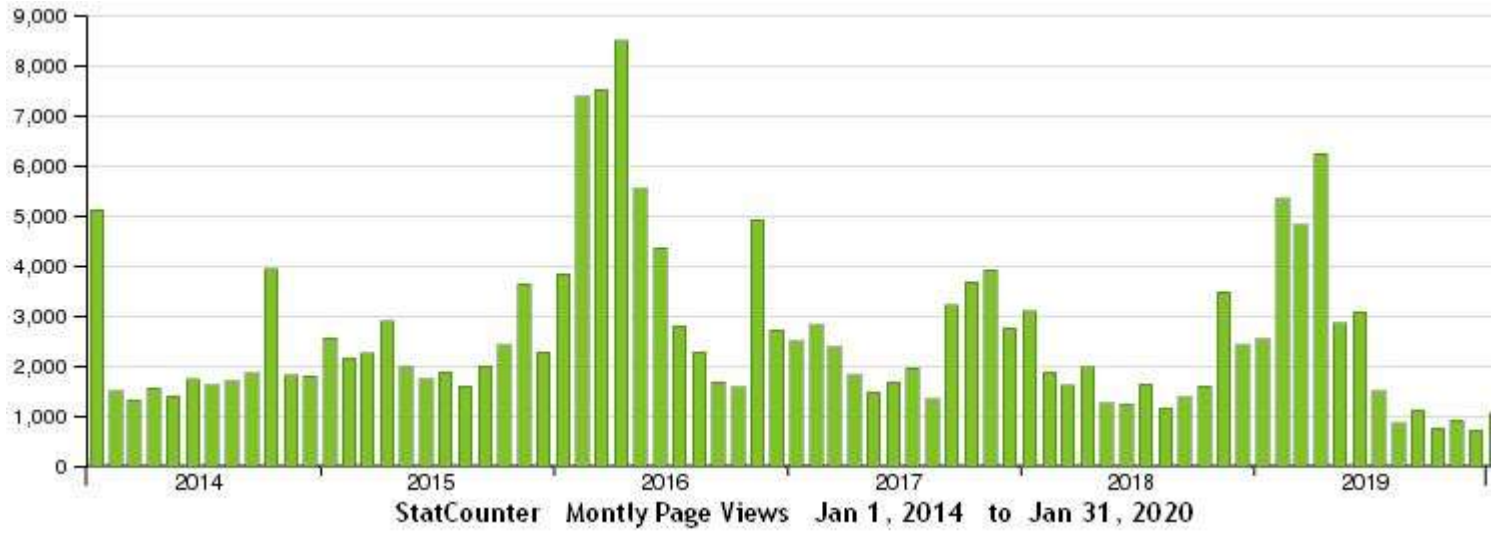
To encourage the communications among different fields to promote interdisciplinary studies

Our instruments:

(1) web site
(2) mailing list
(3) newsletter
(4) financial support for meetings, databases, and campaigns
(5) database collection
(6) capacity building

Web-site: www.varsity.org

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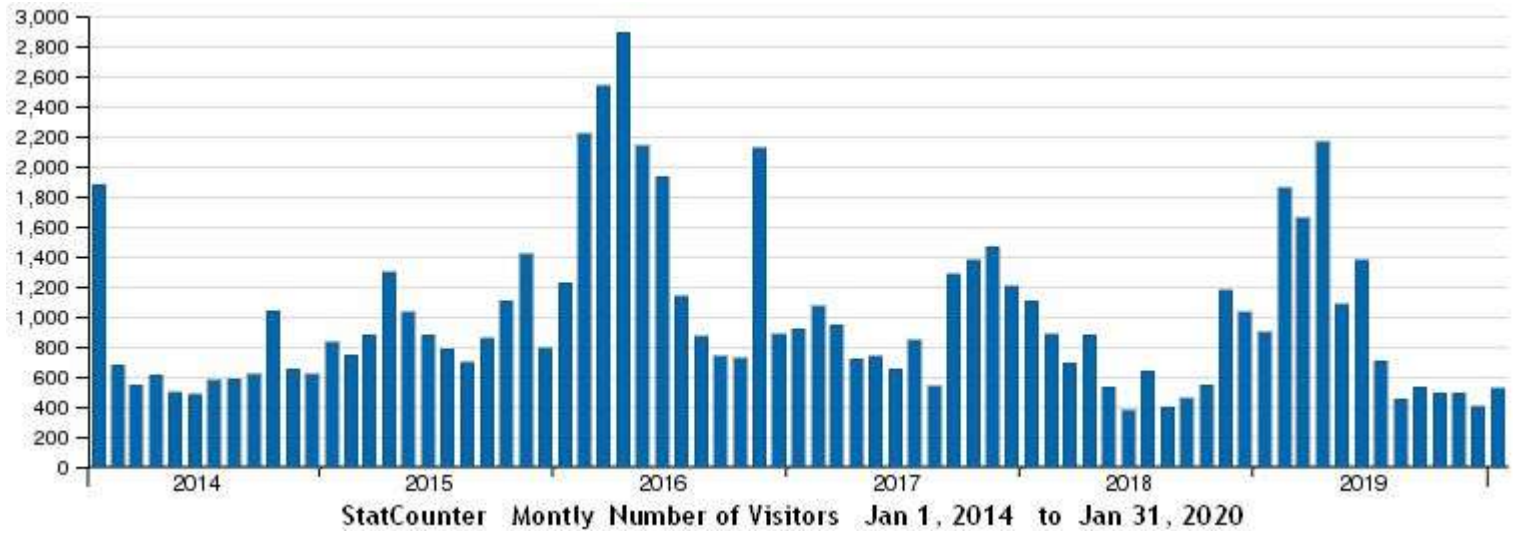
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Mailing list

A total of **1116** scientists from **72** countries

SEE: 637

ISEST Mini/Max: 774

SPeCIMEN: 620

ROSMIC: 824

VarSITI newsletters


SCOSTEP

VarSITI

Variability of the Sun and its Terrestrial Impact (VarSITI)
SEE / ISEST-Minimax24 / SPeCIMEN / ROSMIC
http://www.varsiti.org/

Vol. 19, October 2018

VarSITI Newsletter

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Article 1

Project for Solar-Terrestrial Environment Prediction (PSTEP)

Kanya Kusano
Institute for Space-Earth Environmental Research (ISEE), Nagoya University, Nagoya, Japan

Kanya Kusano

Although solar activity may significantly impact the global environment as well as socio-economic systems through variety of processes (Fig. 1), the mechanisms for solar activities and the subsequent processes have not yet been fully understood. Thus, modern society, which is supported by advanced information systems, is at a risk from severe space weather disturbances and the long-term variation of solar-terrestrial environment. Project for Solar-Terrestrial Environment Prediction (PSTEP) was launched in order to improve this situ-

Figure 1. The subject of PSTEP study. The objective of PSTEP is to improve the feedback between the scientific research and the operational forecast of space weather disturbances and social impacts.

- ✓Articles
- ✓Highlights of young scientists
- ✓Short news
- ✓Meeting schedule

4 issues per year (up to vol.21)

Editors

Kazuo Shiokawa

Katya Georgieva

Newsletter secretary

Mai Asakura

Ayumi Asai

Miwa Fukuichi

Megumi Nakamura

One secretary was hired to edit this newsletter by ISEE.
This secretary also maintain the mailing list.

VarSITI Newsletter vol.1–21

Articles: 60 articles from 24 countries
Highlight of young scientists: 49 articles from 22 countries
Meeting reports: 85 articles from 28 countries
Short news: 24 articles from 8 countries

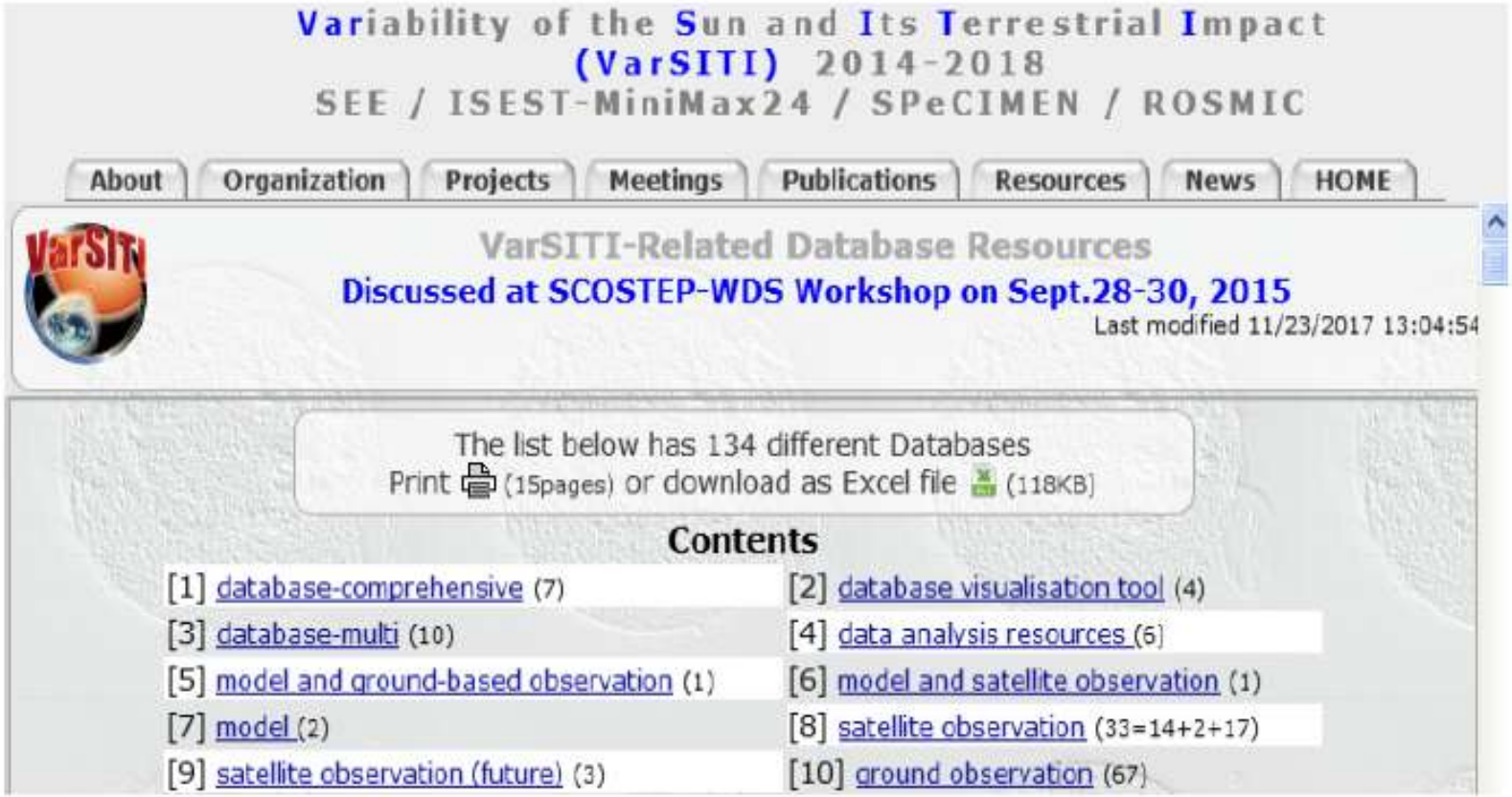
financial support for meetings, databases, and campaigns

For the 5-year duration of the VarSITI program we have organized or supported

- 64 meetings or sessions
  including VarSITI2016, VarSITI2017, VarSITI2019
- 16 databases
- 1 campaign
- 1 interdisciplinary project

database collection

A collection of solar-terrestrial databases at VarSITI's web site



This effort to collect VarSITI-related database was initiated after the SCOSTEP-WDS workshop in 2015. Co-chairs ask the VarSITI members to provide information of these databases via the VarSITI mailing list. Some database supported by SCOSTEP/VarSITI funding are also added.

Capacity building

July 2017: Irkutsk, Russia, 35 students from 5 countries

Sept 2017: Ota, Nigeria, 38 students from 7 African countries

Sept 2015: Abuja, Nigeria, 65 students from 7 African countries

March 2015: Bandung, Indonesia, 39 students from 9 Asian countries.

March 2018: Bandung, Indonesia, 40 students from 7 Asian countries.

VarSITI Closing Symposium

June 10÷14, 2019, Sofia, Bulgaria

About this Symposium

Description:

VarSITI, the scientific program of **SCOSTEP**, is coming to an end. For five years, more than 1,100 scientists from 71 countries have been working on its four scientific projects:

- **SEE** (Solar Evolution and Extrema),
- **MiniMax24/ISEST** (International Study of Earth-affecting Solar Transients),
- **SPeCIMEN** (Specification and Prediction of the Coupled Inner-Magnetospheric Environment), and
- **ROSMIC** (Role Of the Sun and the Middle atmosphere/thermosphere/ionosphere In Climate)

VarSITI focuses on the recent and expected future solar activity and its consequences for the Earth, over various time scales from thousands of years to milliseconds, and at various locations from the solar interior to the Earth's atmosphere. In particular, VarSITI focuses on the interconnections in the Sun-Earth system, and encourages the interaction among scientists working on different aspects of this complex system.

The purpose of this Closing Symposium

is to summarize the results of the program: what progress has been made, what new scientific questions have emerged, what should be the focus of the next scientific program.

VarSITI Completion Symposium

June 10÷14, 2019, Sofia, Bulgaria

http://newserver.stil.bas.bg/VarSITI2019/

98 participants
from 24 countries

VarSITI Closing Symposium

June 10÷14, 2019, Sofia, Bulgaria

http://newserver.stil.bas.bg/VarSITI2019/

All presentations are online

1. **Mechanisms of solar variability and its Earth-affecting manifestations**
2. **Long-term solar variability and its impacts on the heliosphere and the terrestrial system including solar wind, geomagnetic field, and Earth's climate (Space climate)**
3. **Short-term solar variability and Earth-affecting events, and the reaction of the terrestrial system to solar/heliospheric drivers (Space weather)**
4. **Coupling between the Earth's atmosphere and space under quiet or active Sun**
5. **Sun to Earth event case studies**
6. **Sun-Earth related data: definition, maintenance, archiving**
7. **Predictability of the Variable Solar-Terrestrial Coupling (PreSTo): The science behind**