



Variability of the Sun and Its Terrestrial Impact (VarSITI)

SCOSTEP Scientific Program 2014-2018

contact: Nat Gopalswamy

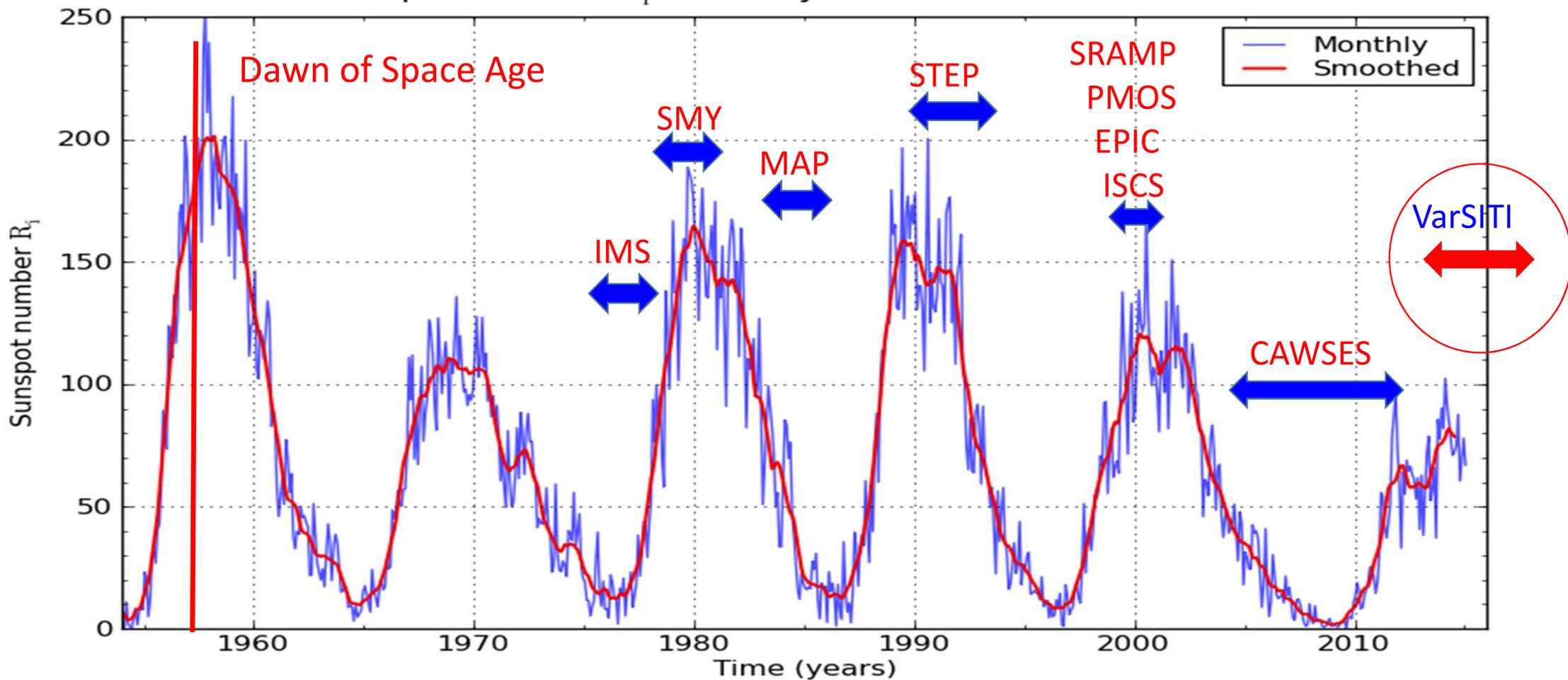
(nat.gopalswamy@nasa.gov)



52nd UNCOPUOS/STSC Meeting 2015 February 05 Technical Presentation by Nat Gopalswamy
Agenda item - Space Weather

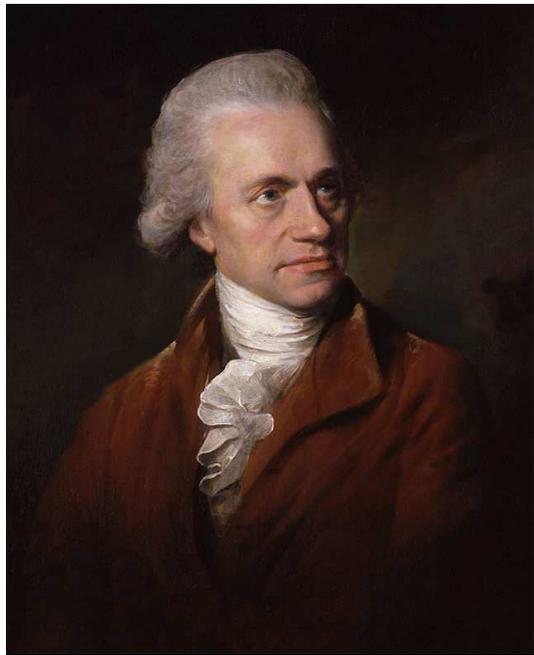
Solar Variability and SCOSTEP Scientific Programs

International sunspot number R_i : monthly mean and 13-month smoothed number

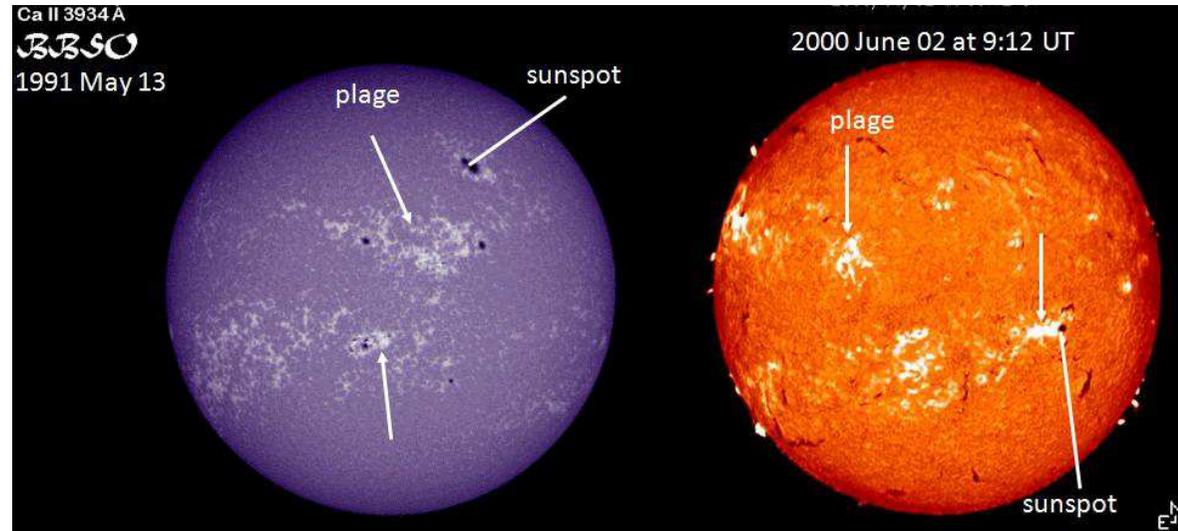


Long-term Variability Impacting Earth...

- In 1801 Herschel reported to the Royal Society that five prolonged periods of few sunspots correlated with high wheat prices in England.
- Herschel inferred that less number of sunspots indicated less heat and light from the Sun so the wheat production was low and the wheat was costly
- Herschel was ridiculed for this report, but now we know that when there are more sunspots, the Sun emits more radiation because of the brighter regions appearing around the sunspots



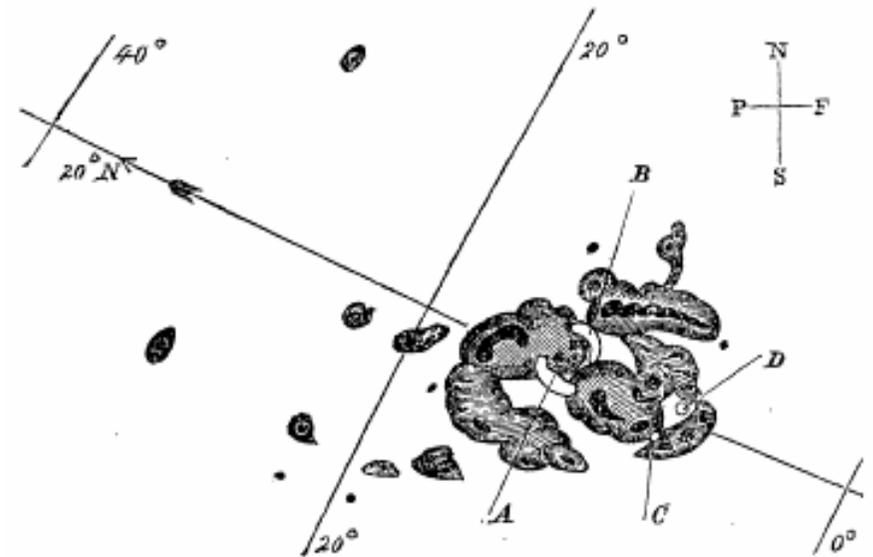
Friedrich Wilhelm Herschel
1738 – 1822
discoverer of Uranus



Discovery of a Solar Eruption

On September 1, 1859 Richard C. Carrington and R. Hodgson in England independently observed a sudden brightening from a Sunspot region

A geomagnetic storm commenced on September 2 – about 17.5 hours later. Carrington hinted at the connection, which we now know is true

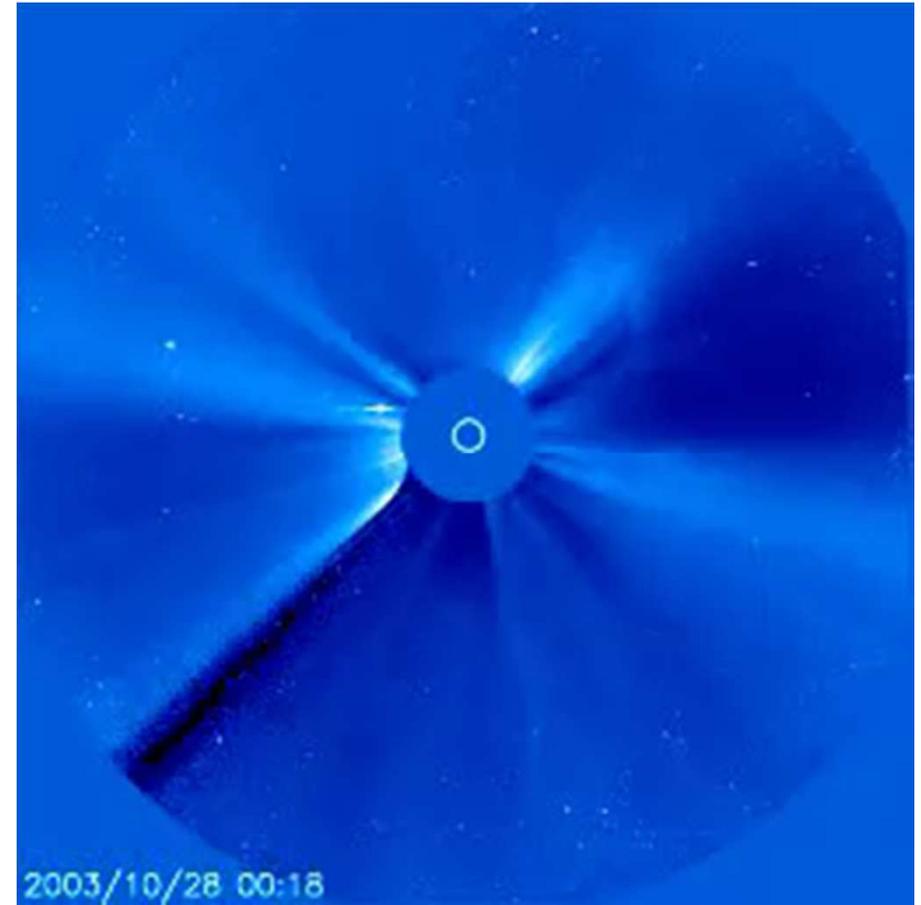
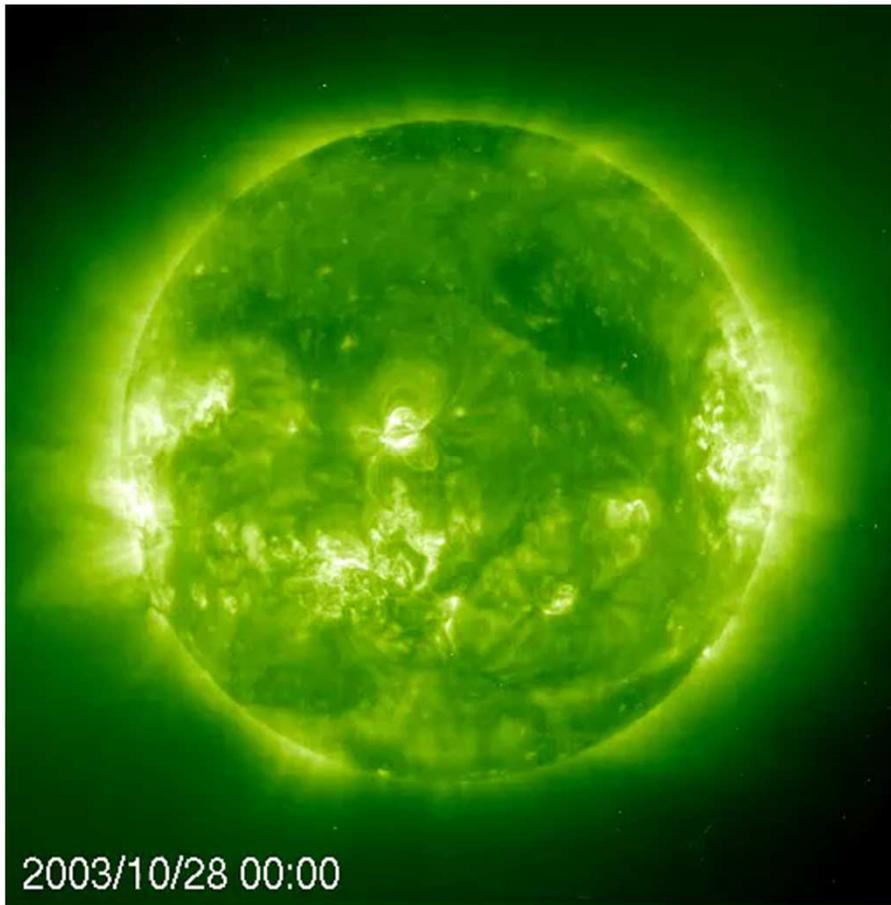


Drawing by Carrington

A disturbance from the Sun must have traveled with a speed of about 2500 km/s to arrive at Earth in 17.5 hours (Sun-Earth distance is about 150 million km)

Modern Version of Solar Eruptions

ESA/NASA



Four Projects of VarSITI

varsiti.org

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

VarSITI Co-chairs:
Katya Georgieva (Bulgaria)
Kazuo Shiokawa (Japan)

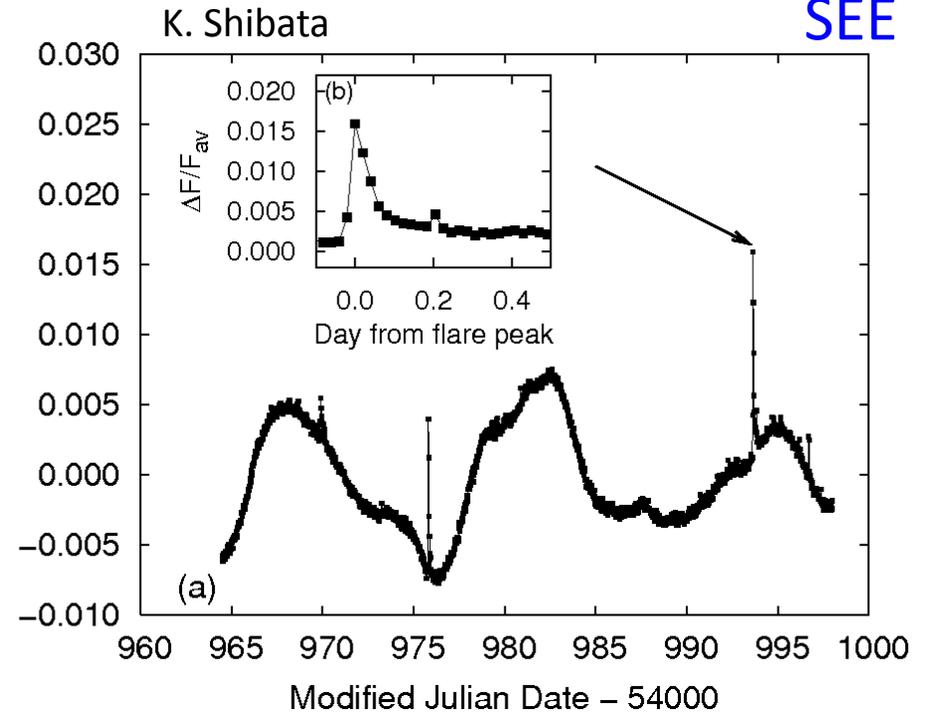
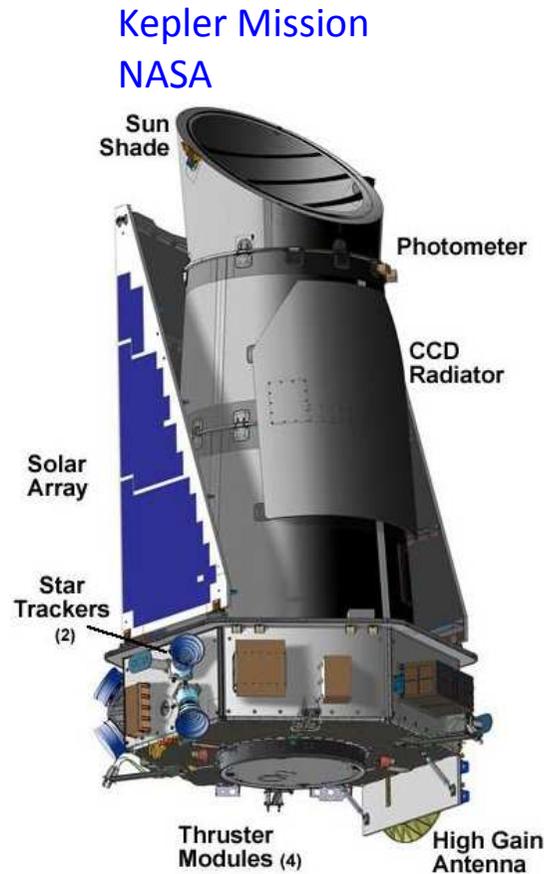
VarSITI was established by an international team of experts in the International Space Science Institute in Bern, Switzerland in 2013 and launched in 2014

VarSITI explores Sun-like Stars to understand Extreme Events

SEE



The OGLE Telescope with Milky Way
courtesy: Yuri Beletsky



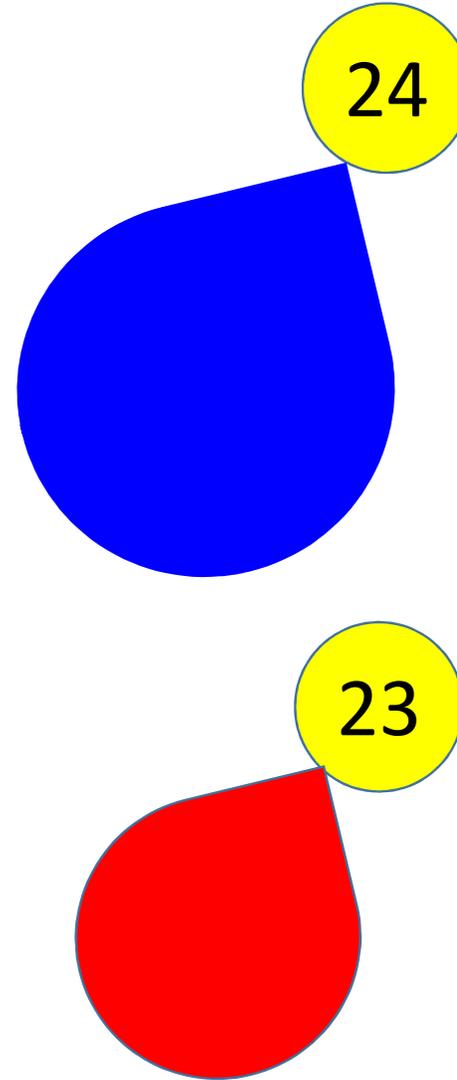
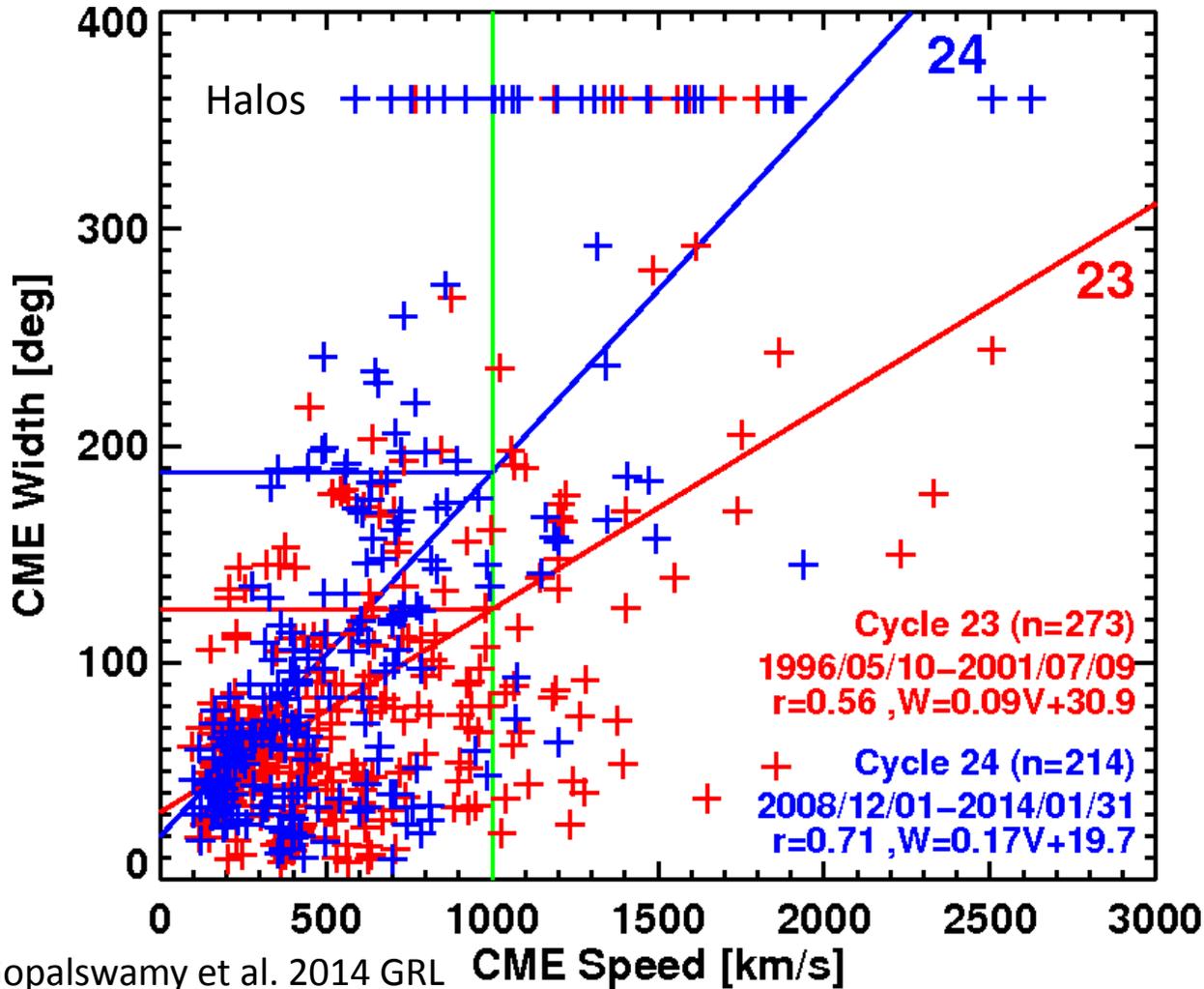
Japanese scientists have identified flares that are 1000 times more powerful than solar flares on scores of Sun-like stars observed by NASA's Kepler mission.

There is a small probability that such flares can occur on the Sun

Anomalous Expansion of CMEs in Cycle 24

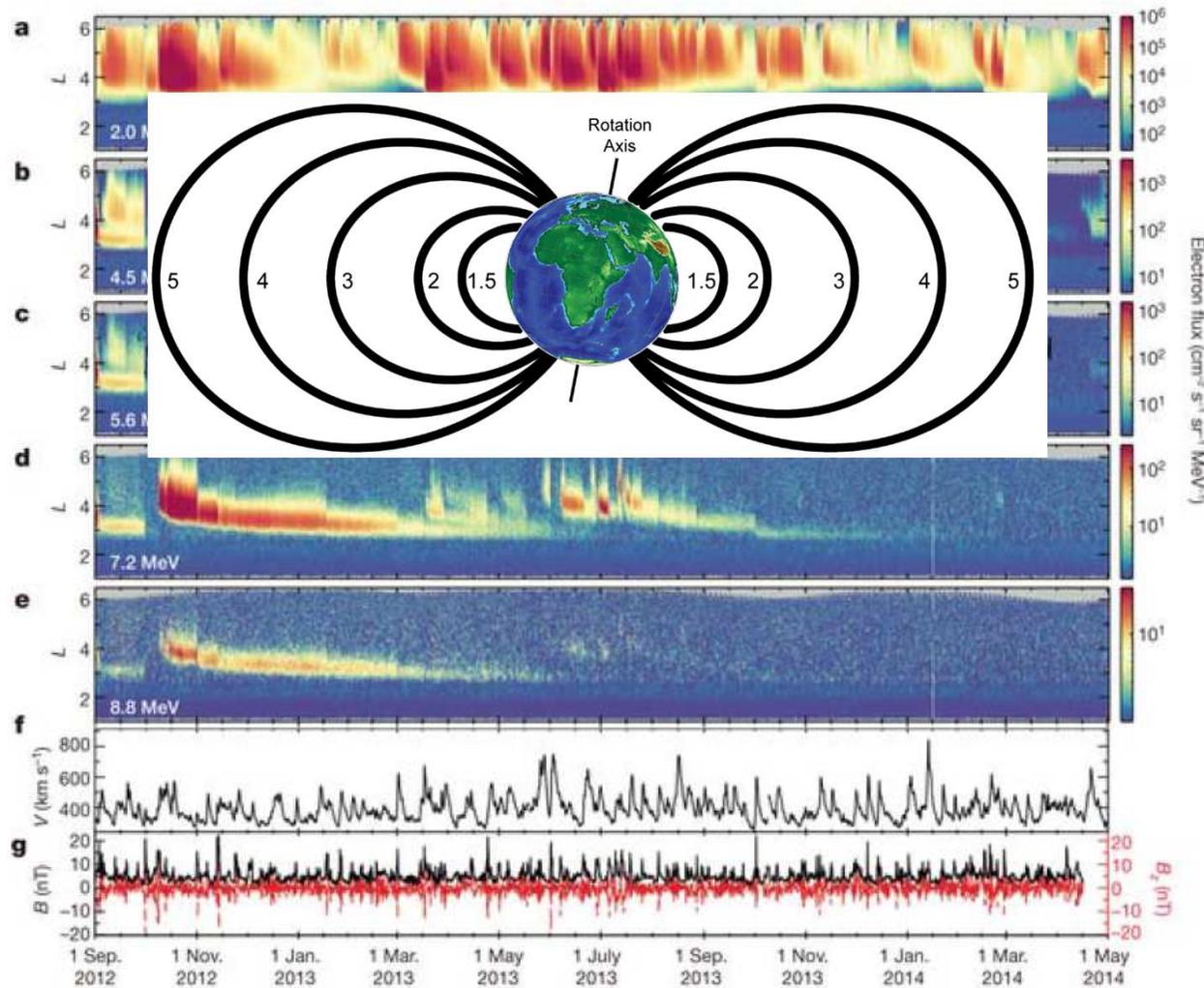
ISEST/MiniMax24

Cycle-24 CMEs are 52% wider for $V=1000$ km/s



Lower outside
Pressure -->
larger CMEs

Higher outside
Pressure -->
Smaller CMEs

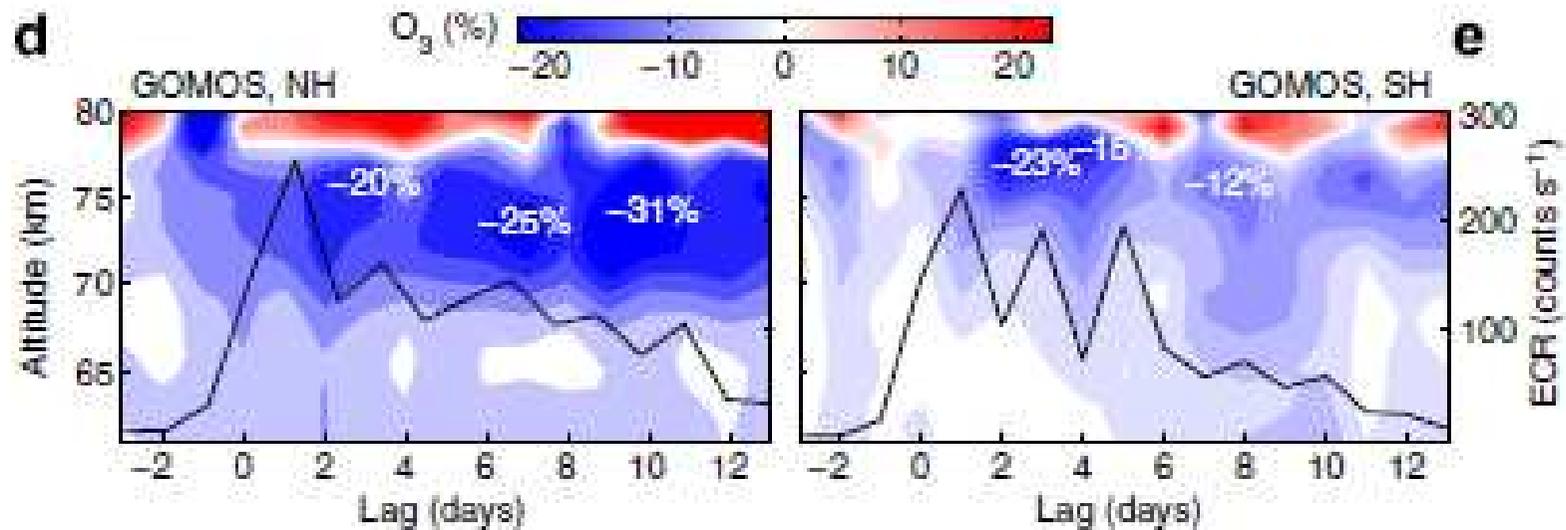


SPeCIMEN

High energy electrons measured by REPT sensors throughout the mission

Never seem to extend inwards of $L \approx 2.8$. This forms a particularly clear and sharp boundary for the ultrarelativistic electrons

Baker et al. (Nature, 2014): Discovery of sharp inner boundary for the ultrarelativistic ($E > 5\text{MeV}$) electrons in the Earth's radiation belts.



Electron precipitation leads to Ozone depletion
 Northern and Southern Hemispheres show different impacts

ROSMIC

Andersson et al. (Nature Comm., 2014): First evidence for radiation belt electron precipitation impact on atmospheric ozone in long term.



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 SEE / ISEST-Minimax24 / SPeCIMEN / ROSMIC
<http://www.varsiti.org/>

Vol. 4, January 2015

VarSITI Newsletter

Edited by Co-chairs
 Drs. Georgieva and Shiokawa

The Newsletter activity is supported by Japan at the Solar Terrestrial Research Laboratory in Nagoya

Inside this issue

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Project ROSMIC

Article 1:



CASSIOPE Enhanced Polar Outflow Probe (e-POP)

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¹Department of Physics and Astronomy,
 University of Calgary, Calgary, Canada



Andrew Yau



Gordon James

Investigation using data from Canadian Space Agency's CASSIOPE mission

varsiti.org

VarSITI Newsletter brings current results to the community 4 times a year

NASA Living with a Star (LWS) Program has Announced Support for SCOSTEP/VarSITI Projects

- Solicitation: NNH14ZDA001N-LWS, Heliophysics Living With a Star Science 2015
- Three-year awards to coincide with the 2014-2018 timeframe of VarSITI
- Proposals need to be relevant to VarSITI themes
- PIs to collaborate and share their models and results with each other and the international VarSITI project leaders
- More details: <http://nspires.nasaprs.com/>



In particular, Germany, India, Japan provide substantial funding for VarSITI Research

Initial VarSITI Results to be Published in American Geophysical Union Journal

Editors:

Qiang Hu (USA)

Bernd Funke (Spain)

Martin Kaufmann (Germany)

Olga Khabarova (Russia)

Jean-Pierre Raulin (Brazil)

Craig J. Rodger (New Zealand)

David F. Webb (USA)

- Papers presented at SCOSTEP's 13th Quadrennial Symposium in China (October 2014)
- Related papers from the community
- Peer-reviewed
- Special issue named VarSITI

The logo for the Journal of Geophysical Research (JGR), consisting of the letters 'JGR' in a bold, white, sans-serif font on a dark blue background.The logo for AGU Publications, featuring a stylized white icon of a globe or sphere to the left of the text 'AGU PUBLICATIONS' in a white, sans-serif font.

VarSITI Activities are being Expanded with Cooperation from ICSU/WDS



SOHO (ESA & NASA)

SCOSTEP-WDS Workshop

Global Data Activities for the Study of Solar-Terrestrial Variability

28-30 September 2015

National Institute of Information and Communications Technology (NICT), Tokyo, Japan

Home Programme Venue Committees Schedule Contact Links



Scope

<http://isds.nict.go.jp/scostep-wds.2015.org/>

This joint workshop of the [Scientific Committee on Solar-Terrestrial Physics \(SCOSTEP\)](#) and the ICSU World Data System (ICSU-WDS) on 'data' will be held on 28–30 September 2015 in Tokyo, Japan. The principal objective of the workshop is to stimulate interaction among data providers (WDS members, data centres, data networks, etc.), data scientists, and data-oriented researchers of the SCOSTEP community. The new [VarSITI*](#) program of SCOSTEP will strive for international collaboration in data analysis, modelling, and theory to understand how the solar variability affects the Earth's environment. Long-term preservation and provision of quality-assessed data and

SCOSTEP
Scientific Committee on Solar-Terrestrial Physics



ICSU
WORLD DATA SYSTEM

Important Dates

Abstract Submission:

1 April – 1 August 2015

Summary

- VarSITI is the new SCOSTEP scientific program to run during 2014-2018 (one year completed)
- About 1000 Scientists from all over the world are participating in the VarSITI program to advance Sun-Earth connection studies
- Interesting discoveries are being made and the results published
- Solar terrestrial science will reach as many developing countries as possible via SCOSTEP's capacity building and outreach activities