Press Release

名古屋大学

太陽活動の低下の原因とその地球への影響を調べるために、SCOSTEP が VarSITI プログラムを開始

国際科学委員会（ICSU）傘下の国際組織である太陽地球系物理学・科学委員会（SCOSTEP）は、新しい国際協同科学プログラム VarSITI（太陽活動変動とその地球への影響）を 2014 年 1 月 13 日から開始します。世界中の太陽地球系科学の科学者がこの VarSITI プログラムに参加して、なぜ近年の太陽活動がこのように低下しているのか、そしてそれが地球とその周辺の宇宙環境にどのように影響があるか、を理解するためのさまざまなプロジェクトが開始されます。VarSITI は 2014-2018 年の 5 年間、継続します。名古屋大学太陽地球環境研究所は、本プログラムの中心的な実施機関になっています。Var SITI の成果は、地球温暖化などの気候変動に対する太陽の影響を理解する以外に、人工衛星を安全に信頼できるように運用することに貢献します。

本プログラムの開始に合わせて、2014 年 1 月 13 日に国際的に press release を行うことになりましたので、お知らせします。

太陽活動の低下の原因とその地球への影響を調べるために、SCOSTEP が VarSITI プログラムを開始

2014 年 1 月 13 日発信用

報道連絡先：Nat Gopalswamy（SCOSTEP 理事長、NASA, nat.gopalswamy@nasa.gov), Marianna Shepherd（SCOSTEP 事務局長、カナダ・ヨーク大学, mshepher@yorku.ca）

国際太陽地球系物理学・科学委員会（SCOSTEP）は新しい科学プログラム VarSITI（太陽活動変動とその地球への影響）を 2014 年 1 月 13 日から開始します。世界中の太陽地球系科学の科学者がこの VarSITI プログラムに参加して、なぜ近年の太陽活動がこのように低下しているのか、そしてそれが地球とその周辺の宇宙環境にどのように影響があるか、を理解するための研究を行います。VarSITI は国際協同プログラムで、2014-2018 年の 5 年間、継続します。

SCOSTEP は国際科学委員会（ICSU）傘下の国際組織です。ICSU のモットーは「社会の利益になるための国際的な科学を強化する」というものです、SCOSTEP はこの中で、地球上の生命や社会に関連した太陽地球系科学に関する組織です。VarSITI の成果は、太陽活動の変化が地球温暖化などの気候変動にどのように影響を与えるか、など、地球上の生命や社会が太陽から受ける影響をより良く理解することに貢献します。また、測位衛星や通信衛星などの宇宙空間の人工天体を安全に信頼をもって運用することにも貢献します。

2013 年に成功裏に終了した SCOSTEP のプログラム CAWSES（太陽地球系の天気と気候）のあとを受けて、VarSITI プログラムは、科学探査がはじまって以来最も低調な太陽活動に注目して研究を推進します。

VarSITI プログラムは、2013 年に行われた国際科学コミュニティの協力体制に関する国際的な議論の中で形成されてきました。VarSITI プログラムには、1）太陽磁場と極端現象、2）地球に影響を与える太陽の過渡現象、3）内部磁気圏の変動、4）地球大気のプロセス、の４つのテーマがあります。これらのテーマを研究していくために、国際的な著名研究者がリーダーを務める 4 つのプロジェクトが推進されます。

世界各国で取得・開発されているデータ、モデル、理論を通した太陽地球系科学に関するこの国際的な連携を続けて行くことが強く望まれています。SCOSTEP は特に、学生や発展途上国の研究者がこの VarSITI プログラムへ参加することを強く支援します。

それぞれの VarSITI のプロジェクトの元で、さまざまなワーキンググループが形成されます。このプログラムへの参加を希望される研究者・学生の方は、VarSITI の co-chair Katya Georgieva (katyageorgieva@msn.com)か Kazuo Shiokawa（shiokawa@stelab.nagoya-u.ac.jp ）にご連絡下さい。

VarSITI に関する Web サイトは www.varsiti.org になります。

以上

SCOSTEP Launches VarSITI Program to Explore the Origin and Consequences of a Weak Sun

FOR RELEASE January 13, 2014

Media Contact: Nat Gopalswamy (SCOSTEP President, NASA GSFC, nat.gopalswamy@nasa.gov) and Marianna Shepherd (SCOSTEP Secretary, York University, mshepher@yorku.ca)

The Scientific Committee on Solar Terrestrial Physics (SCOSTEP) is launching its new scientific program VarSITI (Variability of the Sun and Its Terrestrial Impact) on January 13, 2014. Solar-terrestrial scientists from all over the world participate in the VarSITI program to understand why the Sun is so weak these days and how it will affect Earth and its space environment. VarSITI is an international interdisciplinary research program that will run for next five years.

SCOSTEP is an Interdisciplinary body of the International Council for Science (ICSU). The ICSU motto is "strengthening international science for the benefit of society" . SCOSTEP focuses on the science of Sun-Earth connection relevant to life and society on Earth. The outcome of VarSITI will contribute to our better understanding of how life and society on Earth is affected by the Sun, e.g., solar effects on Earth's climate change. This outcome is also used for safe and reliable operation of space vehicles, such as navigation and communication satellites.

Following a highly successful program known as CAWSES (Climate and Weather of the Sun-Earth System) that just ended, the VarSITI program will focus on the declining phase of solar activity, which is already at its lowest level since the sawn of the space age.

The VarSITI program is established after a collective effort by the international scientific community over the past year. It will focus on four major themes: solar magnetism and extreme events, Earth impacting solar transients, magnetospheric changes, and consequences and processes in Earth's atmosphere. In order to make progress on these themes, four scientific projects have been defined, which are headed by international experts.

We look forward to continuing our global cooperation in solar terrestrial research using data, models, and theory developed from all over the world. In particular SCOSTEP will promote involvement of students and scientists from developing countries in the VarSITI projects.

Various working groups are being formed for a thorough scientific investigation under each VarSITI project. Anyone interested in getting involved should contact Katya Georgieva (katyageorgieva@msn.com) or Kazuo Shiokawa (shiokawa@stelab.nagoya-u.ac.jp), the two co-chairs of VarSITI.

For more information, please visit www.varsiti.org

SCOSTEP
Scientific Committee on Solar-Terrestial Physics
太陽地球系物理学・科学委員会

1966年のICSU(International Council of Scientific Unions)総会で臨時委員会として設立。1978年以降は常置委員会。太陽地球系物理学（STP: Solar-Terrestrial Physics）において、地球惑星科学の分野間にまたがる広い領域で、一定期間にわたる国際学術協力事業を提案・実施。また、国際研究集会を企画・開催し、さらに各種プロジェクトで得られるデータを、世界資料センター（WDC: World Data Center）を通じて広く研究者に発信する。

SCOSTEPに対応する国内組織＝日本学術会議・地球惑星科学委員会・国際対応分科会・SCOSTEP小委員会

第22期委員(2011-2013)：荻野龍樹（委員長）、中村卓司（幹事）、柴田一成（連携会員）、津田敏隆（連携会員）、大村善治、草野完也、坂尾太郎、塩川和夫、篠原育、高橋幸弘、寺田直樹、長妻努、廣岡俊彦、星野真弘、山本衛

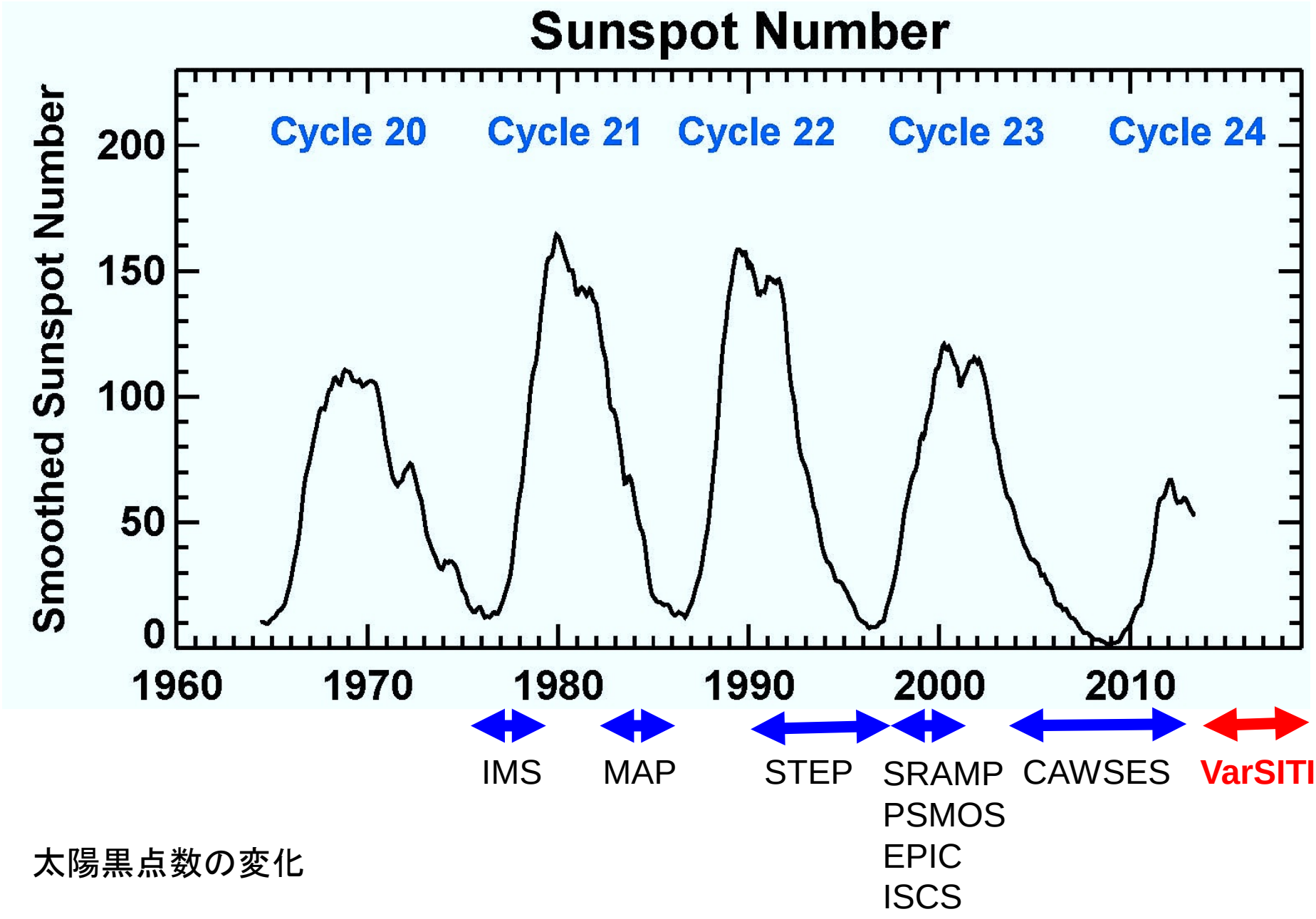
SCOSTEPが実行してきた国際協同研究プログラム

1976-1979: IMS (International Magnetosphere Study)
　　国際磁気圏観測計画
1982-1985: MAP (Middle Atmosphere Program)
　　中層大気国際協同観測計画
1990-1997: STEP (Solar-Terrestrial Energy Program)
　　太陽地球系エネルギー国際協同研究計画
1998-2002: Post-STEP（S-RAMP, PSMOS, EPIC, and ISCS)
　　STEPの成果を継承する4プロジェクト群
2004-2008: CAWSES (Climate and Weather of the Sun-Earth System）
　　太陽地球系の気候と天気
2009-2013: CAWSES-II (Climate and Weather of the Sun-Earth System-II)
　　太陽地球系の気候と天気－II
2014-2018: VarSITI (Variability of the Sun and Its Terrestrial Impact)
　　太陽活動変動とその地球への影響

Variability of the Sun and Its Terrestrial Impact

Katya Georgieva and Kazuo Shiokawa

VARSITI co-chairs



太陽黒点数の変化

VarSITIは科学観測が開始して以来、最も低い太陽活動を観測する。

VarSITIのまとめのスライド

Variability of the Sun and Its Terrestrial Impact

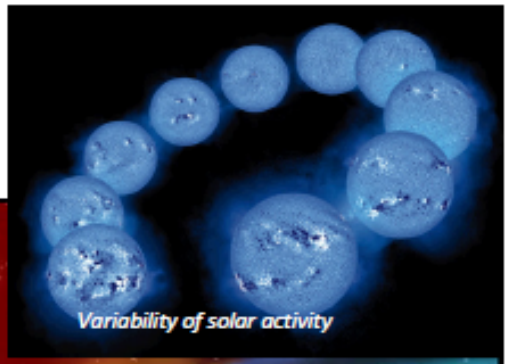
VarSITI

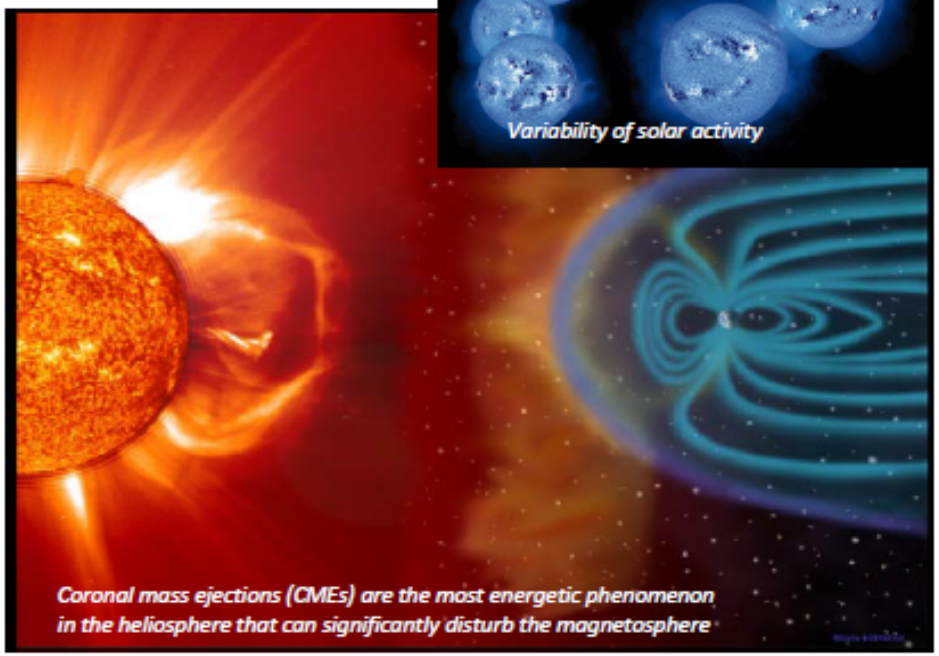
SCOSTEP is an ICSU Interdisciplinary Body tasked with the responsibility to organize long-term scientific programs in solar terrestrial physics and *Variability of the Sun and Its Terrestrial Impact (VarSITI)* is that program for the period 2014 – 2018. VarSITI was defined based on a community effort in the form of a forum organized by the International Space Science Institute (ISSI) in Bern in May 2013. The VarSITI program will strive for international collaboration in data analysis, modeling, and theory to understand how the solar variability affects Earth. The VarSITI program will have four scientific elements that address solar-terrestrial problems keeping the current low solar activity as the common thread:

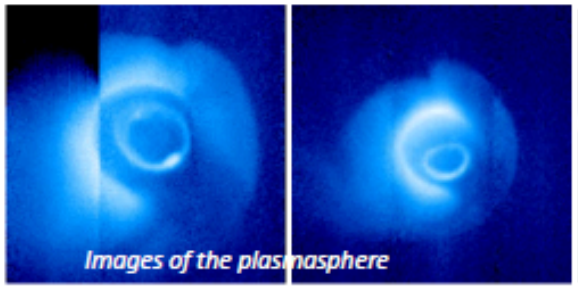
1) SEE (Solar evolution and Extrema)
2) ISEST (International Study of Earth-affecting Solar Transients/MiniMax24)
3) SPeCIMEN (Specification and Prediction of the Coupled Inner-Magnetospheric Environment), and
4) ROSMIC (Role Of the Sun and the Middle atmosphere/ thermosphere/ionosphere In Climate).

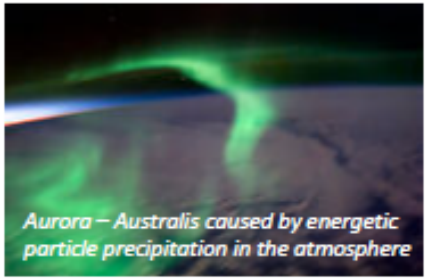
VarSITI Co-Chairs:

Prof. Katya Georgieva, Bulgaria
Prof. Kazuo Shiokawa, Japan


Variability of solar activity


Coronal mass ejections (CMEs) are the most energetic phenomenon in the heliosphere that can significantly disturb the magnetosphere


Images of the plasmasphere


Aurora – Australis caused by energetic particle precipitation in the atmosphere

VarSITIの4つのプロジェクト

- **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)**

Solar Evolution and Extrema (SEE)

Are we at the verge of a new grand minimum ?

Project Co-Leaders:

Prof. Petrus C Martens, Montana State University, USA
Prof. Dibyendu Nandi, Indian Institute of Science Education and Research, Kolkata, India
Prof. Vladimir N. Obridko, IZMIRAN, Moscow, Russia

Goals & Objectives:

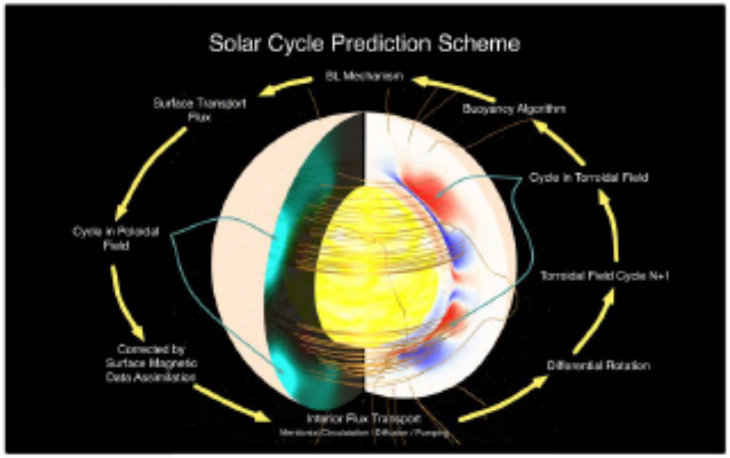
1) Reproduce magnetic activity as observed in the Sunspot record, including grand minima and extended minima in dynamo simulations,
2) Amalgamate the best current models and observations for solar spectral and wind output over the Earth's history,
3) Determine the size and expected frequency of extreme solar events.

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

Anticipated Outcome:

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



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

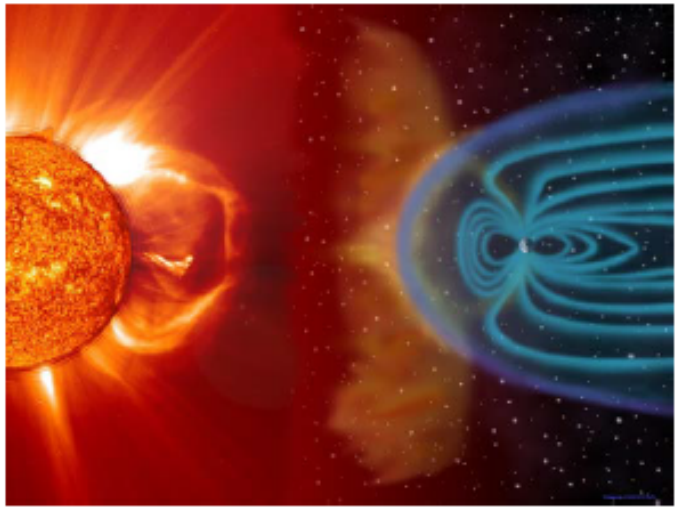
Can we predict the impact of solar transients on space weather?

Project Co-Leaders:
Prof. Jie Zhang, George Mason University, USA
Prof. Manuela Temmer, University of Graz, Austria
Dr. Nat Gopalswamy, USA

Goals & Objectives: 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.

1) Carry out campaign study to 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.
2) Use observations to Identify all Earth-affecting flares, CMEs, SEPs and CIRs during the STEREO era and their solar sources.
3) Use theoretical studies and numerical simulations to understand the structure, evolution and dynamics of CMEs and the global context of transient events.
4) Carry out campaign study to integrate theory, simulations and observations in order to get a complete view of the chain of cause-effect activities from the Sun to the Earth.

Science 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. A significant improvement of space weather prediction to forecast the arrival time and expected intensity of solar transients.

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

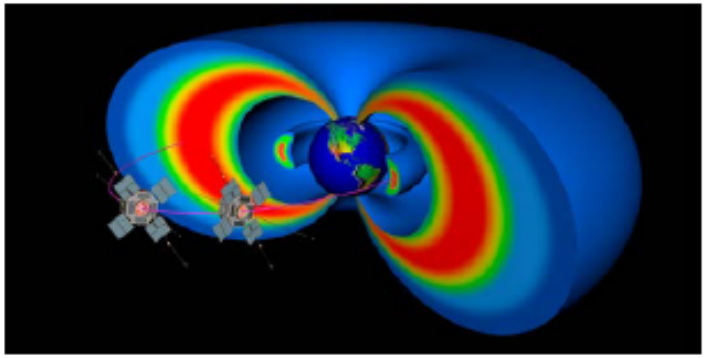
What is the physics behind radiation belt electron flux dynamics to enable the development of predictive models?

Project Co-Leaders:

Dr. Jacob Bortnik, University of California, Los Angeles USA

Prof. Craig J. Rodger, University of Otago, New Zealand

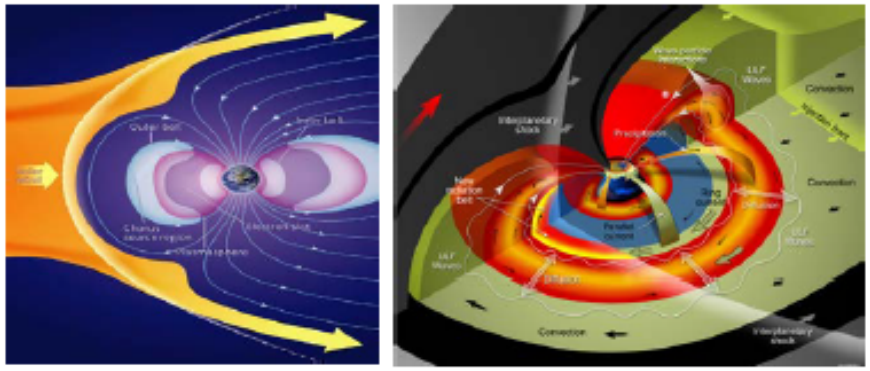
Goals & Objectives: The quantitative prediction and specification of the Earth's inner magnetospheric environment based on Sun/solar wind driving inputs.



The SPeCIMEN project is particularly timely given the recent launch of NASA's Van Allen Probes, the most recent mission to investigate the physical processes that control the dynamical behaviour of the Earth's radiation belts, eponymously named after its discovered, Prof. James Van Allen. During the 5-year VarSITI programme multiple additional satellites are expected to be launched, providing a constellation of spacecraft focused on the inner magnetosphere.

Science Questions:

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?



A schematic of the inner magnetosphere, showing the high velocity solar wind impinging upon the Earth's magnetic field (yellow, left), compressing it, and flowing around the boundary forming the magnetopause. Closer to the Earth are pictured regions of high energy electrons in two distinct zones of radiation (inner belt, outer belt, and slot region separating them), the cool, high-density plasma region known as the plasmasphere, and a region dominated by an electromagnetic wave known as chorus. The formation of the radiation belts is an active area of research which is intimately coupled with the dynamics of the solar wind, plasmasphere, and chorus region.

Anticipated Outcome: A series of coupled, related models that quantitatively predict the dynamical evolution of the inner magnetospheric state (radiation belts, ring current, cold plasma distribution, plasmasheet, convection electric field, and so on).

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

What influence does Solar Forcing have on Climate and Weather?

Project Co-Leaders:

Prof. Dr. Franz-Josef Lübken, Leibniz Institute of Atmospheric Physics, Germany

Dr. Annika Seppälä, Finnish Meteorological Institute, Finland

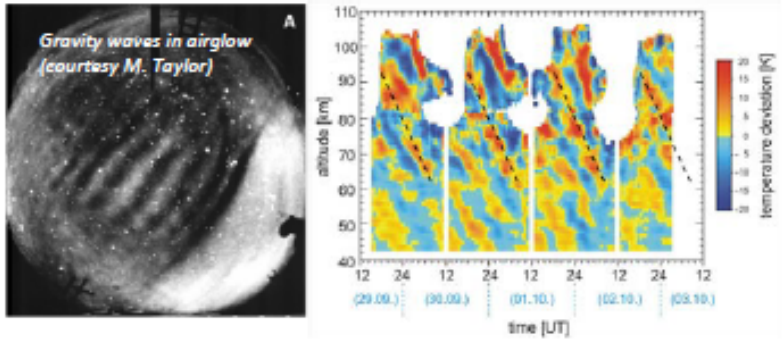
Prof. William E. Ward, University of New Brunswick, Canada

Goals & 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 anthropogenic forcing over various time scales from minutes to centuries.

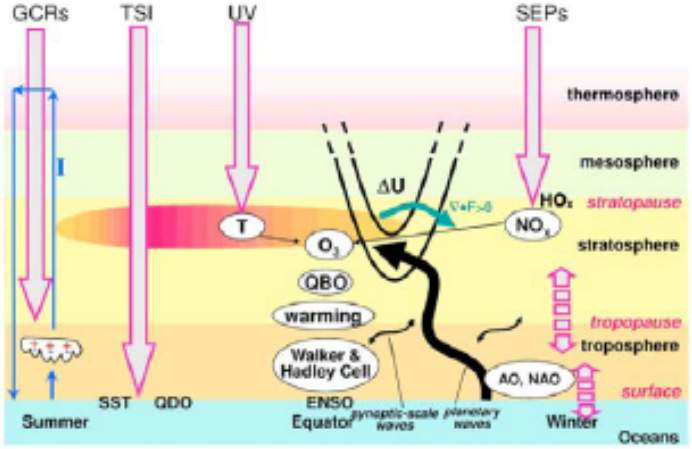
Science Questions:

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.

Anticipated Outcome: The development of a better understanding of the impact of solar activity on the entire atmosphere, relative to anthropogenic forcing and natural long term variability.



Gravity waves in temperature (Courtesy of IAP, Kühlungsborn)



Mechanisms of Solar Influence (after Gray et al, 2010).