

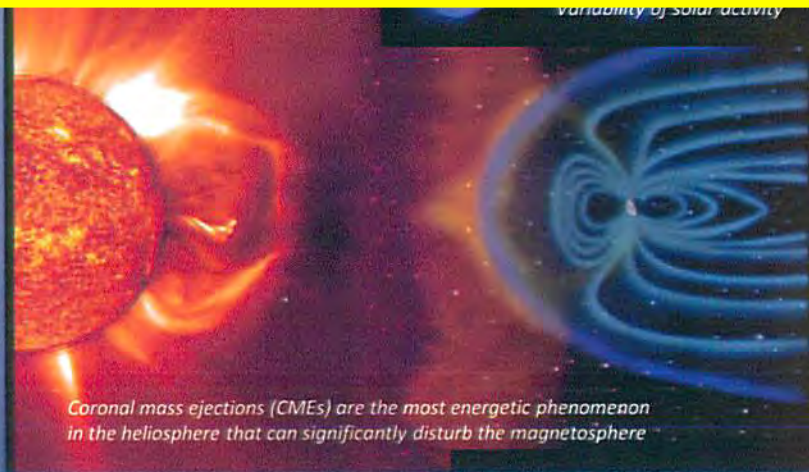
# SCOSTEP: Understanding climate and weather of the Sun-Earth System



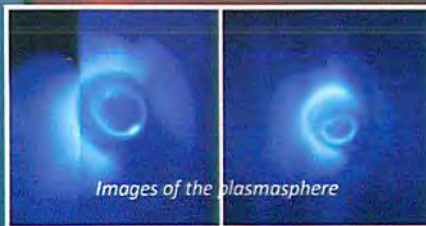
## INTRODUCTION

The Scientific Committee on Solar-Terrestrial Physics (SCOSTEP) was established in January 1966 by the International Council of Scientific Unions (ICSU) as the Inter-Union Commission on Solar-Terrestrial Physics (IUCSTP). In September 1978, with the ratification of the current Constitution by the XVII<sup>th</sup> ICSU General Assembly, SCOSTEP became a Scientific Committee of ICSU charged with the long-term responsibility of promoting international interdisciplinary programs of finite duration in solar-terrestrial physics. It aims to develop and sustain student interest in Sun-Earth connections, to promote efficient exchange of data and information between solar and terrestrial scientists in all countries, and to seek projects and programs that cross over traditional boundaries of physical regions and focused scientific disciplines. The current scientific program (2009 – 2013) is the Climate and Weather of the Sun-Earth System (CAWSES), which is described in this brochure.

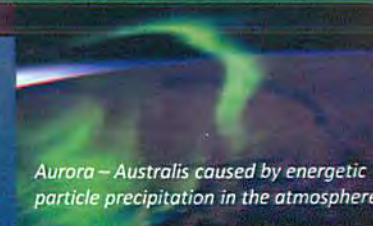
This pdf circulated in ISWI Newsletter (Vol 5, Number 37) on 25 Mar. 2013.



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



Images of the plasmasphere



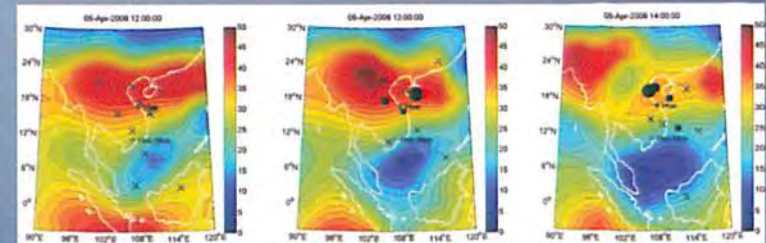
Aurora – Australis caused by energetic particle precipitation in the atmosphere

# CLIMATE AND WEATHER OF THE SUN-EARTH SYSTEM (CAWSES)

The CAWSES program endeavours to address the complex characteristics of the Sun-Earth system and its variability. The Sun, heliosphere, magnetosphere, ionosphere and atmosphere act as a system of systems. The aim is to bring together worldwide resources, including space- and ground-based instruments, data archives, and the cyber infrastructure to understand the short-term (Space Weather) and long-term (Space Climate) processes throughout the Sun-Earth system. Understanding the variability has societal implications including human activities in space, reliability of technological systems in space and on the ground, climate change and ozone depletion.

The main objectives of CAWSES are: (i) to help coordinate international activities in observations, modeling, and applications crucial to achieve the scientific understanding of the Sun-Earth system, (ii) to involve scientists in both developed and developing countries in collaborative research, and (iii) to provide educational opportunities for students of all levels and outreach activities geared to the general public. The activities CAWSES are organized around four Task Groups (TGs) that address four major scientific questions:

- TG1. What are the solar influences on the Earth's climate?
- TG2. How will geospace respond to an altered climate?
- TG3. How does short-term solar variability affect the geospace environment?
- TG4. What is the geospace response to variable inputs from the lower atmosphere?



*Total Electron Content (contour plot) and scintillation occurrence (cross: lack of scintillation; black dot: scintillation) over Vietnam on April 2006. Ionospheric scintillations monitoring and study is indispensable to forecast their occurrences and to mitigate their effects on navigation and communication systems.*

Several countries have dedicated CAWSES programs, including France, Germany, India, Russia, Japan, and Taiwan. Science results are presented at the Quadrennial Solar Terrestrial Physics (STP) symposia. The most recent one was held in Berlin in 2010 (<http://www.iap-kborn.de/SCOSTEP2010>).

Additional meetings are also held to highlight the current scientific program of SCOSTEP. For example, the 2007 CAWSES workshop in Kyoto, Japan, resulted in an excellent book, available on line: [www.terrapub.co.jp/onlineproceedings/ste/CAWSES2007/index.html](http://www.terrapub.co.jp/onlineproceedings/ste/CAWSES2007/index.html). Results from the German CAWSES Priority Program were published in 2013 in a book available on line: <http://www.springer.com/earth+sciences+and+geography/atmospheric+sciences/book/978-94-007-4347-2>

# OUTREACH

SCOSTEP has been sponsoring a series of 'Comic Books' designed to raise the awareness of the general public, and young people in particular, about issues in solar-terrestrial science. An initiative of Prof. Yosuke Kamide, Solar-Terrestrial Energy Laboratory, Nagoya University. Originally produced in Japanese, the books have been translated into English, French, German, Italian, Russian, Spanish, Hindi and Korean, with translation now ongoing into Chinese, Czech, Finnish, Hebrew, Marathi, Nigerian (Hausa, Igbo, Yoruba & Pidgin), Swedish, Thai and Tamil. Blank drawings are available to translate the books into other languages.



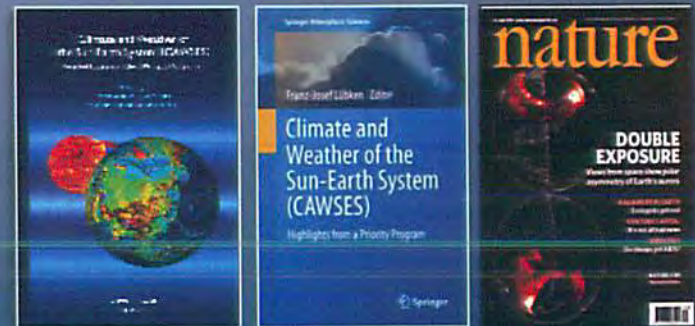
Front covers of several comic books published by SCOSTEP/CAWSES

During the Space Festival 2012 in Coimbatore, India (Jul 9 – 14, 2012) organized by the Bharathiar University, SCOSTEP Comic Books translated into Tamil, a classical language from Southern India, were released by the former President of India, Dr. APJ Abdul Kalam.



The release of the COMIC Books in Tamil at the Space Festival 2012 in Coimbatore, India (Jul 9-14, 2012). The former president of India, Dr. APJ Abdul Kalam (inset)

Ten thousand copies were printed and distributed to the students. The Space Festival had several outreach activities organized by the SCOSTEP President, Nat Gopalswamy, Joseph Davila (CAWSES co-chair), S. Gurubaran (CAWSES TG4 co-chair), and P. K. Manoharan (CAWSES – India). The Festival was attended by more than 100,000 students (elementary school to high school) and general public.



CAWSES I-2007 book; German CAWSES Priority Program; Conjugate imaging of aurora in both hemispheres and inter-hemispheric currents (Lundal and Østgaard, Nature, 2009)

## CAPACITY BUILDING

SCOSTEP/CAWSES cosponsors space science schools run by the International Space Weather Initiative (ISWI). The 2010 Summer School, was held from 28 October to 4 November 2010, in Bahir Dar, Ethiopia and was hosted by Bahir Dar University, Ethiopia and Boston College. Young scientists from the following African countries participated in the Summer School: Algeria, Cameroon, D. R. Congo, Ethiopia, Ivory Cost, Kenya, Madagascar, Malawi, Nigeria, Rwanda, South Africa, Sudan, Tanzania, Uganda, and Zambia.



The school was co-sponsored by NASA, USA, the European Office of Aerospace Research and Development (EOARD), UK; SCOSTEP/CAWSES, the International Center for Theoretical Physics (ICTP), Italy; Bahir Dar University, Ethiopia; Boston College, USA; Air Force Research Laboratory (AFRL), USA; University of Michigan, USA; Kyushu University, Japan; University of Calgary, Canada; Massachusetts Institute of Technology (MIT), USA; German Aerospace Center, Germany.

SCOSTEP/CAWSES also cosponsored the 2011 ISWI School in Slovakia (Aug 2011), the 2012 Conference of *Balkans, Black Sea and Caspian Sea Regional Network on Space Weather Studies*, Romania (Oct 2012) and the Chapman Conference on longitudinal and hemispheric dependence of space weather, Nov 2012, Addis Ababa, Ethiopia



*Africa Hall at the United Nations Economic Commission for Africa (UNECA), the venue of the Chapman Conference in Addis Ababa, Oct 2012.*

SCOSTEP has also become a major partner in running the Space Science Schools organized by the International Space Weather Initiative, thanks to a grant from SCOSTEP's parent body, the International Council for Science (ICSU). The most recent school was hosted by the National Space Agency of Indonesia (LAPAN) in Ciloto, during Sep 17-26, 2012. The school was co-sponsored by the MAGDAS group of Kyushu University, Kyoto University, IPS Australia, KASI (Korea), and Alcala University, Spain. In addition a one-day teacher workshop run by scientists from Stanford Solar Center, Stanford University with SCOSTEP support, and an ISWI instrument workshop, featuring low-cost instruments such as MAGDAS (Kyushu University), CALLISTO (ETH Zentrum, Switzerland), and GPS receivers (École Polytechnique, Paris, France) took place.



*International School on Atmosphere - Ionosphere Radars and Radio Sounding: Science and Applications, Nov 15-24, 2010, Taiwan*



*Japan-Peru: FMT Summer School and Data Analysis Workshop held Jul 20-27, 2011 at Hida Observatory, Kyoto University in Japan, and on Jul 28-31, 2011 at National Astronomical Observatory of Japan*



*The participants in the Science Teacher Workshop on Sep 24, 2012, Bandung, Indonesia*

