



# Implementation Plan

From GWSWF (SCAR Action Group) to  
GBA(SCAR Expert Group)

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## **Strategic Plan 2011-2016**

### **Antarctic Science and Policy Advice in a Changing World**

[http://www.scar.org/strategicplan2011/SCAR\\_Strat\\_Plan\\_2011-16.pdf](http://www.scar.org/strategicplan2011/SCAR_Strat_Plan_2011-16.pdf)



# Preface

..... Antarctica and the Southern Ocean are a natural laboratory where global forces play out in ways not experienced or observable elsewhere on the planet. **Antarctica also serves as a unique vantage point to look outwards from our planet to observe near-Earth space, our solar system and beyond.** In a time of economic stress, it is important that resources be utilized to optimum affect, that investments in science in Antarctica be justified, and that the community develops and shares a collective vision of future scientific directions.....

**Mahlon “Chuck” Kennicutt II,  
President of SCAR 2008-2012**

**And later on:**

**The Poles as a Vantage Point - Near-Earth** space is an integral part of the Earth system, providing the **link between the Sun and Earth primarily through the Polar Regions and posing a potential hazard to spaceborne and ground based technology** on which society is increasingly dependent.

# Summary of SCAR'S Strategic Plan 2011-2016

- ... The Antarctic region is a “natural laboratory” for scientific research of importance in its own right and impossible to achieve elsewhere on the planet...
- SCAR will accomplish its vision and mission by:
  - - encouraging excellence in Antarctic and Southern Ocean research by developing transformational scientific programmes that address issues of regional and global importance;
  - ...-motivating **cooperation with Arctic** counterparts (e.g., International Arctic Science Committee);
  - ...-facilitating **unrestricted access to** Antarctic scientific data as a portal to repositories;
  - .... SCAR encourages **multi-disciplinary cooperation** and aims to increase the involvement of the wider scientific community in SCAR's initiatives.
  - SCAR organizes its core scientific activities as Life sciences, Geosciences and Physical sciences. Scientific frontiers often lie at the **interfaces between disciplines**, requiring interdisciplinary approaches to advance knowledge.
  - The Antarctic continent is **also a unique place** for astronomical and **solar-terrestrial observations of phenomena such as interactions between the Sun and the Earth.**



# Examples of SCAR Partners in 2010 (from Strategic Plan)

## **SCOSTEP**

Scientific Committee on Solar  
Terrestrial Physics



<http://www.yorku.ca/scostep/>

<http://www.scostep.ucar.edu/index.html>

# Why Now?

The past decade has seen the creation of a remarkable new capability to observe conditions simultaneously in regions from Sun-to-Earth using combinations of **worldwide space and ground-based observing platforms**. Simultaneously, new models of the solar dynamo that enable physics-based predictions of solar magnetic variability, suites of cutting-edge Sun-to-Earth coupled models, and **"whole atmosphere" models that simulate tropospheric climate** with linkages all the way to the upper atmosphere and space weather have become available along with the necessary advances in computer hardware and software. Open data policies and a developing system of virtual observatories are making diverse data sets widely available to the research community. The availability of data by itself, however, is not enough.

SCOSTEP CAWSES II program

<http://www.cawses.org/CAWSES/Home.html>

# SCOSTEP

The new quinquennial (2009-2013) scientific program of SCOSTEP: CAWSES II

CAWSES is an international program sponsored by SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) and has been established with the aim of significantly **enhancing our understanding of the space environment and its impacts on life and society**. The main functions of CAWSES are to help coordinate international activities in observations, modeling and theory crucial to achieving this understanding, to involve scientists in both developed and developing countries, and to provide educational opportunities for students at all levels.

*CAWSES-II: Towards Solar Maximum provides an opportunity for the community to study the entire rising phase of solar cycle 24* and for making comparisons with the previous and ongoing work in CAWSES during the declining phase of the solar cycle. A systems approach will be used to make progress on questions that require interdisciplinary research and international collaboration. In order to establish this systems approach, we are proposing to develop an International Virtual Institute that will provide the sustainable enabling infrastructure.

Four scientific questions will form the basis for CAWSESII:

- (1) What are the solar influences on Earth's climate?
- (2) How will geospace respond to an altered climate?
- (3) How does short-term solar variability affect the geospace environment?
- and (4) What is the geospace response to variable waves from the lower atmosphere?

# ***CAWSES Committee Members*** ***(March 2008) (1)***

**Susan Avery, Chair, D. Pallamraju, Scientific Coordinator, D. Ellsworth, Program Administrator**

## **Theme 1: Solar Influence on Climate**

M. Lockwood-Co-Chair UK

L. Gray-Co-Chair UK

## **Theme 2: Space Weather: Science and Applications**

J. Kozyra - Co-Chair, US

K. Shibata - Co-Chair, JP

## **Theme 3: Atmospheric Coupling Processes**

F-J. Luebken- Co-Chair DE

J. Alexander- Co-Chair USA

## **Theme 4: Space Climatology:**

C. Fröhlich - Co-Chair, CH

J. Sojka - Co-Chair, USA



# ***CAWSES Committee Members (March 2008) (2)***

## **THEME 2: SPACE WEATHER: SCIENCE AND APPLICATIONS**

- WG 2.1 Enhanced Resolution GPS TEC Maps: A. Coster (Leader), **C. N. Mitchell**, ...
- WG 2.2 CAWSES/IAGA/GEM Magnetospheric Observations: I. Mann (Leader)
- WG 2.3 Solar Sources of Geoeffective Disturbances: N. Gopalswamy (Leader)
- WG 2.4 Continuous H $\alpha$  Imaging Network (CHAIN) H. Kurokawa, (Leader)
- WG 2.5 Space Weather Applications
- WG 2.6 Models, Simulations and Data Assimilation S. T. Wu (Leader)
- WG 2.7 Coordinated Data Analysis

# ICESTAR

## Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research

- ✓ The ICESTAR programme will deal with various geophysical and **upper atmospheric phenomena** developing either simultaneously over both the **Northern and Southern polar regions** (i.e., controlled by external forces and producing bi-polar effects) or connected through the interhemispheric geomagnetically-conjugate coupling.
- ✓ The uniqueness of this programme was that it will focus for the first time on identification and specification (quantification) of various mechanisms that control **bi-polar regional differences or commonalities in the magnetosphere-ionosphere coupling** and the corresponding upper atmospheric phenomena over both polar regions.
- ✓ These bi-polar (or interhemispherically conjugate features) might be intrinsic to the polar ionosphere and upper atmosphere or be caused by long-term or abrupt changes in the near-Earth electromagnetic environment forced by the solar activity.
- ✓ The programme outcome will be the better understanding of concerted responses of both polar regions to electromagnetic variations and plasma dynamics in interplanetary space that specify **near-Earth space climate and weather**.
- ✓ It is suggested that SCAR should lead this new programme in collaboration with the International Arctic Science Committee.

# ICESTAR

## Scientific Research Project, endorsed and funded by SCAR 2005 – 2009

Co-Chair: Allan Weatherwax, Siena College (USA)

Co-Chair: Kirsti Kauristie, Finnish Meteorological Institute (Finland)

Here follow some points extracted from the first year report of the project:

The Emergence of **New Datasets**. It is the right time to begin to create tools to examine the entire system as a whole.

Enable **Easy Access to Distributed Data**. Many research groups are creating data assimilation tools that require the use of as many data sources as possible.

Uniqueness of Antarctica. The Antarctic continent offers a unique vantage point for examining the near-Earth space environment, spanning from the top of the troposphere, through the stratosphere, mesosphere, thermosphere, and ionosphere, and into the magnetosphere.

Underscore some of the **similarities and differences between the Arctic and Antarctic**.

Focused Science. The ICESTAR programme will enable focused upper atmosphere scientific research from Antarctica.

International Cooperation: Studies of the polar upper atmosphere fundamentally **require international collaboration**.

***The SRP ended on August 2010.***

# BipAG II

## Joint IASC/SCAR Bipolar Action Group on Science Cooperation

To assist IASC and SCAR in thinking about how they might work yet more closely together in future, and how they might best contribute to the International Polar Year and its legacy, a Joint Bipolar Action Group (BipAG) was formed in early 2008. This joint Action Group provided very useful advice to the SCAR and IASC Executive Committees and helped to initiate a number of **joint bipolar activities**.

SCAR and IASC have now agreed to perpetuate this joint advisory group for another two years and to establish **BipAG II, the joint Bipolar Action Group on Science Cooperation, with the term of reference to advise the SCAR and IASC Executive Committees on the development of instruments such as workshops, programmes and networks to address bipolar issues**. IPY Legacy issues are now considered at the level of joint meetings of the SCAR and IASC Executive Committees.

Membership	Country of Residence / Area of Expertise	
Cynan Ellis-Evans - Chair	UK	Biology
Francisco Navarro	Spain	Ice sheets
Detlef Damaske	Germany	Geology
Sung-Ho Kang	Korea	Marine
Alexander Klepikov	Russia	Oceanography / Climate
Thamban Meloth	India	Ice cores
Gail A. Fondahl	Canada	Social Sciences
Mark Parsons	USA	Data
Jenny Baeseman	Norway	APECS
Volker Rachold (ex officio)	Germany	IASC Executive Secretary
Mike Sparrow (ex officio)	UK	SCAR Executive Director

GBA

**GNSS based studies of the Bipolar Atmosphere**

## BACKGROUND

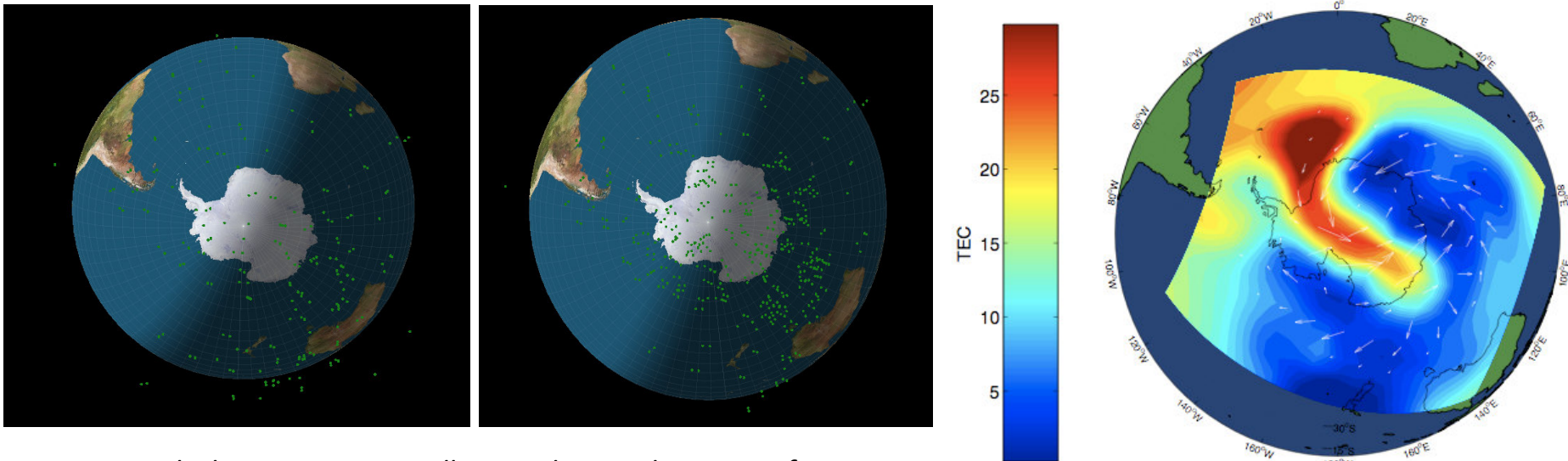
Following the evolution of the solar cycle from the current minimum to the upcoming maximum and back in the next decade will offer further more advanced opportunity to investigate the influence of solar activity on the ever increasing complexity of human society. **Never in the past have technological arrays and utility networks been so widely dispersed and intensively operated as at present.** The effects of solar terrestrial interactions on systems and arrays are going to be most intense and disturbances most felt by the general public in the current cycle of solar activity.

**The higher exposure to solar perturbations of such technology in the polar regions is going to allow more extended investigations,** both in variety of nature and extent in position. One particular technological system has largely grown over the recent years, and its sophistication is going to allow more extended studies of solar terrestrial effects in the field of ionospheric dynamics: Global Navigation Satellite Systems (GNSS).

Joining the evolving GNSS (Galileo, GPS, GLONAS) array to the more extended classical Global Positioning System (GPS) coverage in the polar regions, and in particular in Antarctica, it will be possible to assess the **evolution of solar disturbances to the Earth ionosphere, to a never attained precision and extent,** through the next solar maximum, expected for 2013, and through the decline of the cycle up to 2021.

GWSWF Action Group took advantage of the ICESTAR and POLENET experiences that, in the IHY and IPY frames, gathered several teams dealing with GNSS monitoring.

From the GWSWF experience we have envisaged the possibility to create working groups on specific themes, as, for instance, the case of using geodetic data to study space weather events.



*Ray paths between GPS satellites and ground receivers from existing sites only (left) and from current and planned POLENET sites (right) (Courtesy Un. Of Bath).*

Total Electron content 11-Feb-2004 15:40:00UT

*(Yin et al., JASTP, 2008)*

The strength of GWSWF stands in its **multidisciplinary** meant as the key to overcome relevant difficulties, first of all, the poor coverage of Antarctica. GBA intends to continue on this route, intensifying the efforts to build a robust net of collaborations.

## **SCOPE**

GBA Expert Group aims to use the existing GPS POLENET array and the growing coverage of modern GNSS systems, relying on the availability of advanced modelling and on the opportunity offered by the advancing solar cycle, to answer a variety of space weather/weather related needs.

The present program naturally **falls within the realm of “space weather studies”, and builds up on the results of the ICESTAR SRP, which just concluded its work.**

## **OBJECTIVE**

GPS was originally deployed in the Antarctic field to monitor geodetic stability; the more advanced GNSS systems, through their dual frequency capability, allow continuous monitoring of the ionospheric characteristics and dynamics, and they are at this time attaining the spatial coverage that will allow real monitoring of ionospheric modifications, even in the 3D perspective, through tomography. Water vapor content in the column joining the receiver and the satellite can be monitored also; this makes the present program natural contributor to studies of climate and tropospheric weather as well, also in the framework of SCAR programs like AGCS, and the others connected with climate studies.

- Specification and prediction of the state of the Solar-Terrestrial system involving the assimilation and integration of data from various sources (different instruments, sampling at various locations, operation by different people and organizations).***
- Understanding the complex geospace environment to describe many of its component parts.***
- Work on case by case basis to investigate deeper how extraordinary space events can result on the ground-based systems.***

## **INVOLVED COUNTRIES (Current status)**

Argentina, Australia, Brazil, Canada, China, Finland, Germany, Italy, Poland, Slovenia (not yet SCAR member), South Africa, UK, USA, ...



## STRUCTURE OF THE PROPOSED EXPERT GROUP

**Tacking into account the main objective and the multi-instruments approach, the proposed expert group can be structured as follows (*chairs, co-chairs TBD*):**

- Solar-Terrestrial interactions and ionospheric effects in the current solar-cycle
- Multi-instruments investigation of the upper atmosphere plasma dynamics and generation(SuperDarn, GNSS, ionosondes, VLF, etc..)
- Scintillation climatology, TEC fluctuation, scale structures, C/N statistics, etc...
- Lower atmosphere delay on GNSS based systems (water vapor reconstruction etc...)
- Modelling and models testing
- Data management
- Coordination with other programs inside and outside SCAR (e.g. URSI, CAWSES II, SuperDarn, EISCAT 3D,...)

## PROPOSED DELIVERABLES (Coordination TBD)

- GNSS data format definition for atmospheric studies (Upper atmosphere and lower atmosphere)

- Maps of ionospheric scintillation over Arctic and Antarctic as function of IMF, Solar activity, season, MLT, etc...

- Maps and vertical profiles of water vapour content

- Website development, data sharing, outreach and dissemination of the results

Home - Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti Aiuto

http://www.gswsf.scar.org/

Più visitati Come iniziare Huse Rey Juan Carlos... Ultime notizie

### GPS for Weather and Space Weather Forecast (GWSWF)

HOME PARTICIPANTS INFRASTRUCTURES CONFERENCES RESOURCES DATA JOIN US!

GPS for Weather and Space Weather Forecast (GWSWF) is an Action Group endorsed by SCAR. It is a joint SSG-GeoScience and SSG-Physical Sciences Action Group.

#### PROPOSED SCIENCE PLAN - Introduction

The high latitudes ionosphere contains the footprints of processes that have their origin in the interplanetary space. Many different techniques are now available for probing the ionosphere, from radar measurements to the analysis of radio cosmic noise. Among them the use of GNSS high rate (50 Hz) measurements allows to image the 3D plus time evolution of the ionospheric plasma over restricted regions. Mathematical techniques combined with experimental observations provide the ability to study the ionosphere from high in the F-region to the bottom of the D-layer. The coupling processes from the magnetosphere and to the neutral lower atmosphere can be considered. At high latitudes, perturbations due to solar events have a high occurrence rate even during the solar minimum. These spatially distributed perturbations that propagate towards middle latitudes with variable time delays can seriously degrade technological systems useful for human life.

#### Scientific Content

Because of the lack in GNSS high-rate sampling receiver coverage over polar regions, particularly in Antarctica, the **Action Group** will contribute to answering questions that are still open within the Sun-Earth interactions studies. Some of the current issues in scientific international debate of particular interest are:

1. characterization of the cause-effect mechanisms driving the formation and evolution of ionospheric irregularities;
2. distribution and evolution of precipitable water vapour in polar regions which play a key role in the characterization and evolution of global earth phenomena.

#### Proposed Scientific Objectives

1. Encourage the establishment of a permanent network of GNSS receivers for a multi-purposes investigation over Arctic and Antarctica.
2. Stimulate international collaboration addressed to bi-polar investigations particularly at conjugate regions.

#### Cross Cutting Issues

The POLENET (SCAR-Geosciences Standing Group) and ICESTAR – UAMPY(Upper Atmosphere Monitoring for Polar Year, SCAR-Physical Sciences Standing Group) communities are cooperating to achieve the following:

1. Ionospheric imaging over Antarctica.
2. Exchange of data and expertise for the application of tomography to other fields of interest for both communities (e.g. 3D water vapour reconstruction).
3. Exchange of technologies to install and manage remote GPS stations.
4. Possibility to host instruments in the polar stations represented by the two communities.

NEWS: Second GWSWF meeting 11 - 12 April 2011, Modena, Italy

Site maintained by Silvia Pau (silvia.pau@ingv.it)

And now... let's start the brainstorming!



Backup slides

# ***CAWSES Committee Members (March 2008) (1)***

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## **Theme 1: Solar Influence on Climate**

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## **WG 1.1 Assessment of Evidence for the Solar Influence on Climate**

Leader : J. Beer, [beer@eawag.ch](mailto:beer@eawag.ch)

## **WG 1.2 Investigation of the Mechanisms for the Solar Influence on Climate:**

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