

## **Geosciences Standing Scientific Group Business meeting**

### **Report to SCAR executive and SCAR National Delegates**

#### **St.Petersburg– July 2008**

The Geoscience Standing Scientific Group of SCAR covers activities that range over geological, geophysical and geodetical scientific research.

The report of the activities carried out in 2007 and 2008 by the SCAR Standing Scientific Group on GeoScience (SSG-GS) is include in the SCAR Annual Report (IP 01) document and is added as appendix 1.

A report of the GSS-GS business meeting held in St.Petersburg , 5-7 July 2008 is presented here for the SCAR Delegates meeting in Moscow, 14-16 July 08.

Expanded reports of the work of various SSG-GS sub-groups will be available on the SCAR web site (<http://www.geoscienc.scar.org>) and will be published in the GeoReach E-newsletter. The web site also will contain national and other reports on science produced by the SSG-GS.

#### **Intersessional Activities of the SSG-GS CO**

**Communications with SCAR Executive.** The Chief Officer attended intersessional executive committee meetings in Washington D.C, USA, in July 2007 and in St Petersburg (July 2008).

**SCAR Fellowships:** The Chief Officer read and ranked the applications for these fellowships, which were generally very good, and made recommendations to the Executive who made the final decision.

**JCADM Review:** The Chief Officer assisted in the review of JCADM, as part of a working group including other SSG COs.

#### **SSG-GS Business Meeting Report**

The SCAR GeoScience SSG and associated groups met from the 5<sup>th</sup> to 7<sup>th</sup> July at SCAR XXX, following the agenda presented in Appendix 2.

In addition to the plenary meetings of the SSG-GS, Action and Expert Groups, also met separately. The SSG-GS agenda was planned to ensure minimal parallel sessions overlapped with the SSG-GS plenary, to enable full attendance of national representatives at the SSG-GS Plenary.

The SCAR Science Symposium succeeded in attracting a large group of interested scientists to parts of its programme and facilitated much cross-disciplinary communication.

The SSG-GS Secretary has an almost complete list of National Representatives to the Geoscience SSG. It is proposed to maintain this list and to integrate it with the SCAR Excom list. It is essential to compile a complete data-base of all relevant information on SCAR Geoscience representatives of Antarctic National Programmes.

A decision regarding the SSG-GS has been approved to require SCAR National Representatives in the GeoSciences to send a National Report on their country's activities in Antarctica during the inter-sessional period to the SSG-GS COs two months prior to the next SCAR Meeting. The COs will distribute all reports to each National Representative and make them available on the SCAR website for easy download. During future SSG-GS Business Meetings a short time (approximately 5 minutes) will be planned for explanations of National Reports, if required.

The SSG-GS members appreciated the importance of enhancing communications through the GeoReach electronic newspaper and they agree to continue to support (with 2 000 \$ per year) the publication of GeoReach three times per year. It will be done in parallel with highlighting GeoScience publications on the SCAR web site.

National Reports were given by China, Japan, Finland, Germany and New Zealand.

The 4-yearly SCAR ISAES Meeting, held in Santa Barbara, August 2007, was a resounding success and the Proceedings volume has already been published on line and in hard copy. There is a \$24k carry-forward from that meeting which will be retained until the next meeting of this group. We are looking to the official candidature of next ISAES-11, which must be held in 2011 or soon thereafter. Possibilities of hosting the meeting at the moment include Edinburgh (Scotland) and Cape Town (South Africa).

Office Bearers for 2006-08 were Prof. A. Capra – CO, Prof. R. Powell - DCO and Prof. B. Storey - Secretary; their 4-year term ended at this St. Petersburg meeting. Election of new officers followed the group's rules and results are listed below.

### **Office Bearers 2008-2010**

**Chief Officer: Prof Alessandro Capra** - Department DIMeC - University of Modena and Reggio Emilia , ITALY.

**Deputy Chief Officer: Dr. Phil OBrien** Geological Service -Australia

**Secretary: Dr. Mike Hambrey** – University of Wales, United Kingdom.

### **SSG-G Business Meeting Presentations**

In addition to AG and EG reports, the following presentations were made:

SCAR Executive Officer, Mike Sparrow made a presentation on the developments within SCAR.

More presentations were contributed from the following different research projects and research groups:

David Carlson presented an update of IPY,  
Helen Campbell presented an update of JCADM,  
SCA-GI was reported by Henk Brolsma and a recommendation has been proposed (see below).

Martin Siebert presented an update on SALE and ACE .

ANDRILL report was presented by Frank Rack.

SDSL updates were presented by Alan Cooper.

LIMA project were described by Adrian Fox.

A proposal for a new AG on Cold Seeps and Hydrothermal Vents in Antarctica was made by Phil O'Brien (see new AG proposal).

A proposal for a new inter-SSG AG on "GPS weather and space forecasting" has been presented by Pierguido Sarti (see new AG proposal).

The proposal for the POLENET PPLG was presented by Terry Wilson (see attached recommendation).

Following are short reports made by some of those speakers:

#### **SCAR Progress and Plan-** (Dr. Mike Sparrow)

Dr Mike Sparrow, the new Executive Officer, gave a talk about SCAR Progress and Plans on behalf of the Executive Director, and its précis follows.

SCAR membership continues to grow. There have been applications from Romania and the International Astronomical Union to join SCAR as well as for Malaysia to become a full member. SCAR has also been registered as a UK company and charity, which will help us financially but does not affect our status as an international organization.

A 50<sup>th</sup> anniversary book is being produced that looks at SCAR's contributions over the past 50 years and we are in the process of completing the Antarctic Climate Change and Environment review (ACCE). This will be published as a book early in 2009, and will be a significant contribution to the IPY.

Our 5 major scientific research programmes have just had their 4-yearly external peer review - all received *excellent* ratings. We have also been reviewing the way in which we manage Antarctic scientific data and information, and this has led to the development of a draft strategy on that subject. We need the SSGs to advise the ATS, through SC-ATS, where the frontiers of science are going to be in the near future, and the implications of change for the environment.

With some 1400 registrants, this has been the largest Open Science Conference so far. One possible new development for the future is that we may hire someone to manage conference registration in-house, to cut registration fees. The next OSC will be in BA in the southern winter of 2010. That same year SCAR is also co-sponsoring the 2nd IPY conference, which will be held on June 8-12, 2010, in Oslo.

SCAR science is at the forefront of many IPY projects and we are now actively thinking about the IPY legacy through, for example, observing systems (e.g. SOOS and PAntOS) and the data and information management strategy. IPY is also about education and outreach and our main contribution is through the Fellowship programme – we continue to be able to support 3-4 research fellows per year. We are also co-sponsoring, with IASC, the Association of Polar early Career Scientists (APECS).

There will be three SCAR medals this year: We need your suggestions for medallists for 2010. We continue to build partnerships with other organisations, e.g. the World Climate Research Programme, the International Arctic Science Committee, and the newly formed International Association for Cryospheric Sciences.

This is SCAR's 50<sup>th</sup> anniversary year and has been both busy and productive, thanks largely to the work of the SCAR science groups.

#### **JCADM** (Helen Campbell)

The JCADM representatives gave a brief introduction to JCADM, suggested ideas for collaboration with the SSGs and SRPs and gave an overview of the draft SCAR Data and Information Strategy.

The meeting concluded that professional data management is an intrinsic part of good science, that JCADM and SSGs should work together on creating data discovery portals for the SRPs and should use the SCAR Data and Information Strategy whenever building new data systems. The JCADM representatives solicited feedback from the SSG on the development of the SCAR Data and Information Strategy.

#### **Landsat Image Mosaic of Antarctica (LIMA)** presented by Adrian Fox, British Antarctic Survey.

LIMA is the first seamless mosaic of Landsat ETM+ images covering the whole continent north of the 82°30'S orbital limit. It is freely available for download, to support science, mapping and logistics and be a baseline for change monitoring, through a website interface at <http://lima.usgs.gov>. The mosaic is based on careful selection and mosaicking of nearly 1100 scenes to minimise cloud cover and the date range of the scenes.

The LIMA project was a joint USGS, NASA and BAS project funded by the US National Science Foundation for IPY. The project is complete and the mosaic products were launched in November 2007. Products include a panchromatic mosaic at 15 m resolution, colour mosaics of bands 3,2,1 and 4,3,2 sharpened to 15 m resolution, and mosaics with different degrees of contrast stretch to highlight glaciological features. In addition all bands of all the original scenes can be freely downloaded.

A separate NASA website developed delivers education and public outreach materials linked to LIMA <http://lima.nasa.gov>.

#### **SCAR SC-AGI presented By Henk Brolsma**

The chair of SC-AGI addressed the SSG-GS to advise them that the standing resolution was being revised to consider the distribution of digital maps but also to remind the geosciences group that:

- ) they need to continue to distribute geological maps as they had done in the past
- ) that all geological maps had been added to the SCAR map catalogue
- ) that maps can be added on line

-) that SC-AGI would send the chair of SSG-GS a distribution list of institutions maps should be sent to.

## **AG and EG business meeting Report**

The meeting made a number of changes in its activities. Two Action Groups are proposed and included in our recommendations.

One EG, ANTEC, was terminated. However, POLENET, proposed as a PPG, will continue to pursue a scientific scope close to that of ANTEC (see recommendations). One AG, SIGE is recommended to continue as an EG. Other EGs were approved for continuation for another 2 years. Each AGs, EG within SSG-GS is listed below.

### **SSG-GS structure 2008-10**

#### **Action Group**

Cold Seeps and Hydrothermal vents in the Antarctic (new proposal)  
GPS weather and space forecast (new proposal)

#### **Expert Group**

SIeGE	Chair: R.Powell (NZel)
GIANT	Chair : G.Johnstone (Aus) co-chair M.Poutanen (Fin)
PERMAFROST - EGGPE	Chair: J. Bockheim (USA)
IBCSO	Chair: H.W.Shenke(GER)
ADMAP	Chair :M.Ghidela (Arg)

**Action Group SIGE (Chair: Bryan Storey- NZel) – below proposed as an EG SIeGE ( Chair: R.Powell, USA)**

#### **SIeGE aims to:**

- Understand the geology and basal ice sheet processes beneath the Antarctic ice sheets.
- Coordinate and develop multinational capabilities in geophysics and drilling to address broad geoscience problems.
- Ensure maximum multidisciplinary science benefit comes from drilling and geophysical exploration.

The SCAR Action Group **SIeGE** held its first meeting at in St Petersburg on Sunday 6<sup>th</sup> July. Brief presentations outlining the capabilities, organizational structure and future plans were given for the following groups:

ANDRILL, Frank Rack

IODP, Laura de Santis

FASTDRILL, Ross Powell

SALE, Martin Siebert

ICECAP, Duncan Young

AGAP, Fausto Ferraccioli

Gamburtsev drilling, Xiaohan Liu

The group supported the concept of developing a coordinated drilling programme including geophysical exploration techniques to understand the geology and basal ice

sheet processes beneath the Antarctic ice sheets. The group endorsed a multidisciplinary approach that combined with ice core drilling and biological investigations of the ice and sub ice environment. As a first step towards an Integrated Antarctic Drilling Programme the group will produce a white paper documenting science objectives, current drilling capabilities, current and future projects, planned technology developments, and future challenges.

**Expert Group GIANT (Geodetic infrastructure of Antarctica)**  
( Chair – G.Jhonstone, AUS- Co-chair- M.Poutanen,FIN)

GIANT part for GSSG report 2008: The Expert Group on Geodetic Infrastructure of Antarctica (GIANT) provides a common geodetic reference system for all Antarctic scientists and operators. It also contributes to global geodesy for studying the physical processes of the earth and the maintenance of the precise terrestrial reference frame, and provides information for monitoring the horizontal and vertical motion of Antarctica. Together with SCAR's Antarctic Neotectonics (ANTEC) Expert Group, GIANT is strongly involved in the bipolar IPY POLENET (Polar Earth Observing Network) project, to which GIANT will contribute the Antarctic GPS component. A POLENET workshop was organized in the frame of the 10th ISAES in Santa Barbara/USA in August 2007. Good progress has also been made in the field of physical geodesy (gravity data for an improved Antarctic geoid) and tide gauge operation.

**Expert Group on Antarctic Permafrost and Periglacial**  
( Chair: J.Bockheim-USA)

Researchers of EGPPE were unavailable to attend SSG-G business meeting and XXX SCAR IASC/OSC, because the Ninth International Conference on Permafrost in Fairbanks, Alaska was planned contemporary to XXX SCAR. Detailed report of SSG-G is on Appendix 1.

**Expert Group IBCSO (International Bathymetric Chart of the Southern Ocean) ( Chair: H.W. Shenke- GER)**

The 2nd Business Meeting of IBCSO took place on 6th July 2008 in St. Petersburg and was attended by 15 representatives from 10 nations. Major aim was to reflect the actual status of IBCSO activities. In order to enlarge the network and to strengthen the work and outreach, it is recommended to emphasize specifically the call for delegates from each member country w.r.t. SCAR Circular 770.

Recognizing that a large amount of multibeam and single beam data, collected by research vessels, are not available to this project, an inventory of all past research cruises will be compiled, and jointly with COMNAP utilized to request the delivery of the seafloor data to international data centres, or directly to IBCSO. The data exchange and data policy will be based on the IOC/IODE regulations.

Regions of very sparse bathymetric data in the southern Indian and Pacific Oceans, the Weddell, Ross, and Amundsen Seas were identified. Research vessels operating in

these regions should be requested to perform if feasible multibeam surveys and, especially, collect data along transit lines.

A presentation about the BEDMAP emphasised that it has a strong link to IBCSO, since it forms the continuation of the sea floor topography underneath the Antarctic ice sheet. The compilation of a homogeneous, differentiable and seamless digital earth model is of special scientific value, since it describes the joint interface between the geosphere and the hydrosphere/cryosphere.

It was agreed amongst the participants that annual meetings of the IBCSO Editorial Board are indispensable in order to maintain rapid advancement. To support the work of IBCSO, additional funding, i.e. for meetings, should be sought from other organizations. The next meeting is scheduled to be held in 2009.

### **Expert Group on Antarctic Digital Magnetic Anomaly Project (ADMAM) ( Chair: M.Ghidela- ARG)**

The ADMAM expert group held a special meeting during SCAR 30th at St Petersburg. About 15 working group members were present, as well as a representative of the WDMAM (World Magnetic Anomaly Map) project.

Main achievements were:

- 1) The distribution of the ADMAM CD with line magnetic data and magnetic anomaly grids for all the surveys between IGY 1957-58 and 1999. The CD includes the compilation of low altitude data (aeromagnetic, shipborne, land surveys) and Magsat data, as well as a grid of long wavelength magnetic anomalies made by the joint adjustment of the Magsat data at high altitude and the low altitude data. The official release will be shortly accomplished with the publication of a paper on a peer reviewed journal.
- 2) Plans for the organization of this work: a data manager is needed, as The commemoration of the CD release with a third special journal of the ADMAM papers on a peer reviewed journal.
- 3) An update of the work that is being done with the data acquired by several countries from year 2000 to the present, with the geomagnetic reference model for the Antarctic and the new satellite magnetic compilations.
- 4) Year 2010 is the estimated time for the completion of the second version of the ADMAM compilation.

the amount of compilation work has increased significantly (~1.5 million line km for the 1999 map and more than 2 millions to add). There are three initiatives for this

### **Expert Group ANTEC (Antarctic Neotectonics) (Chair :T.Wilson- USA) below proposed as an PPG POLENET ( Chair: T.Wilson-USA)**

#### Activities 2006-2008:

- GPS Planning Workshop, Dresden, 2006
- Seismology planning Workshop, AGU, San Francisco, 2006
- EGU, 2007: A) Overview, IPY session; B) Information meeting
- ISAES Santa Barbara, 2007: A) Workshop; B) Thematic Sessions
- AGU, 2007: A) Overview, IPY session; B) E&O overview

- SCAR/IASC, 2008: A) Overviews: E&O, Science; B) Workshop; C) SPPG proposal
- AGU session proposed, Fall Meeting, 2008

#### Key Achievements, 2006-2008

- Field deployments
- Technological Development for Remote Stations  
([http://facility.unavco.org/project\\_support/polar/remote](http://facility.unavco.org/project_support/polar/remote) & <http://www.passcal.nmt.edu/Polar/index.html>)
- Education & Outreach activities ([www.polenet.org](http://www.polenet.org))
- Proposal for Scientific Programme Planning Group

## **NEW Ag and EG proposal**

### **Action Group on “GPS Weather and Space Weather Forecast”**

A detailed proposal has previously been presented, see appendix 1.

This is a joint proposal for a new action group in Geosciences and Physical Sciences, is a product of the 2006 cross-linkages workshop, and has the goal to promote GPS data exchange and to provide ionospheric imaging, facilitate data and technology exchange with the broader community.

The group will deliver greater understanding of the polar ionosphere and ionospheric processes.

Specifically, the objectives of this group have the following aims:

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

The group will involve the following:

- . One meeting per year among the WG members
- . Joint publications on peer reviewed journals
- . Joint presentation at national and international conferences
- . Web site realization, maintenance and updating

### **SCAR Action group on Cold Seeps and Hydrothermal vents in the Antarctic**

This Action Group will identify areas within the CCAMLR region likely to contain Vulnerable Marine Ecosystems around cold seeps and hydrothermal vents to assist in their management. It is proposed in response to CCAMLR Conservation Measure 22-06. The Action Group will:

- Identify geophysical methods suitable for identifying areas of methane and hydrothermal discharge in the Antarctic.
- Review existing geophysical data to identify regions with a higher likelihood of containing such discharge features.
- Assess the vulnerability of biological communities associated with cold seeps and hydrothermal vents to anthropogenic impacts.

Results will be provided to CCAMLR in reports and GIS. Other science outputs will develop as results unfold.

Proponent: Philip O'Brien, Australia

**POLENET proposal as PPG**

**Proposed Budget requirement for 07-08**

<b>Action Group</b>	<b>Expert Group</b>	05-06 not expended Forwarded 26.000	<b>Budget 07</b>	<b>Budget 08</b>
Communication activity no more AG		1.700	<b>2.000</b>	<b>2.000</b>
SUBICE			<b>3.000</b>	<b>3.000</b>
	<b>Geographic Information</b>	8.300		
	<b>GIANT Geodetic Infrastructure</b>	6.000	<b>3.000</b>	<b>1.500</b>
	<b>New International Bathymetric Chart of the Southern Ocean- IBCSO</b>	2.500	1000	1000
	<b>ADMAP</b>	3.500		<b>2.500</b>
	<b>ANTEC</b>	4000	<b>5.000</b>	<b>5.000</b>
	<b>IPY initiatives (meeting)</b>	2000		
	<b>ISAES 07</b>		<b>15.000</b>	
Total			<b>29.000</b>	<b>15.000</b>

<b>Initiatives</b>	<b>Action and Export Group</b>	<b>05-06 06 expenditure</b>	<b>Budget 07</b>	<b>Budget 08</b>
	<b>Cold seeps AG</b>		<b>3000</b>	<b>3000</b>
	<b>GPS weather AG</b>	<b>5000</b>		
	<b>SIeGE EG</b>	3000		<b>3.000</b>
	<b>GIANT Geodetic Infrastructure EG</b>	2000	<b>1.000</b>	<b>3000</b>
	<b>IBCSO EG</b>		<b>4000</b>	<b>2000</b>
	<b>ADMAP EG</b>	4000		<b>2.000</b>
	<b>POLENET -SERCE</b>	10000		2000
<b>Communication and web site</b>		2000		<b>2.000</b>
<b>Total</b>		<b>26 000</b>	<b>9.000</b>	<b>17.000</b>

## **Recommendations**

### **Internal recommendations**

#### **1. Concerning National Representatives Reports on Geoscience activities :**

This is a new Recommendation to enhance communication within the Geoscience Antarctic Community, GSSG, and to inform all Antarctic Geosciences researchers on National initiatives, We recommend that :

- a report from National representatives should be send to SSG-G two months before the SCAR General Assembly and SSG-G business meeting ( next in 2010);
- all National Reports will be distributed by e-mail to all National Representatives in Geosciences and they will be published on the SCAR SSG-GS web page;
- short ( about five minutes) oral reports will be given at SSG-G business meeting by national representatives.

## **2. Concerning SCAR Action group on Cold Seeps and Hydrothermal vents in the Antarctic**

This Action Group will identify areas within the CCAMLR region likely to contain Vulnerable Marine Ecosystems around cold seeps and hydrothermal vents to assist in their management. It is proposed in response to CCAMLR Conservation Measure 22-06. The Action Group will:

1. Identify geophysical methods suitable for identifying areas of methane and hydrothermal discharge in the Antarctic.
2. Review existing geophysical data to identify regions with a higher likelihood of containing such discharge features.
3. Assess the vulnerability of biological communities associated with cold seeps and hydrothermal vents to anthropogenic impacts.

Results will be provided to CCAMLR in reports and GIS. Other science outputs will develop as results unfold.

Proponent is Philip O'Brien, Australia

***Recommend that SCAR approve the establishment of an Action Group on “Cold Seeps and Hydrothermal vents in the Antarctic” jointly with the Standing Scientific Group on Life Sciences***

## **3. Concerning the constitution of a new expert group SIeGE**

*Recognizing* that further understanding of Antarctica's geological, ice sheet and climatic history absolutely requires sub-ice sheet and sub-ice shelf data,

*Noting* that on-going and future initiatives are planned to conduct geophysical surveys for, and to recover geological samples from subglacial environments,

*Cognizant* of SCAR's role in enhancing opportunities for international collaboration, and coordination of activities and shared use of national resources,

*Ensuring* that there is a maximum multidisciplinary, multinational science benefit,

*Seeking* to assist in the initiation of, and planning for international scientific expeditions for subglacial geological exploration, and in the facilitation and dissemination of research results,

*Acknowledging* that the Action Group on Sub-Ice Geological Exploration (SIGE) completed its task and in its report recommends establishing an Expert Group in subglacial geological exploration,

***Recommend that SCAR approve the establishment of an Expert Group for Sub-Ice Geological Exploration (SIeGE) within the Standing Scientific Group on GeoSciences.***

Goals of the SIeGE EG are to:

evaluate and synthesize potential geological targets for subglacial sampling based on current information,

determine areas of high scientific interest to define targets for future surveying for geological sampling,

provide a forum to exchange ideas on potential geological targets and communicate plans of national and multinational initiatives for campaigns to achieve the surveying and sampling,

provide a forum for reviewing existing ice drilling and geological sampling technology and to establish plans for developing new technologies required to achieve the surveying and sampling.

#### **4- Concerning new Action Group inter SSg with SG-PS & GPS weather and weather forecast”**

The cross-SSG workshop in Rome, November 2006, resulted in the initiative of proposing a joint Action Group, GPS Weather, sponsored by the SSG/GS and SSG/PS; this will draw together the instrumental array and expertise of the POLENET program array, the expertise in ionospheric research of the ICESTAR GPS scientists (UAMPY), and the skills of the meteorology experts, into a combined effort for data analysis and archival.

***Recommend that SCAR approve the establishment of an Action Group for “GPS weather and weather forecasts” jointly within the Standing Scientific Groups on GeoSciences and on Physical Sciences.***

#### **5 Concerning Geological Map Catalogue distribution by SC-AGI**

The chair of SC-AGI addressed the SSG-GS to advise them that the standing resolution was being revised to consider the distribution of digital maps.

***Recommend that SC-AGI continue to distribute geological maps as they had done in the past; that all geological maps are added to the SCAR map catalogue.***

SC-AGI guarantee that maps can be added on line and that SC-AGI would send the chair of SSG-GS a distribution list of the institutions that maps should be sent to.

### **New Recommendations**

#### **1. Concerning SCAR seeking observer status with the Intergovernmental Panel on Climate Change**

DRAFT Recommendation from GeoSciences/Life Sciences/Physical Sciences

Recognising the key role Antarctica plays in the global climate system, the changes that have become evident in recent decades and the likely consequences from future changes;

Acknowledging the important role played by the IPCC in assessing climate science since its inception in 1988;

Noting that Antarctica is the only region of the earth that has no representation except through claimant states;

Cognizant of SCAR's role and responsibility in the Antarctic Treaty System for initiating, facilitating and disseminating the results of Antarctic research;

Seeking to assist the IPCC to the greatest extent possible in future planning for the consideration of Antarctic research in its assessment of the state of the earth's climate system, past, present and future:-

**Recommend that SCAR seek observer status through the process outlined in INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (14.III.2008) TWENTY-EIGHTH SESSION IPCC-XXVIII/Doc.5, Corr.1**

## **2. Concerning the proposal for a SCIENTIFIC PROGRAMME PLANNING GROUP on “Solid Earth Response and influences on Cryospheric Evolution (SERCE)” [replaces POLENET proposal]**

The polar regions have unique geodynamic environments where the solid earth, the cryosphere, the oceans, the atmosphere and the global climate system are intimately linked. Understanding polar environmental change is of global interest, particularly with regard to predicting the contributions of polar ice sheets to global sea level rise. A scientific expert group of SCAR focused on Antarctic NeoTECTonics (ANTEC) was convened to promote and coordinate multidisciplinary, multinational research aimed at improving understanding of the unique neotectonic regime of the Antarctic plate.

The efforts of the ANTEC group culminated in the Polar Earth Observing Network (POLENET) International Polar Year core activity, in which 28 nations are collaborating in the Arctic and the Antarctic to obtain data from geophysical observatories. POLENET is acquiring systems-scale observational data in the Earth's polar regions and aims to provide a legacy in observational infrastructure and technological capability in autonomous monitoring in extreme environments. The science programme of POLENET was assembled from the individual projects of the consortium, and includes investigating polar geodynamics, the earth's magnetic field, crust, mantle and core structure and dynamics, and systems-scale interactions of the solid earth, the cryosphere, the oceans and the atmosphere. Bipolar field activities are focused on deployment of autonomous observatories at remote sites on the continents, coordinated with measurements made at permanent station observatories and by satellite campaigns.

Geodetic studies from POLENET, including GPS measurements of crustal motion, tide-gauge measurements of relative sea-level change, and gravity measurements of mass change, constitute essential elements in developing an understanding of the stability and mass balance of the cryosphere and of ongoing sea-level change.

Owing to its remoteness and hostile environment, knowledge of Antarctic crustal motions, seismicity, and ice sheet evolution has remained poorly constrained relative

to the northern hemisphere. By the middle of the next decade many new data sets will have been collected that will serve to advance our understanding of GIA. These include those from glacial geology (e.g., new and planned cosmogenic dating studies), marine geophysical surveys of ice sheet extent and retreat timing and direct observations of GIA using GPS. During the IPY, an unprecedented new GPS data set is being acquired through the deployment of the POLENET geophysical network across the entire Antarctic continent. POLENET data are being acquired by a large number of nations in individual projects. Complementary data are being acquired in the Arctic, particularly in Greenland, during the IPY. It is essential that an internationally coordinated approach to data analysis and synthesis be established in order to optimize the science outcomes of these new data sets. The proposed SERCE scientific research programme will provide the international framework and scientific leadership to investigate systems-scale solid earth – ice sheet interactions across Antarctica and relate these results to global earth system and geodynamic processes.

***Recommend that SCAR approve the Programme Planning Group on “Solid Earth Responses and influences on Cryospheric Evolution (SERCE)”***

The future SERCE Scientific Research Programme will be aimed at improving understanding of the solid Earth response to cryospheric and tectonic forcing.

The proposed Programme Planning Group will:

1. Identify and develop key disciplinary and interdisciplinary science components of a science programme aimed at advancing understanding of the interactions between the solid earth and the cryosphere, including glacial isostatic adjustment (GIA) and ice mass change and the influence of solid earth parameters (heat flow, disposition of sediments) on ice sheet dynamics. The programme will be designed to synthesize and interpret extensive new data sets obtained during IPY, including those from the major international Polar Earth Observing Network (POLENET) geophysical sensor deployment and recent/planned data from glacial geology and ice sheet modeling studies.
2. Communicate and coordinate with other international groups investigating ice mass change, ice sheet contributions to global sea level rise, glacial isostatic adjustment models of Greenland and other ice caps, and other pertinent research efforts.
3. Work with SCAR action/expert groups and research programmes to promote interdisciplinary science using POLENET data.
4. Provide an international framework for maintaining, and potentially augmenting, the remote autonomous POLENET infrastructure as the International Polar Year (IPY) ends.

The SERCE Chief Officer is not yet selected. A decision on this will be made in consultation with EXCOM after SCAR Delegates approval.

In appendix 3 is a detailed description of SERCE, including:

Chairs

Core memberships

The scientific objectives

Scientific background

Program rationale and methodologies

Program management

Programmatic and outreach/educational objectives  
Initial Implementation Plan for SERCE SP Planning Group, 2008-2010.

## Appendix 1

# Annual Report to the SCAR Executive Committee Standing Scientific Group on Geosciences 2008

### 1. Introduction and Highlights

The AG and EG activities in 2007-08 were focused on IPY activities, relatively even to field research.

In 2007 was held the **Xth ISAES** International Symposium on Antarctic Earth Science, August 26-31, Santa Barbara at University of California, California, USA; it is a very important event for Antarctic Geoscience that have been planned every four years.

Detailed description and summary of the event could be read on SCAR web page or on e-journal Georeach newsletter.

GI (Geographic Information) EG within SSG-G became a SCAR Standing Committee (Standing Committee on Antarctic Geographic Information - **SCAGI**).

ANTEC EG ceased to exist as a SCAR EG and the activities of this group have been absorbed within the IPY POLENET Programme, which can be accessed via the POLENET web site: <http://www.polenet.org/>.

**POLENET** will be proposed as **Scientific Programme Planning Group (SPPG)** for 2008-10 at the next Scar Executive in St.Petersburg with the ambition to become **SRP** in 2010.

The creation of a working group between ICESTAR/IHY and POLENET through UAMPY will be proposed at Scar Exec in St. Petersburg . The Proposed title is **GPS for weather and space weather forecast** ( see more informations in attached document)

### 2. SSG-G 06-08 structure

The Standing Scientific Group on Geosciences (SSG-G) comprises the following group approved at XXIX SCAR in 2006:

- *Action Groups (AG):*
  - SIGE** (Sub-Ice Geological Exploration)
- *Scientific Programme Groups (SPG):*
  - Antarctic Climate Evolution (**ACE**)
  - Subglacial Antarctic Lake Environments (**SALE**, jointly sponsored with the Geosciences Standing Scientific Group)
- *Expert Groups (EG):*
  - Geodetic Infrastructure of Antarctica (**GIANT** )
  - Expert Group on Antarctic Permafrost and Periglacial Environments (**EGGPE**)
  - International Bathymetric Chart of the Southern Ocean (**IBCSO**)
  - Antarctic Digital Magnetic Anomaly Project (**ADMAPP**)
  - ANTEC: Antarctic Neotectonics has drapped in **POLENET** , IPY project.

### 3. Action groups reports

#### **SIGE Sub-Ice Geological Exploration ( Chair Bryan Storey - NZL)**

The Sub-Ice Geological Exploration (SIGE) Action Group aims to look into ways of developing a collective SCAR-wide pan-Antarctic approach to

drilling into the rocks beneath the ice to improve our understanding of Antarctica's geological history. The first meeting to develop a five year work plan will be held in St Petersburg at the SCAR Open Science Conference July 2008.

#### 4. Expert Groups reports

##### ***GIANT Geodetic Infrastructure of Antarctica (Chair: Reinhard Dietrich - GER)***

The Expert Group on Geodetic Infrastructure of Antarctica (GIANT) provides a common geodetic reference system for all Antarctic scientists and operators. It also contributes to global geodesy for studying the physical processes of the earth and the maintenance of the precise terrestrial reference frame, and provides information for monitoring the horizontal and vertical motion of Antarctica. Together with SCAR's Antarctic Neotectonics (ANTEC) Expert Group, GIANT is a leader in the bipolar IPY POLENET (Polar Earth Observing Network) project, to which GIANT will contribute the Antarctic GPS component. A POLENET workshop was organized in the frame of the 10<sup>th</sup> ISAES in Santa Barbara/USA in August 2007.

##### ***EGGPE Antarctic Permafrost and Periglacial Environments (Chair: by J.G. Bockheim -USA)***

###### Aims and Objectives

- A common web-accessible repository for permafrost and soils data.
- The production of thematic maps on Antarctic permafrost and soils.
- A system of boreholes providing data on permafrost and soil properties, records of past environmental change, and recording permafrost responses to climate change.
- A well-designed monitoring system recording active layer and periglacial process responses to climate change along selected environmental gradients.

###### Highlights of 2007

- Hosted workshop attended by 17 persons from 7 countries at the 10th International Symposium on Antarctic Earth Sciences (Santa Barbara, USA, August 2007).
- Publication in December 2007 of special issue of *Geoderma* containing 13 papers by authors from 8 countries and entitled "Antarctic Soils and Soil-Forming Processes in a Changing Environment" (edited by J. Bockheim, USA and M. Balks, NZ)
- Funding of three IPY projects by Portugal, Spain, and Brazil.
- Development of legends for soil and permafrost map units.
- Preparation of provisional soil and permafrost maps of (i) Transantarctic Mountains (Bockheim, USA; McLeod and Balks, NZ) and (ii) Antarctic Peninsula and islands (Lopez-Martinez, Spain; Schaefer, Brazil) and a permafrost map of the Andes (Trombotto, Argentina).
- Publication of more than 50 papers in refereed journals pertaining to soils and permafrost in Antarctica, in the period 2005-2008.
- Development of the LATITUDE60 project in Portugal that includes:
  - a 18' film about Antarctic Permafrost research distributed to over 200 schools in Portugal
  - permafrost scientists gave about 30 talks in high schools all over Portugal, including the Azores, about Antarctic Permafrost research
  - permafrost scientists wrote daily reports and answered to questions by students, directly from the Antarctic
  - 1st Iberian Workshop on Antarctic Peninsula Permafrost and Climate Change, 17 December 2007, Lisbon (Portugal) that joined the main Iberian groups working on permafrost in order to plan the antarctic campaign of 2007-08 and future joint activities.

###### Progress

- The ANTPAS database is maintained by Waikato University (Balks, NZ; <http://erth.waikato.ac.nz/antpas>).

- Provisional permafrost maps have been prepared for the Transantarctic Mountains and portions of the Antarctic Peninsula.
- The Italians have added three new ice-wedge monitoring sites established along the Antarctic Peninsula and Ross Sea region (Raffi & Guglielmin).
- A consortium of countries continue to monitor the active layer depth, permafrost temperatures in boreholes, and soil climate in the McMurdo Dry Valleys, North Victoria Land, and South Shetland Islands.

#### Plans

- An ANTPAS workshop at the June 2008 Ninth International Conference on Permafrost in Fairbanks, Alaska (J. Bockheim).
- An informal ANTPAS workshop at the July 2008 SCAR Open Science Conference in St. Petersburg, Russia (J. Lopez-Martinez).
- Preparation of electronic versions of soil and permafrost maps and databases of the Transantarctic Mountains and Antarctic Peninsula region.
- Development of a Cryosol session with an Antarctic focus for the International Union of Soil Scientists meeting in Brisbane, Australia in 2010.

#### ***ADMAP Antarctic Digital Magnetic Anomaly Project () (Chair: Marta E. Ghidella -ARG)***

The Antarctic Digital Magnetic Anomaly Project (ADMAP) aims to map Antarctica's magnetic anomaly field to aid in understanding geological processes. It is managed jointly with IAGA (International Association of Geomagnetism and Aeronomy). ADMAP contributes data to the World Magnetic Anomaly Map (for details see: <http://www.geology.ohio-state.edu/geophys/admap>).

During 2007, ADMAP updated a DVD of the compilation of data up to year 1999 for release to the World Data Centers; developed and promoted regional and continental scale interpretation of the ADMAP data; updated near-surface anomaly predictions; continued the compilation of a rock magnetic properties database in support of geological applications of the Antarctic magnetic anomalies; developed an Antarctic Reference Model (ARM) for improved magnetic anomaly determination in the Antarctic; and worked on establishing a spherical harmonic cap (SHC) model for the database to facilitate analytical manipulations of the Antarctic magnetic anomaly grid for geological applications.

The ADMAP team met at the 10th International Symposium of Antarctic Earth Sciences (Aug. 07 in Santa Barbara, CA, USA), where representatives from BAS, AWI and VNIIO reported on the efforts of their agencies to contribute their new extensive magnetic anomaly data holdings to the digital database. In 2008, ADMAP will continue compiling all available terrestrial, marine, and satellite magnetic survey data collected since the IGY 1957-58 for the region south of 60oS into the ADMAP digital database. However, as magnetic surveys since the 2001 compilation have nearly doubled the amount of magnetic anomaly data for inclusion into the database, ADMAP is in need of acquiring the services of a database manager to monitor these activities and incorporate the new data into the database as they become available. SCAR will help sponsor a workshop to formally release the updated database to the World Data Centers. ADMAP will continue developing and promoting regional and continental scale interpretation efforts and help identify areas for new collaborative magnetic surveys.

#### ***International Bathymetric Chart of the Southern Ocean (IBCSO) ( Chairs: Hans Werner Schenke & Norbert Ott- GER)***

The SCAR Expert Group on the International Bathymetric Chart of the Southern Ocean (IBCSO) aims on the production of a high quality bathymetric map of the Southern Ocean together with additional topographic, geophysical, and other data. The IBCSO is a contribution to the General Bathymetric Chart of the Oceans (GEBCO). The Intergovernmental Oceanographic Commission (IOC) and the International Hydrographic Organization (IHO) provide official support to IBCSO by adoption as a regional ocean mapping program and assistance of the Hydrographic Commission on Antarctica (HCA).

Together with a great number of institutions the IBCSO group focuses on the expansion of the international collaboration for data collection and exchange in 2007. New multibeam data were collected and processed by the Alfred Wegener Institute during two Polarstern cruises in Antarctic

waters. Close collaboration for data exchange is agreed with other Southern Ocean and Antarctic mapping programs, namely Radarsat Antarctic Mapping Program (RAMP), Antarctic Bedrock Topography (BEDMAP2), Antarctic Digital Magnetic Anomaly Project (ADMAG), Earth Topography (ETOPO2), and GEBCO. Due to its distinct interdisciplinary concept IBCSO has been assigned high priority within the IOC Ocean Mapping Program.

The IBCSO project was presented and discussed at several meetings and international conferences. A first IBCSO meeting was arranged during the 10<sup>th</sup> ISAES at the University of California, Santa Barbara in August 2007. The IBCSO Editorial Board, now consisting of 15 experts from the fields of hydrography, oceanography, and ocean mapping, has been established. A presentation of IBCSO and its contributions to other projects was given to the meeting of the GEBCO Sub-Committee on Digital Bathymetry (SCDB) in New York (September 2007), the SCAR/SCOR Oceanography Expert Group (EG Ocean) planning meeting of the Southern Ocean Observing System (SOOS) in Bremen in October 2007, the meeting of the Standing Committee on Antarctic Geographic Information (SC-AGI) in Buenos Aires, October 2007, and at the Annual Meeting of the GEBCO Guiding Committee in Paris, November 2007.

Exceeding support on the IBCSO is provided by SCAR, which is interested in using IBCSO products for a variety of scientific projects and applications. The buildup of bathymetric databases is strongly recommended in consideration of the International Polar Year. SCAR and SCOR distributed Circular Letters with regard to bathymetric data acquisition in polar regions and transfer to the project databases. Additionally, the SCAR/SCOR Expert Group on Oceanography formulated an explicit request to member states for bathymetric data needed for the completion of the Bathymetric Charts in Antarctica.

Main objective of the IBCSO project is the production of a bathymetric map series for the entire Southern Ocean. This comprises printed maps as well as digital web maps for use in GEBCO and other projects. Major topics in the near future are:

- data compilation and evaluation of bathymetric data from various sources
- ship track inventories with existing multibeam data
- organizing meetings and workshops of the Expert Group on IBCSO
- presentation of IBCSO at meetings, conferences and organizations
- request for funding and additional support to strengthen the IBCSO network

Contact addresses are Hans Werner Schenke ([Hans-Werner.Schenke@awi.de](mailto:Hans-Werner.Schenke@awi.de)) and Norbert Ott ([Norbert.Ott@awi.de](mailto:Norbert.Ott@awi.de)). For more detailed information about the Expert Group on IBCSO see [www.ibcso.org](http://www.ibcso.org).

## 5. Scientific Programme Groups

The SSG-G is co-sponsoring the SALE SPG (SSG-LS) and ACE SPG.

For ACE and SALE reports see o separate specific sections.

Alessandro Capra

SSG-G Chief Officer

SCAR Standing Scientific Group on Geosciences

Modena, March 2008

**List of Acronyms and Abbreviations**

ACE	Antarctic Climate Evolution
ADMAP	Antarctic Digital Magnetic Anomaly Project
AG	Action Group
AGCS	Antarctica and the Global Climate System
ANTEC	Antarctic NeoTECtonics
ATCM	Antarctic Treaty Consultative Meeting
AWI	Alfred Wegener Institute for Polar and Marine Research
BAS	British Antarctic Survey
CGOM	Consultative Group on Ocean Mapping
COMNAP	Council of Managers of National Antarctic Programmes
EBA	Evolution and Biodiversity in the Antarctic
EG	Expert Group
EGGPE	EG on Antarctic Permafrost and Periglacial Environments
ETOPO2v2	2-Minute Gridded Global Relief Data
GDA	Digital Atlas Centenary Edition
GEBCO	General Bathymetric Chart of the Oceans
GI	EG Geographic Information
GIS	Geographic Information System
HCA	Hydrographic Committee on Antarctica
IBCSO	International Bathymetric Chart of the Southern Ocean
ICESTAR	Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research
ICSU	International Council for Science
IHO	International Hydrographic Organization
IHY	International Heliophysical Year
IOC	Intergovernmental Oceanographic Commission
IPY	International Polar Year
ISAES	International Symposium on Antarctic Earth Sciences
LDEO	Lamont-Doherty Earth Observatory
NGDC	National Geophysical Data Center
NSF	National Science Foundation
POLENET	POLar Earth observing NETwork
Radarsat	Radar Satellite
RAMP	Radarsat Antarctic Mapping Project
RV	Research Vessel
SALE	Subglacial Antarctic Lake Environments
SCAGI	Standing Committee on Antarctic Geographic Information
SCAR	Scientific Committee on Antarctic Research
SC-ATS	Standing Committee for the Antarctic Treaty System
SCDB	Subcommittee on Digital Bathymetry
SCOR	Scientific Committee on Oceanic Research
SCUFN	Sub-Committee on Undersea Feature Names
SIGE	Sub-Ice Geological Exploration - AG of SSG-G
SOGIS	Southern Ocean Geographic Information System

SPG	Scientific Programme Group
SSG–G	Standing Scientific Group on Geosciences
SSG–LS	Standing Scientific Group on Life Sciences
UAMPY	Upper Atmosphere Monitoring for Polar Year

Attached Document

**Proposal from ICESTAR (SCAR SRP), SSG-LS,SSG-GS, POLENET (IPY project)**

Introduction

**ICESTAR/IHY** is a core project, defined as cluster 63, endorsed by IPY. It coordinates multinational research on solar-generated events which affect the composition and dynamics of the atmosphere in the terrestrial polar areas. The activity brings together two complementary programmes: the International Heliophysical Year (IHY) (EoI 172) and ICESTAR (EoI 554), endorsed by SCAR. The joint project includes the collective effort of 24 international consortia which submitted their Expressions of Intent (EoIs) to the IPY call in January 2005. Between them, **UAMPY** (Upper Atmosphere Monitoring for Polar Year 2007-2008) Consortium proposes to create the necessary international cooperation to develop a polar upper atmosphere observation network on both the hemispheres. It should allow unprecedented observation of the polar ionosphere, with extended auroral and polar coverage, making possible the mapping of features from mid- through polar latitudes and the studies of associated polar ionospheric processes. **The project includes a unique ability to monitor polar scintillation globally.** Scintillation is a significant concern for trans-polar navigation and communication. The potential exists for numerous new studies - both scientific and practical investigations.

The UAMPY consortium is composed by: INGV (Istituto Nazionale di Geofisica e Vulcanologia – Rome, ITALY), IFAC/ISC-CNR (Istituto di Fisica Applicata “Nello Carrara”/Istituto dei Sistemi Complessi, Florence, ITALY), UNIVERSITY OF BATH (UK), SRC-PAS (Space Research Center, Polish Academy of Sciences Warsaw, POLAND), UNIVERSITY OF CALGARY (CANADA), HMO (Hermanus Magnetic Observatory, Hermanus, SOUTH AFRICA) together with other collaborators of the South African Space Physics community including ISSA (Institute for Satellite and Software Applications), HartRAO (Hartebeesthoek Radio Astronomy Observatory), NWU(Northwest University), UND (University of KwaZulu-Natal in Durban), UP (Department of Electrical, Electronic and Computer Engineering, University of Pretoria). These groups manage several experimental observations in **Arctic and Antarctica**: GPS scintillations receivers at Ny Alesund (Svalbard, Norway) and along the EISCAT sites in Tromso, Kiruna and Sodankyla; ionosonde, scintillation receivers and magnetometer at the Polish Polar Station in Hornsund (Svalbard); the Canadian GPS Network for Ionosphere Monitoring (CANGIM); riometers and a digital ionosonde AIS-INGV (Advanced Ionospheric Sounder INGV) in Antarctica at the Italian Station “Mario Zucchelli”; magnetometer, riometer, GPS dual frequency receivers and HF Radar (part of the SuperDARN network) at the South Africa observatory at the SANAE IV in Antarctica.

Recently other groups demonstrated their interest in sharing their GPS measurements for ionospheric studies. In particular in Antarctica (Research Station “Comandante Ferraz”, King George Island) and over the Brazilian territory two Institutions, the Brazilian Institute of Geography and Statistics (IBGE) and Instituto Nacional de Pesquisas Espaciais (INPE), manage several high rate sampling GPS receivers, measuring TEC and scintillations see [http://www.space.fmi.fi/ipyid63/instrument\\_networks/america-south/braz.html](http://www.space.fmi.fi/ipyid63/instrument_networks/america-south/braz.html) and <http://www.dae.inpe.br/iono/iongps/indexPort.html>). Moreover University of Nottingham and Sao Paulo State University are collaborating with INGV to develop techniques of mitigation of the positioning errors caused by ionospheric scintillations. Also China express interest in be involved in such initiatives and the Polar Research Institute of China (PRIC) and the China Research Institute of Radiowave Propagation (CRIRP) offer their expertise and measurements of the ionospheric plasma in Arctic

(Svalbard, Tromso, Sodankyla and Oulu) and in Antarctica (ZhongShan Station and Greatwall Station) to this proposed cross-link working group.

As this long experience the goal is to share data, know-how, expertise and models for studying ionospheric plasma evolution and dynamics with a multidisciplinary approach. To achieve the result the efforts are mainly addressed to:

- Coordinate the existing experimental observations to monitor the upper atmosphere phenomena;
- Enlarge the experimental equipment with the installation of other scintillations receivers necessary to cover the **current lack over the poles**;
- Collect the upper atmosphere data for constituting a robust database and archive for scientific as well as for Space Weather aims;
- Study and develop the ionospheric scintillation modelling and the simulation of physical processes causing structuring of the high-latitude ionosphere;
- Design a server for the remote control and management of the instrumentation, for hosting the database and for retrieving added value products (plots, maps, etc.).

The efforts that are undertaken by the scientific polar community to widen the perspective of operational scientific investigations towards the realization of multidisciplinary coordinated facilities and observations are central to **POLENET** project. The technical and scientific challenges that are going to be addressed by POLENET are numerous. On the scientific side, the primary co-location of GPS systems (Figure 1) and seismometers, possibly completed with meteorological sensors, geomagnetic observatories, tide gauges and bottom pressure gauges would realize a step towards the acquisition of **coordinated geophysical observations of the Earth system and its processes**.

Furthermore, the **GPS network** itself is going to benefit of a much denser and more homogeneous distribution of observing sites; this will certainly provide a more effective tool for performing polar observations in the field of geophysics and physical sciences. In particular, a continuous geodetic monitoring, exploited through GPS permanent stations, would accurately determine the 3-D motion of the crust. Besides all geodynamical applications, an accurate monitoring of vertical displacements will undoubtedly benefit the investigations related to cryosphere stability and ice mass balance, providing robust constraints on ongoing processes. Sea level change and post-glacial rebound are directly affected by modifications of the ice sheet; these investigations are particularly important as the modifications seem to occur at an unpredicted high rate of change. Finally, the possibility to co-locate the remote GPS stations with Automatic Weather Stations would allow to determine the distribution and evolution of **Precipitable Water Vapour in polar regions**; these latter areas play a key role in the characterization and evolution of global earth phenomena. Furthermore, water vapour is one of the most important greenhouse gases: its distribution and variability are crucial for inferring about climate change and possible related scenarios.

A close cooperation between scientists involved in GPS based atmospheric investigation is crucial for optimising any effort that is devoted to a densification of the polar GPS network and towards the enhancement of its performances.

On the operational side, coordinated actions devoted to optimisation and enhancement of highly accurate standardised performances of remote unmanned observing stations will be maximised by a coordinated effort in evaluating the different needs related to designing and planning the installations and the related technical solutions.

**Cross-link Proposal between ICESTAR/IHY and POLENET through UAMPY**  
**Proposed title: GPS for weather and space weather forecast**

**Aims of the proposal:**

Polar-ionosphere imaging over Antarctica using GPS data is of great challenge due to poor coverage of ground-based GPS receivers. It is difficult to track and image high-speed moving ionospheric structures without good coverage of observations. However, as the POLENET network has been proposed, the study of the ionosphere over the southern polar cap by radio tomography becomes promising. The new imaging technique, developed by the University of Bath and known as MIDAS (Multi-Instrument Data Analysis System), is unique in its approach to ionospheric imaging because it performs a four-dimensional inversion. The technique assimilates different kind of data: ionospheric characteristics from vertical soundings (virtual heights and critical frequencies of the layers), parameters from backscattering radars (typically power and velocity of the echoes), GPS data (TEC and scintillation indices), ionospheric vertical profiles and ingests also models to reconstruct the spatial-temporal condition of the ionospheric plasma. To work properly MIDAS needs data and models and, naturally, the scientific expertise to evaluate and interpret the results. In this frame the UAMPY contribution to the proposed working group is crucial as it groups experts in different branches of the upper atmosphere physics. Most of them manage also instruments and models fundamental to provide the necessary information to the tomography technique.

Figure 1 shows the locations of GPS receivers from IGS sites (green) and planned POLENET sites

(red). Using simulated observations from IGS receivers and POLENET receivers, ray paths between

ground GPS receivers and satellites, which are projected onto the surface of the Earth (see Figure 2),

are generated from the current IGS sites (left panel of Figure 2 ), as well as from both current and

planned sites (right panel of Figure 2). From figure 2 it is evident the potential of the proposed wg to

improve the polar ionosphere knowledge.

**Objectives:**

The **POLENET** and **ICESTAR - UAMPY** Communities could have **mutual benefits** in terms of:

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

**Deliverables:**

1. One meeting per year among the WG members
2. Joint publications on peer reviewed journals
3. Joint presentation at national and international conferences
4. Web site realization, maintenance and updating

The suggested **Working Group** is composed as follows:

From **ICESTAR - UAMPY**: Giordiana De Franceschi (Chair), Kirsti Kauristie, Lucilla Alfonsi, Ben Opperman, Massimo Materassi, Ping Yin, Galera Monico, Eurico R. de Paula, Emilia Correia.

From **POLENET**: Alessandro Capra (Co-Chair), Dorota Brzezinska, Jan Cisak, Larry Hothem, Gennady Milinevsky, Pierguido Sarti, Yevgen Zanimonskiy.

Participating Countries: **Italy, Brazil, South Africa, China, UK, Poland, Finland, Ukraine, ...**

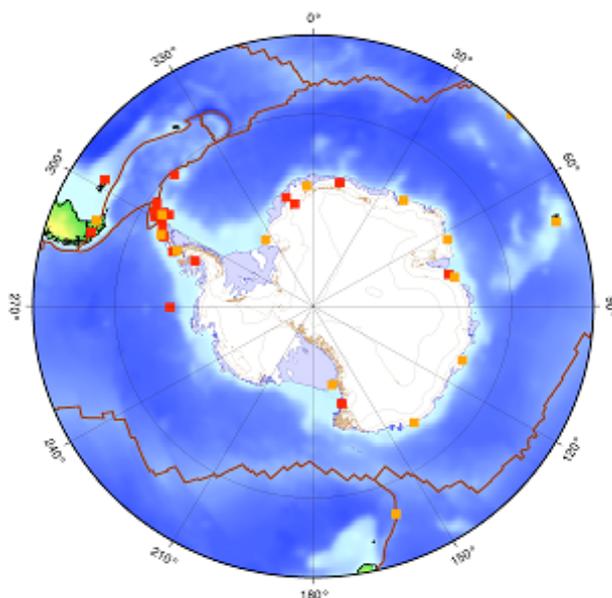


Figure 1– GPS Observatories in POLENET, courtesy of SCAR website.

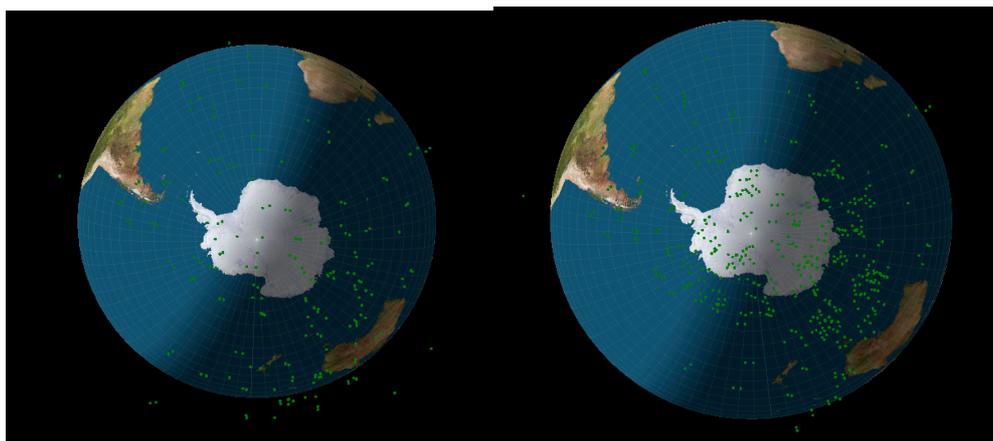


Figure 2 Ray paths between GPS satellites and ground receivers from existing sites only (left) and from current and planned POLENET sites (right).

#### Relevant recent References:

Perrone L., L. Alfonsi, V. Romano, G. De Franceschi, Polar cap absorption events of November 2001 at Terra Nova Bay, Antarctica, *Annales Geophysicae*, Vol. 22, pp 1633-1648, 8-4-2004.

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Mitchell, C. N.; Alfonsi, L.; De Franceschi, G.; Lester, M.; Romano, V.; Wernik, A. W., GPS TEC and scintillation measurements from the polar ionosphere during the October 2003 storm, *Geophys. Res. Lett.*, Vol. 32, No. 12, L12S03 10.1029/2004GL021644, 2005.

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Coster A., Skone S., De Franceschi G., Alfonsi L., Romano V., Global studies of GPS Scintillation, proceedings of ION 2005 National Technical Meeting, January 24-26, 2005 San Diego, California

G. De Franceschi, L. Alfonsi, V. Romano, ISACCO: an Italian project to monitor the high latitudes ionosphere by means of GPS receivers, "Eye on ionosphere" GPS Solutions, DOI 10.1007/s10291-006-0036-6, 2006.

W. Wernik, L. Alfonsi, M. Materassi, Scintillation modelling using in-situ data, Radio Science, 2006RS003512, 2007.

De Franceschi G., L. Alfonsi, V. Romano, M. Aquino, A. Dodson, C. N. Mitchell, A. W. Wernik, Dynamics of high latitude patches and associated small scale irregularities, in press, Journal of Atmospheric and Solar-Terrestrial Physics, doi:10.1016/j.jastp.2007.05.018 , 2008.

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**Appendix 2 Geosciences Business Meeting 08 Agenda****Sunday 6<sup>o</sup> of July – AM 9:00-13:30**

- 9:00- 9:30 Meeting Agenda approval (A. Capra)  
CO report (A. Capra)  
SSG-G budget
- 9:30-9:45 IPY developments (D. Carlson)
- 9:45- 10:00 Developments within SCAR (M.Sparrow)
- 10:00-10:40 Short Report from the Action and Expert Groups:  
SIGE AG (B. Storey)  
GIANT EG (R. Dietrich )  
International Bathymetric Chart of the Southern Ocean (IBCSO) EG (H-W. Shenke)
- 10:40- 11:00 Geoscience National representatives reports and  
comments
- 11:05-11:30 Coffee break
- 11:30-11:45 Report on SCA GI (Henk Broelsma)
- 11:45-12:05 From SCAR SRP:  
SALE and ACE (M.Siegert)
- 12:10-12:15 Geodesy and geophysical editorial initiative  
(A.Capra)
- 12:15-12:25 Geospatial (Air photo-satellite imagery) info – LIMA  
( A.Fox)
- 12:25-12:35 ANDRILL and Geological drilling (F. Rack)
- 12:35-12:45 MARINE Seismics and Survey Coordination (P.  
O'Brien)

**GSSG plenary****Monday the 7<sup>o</sup> - PM 14:30- 16:45**

- 14:30-14:40 Nominations for SSG-G officers and voting  
procedure
- 14:40- 15:05 Report on JCADM (H.Campbell) and discussion
- 15:05-15:15 SDLS (A. Cooper)
- 15:15- 15:25 Report from the Action and Expert Groups: :  
Antarctic Digital Magnetic Anomaly Project (ADMMap) EG (M. Ghidella)
- 15:25-15:35 GPS WEATHER – Inter SSG WG Icestar/Polenet new  
initiative (P.Sarti)
- 15:35 –15:45 POLENET proposal as Programme Planning Group  
(T.Wilson, )
- 15:45-16:00 coffee break
- 16:00-16:30 Election of officers
- 16:30-16:45 Recommendations and report to SCAR Exec  
SSG-G Budget for 2009-10  
Meeting closure

## Appendix 3

### Proposal for a SCIENTIFIC PROGRAMME PLANNING GROUP

#### Solid Earth Response and influences on Cryospheric Evolution (SERCE)

A SPPG is fostered by SSG-G with the aim to develop and to propose a Scientific Research program (SRP) titled “Solid Earth Response and influences on Cryospheric Evolution (SERCE)”.

SRP title: **Solid Earth Response and influences on Cryospheric Evolution (SERCE)**

SSG submitting proposal: **Geosciences – SSG-G**

Expected duration : **6-8 years**

SCAR funding needed for 09-10 SPPG: **\$10 000**

SPPG **Chief Officers** –

SPPG **core membership:** Tentative list

Sridhar Anandakrishnan (Geophysics/Glaciology; USA)

Alessandro Capra (Geodesy; Italy)

Gino Cassasa (Glaciology, Ice mass balance; Chile)

Reinhard Dietrich (GNSS, Gravity field; Germany)

E. Dongchen (Geodesy; China)

Richard Hindmarsh (Ice sheet modeling; U.K.)

Thomas James (Glacial isostatic modeling; Canada)

Masaki Kanao (Seismology; Japan)

Matt King (Geodesy, modeling; U.K.)

Markku Poutanen (Geodesy; Finland)

Terry Wilson (Neotectonics, GPS; USA)

#### Solid Earth Responses and influences on Cryospheric Evolution (SERCE) SRP description

##### 1. *The objectives of the program*

The proposed *Programme Planning Group* will:

5. Identify and develop key disciplinary and interdisciplinary science components of a science programme aimed at advancing understanding of the interactions between the solid earth and the cryosphere, including glacial isostatic adjustment (GIA) and ice mass change and the influence of solid earth parameters (heat flow, disposition of sediments) on ice sheet dynamics. The programme will be designed to synthesize and interpret extensive new data sets obtained during IPY, including those from the major international *Polar Earth Observing Network* (POLENET) geophysical sensor deployment and recent/planned data from glacial geology and ice sheet modeling studies.
6. Communicate and coordinate with other international groups investigating ice mass change, ice sheet contributions to global sea level rise, glacial isostatic adjustment models of Greenland and other ice caps, and other pertinent research efforts.
7. Work with SCAR action/expert groups and research programmes to promote interdisciplinary science using POLENET data.
8. Provide an international framework for maintaining, and potentially augmenting, the remote autonomous POLENET infrastructure as the International Polar Year (IPY) ends.

The future SERCE *Scientific Research Programme* will be aimed at improving understanding of the solid Earth response to cryospheric and tectonic forcing. The scientific objectives will include:

1. Integrate and synthesize geodetic observations obtained from the multinational POLENET geophysical network during IPY to obtain a velocity field (vertical and horizontal) across the Antarctic continent.
2. Integrate and synthesize seismological data obtained from the POLENET geophysical network during IPY to map Antarctic lithospheric and upper mantle structure and rheological properties.

3. Synthesize available observations and carry out glaciological modelling to obtain an improved understanding of Antarctic Ice Sheet (AIS) evolution since Last Glacial Maximum (LGM).
4. Develop improved models of glacial isostatic adjustment constrained by vertical crustal motion observations (objective 1), improved earth structure (objective 2), and improved ice sheet history (objective 3).
5. Improve the estimates of present-day ice mass balance obtained from satellite observations. Provision of improved constraints on the rates of gravitational change and crustal uplift due to GIA will remove one of the largest uncertainties in analysis of satellite data for present-day change.
6. Document ice sheet boundary conditions and subglacial processes from seismological and glacial surface motion observations.
7. Determine seismicity levels in Antarctica and link to cryospheric and tectonic processes.
8. Better understand neotectonic processes through analysis of improved earthquake catalogues and horizontal crustal motion observations.
9. Improve the understanding of ionospheric and tropospheric processes through analysis of new POLENET space-geodetic observations.

Programmatic and outreach/educational objectives will include:

10. Provide a coordination body for ongoing maintenance and augmentation of the POLENET geophysical network established during IPY.
11. Provide a forum for exchange of metadata and data, and for sharing of technical information and improvements essential to establishing and maintaining autonomous remote geophysical observatories.
12. Provide educational and outreach materials on Antarctic crustal motions and seismicity, solid-Earth and cryospheric evolution, and present-day ice sheet mass balance.

### ***Scientific background***

The polar regions have unique geodynamic environments where the solid earth, the cryosphere, the oceans, the atmosphere and the global climate system are intimately linked. Understanding polar environmental change is of global interest, particularly with regard to predicting the contributions of polar ice sheets to global sea level rise. A scientific expert group of SCAR focused on Antarctic NeoTECTonics (ANTEC) was convened to promote and coordinate multidisciplinary, multinational research aimed at improving understanding of the unique neotectonic regime of the Antarctic plate. In particular, ANTEC's charter included encouraging and coordinating deployment of remote geodetic and seismic stations across the continent, encouraging installation of permanent instruments and regional networks of instruments (GPS, tide gauge, gravity, seismic), and coordinating sharing of instrumentation, logistics, and data. The ANTEC group convened a series of workshops and thematic science sessions to identify promising research directions and to develop an implementation plan for geophysical deployments across the Antarctic continent.

Neotectonic motion across Antarctica is expected to occur due to displacements on active structures, deformation associated with active volcanism, and due to glacio-isostatic adjustment (GIA) of the Earth in response to changes in ice mass load. Predicted vertical motions due to GIA exceed 4 mm/year over large areas of the continent and range up to 20 mm/year - rates that can be measured with precision GPS. Discovering modern structural displacements (for example across the West Antarctic rift system) and testing different GIA models requires a distributed array of GPS stations across the continental interior. In addition to promoting broader acquisition of GPS measurements, ANTEC recognized the importance of many interdisciplinary goals, including the integration of geodetic results with geological records, the incorporation of GPS measurements into GIA and other geodynamic modeling, the development of new comprehensive ice history models, the resolution of rheological properties of the crust and mantle that influence crustal motion patterns and rates, and the assimilation of ground-based measurements with data from current space missions.

Glacio-isostatic adjustment (GIA) is the response of the Earth to past and present-day changes in ice sheets and glaciers. In Antarctica GIA is an important, and in most regions, the predominant, process causing neotectonic crustal motions. GIA models combine an ice sheet history with an assumed Earth rheology to predict past and present crustal motion, sea-level change, and changes to the Earth's gravitational field. Current GIA models give different spatial patterns of uplift and also differ by about a factor of two in the peak predicted uplift rate, owing to the very different ice sheet histories that were

assumed. Earth rheology is poorly known in the region, and this also contributes to the variability in GIA model predictions.

The history of the Antarctic ice sheet during and since the Last Glacial Maximum (LGM) is an essential component of GIA models. Although data constraining the magnitude and timing of ice mass change since the LGM are accumulating from glacial geological and related studies at individual locations, ongoing efforts to compile these data into continent-wide ice models are required. In addition, there is ongoing active research into the role of plate configuration, vertical tectonics, and paleotopography in the inception of the Antarctic ice sheets.

Seismological studies of the structure of the crust and mantle beneath Antarctica are essential for deciphering the geological evolution of the continent, but also have important bearing on the interactions between the solid earth and the cryosphere that rests upon it. To obtain more accurate earth models for GIA predictions, we need to know how the physical properties and thermal structure vary laterally and with depth in the East and West Antarctic crust and mantle. Existing seismic stations allow resolution of the structure beneath the continent at a horizontal scale of ~1000 km – sufficient to detect fundamental differences in the lithosphere beneath East and West Antarctica, but not to clearly define the structure within each sector. Seismological mapping of earth properties provides a proxy for mantle temperature, which can be used to predict heat flux to the base of the ice sheets, a fundamental control on ice sheet dynamics. In addition, our knowledge of the seismicity of the Antarctic continent is limited by the sparse distribution of seismic stations and the detection level for earthquakes remains inadequate for full evaluation of seismotectonic activity. New instrumentation to monitor seismicity can address the geodynamic paradox between active neotectonic processes vs. the low level of seismicity in Antarctica. Importantly, it can also contribute to understanding ‘glacial earthquake’ processes, which may be related to changing basal conditions of the ice sheets due to a warming environment.

The efforts of the ANTEC group culminated in the *Polar Earth Observing Network* (POLENET) International Polar Year core activity, in which 28 nations are collaborating in the Arctic and the Antarctic to obtain data from geophysical observatories. POLENET is acquiring systems-scale observational data in the Earth’s polar regions and aims to provide a legacy in observational infrastructure and technological capability in autonomous monitoring in extreme environments. The science programme of POLENET was assembled from the individual projects of the consortium, and includes investigating polar geodynamics, the earth’s magnetic field, crust, mantle and core structure and dynamics, and systems-scale interactions of the solid earth, the cryosphere, the oceans and the atmosphere. Bipolar field activities are focused on deployment of autonomous observatories at remote sites on the continents, coordinated with measurements made at permanent station observatories and by satellite campaigns.

Geodetic studies from POLENET, including GPS measurements of crustal motion, tide-gauge measurements of relative sea-level change, and gravity measurements of mass change, constitute essential elements in developing an understanding of the stability and mass balance of the cryosphere and of ongoing sea-level change. There is a critical need to understand the contribution to sea-level change due to changes in mass balance of the major ice sheets of the world, most importantly the Antarctic and Greenland ice sheets. Accurate measurement of millimeter-scale vertical and horizontal crustal motions is possible in only 2-5 years if continuous GPS trackers are deployed. Deployment of C-GPS stations in optimal positions with respect to historical and modern ice mass changes, and at sufficiently high spatial resolution, provides robust constraints on ice models, improving our ability to predict sea-level change. Deployment of C-GPS stations across tectonic blocks and boundaries allows crustal motions due to global plate motion and intraplate neotectonic deformation to be measured and velocity fields to be mapped and modeled.

Seismological data from the observatories will provide the first relatively high-resolution data on the Earth beneath the polar seas and ice sheets. Advanced techniques to image the Earth’s deep interior, such as seismic tomography, will be used to place constraints on the planet’s internal processes. Seismic imaging of the crust and mantle will assess causes for anomalously high elevations in East Antarctica, linked with ice sheet development, will provide information on heat flow and mantle viscosity that are key factors controlling ice sheet dynamics and the Earth’s response to ice mass change.

#### ***Program rationale and methodologies***

Owing to its remoteness and hostile environment, knowledge of Antarctic crustal motions, seismicity, and ice sheet evolution has remained poorly constrained relative to the northern hemisphere. By the middle of the next decade many new data sets will have been collected that will serve to advance our understanding of GIA. These include those from glacial geology (e.g., new and planned cosmogenic dating studies), marine geophysical surveys of ice sheet extent and retreat timing and direct observations of GIA using GPS. During the IPY, an unprecedented new GPS data set is being acquired through the deployment of the POLENET geophysical network across the entire Antarctic continent. POLENET data are being acquired by a large number of nations in individual projects. Complementary data are being acquired in the Arctic, particularly in Greenland, during the IPY. It is essential that an internationally coordinated approach to data analysis and synthesis be established in order to optimize the science outcomes of these new data sets. The proposed SERCE scientific research programme will provide the international framework and scientific leadership to investigate systems-scale solid earth – ice sheet interactions across Antarctica and relate these results to global earth system and geodynamic processes.

As the results of satellite missions aimed at detecting and monitoring changes in ice mass in the earth's polar regions are emerging, it has become increasingly clear how important it is to advance our knowledge of systems-scale GIA patterns. Because the spaceborne platforms measure an integrated signal that includes a GIA component, accurately removing this component is essential to deriving ice mass balance. Many recent authors have shown that the so-called "PGR [post-glacial rebound] correction" applied to remove the GIA component is the largest source of error in ice mass balance estimates derived from the time-varying gravity measurements from the GRACE mission. Ongoing studies of rapid change of outlet glaciers have shown that ice dynamical responses resulting in increased evacuation of ice, at least in part related to changes in basal conditions of the glaciers and ice sheets, are important controls on ice mass change. It is clear that *in situ* constraints and ongoing synthesis and modeling efforts evaluating GIA and other processes and feedbacks between the cryosphere and the solid earth system are now more urgent than ever.

SCAR has the opportunity to take a leading role in advancing in this aspect of Antarctic environmental change. Strengthened scientific ties between a variety of SCAR groups will accelerate this. The proposed SERCE programme would aim to promote integrative efforts such as:

- Improving ice sheet models, working with the ISMASS group, by combining GPS-derived uplift rates, knowledge of ice sheet substrate and basal heat flux derived from seismological observations, and ice sheet histories synthesized from glacial geology, marine geophysics and glaciological modeling.
- The GPS, seismic and meteorological data being collected by POLENET will be used by a global community that extends beyond the traditional polar community. The proposed SERCE group will help to ensure that the POLENET data from the polar regions are incorporated in global studies of environmental change, including studies of tropospheric water vapour and space weather, through working with the AGCS and ICESTAR programmes, as well as the proposed GPS-Weather cross-SGG group.
- Working with the PantOS group to provide a forum for remote station network information exchange and to help coordinate the use of remote networks such as POLENET as a platform for deployment of additional sensors (e.g., weather stations).

### ***Program management***

An international steering committee will be established for SERCE. A wide range of disciplinary experts to guide the developing science program, as well as representatives from the many nations contributing to acquiring POLENET data, will be assembled. The SC will interact with IRIS, UNAVCO, SCAR, IASC, and national polar operators to promote participation of the widest possible array of nations and researchers, to ensure coordination of technologies and logistics, and to establish open data archiving and access. The SC will plan annual workshops to review, assess and exchange results, and to promote integrated interpretation and modelling efforts. Thematic symposia will be planned at international meetings, with resultant publications.

### ***Initial Implementation Plan for SERCE SP Planning Group, 2008-2010***

1. Encourage and coordinate ongoing field deployments during IPY and beyond

2. Convene an multidisciplinary workshop to establish priority research themes and groups for the SERCE program:  
⇒April, 2009, before or after EGU, to be held in Modena, Italy, hosted by Alessandro Capra.
3. Convene a workshop aimed at establishing integrated data processing schemes for continent-wide POLENET data compilations  
⇒2010, to be organized by Reinhard Dietrich, Matt King, and others.
4. Organize thematic science sessions  
⇒AGU (2008)  
⇒EGU (2009)  
⇒IPY-Oslo - 2010  
⇒SCAR – 2010
5. Work with other international programmes with common goals to ensure appropriate integration of activities, e.g. the COST (European Cooperation in the field of Scientific and Technical Research) Action ES071 on *Improved Constraints on Models of Glacial Isostatic Adjustment* (Matt King, Chair).
6. Proposal for Scientific Research Programme: SCAR - 2010