

Scientific Committee on Antarctic Research**Standing Scientific Group on Physical Sciences****Report to the Delegates, SCAR XXIX July 2006**

SCAR funding for the next 2 years (in USD) - \$17K in both 2007 and 2008

Summary of five main achievements

1. The cross-SSG workshop in Amsterdam established links with the Life Sciences SSG for the provision of future climate scenarios for the assessment of environmental change during the next century.
2. The MOSAK workshop on the Antarctic wind field produced an important report assessing our current understanding of the near-surface flow across the continent.
3. A cross SSG workshop on climatic, biological and cryospheric variability was organised for SCAR XXIX.
4. The PASTA Action Group has shown that the Antarctic plateau is the best place on Earth for surface-based astronomy.
5. The ISMASS Expert Group and the ITASE project have facilitated the publications of a major review of Antarctic mass balance through a special volume of *Annals of Glaciology*.

Report of the SSG as a whole

The Standing Scientific Group on Physical Sciences (SSG/PS) was formed in July 2002 at SCAR XXVII during the major re-organisation of SCAR. It brought together SCAR's involvement in solar-terrestrial and astrophysical research, astronomy from the Antarctic, meteorology and atmospheric physics, recent climate change research and glaciology. It therefore covers a very broad range of scientific interests.

The first two years of the group's life were largely concerned with the planning of the two Scientific Research Programmes (SRPs) that come under the SSG - Antarctica and the Global Climate System (AGCS) and Interhemispheric Conjugacy in Environmental, Solar-Terrestrial and Aeronomy Research (ICESTAR). With the approval of these programmes at SCAR XXVIII the main focus of SSG/PS has been on its Action and Expert groups. In the following sections we provide detailed reports on the progress and plans of these groups, but here we highlight some points relevant to the SSG as a whole and concerns that need addressing.

The last two years have been very busy for many scientists working in Antarctic research preparing their plans for the IPY. This will offer an excellent opportunity to address many important questions that concern the SSG.

SSG/PS has continued to try and establish links with other organisations working in relevant fields, such as the Climate and Cryosphere Programme (CliC) of the World Climate Research Programme, the International programme of Antarctic Buoys (IPAB), the CLIVAR/CliC Southern Ocean Implementation Panel, the Cryosphere Theme of the Integrated Global Observing Strategy (IGOS), the International Antarctic Zone Programme, the Integrated Analyses of Circumpolar Climate Interactions and Ecosystem Dynamics in the Southern Ocean (ICED), the Scientific Committee on Solar Terrestrial Physics (SCOSTEP), the SCAR/SCOR Oceanography Group and the Integrated Partnerships in Ice Core Sciences (IPICS).

At its meeting in Hobart, the SSG considered our links with ICSU's Scientific Unions. It was felt that we already had good links with IUGG through its associations such as IAMAS and IAPSO. However, it was agreed to consider how we could establish better links between SCAR and the International Astronomical Union. We also agreed to examine the work of the International Union of Pure and Applied Chemistry (IUPAC) to see if their interests overlapped with those of SCAR.

There have been no significant problems in the running of the SSG over the last 2 years, but we would note the following points:

- Communications with the SSG/PS members in some countries was difficult. Soon after SCAR XXVIII messages from some email addresses started to be returned and it was not possible to find workable addresses. We would encourage the national SCAR programmes and the individual scientists to keep us informed of their current email addresses.
- Prior to SCAR XXIX it would have been very useful for the officers of the SSG to have been informed of the names of the national delegates to the SSG.
- There are still a number of SCAR nations who we have not been able to draw into our SRPs, despite them working in the relevant areas of science. We would encourage all the national programmes to participate in these world class programmes of science.

The 4 year terms of office of the SSG/PS Chief Officer, Deputy Chief Officer and Secretary came to an end in Hobart. A call for nominations for these three posts was issued several months ahead of SCAR XXIX and an election held at the second plenary of the group. The following officers were elected unanimously for a 4 year term:

Chief Officer – Dr. Maurizio Candidi (Italy)
 Deputy Chief Officer – Prof. David Bromwich (USA)
 Secretary – Dr. Tas van Ommen (Australia)

Reports on the Action and Expert Groups

Ice Sheet Mass Balance and Sea Level (ISMASS) Expert Group

There has been significant progress (by the national agencies and individual researchers) towards the scientific objectives of ISMASS during the past two years. Since Bremen most of the work of ISMASS has been carried out by email. The proceedings of the ISMASS/ITASE symposium in Bremen has been published by the International Glaciological Society in *Annals of Glaciology* 41, with financial support from SCAR.

During the next two years, ISMASS, with ITASE and ASPECT, will organise a major symposium on Antarctic Glaciology in the IPY. The symposium is planned to be held in 2008 in the week of or immediately after SCAR XXX, in St. Petersburg.

The scientific activities of various nations aimed at understanding the mass balance of the Antarctic Ice Sheet will continue, coordinated by the new ISMASS convenor, Dr. Kees van der Veen (USA).

Oceanography Expert Group

This Expert Group has been in existence for 2 years since it was converted from an Action Group at SCAR XXVIII. The overall goal of the Expert Group is to encourage an inter-disciplinary approach to Southern Ocean observations, modelling and research. The Group provides a framework to facilitate coordination between the physical oceanographic research groups and to identify historical and reference data sets.

The initial focus of the Group is on physical oceanography. An important aspect of this focus is to bring together scientists and data managers who can aid in establishing a comprehensive set of historical Southern Ocean data comparable to the comprehensive READER data set compiled for the atmosphere. The potential of the International Polar Year (IPY) will be used to address data holders. The review of available Southern Ocean data sets undertaken by the Group showed that ongoing efforts by Dr. A. Orsi (Texas A&M University) have resulted in a comprehensive data set with more than 90,000 hydrographic stations. This data set is available in digital and printed forms and includes analysis tools that are easy to use. This data set is complemented by the efforts of Dr. M. Meredith (British Antarctic Survey) in the context of AGSC. The task now is to keep the maintenance of those efforts ongoing and to provide actual data sets to the community. In spite of close cooperation with CLIVAR, JCADM and IPY this is a demanding task because sustainable funding is needed.

Three major topics will be addressed over the next 2 years:

1. To make multidisciplinary data sets available to the community and secure them for the future.

2. To draw attention to the increasing concentration of CO² in the atmosphere, which will potentially result in a significant change of the biogeochemical status of the Southern Ocean.
3. The Group will take the lead in bringing together current observing system plans for the Southern Ocean into an integrated design plan, identifying gaps and working to eliminate these. This initiative will build on the work of the CLIVAR CLiC project and the POGO/CoML workshop to be held in Hobart on July 15, 2006.

The Antarctic Astronomy and Astrophysics (AAA) Expert Group

This Expert Group coordinates efforts to explore the potential for astronomical observations in the Antarctic. The Earth's atmosphere is *the* major problem for ground-based astronomy and the Antarctic plateau is an outstanding location for visible and infra-red astronomy because it is high, cold and has smooth, stable, low-turbulence air-flow to reduce refractive index variations.

Over the last two years AAA has been considering the whole question of how SCAR should be involved in astronomy and astronomical site testing on the continent. The PASTA Action Group (report below) has completed its 4 year lifetime. AAA would like to have an SRP on Astronomy from Antarctica. To this end AAA would like to form a Programme Planning Group (PPG) on Antarctic Astronomy. This would prepare a draft outline proposal to be presented to the SCAR Executive in July 2007. If the proposal was received favourably a full proposal would be prepared for SCAR XXX in 2008.

Plateau Astronomy Site Testing in Antarctica (PASTA) Action Group

This group is concerned with testing of specific sites across the continent that may be suitable for astronomical studies. South Pole is well characterised following a decade (1994-2004) of site testing and many successful astronomical experiments. Recent work has concentrated on investigating the conditions at Dome C, and plans have been prepared for site testing at Dome A. There have been many successes over the last 2 years. Analysis of Automatic Weather Station data, and summertime precipitable water vapour measurements using a portable photometer at Dome C, confirm the potential of the site for millimetre astronomy. The first measurements of the IR sky brightness were also made at Dome C. A Chinese expedition to Dome A in 2004/5 installed an automatic weather station built by the AAD, and a CCD camera built by UNSW. New traverses are planned for 2007/8 and 2008/9.

In the future Australia (UNSW), in collaboration with Italy and France, is building a special-purpose SODAR to measure the boundary layer thickness to ~ 2 metre precision. A joint China-Australia experiment to site-test Dome A beginning in 2007/8. This will hopefully lead to HEAT, a terahertz telescope at Dome A, PILOT, a 2.4-metre optical/IR telescope at Dome C, LAPCAT, an 8.4-metre optical/IR telescope and GMTA, 21-metre optical/IR "extremely large telescope".

A consortium of 21 scientific institutions, industrial companies and the two Antarctic programmes of France and Italy (ARENA) has been funded by the EC to network on the subject of developing plans for astronomy at Dome C.

Operational Meteorology Expert Group

This group was formed to provide a link between the research community of Antarctic meteorologists and climatologists, and the operational meteorological observing and forecasting groups. It mainly works via email, although a meeting was held in Hobart at SCAR XXIX. The group has a web site at http://www.antarctica.ac.uk/met/jds/met/SCAR_oma.htm, which is regularly updated with news, background information and links to other appropriate sites.

The group has been active in a number of ways. Support to improve the distribution of Antarctic synoptic data from manned stations, AWS and ships has been provided. The convenor of the group, Jon Shanklin, provides linkage between SCAR and WMO through his role with SCAR and as the UK member of the WMO EC-Working Group on Antarctic Meteorology and chair of its expert group on Antarctic telecommunications. As a result of the SCAR READER project, BAS is now the GCOS lead centre for Antarctica, which allows a further channel for communication.

Ice Core Drilling Expert Group

The SCAR Expert Group on Ice Drilling was formed in 2004 to be a focus for both the Antarctic and Arctic ice drilling communities and to share knowledge of the technology in this rapidly advancing field. An informal meeting on deep ice core drilling was held at Schneefernerhaus meteorological observatory in Germany in September 2004. This was sponsored by the AWI and attended by 17 drillers from 8 countries. At this meeting a plan was put forward to develop a charter for the group and to develop a potential structure. The next workshop is scheduled for September 2006 in the US, sponsored by NSF. The group has considered the challenges to drilling including drilling in warm ice (basal conditions), sub-glacial sampling, better quality ice core in brittle zone, fast access drilling, replicate sampling and contamination-free sampling of sub-glacial water.

Action Group on King George Island Science

This group was established in 2004 to review the science that is taking place on the island and to try and suggest means by which coordination could be improved to make better use of the available resources.

Over the last 2 years the focus has been on creating an inventory of the science that is currently taking place on the island. The main activities have been concerned with meteorology and other physical sciences. However, over the next 2 years it is intended to have greater involvement of the biological community. By SCAR XXX we will have a complete inventory of KGI science and a series of recommendations regarding cooperation and coordination.

A special KGI Action Group web-site has been created at the Russian Arctic and Antarctic Research Institute (<http://south.aari.nw.ru>).

Action Group on Modelling and Observational Studies of Antarctic Katabatics (MOSAK)

MOSAK was created in 2002 to try and improve our understanding of the Antarctic near-surface wind field, which is of great importance to understanding the climatology of the continent. It has a major impact on blowing snow, sea ice, polynyas, coastal oceanography and operations. Over the last two years case studies have been carried out on Antarctic extreme wind events, improving the representation of winds in climate models and assessing how the wind field will develop over the next 100 years.

A workshop on the Antarctic wind field was held in Kuala Lumpur, Malaysia in March 2006. Here the progress with MOSAK was reviewed and a series of recommendations made for future work. It was suggested that a higher resolution Antarctic wind field be produced at a resolution of around 10 km for validation of climate models. It was also suggested that the network of automatic weather stations be maintained both for research applications and for use in weather forecasting. Assessment of future climate scenarios suggests that the katabatic winds will decrease slightly over the next century as temperature on the plateau are expected to rise by several degrees. A report on the meeting has been submitted to the Bulletin of the American Meteorological Society. At the SSG plenary it was agreed that the work of MOSAK would move into the AGCS SRP.

IPY Contributions

Scientists from SSG/PS are involved in a large number of IPY projects. For example, AGCS is involved with nine IPY projects and 47 Expressions of Interest were submitted from ICESTAR. Two EOIs were submitted on astronomy from Antarctica.

Progress with recommendations

At SCAR XXVIII SSG/PS had three internal recommendations and seven external. Progress on these is discussed below.

Internal recommendations

Recommendation SCAR XXVIII – 1 An Expert Group on Oceanography

Established.

Recommendation SCAR XXVIII – 2 A new Action Group on King George Island science

A cross-SSG Action Group has been established.

Recommendation SCAR XXVIII – 3 A new Expert Group on Ice Drilling Technologies

Established.

External recommendations

Recommendation SCAR XXVIII – 13 Concerning site testing for astronomical observations

Some instrumentation has been deployed on the Antarctic Plateau to assess conditions for astronomy, but there is still scope for additional deployments.

Recommendation SCAR XXVIII – 14 Concerning drifting buoys

The International Programme for Antarctic Buoys (IPAB) notes that there have been a number of deployments over the last 2 years, although the geographical distribution is not optimal and there is a need for additional buoys with the IPY imminent.

Recommendation SCAR XXVIII-15 - Concerning continued support of existing geospace observatories

Networks of HF radars, magnetometers, and auroral instruments are being completed and extended.

Recommendation SCAR XXVIII - 16 Concerning the transmission of space weather data

Broadband communications is increasingly being used to transmit scientific data from the Antarctic to some national operators.

Recommendation SCAR XXVIII - 17 Concerning Mesosphere-Stratosphere-Troposphere Incoherent Scatter (MST/IS) Radar

Planning is still underway for the deployment of a MST/IS radar.

Recommendation XXVIII - 18 Concerning upper air meteorological data from the Antarctic Peninsula

Rothera is launching several radiosondes a week, but additional radiosonde launches are needed, especially from the tip of the peninsula..

Recommendation SCAR XXVIII - 19 Concerning meteorological reports from Dome C

A surface and upper air meteorological programme has been established at Dome C.

Points for the delegates to note.

The SSG asks the Delegates to note that we have established three new groups. These are described in detail in Annex 1.

1. A new Action Group on Pan-Antarctic Observations Network (PAntOS)

The proposed multidisciplinary Action Group on the Pan-Antarctic Observational Network (PAntOS) will focus on compiling details about the currently existing observational networks in the various scientific disciplines covered under the umbrella of the SSG/PS. The main goal of the proposed Action Group is to address the scope and implementation strategies for the follow-on development of the interdisciplinary Pan-Antarctic Observations Network encompassing the Antarctic Continent and the surrounding Southern Ocean. The optimum network scale for each element of the observing system will be investigated. This system of observing networks will focus on the measurement of conditions and detection of fundamental variations. The network

will serve both scientific and operational needs, and will help for high-resolution regional climate reanalysis poleward of 50°S.

2. A new Action Group on Contamination

Based on data available today, a detailed map of environmental contamination over a vast area of Antarctica can be drawn, with respect to the various classes of pollutants, sulphur-containing organic compounds, heavy metals and radio-nuclides.

The new Action Group's objectives are as follows:

1. To understand the mechanisms and processes controlling distribution and transport of micro-components in polar environments, and their environmental effects.
2. To assess the effects of global climatic changes on processes controlling the dispersion and transport of micro-components and to estimate the contribution of micro-components on climate and environmental changes in polar regions.
3. To elucidate and quantify the chemical exchange processes between the atmosphere and Antarctic ice and snow.
4. To monitor the environmental characteristics in Antarctica and set up a data base of environmental parameters to follow the environmental evolution in polar regions.

A workshop is planned in Italy next year, possibly in Venice.

3. A new SRP Programme Planning Group on Antarctic Astronomy and Astrophysics

A new Scientific Research Programme planning group has been established within SSG/PS, to prepare a proposal for a new SRP. The objective is to formulate a proposal to coordinate the astronomical and astrophysical research carried out in Antarctica. The scientific objective of the new programme will be to investigate all aspects of research on the formation of the Universe, the formation of new stars, the evolution of the observation of such systems through the various ranges of wavelength, the formation of stellar system, the search for extrasolar planets, and the search for biosignatures on extrasolar planets. Both observations of electromagnetic signals and particles will help to understand the structure and evolution of the systems under study.

New Recommendations

Internal to the SSG

The Delegates are asked to note several recommendations internal to the SSG, which are listed in Annex 2.

Recommendations internal to SCAR

Recommendation SSG/PS - 1 - Concerning International Partnerships in Ice Core Sciences

Recognising the value of the palaeoclimate archive contained in ice cores, on a range of time scales spanning annual/decadal periods through to glacial cycles;

- *highlights* the IPICS (International Partnerships in Ice Core Sciences) initiative, a group of specialists from 19 countries, who have met several times, sponsored by the NSF OPP and EPC, to focus the goals

of the discipline over the next 10 to 15 years, specifically four themes which have been developed into White Papers:

- *The oldest ice core*: A 1.5 million year record of climate and greenhouse gases from Antarctica;
- *The last interglacial and beyond*: A northwest Greenland deep ice core drilling project;
- *The IPICS 40,000 year network*: a bipolar record of climate forcing and response;
- *The IPICS 2kyr array*: a network of ice core climate and climate forcing records for the last two millennia;

Noting the complementary nature of the research goals of IPICS with existing SCAR Science Programmes, particularly ACE and AGCS (including the ITASE project) and the reliance on the technical expertise of the PS SSG Ice Drilling Expert Group;

Welcomes the establishment of an international network of scientists and engineers committed to drive forward ice core research into the future;

Recommends:

- SCAR endorsement and co-sponsorship of IPICS.

Recommendation SSG/PS – 2 The biogeochemical status of the Southern Ocean

The increasing concentration of CO₂ in the atmosphere and the consequences for the biogeochemical status of the Southern Ocean in particular the pH of the ocean are issues of concern. They may have consequences for the ecosystem of the Southern Ocean and require monitoring and research. SCAR should support research being undertaken by IMBER and SOLAS in this area. In particular, SCAR should encourage the SCAR Evolution and Biodiversity group to consider and discuss this issue. There should be particular attention given to this issue at the next Ocean Science conference, i.e. a special session.

Recommendations external to SCAR

Recommendation SSG/PS - 3: Concerning Upper Air Meteorological Data from the Antarctic Peninsula. (replaces XXVIII-18 (see above)).

Recognizing the importance of upper air observations for operational numerical weather prediction in the Antarctic Peninsula, a region of marked climatic change over recent decades,

SCAR urges National Operators of Antarctic Programmes based in the Antarctic Peninsula to re-activate routine radiosonde measurements, especially from the tip of the peninsula.

Recommendation SSG/PS - 4: Concerning Upper Air and Ionospheric Observations Along the Antarctic Peninsula

Recognising that the Antarctic Peninsula is a unique topographic feature that may significantly interact with the tropospheric flow and thus may be a source of atmospheric gravity waves, which can propagate to ionospheric heights,

SCAR urges (i) countries making upper air and ionospheric observations along the Antarctic Peninsula to continue to do so regularly at least till the end of the IPY, and preferably beyond, and (ii) countries not making such measurements either to do so or to consider providing some financial support to those which do so.

Recommendation SSG/PS – 5 Concerning monitoring of solar-terrestrial parameters during the IPY

In view of IPY, there is concern regarding planned closures and/or delays in the commissioning of instruments that will provide irreplaceable data during the IPY timeframe. Examples are: the Antarctic SuperDARN radars, VLF receivers, magnetometers, and ionosondes. The Scientific Committee on Antarctic Research (SCAR) recommends support by national funding agencies for continued operation during, and advanced commissioning of new instrumentation to be ready for the International Polar Year (IPY) 2007-2008.

Recommendation SSG/PS – 6 Concerning Sea ice observations

The Antarctic Sea Ice and Climate Program has developed a protocol for making standardised and quantified observations of sea ice properties from vessels operating in the Antarctic pack ice zone. The ASPECT data archive now comprises 83 voyages of data that provide an extremely valuable resource to the climate and modelling communities. The SSG/PS recommends that COMNAP urges national programmes to contribute sea ice observations made from their icebreaking research and supply vessels. This may include training of ship officers to conduct observations.

Recommendation SSG/PS – 7 Concerning Drifting buoys

As part of the plan for increased observations in the sea ice zone for IPY, SCAR encourages delegates to commit financing for one or more data buoys to be deployed by the logistic resources which is being coordinated by the International Programme for Antarctic Buoys.

Recommendation SSG/PS – 8 Concerning Meteorological observations for weather forecasting and the IPY

Real-time surface meteorological observations from both land and sea remain critical in providing accurate weather forecasts. Such observations are also vital for many science programmes and are the key data for studies of climate change. SCAR recommends that:

- a) All research and supply ships operating in Antarctic waters and traverse parties (using the MOBIL code) should contribute real-time meteorological observations to the WMO GTS.
- b) Climatic data from land stations should be submitted to GCOS via the WMO GTS shortly after the end of each month.
- c) In order to help planning of instrument deployment opportunities the group requested COMNAP to construct a web page listing intended ship movements.
- d) meteograms for Antarctic and sub-Antarctic stations should be put in the public domain.

Budget

Physical Sciences SSG Budget for 2007 and 2008

Activity	2007	2008
IPICS	1700	-
ISMAS	1700	5K
Oceanography	3350	5K

Ice Drilling Workshop	1700	1700
PANTOS	-	1700
High Latitude Climate Change Workshop	3350	-
SSG Cross Linkages Meeting	900	950
IGOS/Cryo Report	1700	-
Contamination Action Group	900	950
Astronomy	1700	1700
Total	17K	17K

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XXIX SCAR Agenda 4.3

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Annex 1. Points for the Delegates to note

1. A new SSG/PS Action Group on Pan-Antarctic Observations Network (PAntOS)

A Multidisciplinary Action Group of the Standing Scientific Group on Physical Sciences (SSG/PS)

Antarctica is a region with a very limited record of conventional observations – with low spatial coverage and only about half a century of regular observations. Although climate changes across the Antarctic continent and Southern Ocean are not yet as pronounced as are currently seen in the Arctic, expected environmental changes in the Antarctic might be abrupt and pose specific concerns such as a high risk of rapid sea level rise due to melting and destruction of the West Antarctic ice sheet. Connecting solar-terrestrial (geospace) physical processes to the Antarctic atmosphere dynamics may help in identifying triggering mechanisms for environmental change in the snow and ice cover and ice sheets dynamics.

These make compelling arguments for a re-evaluation of the existing Antarctic observation infrastructure and recommending improvements that will help deliver a coherent set of pan-Antarctic, long-term, and multidisciplinary observations focused on the entire chain of effects from geospace to the Earth's surface. An important focus will be on integrating the conventional observations with the vast amounts of satellite remote sensing that are currently available for high latitudes of the Southern Hemisphere. It is impossible to describe current environmental conditions in the Antarctic without these synthesized observations, let alone understanding of some of the climatic changes that are underway around the Antarctic Peninsula and their connections to the rest of the Earth climate system.

The proposed multidisciplinary Action Group on the Pan-Antarctic Observational Network (PAntOS) will focus first on compiling details about the currently existing observational networks in the various scientific disciplines covered under the umbrella of the SSG/PS. The main goal of the proposed Action Group is to address the scope and implementation strategies for the follow-on development of the interdisciplinary Pan-Antarctic Observations Network encompassing the Antarctic Continent and the surrounding Southern Ocean. The optimum network scale for each element of the observing system will be investigated. This system of observing networks will focus on the measurement of conditions and detection of fundamental variations of physical parameters in the Antarctic system, providing data that are easily compared and analyzed via cyberspace-based tools (e.g., virtual observatories). The network will serve both scientific and operational needs, and will help for high-resolution regional climate reanalysis poleward of 50°S.

The PAntOS network can be built on and enhance existing national and international observing efforts for the delivery of easily accessible and reliable pan-Antarctic observations. The PAntOS Action Group will:

- 2007 Deliver a comprehensive analysis of the existing observations networks with an initial assessment of where deficiencies or over-provision exist, and recommend protocols for including data in a Virtual Antarctic Observatory.
- 2008 Provide recommendations to improve and enhance existing systems for the forming of the interconnected multidisciplinary Antarctic observing network.

An initiative group: (to be extended in an inclusive effort for wider geographical membership, especially among SCAR member countries)

David Bromwich (USA; atmosphere)

Berry Lyons (USA; oceanography)

Victoria Lyttle (Norway; cryosphere)

Paul Mayewski (USA; snow and ice)

Scott Palo (USA; aeronomy)

Vladimir Papitashvili (USA; solar-terrestrial sciences)

Jonathan Shanklin (UK; meteorology)

2. A new Action Group on Environmental Contamination in Antarctica

Life and its environment on Earth form a tightly coupled system. Understanding the way this system functions and interacts is a formidable scientific challenge, and it is also an urgent priority owing to the growing effects of human activities on the quality both of life and environment. From this point of view, Antarctica is a unique area for monitoring the global environmental quality, for studying the processes controlling the transport and dispersion of micro-components at global level, and for assessing their relationships with climate changes.

Leading scientific organizations involved in polar studies are planning to carry out inter-disciplinary research, monitoring and surveying activities designed to extract new knowledge from the Antarctic continent from which national and international policy and society should benefit. The main objective of these programs is to determine key drivers that control climate change and the processes influencing the global atmosphere past and present. Data and feedback from this can then be employed to improve models used to predict climate change and their environmental effects.

The possibility to study records of atmosphere, snow and ice composition as a function of time together with the improvement in the knowledge of interaction ice/atmosphere/water make this continent the ideal environment to carry out these studies.

The international context

There are several research projects going-on at an international level on this matter. The following are some of the most important:

- the British Antarctic Survey has set up a project entitled “Climate and Chemistry: forcings, feedbacks and phasings in the Earth System (CACHE)” in the framework of “Global Science in the Antarctic Contest (GSAC)”. The aim is to determine the key drivers that have controlled climate change and the chemistry of the global atmosphere past and present, and to improve computer models used to predict climate change;

- the Australian Antarctic Division has undertaken a project on the impact of human activity on Antarctica;

- the Belgian research program on the Antarctic is mainly focused to contribute to the development of the knowledge required for a science-based conservation and management of the Antarctic environment and to the assessment of the mechanisms through which the Antarctic and the global climate interact.

In the last 20 years Italy has been carrying out research in Antarctica with regard to Environmental Contamination. This has led to a decisive contribution in the development of new environmental policies by providing reference values of various contaminants for the whole world and by acting as a stimulus to other countries to set up similar projects. The integration of these projects can represent a more efficient solution to safeguard environment a global scale. The data which have been obtained so far within the Italian Research Programme in Antarctica allow to assess the distribution of micro-components either contaminants and not contaminants, to understand some processes affecting the environmental characteristics at local and global scale. Some of the most significant results are briefly reported

Environmental contamination

On the basis of data available today, we can draw a detailed map of environmental contamination over a vast area of Antarctica. This map related to the various classes of pollutants, sulphur-containing organic compounds, heavy metals and radio-nuclides. The following are some of the most significant results which have highlighted important aspects at a global level:

the lead decrease and the corresponding increase in PGE (Platinum Group Elements) and PAH concentration in ice cores as a consequence of the massive introduction of catalytic converters during the 80th; (figure 1)

a significant flattening in CFC growing curve in atmosphere as a consequence of the international limitation in their use;

the seasonal variation in the content of metals (toxic and essential) in marine waters which should help us to better understand the effects of climate change; (figure 2)

the influence of the cosmic dust on the ozone cycle and on the global climate conditions of our planet.(figure 3)

Exchange processes between atmosphere and oceans

Studies on global changes have investigated the exchange processes between the atmosphere and sea surface, and also the role played by the sea-surface micro-layer in the mechanisms of the formation of the marine aerosol which spreads and transports pollutants at a global level.

The sea-surface micro-layer was sampled using a prototype of a sampling system developed within this project. This micro-layer was found to contain various classes of organic micro-pollutants, up to one hundred thousand times higher than in the seawater underlying this layer.

A chemical analysis of ice cores enabled us to study the variations in the oceanic productivity over the course of past eras, via the reconstruction of atmospheric input of iron and other bio-essential elements. The variations in the oceanic input of these elements significantly affect climate change (figure 4).

The most significant results have highlighted processes of great interest at a global level. For example:

seasonal variation in the content of sulphur-containing organic compounds in marine waters, which should aid our understanding of the mechanisms that regulate climate change;

the distribution of the organic micro-pollutants in sub-surface waters, micro-layers and aerosols that help to clarify the exchange processes between water and atmosphere, and the transport of micro-components via the marine aerosol (table).

Reference materials and specimen bank

To warranty accuracy of results were prepared certified reference materials for Antarctic matrices that have been obtained via international circuits. The materials, actually available for the international scientific community, are distributed in Italy by ENEA, by the Istituto Superiore di Sanità, and by two prestigious international institutions: IRMM (in the EU) and NIST (in the USA).

The development of the Antarctic Environment Specimen bank represents the only tool at an international level for the verification (even retrospective), of the validity of experimental data. In the future it will enable the investigation of any new issues that might emerge arising from new scientific knowledge.

Preliminary list of the Action Group's objectives

To understand mechanisms and processes controlling distribution and transport of micro-components in polar environments.

To assess environmental effects of micro-components on polar regions

To assess effects of global climatic changes on processes controlling the dispersion and transport of micro-components.

To estimate the contribution of micro-components on climate and environmental changes in polar regions.

To elucidate and quantify the chemical exchange processes between the atmosphere and Antarctic ice and snow.

Monitoring the environmental characteristics in Antarctica and setting up one data base of environmental parameters to follow the environmental evolution in polar regions.

Future actions

The proposers are planning to organize a workshop in Italy next year, possibly in Venice. Representatives of several countries will be invited to participate in the preparation of the final document which will be finally submitted to the Standing Scientific Committee in Physical Sciences of SCAR.

International Organizations which have already expressed interest to this Action group

Prof. Kevin Rosman
Applied Physics Department, Curtin University, Perth, Western Australia

Prof. Claude Boutron
LGGE, Grenoble France

Dr. Sungmin Hong
Korean Polar Research Institute, KORDI, Ansan, South Korea

Prof. Berry Lyons
Byrd Polar Research Center, Ohio State University, Columbus, Ohio, USA

International Organizations which are expected to expressed interest to this Action group

Dr. Qu Tanzhou
Director of the Chinese Arctic and Antarctic Administration, Beijing, China

Prof. Guibin Jiang
Research Center for Eco-environmental Sciences, Chinese Academy of Sciences, Beijing, China

3. A new Scientific Research Program planning group on Antarctic Astronomy and Astrophysics

Astrophysical observations require minimum interference from the Earth's atmosphere, low thermal background, low absorption and high angular resolution. The moderate "launch costs" for Antarctic plateau observatories make them an attractive alternative to space.

Astronomy from the Antarctic came of age in the last decade with a cosmological result of major significance. Balloon-borne millimetre observations of the cosmic microwave background from the first BOOMERANG flight led directly to the discovery of the zero-curvature Universe. Submillimetre astronomy has also prospered in the Antarctic: the South Pole Telescope is expected to deliver a large-area survey of the hot gas in clusters of galaxies with a uniquely uniform redshift distribution; this will probe the nature of "dark energy", the biggest constituent of a "flat" Universe.

Now it is time for SCAR to initiate "*Astronomy and Astrophysics from Antarctica*" aimed at understanding the overarching ecological processes in the Universe, from the formation of the Universe itself, to the birth of stars and of planetary systems around stars other than the Sun, the evolution of stellar systems from one wavelength range to the other, the return of heavy element enriched materials to the interstellar medium, and the formation of molecular clouds.

SCAR will add value by fostering international cooperation in order to permit goals to be achieved that are beyond those of single national programs. Primary objectives for AAA will be exoplanet biosignatures, high angular resolution, time domain astrophysics, microwave cosmological background radiation studies.

In the next two years the AAA Planning group will consult with the community, clarify the objectives of the research in these and other proposed astrophysical themes, and create a roadmap that will allow groups to make progress towards achieving these goals.

The notion of precursor projects is a useful one in road-mapping. National goals will differ for facilities of common interest. It is important to pursue the scientific goal of a facility all the way to the science. A multi wavelength approach will be necessary to meet SCAR's expectations for a full AAA program. Multidisciplinary links outside astronomy also need to be addressed in the roadmap.

SCAR can enhance the scientific value of Antarctic astronomy by moving to establish the AAA Scientific Research Programme at this time. The benefits of coordination and international collaboration will be keenly felt. A strong AAA program will also strengthen the accomplishments of SCAR, with the promotion of frontier science driven coordination and collaboration.

The AAA Scientific Research Programme planning group will be made up of members of the existing AAA Expert Group plus other contributors, and will produce a preliminary proposal for the 2007 SCAR Executive with a view to submitting a full, formal proposal to the 2008 SCAR meeting in St Petersburg. Once the AAA Scientific Research Programme is established, the AAA Expert Group will be dissolved.

Jeremy Mould and John Storey for the AAA Expert Group, July 2006.

Annex 2. Recommendations internal to SSG/PS.

Expert Group on Operational Meteorology in Antarctica

1. SCAR web sites should use the .aq domain if possible.
2. The group recommended that the SCAR READER database should be extended to cover the sub-Antarctic islands.

Annex 3

1) ICESTAR recommendation

In view of IPY, there is concern regarding planned closures and/or delays in the commissioning of instruments that will provide irreplaceable data during the IPY timeframe. Examples of instruments that are essential to the fulfillment of ICESTAR objectives, and which are believed to be under threat of closure or temporary cessation of operation include: the Antarctic SuperDARN radars, VLF receivers, magnetometers, and ionosondes. In-situ instruments with a smaller field of view at a specific Antarctic location are unique, as large distances between stations often mean there is no overlap in instrument fields-of-view. Sensors with wider fields-of-view that do overlap, such as SuperDARN radars, do not necessarily observe the same physical phenomena due to radar aspect angle considerations when scattering from ionospheric convection patterns; the larger bi-hemispheric picture of geophysical phenomena during IPY is thus likely to be compromised. The loss of these instruments during IPY will significantly compromise our ability to measure and understand the upper atmosphere in both polar regions that is the goal of the SCAR ICESTAR programme and its associated IPY programme. The Scientific Committee on Antarctic Research (SCAR) recommends support by national funding agencies for continued operation during, and advanced commissioning of new instrumentation to be ready for the International Polar Year (IPY) 2007-2008.

2) ANTARCTIC PENINSULA TROPOSPHERE IONOSPHERE COUPLING (APTIC) (recommendation to SCAR)

Considering that

The Antarctic Peninsula is a unique knife-edge topographic feature in the Antarctica which may significantly interact with the tropospheric flow and thus may be a source of atmospheric gravity waves which can propagate to ionospheric heights.

There is a renewed interest on the determination of a gravity wave climatology for Antarctica using current satellite radio occultation techniques.

There are long series of meteorological, upper air and ionospheric observations along the Antarctic Peninsula which have been used to derive reference climatological features.

It is highly important to compare ground based observations and satellite determinations to ensure a better understanding of gravity wave activity.

SCAR strongly recommends that

Upper air and ionospheric observations along the Antarctic Peninsula should be continued on a regular basis at least till the end of the International Polar Year.

Countries currently supporting these observations be encouraged to provide further funding to secure the continuation of these observations.

Countries not participating in the observations consider the possibility of providing some funds to help to this end.