WP 09

Agenda Item: 5.3

Person Responsible: Maurizio Candidi

XXXI SCAR Delegates Meeting

Buenos Aires, Argentina, 9-11 August 2010

SCAR Standing Scientific Group on Physical Sciences (SSG/PS)

Report to the Delegates, SCAR XXXI, 9 August 2010

Executive Summary

Title: SCAR Standing Scientific Group on Physical Sciences (SSG/PS), Report to the Delegates, SCAR XXXI Aug. 9th, 2010

Authors: M. Candidi, D. Bromwich, T. van Ommen

Relevant URLs or references to other reports:

Introduction/ Background:
No comments were raised at the SSG/PS business meeting on the content of the Strategic Plan. SSG/PS was invited to send comments to SCAR. No major change to the structure of the SSGs was deemed necessary. The structure and cadence of the OSC were addressed; no consensus was reached on possible improvements.

The achievements of the current SRPs were noted; appreciation was expressed for the developments; AGCS is looking at future updates of the ACCE report; ICESTAR is coming to a termination as an SRP, after achieving the major objectives, especially with respect to the establishment of several VOs. The AAA program raises wide expectation for the results to be achieved. Some ideas for future SRPs were proposed to SSG/PS: ATHENA, to proceed on sub-glacial lakes, after SALE; ocean acidification; GPS studies of the ionosphere; ISMASS.

Important Issues or Factors:
The present roster of Expert/Action groups was analysed:

- The importance of the ISMASS program was underlined; its leadership shall be extended to C. Hulbe and Francisco.... to ensure connection with IASC so that ISMASS develops into a fully bipolar group with the IASC Working Group on Glaciology.
- R. Bellerby presented the Ocean Acidification theme; the formation of a new Action group on the subject, joint with LS, was approved. The new group may consider developing into an SRP, as suggested by the cross-SSG meetings.
- SSG/PS approves the idea that the ECA action group should develop into a joint group with LS, to include biological aspects of Antarctic contamination.
- PCPBEA: SSG/PS notes the positive developments and encourages further action.
- IPICS plans extention of the scope of the Greenland NEEM project to encompass the last interglacial period in ice cores from both hemispheres. The potential for a new high-resolution Antarctic record at comparable resolution with the NEEM core over a similar period is being considered.
- The WSWF Action group is finding synergies with the GIANT and POLENET groups of GS; ICESTAR is considering ways to interact with WSWF, generating joint scientific objectives. This is again an effect of the cross-SSG meetings initiative.
- The SOOS program of the EG Oceanography produced its implementation plan.
- The Operational Meteorology group reports that since Sept. 2009 there are two radio-sonde launches per week from Marambio; this is in part a product of the recommedations on King George Island activities.
- PACT developed the database relevant to their new definition of the chemical tropopause; the action group will be dissolved after the publication of their results.

Budget Implications: Estimated SCAR funding needed by SSG/PS for the next 2 years (in USD) $ 21.700 in 2011 and $ 21.700 in 2012. (Pending approval of the finance committee)

SCAR Standing Scientific Group on Physical Sciences (SSG/PS)

Report to the Delegates, SCAR XXXI Aug. 9th, 2010

Summary of main achievements within SSG/PS:

1) AGCS led the cross-SCAR development of a major review on Antarctic Climate Change and the Environment (ACCE), synthesizing knowledge on past, present and possible future changes in Antarctica and the Southern Ocean, and their impact on the biota (http://www.scar.org/publications/occasionals/acce.html). Two talks on ACCE were presented by the SCAR Executive Director at the UN Framework Convention on Climate Change conference (Copenhagen, December 2009). A review summarising the results of the ACCE work was published in December 2009 in Antarctic Science by Convey et al. A more limited version entitled "State of the Antarctic and Southern Ocean Climate System (SASOCS)" appeared in Reviews of Geophysics (Mayewski et al., 2009)
2) ICESTAR scientists presented in Nature images of the aurora taken simultaneously in the Northern and the Southern hemispheres. These images reveal indisputable evidence that the auroras in the two hemispheres can be totally asymmetric. These findings contradict the commonly made assumption of aurora being mirror images of each other. See Laundal, K. M. and Østgaard, N., Nature 460, 491-493 (2009).
3) Following a request made to ATCM by the Stockholm Convention for information on persistent organic pollutants in the Antarctic Treaty Area, SCAR's Action Group on Environmental Contamination in Antarctica (ECA) prepared a comprehensive report I(P 69, *Persistent Organic Pollutants in the Antarctic: an Update, in the documentation of ATCM., ATCM meeting 2009).*
4) In the framework of the activity of AAA, the new SRP, Astronomy and Astrophysics in Antarctica, the ARENA consortium (Antarctic Research European Network for Astrophysics), supported by the European Union, released a roadmap for further development of astronomy and astrophysics on the Antarctic plateau. It is based on the results of the investigations made by experts in atmospheric physics and several relevant fields of astrophysics, from 8 countries; it identifies the science cases that would most benefit from the Antarctic plateau conditions. It describes a suite of appropriately designed instruments and projects. Main focus of the study was the Antarctic French-Italian base at Dome-C. (see http://arena.unice.fr/IMG/pdf/ARENA_leaflet_english.pdf)

Report of the SSG as a whole

The most relevant innovation in the operation of SSG/PS consists in the periodical meeting with the other SSG's and the SCAR executive, to discuss ideas that may lead to cross-SSG activities, and in the end to cross disciplinary research programs. Three such meetings have been conducted until now, and several of the successful SCAR groups that are now active derive from discussions held in those occasions. PCPBEA, GWSWP are to be mentioned, regarding SSG/PS.

SSG/PS and the IPY:

AGCS contributions to IPY :

- Multi-national traverses across Antarctica as part of the International Trans-Antarctic Scientific Expedition (ITASE) to measure ice thickness, snow and ice chemistry, snow accumulation rates and ice flow, thereby reconstructing climate;
- Brazilian-Chilean-USA ice core drilling and airborne radar survey on the Detroit Plateau, Antarctic Peninsula, for the Climate of the Antarctic and South America (CASA) programme;

- Oceanographic transects across the Southern Ocean and the Antarctic margins as part of the Climate in Antarctica and the Southern Ocean (CASO); and Synoptic Antarctic Shelf-Slope Interactions Study (SASSI) programmes.
- Two cruises of the UK-USA Diapycnal and Isopycnal Mixing Experiment in the Southern Ocean (DIMES), which seeks to test and redefine the present paradigm of Southern Ocean mixing and its grip on the ocean's overturning circulation.

Heliosphere Impact on Geospace, ICESTAR contributions to IPY.

- International Polar Year Project #63: Heliosphere Impact on Geospace, included 29 international research groups and was jointly managed by the SCAR ICESTAR program and the International Heliophysical Year (IHY) group (IHY, http://ihy2007.org). During the IPY years, IHY established, with the support of the United Nations, space science activities in several developing countries.
- The outcome of these activities is summarized in the book "Putting the "I" in MIHY" (Editors: Thompson, Gopalswamy, Davila, and Haubold). Multinational IHY research still continues through the International Space Weather Initiative and as Whole Heliosphere Interval activities.
- ICESTAR and IHY had complementary roles in the Cluster 63: IHY arranged overarching synoptic observation campaigns and provided systems and assessment processes in order to facilitate the harvesting of interdisciplinary observations; ICESTAR led efforts in establishing Virtual Observatories (VOs) for various geospace observations.

SSG/PS and other ICSU bodies:

SCOSTEP

STP-12, the 12th meeting on Solar Terrestrial Physics of SCOSTEP, was held in Berlin, July 11-16, 2010, with SCAR sponsorship. The current SCOSTEP program is Climate and Weather in the Sun-Earth System (CAWSES); it has the overall goals of fostering a scientific approach to understanding the short term (Space Weather) and long term (Space Climate) variability of the integrated solar-terrestrial environment. The main thrust of "CAWSES-II: Toward Solar Maximum from 2009 to 2013" is to treat the entire solar-terrestrial domain as one system. The scientific sessions were grouped according to the major themes of CAWSES: Solar influences on climate. Space weather: science and impacts. Atmospheric coupling processes. Space climatology. Advances were noted especially in the interaction of ionospheric and stratospheric processes on the lower layers of the Earth atmosphere, down to tropospheric altitudes.

SCOR:
SCAR's main cooperation with SCOR is through the SCAR/SCOR Oceanography Expert Group and the Southern Ocean Observing System (www.scar.org/soos) initiative that this group has taken the lead with. SCAR and SCOR co-sponsor other activities such as the Integrating Climate and Ecosystem Dynamics in the Southern Ocean (ICED) programme (http://www.iced.ac.uk/). SCAR and SCOR will continue to explore mutual areas of coordination such as ocean acidification.

The reader is referred to the respective reports for details on the Scientific Research Programs that refer to SSG/PS, AGCS WP14, ICESTAR WP16 and AAA WP18, and for the inter disciplinary SRP SALE – Sub Antarctic Lake Exploration WP17.

Reports on the Action and Expert Groups

Ice Sheet Mass Balance and Sea Level (ISMASS) Expert Group. *Leader:* C. van der Veen (USA)

The IPCC Fourth assessment Report acknowledged that current models do not adequately treat the dynamic response of ice sheets to climate change, and that this is the largest uncertainty in assessing potential rapid sea level rise. At the ice-sheet modelling Workshop, July 2008 SCAR/IASC meeting, in St. Petersburg, Russia, a strategy was developed to (i) improve the physical understanding of ice-sheet processes responsible for rapid change; (ii) incorporate improved physical understanding into numerical models; (iii) assimilate appropriate data into the models for calibration and validation; and (iv) develop prognostic whole ice-sheet models that better incorporate nonlinear ice-sheet response to environmental forcing. The Workshop resulted

in a Science Plan for a joint SCAR/IASC/WCRP-CliC programme outlining research and observational strategies over the next five years, building on existing research groups as appropriate. The Executive Summary for the Science Plan is as follows:

> **Introduction/ Background:** The importance of ice sheet modeling efforts has been magnified by recent reports suggesting that sea level rise remains the most poorly constrained and potentially catastrophic impact of climate change.
>
> **Important Issues or Factors:** First, three scientific questions of great significance are posed. Englacial processes and the closely related numerical schemes for addressing them will be pivotal to advancement on the questions, but other component processes will play a role as well. Questions to be addressed are: Will climate change lead to irreversible (non-linear, rapid) ice-sheet response? Does a rapid change lead to a large mass change? Are observed rapid changes "natural variability" or responses to warming?
>
> In this contribution, the scientific background for each of the questions was presented. A "roadmap" consistent with available data for studying the questions was proposed.
>
> **Recommendations/Actions and Justification:** The SSGs and Delegates (along with potential partners such as ISMASS) need to evaluate how to take this initiative forward; for example should ISMASS be a potential future SRP?
>
> **Partners:** IASC are interested in cosponsoring the ISMASS initiative.

The first step towards the implementation of the Plan has been a Summer School on Ice Sheet Models for the 21st Century (Portland, Oregon, USA, 3-14 August 2009, see SCAR Report n. 36, Nov 2009). The school was jointly funded by ICSU and NSF. The major tangible outcome of the Summer School was a set of lecture notes available at http://websrv.cs.umt.edu/isis/index.php/Summer_Modeling_School. They provide the glaciological community with an up-to-date overview of the science and observational techniques that will serve to guide further research efforts. Lectures were held on the theoretical basis of ice sheet modelling, basal conditions, data sets for ice sheet modelling, ice shelves and distributed stress-field solutions, quantifying model uncertainty, glimmer, the community ice sheet model, and higher-order models, and coupling the Cryosphere to other Earth systems.

The newly built community will continue to work on these issues, providing input to SCAR's programme on Ice Sheet Mass Balance and Sea Level, and through that to the Intergovernmental Panel on Climate Change. These results will also feed in to WCRP's Climate and Cryosphere (CliC) programme, which is co-sponsored by SCAR and IASC. Building on the success of the Summer School (as evidenced by the Course Evaluations), possibilities for repeating the Summer School in 2011 are being explored.

***Oceanography Expert Group**: Leader Mike Meredith (UK)*

The major effort of this group consisted in starting the development of a Southern Ocean Observing System (SOOS), following the initial requirements of ATCM Resolution 3 (2007), which welcomed and supported "the proposal by SCAR to establish a multi-disciplinary pan-Antarctic observing system, which will, in collaboration with others, coordinate long-term monitoring and sustained observation in the Antarctic". This is one of the key recommendations from the ACCE Report. The SOOS is also a significant legacy of the recent International Polar Year.

The design of a SOOS was led by a partnership of organisations: SCAR, the Scientific Committee on Oceanic Research (SCOR), The Census of Antarctic Marine Life (CAML), the Global Ocean Observing System (GOOS), the World Climate Research Programme (WCRP) and the Partnership for Observations of the Global Ocean (POGO). Other groups such as IAATO and COMNAP have provided significant feedback. The US NOAA programme also provided funds for holding SOOS workshops to further the SOOS design plan. Views have been solicited from as wide a range of interested parties as possible in order to finalise the plan.

Despite the fact that the southern ocean plays unique and critical roles for both the physical Earth system and its overall ecology, the Southern Ocean is poorly monitored, not least because of its harsh conditions and geographical remoteness. Southern Ocean continuous observations are needed to understand and predict global climate change accurately. Antarctic resupply vessels can make many observations routinely. A key problem concerns measurement of ocean properties year-round beneath the sea ice. Moorings, gliders,

instrumented marine mammals and modified Argo floats provide various means of escaping from this constraint. Commitments are needed to sustain the necessary *in-situ* observations in this remote area. The scientific achievements of the IPY demonstrate the power and value of integrated, multi-disciplinary observations. The challenge in the years ahead is to build on these IPY achievements to ensure a sustained commitment is made to observations of the Southern Ocean.

Ocean Acidification Report

Another activity in the framework of research on the Southern Ocean was started after the cross-SSG meetings identified ocean acidification as one possible area for a dedicated study. Richard Bellerby formulated a report that introduces ocean acidification and the sensitivity of the Southern Ocean to rising ocean carbon dioxide (CO_2) levels. There are measurable changes in marine carbonate chemistry that have been shown to change physiological and biogeochemical systems. Although there are developments towards a greater understanding of global acidification and development of observational and experimental strategies, the Southern Ocean is poorly represented. There is no present coordination of ocean acidification research and there is a very great need for an Action Group to promote and manage Southern Ocean acidification research. Changes will be seen very soon in the Southern Ocean and the consequences will be large both for ocean feedbacks to the global climate system and to ecological systems with large changes in biodiversity and marine ecosystem services. Research into Southern Ocean acidification is in its infancy. At present, there is no one organisation that is addressing the lack of coordination and management of ocean acidification research. SSG/PS approved the proposal to establish an Action Group on the subject under the leadership of R. Bellerby. ToR's have been provided by the leader.

***Operational Meteorology Expert Group**: Leader Steve Colwell (UK)*

The webpage for the expert group is regularly updated with news from the operational meteorology world, there are also many links from this webpage to other operational meteorology sites and online weather forecast pages, the web page can be found at http://www.antarctica.ac.uk/met/jds/met/SCAR_oma.htm

Since September 2009 there have been two radio-sonde launches per week from Marambio station at the top of the Antarctic Peninsula and we are now seeing almost all of the CLIMAT messages on the GTS (Global Telecommunication System).

The International Antarctic Weather Forecast Handbook is now available online as webpage's that are searchable and also some updates have been added to the handbook and any new updates can now easily be added.

Two Google Earth plugins have been created, one to access the archived meteorological data that is held at BAS which includes data from most of the manned stations and from most of the automatic weather stations. The second one gives access to the real-time meteorological data that are received at BAS via the GTS.

The expert group is looking into how precipitation measurements are currently made in Antarctica end evaluating the new optical precipitation measure devices that are now available.

***Environmental Contamination in Antarctica Expert Group**: Leader G. Capodaglio (Italy).*

Following a request made to ATCM by the Stockholm Convention for information on persistent organic pollutants in the Antarctic Treaty Area, SCAR's Action Group on Environmental Contamination in Antarctica (ECA) prepared a comprehensive report. It includes an extended review of scientific objectives, available data, and possible fields in which further research should be conducted; the following recommendations are made:

1. Establish a coordinated Antarctic Monitoring and Assessment Programme (AnMAP).
2. Collect all published data in a database and archive in a way in which they can be used effectively for global assessment. Point out gaps and involve various Antarctic national research programmes to cover such gaps.
3. Create a database, with limited access if required, of all data acquired by the national programmes on the local environmental impacts of research stations (Madrid protocol).
4. Create an inventory of all Antarctic Environmental Specimen Banks (AESBs), and a suitable information system, including the availability of samples.

5. Integrate the ECA database in the SCADM by construction of one dedicated portal.
6. Encouraged faster processes, from sampling to analysis and data processing, to ensure published data is up-to-date. Often data refer to samples collected up to ten years earlier.

IPICS - International Partnership on Ice Coring Science Expert Group: Leader E. Wolff (UK).

The main formal activity of IPICS in 2009 was the major workshop held in Oregon in July 2009 on "Science and Technology for the Next Generation of International Ice Coring". This was reported in 2009. A meeting/progress report is expected to be published in Eos imminently. There has been rather slow progress in linking IPICS2k to the PAGES2k networks, although it is hoped that a recent appointment accelerates this progress. Meanwhile, contributions to the 2k network are being developed by IPICS partners. Contributions toward the IPICS 40k network project are also emerging with drilling at WAIS Divide and new or improve deglacial records from Talos Dome, Berkner Is., and Law Dome. There has been substantial discussion and work about possible sites for an oldest ice core with new geophysical data from Antarctica becoming available during the year. Much of IPICS practical effort at the moment is directed to the Greenland NEEM project (http://neem.nbi.ku.dk/); but of course this is of less interest to SCAR).

At the Oregon meeting, the IPICS steering committee discussed the idea of extending the scope of the Greenland NEEM project to encompass wider consideration of the last interglacial period in ice cores from both hemispheres. This was unanimously agreed. The meeting noted the potential for a new high-resolution Antarctic record that could be compared at comparable resolution with the NEEM core over a similar period. A fuller description of this is being developed within IPICS.

IPICS agreed to organize a major ice core open science conference in 2012 - after an international competition, the venue is now settled as Giens in the south of France, for September 2012 (exact date to be fixed soon). The meeting is expected to be published through the International Glaciological Society. The chief organizer is Jérôme Chappellaz.

Eric Wolff and Ed Brook

PAntOS, Pan Antarctic Observing System Action Group. *Leader: Scott Palo (USA).*

This Action Group never really started its work, and will be closed.

Polar Atmospheric Chemistry at the Tropopause (PACT) Leaders: G. Milinewsky and A. Klekociuk.

The analysis methods and database content for the initial release of the PACT database have been developed and refined using 5 years of ozonesonde measurements from Davis (Antarctica) and Macquarie Island (sub-Antarctic). Documentation and initial data will be available during the 3rd quarter of 2010 from the web site at the Australian Antarctic Data Centre (http://data.aad.gov.au/aadc/pact/). The initial data release will include:

1. Profiles of ozone mixing ratio and partial pressure in the vicinity of the tropopause, at 100 meter vertical resolution with vertical coordinates of geopotential height, pressure, potential temperature, and potential vorticity.
2. The height of the chemical, thermal and dynamical tropopause.
3. Ten day forward and backward trajectory information at selected potential temperature surfaces intersected by the ozoneosonde profiles. The trajectories are obtained from the Goddard Automailer for NCEP and GEOS meteorological assimilations (http://acdbext.gsfc.nasa.gov/Data_services/automailer/).
4. Diagnostic flags and metadata.

The PACT team has developed a robust definition of the chemical tropopause as the height at which the vertical gradient in the ozone mixing ratio is 75 ppbv km^{-1} in a measurement profile which has been binned to 500-metre vertical resolution, to obtain information on the its location based solely on high resolution radiosonde measurements. Using this definition, comparisons with the thermal and dynamical tropopause have been made, and a diagnostic for stratosphere-troposphere exchange has been developed for inclusion in the database.

The aims and initial analysis for PACT was presented at a half-day workshop during the 36th Annual European Meeting on Atmospheric Studies by Optical Methods (Kyiv, Ukraine, August 2009). Presentation from this workshop and other relevant material can be downloaded from http://data.aad.gov.au/aadc/pact/.

Andrew Klekociuk and Gennadi Milinevsky

***Action Group on King George Island Science*:**
A report is included in the SCARXXXI Documentation as WP11.

***Prediction of Changes in the Physical and Biological Environment of Antarctica*.** Leader: J. Turner

Achievements.

ACCE - Members of the group have been heavily involved in the preparation of the SCAR Antarctic Climate Change and the Environment (ACCE) report.

High horizontal resolution climate modelling - The current generation of global climate models have a relatively coarse horizontal resolution (around 200 km), insufficient to resolve the complex orography, and consequently also the ecology, of the Antarctic Peninsula and many coastal areas of the continent. A series of experiments was run with a regional climate model with horizontal resolutions in the range 12 to 1 km, to cover the benthic, pelagic, and terrestrial assemblages patch sizes. This allows to determine the resolution required to simulate wind fields around the continent, which is important in air-sea-ice interactions.

Natural climate variability - The climate of the Antarctic has large natural variability due to interactions between atmosphere, ocean and ice, which can result in feedbacks that amplify small perturbations. The separation of natural climate variability from anthropogenic factors is difficult, and so is the prediction of climate evolution and the response of the biosphere. The natural variability of the Antarctic climate system will be studied through long (1000 year) runs of climate models with all forcings held constant.

Constraining predictions with observations - Different climate models give different predictions of future climate due to differences in the simulation of processes such as cloud formation. Observations can be used to help determine which climate models are most reliable. Available temperature data will be used to constrain predictions of future Antarctic-wide temperature change in a range of different climate models.

Using atmospheric data to understand species dispersal - Antarctic terrestrial habitats are typically 'island like', isolated on various geographical scales. However, some terrestrial biota are widely distributed. Passive dispersal with air movement (wind) provides a frequently postulated mechanism for explaining this wide distribution. Currently PCPBEA uses atmospheric model data to assess the frequency of rapid wind-driven dispersal, with the goal of providing a species specific assessment by combining the atmospheric data with physiological data for species groups such as springtails.

Results on the response of the Antarctic ecosystem to recent changes in the physical and chemical environment:

1. All ecosystem components related to the sea-ice are already significantly affected by its decrease. Krill stocks in the SW Atlantic sector are reduced; negative consequences for other tropic levels ranging from microorganisms to whales are expected. Primary productivity can both increase and decrease in areas with shorter periods of sea-ice cover along the WAP. In the theoretical scenario of a Southern Ocean without sea-ice primary productivity is expected to increase by 25%. Also in the open water areas increased primary production is expected in case of further atmospheric warming. Vegetation on the Antarctic Peninsula, along with associated fauna, will extend their distributions. Some penguins will suffer from changes of the terrestrial climate conditions. Emperor colonies could become extinct and Adelies are expected to shift their distribution range further south.
2. Disintegration of ice-shelves causes drastic changes in marine environmental conditions. Locally new habitats for invaders will be provided but organisms adapted to the under-ice conditions will probably become extinct. These new areas of open water could also act in the future as CO_2 sinks. Increase of freshwater run-off will „pollute" coastal areas.
3. There is not yet clear evidence for direct effects of increased SST, but e.g. the occurrence of invaders cannot be excluded, as already observed for terrestrial habitats on sub-Antarctic islands. Turnovers in species composition are expected to become most obvious at the margin of the Antarctic water mass due to a shift of the ACC to the south.

4. Acidification might become the most serious problem in the future because almost the entire marine environment might become affected and organisms cannot survive in refuges. So far whaling and bottom fishing must be considered the most serious anthropogenic changes in the Southern Ocean ecosystem. For the future the impact of climate change can be regarded the most serious actual threat of life in the Antarctic.

Improved predictions - during the Cambridge meeting the first projections were presented of the temperature evolution at different water depths, which is of high relevance for the marine ecosystem since most species inhabit the sea-floor. Also the latest results on future changes in hydrodynamic circulation patterns and strengths, as well as sea-ice and the response of the marine and terrestrial ecosystem were presented and discussed. Most of these biological and physical scenarios have been used in the ACCE report. Agreed actions focused on the scientific output of the group, on recommendations to emphasize long term observations and to study physiological limits and ecological demands of ecological key species.

The scales of change – at the Bremerhaven meeting several presentations dealt with the spatial and temporal resolution of physical measurements and predictions, since many biological processes have a short-term (e.g. seasonal) and small-scale (e.g. krill swarm) component. The relevance of a 25% sea-ice reduction and, as a consequence, a 10% increase in algal production for the entire marine ecosystem, especially trophic key species such as the Antarctic siverfish, was stressed.

Future plans

The Fifth IPCC Assessment Report (AR5) – The climate model output that will form the basis of the report will be released in late 2010 from the Coupled Model Intercomparison Project (CMIP). This CMIP5 database will be a powerful tool with which to generate improved predictions of the physical environment of the Antarctic. We will assess how the models simulate the observed changes during the late Twentieth Century and weight the predictions for the coming century accordingly to produce improved predictions.

Meeting on Antarctic prediction - the group are considering a possible workshop on changes in the physical environment and the response of benthic and pelagic assemblages based on the bioregionalisation approach.

Outreach

The group maintains a web site that provides details of activities and formal minutes of meetings at http://www.antarctica.ac.uk/met/SCAR_ssg_ps/Prediction/

***GPS for Weather and Space Weather Forecast*:** Leader: G. De Franceschi

A meeting of the SCAR action group was held at INGV, Rome, on Sept. 10-11, 2009. The scientific objectives of the AG activity were highlighted: The high latitudes ionosphere contains the footprints of processes that have their origin in interplanetary space. Different techniques are available for probing the ionosphere (e.g. radar measurements and the analysis of radio cosmic noise). Among them the use of GNSS high rate (50 Hz) measurements allows to describe the 3D plus time evolution of ionospheric plasma over restricted regions. Mathematical techniques combined with experimental observations provide the ability to study the ionosphere from the top of the F-region to the bottom of the D-layer. Thus, coupling processes from the magnetosphere to the neutral lower atmosphere can be considered. One of the main operational objectives of the group is the implementation of a permanent network of GNSS receivers for a multipurpose investigation over the Arctic and in Antarctica. The promotion of International collaboration for bi-polar investigations, particularly at conjugate regions, was also advocated, to pursue the development of unprecedented imaging of the Antarctic ionosphere.The group recommended the establishment of contact with SCADM (Standing Committee Antarctic Data Management). The interaction with the Geoscience community concerning data (policy, quality, archiving, sharing, etc.) was addressed. The discussion continued with the data format issue. A form, to be filled by the Action Group participants, was prepared to specify the data format, sampling rate, and whatever else needed in order to have a clear picture on the data specification needed.

The SERCE (http://www.scar.org/researchgroups/geoscience/serce/) proposal, presented by the POLENET community, is a possible candidate for a future SRP. Among the various SERCE topics, there is an explicit mention of the objectives of this Action Group. This will motivate close contact of the AG with the SERCE

community. SERCE is looking for people covering their issues, with a possible interest by GIANT (Geodetic Infrastructure of Antartica) (http://www.scar.org/publications/reports/23/giant/index.htm).

Antarctic Clouds and Aerosols - possible SCAR action group: Leader J. Turner

The IPCC has identified the indirect aerosol effect as the biggest uncertainty in the Earth's climate system. For this reason in many regions worldwide great efforts are being made to measure aerosols and cloud microphysical properties and the associated effect on the climate. However, in the Antarctic very few measurements have been made of cloud microphysical properties. Climate model representations of the Antarctic climate rely on parameterisations of clouds and cloud properties that based on mid latitude observations and these are likely to be wrong -for example the number nuclei available for the formation of cloud particles will be very different in the pristine air over the Antarctic. Also the source of many of the cloud nuclei found at high southern latitudes may be either the exposed rock or biological activity in the seas surrounding Antarctica. Climate change will affect both these sources and so they may act as strong climate feedback. Therefore we must understand the process that may be important for the formation of aerosols and Antarctic clouds if we are to successfully model climate change both regionally in Antarctica and globally.

A recent SCAR sponsored workshop on Antarctic clouds hosted by Byrd Polar Centre has proposed an International programme to coordinate the investigation of Antarctic clouds. It is suggested that this programme would have a series of special observing periods in Antarctic when both intensive ground based measurements would be made at the same time as in-situ measurements would be made with instrumented aircraft. It is hoped that such a programme would also include both regional and global modelling to help understand the observations and act as a test bed for new parameterisations of clouds.

As a first step to formation of an international programme we would like to set up a SCAR Action Group on Clouds and Aerosols. The group would have the following objectives -

1. Encourage the development of a climatology of Cloud Microphysical properties over both the Antarctic Coastal area and over the Antarctic plateau. It hoped that this climatology will be the product of international cooperation, using ground based observation, in-situ measurements and satellite remote sensing.
2. Identification of the sources of cloud nuclei that are important for the formation of Antarctic clouds.
3. The development of new improved parameterisations of Antarctic clouds for inclusion within regional and climate models.

Over the next two years it is planned that the Action Group will develop and coordinate the proposed programme, with some data from already planned projects becoming available to help with the planning of the new programme. It is hoped that some SCAR would again be available to sponsor a further workshop on Antarctic Clouds in 2012 to help foster the international collaboration required for this type of programme.

Budget .

Group	2011	2012	Explanation	Comments
IPICS	2500	3000	2011 is for support to facilitate an IPICS project steering meeting (2k, or oldest ice); 2012 is toward Open Science Conference, for which a separate $10000-20000 bid has been made for central funds.	Central major meeting funding request from Eric Wolff and Ed Brook sent to Mike Sparrow
PPG "Beyond AGCS"	2500	3000	To assist gathering PPG members, possibly aligned with existing meetings	Document provided
PACT	2000		Publication expenses - PACT paper 'Polar chemical tropopause characteristics: Analysis from the PACT database' in ACP	Written request provided.
ECA	1000	1000	Support for web site and data base maintenance; contacts to make AG joint	Support for web site and data base maintenance; contacts to

			with LS	make AG joint with LS
ISMASS	3000	3000	facilitate participation of international members in the IASC Working Groups meeting scheduled for January 2011 in Potsdam	
PPG Acidification	1000	1000	Support contacts	Support contacts
ICESTAR	1000	1000	Support students for ICESTAR sessions at AGU meetings	Support students for ICESTAR sessions at AGU meetings
PCPBEA	2700	2700	Support contacts	Support contacts
Oceanography	1000	1000	Support contacts	Support contacts
GWSWF	2000	3000	Support for person attending AGU SF 2010, $1000; Support for spring meeting 2011 on AG+ICESTAR+GIANT+POLENET, $3000; Support for SCAR 2012 Portland, $3000	The AGU 2010 request should come from the present underspend, reducing 2011 to 2000. Written request provided
Opmet	3000	3000	Request 3-5k for travel and subsistence to get extra people to annual Antarctic AWS and model workshop, and also have annual meeting of EG. Will allow increase in attendance and allow early career scientists to attend.	Written request provided.
TOTAL	21700	21700		

Officers of the Physical Sciences SSG up to SCARXXXI

Dr Maurizio Candidi (Italy) (Maurizio.candidi@ifsi-roma.inaf.it) Chief Officer
Dr. David Bromwich (USA) (bromwich.1@osu.edu) Deputy Chief Officer
Dr. Tas van Ommen (Australia) (tas.van.ommen@aad.gov.au) Secretary

Elections. Elections were held for the positions of the three officers. The new officers of SSG/PS are as folows

Dr. T- Yamanouchi (Japan) Chief Officer
Dr. M. Candidi (Italy) Deputy Chief Officer
Dr. T. Van Ommen (Australia) Secretary

List of attendees to Buenos Aires SSG/PS business meeting:

Alfonsi	Lucilla	lucilla.alfonsi@ingv.it
Ansorge	Isabelle	isabelle.ansorge@uct.ac.za
Candidi	Maurizio	maurizio.candidi@ifsi-roma.inaf.it
Capodaglio	Gabriele	capoda@unive.it
Carrosco	Jorge	jorge.corrosco@meteochile.cl
Cilliers	Pierre	pjcilliers@hmo.ac.za
Colwell	Steve	src@bas.ac.uk
Correia	Emilia	ecorreia@craam.mackenzie.br
Costa	Alfredo J	alcosta@dna.gov.ar
Curtosi	Antonio	tcurtosi@dna.gov.ar
De Franceschi	Giorgiana	giorgiana.defranceschi@ingu.it
Deshler	Terry	deshler@uwyo.edu
Fogt	Ryan	fogtr@ohio.edu
Geller	Laurie	lgeller@nas.edu
Heinemann	Günther	heinemann@uni-trier.de
Hong Tat	Ewe	eweht@utar.edu.my
Hulbe	Christina	chulbe@pdx.edu
Klepikov	Alexander	klep@aari.ru
Leppäranta	Matti	matti.lepparanta@helsinki.fi
Marinsek	Sebastian	smarinsek@dna.gov.ar
McConnell	Joe	joe.mcconnell@dri.edu
Navarro	Francisco	francisco.navarro@upm.es
Ommanney	Simon	simon.ommanney@ns.sympatico.ca
Papitashvili	Vladimir	vapita@nsf.gov
Rafanelli	Claudio	claudio.rafanelli@ifa.rm.cnr.it
Samah	Azizan Abu	azizans@um.edu.my
Sato	Natsuo	nsato@nipr.ac.jp
Sharp	Nigel	nsharp@nsf.gov
Simões	Jefferson	jefferson.simoes@ufrgs.br
Skvarca	Pedro	pskvarca@dna.gov.ar
Storey	John	j.storey@unsw.edu.au
Sultan	Emmannuelle	emmannuelle.sultan@locean-ipsl.upmc.fr
Tosonotto	Gabriela	gtosonotto@dna.gov.ar
Turner	John	jtu@bas.ac.uk
van Ommen	Tas	tas.van.ommen@aad.gov.au
Veerman	Johan	jveerman@rree.gob.pe
Weatherwax	Allan	aweatherwax@siena.edu
Yamanouchi	Takashi	yamanou@nipr.ac.jp

Recommendations

New recommendations (internal to SCAR)

SSG/PS recommends that an Action Group on Ocean Acidificationp be installed to lead to a future proposal for SRP. The Group is jointly supported by PS and LS.

Terms of reference for a SCAR Ocean acidification Action Group

The ocean provides an important service in absorbing from anthropogenic CO_2 perturbations of the natural carbon cycle and therefore lowering the warming effect of a larger atmospheric CO_2 reservoir. To present, the oceans have absorbed 50% of anthropogenic CO_2 (defined as the excess CO_2 in the system over the natural cycle) and at present are taking up about 25% annually. There is, however, a cost to this natural carbon mitigation. As carbon dioxide dissolves in seawater the speciation of dissolved inorganic carbon is altered - a process termed ocean acidification. There are measurable changes in marine carbonate chemistry that have been shown to change physiological and biogeochemical systems. Although there are developments towards a greater understanding of global acidification and development of observational and experimental strategies, the Southern Ocean is poorly represented. There is no present coordination of ocean acidification research and there is a very great need for an Action Group to promote and manage Southern Ocean acidification research.

The initial form of the action group with consist of a cross-disciplinary team of ocean acidification experts representing the fields of marine carbonate chemistry, global and regional modelling, pelagic marine ecology, benthic marine ecology, ecotoxicology/physiology and paleoceanography. The group will be setup and led by Richard Bellerby, Bjerknes Centre for Climate Research, Norway

The Action Group will:

- Define our present understanding of the contemporary rates and future scenarios of Southern Ocean acidification.
- Document ecosystem and organism responses from experimental perturbations and geological records.
- Identify present and planned observational and experimental strategies
- Identify gaps in our understanding of the rates and regionality of ocean acidification
- Define strategies for future Southern ocean acidification research
- The above work-plan will be undertaken with consultation with existing and evolving global ocean acidification efforts (e.g SOLAS/IMBER Sub Group 3, US Ocean Carbon Biogeochemistry and the SCAR Integrated Ecosystem and Climate Dynamics group and the Expert Groups on Oceanography and Prediction of Change).

Recommendations external to SCAR

Concerning continued support of existing geospace observatories and new equipment deployed during IPY 2007-2009. SCARXXXI- SSG/PS-? (SCARXXX- SSG/PS-6)

The Scientific Committee on Antarctic Research (SCAR) is concerned regarding interruptions of data and downgrading in their maintenance. The equipment under threat have provided and continue to provide irreplaceable data. Examples are: VLF receivers, magnetometers, riometers, aurora cameras and ionospheric scintillation monitors. SCAR recommends support by national funding agencies for continued operation of these infrastructures and for reliable archiving solutions for the data that they are providing."