SCAR Cross-Linkages Workshop
6-8 November 2006

Societa Geografica Italiana,
Villa Celimontana, Rome, Italy

ATTENDEES:

Carlo Barbante, Italy, Member SALE
Tom Bracegirdle, UK, Member AGCS SRP
Maurizio Candidi, Italy, Chief Officer SSG Physical Sciences (meeting convenor)
Alessandro Capra, Italy, Chief Officer SSG Geosciences
Peter Convey, UK, Co-chair EBA SRP
Jane Francis, UK, Member ACE SRP
Ad Huiskes, Netherlands, Chief Officer SSG Life Sciences, Member EBA SRP
Kirsti Kauristie, Finland, Co-chair ICESTAR SRP
Chuck Kennicutt, USA, Secretary SALE SRP, V-P SCAR
Toni Meloni, Italy, Vice President SCAR
Guido di Prisco, Italy, Co-chair EBA SRP
Volker Rachold, Sweden, Director IASC (by telephone)
Claudio Rafanelli, Italy, Member JCADM
Colin Summerhayes, UK, Executive Director SCAR
John Turner, UK, Chair AGCS SRP

1. OPENING

Maurizio Candidi opened the workshop and welcomed the attendees. He invited the Director of the International Home of Geography, Professor Giuliano Bellezza, the hosting organisation, to welcome participants. He noted that CSNA and PNRA would host a workshop dinner on the Monday evening, courtesy of Dr. Antonio Meloni.

Maurizio then explained the objectives for the meeting.

(i) primary objective: to encourage the development of cross-discipline research within SCAR, to develop concrete actions that will lead to a closer working relationships between SCAR's SRPs and the SSGs, including ways to make these interaction work better – such as joint sponsorship of workshops, science sessions at meetings, combining efforts on education, outreach and communication, and on data where appropriate, and other activities that will bring the communities together.

(ii) how are the different SRP are planning to deal with the data sharing and archiving issues.

(iii) IPY developments

With regard to encouraging the development of cross-discipline research within SCAR, this is already working within the SSG's (one example: atmospheric parameters that characterise the atmosphere are relevant to astronomers; cross disciplinary research is being done by atmospheric physicists and astronomers, to determine the properties of the atmosphere in Antarctica, as relevant to the design of telescopes). What else can we think of, that is not already being done?

With regard to developing concrete actions that will lead to a closer working relationships between SCAR's SRPs or between the SSGs, including ways to make these interactions work better, there is considerable potential (one example: the Oceanography group under SSG-PS should also have links with and make presentations to SSG-LS; another example – the cross disciplinary AGCS-ACE-EBA workshop in Hobart in July 2006). Should we develop more joint sponsorship of workshops, science sessions at meetings? Do we work hard enough to make sure that SCAR activity is visible at discipline specific meetings? For example: are there SCAR-related symposia as part of IUGG2007, in Perugia? The answer is yes, but it raises the question should we work harder to make sure that the SCAR Union representatives act in time to enable us to suggest sessions cosponsored by SCAR? And, further, how do we get involved in the planning for future such meetings?

With regard to combining efforts on education, outreach and communication

This will be dealt with in the presentations of the various SRP's. What is expected of SSG's, in view of the SCAR communication plan? SRPs and SSGs should be developing their ideas on how to implement the SCAR capacity building education and training plan and the SCAR communications plan in their specific areas.

With regard to data sharing, this is the province of JCADM working with the SSGs and SRPs. The development of a SCAR data and information strategy has been postponed pending the development of such a strategy by the IPY data committee, which is co-chaired by the chair of JCADM.

With regard to the IPY, SSG heads were asked to address a number of actions by the SCAR ad hoc IPY Advisory Committee meeting in Hobart in July 2006. Most of these actions have been completed. Each SRP and several subgroups within each SSG has an association with an IPY programme, and the responsibility for action is down at the appropriate level (e.g. CAML).

The group reviewed progress against the actions from the previous meeting. The following actions are still outstanding:

Action 1: Secretariat: Create a focus for SCAR's chemical research activities on the SCAR web site (by end 2006).

Action 2 (related to 1): Secretariat (with John Turner): Put a note on the SCAR web site about how ozone measurements are made and by whom (i.e. outside the SCAR groups)(by end 2006).

Action 3: (Turner): Working with Eric Wolff (BAS and IGAC), and T.Yamanuchi (Japan), develop a possible Aerosol-READER (by mid 2007).

Action 4: (Secretariat and John Turner): Design and populate the key fields database section on the SCAR web site, under Antarctic Information with links to SSG-PS (e.g. including ICE-READER; OCEAN-READER, monthly sea-ice fields, and global data sets of ECMWF etc)(by end 2006).

It was noted that no significant action had taken place on one of the recommendations from the Amsterdam, cross-linkages meeting, which led to continuance off the following action:

Action 5: Secretariat: Results obtained within SCAR activities on Place names, Map production and collection, and GIS systems implementation should be made available to all SSGs and SRPs, to help to establish cross-linkages between the SSGs and SRPs.

2. GOALS, OBJECTIVES, AND IMPLEMENTATION OF THE SPECIAL RESEARCH PROGRAMMES

2.1 AGCS

John Turner presented goals for and progress with AGCS (Antarctica and the Global Climate System) programme. The programme comprises four themes:

1. Decadal time scale variability in the Antarctic climate system
2. Global and regional climate signals in ice cores
3. Natural and anthropogenic forcing on the Antarctic climate system
4. The export of Antarctic climate signals

There is now an AGCS newsletter – NOTUS

Action 6: (Secretariat) Put link to NOTUS on SCAR web site (ASAP).

AGCS is developing a 'white paper' on climate change (led by P. Mayewski), as a prelude to the larger study of Antarctic Climate and Environment.

AGCS has developed OCEAN-READER, which displays data and identifies gaps.

Action 7: (Secretariat): Put link to OCEAN-READER on web site (ASAP).

AGCS has produced some new papers – e.g.:

(i) Meredith and Hogg paper links stronger westerlies to eddy kinetic energy in the Antarctic Circumpolar Current.
(ii) John Fyfe paper shows that models can reproduce observed mid depth warming in the Southern Ocean, where full effect of human impact is masked by volcanic outputs.

AGCS will be working on the role of polar stratospheric clouds, and on greater poleward advection of heat by the atmosphere when the SAM is weak. There will also be a Southern ocean-ice model comparison (SIOMIP).

Discussion identified need to link AGCS work on upper atmosphere clouds and tropospheric warming to research going on in CAWSES and ICESTAR.

Action 8: (Turner and Kauristie) to work on links between AGCS and ICESTAR (ongoing).

Action 9: (Turner, Siegert, Dunbar) to consider links between ACE and AGCS – where possible (ASAP).

Tom Bracegirdle talked about climate projections for the Antarctic, based on 20 model outputs prepared for the current IPCC report (Assessment Report No. 4), assuming doubling of present CO2 by 2100, looking at their strengths, weaknesses and the necessity for weighting, relating the model outputs to the needs of EBA, and looking at overall trends. Some of the models do capture or partly capture the warming of the Antarctic Peninsula – this is an advance over the previous IPCC. The models capture the average precipitation, but there is large uncertainty both in the data and the models. Models also capture the increase in wind speed. While several models do not capture the peninsula warming, it is captured by the ensemble average but only for the winter. The mechanism for this warming has not been conclusively determined, but it is plausible that it is a signal propagating down from the tropics. The summer warming is more restricted and may be a function of local orography, which is too local to be captured by the models. Several of the models had big errors in relation to the data, and thus were given a low weighting; the models with least error were given a high weighting. Seasonal projections can be obtained for future time periods (next 100 yrs) from the weighted models. In contrast to the recent warming pattern, which shows the strongest warming focussed mainly over the peninsula, strong winter warming (up to 0.6C/decade) is projected to occur over most of the marginal ice zone. Central Antarctica is projected to warm at 0.4C/decade in all seasons. Sea ice extent is projected to decrease by 25%. Precipitation is projected to increase 3.3mm/decade on average over the continent, but mostly around the edges. Westerlies will get stronger over the ocean, mostly in autumn, but coastal easterlies will decrease. Future - need higher spatial resolution, e.g. down to 5-10km.

2.2 ACE

Jane Francis reported on the goals and progress with ACE (Antarctic Climate Evolution) programme. The programme attempts to understand the climate

history of the Antarctic and tries to link climate history to climate modelling and ice sheet modelling. The programme focuses on the climatic evolution of the Tertiary and Quaternary, up to the end of the Last Glacial Maximum. The last time we had CO2 levels as high as those at present (380ppm) was several million years ago. A lot of work has taken place on the Lambert-Amery glacier-ice shelf region, where it can be shown that field evidence favours much thinner ice than models show for the last glacial maximum. New work is going on to ascertain the Neogene glacial history of different parts of Antarctica, when glaciation came and went and small trees grew near the Beardmore Glacier. This is the time of transition from a warmer to a colder Antarctica. Further back we see the ice cap building up around 34 million years ago, probably due to a fall in CO2 globally. The IAES meeting in Sta Barbara in fall 2007 will help to improve understanding of the plant record and its relation to early ice formation. Drilling (via ANDRILL) is needed to get back to the geological records from the Neogene and earlier.

ACE includes airborne radar studies of the thickness and stratigraphy of the ice sheet, which will help to establish the history of ice build up, e.g. around the Gamburtsev Mountains.

Jane also talked about glaciers in a greenhouse world (the Cretaceous 140 to 65 million years ago) when carbon dioxide levels were high. Despite these high levels it appears there may still have been some ice sheets e.g. as suggested by oxygen isotope data from the Maastrichtian; these correlate with large sealevel changes (20-25 m) recorded in seismic stratigraphic records. There is a good record of seafloor sediments of this age on Seymour Island in the Weddell Sea. It contains glauconite layers representing slow sedimentation when glaciers may have formed on land. There are some layers near the Cretaceous-Tertiary boundary that contain large pebbles like the drop stones from icebergs. These signs provide indirect evidence for Cretaceous ice.

2.3 EBA

Pete Convey presented the goals and progress with the EBA (Evolution and Biodiversity in the Antarctic) programme. EBA includes past present and future elements. It seeks to understand what underlines the evolution and diversity of life in and around Antarctica, and to predict possible changes in the light of climate change. EBA has five research strands (work packages) in marine and freshwater science (the link between the two fields is novel in the Antarctic):

1. Evolutionary history of Antarctic organisms
2. Evolutionary adaptation to the Antarctic environment
3. Patterns of gene flow within, into and out of the Antarctic, and consequences for population dynamics: isolation as a driving force
4. Patterns and diversity of organisms, ecosystems and habitats in the Antarctic, and controlling processes.
5. Impact of past, current and predicted future environmental change on biodiversity, and ecosystem function.

There are potential links with ACE in 1 and 4, and with AGCS in 4.

Highlights include some continuance with the past, e.g. in the SCAR MarBIN marine and RiSCC terrestrial biodiversity databases; the plans for the Census of Antarctic Marine Life (CAML); and the synthesis volumes from the Ecology of the Antarctic Sea Ice Zone (EASIZ) and the Regional Sensitivity to Climate Change in Antarctic Terrestrial and Limnetic Ecosystems (RiSCC) programmes .

MarBIN is a network for marine biodiversity information. It is the Antarctic node of the Ocean Biogeographical Information System (OBIS) and links to the Global Biodiversity Information Facility (GBIF). It helps to establish a census of Antarctic marine biodiversity and to look at patterns of biodiversity, and to identify gaps.

CAML has been accepted as an IPY project, and may have 8-10 or so ships. It is part of a larger, global, Census of Marine Life (COML) programme. Ship plans are now being developed. Data will go into MarBIN. It will undertake a species inventory for the Southern Ocean.

RiSCC established trends in Antarctic terrestrial and limnetic ecosystems, and was wound up as EBA started. RiSCC is one foundation of EBA. EASIZ is another, and its results have also just been published in a synthesis volume as a special issue of Deep Sea Research. The third foundation element is derived from the previous Evolanta programme, itself also responsible for earlier special issues of Antarctic Science.

A major new finding is that the biota of the Antarctic Peninsula is very different from that of the rest of the continent, i.e. there is a striking biogeographical ‘divide’ between the two. This is one of several lines of evidence that suggests that the biota does not have a ‘recent’ origin. Within these two areas there are also local centres of endemism and diversity, suggesting that future research will identify further biogeographical regions within the continent.

Molecular biology has demonstrated that it has a significant role to play. For instance, molecular clocks can be used to quantify evolutionary patterns. In one study they suggest a 40 million year separation between two endemic fly species (occurring on the Peninsula and South Georgia respectively).

Human impacts can be (and have been) important in introducing alien species worldwide. At least 200 alien plans and animals have been introduced into the sub-Antarctic, some with drastic effects on local species and ecosystems. This is a ‘warning’ about what may happen in Antarctica itself. Most invertebrates and locations have been poorly surveyed. There is virtually no microbial data. We know little about alien marine species. There is a risk also in transferring indigenous species from one part of Antarctica to another where they don’t currently exist, so breaking down original endemism and irreversibly impacting biodiversity, as well as compromising a potential research resource.

.
The Committee on Environmental Protection (CEP) held a workshop on alien species earlier this year, stimulated by RiSSC. SCAR held a workshop this year at Stellenbosch on baseline terrestrial biodiversity data in relation to alien pressure. EBA has contributed to the latitudinal gradient project. EBA is planning joint sessions with ACE for 2007.

Guido di Prisco talked about one particular aspect of EBA – ICEFISH (International Collaborative Expedition to collect and study Fish Indigenous to Sub-Antarctic Habitats), an IPY project. In passing he noted that the decline in sea ice is already causing certain species to move away, and others to move in, to the Antarctic Peninsula area. He also commented in passing on the notion that the rapid rate of climate change may be associated in future with an extinction event.

ICEFISH focuses on relating the notothenoid fishes to the transitional fish fauna of the subAntarctic. The first ICEFISH cruise was in 2004. Second one we hope will be in 2007, visiting Campbell and Auckland and Macquarie islands, Scott Island, Antipodes Islands and the Balleny Islands. There is a link to CAML, and also the Antarctic Benthic Deep-Sea Biodiversity programme (ANDEEP).

Both ICEFISH cruises produced or will produce good bathymetric data
Action: Secretariat to work with ICEFISH to make sure their bathymetric data get to SCAR's IBCSO programme.

The group noted the need to follow palaeontological evidence through into the evolution of modern organisms.

2.4 SALE

Chuck Kennicutt presented plans for and progress with SALE (Subglacial Antarctic Lake Enviroments). SALE is interdisciplinary in nature including members from 9 countries representing a range of scientific disciplines including limnology, geochemistry, molecular biology, ecology. glaciology, hydrology, geophysics, and geology. Future directions were agreed recently at the SALE workshop in Grenoble, France, in April 2006, on "SALE in the IPY: Advanced Science and Technology Planning". The meeting was attended by 84 participants from 11 countries. SALE science includes major research initiatives in the geodynamics of lake evolution; subglacial hydrology; ice dynamics; microbiological life, evolution and adaptation, limnology and biogeochemistry; paleoclimate records; and global climate connections. These research themes have close connections and complementary research goals with other SCAR SRPs ACE, EBA, and AGCS. Cross links are facilitated by SALE member participation in ACE and EBA.

SALE's major research themes include:

- Using studies of lake evolution to improve understanding of the evolution of Antarctica. For example, subglacial sedimentary records will provide unique information about Antarctic paleoclimate, ice sheet history, and stability that can be found nowhere else.

- Encouraging the development of the next generation of ice sheet models that will incorporate the subglacial environment as an important element of the system.

- Defining the role of large volume discharges of subglacial water on (past) ocean circulation and deep-water formation, past and future climate change, geomorphic change, material exchange between lakes, and consequent biological diversity.

- Establishing the phylogenetic and metabolic diversity of subglacial organisms and their evolution, determining the probable seed organisms for these environments, and evaluating the special adaptations organisms have made to these unique environments.

Major advances in SALE science have been reported in a series of publications over the last year and include:

- Subglacial lakes are common features of ice sheets, there are more than 145 identified subglacial lakes.

- There is a spectrum of subglacial environments and the beginnings of a classification system.

- Subglacial hydrologic systems exist and there is evidence of rapid water movement beneath ice sheets.

- Subglacial lakes and ice streams appear to be linked inferring that subglacial lakes influence ice sheet movement.

- Paleo-outbursts of subglacial waters have influenced land forms, and may be linked to past global climate change.

SALE Education, Outreach, and Communications activities include a program office web site, publications, an in-progress brochure, an e-Bulletin Board (150 subscribers), and an IPY program (SALE-UNITED). An EOS feature article is in revision. SALE holds sessions at major science meetings world-wide. SALE is working with the ice drilling and coring communities to develop the needed technologies. A future workshop with ANDRILL, IODP, Continental Drilling Program, and the ice coring and drilling communities is under discussion.

In discussion the question was raised about the possibility for contamination of lake waters by drilling. It was noted that SCAR has a position on the need for ‘clean’ drilling and environmental stewardship that was clearly stated in Shanghai, and that has not changed since. The Russians have gone through

the appropriate approval processes within the Antarctic Treaty Consultative Meeting (ATCM) and the CEP for continuation of the drilling at Vostok.

Action 10:(Secretariat): Get connections developed between IPICS, SCAR's Ice Drilling Technology Group, and the SSG-GS SIGE Group (by mid 2007).

Action 11: (All): Aim to get front-page articles on our activities in EOS or similar journals (ongoing).

2.5 ICESTAR

Kirsti Kauristie presented plans for and progress with ICESTAR. ICESTAR like the other SRPs carries out its work through a number (4) of subgroups, on the global electrical circuit, the magnetosphere-ionosphere coupling, on inter-hemispheric comparisons of solar effects, and on data portal development. Highlights are represented by 5 papers:

(i) effects of solar energetic particles (protons) on middle atmospheric chemistry. These cause chemical reactions producing NO2, above about 40km, which can be measured by GOMOS satellite measurements. NO2 is associated with ozone destruction inside the polar vortex.

(ii) control of equatorial ionosphere plasma density anomalies near the equator. The westward neutral wind drags positive ions westward creating a low density area in which the plasma can drift upwards. The control is by atmospheric tides and it appears as longitudinal modulation in the plasma density.

(iii) sprites, streamers and beads have been studied for their characteristics. These are transient luminous events that appear above thunderstorms. Observations of a recently developed advanced imaging system have been used for statistical analysis of streamer and bead lifetimes and scale sizes.

(iv) solar wind energy input to the magnetosphere. Solar wind energy gets into the magnetosphere and drives global plasma circulation there, which maps along the geomagnetic field lines to a convection pattern in the polar ionospheres. This pattern is associated with the cross-polar cap potential (CPCP), which can be used as a proxy for the coupling efficiency between the solar wind and magnetosphere. CPCP drives large-scale currents which couple the magnetosphere and ionosphere by flowing along the geomagnetic field lines. Magnetohydrodynamic (MHD) simulations show saturation effects in the CPCP with some hemispheric asymmetries due to the different solar illumination conditions affecting the background ionospheric conductances in the polar regions. For the same reason asymmetries are observed also in the field aligned current systems but the observed asymmetries are significantly smaller than MHD simulations yield. The highlighted studies present new information about the CPCP saturation effect and give an explanation for the big difference in simulated and observed field-aligned current intensities.

(v) hemispheric asymmetries in auroral substorms, studied using IMAGE satellite. The topology of the geomagnetic field defines the morphology and dynamics of large-scale auroral displays (like substorms). Thus in

interhemispheric comparison studies the southern and northern regions linked by the same magnetic field lines (i.e. magnetically conjugate regions) should be analysed together. Several empirical models exist for determining the nominal conjugacy, but these models may fail in real conditions, e.g. in cases where the solar wind magnetic field has a strong east-west component, which causes twist in the magnetotail. The highlighted study investigates an extensive data set of substorm onset locations observed by the IMAGE (Imager for Magnetopause-to-Aurora Global Exploration) satellite in southern and northern hemispheres. The paper demonstrates that the empirical models, which are currently widely used in conjugacy studies, are not able to reproduce the magnetotail twisting properly: observed asymmetries in the substorm onset locations are 5-10 times larger than the empirical models anticipate. This message is important for the whole solar-terrestrial research community to keep in mind when conducting research on bi-polar geospace phenomena.

ICESTAR is linked to both IPY and International Heliophysical Year (IHY). The IPY and IHY proposals to IPY have been combined in a project for heliosphere impact on geospace. 22 countries are involved in this bipolar study.

Examples of future IPY activities:

(a) monitoring ionospheric electron content and irregularities using GPS receivers. If we know more about the ionosphere and its effects we can make GPS more accurate. There is also a potential link to POLENET, which has a wide network of GPS receivers.

(b) TIMIS studies the possible link (transfer of energy) between powerful weather systems and the upper atmosphere/ionosphere.

There will be an ICESTAR kick off meeting Feb 5-9 2007, Helsinki, and a Greenland space science meeting in May 4-9, 2007.

3. OTHER POSSIBLE LINKS BETWEEN SRPS AND/OR BETWEEN SSGS.

3.1 SSG-PS: Maurizio Candidi's Report

There are potential links between SSG-GS and SSG-PS in using the networks of GPS receivers in the SSG-GS geodetic network, which can be used for ionospheric tomography

There are also potential links between SSG-PS's new expert group on PantOS [Pan Antarctic Observing System] (the analog of AON, the Arctic Observing Network). The goals of PantOS are:-

1. Address, identify, and understand the current system of observations around the Antarctic:
 - in disciplines carrying their own networks of ground- and marine-based
scientific observations;

- in routine ground- and marine-based observations (meteorology, ice cover, etc.) carried by either science groups or national logistics operators;
- in satellite observations of the pan-Antarctic region.

2. Identify key variables which need to be observed in the Antarctic over a
long time for terrestrial climate change studies, as well as understanding
climatology of near-Earth space (geospace) and corresponding solar activity which ultimately affects the Earth's climate.

3. 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.

4. Provide recommendations to improve and enhance existing systems for the forming of the interconnected multidisciplinary Antarctic observing network.

There are also potential links with other groups through the SSG-PS new expert group on Environmental Contamination in Antarctica (ECA). Its activities include:

- Inventory of the past, on-going and future research projects at an international level dealing with environmental contamination in the Antarctic continent, e.g.:

  - Database and maps of chemical, physical and biological environmental parameters to follow the evolution of the environment in Polar Regions.
  - Analysis of local and long range contributions to the environmental contamination in a polar region.
  - Exchange processes between atmosphere, hydrosphere and the Antarctic continent involving chemical, physical and biological parameters of environmental interest.
  - Mutual interaction between climate and environmental changes, and processes controlling the dispersion and transport of micro-components in Polar Regions.

-Extension and aggregation of scientists interested in Environmental Contamination in Polar regions.
-Implementation of a web site to share available information with the international community.
-Training of new generations of polar scientists.
-Workshop on “Environmental Contamination in Antarctica - ECA” (Venice, 2007). Representatives of several countries will participate in the preparation of the final document. Workshop objectives include:

  - Analysis and comparison of national research projects.

- Coordination of studies on the Environmental Contamination in Polar Regions.
- Identification of new research subjects for a better understanding and analysis of Environment Contamination on a global scale.
- Start up and implementation of an international program on the Environmental Contamination in Polar Region studies on the Environmental Contamination in Polar Regions.
- To identify new research subjects for a better understanding and analysis of Environment Contamination on a global scale.
- Start up and implementation of an international program on the Environmental Contamination in Polar Regions

ECA relates to the potential Aerosol READER project mentioned above in Action 3.

Action 12: (Turner) link the proposed aerosols activity with the contamination group. ASAP. Bring in biological contamination component through interaction with EBA.

3.2 SSG-GS: Alessandro Capra's Report

POLENET: Polar Earth Observing Network is a major bipolar SSG-GS IPY programme. Observatories incorporate GPS, gravity, seismology, magnetic, tide gauge and met data. There is a possible link to ICESTAR. Observations are for plate kinematics and for atmospheric applications. Need a working group combining ICESTAR, SSG-GS and SSG-PS to ensure effective use of GPS/POLENET, and to encourage co-location of GPS and met stations for atmospheric parameters.

Ad noted that we need to improve connections between SSG-LS and the permafrost programme, for terrestrial biology.

Action 13: Ad and Alessandro to create links between terrestrial biologists and permafrost group. ASAP

Action 14: Turner to create link to permafrost group for studies of climate forecasts and their effects.

3.3 SSG-LS: Ad Huiskes' Report

The seals group has finalised the APIS Report. It is now proposing to develop a new project in Marine Mammal Exploration of the Oceans, Pole to Pole (MMEOPP), which will link to EBA.

The bird group continues to be active. It is working to define Important Bird Areas, and is assessing the status of the Southern Giant petrel, for the CEP. The group is working with CCAMLR and CEP on the need for marine reference areas in the Southern Ocean. This is linked to the need for Marine Protected Areas (MPAs) in which CCAMLR has considerable interest.

It has been proposed that these two groups should merge into a higher predators group.

Continuous Plankton Recorder group (Australia, Japan, Germany, UK) is mapping plankton in Southern Ocean, providing links to EBA, CAML, MarBIN and CCAMLR. Need to engage more users (e.g. Spain).

Much of what SSG-LS does is in support of EBA.

Action 15: Secretariat. Create web page linking all SCAR databases. ASAP.

Action 16: Mike Meredith for AGCS-Oceans to connect with Graham Hosie (CPR-AG), to link plankton and climate date.

4. SPECIFIC REQUIREMENTS FOR IMPROVING LINKAGES

4.1 IASC

Colin Summerhayes reminded the group that SCAR and IASC intend to combine their efforts in selected fields and activities (to be decided by mutual agreement) so as to raise the level of impact of both organizations in terms of making scientific advances and of advising policy makers (for example of the likelihood and likely effects of climate change), as well as to avoid duplication. These linkages are now the subject of a Letter of Agreement under which SCAR and IASC agree:

(i) to invite each other to attend the meetings of their major bodies (SCAR Delegates' Meeting and IASC Council);
(ii) to encourage appropriate linkages between the relevant existing SCAR and IASC scientific projects;
(iii) to encourage their scientific communities to develop joint bipolar projects and approaches in appropriate fields;
(iv) to work together in arranging workshops, conferences, and reports on topics of mutual scientific interest;
(v) to exchange ideas on best practices in data and information management;
(vi) to exchange newsletters and advertise each other's newsletters and web sites on their own web sites;
(vii) to develop combined approaches to communicating with the wider community on the significance of polar research to the solution of societal issues, including their respective experience in giving advice to the AC and ATCM.

The agreement will remain in force for 5 years, thereafter be reviewed and continued as appropriate.

This background preceded a telephone conference with Volker Rachold, Executive Director of IASC, in which he described what IASC is, how it is structured, and what it does. IASC involves 18 countries, all (apart from Iceland) are Members of SCAR. IASC is affiliated to ICSU and run in much

the same way as SCAR. It identifies scientific priorities, creates working groups, assists in developing scientific proposals, and funds younger scientists to attend meetings. The emphasis is on circum-Arctic cooperation. Usually 10-15 projects are supported.

IASC co-sponsored with the Arctic Council the recent Arctic Climate Impact Assessment (ACIA). IASC also from time to time sponsors major conferences to develop plans for the future, through the ICARP mechanism (International Conference on Arctic Research Planning), the latest of which was in late 2005. The community is now developing the suggested science plans for implementation. IASC is also involved in the IPY.

A key new venture is the International Study of Arctic Climate (ISAC), which developed out of the SEARCH programme. ISAC is a long-term, multidisciplinary program to study the effects of environmental changes on the circumpolar Arctic system and the globe. Its main objective is to observe and understand the characteristics of the entire Arctic System and its responses to change in order to develop the best adaptation and mitigation strategies. It will develop in partnership with the Arctic Ocean Science Board (AOSB).

Annually IASC organises the Arctic Science Summit Week (ASSW), which provides an umbrella for the meetings of many groups with Arctic science interests, and provides opportunities to improve cooperation, collaboration and coordination. As well as business meetings, the ASSW includes a short science meeting, as well as a projects meeting.

SCAR 2008 will have a bipolar theme and be organised jointly with IASC.

It was noted that ICESTAR is bipolar.

Action 17: Kirsti Kauristie: Send details of the ICESTAR Kick-off meeting to Volker (ASAP).

John Turner noted that in 2004 SCAR had cosponsored a climate workshop in Fairbanks, results of which had recently been published in the Journal of Climatology. SCAR would like to work with IASC to co-organise a follow-up workshop in late 2007.

Action 18: Turner: Send Fairbanks paper to Volker, and arrange joint follow-up climate workshop. ASAP.

Jane Francis noted that SCAR has an interest in Arctic Climate Evolution on geological time scales. IASC has not been very active in paleoclimate studies, but there are some groups doing this work in the Arctic. Volker noted that Permafrost is an area of active interest and that a group is drilling into Siberian lakes to establish a past climate history.

Action 19: Jane Francis: work with Volker to make connections between the Arctic and Antarctic paleoclimate communities.

Claudio asked what IASC is doing in the area of data and information management. Nothing much is happening at the moment, and IASC might benefit from following a system like that developed under SCAR's JCADM.

Action 20: JCADM (Taco): contact Volker with a view to assisting IASC to develop a comprehensive approach to data and information management.

Guido asked if SCAR can present its science during ASSW, as the basis for developing bipolar links. Volker considered that it may be feasible to have a SCAR presentation as part of ASSW Projects Day.

Action 21: SCAR President and Exec Dir to discuss how best to make a SCAR presentation during ASSW in March 2007, and to discuss this with Volker.

Chuck mentioned that the US SCAR committee will be meeting in association with ASSW, which gives us an opportunity for the SCAR President and Executive Director to connect with that committee.

Action 22: Chuck and Colin to work together to see how a connection can be made between US SCAR and SCAR 'international' during ASSW, and to explore the possibility of a SCAR presentation being made to US SCAR.

4.2 COORDINATION ON KING GEORGE ISLAND

The SCAR Delegates have expressed some concern about the lack of coordination of scientific research between the different SCAR Members occupying stations on King George Island, raising the possibility that there may be significant duplication of effort. Delegates action 12 from XXIX SCAR asked Chief Officers to develop a joint recommendation on the coordination of scientific activities on King George Island, for consideration at XXX SCAR (2008). In the meantime John Turner had been working with the KGI Action Group (Victor Lagun, of Russia) to find out what is going on on KGI. He showed a matrix indicating broadly what types of activity are happening at a selection of KGI stations, but the table is (a) incomplete as regards stations, and (b) at too low a level of detail (e.g. biological science, with no indication of whether it is marine or terrestrial). Ideally we need an inventory of the science, based on a follow up to Victor Lagun's table, but the list needs to be complete (we might start by getting the KGI station list from COMNAP). In addition, the group recommended that the Standing Committee on Antarctic Geographic Information (SC-AGI) be consulted to see what its new GIS system for KGI showed. One example of where coordination could improve results lay in the area of radiosondes. Ideally we would like to see the KGI community banding together to support a radiosonde programme that might utilise the radiosonde launch facilities of the Russian station.

It was suggested that coordination could be improved by adopting a community approach, for instance through a science coordination committee of the kind that has been developed at Ny Alesund, on Svalbard and which has produced the Ny Alesund management plan (produced by the NYSMAC Ny Alesund Science Management Action Committee. Such a committee might then also organise an annual conference where results could be displayed, which would lead to further collaborative work and associated advances.

Action 23: secretariat, in consultation with Chief Officers and Victor Lagun (i) get the KGI station list from COMNAP; (ii) check what national reports say about KGI activities; (iii) find out what the SC-AGI GIS shows for KGI; (iv) develop contact points for each country and station active on KGI; (v) develop an inventory of activities; (vi) relate it to SCAR activities; (vi) cross check the Ny Alesund coordination mechanism; (vii) produce a report setting out KGI science and making recommendations for the future regarding coordination.

The group felt that there was a need not simply to improve coordination at the field level on the island, but also to integrate KGI research with SCAR programmes to the extent possible.

Action 24: Secretariat to circulate information about SCAR programmes to KGI bases, with a view to encouraging them to integrate their research with SCAR programmes.

It would be useful to organise a half-day meeting in St Petersburg on the topic of KGI coordination, at which examples of ongoing research could be given, and ideas for coordination could be explored.

Action 25: Secretariat + Chief Officers + Victor Lagun to plan a half day workshop for XXX SCAR on KGI scientific research coordination.

4.3 OCEAN ACIDIFICATION (BASED ON TALK BY NICK OWENS OF PML)

John Turner presented Nick Owens' paper as given to the Partnership for Observations of the Global ocean (POGO) by Mike Meredith. As CO2 goes up, ocean pH goes down. The predicted drop is by 0.77 units over the next 1000 years. Present is about 8.2; 2100 will be about 7.8. Acidification degrades shells of reef building carbonate organisms, shelled invertebrates, coccolithophores and pteropods, thus changing ocean biodiversity. Changes in pH also affect the speciation of nutrients (phosphate and nitrate), with further knock-on effects.

Geological question is – if it is the case that the oceans will become more acid in a greenhouse world, how do we explain the high carbonate skeletal remains of periods like the Cretaceous.

Action 26: Jane to check on palaeocean chemistry in relation to ocean acidification.

5. LONG TERM MONITORING AND OBSERVATORIES

John Turner discussed the progress being made and plans for a major study of **Antarctic Climate Change**. A 'white paper' is currently being developed. The major study should be ready in draft form for the XXX SCAR Delegates meeting. This topic needs further discussion (see 6.2).

Colin Summerhayes reported that the SCAR/SCOR Oceanography Group had taken on the challenge of developing a **Southern Ocean Observing System (SOOS)**, something that had been called for by the IPY. This would be developed in consultation with interested communities such as CCAMLR, CAML, IWC, POGO, JCOMM (WMO and IOC), GOOS (IOC), GCOS (WMO) and the Group on Earth Observations (GEO). The first meetings on this topic had taken place in Hobart in July 2006. The next meeting would probably be in October 2007.

Colin Summerhayes also reported on the effort to develop a sustained **Observing System for the Cryosphere**, which would take the form of a contribution to the work of the Partnership for an Integrated Global Observing Strategy (IGOS), which involves the UN agencies, the international research agencies (ICSU, WCRP, IGBP) and the space agencies. The present draft document needs to be circulated through the SSG-PS community for comment and improvement, and to encourage 'ownership' of the implementation process in the Antarctic by SSG-PS and its relevant subgroups (also by the permafrost group in SSG-GS).

Action 27: Exec Dir discuss with M. Candidi and A. Capra the mechanism to use to get 'buy-in' from the SSGs for the implementation of the Cryosphere Theme.

Claudio made a presentation on **JCADM**, noting how JCADM was evolving to take on board new developments like the various READER databases and MarBIN. The de-facto SCAR policy for data is that all data should be exchanged or at least available for exchange, in accordance with Antarctic Treaty article III 1c. The de facto SCAR data strategy is that all SCAR programmes should make their data available through NADCs to JCADM and the metadata should be made available to all by JCADM through the Antarctic Master Directory (AMD). JCADM is working with the IPY data subcommittee to develop a data policy and data strategy for the IPY. When those are developed they will be adapted as upgrades to the current SCAR data policy and strategy.

John Turner discussed again the need to create data fields for particular kinds of data for which there was a common and widespread requirement, and to make them readily available via the SCAR web site.

Action 28: Chief Officers and SRP leaders to work with John Turner to identify the data sets for which data fields were required, and to arrange for them to go on the SCAR web site.

6. BREAK-OUT GROUPS: SPECIFIC REQUIREMENTS FOR IMPROVING LINKAGES

6.1 POLENET-ICESTAR-GPS-Meteorology

GPS has been used for a long time for determination of atmospheric physical parameters and for weather forecast. GPS data can be used to measure properties of the troposphere and the ionosphere, for example to determine instantaneous water vapour and continuous precipitable water vapour. GPS receivers capable of using two frequencies can also be used to determine total electronic content (TEC) and TEC gradients in the ionosphere. Instruments with upgraded sampling rates can be used to detect ionospheric scintillations.

Use extended observing network planned for POLENET. Co-locate GPS and met stations for atmospheric parameters in real time or for post-processing. Need to study algorithms to model the troposphere and ionosphere using GPS data. Collaborate with groups from IHY, which will operate GPS receivers and other ionospheric monitoring devices in Arctic and equatorial regions to get a global picture. Goal: a centralised GPS data archive (planned for POLENET to be ready by 2009 and integrated with the SCAR GIANT programme). Provide a TEC monitoring service. Need a working group to work on these activities (including Capra and Kauristie and others).

Action 29: Kirsti Kauristie and Alessandro Capra: create a POLENET-ICESTAR-GPS-Meteorology Working Group within GIANT.

6.2 Climate Change (AGCS-EBA)

The group started from the plans for an Antarctic Climate Analysis that were developed at the Amsterdam cross linkages meeting, and developed a more elaborate plan for the book that will emerge from this study by XXX SCAR in 2008. It was agreed that the process should be governed by a 6-person editorial committee.

Action 30: John Turner: continue with the planning for an Antarctic Climate Analysis with a view to producing a book draft for XXX SCAR, and developing a budget plan for the Executive Committee.

6.3 Weather and Upper Atmosphere Linkages (AGCS-ICESTAR)

This covers ionospheric effects of strong weather fronts.

Previous work on this topic was carried out by APTIC (Antarctic Peninsula Troposphere Ionosphere Coupling) led by Alberto Foppiano. This will be continued through the TIMIS IPY proposal by Yuri Yampolsky, through a measurement campaign (meteorological parameters and magnetic variations) during the IPY. AGCS can support this work in the wider context through providing meteorological data from other Antarctic stations (MET-LOG), and

can help in the interpretation, and by providing modelling assistance where necessary. JCADM's databases need to be checked to see what supporting geospace data are available. There is also the possibility of collaboration with the Argentinian Polar research Institute (via contact with professor Araujo).

Action 31: Kirsti Kauristie to contact Yampolsky about these possibilities, check the funding status of TIMIS, check plans for preparatory work with the existing databases, and introduce people to the above mentioned opportunities for collaboration.

6.4 EBA-SALE-ACE(+)

The key question is the extent to which present biota has descended from past organisms. The group focused on the need to identifying biological refugia and to analyse their roles in the evolution of Antarctic biodiversity. Refugia may include, for instance: nunataks, coastal strips, sub-glacial lakes, dry valleys, peri-Antarctic islands, volcanic hot spots, and cold seeps. Important questions include, for example: How extensive was the Miocene ice sheet? Was it consistent with continuity of life in the region? How coherent are the lines of evidence for Antarctic paleo-history (the fossil record, the molecular biology record, the temperature record, the records of ice extent, and the requirements of the ecosystem? What was the "real" extent of past ice sheet extent? Would it have wiped out refugia? Are ice advances agents of extinction events? What are the lines of evidence for and against refugia?

Next steps:
(i) form an action group to take this thinking forward. The group should include glacial geologists, glacial geomorphologists, biogeographers, molecular biologists, phylogeographers, geologists/paleontologists, paleoclimatologists (data modellers).

(ii) compile evidence for Miocene ice sheet extent;

(iii) carry out or capitalise on case studies (e.g. of the Antarctic Peninsula and SG fly study; Dronning Maud Land nunatak mites; Gondwana faunal/floral relicts; Victoria Land insects).

(iv) where the molecular evidence is linked to evolutionary time scale, it should be linked to the geological record.

(v) compile paleontological evidence for the descent of younger biotas.

(vi) highlight gaps and questions.

(vii) aim to produce a "perspectives" paper showing that all is not cut and dried, but that there are substantial implications.

Action 32: Jane Francis, Pete Convey and Chuck Kennicutt to establish the joint ACE, EBA, SALE working group to examine the history and effects of refugia

7. Other Business

7.1 Additional Costs in Support of IPY Data SubCommittee

The group did not favour setting aside money from the SCAR reserve to assist with funding the activities of the IPY Data SubCommittee.

Action 33: Secretariat to report back to IPY office regarding funding for the IPY data group.

7.2 The ATCM Lecture

The group noted that Prof Lou Lanzarotti was unable to give the geospace (ICESTAR) lecture in 2007, and suggested that he be asked to give the talk in 2008. For 2007, the group noted that the IPCC report would be tabled in that year and agreed with the suggestion that therefore the role of Antarctica in the modern global climate system should be highlighted at the ATCM meeting. It was suggested that since the SCAR President will be attending the ATCM, he could be asked to deliver this lecture, calling on the SCAR climate programmes for input, and avoiding past climate change – which had been dealt with at the ATCM in Edinburgh in 2006. The group suggested that astronomy could be selected as the basis for the SCAR lecture in 2009, and, further, that a long term plan for ATCM talks should be developed.

Action 34: Secretariat to consult with the Executive Committee on plans for the SCAR Lecture to the ATCM, and to issue invitations as appropriate.

7.3 Next Cross Linkages Meeting

It was suggested that the cross-linkages meetings for the future should be tied to the July cycle of meetings of the Executive Committee and Chief Officers. Unfortunately that would not work in 2007, because the SCAR Executive and Chief Officers meetings overlapped with IUGG.

Action 35: Secretariat and Chief Officers to consult on possible dates for the 2007 cross-linkages meeting.

8. List of Actions

	Action	Person(s) responsible	Deadline
1	Create a focus for SCAR's chemical research activities on the SCAR web site	Secretariat	end 2006
2	Put a note on the SCAR web site about how ozone measurements are made and by whom (i.e. outside the SCAR groups)	Secretariat (with John Turner):	end 2006

3	Working with Eric Wolff (BAS and IGAC), and T.Yamanuchi (Japan), develop a possible Aerosol-READER	(Turner):	mid 2007
4	Design and populate the key fields database section on the SCAR web site, under Antarctic Information with links to SSG-PS (e.g. including ICE-READER; OCEAN-READER, monthly sea-ice fields, and global data sets of ECMWF etc	Secretariat and John Turner	end 2006
5	Results obtained within SCAR activities on Place names, Map production and collection, and GIS systems implementation should be made available to all SSGs and SRPs, to help to establish cross-linkages between the SSGs and SRPs.	Secretariat:	End 2006
6	Put link to NOTUS on SCAR web site	Secretariat)	ASAP).
7	Put link to OCEAN-READER on web site	Secretariat)	ASAP).
8	work on links between AGCS and ICESTAR	Turner and Kauristie	ongoing
9	consider links between ACE and AGCS – where possible	Turner, Siegert, Dunbar	ASAP
10	Get connections developed between IPICS, SCAR's Ice Drilling Technology Group, and the SSG-GS SIGE Group	Secretariat	mid 2007
11	Aim to get front-page articles on our activities in EOS or similar journals	All	ongoing
12	link the proposed aerosols activity with the contamination group and bring in biological contamination component through interaction with EBA.	Turner	ASAP
13	create links between terrestrial biologists and permafrost group	Ad and Alessandro	ASAP
14	create link to permafrost group for studies of climate forecasts and their effects	Turner	ASAP
15	. Create web page linking all SCAR databases	Secretariat	ASAP
16	AGCS-Oceans to connect with (CPR-AG), to link plankton and climate date	Mike Meredith & Graham Hosie	ASAP
17	Send details of the ICESTAR Kick-off meeting to Volker Rachold (IASC)	Kirsti Kauristie	ASAP
18	Send Fairbanks paper to Volker Rachold (IASC), and arrange joint follow-up climate workshop	Turner	ASAP
19	work with Volker Rachold (IASC) to make connections between the Arctic and Antarctic paleoclimate communities	Jane Francis	ongoing

20	contact Volker Rachold with a view to assisting IASC to develop a comprehensive approach to data and information management	Taco de Bruin	ongoing
21	discuss how best to make a SCAR presentation during ASSW in March 2007, and to discuss this with Volker Rachold.	SCAR President and Exec Dir	ASAP
22	see how a connection can be made between US SCAR and SCAR 'international' during ASSW, and to explore the possibility of a SCAR presentation being made to US SCAR	Chuck and Colin	ASAP
23	(i) get the KGI station list from COMNAP; (ii) check what national reports say about KGI activities; (iii) find out what the SC-AGI GIS shows for KGI; (iv) develop contact points for each country and station active on KGI; (v) develop an inventory of activities; (vi) relate it to SCAR activities; (vi) cross check the Ny Alesund coordination mechanism; (vii) produce a report setting out KGI science and making recommendations for the future regarding coordination.	secretariat, in consultation with Chief Officers and Victor Lagun	Before July 2007
24	circulate information about SCAR programmes to KGI bases, with a view to encouraging them to integrate their research with SCAR programmes	Secretariat	ASAP
25	plan a half day workshop for XXX SCAR on KGI scientific research coordination	Secretariat + COs + Victor Lagun	For XXX SCAR
26	check on palaeocean chemistry in relation to ocean acidification	Jane Francis	End 2006
27	discuss the mechanism to use to get 'buy-in' from the SSGs for the implementation of the Cryosphere Theme.	Exec Dir plus M. Candidi and A. Capra	ASAP
28	identify the data sets for which data fields were required, and to arrange for them to go on the SCAR web site.	Chief Officers and SRP leaders	End 2006
29	**create a POLENET-ICESTAR-GPS-Meteorology Working Group within GIANT.**	**Kauristie and Capra**	**July 2007**
30	**continue with the panning for an Antarctic Climate Analysis with a view to producing a book draft for XXX SCAR, and developing a budget plan for the Executive Committee.**	**John Turner**	**July 2007**
31	**contact Yampolsky about ionospheric effects of strong weather fronts.possibilities, check the funding**	**Kirsti Kauristie**	**July 2007**

	status of TIMIS, check plans for preparatory work with the existing databases, and introduce people to the opportunities for collaboration.		
32	**establish a joint ACE, EBA, SALE working group to examine the history and effects of refugia**	**Jane Francis, Pete Convey and Chuck Kennicutt**	**July2007**
33	**report back to IPY office regarding funding for the IPY data group.**	**Secretariat**	**ASAP**
34	**consult with the Executive Committee on plans for the SCAR Lecture to the ATCM, and to issue invitations as appropriate.**	**Secretariat**	**ASAP**
35	**consult on possible dates for the 2007 cross-linkages meeting.**	**Secretariat and Chief Officers**	**July 2007**

CLOSE OF MEETING

The meeting closed at 1530 on Wednesday 8 November 2006

ANNEX 1: AGENDA

1. Opening
2. Reports on progress on Amsterdam actions
2. Updates on Implementation of SRPs
    a. AGCS (John Turner)
    b. ACE (Jane Francis)
    c. EBA (Pete Convey/ Guido di Prisco)
    d. SALE (Chuck Kennicutt)
    e. ICESTAR (Kirstie Kauristie)
3. Other possible links between SSGs
a. SSG-PS (Candidi/Turner)
b. SSG-GS (Capra)
c. SSG-LS (Huiskes)
4. Specific requirements for improving linkages
cross-SSG Action Group on King George Island (Turner)
Biogeochemistry of the Southern Ocean
IASC (Rachold)
other

5. Long term monitoring and observatories

Antarctic Climate Change programme (Turner)
Southern Ocean Observing System (Summerhayes)
Cryosphere Theme (Summerhayes)
SCAR Data Policy (Barbante)
Key data fields database (Turner)
others

6. Break-out Groups
7. Conclusions, Recommendations

ANNEX 2 LIST OF ACRONYMS

ACE	Antarctic Climate Evolution
ACIA	Arctic Climate Impact Assessment
AGCS	Antarctica in the Global Climate System
AMD	Antarctic Master Directory
ANDEEP	Antarctic Benthic Deep-Sea Biodiversity
ANDRILL	Antarctic Geological Drilling Project
AON	Arctic Observing Network
AOSB	Arctic Ocean Sciences Board
ASSW	Arctic Science Summit Week
ATCM	Antarctic Treaty Consultative Meeting
BAS	British Antarctic Survey
CAML	Census of Antarctic Marine Life
CAWSES	Climate and Weather of the Sun-Earth System
CCAMLR	Convention on Conservation of Antarctic Living Marine Resources
CEP	Committee for Environmental Protection
COML	Census of Marine Life
COMNAP	Council of Managers of National Antarctic Programmes
CPR-AG	Continuous Plankton Recorder Action Group
CSNA	Commissione Scientifica Nationale per l'Antartide
EASIZ	Ecology of the Antarctic Sea Ice Zone
EBA	Evolution and Biodiversity in the Antarctic
ECA	Environmental Contamination in Antarctica
ECMWF	European Centre for Medium Range Weather Forecasting
EOS	Title of American Geophysical Union Transactions
GBIF	Global Biodiversity Information Facility
GCOS	Global Climate Observing System
GIS	Geographic Information Systems
GPS	Global Positioning System
IAES	International Antarctic Earth Sciences
IASC	International Arctic Science Committee
IBCSO	International Bathymetric Chart of the Southern Ocean
ICARP	International Conference on Arctic Research Planning
ICEFISH	International Collaborative Expedition to collect & study Fish Indigenous to Sub-Antarctic Habitats
ICESTAR	Interhemispheric Conjugacy Effects in Solar Terrestrial and Aeronomy Research
ICSU	International Council for Science
IGAC	International Global Atmospheric Chemistry
IGBP	International Geosphere-Biosphere Programme
IGOS	Integrated Global Observing Strategy
IHY	International Heliophysical Year
IMAGE	Imager for Magnetopause-to-Aurora Global Exploration
IOC	Intergovernmental Oceanographic Commission
IODP	Integrated Ocean Drilling Program
IPCC	Intergovernmental Panel on Climate Change
IPICS	International Partnership in Ice Core Science

IPY	International Polar Year
ISAC	International Study of Arctic Climate
IUGG	International Union of Geodesy and Geophysics
IWC	International Whaling Commission
JCADM	Joint Committee on Antarctic Data Management
JCOMM	Joint IOC/WMO Commission for Oceanography and Marine Meteorology
KGI	King George Island
MarBIN	Marine Biodiversity Information Network
MMEOPP	Marine Mammal Exploration of the Oceans, Pole to Pole
MPA	Marine Protected Area
NADC	National Antarctic Data Centre
NYSMAC	Ny Alesund Science Management Action Committee
OBIS	Ocean Biogeographical Information System
PantOS	Pan Antarctic Observing Systems
PNRA	Programme Nationale di Ricerce Antartide
POGO	Partnership for Observations of the Global Ocean
READER	Reference Antarctic Data for Environmental Research
RiSCC	Regional Sensitivity to Climate Change in Antarctic Terrestrial and Limnetic Ecosystems
SALE	Subglacial Antarctic Lake Environments
SC-AGI	Standing Committee on Antarctic Geographical Information
SCAR	Scientific Committee on Antarctic Research
SIGE	Sub-Ice Geological Exploration
SIOMIP	Southern Ocean-ice model comparison
SOOS	Southern Ocean Observing System
SRP	Scientific Research Programme
SSG	Standing Scientific Group
SSG-GS	SSG on Geosciences
SSG-LS	SSG on Life Sciences
SSG-PS	SSG on Physical Sciences
WCRP	World Climate Research Programme
WMO	World Meteorological Organization