



IASC 2012

BULLETIN

[IASC] · INTERNATIONAL ARCTIC SCIENCE COMMITTEE

The International Arctic Science Committee (IASC) is a non-governmental, international scientific organization. The IASC mission is to encourage and facilitate cooperation in all aspects of arctic research, in all countries engaged in arctic research and in all areas of the arctic region. Overall, IASC promotes and supports leading-edge multi-disciplinary research in order to foster a greater scientific understanding of the arctic region and its role in the Earth system.

TO ACHIEVE THIS MISSION IASC:

- Initiates, coordinates and promotes scientific activities at a circumarctic or international level;
- Provides mechanisms and instruments to support science development;
- Provides objective and independent scientific advice on issues of science in the Arctic and communicates scientific information to the public;
- Seeks to ensure that scientific data and information from the Arctic are safeguarded, freely exchangeable and accessible;
- Promotes international access to all geographic areas and the sharing of knowledge, logistics and other resources;
- Provides for the freedom and ethical conduct of science;
- Promotes and involves the next generation of scientists working in the Arctic; and
- Promotes bipolar cooperation through interaction with relevant science organizations.



IASC Bulletin 2012

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INTERNATIONAL ARCTIC SCIENCE COMMITTEE

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[IASC] · STRUCTURE

Representatives of national scientific organizations from all 19 member countries form the IASC Council. The President of IASC is elected by Council, which also elects 4 Vice-Presidents to serve on the Executive Committee. Council usually meets once a year during the Arctic Science Summit Week (ASSW). The IASC Executive Committee operates as a board of directors and manages the activities of IASC between Council meetings. The Chair is the President of IASC.

The IASC Secretariat implements decisions of the Executive Committee and Council, manages IASC finances, conducts outreach activities and maintains international communication.

IASC MEMBER COUNTRIES

Canada	Canadian Polar Commission	www.polarcom.gc.ca
China	Chinese Arctic and Antarctic Administration	www.chinare.gov.cn
Denmark/Greenland	The Commission for Scientific Research in Greenland	www.fi.dk
Finland	Delegation of the Finnish Academies of Science and Letters	www.tsv.fi/international/akatemiati/
France	Institut Polaire Français	www.institut-polaire.fr
Germany	Deutsche Forschungsgemeinschaft	www.dfg.de
Iceland	RANNÍS, The Icelandic Centre for Research	www.rannis.is
Italy	National Research Council of Italy	www.cnr.it
Japan	Science Council of Japan, National Institute of Polar Research	www.nipr.ac.jp
The Netherlands	Netherlands Organisation for Scientific Research	www.nwo.nl
Norway	The Research Council of Norway	www.forskingsradet.no
Poland	Polish Academy of Sciences, Committee on Polar Research	www.polish.polar.pan.pl
Russia	The Russian Academy of Sciences	www.ras.ru
Republic of Korea	Korea National Committee on Polar Research	www.kopri.re.kr
Spain	Comité Polar Español	www.micinn.es
Sweden	The Swedish Research Council	www.vr.se
Switzerland	Swiss Committee on Polar Research	www.polar-research.ch
United Kingdom	Natural Environment Research Council	www.nerc.ac.uk
USA	Polar Research Board	www.dels.nas.edu/prb/



PHOTO: ED STOCKARD

Clean science requires tyvek suits. Two science techs at summit have been out sampling snow at Summit Station, Greenland. It is a tough and sometimes extremely chilling job and these techs are dedicated to the task.



IASC 2012

BULLETIN

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[IMPRINT]

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COVERPHOTO: ADAM NAWROT
Two Svalbard reindeers on Wedel Jarlsberg Land, Svalbard.

[PREFACE]

Each year the International Arctic Science Committee (IASC) compiles and presents in its annual Bulletin an overview of the diverse activities conducted and sponsored by IASC. In addition to an annual report of new and continuing initiatives, the Bulletin also includes updates about prospects for future activities.

The year 2011 was an important year for IASC. Following a very successful kick-off workshop in Potsdam in January, the five IASC Working Groups - Atmosphere, Cryosphere, Marine, Social and Human Sciences, and Terrestrial - continued to gain momentum. Within just one year an impressive number of cutting-edge activities were initiated by the Working Groups in cooperation with IASC's various partner organizations.

The Arctic Science Summit Week (ASSW) 2011 held in Seoul, Republic of Korea, was the second ASSW to include a Science Symposium. The theme "The Arctic: New Frontier for Global Science" attracted almost 350 participants from over twenty countries. Planning for the next Science Symposium, to be held during the ASSW 2013 in Krakow, Poland, is already underway. The ASSW 2012 will not include a Science Symposium, but will be held in conjunction with the third and last conference of the International Polar Year (IPY) 2007/2008, the 2012 Montreal Conference "From Knowledge to Action".

For several years, IASC has been working closely with its southern hemisphere counterpart, the Scientific Committee on Antarctic Research (SCAR). A renewed Letter of Agreement confirmed the value of this synergy between the two organizations and a first joint newsletter publication by SCAR and IASC underlined the importance of bipolar research. Within the family of the International Council for Science (ICSU), SCAR and IASC play a key role in activities relating to polar science and at the 30th ICSU General Assembly SCAR, IASC and the Association of Polar Early Career Scientists (APECS) were given the unique opportunity to address the ICSU General Assembly.

In 2011, IASC also formalized its partnership with the University of the Arctic (UArctic) and the International Arctic Social Sciences Association (IASSA) in a trilateral Letter of Agreement. All three organizations agree that there are many common interests regarding international and multi-disciplinary cooperation in arctic research, education and outreach.

Another formal agreement was signed between IASC and the International Network for Circumpolar Health Research (INCHR). In the Letter of Agreement, the two organizations recognize their common interests in scientific research in the polar regions and that there is much to be gained from developing a synergy in promoting health research in the Arctic.

Three major reports, all partly related to the IPY, were published in 2011 with IASC participation. The comprehensive IPY summary report "Understanding Earth's Polar Challenges", prepared by the ICSU and World Meteorological Organization (WMO) Joint Committee for the IPY and compiled by some 300 authors and reviewers, showcases the findings from the IPY. The "Snow, Water, Ice and Permafrost in the Arctic (SWIPA)" assessment, coordinated by Arctic Council's Arctic Monitoring and Assessment Programme (AMAP) and produced in collaboration with IASC, the Climate and Cryosphere (CliC) project and IASSA, brings together the latest scientific knowledge about the changing state of each component of the arctic cryosphere. The "State of the Arctic Coast 2010" report, jointly published by IASC, the Land-Ocean-Interactions in the Coastal Zone (LOICZ) project, the International Permafrost Association (IPA) and AMAP, takes a social-ecological approach that explores the implications of change for the interaction of humans with nature in the arctic coastal zone.

Another major international initiative that can be considered an outcome of the IPY is the Sustaining Arctic Observing Networks (SAON) process, which was initiated by IASC and the Arctic Council in early 2007.

After a preparatory phase, the SAON initiative made the transition from a planning process to active implementation after formal approval by IASC Council and Arctic Council last year.

IASC is committed to maintaining the momentum generated by the IPY and is actively involved in several new initiatives to secure its legacies. For example, WMO with the support of IASC and other international organizations initiated a discussion on developing a new long-term polar initiative, which stems from the initial proposal to organize an International Polar Decade (IPD). Similarly, the Arctic Council, with IASC's participation, is in the process of designing another major assessment, the Arctic Change Assessment (ACA). And IASC is starting to prepare for an important event, namely its 25th anniversary in 2015. We are looking forward to these interesting developments leading us into the future of international arctic research.

Collaboration, cooperation and partnership are essential for the continued success and relevance of arctic research. Many individuals and groups have contributed to the development of IASC during the last year and we would like to thank them all, in particular our Council, Executive Committee and Working Group members.

David Hik | IASC President

Volker Rachold | IASC Executive Secretary

PHOTO: ED STOCKARD

This area of the Greenland ice sheet margin has been subjected to flooding and draining in an event termed a „jökulhlaup“. The ice blocked lake outlet floats upward and water and ice rush out.

PHOTO: COLE MOSZYNSKI
A close up of frazzle ice in a sampling hole in Allen Bay, which was part of field research for the sea ice-based study Arctic-ICE (Arctic – Ice-Covered Ecosystem in a Rapidly Changing Environment) in Resolute Passage, Nunavut, Canada. The underlying objective of the study is to determine the various pathways of carbon flow within the lower trophic levels of the ice-covered ecosystem using observational process studies in support of one- and three-dimensional ecosystem models.

1. IASC Internal Development

» 1 IASC Internal Development



IASC Organization

The International Arctic Science Committee (IASC) is a non-governmental organization that encourages and facilitates cooperation in all aspects of arctic research, in all countries engaged in arctic research and in all areas of the arctic region. To fulfill its mission, IASC promotes and supports leading-edge multi-disciplinary research

in order to foster a greater scientific understanding of the arctic region and its role in the Earth system. IASC was established in 1990, began operations in 1991, and today comprises 19 member countries. The IASC member organizations are national science organizations covering all fields of arctic research.

Country	Organization	Representative
Canada	Canadian Polar Commission	David Hik, President
China	Chinese Arctic and Antarctic Administration	Huigen Yang
Denmark/Greenland	The Commission for Scientific Research in Greenland	Naja Mikkelsen, Vice-President
Finland	Delegation of the Finnish Academies of Science and Letters	Kari Laine
France	Institut Polaire Français	Gérard Jugie
Germany	Deutsche Forschungsgemeinschaft	Karin Lochte
Iceland	RANNÍS, The Icelandic Centre for Research	Thorsteinn Gunnarsson
Italy	National Research Council of Italy	Carlo Barbante
Japan	Science Council of Japan, National Institute of Polar Research	Hiroshi Kanda
The Netherlands	Netherlands Organisation for Scientific Research	Louwrens Hacquebord
Norway	The Research Council of Norway	Susan Barr, Vice-President
Poland	Polish Academy of Sciences, Committee on Polar Research	Jacek Jania
Russia	The Russian Academy of Sciences	Vladimir I. Pavlenko
Republic of Korea	Korea National Committee on Polar Research	Byong-Kwon Park, Vice-President
Spain	Comité Polar Español	Manuel Catalan
Sweden	The Swedish Research Council	Magnus Friberg
Switzerland	Swiss Committee on Polar Research	Martin Luethi
United Kingdom	Natural Environment Research Council	Cynan Ellis-Evans
USA	Polar Research Board	Jackie Grebmeier, Vice-President

TABLE: An overview of all IASC Council members, including the countries and organizations they represent.

IASC Council

Representatives of national scientific organizations from all IASC member countries form the IASC Council that meets once a year during the Arctic Science Summit Week (ASSW). The Council members ensure an input of a wide range of scientific and technical knowledge and provide access to a large number of scientists and administrators through their national committees.

IASC Council members have the responsibility to:

- » Develop policies and guidelines for cooperative arctic research;
- » Establish Working Groups (WGs) that address and act on timely topics in arctic science;
- » Recommend, in cooperation with the WGs, implementation plans for IASC programs and activities;
- » Decide on the participation of national scientific organizations from the non-arctic countries; and
- » Organize arctic science conferences.

IASC Executive Committee

The Executive Committee operates as a board of directors and manages IASC's activities between Council meetings. The Executive Committee consists of five, by Council elected officials: the President and four Vice-Presidents, and the Executive Secretary.

IASC Secretariat

The IASC Secretariat is responsible for the daily operations of IASC. The IASC Secretariat staff consists of:

Volker Rachold | Executive Secretary

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Mare Pit | Executive Officer

E-mail: mare.pit@iasc.info

Sara Bowden | Executive Officer

E-mail: sara.bowden@iasc.info

Heike Midleja | Administrative Assistant

E-mail: heike.midleja@iasc.info

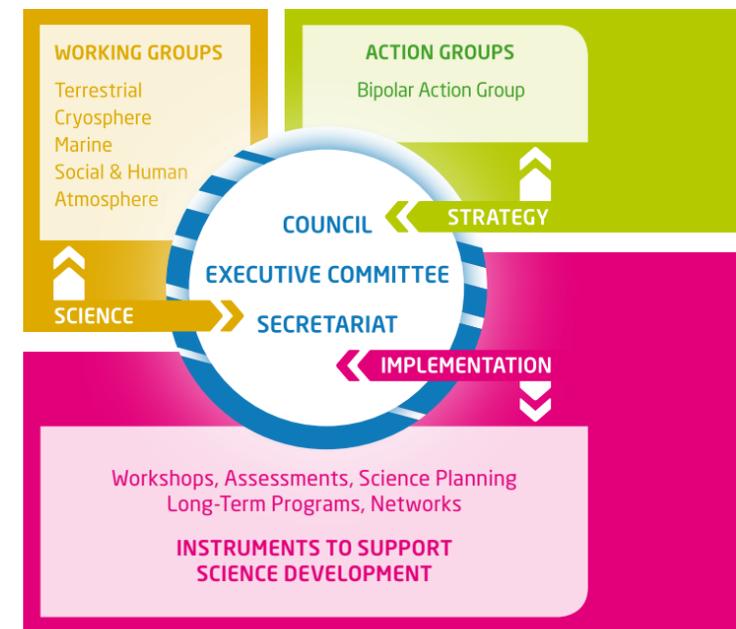


PHOTO: A group photo taken at the IASC Executive Committee (ExCom) meeting held in November 2011. At this meeting in Sidney, Vancouver Island, Canada, the ExCom was joined by Fred Roots, the very first IASC President from 1991 until 1993. From top to bottom and left to right: Volker Rachold (Executive Secretary), David Hik (IASC President), Sara Bowden (IASC Executive Officer), Fred Roots (past IASC President), Susan Barr (IASC Vice-President), Jacqueline Grebmeier (IASC Vice-

President) and Byong-Kwon Park (IASC Vice-President). Missing in this photograph is Naja Mikkelsen (Vice-President).

FIGURE: Diagram representing the key elements of the IASC organizational structure.

PHOTO: CHRISTIAN LETTNER
A pond has fallen dry during summer in a Cottongrass- (*Eriophorum scheuchzeri*) and Tundrigrass- (*DuPontia psilosantha*) dominated fen in front of Dombjerg near Zackenberg Research Station, Northeast Greenland.



2. IASC Working Groups

» 2 IASC Working Groups



The core elements of IASC are its Working Groups (WGs). IASC WGs identify and formulate science plans, research priorities, encourage science-led programs, promote future generations of arctic scientists and act as scientific advisory boards to the Council. In 2010 the IASC Council established five WGs: Terrestrial, Marine, Atmosphere, Social and Human Sciences, and Cryosphere.

The first combined IASC Working Groups Workshop was held in Potsdam, Germany in January 2011 and brought together all the members of the five WGs. During three intense days of discussion each of the Working Groups selected a Chair and members for their respective Steering Group, summarized the state of research in their field, discussed gaps in re-

search, and identified priority areas for short and longer-term attention. They also worked together to identify emerging crosscutting issues, which span the interests of several Working Groups.

A full year has passed since this kick-off workshop and all-together twelve workshops were organized and/or co-sponsored by the different WGs in 2011, two new networks were established and many more activities are scheduled to take place in 2012. In the following paragraphs the IASC Working Groups present an overview of their foci, their completed activities and plans for the upcoming year. More detailed information about the workshops can be found in Chapter 4: International Science Initiatives.

Terrestrial Working Group

Steering Group

Terry Callaghan, Chair, Sweden
Benjamin Vinegla, Vice Chair, Spain
Warwick F. Vincent, Vice Chair, Canada
Torben Christensen, Vice Chair, Denmark

Working Group Members

Luo Wei – China
Mads Forchhammer – Denmark
Antero Järvinen – Finland
Thierry Boulinier – France
Eva-Maria Pfeiffer – Germany
Karsten Piepjohn – Germany
Jon S. Olafsson – Iceland
Ingibjorg Svala Jonsdottir – Iceland
Takayuki Nakatsubo – Japan
Hiroshi Kanda – Japan
Yoo Kyung Lee – Korea
Jelte Rozema – The Netherlands
Inger Greve Alsos – Norway
Stephen Coulson – Norway
Wiesław Ziąja – Poland
Piotr Głowacki – Poland
Daniel Sanchez-Mata – Spain
Phil Wookey – UK
Donald A. (Skip) Walker – USA
Vanessa Loughheed – USA

Scope

The scientific scope of the Terrestrial Working Group shall include any scientific research on arctic terrestrial and freshwater environments, landscapes and biota, and their responses to, and interactions with, other components of the Earth system. The remit encompasses the dynamics of the arctic system; past, present and future.

Geographically, the main area of interest of the IASC Terrestrial Working Group encompasses lands and fresh water within the area north of the latitudinal tree line with arctic climate and arctic vegetation. Several adjacent areas are included that are highly relevant for certain disciplines and projects (a) boreal oceanic tundra (e.g. the Aleutian Islands, North Atlantic islands), (b) alpine tundra that is continuous with the arctic tundra (e.g. the central highlands of Iceland, the Scandes Mountains, the Polar Urals), (c) the forest tundra, and (d) drainage basins to the south that connect with freshwater and marine areas of the Arctic.

Scientific Priorities

- » Estimating past changes in arctic geo- and biodiversity, measuring current change and predicting future changes;
- » Determining the net effect of the terrestrial and freshwater environmental and biosphere's processes that amplify or moderate climate warming;
- » Developing high spatial resolution models of terrestrial geosystems and ecosystem change, and other tools that can be used by arctic stakeholders for adaptation strategies and sustainable management of natural resources and ecosystem services;
- » Developing unifying concepts, fundamental theories and computer models of the interactions among species, interactions between species and their environment, and the biology of life in extreme environments; and
- » Determining the role of connectivity in the functioning of arctic terrestrial systems, including connections within the arctic and the global system.

Crosscutting

Understanding the major issues within the wide disciplinary and geographical scope of the Terrestrial Working Group requires interaction with the other

PHOTO: CHAS JONES

International Arctic Research Center Research Engineer Bob Busey maintains a weather station near Kugarok, Alaska, which is part of a series of stations being used to monitor regional weather patterns and changes in climate across Alaska.

IASC Working Groups. The initial priority activities developed by the Terrestrial WG would benefit from interactions with all the Working Groups

Activities

Understanding Biodiversity Changes and Causes

On October 12, 2011 the Terrestrial WG co-sponsored a joint conference on "Understanding biodiversity changes and causes" in Hvalsø, Denmark. International, regional, national and local actors have initiated projects and programs to further knowledge of landscape, climate and ecosystems to improve the ability to detect changes that allow people to deal with some of the challenging issues that the Arctic is facing today. The potential for collaboration was recently discussed among some circumpolar initiatives, such as IASC, the Circumpolar Biodiversity Monitoring Program (CBMP) of the Conservation of Arctic Flora and Fauna (CAFF) Working Group and the International Study of Arctic Change (ISAC). It was decided to hold a workshop to bring together some of the players in arctic terrestrial biodiversity research and monitoring to identify synergies and potential areas of collaboration.

Microbial Genomics in the Arctic Cryosphere

In a different activity, the Terrestrial WG, in cooperation with the IASC Cryosphere WG, supported the participation of early career scientists at the international CAREX Conference on Life in Extreme Environments to represent the theme 'microbial genomics of the arctic cryosphere'. The group reported back on their experiences and shared their research through a virtual poster session that was organized in cooperation with the Association of Polar Early Career Scientists (APECS). Molecular technologies in the life sciences are transforming our view of biodiversity, biological processes, ecology and evolution. This is especially true in microbiology, where application of DNA and RNA-based approaches has shown that much of the world's biodiversity lies within the three domains of microbial life: Eukarya, Archaea and Bacteria.

Interactions between Sea Ice, Near Coastal Processes and Terrestrial Ecosystem Dynamics

A "Mini conference on Interactions between sea ice, near coastal processes and terrestrial ecosystem dynamics" was co-sponsored by the Terrestrial WG and the Cryosphere WG. The mini conference took place in September in Nuuk, Greenland. Other partners in this initiative were the EU-RTN project GREENCYCLES II, the top-level research initiative NCoE DEFROST, the EU INTERACT infrastructure project, the Greenland Climate Research Centre and several national Danish, Greenlandic and Swedish projects. The main goal of the mini conference was to get a varied group of experts together and to provide a deliverable that incorporated an integrated view of arctic carbon cycling, with an emphasis on connections and trends with the marine environment that previously have been overlooked or underexposed.

Other Identified Priority Activities

The Terrestrial WG has convened sub-groups that will, over the next 12-18 months:

- » Develop an action plan for research on the factors that shape biodiversity in the Arctic: a draft proposal on invasive species is already in preparation;
- » Facilitate building capacity for species identification, for making a biodiversity inventory and an improved biodiversity monitoring program;
- » Develop an action plan to improve the measurement and monitoring of greenhouse gas emissions and other feedbacks to climate focus initially on the lability of carbon in arctic soils and permafrost to give input to the International Permafrost Association (IPA) carbon mapping project; and
- » Assess and improve our current understanding of landscapes in rapid transition.

<http://www.iasc.info/index.php/home/groups/working-groups/terrestrial>



Marine Working Group

Steering Group

Savithri Narayanan, Chair, Canada
Bert Rudels, Vice Chair, Finland
Rolf Gradinger, Vice Chair, USA
Harald Loeng, Past Chair, Norway

Working Group Members

Jinping Zhao – China
Naja Mikkelsen – Denmark
Morten Hotegaard Nielsen - Denmark
Kari Strand – Finland
Michael Klages – Germany
Heidi Kassens - Germany
Steingrímur Jónsson - Iceland
Gudrun Marteinsdottir – Iceland
Stefano Aliani - Italy
Koji Shimada – Japan
Sung-Ho Kang – Korea
Hein J.W. de Baar - The Netherlands
Marit Reigstad – Norway

Jan Piechura – Poland
Jan M. Weslawski - Poland
Miquel Canals – Spain
Francisco Gordillo – Spain
Leif Anderson - Sweden
Jeremy Wilkinson – UK
Sheldon Bacon – UK
Mary-Louise Timmermans - USA

Scope

The geographic scope of the Marine Working Group shall be the Arctic Ocean and the Subarctic Seas. The scientific scope of the Marine Working Group shall include, but not be limited to any marine natural science or engineering research.

Scientific Priorities

The core of the Marine WG of IASC has been active as the Arctic Ocean Sciences Board (AOSB) for the past 25 year. Therefore, their priorities and activities are ongoing and well established. However, the membership expanded considerably when AOSB merged with IASC in 2009 and the meeting in Potsdam in January

PHOTO: IÑIGO GARCIA ZARANDONA
Research Vessel Jan Mayen is making its way deep into the ice of the Barents Sea.

2011 offered the first opportunity for the new and expanded membership to meet. Since their terms of reference were already agreed upon, the group focused first and foremost on discussion and approval of its five-year strategy (priority areas of research), secondly on its ongoing activities, and lastly on development of cross-cutting initiatives that could be undertaken with other IASC WGs.

Scientific Priorities of the Marine WG are:

- » Predicting and understanding rapid changes to the Arctic Ocean system;
- » Understanding sea ice structure dynamics and the arctic system;
- » Understanding biological and ecosystem processes in the arctic and sub-arctic seas;
- » Understanding geochemical processes in the arctic and sub-arctic seas; and
- » Improving access to the geological record of the Arctic Ocean.

Activities

Many of the activities undertaken by the Marine WG are directly related to the priorities outlined above. Some of the priority areas have no current activities but the Marine WG will entertain new activities in these areas in 2012 and beyond. Following the Potsdam meeting, the Marine WG held its annual meeting during the ASSW 2011 in Seoul, Korea. At this meeting it approved a number of activities related to the priorities identified in its five-year plan.

Understanding Sea Ice Structures and Dynamics

The Marine WG was instrumental in drafting a crosscutting proposal with the Cryosphere WG and Atmosphere WG to better understand sea ice structure and dynamics by creating an IASC network entitled the Arctic Climate System Network (ACSNet). This program aims through the coordination and networking of existing or emerging fieldwork, to implement an intensive cross-disciplinary

study of the role of the polar seas in climate. The essential aim of ACSNet is to devise a common space-time framework for individual research projects arguing for the combining of disparate efforts to form an intensive, international and multidisciplinary research effort - initially with its focus on the Greater Canada Basin and its marginal ice zone. Chaired by Marine WG member Mary Louise Timmermans, the ACSNet will hold its first open meeting during the IPY Montreal Science Conference in April 2012.

The Site Survey Challenge

The Working Group co-sponsored with the European Science Foundation a workshop on "Overcoming Barriers to Arctic Ocean Scientific Drilling: the Site Survey Challenge" in November 2012 in Copenhagen, Denmark. Chaired by WG member Naja Mikkelsen, the workshop aimed to develop a site survey and planning strategy based upon existing and planned proposals for deep sea drilling in the Arctic Ocean.

Distributed Biological Observatory

Also in November, the Marine WG partnered with the Pacific Arctic Group (PAG) to support a Distributed Biological Observatory Workshop in Victoria, Canada. The Distributed Biological Observatory (DBO), led by Jacqueline Grebmeier, is designed as a change detection array for the identification and consistent monitoring of biophysical responses in pivotal geographic areas that exhibit high productivity, biodiversity and rates of change. PAG is undertaking a pilot program of this array. With the goal of the Marine WG to both understand biological processes and ecosystem change in the Arctic, the WG is supporting actions to harmonize DBO activities in the Pacific sector with similar and ongoing planned activities in the Atlantic sector of the Arctic.

Arctic in Rapid Transition

The Arctic in Rapid Transition (ART) Initiative is an integrative, international, interdisciplinary, pan-arctic network to study the spatial and temporal changes

in sea ice cover, ocean circulation and associated physical drivers over multiple timescales to better understand and forecast the impact of these changes on the ecosystems and biogeochemistry of the Arctic Ocean. The ART initiative was initiated by early career scientists in October 2008 and subsequently endorsed by the Marine WG. The ART Executive Committee (EC), chaired by Carolyn Wegner, held a meeting in November in Copenhagen to develop several funding proposals for activities in 2012 and beyond. Additionally, the EC is planning a workshop in October 2012 in Sopot, Poland entitled "Overcoming challenges of observation to model integration in marine ecosystem response to sea ice transitions".

Integrated Arctic Ocean Observing System

During the IPY, the WG organized and supported the integrated Arctic Ocean Observing System (iAOOS), which supported many new observational initiatives in the Arctic Ocean and sub-arctic seas. The Marine WG now envisions a Sustained Arctic Observing Network (SAON) of technical capacity, human resources, good will and commitments that will compile Arctic Ocean data acquired during the IPY, and complete its standardization, synthesis and timely migration from project archives to a single internally consistent public resource. At this point, the focus of the WG is proposing a modest demonstration project to explore and address the challenges of this vision. The demonstration will focus attention only on observations from moored instruments during IPY. The hope is to assemble and provide easy access to as much data as possible. The consolidated data will further be integrated to form a preliminary synthesis of the state of the Arctic Ocean during the IPY. A core group of individuals, led by Humfrey Melling, has been working to realize this vision and held a discussion with Principal Investigator (PIs) in November 2011 during the Arctic Sub-arctic Ocean Fluxes (ASOF) meeting in Bergen, Norway. A subsequent larger meeting with data managers and PIs is being planned for 2012.

Formal Partnership with ICES

During 2011, IASC, on behalf of the Marine WG, signed a Memorandum of Understanding (MoU) with the International Council for the Exploration of the Sea (ICES). Under this MoU, the Working Group will jointly sponsor two sessions at the September 2012 Annual Science Conference of ICES. Taking into account the Marine WGs long experience with subarctic influences on the physical dynamics of the Arctic and the biogeochemical responses, it will cosponsor a session on "The Role of the Arctic in Climate Change" and "Sub-arctic-Arctic Interactions: Ecological Consequences." This will be the first of what hopefully will be many more collaborations with ICES.

<http://www.iasc.info/index.php/home/groups/working-groups/marineaosb>



PHOTO: IÑIGO GARCIA ZARANDONA
A walrus is resting near the settlement of Smeerenburg on Amsterdam Island in Northwest Svalbard.

Atmosphere Working Group

Steering Group

Jim Overland, Chair, US
Michael Tjernström, Vice Chair, Sweden
Hiroshi Tanaka, Vice Chair, Japan

Working Group Members

Claude Labine – Canada
Bian Lingen – China
Henrik Skov - Denmark
Timo Vihma – Finland
Lasse Makkonen - Finland
Kathy Law - France
Klaus Dethloff – Germany
Günther Heinemann – Germany
Halldor Bjornsson – Iceland
Gudrun Nina Peterson - Iceland
Vito Vitale – Italy
Young Jun Yoon - Korea
Kjetil Tørseth – Norway
Anna Sjöblom – Norway
Tadeusz Niedźwiedź - Poland
Rajmund Przybylak – Poland
Angel Frutos Baraja – Spain
John Cassano - USA

Scope

The geographic scope of the Atmosphere Working Group shall be the Arctic but will also include the Arctic's responses to global change processes (arctic amplification) and impacts of arctic changes on the northern hemisphere atmospheric circulation.

The scientific scope of the Atmosphere Working Group shall include any scientific research towards understanding and prediction of arctic change, including the fate of perennial sea ice and the global atmospheric consequences of its disappearance. This

includes past climate states, investigation of arctic processes across data sets and approaches, and climate model projections of the future.

Scientific Priorities

During its inaugural meeting in Potsdam in January 2011, the WG decided to focus its efforts upon two scientific priorities. In addition, the WG is providing support for historical data retrieval and reanalysis.

- » The first of the priorities for the Atmosphere WG is to engage fully with the World Climate Research Programme (WCRP) to develop a program on polar climate predictability. Polar climate predictability is an issue of growing concern particularly as it becomes clear that arctic amplification has an impact on lower latitudes. IASC, together with WCRP can play a leading role in bringing the international community together to address issues related to decadal and multi-decadal prediction.
- » The second scientific priority is to initiate the planning and design of a long-term, international, observational ice camp observatory in order to provide much needed observations to support regional and global climate model simulations.

Activities

The Atmosphere WG has held two ad hoc meetings, one at the ASSW in Seoul, Korea in April 2011 and one at the WCRP Open Science Conference in Denver, USA in October 2011. It will meet again at the ASSW in Montreal in April 2012.

Drifting Sea Ice Observatory

In September 2011, the Working Group sponsored an inaugural workshop of approximately 50 participants on the underlying scientific justification for a long-term, internationally supported drifting sea ice observatory. The workshop, held at AWI Potsdam and chaired by the German WG member, Klaus Dethloff, was entitled "Atmospheric Investigations on a Drif-



ting Observatory on the Arctic Sea and Regional and Global Climate Model Simulations (AIDA-RCM)". The workshop resulted in the appointment of a core group that will further develop the concept. A white-paper is currently in development and a follow-up workshop will take place in the spring of 2012 in the United States, which will provide the input for the write-up of a science plan.

The Atmosphere WG sponsored a mini-workshop prior to the WCRP open science conference in order to obtain community feedback on the concept of the internationally supported drifting sea ice observatory. The workshop was held on October 23 and approximately 25 people attended and offered suggestions and comments on the development of such a program. The participants were widely encouraging of the effort. It was agreed that the WG will engage the Climate and Cryosphere (CliC) project Sea Ice WG and the IASC Cryosphere WG in this effort.

Polar Climate Predictability

Also on October 23 in Denver, the WG sponsored an open workshop with WCRP on how to energize the international community to participate in activities to improve polar climate predictability. This workshop resulted in the Atmosphere WG taking a leading role

in this effort to better define what is meant by predictability and to add a focus on sea ice and its impact on polar climate predictability in the decadal to multi decadal timeframe. The WG will co-sponsor a workshop in Toronto, Canada in April 2012 to further define this activity and begin developing a science plan to support it.

Related to the theme of polar climate predictability, the WG, in collaboration with the US Polar Research Board, hosted a session at the American Geophysical Union Fall Meeting on "Coupled Process in the Polar System", which focused on feedbacks, amplification and impacts on the mid-latitudes.

Perceptions and Representations of Polar Climate Science

The Atmosphere WG, in close cooperation with the Social and Human Sciences WG, is hosting a session at the IPY Montreal Science Conference on Public Perception of Arctic Change, specifically focusing on the question: "Why is the public becoming more skeptical about climate change even as evidence to the contrary mounts?"

<http://www.iasc.info/index.php/home/groups/working-groups/atmosphere>

PHOTO: MAREK KASPRZAK
A view from Jens Erikfjellet (575 m a.s.l.) to Solheimfjellet (795 m a.s.l.) and next Raudfjellet (1014 m a.s.l.), Wedel-Jarlsberg Land, Svalbard.



Social and Human Sciences Working Group

Steering Group

Peter Schweitzer, Chair, USA
 Sylvie Blangy, Vice Chair, France
 Gail Fondahl, Vice Chair, Canada
 Louwrens Hacquebord, Former Chair, The Netherlands

Working Group Members

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 Lone Dirckinck-Holmfeld - Denmark
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 Joachim O. Habeck – Germany
 Joan Nymand Larsen – Iceland
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 Ryszard Czarny - Poland
 Dongmin Jin – Korea
 Gunhild Hoogensen Gjørsv - Norway
 Alf Håkon Hoel – Norway
 Peter Sköld – Sweden
 Philippe Geslin - Switzerland
 Sven D. Haakanson - USA

Scope

The scientific scope of the Social and Human Sciences Working Group shall include all aspects of social sciences and humanities research in the Arctic, as well as their connections with other IASC Working Groups. The actual work of the Social and Human Sciences WG will be determined by a dynamic list of scientific focus areas.

The geographic scope of the WG shall be the Arctic as defined in the map accompanying the Arctic Human Development Report (AHDR). The geographic scope can be extended south where it is appropriate for an understanding of arctic social and human processes.

Scientific Priorities

The Social and Human Sciences WG members agreed upon the following list of scientific foci. It is to be expected that this list will be significantly refined within the first year of the WG's existence and continually updated thereafter.

- » Indigenous peoples and change: adaptation and cultural and power dynamics;
- » Exploitation of natural resources: past, present, future;
- » Histories and methodologies of arctic sciences and arts;

- » Perceptions and representations of the Arctic;
- » Human health and well-being; and
- » Security, international law and cooperation.

Crosscutting themes

Based on the scientific foci, the following list of cross-cutting issues was adopted. The list is based on WG needs as well as on opportunities provided by the focus areas of other working groups. The list of cross-cutting issues is as dynamic as the list of scientific foci; its development and refinement will depend on actual cross-working group interactions.

- » Human health, wellbeing and ecosystem change;
- » Collaborative community research on climate change;
- » Competing forms of resource use in a changing environment;
- » People and coastal processes; and
- » Perception and representation of arctic science.

Activities

Public sessions at the International Congress of the Arctic Social Sciences

The Social and Human Sciences WG organized a "Public Information and Feedback Session" during the 7th International Congress of the Arctic Social Sciences (June 22, 2011 Akureyri, Iceland) and drew quite an audience. The inclusion of a WG that focuses on the social sciences and humanities into the core IASC structure was experienced as a welcome recognition of the importance of these sciences in the Arctic and emphasized the importance of cross-disciplinary research approaches that have not always been so natural in the past.

The Working Group also organized its annual WG meeting in Akureyri on June 22nd and 23rd. During the Working Group Meeting the members discussed

the upcoming initiatives and priorities and reported on activities undertaken at a national level. Discussions on cooperation on a crosscutting and bipolar level were explored with two invited speakers: Hartwig Kremer of the Land-Ocean Interaction in the Coastal Zone (LOICZ) project and Daniela Liggett, member of the Scientific Committee on Antarctic Research (SCAR) Social Sciences Action Group. Smaller task teams were formed to take on upcoming activities and further develop suggested ideas.

Perceptions and Representations of Arctic Science

At the final day of the ICASS Conference the WG organized a well-attended Roundtable on "Perceptions and Representations of Arctic Science". There are multiple and contested perceptions and representations of Arctic science. There has been an increasing if not widespread awareness of potential and actual misunderstandings on all parts, but even though this issue has been raised on earlier occasions, the issue has yet to be discussed systematically. Therefore the IASC Social and Human Sciences Working Group believed it was time to explore in a roundtable format how to further address the interconnection of arctic science, politics, stakeholders, the media, and the wider public. The invited speakers and participants included scientists from different disciplines, countries and also communication advisers and journalists. A full report on the roundtable was published in the IASSA newsletter Northern Notes. The WG will take the roundtable concept further and organize more targeted public sessions that deal with the more specific actors identified in this first more general round. The next session on "Perceptions and Representations of Polar (Climate) Science" will be organized in cooperation with the Atmosphere WG at the IPY 2012 Montréal Science Conference. The WG will also explore the possibility of cooperation with a polar journal on a special edition on the topic.

Local Ecosystem Changes and Adaptation

Another WG initiative that is still in development

PHOTO: JOACHIM OTTO HABECK

In many parts of the Russian North, the helicopter is the fastest and easiest means of transportation, but also the most expensive one. Fuel prices and changing state subsidies determine the accessibility of remote settlements and the spatial mobility of their inhabitants. This photograph was taken in Kolvaty, Russia, 1998.

concerns a community-based workshop that will focus on local ecosystem changes and adaptations. The Working Group will collaborate with the community and local industry in planning and conducting the proposed workshop.

Advocating the Social Sciences and Humanities in Arctic Research

An ongoing activity of the WG is the inventory of existing funding opportunities and further advocate the humanities and social sciences in the funding structures for international arctic research. The national reports will be made available online and distributed through the various networks for social scientists.

The WG has also decided to support and contribute to the Arctic Human Development Report II (AHDR II), led by the Stefansson Arctic Institute in Akureyri, Iceland. A number of WG members will be engaged in the report as lead or contributing authors.

Finally, the WG is planning a joint session with the Social Science Action Group of SCAR entitled "Changing Poles: Challenges to Antarctic and Arctic Communities and Institutions" at the SCAR Open Science Conference in July 2012 in Portland, USA.

<http://www.iasc.info/index.php/home/groups/working-groups/socialahuman>

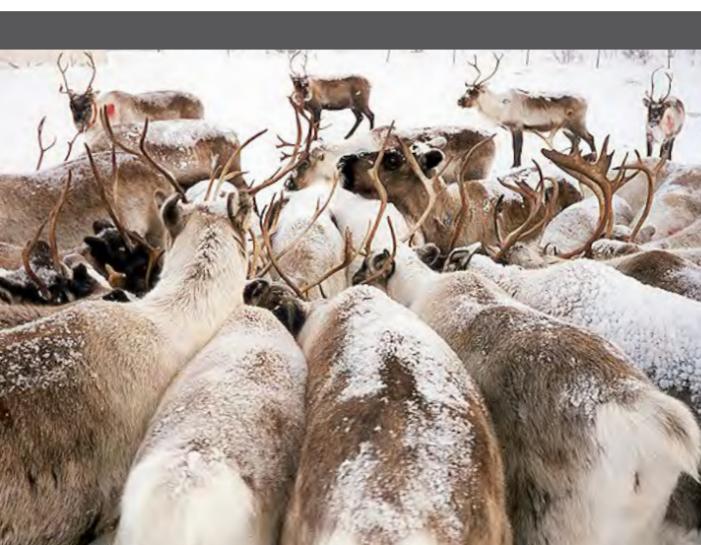


PHOTO: SYLVIE BLANGY

With climate change and warm winters, the top layer of the snow cover can freeze to an almost impenetrable hardness. Digging this kind of snow is no longer possible for reindeers. At this time the reindeer herder has to direct the flock to good "luppo-pastures," areas of old forest where there is sufficient horsetail lichen and other tree-hanging lichens available or to gather them and feed them in a corral nearby the village. This group of reindeer belongs to Britt Marie Labba and Per Nils Pääviö from Övre Soppero also tourism entrepreneurs.

Cryosphere Working Group

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Jacek Jania – Poland
Francisco Navarro – Spain
Georgia Destouni – Sweden
Martin Lüthi – Switzerland
Francesca Pellicciotti – Switzerland
Walter Meier – USA
Elizabeth Hunke – USA

Scope

The geographic scope of the Cryosphere Working Group shall be those areas of the Arctic and contiguous areas of the sub-Arctic where one or more elements of the cryosphere (including the Greenland ice sheet, mountain glaciers, ice caps, icebergs, sea ice, snow cover

and snowfall, permafrost and seasonally frozen ground, and lake- or river-ice) plays an important role in surface-climate interactions and/or the fresh water budget. It will include the Arctic Ocean and surrounding seas, Alaska, Canada's northern territories, Greenland, Iceland, Svalbard and the Russian arctic archipelagos, and parts of Canada, Scandinavia, and northern Russia that lie polewards of the southern limit of discontinuous permafrost.

The scientific scope of the Cryosphere Working Group shall include any scientific or engineering research relating to the arctic and sub-arctic cryosphere, including its interactions with the climate, oceans, and biosphere.

Scientific Priorities

The Cryosphere WG decided to focus its efforts upon three major scientific priorities.

- » Sea-ice boundary layer dynamics, particularly as they relate to biogeochemical exchanges and polar amplification;
- » Permafrost, including support of activities being undertaken by the International Permafrost Association (IPA); and
- » Tidewater glacier dynamics and response to climate change, with a focus on methods for studying these issues. This activity is intended to have a large early career scientist and training component.

Activities

In support of these priorities, the WG has undertaken a number of activities in the past year and is planning several more for 2012. Following the inaugural meeting of the group, the Cryosphere WG entertained a number of proposals for activities and supported several of them. In 2011, the Working Group also supported the development of the Arctic Climate System Network, a new crosscutting initiative of IASC, and two Terrestrial WG activities, one related to microbial genomics in cold regions, and the other

related to sea ice, near-coastal process and terrestrial ecosystem dynamics.

Global Terrestrial Network on Permafrost

The Working Group co-sponsored with the IPA a November 2011 workshop in Potsdam, Germany. The aim of the workshop was to promote an effort to define user requirements for the Global Terrestrial Network on Permafrost (GTN-P) and encourage the international standardization of permafrost measurement methods. This workshop included a number of early career scientists supported by the WG.

Assessing the Mass Balance of the World's Land Ice

In 2011, the Cryosphere WG also supported a meeting of the Glacier and Ice Cap (GIC) Working Group, which is an international ad-hoc group of glaciologists specializing in global assessments of the mass balance of the world's land ice (exclusive of the two ice sheets in Greenland and Antarctica). Their purpose is to improve the global inventory of glaciers and ice caps, compiling a current assessment of glacier and ice cap loss rates, improving existing loss rate projection methods, developing new projection methods, and preparing publications on these subjects, all in time for the literature deadline for the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment, on 31 July, 2012. The WG supported their 19-21 June, 2011 meeting where efforts were made to begin drafting the IPCC report.

Atmosphere-Sea Ice-Ocean Boundary Layer Processes

The Cryosphere WG is organizing a workshop in Boulder, USA in May 2012 on atmosphere-sea ice-ocean boundary layer processes and their role in polar change. This workshop aims to bring together observational experts, theorists and modelers interested in exploring the physical, chemical and biological exchanges between the atmosphere, ice and ocean in the polar seas. The WG is coordinating this activity with the Atmosphere WG, the CliC project and SCAR.

Tidewater Glaciers

Third, the Cryosphere WG is developing a long-term effort on tidewater glaciers that includes a series of workshops and training sessions on research methods including terrestrial photogrammetry as applied to the dynamics and change of tidewater glaciers. This initial activity will begin in January 2012 at the IASC Network on Arctic Glaciology (NAG) meeting in Poland where efforts will be undertaken to define a long-term activity and begin discussion of a series of workshops and training activities to be run by the WG in collaboration with other partners.

The first training exercise for early career scientists is being planned for the summer of 2012 and will be a training exercise in Svalbard aboard the Polish R/V Horyzont II. The intent is to include up to 25 mostly early career scientists in this activity, to spend 4 days visiting tidewater glaciers and holding workshops aboard the vessel, including one on terrestrial photogrammetry. The long-term objective is to undertake a multi-year international effort focused on tidewater glacier dynamics and interactions with the atmosphere and ocean, as well as on training the next generation of scientists in this field.

<http://www.iasc.info/index.php/home/groups/working-groups/cryosphere>



PHOTO: MAREK KASPRZAK

An ice cliff of Hansbreen glacier by the fjord Hornsund, Wedel-Jarlsberg Land, Svalbard.

PHOTO: ANGUS DUNCAN
Two curious arctic foxes on the Devon Island ice cap. The photo was taken during fieldwork for the IPY
GLACIODYN project that examines dynamic response of arctic tidewater glaciers to climate change.



3. IASC NETWORKS

» 3 IASC Networks

IASC provides seed money and in-kind support for the founding, development, and ongoing operation of thematic networks that assist the organization in fulfilling its scientific mission. In general IASC supported activities are international, encourage circum-arctic activities and strive to involve early career scientists.

Arctic Palaeoclimate and its Extremes (APEX)

2011: Towards APEX II

The idea for an international research network on Arctic Palaeoclimate and its Extremes (APEX) originated in October 2004 at a workshop in Brorfelde, Denmark. The motivation for forming a new network was to continue and develop further the interaction between scientists and institutions that had been involved in the two previous research programs: the Polar North Atlantic Margins Late Cenozoic Evolution (PONAM) (Elverhøi et al., 1998) and the Quaternary Environments of the Eurasian North (QUEEN) (Thiede et al., 2004). An important additional aim was to let the next generation of scientists fostered during these two programs come forward and take leading roles.

APEX developed rapidly, building on the excellent legacy from PONAM and QUEEN. The geographic scope was increased from primarily Svalbard, Greenland and Northern Eurasia to encompass the entire arctic circumpolar region.

Following from the recognition of APEX as one of the lead International Polar Year (IPY) 2007/2008 "cluster" coordinating projects, the First APEX Conference and Workshop was organized in 2007. One year later, APEX was formally endorsed by IASC as one of their supported network activities. For many scientists working on the palaeoclimate evolution of the arctic regions, specifically concerning the Quaternary period, APEX has grown to become the main network for focused scientific discussions, and exchange of ideas and planning of new fieldwork. The annual Conference and Workshop continues to be our main forum. Summaries of some of APEX's scientific results have been published in special APEX volumes of peer-review journals: Issue 2 in volume 27 of *Polar Research* 2008 and issues 25-25 in volume 29 of *Quaternary Science Reviews* 2010.

Fifth Conference and Workshop

The most recent, Fifth APEX Conference and Workshop 2011, was hosted by the University Centre of Svalbard (UNIS), situated in Longyearbyen. The meeting comprised scientific presentations, a one-day boat



excursion to Billefjorden to visit the site Kapp Ekholm, and a one-day workshop aimed at starting the work towards synthesizing the most recent years of scientific results within APEX.

To set the scene for our last day of workshop discussions, we had asked the network community for presentations during the first conference day that were related to the original APEX scientific themes:

- » **Cold extremes:** Arctic marine and terrestrial glacial maxima; sea level minima and sea-ice maxima; Arctic Ocean palaeoceanography; ice shelf extent; past atmospheric circulation;
- » **Warm extremes:** Interglacial and interstadial environments; sea level maxima; sea-ice minima; Arctic Ocean palaeoceanography; ice shelf extent;
- » **Hydrological extremes:** Fluvial-marine interaction; freshwater budget and ice-dammed lakes;
- » **Permafrost extremes:** Maximum and minimum extent; rates of change; response to climate change;
- » **Glacio-dynamical extremes:** Ice sheet configurations and instability; palaeo-ice stream dynamics and feedback mechanisms; and
- » **Biotic change:** Evolution of the arctic marine and terrestrial biosphere and its response to extreme palaeoclimatic conditions; ice-age development of human settlement.

The field excursion to Kapp Ekholm was a unique opportunity for the APEX community to visit the site, famous for its fossil shells of *Mytilus edulis* requiring warmer conditions than present. Leading scientists who work on the site gave a series of presentations. Kapp Ekholm comprises a coastal sequence of sediments, exposed in a cliff, which extends back in time over several previous interglacials, when sea-level was higher than present. It has become a type site for our understanding of the Late Quaternary of the Svalbard – Barents Sea region. Despite this long history of research, there remains debate over the precise ages of the sequences exposed.

The third day of the meeting comprised a focused discussion around four topics that APEX considered were suitable for exploring further at our upcoming Sixth meeting in 2012, forming a synthesis of what we now think of as APEX I. The intention is that these themes will provide a basis for synthesis papers that will be discussed at our Sixth meeting, providing a benchmark review of the state of APEX science. The papers will be submitted as a set of reviewed papers to an international journal later in the year.

Sixth Workshop and Conference

The Sixth APEX Workshop and Conference will be hosted by Oulu University at Oulanka Research Station, Finland (May 15-19th 2012). The Sixth APEX Conference

PHOTO: Group photo with the participants of the Fifth APEX Conference and Workshop, hosted by the University Centre of Svalbard (UNIS).

and Workshop comprises two days with the main focus on the following themes:

- » The Postglacial Arctic
- » The Glacial Arctic
- » The Eemian Arctic

A second objective of the Sixth APEX Meeting is to develop the footings for APEX II – the next program in the series for APEX. The intention is for the current scientific leaders to pass the responsibility for APEX to a new set of colleagues, drawn from those who have emerged as important players in APEX I. This way we hope to maintain the impetus of APEX by developing a new research agenda to take our community forward for the next five years.



PHOTO: Svend Funder (left) from the University of Copenhagen, Denmark and Jan Mangerud (right) from the University of Bergen, Norway at the Fifth APEX Conference and Workshop.

Outlook

The outlook for the APEX program could not be brighter. The community has grown in strength over the last five years and is now recognized as one of the leading programs of interdisciplinary arctic palaeo-environmental research, especially during the Quaternary. We have a unique community of scholars working across the Arctic on land and at sea. Our community has strengths in field-based observations, in advanced laboratory analysis, as well as in computation modeling to both hind- and forecast what has happened in the past and what may happen in the future. The community comprises a balance of colleagues at different stages in their careers, and plays an important role in fostering early career scientists in a supportive environment. We greatly look forward to the Sixth APEX Conference in Finland and, in due course, to the challenges set by APEX II.

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Network on Arctic Glaciology (NAG)

The Network on Arctic Glaciology (NAG) is a group of scientists with interests in the dynamics of arctic glaciers and their response to climate change. It holds an annual meeting, and has been involved in the organization of summer schools and workshops (such as the one on the use of automated measuring systems on glaciers that was held in Pontresina, Switzerland from 23-26 March, 2011, organized by Carleen Tilm-Reijmer). NAG members have played a prominent role in writing the chapter on Mountain Glaciers and Ice Caps in the forthcoming report on Snow, Water, Ice and Permafrost in the Arctic (SWIPA) that was commissioned by the Arctic Council and will be published early in 2012.

NAG also initiated the International Polar Year program Glaciodyn, and several field experiments initiated for Glaciodyn continue today (for example the Dutch/Swedish collaboration on Nordenskiöldbreen, Svalbard, Norwegian activities on Kronebreen and Austfonna, Svalbard, and the Canadian program on Belcher Glacier, Devon Island). NAG members are also at the core of GICAC (Glaciers and Ice Caps Assessment Consortium), an ad hoc group convened to undertake research in support of the lead authors for the Cryosphere and Sea Level chapters of the 5th IPCC Assessment Report. This group (led by W. Tad Pfeffer and Georg Kaser) met twice in 2011 – at Winter Park, Colorado, in June and at Randolph, New Hampshire, in September, and has focused its efforts on producing a complete global set of glacier outlines that will allow extraction of hypsometric information for the global glacier cover from the ASTER GDEM2, and on compiling data from all recent regional assessments of ongoing glacier change. IASC provided support for both the Pontresina Workshop and, through its Cryosphere Working Group, for the GICAC group.

NAG Meetings

The 2011 meeting, held in Winter Park, Colorado, and organized by W. Tad Pfeffer, attracted 17 participants from five countries (USA, Canada, Denmark, Poland and Japan), a smaller attendance than usual. As the meeting spanned three days, however, there was ample time for discussion of both the presentations and the future of the group within the new IASC structure, and attendees found it a very productive meeting. IASC provided support for the attendance of early career scientists at the meeting. The 2012 meeting was held in January in Zieloniec, Poland, and a report on this meeting will be included in the 2013 IASC Bulletin. The 2013 meeting is provisionally planned for Obergurgl, Austria.

Improving Estimations of Glacier and Ice Cap Contributions to Sea-level Change

An important problem identified by the IPCC and addressed by NAG has been to quantify the calving flux from marine-terminating glaciers in order to improve the estimate of the contribution of glaciers and ice caps worldwide to sea-level change. In 2011, network members from Russia and Spain collaborated on the development of a new 20 MHz radar system, VIRL7 (described in Vasilenko et al., 2011), specifically designed for retrieving ice thickness from locations near glacier calving fronts. Obtaining the ice thickness near the calving front is crucial to estimating the calving flux to the ocean, but is extremely challenging as the radar energy is scattered by crevasses and absorbed by meltwater. Additionally, the depth of the fjord near the glacier is rarely known, either because it is too dangerous to approach the calving front or because the glacier retreat has opened entirely new waters.

This new radar system was deployed successfully in April 2011 from a helicopter on Hansbreen, Paierlbreen and Austre Torellbreen in southern Spitsbergen by Spanish, Russian, Finnish and Polish NAG members. An early-career scientist from Spain visited the University

of Silesia, Poland, for three months in early 2011, to prepare a catalogue of all glacier thickness measurements from Svalbard (a contribution to the SvalGlac project) under the supervision of NAG scientists. This work has included a large number of members of NAG, from Norway, the United Kingdom, Poland, Denmark, Russia, Spain, Finland, Iceland and Sweden.

During 2011, NAG members from Denmark, USA, the UK and Canada reacted promptly, and in unison with the cryospheric science community, to counteract an erroneous press release from the Times Atlas, claiming that the Greenland Ice Sheet had decreased in area by 15% over the last decade. The scientific community successfully managed to persuade the Times Atlas to correct their new Atlas and to admit publicly that their initial press release was incorrect. This message was successfully communicated to, and picked up by, the global news media.

Cryosphere and Climate

In 2011, the Nordic Council of Ministers (www.norden.org) established a new program on Cryosphere and Climate under the Nordic Top-Level Research Initiative (TRI, <http://www.toppforskingsinitiativet.org>). Several NAG members from the Nordic countries established a consortium called SVALI - Stability and Variations of Arctic Land Ice (<http://www.ncoe-svali.org>). This was funded for the period 2011-2015 as a joint Nordic research programme (Nordic Centre of Excellence, NCoE). The SVALI NCoE will focus on process studies, analyses, sharing of methods, researcher training and outreach activities and for reporting of scientific results regarding the impact of climate change on terrestrial ice in the arctic/North-Atlantic area. It will also carry out advanced Earth Systems Modeling. 17 institutes and University research groups in the Nordic countries will pool their efforts to study the stability and dynamics of the cryosphere, and pursue the implementation of new and improved formulations of key processes that are not well represented in current Earth System Models (ESM).

The three themes of SVALI are "Observing the present – baseline and changes", "Understanding the physical processes" and "Understanding present changes and predicting the future". The SVALI centre has established a Nordic graduate school in Cryosphere Science and Earth System Modeling through joint courses, summer schools, workshops and cross-border integration of PhD projects and postdoc activities. Fellowships for postdocs and PhD students are a substantial part of the SVALI NCoE, which will serve as a platform for international collaboration of Nordic scientists in cryospheric research.

Scientists from NAG are also playing a leading role in the 10 M€ EU FP7 project, Ice2Sea, which runs from 2009-2013 and aims to address the problem of quantifying global sea level rise from glaciers, ice sheets and ice caps worldwide over the next 100 years. The outputs of this project will be scientific publications targeted for the upcoming IPCC report, the creation of a legacy dataset, and the direct communication of results to the public.

Publications

Books of extended abstracts from the Annual NAG meetings have been produced for each year from 2006 to 2010. PDF versions of these reports can be downloaded from: www.iasc-nag.org. Hard copies of books published prior to 2008 are available on request from the secretariat of the Institute for Marine and Atmospheric research Utrecht (IMAU): imau@phys.uu.nl. The books of extended abstracts published from the 2009 and 2010 workshops are available from the Geological Survey of Denmark and Greenland (GEUS).

Peer-reviewed

Members of the network have published a large number of publications over the years. A few select publications representative to the work of NAG are:

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Polar Archeology Network (PAN)

The Polar Archaeology Network (PAN) is an international network based on voluntary efforts of a steering committee and different working groups. Institutions, organizations, individual researchers, and students dealing with arctic and Antarctic archaeology and early history are encouraged to participate.

Global Climate Change and the Polar Archaeological Record

The Polar Archaeology Network organized a first workshop on "Global Climate Change and the Polar Archaeological Record," in February 2011 at the Institute of Archaeology and Social Anthropology, University of Tromsø, Norway. The workshop was designed to catalyze a growing concern among polar archaeologists about global climate change and attendant threats to the polar archaeological record.

Arctic archaeological sites contain the irreplaceable record of the complex histories of the many societies that have lived in the region over past millennia. Archaeological records span most of the Holocene, depending upon location. Most, particularly those with good preservation conditions for organic remains, are largely unstudied, and although extremely vulnerable to destruction, they are poorly monitored and not well protected. Yet they are key to understanding the past, for assessing current and projecting future conditions, and for adapting to change. These data are vital as we seek to support sustainability and increase resilience in northern socio-ecological systems in the face of environmental changes, which appear to be inevitable. More specifically, the workshop was organized around four themes:

- » **Theme 1:** Identification and evaluation of present and future risks to arctic archaeological sites, including most threatened locations;

- » **Theme 2:** Documentation of the effects of global climate change, including monitoring programs;
- » **Theme 3:** Cross-PAN GIS and predictive modeling for identification of future threatened areas; and
- » **Theme 4:** Operational programs and plans for site preservation, data rescue, and data archives, and their implementation.

Threats to the Polar Archaeological Record

The workshop was attended by 13 representatives from most circum-arctic nations including scholars with expertise in related issues such as coastal erosion and paleoecology. The attendees identified a number of wide-spread global change-related threats, including increased coastal erosion (due to sea level rise, possible increases in number and/or strength of storms, and diminished sea ice), increased riverine erosion (due to increases in precipitation amount or intensity and increases in glacial melting), drying of waterlogged sites and bogs (due to hydrological changes), and changes in land use leading to greater ground disturbance (due to changing conditions for agriculture or displacement of populations from more threatened areas).

The warming and thawing of permafrost is a major threat to the archaeological and also paleoecological records. Several attendees presented information on efforts to develop threat assessment matrices (mostly focused on coastal erosion) through survey and modelling, and on various preliminary attempts at preservation and mitigation. Needs for sample archiving, prioritization of research locations, and international collaboration within and beyond the archaeological and paleoecological research communities were also discussed.

The organizers and attendees considered the workshop right in time and place and very successful indeed. New plans for working groups were approved and a



big PAN meeting for the generation of larger working groups on the same issues as covered by the workshop is now being planned in connection with the final Canadian IPY meeting in Montreal in the spring of 2012.

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Circum-Arctic Lithosphere Evolution (CALE)

Circum-Arctic Lithosphere Evolution (CALE) is a multinational and multi-disciplinary research program investigating important questions associated with understanding circum-arctic lithosphere evolution (Fig. 1). The CALE project was officially launched in 2011.

Highlights for 2011

CALE held its first Annual Workshop on 30 May 2011 in association with the International Continental Arctic Margins (ICAM) IV conference in Fairbanks, Alaska. The Workshop was attended by approximately 70% of the CALE network. This first Workshop was important for:

- » Bringing project members together for the first time;
- » Facilitating regional team working sessions and cross-team information sharing;

PHOTO: CHRISTIAN LETTNER
A musk ox (*Ovibos moschatus*) carcass in the Zackenberg area of Northeast Greenland.

- » Defining first year deliverables and research programs;
- » Identifying field campaigns for the 2011 season and beyond; and
- » Establishing the time for the next annual Workshop.

In addition, the Bering Strait team (Team C) held a team workshop in Dec 2011 prior to AGU.

New data acquisition campaigns during 2011 included passive seismic data from Ellesmere Island, bathymetric data from the submarine Chukchi plateau, and field studies in Chukotka (eastern Russia).

There was naturally a large CALE presence at ICAM IV. During the conference, CALE was approached by new prospective partners and as a direct result, CALE now welcomes additional members to the team (see 'Contacts' below). CALE was also represented at the American Association of Petroleum Geologists (AAPG) meeting in Halifax, Canada, the Geological Society (London) Petroleum Geology Conference in London, UK, and the American Geophysical Union (AGU) Winter Meeting in San Francisco, USA. As a direct result of this visibility, CALE has received additional sponsorship from StatOil. This funding will be used to facilitate CALE tectonic reconstructions, via StatOil in-house software, and expert staff experienced in its use and application – a major deliverable for the CALE project.

Contacts

- » Additional CALE sponsorship received from StatOil.
- » Representation from Russian Ministry added to CALE Scientific Steering Committee (Dr. A. Morosov).
- » Representation from the new Tectonic Map of the Arctic added to CALE Scientific Steering Committee (Dr. O. Petrov). This project is part of the Commission for the Geologic Map of the World (CGMW) project: "Atlas of Geological Maps of Circumpolar Arctic" at 1:5 M scale.

Outlook

The next annual CALE Workshop will be held 13 April 2012, following the international conference of the European Geophysical Union (EGU) in Vienna, Austria. Various field campaigns will occur in 2012, including



FIGURE 1

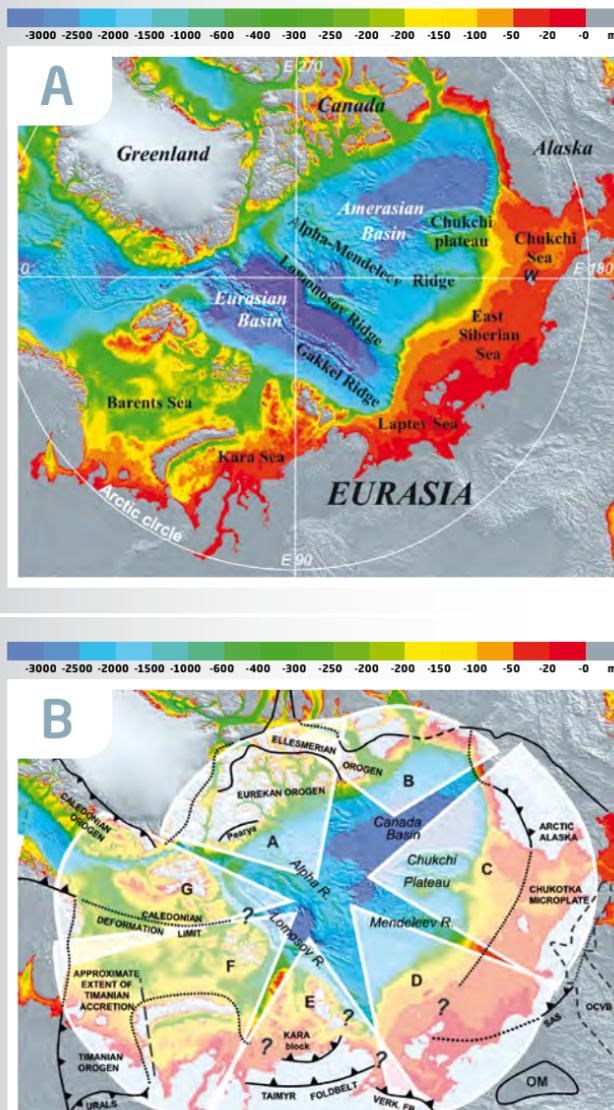


FIGURE 1: (a) Geographic features of the modern Arctic Ocean. (b) Circum-Arctic Lithosphere Evolution (CALE) teams. On this Eocene (circa 55 Ma) Arctic reconstruction, the Eurasian Basin and the Fram Strait have not yet opened [after Pease, 2011]. The translucent white regions represent the territories covered by the seven regional teams of CALE. Main tectonic elements of the circum-Arctic region are shown, including orogens and faults (solid where known and dotted where inferred, thrusts if recognized). Also labeled are the Okhotsk-Chukotka volcano-plutonic belt (OCVB), the Omolon Massif (OM), the South Anyui Suture (SAS), and the Verkhoyansk Fold Belt (VF).

field studies in the Siberian and Canadian Arctic, seismic data collection and analysis, as well as beginning the synthesis of two-dimensional lithosphere-scale cross sections in preparation for circum-arctic geological integration.

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Arctic Climate System Network (ACSNet)

The Arctic Climate System Network (ACSNet) was established in June 2011 as an IASC cross-cutting initiative. The network aims through the coordination and networking of existing or emerging fieldwork to implement an intensive cross-disciplinary study of the Western Arctic ice-atmosphere-ocean system. The essential aim of the ACSNet is to develop a common framework for individual research projects to form an intensive, international and multidisciplinary research effort with focus on the Greater Canada Basin and its marginal ice zone. The ACSNet will facilitate meetings and workshops that provide opportunities for funded projects to increase their scope of research and stimulate cross-disciplinary collaborations. It will be of mutual benefit by adding a worthwhile depth and context to the original programs while generating the intensity and variety of coverage needed to understand the complex workings of the arctic system and its role in the climate.

Scientific programs making up the ACSNet will include a broad range of international field projects spanning multiple disciplines, and membership will include early career scientists. The setup and planning phase of the ACSNet including initial workshops will

PHOTO: IÑIGO GARCIA ZARANDONA
Dramatic mountain view, Hornsund, Svalbard.

take place in 2011-13. The main field phase will be in 2013-15, with a synthesis effort in 2015-16.

The inaugural ACSNet meeting will take place in Montreal Canada (23 April 2012, 5:30-7:30 pm) during the IPY2012 Conference. All interested researchers are invited to attend.

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arctic-climate-system-network-acsnet](http://www.iasc.info/index.php/home/networks/arctic-climate-system-network-acsnet)**

PHOTO: DON PEROVICH
Sampling the water column of the Chukchi Sea from the ice and the ocean. In the foreground two scientists lower a bottle through the ice to collect water samples of the ocean. In the background a team aboard a small boat measures salinity, temperature, and light transmission of the upper ocean.



4. International Science Initiatives

» 4 International Science Initiatives

To promote Arctic science at a global level, IASC is involved in science planning and the initiation and development of international initiatives from major research programs to thematic workshops. Although IASC is not a funding organization, it does make its connections, expertise, and secretarial support available for selected international science initiatives. Initiatives are usually carried out in cooperation with other arctic and international organizations.

Sustaining Arctic Observing Networks (SAON)

During the past year, the Sustaining Arctic Observing Networks (SAON) initiative made a transition from a planning process to an active program. The overall goal of SAON is to enhance arctic-wide observing activities by facilitating partnerships and synergies amongst existing observing and data networks, and promoting sharing and synthesis of data and information.

SAON History

The SAON process started in early 2007 with the formation of an informal SAON Initiating Group (IG) consisting primarily of representatives from several international arctic organizations. It was agreed that SAON should have the purpose to support and strengthen the development of multinational engagement for sustained and coordinated pan-arctic observing and data sharing systems that serve societal needs, particularly related to environmental, social, economic and cultural issues.

The SAON IG submitted to the Arctic Council a final report in December 2008, recommending that the Arctic Council, in collaboration with partners, take on the formal leadership of SAON. In response to this report, the Arctic Council in spring 2009 agreed to lead the further development of SAON and established the SAON Steering Group (SG), composed of representatives from the Arctic Council, IASC and the World Meteorological Organization.

The SAON SG further specified the potential roles and responsibilities of SAON and agreed that the consultation and planning processes for SAON had gone as far as needed, and that transitioning to an implementation phase was necessary. The plan for

the implementation phase of SAON, submitted in spring 2011, was accepted by both Arctic Council and IASC.

In the following months, the Arctic Council and IASC jointly established the SAON Board, with the Arctic Council providing the Chair and IASC providing the Vice-Chair. A key feature of the SAON Board is that it operates according to its own terms of reference and is not bound by either the Arctic Council or IASC rules. In this way, both arctic and non-arctic countries may participate on an equal basis, and activities can go forward without the need for unanimous consent. The initial meeting of the SAON Board was held in January 2012.

SAON Task Teams

The core work of SAON is undertaken by a number of Task Teams which are established by voluntary agreement to define and implement an activity (task) that advances the goal of SAON. Members of each Task Team are responsible for providing the necessary resources. Task Teams may have partners from any country or organization that wishes to contribute to the advancement of SAON. To date, 17 SAON tasks have been identified.

The SAON Board is supported by a Secretariat, drawn from the Secretariats of the Arctic Monitoring and Assessment Programme (AMAP) and IASC.

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International Study of Arctic Change (ISAC)

The past year has been one of growth for the International Study of Arctic Change (ISAC). Following the publication of the Science Plan, ISAC entered an implementation phase, beginning with the Annual Science Steering Group (SSG) meeting held in conjunction with the first IASC working group meeting



in Potsdam, Germany in January 2011. At that meeting the ISAC Science Steering Group defined the ISAC Vision, Mission and Goals and identified a series of priority activities directed toward achieving these. ISAC SSG members also participated in the IASC working group meetings, which strengthened connections between the two organizations and led to new partnerships for ISAC.

International Collaboration in Arctic Research

In the spring of 2011, ISAC, with the support of the International Arctic Research Center at the University of Alaska Fairbanks, the Swedish Research Council and the U.S. National Science Foundation, hosted an international meeting focused on “International Collaboration and Cooperation in Arctic Environmental Change Research Programs” in Fairbanks, Alaska from 30 May – 1 June 2011. The goal of the meeting was to move toward an agreed upon strategy for international collaboration and joint planning of arctic environmental change research programs and related observing activities. Meeting participants represented ten nations and 12 different organizations involved in arctic research and in arctic research planning activities. Major objectives included:

- » Identification of mechanisms for improving international cooperating in arctic environmental change research programs;
- » Begin planning for an Arctic Observing Summit; and
- » Begin implementation of the Responding to Change component of the ISAC Science Program.

Meeting participants recommended specific activities designed to improve and expand collaboration among ISAC partner programs and identified a series of tasks leading to the development of a biannual Arctic Observing Summit, now recognized as an ISAC-led Sustaining Arctic Observing Network (SAON) task. Plans were also finalized for the first ISAC Responding to Change workshop.

New Partnerships

ISAC and INTERACT (www.eu-interact.org) have signed a letter of cooperation. INTERACT is a circumarctic network of terrestrial field stations, and the International Network for Terrestrial Research and Monitoring in the Arctic (INTERACT) consortium has as a major goal, building capacity for identifying, understanding, predicting and responding to change in the Arctic.

The ISAC – INTERACT partnership will help to further collaboration among terrestrial arctic research programs and other research programs also focused on arctic environmental change.

In collaboration with the Ocean University of China, ISAC is developing a Chinese partner office in Qingdao, China. ISAC SSG member Jinping Zhao is the Secretary-General of this office and will be assisted by four associates. The office will maintain a website, linked to the main ISAC website, that makes available ISAC information in Chinese, and that provides a venue for the discussion of scientific issues, especially those linked to sea ice, meteorology, geology and chemistry. In turn ISAC will make available information on Chinese research and, in the future, with the Qingdao office, work to develop special issues synthesizing Chinese research activities. Establishing a branch of the ISAC International Program Office in China will improve communication about arctic research, and further international collaboration. As a first step, the 2012 Annual ISAC SSG meeting was held in Qingdao, China, and the representatives from the Polar Research Institute of China, and from the Chinese Arctic and Antarctic Administration were welcome participants.

Responding to Change

ISAC held the first in a series of responding to change workshops 30 January – 1 February 2012 at Queen’s University, Kingston, Canada. The workshop, “Responding to Arctic Environmental Change: Translating Our Growing Understanding into a Research Agenda for Action” was developed in partnership with Queen’s University School of Policy Studies and the Study of Environmental Arctic Change (SEARCH <http://www.arcus.org/search/index.php>). Members of the arctic research community and of diverse stakeholder groups are coming together to:

- » Establish, among a spectrum of stakeholders, including the science community, a common understanding and definition of what is meant by responding to arctic environmental change;

- » Produce a preliminary assessment of the alignment between information flowing from established arctic observing initiatives and stakeholder needs for information that will be used to inform the planned, international, and recurring Arctic Observing Summit, as well as other programs aimed at understanding arctic environmental change;
- » Identify science questions that align with stakeholder needs for information and that can be addressed in the short-term, with an emphasis on informing risk assessment, risk management, resilience, adaptation, and mitigation over the long-term; and
- » Produce recommendations for advancing science/stakeholder partnerships, and improving communications among these diverse parties.

Workshop results will be presented at the Planet Under Pressure Conference (<http://www.planetunderpressure2012.net/>) in London, 26-29 March 2012, and at the IPY 2012 Conference: From Knowledge to Action, (<http://www.ipy2012montreal.ca/>) in Montreal, 22-27 April 2012. Results will also be published in a white paper for further community input and used to inform the planned Arctic Observing Summit.

Arctic Observing Summit

Plans for the development of a biannual Arctic Observing Summit (AOS) are underway with ISAC assuming responsibility for this; the AOS is a SAON task. The organizing committee has been formed, and Co-Chairs Craig Lee (USA), Martin Jakobsson (Sweden) and Jinping Zhao (China) appointed. The first summit is planned for fall 2012. The objectives of the AOS include, but are not limited to:

- » Providing a regular (biennial) forum for improving coordination and optimizing an international Arctic Observing System;
- » Aligning observational activities with stakeholder needs for information and with pan-arctic science priorities; and

- » Improving observing system performance for a full spectrum of applications, from climate research to the delivery of useful products.

Updates on AOS planning will be available through ISAC (www.arcticchange.org), SAON (<http://www.arcticobserving.org/>), and a variety of other sources.

ISAC Vision, Mission and Goals

Vision

Timely, relevant, and accessible scientific information for responding to rapid arctic change.

Mission

- » ISAC is a program that provides a scientific and organizational framework focused around its key science questions for pan-arctic research including long-term planning and priority setting.
- » ISAC establishes new and enhances existing synergies among scientists and stakeholders engaged in arctic environmental research and governance.
- » ISAC promotes observations, synthesis, and modeling activities to provide an integrated understanding of the past, present and future arctic environment needed for responding to change.
- » ISAC fosters links between arctic environmental change initiatives and relevant global programs.
- » ISAC, in collaboration with partner organizations, provides authoritative and timely scientific information to stakeholders and decision makers for responding to rapid arctic environmental change.

Goals

- » Observing Change: An international, integrated, comprehensive, and sustained arctic observing system responsive to scientific and societal needs for information on arctic change.

- » Understanding Change: Improving projections of the arctic system and identify emerging issues.
- » Responding to Change: Developing and communicating science for problem solving, managing, and adapting to future arctic changes.

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IASC Sponsored Workshops

In 2011 IASC co-sponsored 18 workshops. Three of the workshops were coordinated by the IASC Networks and are reported in chapter 3. The other 16 workshops were supported as a general IASC activity or on the initiative of the newly established IASC Working Groups. The workshops displayed an enormous range of thematic variety and were often cross-disciplinary in nature.

Workshop on the Use of Automatic Measuring Systems on Glaciers

23 to 26 March 2011 | Pontresina, Switzerland

The objective of the Workshop on the use of automatic measuring systems on glaciers was to bring together an international group of researchers to discuss the challenges and possibilities of operating automated measuring systems on glaciers. The meeting was



financially supported by IASC and Utrecht University, in addition to a small registration fee paid by the participants.

A total of 45 participants attended the workshop representing about 20 different countries. Seven early career scientists received travel support from IASC. During the meeting, the participants presented their systems in oral and poster presentations. In addition several participants brought equipment. On March 25 an excursion was organized to the IMAU Automatic Weather Station on the Morteratsch glacier. The program also provided room for small side meetings to plan field activities and joint international projects.

Discussed Subjects

The main part of the meeting consisted of presentations. A variety of issues was discussed ranging from different types of instrumentation, equipment, geographical challenges, power and communication issues. Although the scope of the meeting was measurements on glaciers in general, about two thirds of the presentations were about weather stations and mass balance observations. This illustrates the present core activity of glaciological field observations. Other presented subjects ranged from glacier velocity observations using GPS techniques, the possibilities and issues related to time lapse photography, how to measure sub- and englacial properties, and chemical and biological observations.

The geographical areas discussed in the meeting covered the whole globe. The variety of locations showed that different settings also result in different problems, not only technical. Issues related to location are mainly meteorological (snow fall and melt amount, surface roughness e.g. penitentes, high altitude, low temperatures, wind regime) but also social in terms of acceptance of the local population of the activities. Destruction and stealing of equipment occurs as well as people showing genuine interest and lending a helping hand.

Technical Challenges

The technical issues discussed can be summarized as follows:

- » There are several different weather station designs currently in use. The 'floating' system is well accepted on melting glaciers but is not very useful on glaciers with very rough terrain, e.g. glacier surfaces covered by penitentes. Designs with one or more extendable poles drilled in the ice are very suitable for accumulation areas but can cause stability problems in ablation areas. A very special design is the Innsbruck system, which uses cardan-like joints to keep the instruments horizontal. However, this only works under very special meteorological conditions as can be found on tropical glaciers.
- » There are also several different designs to measure mass balance. Traditionally stakes and sonic height

PHOTO: MAREK KASPRZAK

This photograph of Werenskiold glacier on Wedel-Jarlsberg Land, Svalbard, was taken during the 2011 XXIV Polar Expedition of the University of Wrocław, Poland.



rangers are used. New developments for ablation areas are linear systems using a weight on a wire, and measuring pressure differences in fluid filled hoses. Both systems have the advantage not sinking in the ice but they cannot measure accumulation.

- » Different communication techniques are used, particularly the Argos and Iridium satellite systems, but also radio communications. All have advantages and disadvantages related to the costs involved, distances over which data can be communicated, amount of data that can be transferred, one or two way communication possibilities, and future prospects of the system.
- » Power supply is a recurring subject. Combining and using batteries, solar panels and wind generators can be problematic in terms of moisture in the system, polar nights with no solar radiation and extreme wind events. Questions raised were 'what are the best batteries to use' and 'how to regulate charging of the batteries by solar or wind energy'.

Discussion about these issues did not result in one simple answer. The choices made by individual re-

searchers depend on geographical and meteorological setting in combination with available funds.

Data and Technical Knowledge

The workshop revealed that a large amount of development in different kinds of equipment used on glaciers has taken place. Especially noteworthy is the development in performing subglacial measurements, although they are still limited to wireless pressure and temperature measurements, and radar and seismic measurements. However, some issues are still not solved. For example, to date there is no system available to automatically measure snow density on glaciers.

Other issues raised by workshop participants pertained to data and technical knowledge. Especially in the field of operating Automatic Weather Stations, there is a need for standardization, i.e. to define the 'ideal' weather station. This includes making available information about performance of different brand instruments under extreme conditions as well as comparison of power and communication systems. In general, the importance of data availability and data exchange was stressed. In this respect initiatives such

as SAON and other IPY related data projects were mentioned. But, data exchange is not the only issues of importance; technical knowledge exchange is important as well. In order for groups just beginning in the field of glacial research not to make the mistakes others have already made, the availability of technical information is crucial. A book of extended abstracts from this meeting intends to help in this learning process.

Outcome

The participants have been encouraged to write an extended abstract of their contribution to the workshop. These abstracts will be published, together with a summary of the main discussion points and recommendations in a book of extended abstracts and recommendations. The book will be freely available to the participants and will be published on the workshop website in digital form.

www.projects.science.uu.nl/iceclimate/workshop

Catalysis Workshop on Genetic Monitoring in the Polar Regions

4-6th April 2011 | British Antarctic Survey, Cambridge, UK

The aim of the workshop was to facilitate discussion between experts in genetic monitoring, of polar genetics and polar population history. The discussion revolved around the collaborative use of genetic methods to monitor environmental change at the poles, with the aim of establishing long-term working groups of interested parties who wish to collaborate further on scientific questions arising during initial discussions. It was agreed that a consortium approach would be the most powerful to facilitate genetic monitoring of biological change and workshop organizers are now preparing an opinion paper arising from this workshop for submission to Nature Climate Change. A follow-on symposium titled "Genetic Monitoring of Marine Mammals" received funding and took place at the Society for Marine Mammalogy Biennial in November 2011. Other workshop and symposium proposals are in preparation.

PHOTO: ADAM NAWROT

Two polar bears, a mother and her teenager, are exploring the area around the Polish Polar Station near Hornsund, Spitsbergen.

Key Issues in Polar Genetic Monitoring Research

Key issues that are important to consider in the context of polar genetic monitoring research are:

- » Clarify species definitions for taxa of interest: extensive cryptic speciation or limited research hinders clear genetic and morphological species definitions for many Antarctic taxa;
- » Long generation times mean lengthy time frames over which genetic change can be detected;
- » Huge population abundances of many polar species limits the use of genetic abundance measurements, but can work well for studies of species adaptation;
- » The majority of polar specimen collections have small sample sizes, which limits the range of monitoring approaches that can be initiated with existing datasets;
- » Species specific genetic markers are difficult to obtain as many species are so poorly described genetically; and
- » Polar specimen collections are currently not coordinated or databased in a public repository.

Polar Genetic Monitoring Consortium

The workshop proposed that a consortium of interested parties should be formed to enable the following:

- » Coordinated specimen collection across polar habitats. The best opportunities for large-scale, regular, specimen collection at the poles are (i) at locations close to Antarctic or Arctic bases or to population centres in the Arctic, or (ii) through passive monitoring via regular, remote collection of environmental samples;
- » Standardized sampling protocols to facilitate collection of spatially and temporally comparable datasets;
- » Species-specific marker development for polar species in order to lower costs by shared development of markers; and

- » Development and maintenance of well curated, coordinated polar archives (of geospatially referenced specimens) to enable future monitoring. Ideally these archives would be publically data-based and allow preservation of high quality tissue samples (see 'SNOWBANK' report).

The first three of these are most relevant for groups of polar scientists working on the same taxonomic groups. However a consortium approach must include research on the broadest possible range of polar taxa in order to facilitate concerted ecosystem level monitoring of biological change across habitats.

Discussion Themes

Genetic Monitoring of Biological Responses to Climate Change

Concerning the monitoring of invertebrates, the group identified terrestrial and marine species, which are pragmatic to monitor (key characteristics being: previous genetic assessment of the species, specimen accessibility, absence of 'cryptic' species). In addition, a 'randomized' list of species was created according to some guiding criteria for the marine and terrestrial realm, to provide a relatively random set of species to monitor. Thirdly, some key environmental shifts were identified and those species most 'relevant' to those shifts e.g., those affected by changing water acidity, temperatures etc., were identified.

In the case of the monitoring of polar predators, it was discussed how polar vertebrates are subject to both climate change related impacts and also to impacts from anthropogenic disturbance and past exploitation (e.g. baleen whales, seals). Many are also of interest from a management perspective.

Colonial breeders, e.g., penguins and fur seals, are the most amenable for monitoring approaches as they are central place foragers and can be monitored at fixed locations. The group identified monitoring approaches which may apply best to polar predators,



including changing population connectivity through time, genetic 'population assignment' methods and monitoring of reproductive history and diet.

Types of biological change were also discussed, including: (1) Changes that can be monitored within community assemblages (changing structure and function); (2) Ways of monitoring change in species range through time; and (3) Means of monitoring adaptive change, or the potential for species resilience to change.

Genetic Monitoring of Anthropogenic Change

The discussion focused on the use of genetic monitoring methods for monitoring anthropogenic impacts, including those from fisheries, introduced species and pathogens, pollution, and tourism.

Genetic Monitoring in Polar Management Plans and Assessments

A number of polar species are subject to wide-scale management or regular assessments: these are predominantly fish, baleen whale, penguin, seal and krill

species. Genetic monitoring can augment existing management in terms of monitoring population size, vital rates and diet. It can also provide information additional to existing management about population structuring through time, adaptation in response to exploitation, disease response and loss of diversity.

Roundtable on Perceptions and Representations of Arctic Science

26 June 2011 | Seventh International Congress of Arctic Social Sciences (ICASS) in Akureyri, Iceland
Supported by the Social and Human Sciences Working Group

The Arctic figures strongly in TV documentaries, newspapers, and other media around the world. Polar researchers of many disciplines are an important part of this imagery as their travels and fieldwork make for visually attractive, exotic footage. The International Polar Year 2007-2008 has triggered increasing interest

PHOTO: SYLVIE BLANGY

Waiting for the reindeer herd. Agneta Margit and Nils Tomas Labba are reindeer herders, Sámi from Övre Soppero in Northern Sweden. They belong to the Saarivuoma sami village (sameby). Each year they mark young reindeer calves at their summer camp on the shores of the lake Áltesjavri in Northern Norway. They are sitting by the fire waiting to get the news from the reindeer marking corral up on the mountain of Luotnovarri.

in the Arctic, and strong media coverage is one of its most beneficial outcomes.

However, the dialogue between scholars, Northern residents, the media, and the wider public is not without problems. This has been noted at earlier occasions, such as the Second International Conference on Arctic Research Planning (ICARP II): "The public outside the Arctic has images of the North that are often formed by science, national identity, sovereignty, national pride, and resource pools, while people living in the Arctic have images of their homelands with their cultures, resources, and opportunities for a good life. Scientists' images of the Arctic may be driven by field seasons, access to funding, global politics, and science agendas" (Southcott et al. 2005). Among researchers, there are complaints about misperceptions and misrepresentations of research findings in the media. Journalists and politicians, on the other hand, think that researchers could do a better job in making themselves understood. Residents of Northern communities see researchers flying in and out, but in many cases the latter cannot provide results of immediate relevance for the communities concerned. Researchers, on the other hand, find that Northern residents' observations and explanations about change cannot always be easily connected with conventional scientific forms of knowledge.

Such examples of "messages not getting across" point to the multiple and contested perceptions and representations of arctic science. There has been an increasing if not widespread awareness of potential and actual misunderstandings on all parts, but even though this issue has been raised on earlier occasions, the issue has yet to be discussed systematically. Therefore, the IASC Social and Human Sciences Working Group, believed it was time to explore in a roundtable format how to further address the interconnection of Arctic science, politics, stakeholders, the media, and the wider public.

The invited speakers and participants included scientists from different disciplines, countries and also communication advisers and journalists. The roundtable "Perceptions and Representations of Arctic Science" was organized by Joachim Otto Habeck (lead), Gunhild Hoogensen Gjörv and Peter Sköld at the request of the IASC Human and Social Sciences Working Group. The invited speakers included: Gerlis Fugmann, Lawrence C. Hamilton, Amy Lovecraft, Chris Southcott and Anna Stammler-Gossmann.

A full report on the roundtable was published in the newsletter Northern Notes, published by the International Arctic Social Sciences Association (IASSA). The WG will take the roundtable concept further and organize more targeted public sessions that deal with the more specific actors identified in this first more general roundtable. The Working Group will be co-chairing a follow-up session on "Perceptions and Representations of Polar (Climate) Science" at the IPY 2012 Montreal Conference. The session is a joint initiative of the Chairs of the Atmosphere WG, Jim Overland, and the Social and Human Sciences WG, Peter Schweitzer.

References

Southcott, Chris et al. 2005. *Science Plan 11: Arctic Science in the Public Interest in ICARP II (International Conference on Arctic Research Planning II)*

Glacier and Ice Cap Assessment Consortium WG Meeting

19-21 June 2011 | Winter Park, Colorado, USA
Cryosphere Working Group support

The Glacier and Ice Cap (GIC) Working Group is an international ad-hoc organization of glaciologists specializing in global assessments of the mass balance of the world's land ice exclusive of the two ice sheets in Greenland and Antarctica. The Working Group was formed for the specific purpose of im-

proving the global inventory of glaciers and ice caps, compiling a current assessment of glacier and ice cap loss rates, improving existing loss rate projection methods, developing new projection methods, and preparing publications on these subjects in time for the literature deadline for the IPCC's Fifth Assessment, on 31 July, 2012. The Winter Park, Colorado meeting, was the first formal meeting of the group and progress was made on drafting of the IPCC report.

Specific goals of the meeting included:

1. Prepare Glacier information for IPCC AR5 (31 July 2012 literature deadline);
2. Complete/extend global Glacier inventory past 2005 (present state of global inventory);
3. Revision/improvement of inventory geographic regional definitions;
4. Expand form of assessment beyond simple GT/yr by region;
5. Projections to 2100 required: What methods to use;
6. Future: Better/more efficient methods for maintaining/updating inventory and assessment; and
7. Fast-tracked proposals to US funding agencies (NASA, NSF) to support this work.

Shrub Synthesis Workshop

13 - 19 September 2011 | Davos, Switzerland

The Shrub Synthesis Workshop was an IASC sponsored activity of the Shrub Hub Research Network. During the workshop, 13 participants conducted a data synthesis of growth ring, stem elongation, and other growth data of shrubs from arctic and alpine tundra sites. Recent evidence indicates widespread expansion of canopy-forming shrubs in tundra ecosystems. Remote sensing shows a 'greening' of the Arctic, which has been partially attributed to increasing shrub cover. This increase in woody shrubs is concurrent with increasing temperatures, but the actual mechanisms, the magnitude of change in cover and feedbacks promoting expansion over time have yet to be quantified at the biome scale.

Comparing Shrub Growth Measurements

The participants compared shrub growth measurements (annual growth rings and stem increments) to temperature data from sites around the circumpolar Arctic to test the hypothesis that regional summer warming is causing the current shrub expansion. The goals of this workshop were to discuss the science behind proposed data syntheses, to compile different techniques and data sources of shrub growth measure-

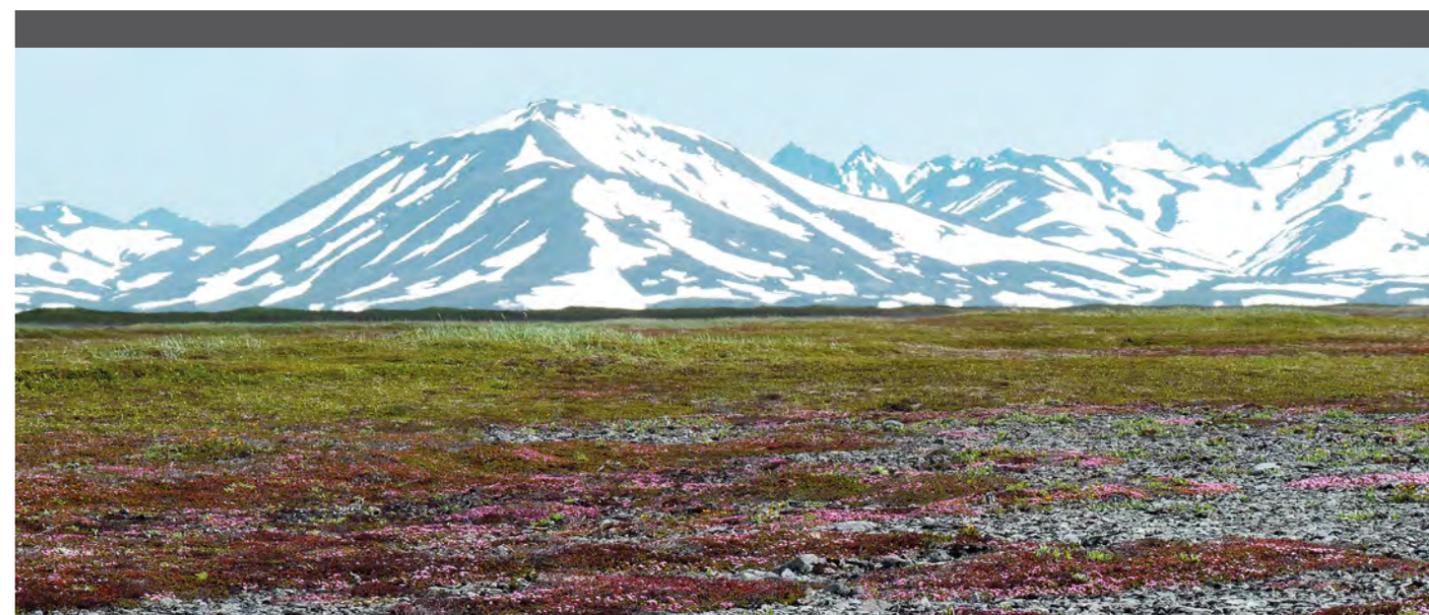


PHOTO: CHRISTOPH ZÖCKLER/ArcCona
A view of the Anana Bay in North Kamchatka, Russia. In this area, participants of the joint BirdLife International Heritage Expeditions project search for the Spoon-billed Sandpiper, a globally threatened bird.

ments, to undertake some preliminary analyses of the compiled data and begin drafting two manuscripts for publication. Each workshop participant contributed relevant growth measurements, growth ring chronologies, accompanying climate data and metadata, and other data about changing abundance of shrubs from their research site.

Participants included 10 early career researchers and involved participants from North America and Europe who work at sites around the circum-polar Arctic and at alpine sites. The workshop organizers were Isla Myers-Smith (University of Alberta/ Université de Sherbrooke, Canada) and Sonja Wipf (SLF, Switzerland).

<http://shrubhub.biology.ualberta.ca/>

Miniconference on Interactions between Sea Ice, Near Coastal Processes and Terrestrial Ecosystem Dynamics

20-21 September 2011 | Greenland Climate Research Center, Nuuk, Greenland
Terrestrial Working Group and Cryosphere Working Group support

In September 2011, the Department of Earth and Ecosystem Sciences held a GreenCyclesII/IASC mini-conference at the Greenland Climate Research Center in Nuuk, Greenland. GreenCycles is an initial training network on global biosphere-climate interactions. The conference was attended by 25 people, of which 7 are connected to the GreenCyclesII network and 18 were external. The participants were based in countries such as the United States, Canada, France, the Netherlands, Denmark, Germany, Greenland and Sweden.

Gathering Experts to Further Knowledge

The goal of this conference was to gather a varied group of experts on sea-ice dynamics, ocean and

land ecosystems, greenhouse gas exchange, the atmosphere and modelling, to further our knowledge on the interaction between ocean and land and how it influences greenhouse gas exchange around the Arctic. Within this interaction, a special emphasis was put on the role of arctic sea-ice extent.

While the main program was scheduled for September 20 and 21, most participants were already in Nuuk in the weekend leading up to the conference, to participate in a field trip in the area, as part of the larger conference program. On Sunday September 18, this field trip went by boat to the Nuuk Basic research station in Kobbefjord, where the participants visited the DEFROST and INTERACT monitoring stations. At these stations, fluxes of methane, CO₂, water vapour and energy are being measured with a variety of methods, such as automatic chambers and eddy covariance, and the equipment used to perform these measurements was explained to the participants. The site gave the participants a chance to walk in tundra vegetation with beautiful snow-topped mountains in the back and also to see retreating glaciers with their own eyes. For some participants, this was the first time they visited a field site in an arctic setting and for those that are involved in modelling, it was an important day where they could experience for themselves what they are trying to simulate in their models.

Observations of Greenhouse Gas Exchanges

The core of the conference program was from Tuesday to Wednesday when 15 participants gave presentations. The main topics addressed were: observations of greenhouse gas exchange above land and on/under sea-ice, the current state of the art in modelling of arctic greenhouse gas exchange, constraints on the global methane cycle from satellite observations, the dynamics of fjord systems from a hydrological and ecological point of view and the spatial connections between vegetation and sea-ice extent. Seven posters also contributed to the conference.

To draw focus to these posters, a poster session was organized on the first day. During this session, the Early-Stage Researchers got the opportunity to discuss their research with more experienced researchers.

The presentations continued on Wednesday and after the last talk, a brainstorm session was held to gather any insights that were developed at the conference. From this, it became clear that our current knowledge of arctic ocean-land interactions is still very limited and in many places insufficient. Nonetheless, recent research has indicated that the discussed interactions are real and significant and all participants could affirm the importance of this research topic. One of the experienced researcher from GreenCyclesII is currently drafting a review publication that addresses our current knowledge and the importance of ocean-land interactions at high latitudes. Contributions from several conference participants has already been sought, for input to this publication.

www.greencycles.org/

Workshop on Atmospheric Investigations on a Drifting observatory over the Arctic Ocean (AIDA)

26-27 September, 2011 | Alfred Wegener Institute for Polar and Marine Research, Potsdam, Germany
Atmosphere Working Group support

Polar regions are important players in the climate system because the widespread surface snow and ice cover in these regions strongly impacts the surface energy budget, which is tightly coupled to global atmosphere and ocean circulation. The observed decrease of arctic summer sea-ice cover over the last decades is best viewed as a combination of strong natural variability due to large-scale dynamics and regional feedbacks in the coupled atmosphere-ice-

ocean-land system with a growing radiative forcing associated with rising atmospheric greenhouse gas concentrations. However, it is yet to be established the degree to which diminishing arctic sea ice and the occurrence of new atmospheric circulation states are driven by a warm phase of decadal-scale climate variability versus anthropogenic forcings. Attribution of ongoing arctic changes is difficult because natural variability may be large enough to partially mask the anthropogenic influences, and because the current understanding of important arctic system process interactions is limited.

The rate of observed sea-ice decline is higher than in IPCC AR4 model simulations, while the causes of these declines and their regional and global impacts are not fully understood. Current regional and global climate models (RCM, GCM) suffer from missing processes and regional feedbacks due to insufficient atmospheric parameterizations; to improve simulations of arctic processes within the global climate system these parameterizations must be further developed and enhanced.

Increasing Demand for Operational Forecasts

The arctic warming and reduction of sea ice cover will result in increasing navigation and exploitation of natural resources. To guarantee the safety of these operations, demands will increase for accurate operational short-term forecasts for weather and sea ice conditions. When applied to the Arctic, numerical weather prediction (NWP) models suffer, however, from basically the same problems as climate models. The general lack of understanding of the complex arctic climate system is clearly associated with insufficient arctic observations and the resulting inadequate modeling and forecasting tools. Due to these deficiencies, there is a significant disconnect between public and political expectations (seasonal to decadal predictions) and current deliverables (climate projections). To reduce this critical lack in understanding with the aim of enabling predictions, longer-term observations of the complex atmosphere-sea-ice



ocean system are needed. Such observations must occur year-round to capture the annual variability of important processes and should rely on enhanced observation techniques relative to those implemented in the past.

A combination of in-situ observations and satellite measurements should be used to monitor important atmospheric and surface parameters that are needed to improve model parameterizations with a strong focus on atmospheric processes and their interactions with the snow- and sea-ice-covered surface. Furthermore, since atmospheric processes, such as those related to the stable arctic planetary boundary layer, are a source of large systematic errors in atmospheric models the measurements must be interfaced with NWP models, regional arctic climate system models (atmosphere-only RCMs, coupled A-O-I RCMs), and global climate system models in order to study the impact of sub-grid scale parameterizations on atmospheric circulation patterns and decadal climate variability.

Manned Atmospheric Observatory under International Leadership

The workshop participants recommended the establishment of a manned atmospheric observatory under international leadership to drift for preferably two years in the ice pack of the Arctic Ocean with instrumentation to observe the most important atmospheric, sea ice and oceanic processes. These measurements will be exploited in regional climate model simulations to evaluate and improve sub-grid scale atmospheric parameterizations in Numerical Weather Prediction, Regional and Global Climate Models. There are differing opinions about the target and domain for deployment of the atmospheric observatory over the Arctic Ocean (Beaufort Gyre or North-West region of Greenland), which need further discussions. A rough estimate for the required instrumentation, ice breaker, overwintering vessel, runway on ice and airplanes for logistics and science flights is around 40-50 Million €. The ultimate AIDA measurement design depends on the science questions to be developed by the scientific community in a follow-up workshop in June 2012 to be organized in coordination with the IASC Atmosphere WG. By spring 2012 it is anticipated that a white paper will be written.

The full workshop report is available under www.iasc.info/index.php/home/groups/working-groups/atmosphere/publications

Understanding Biodiversity Changes and Causes - Synergies in Arctic Terrestrial Biodiversity Research and Monitoring

12 October, 2011 | Hvalsø, Denmark
Terrestrial Working Group support

International, regional, national and local actors have initiated projects and programs to improve our knowledge of landscape, climate and ecosystems in order to strengthen our ability to detect changes that allow us to deal with some of the challenging issues that the Arctic is facing today. The potential for collaboration was recently discussed among some circumarctic initiatives and it was decided to hold a workshop to bring together some of the players in arctic terrestrial biodiversity research and monitoring to identify synergies and potential areas of collaboration.

The meeting was convened by the Circumpolar Biodiversity Monitoring Program (CBMP) terrestrial group, the IASC Terrestrial WG and the international Network for Terrestrial Research and Monitoring in the Arctic (INTERACT). Terry Callaghan represented IASC and INTERACT and aided the planning. The overall objective was based on the recognition that many arctic organizations are involved in biodiversity in one way or another (research, monitoring, building capacity for cataloguing, developing and deploying new techniques, etc) but none covers all the issues and there is no mechanism to enable the various biodiversity interests to work together synergistically. Major arctic organizations and researchers were, therefore, invited to attend the workshop. Organizations represented included the Arctic Council Working Group on the Conservation of Arctic Flora and Fauna (CAFF), CBMP-terrestrial, IASC, INTERACT, ISAC, the World Wildlife

Fund (WWF), the Arctic Monitoring and Assessment Programme (AMAP) and SAON. Specifically, the aims were to:

- » Provide participants with an overview of stakeholders in arctic terrestrial biodiversity research and monitoring, including decision makers, the science community, Indigenous Peoples Organization, and NGOs;
- » Ensure that workshop participants have a clear and full understanding of program goals and outputs of Arctic Council initiatives (SAON, CBMP-Terrestrial Expert Monitoring Group, AMAP), IASC Terrestrial Working Group, ISAC and INTERACT, and opportunities for collaboration within the field of biodiversity; and
- » Identify knowledge gaps and capacity constraints, and produce a list of recommended activities and topics with potential for collaboration within the field of biodiversity research and monitoring including identification of relevant participants.

Output will include minutes and a report. A major output was the general acceptance of the need for the organizations to work together. Terry Callaghan suggested the formation of an "Arctic Biodiversity Coalition" (ABC) formed from representatives of the major organizations working together in an "ABC Synergies Group". This was well-received and now needs a champion to develop it. Professor Gus Shaver represented IASC at the workshop. .

Over 80 participants attended the meeting and there were a number of inspiring presentations as well as a panel and plenary discussion led by Mike Gill (CBMP) and Terry Callaghan (IASC and INTERACT). As the meeting was held back-to-back with an INTERACT meeting, the INTERACT participants could identify how they could contribute to an "ABC". Examples included:

- » INTERACT can act as a one stop shop for access to the network and local communities;

PHOTO: ED STOCKARD

The Big House at Summit Station, Greenland. The Big House is the communal dining area, managers office and a place to relax, chat or watch a movie. It is the main hub of Summit, an NSF funded research station on top of the ice sheet.

- » The INTERACT network can function as an emergency response team if there is a need for urgent action to collect samples from a vast number of sites to assess the effects of extreme events, accidents, etc;
- » INTERACT can host summer schools for young scientists (to fill gaps in expert capacity, e.g., taxonomists);
- » The INTERACT network agreed to host the “Back to the Future” project. The Arctic Council could decide to endorse the project, which would make it part of their monitoring plans and potentially contribute with funding for specific monitoring activities; and
- » INTERACT can provide a platform for international programs and projects that need e.g. circumpolar geographical coverage, gradients, etc. INTERACT could for example play a role in CBMPs Terrestrial Biodiversity Monitoring Plan and provide a platform for the studies included in the ISAC science plan. We could cooperate on education programs and workshops.

Microbial genomics of the arctic cryosphere at the CAREX Conference on Life in Extreme Environments

Dublin, Ireland | 18-20 October 2011
Terrestrial Working Group and Cryosphere Working Group support

Molecular technologies in the life sciences are transforming our view of biodiversity, biological processes, ecology and evolution. This is especially true in microbiology, where application of DNA and RNA-based approaches has shown that much of the world’s biodiversity lies within the three domains of microbial life: Eukarya, Archaea and Bacteria. This initiative from the Terrestrial WG in partnership with the Cryosphere WG, aimed to provide early career scientists with the opportunity to gain better molecular

insights into permafrost soils, thaw lakes and related extreme cold environments, at an international conference on life in extreme environments. After the conference, the supported young researchers organized a successful virtual poster session on the topic in cooperation with the Association for Polar Early Career Scientists and shared their experiences and findings with the larger public.

Here are some conclusions from the reports of the supported scientists:

Punyasloke Bhadury

“Overall the IASC Award helped me to attend this key conference and initiate networking activities with experienced scientists, which will lead to long-term collaboration in areas of polar genomics.”

Paul Wilkinson

“Beyond specific knowledge exchange and making research links, the conference was also useful in establishing a broader understanding of the current progresses and atmosphere of polar microbiology.”

Karen Cameron

“I found the coverage of environments including arctic, Antarctic, deep sea and desert environments to be very useful. Only seldom are these hugely differing extreme environments compared, however it is apparent that there are many important physical, chemical and biological similarities that can be drawn between them.”

Mini-workshop on Polar Predictability

23 October 2011 | Denver, USA
Atmosphere Working Group support

The workshop on polar predictability and arctic amplification included people from the World Climate Research Programme (WCRP) and other interested organizations. The focus was on the development of the agenda for a large arctic amplification workshop co-sponsored by WCRP in early 2012.

Setting the Context

An initial workshop on polar predictability on seasonal to multi-decadal timescales was held by the WCRP project Stratospheric Processes And their Role in Climate (SPARC) in Bergen on 25-29 October, 2011. The Chair of SPARC, Ted Shepherd, stated that we understand many of the physical sources of predictability in the polar climate system but what we lack is a good understanding of many of the feedbacks between the different components of the climate system and the physical causality of the large-scale modes of polar variability. We also lack many of the key observations needed to constrain the presumed sources of polar predictability. However, there has been an explosion of subsea surface observations.

WCRP aims to identify those aspects of climate science that benefit from international coordination. That means identifying gaps, typically where efforts by individual scientists or groups have run into a wall because of the lack of a wider effort.

Some examples of possible research foci for this effort might be:

- » Seasonal predictability and seasonality of long-term changes;
- » Forced and unforced components of decadal predictability;
- » Initial state estimates; and
- » Extent of potential predictability.

Science Priorities Surrounding Polar Predictability

The Chair of the IASC Atmosphere Working Group, James Overland, suggested that there are several themes that could function as initial foci:

- » Arctic Amplification;
- » Loss of sea ice (causes and impacts);
- » Anthropogenic or natural variability;
- » Arctic-mid-latitude linkages;
- » Antarctic Influence; and
- » Seasonal to Decadal Prediction.

Shepherd added the suggestion that a focus should also lie on “imperatives.” Many of the workshop participants articulated a need for better model development. There is a very real need for process teams to work with climate model teams to get process information into climate model. The focus should not be on seasonal predictions, which is already covered by other groups. However, an emphasis on sea ice might be useful. Some participants supported the concept of working on model development for long-term prediction, which is focused on an ensemble framework. The group discussed the need to better define the word “predictability” for this effort. What are the time scales and variables, which will be used? This will help define what observations and what process studies are needed. There is agreement that this group will focus on decadal and longer.

Next Steps

The emerging organizing theme for the spring 2012 workshop appeared to be changes in sea ice, both causes and impacts. Sea ice is already understood as a grand challenge. Causes relate to ocean and atmospheric forcing and arctic feedbacks. Impacts are potential linkages of arctic changes to subarctic weather and climate. In summary the next steps will include:

- » Prepare for the next meeting in Toronto, Canada in 2012;
- » Coordinate with the Climate and Cryosphere (CliC) Sea Ice Group and the IASC Cryosphere Working Group;
- » Develop the sea ice theme further; and
- » From a virtual subgroup to consider the definition of predictability and prepare a white paper.

The full workshop report is available under www.iasc.info/index.php/home/groups/working-groups/atmosphere/publications

Mini-workshop on New Arctic Field Experiment and Model Parameterization

23 October, 2011 | Denver, USA

Atmosphere Working Group support

The mini-workshop addressed the development of a drifting ice station experiment. The focus during this workshop was to sum-up the outcome of the AIDA-R Workshop (see page 61) that was held from September 26-27, 2011 in Potsdam, and decide on the next steps in the process. In Potsdam, the participants looked at defining the necessary measurements. They also discussed observatory design for AIDA. A major conclusion was that for comprehensive measurements, a substantial platform is required.

Next Steps

There has been good work as the result of the workshop in Potsdam. The next step is to develop a science plan. There also needs to be consideration of possible collaborators. One such possibility is the Cryosphere WG. Participants noted that modeling needs to take a high profile right at the start. There needs to be an organizational home at which this can be coordinated and funding sought. There are many possibilities, but this will be an important consideration.

The full workshop report is available under www.iasc.info/index.php/home/groups/working-groups/atmosphere/publications

Overcoming Barriers to Arctic Ocean Drilling: the Site Survey Challenge

1-3 November, 2011 | Copenhagen, Denmark
Marine Working Group support

The Arctic Ocean is one of the last unknown geologic provinces on Earth. The scientific importance of arctic deep-sea drilling for retrieving paleoceanogra-

phic, climatic and tectonic data is well understood, but the lack of adequate site survey data hampers the development of mature drilling proposals. The site survey problem is slowly being solved. For the precise planning of future drilling campaigns including site selection, evaluation of proposed drill sites for safety and environmental protection aspects, etc., comprehensive site survey data are needed. The lack of good site survey data and age control for existing seismic reflection records is one of the biggest limitations for the development of Arctic Ocean scientific drilling proposals.

In order to plan the future of scientific drilling in the Arctic Ocean, the international Magellan workshop "Overcoming barriers to Arctic Ocean Drilling: the site survey challenge" was held in Copenhagen November 1 – 3, 2011. About 33 scientists from Europe, US, Canada, Russia and Korea participated in the workshop. Funding of the workshop was provided by European Science Foundation (ESF); IASC Marine Working Group; and the European Consortium for Ocean Research Drilling (ECORD).

The focus of the workshop was to develop a site survey strategy and discuss site survey campaigns based on the existing proposals and pre-proposals that were discussed and developed during and directly after the ESF-NSF-funded Arctic Drilling Workshop held at the Alfred Wegener Institute in Bremerhaven, Germany, in November 2008 (Coakley and Stein, 2008) and information gathered during the 2003 JEODI workshop in Copenhagen, Denmark (Kristoffersen & Mikkelsen, 2004). The major objectives of the 2011-Magellan workshop were to:

- » Define and outline site survey investigations for specific IODP-type campaigns in Arctic Ocean key areas to be finalized in the development of drilling proposals;
- » Develop a scientific site survey to investigate the tectonic and paleoceanographic history of the

Arctic Ocean and its role in influencing the global climate system as defined by the drilling proposals resulting from the 2008 workshop;

- » Summarize existing opportunities, technical needs, and limitations on drilling in the Arctic Ocean; and
- » Bring together an international group of arctic scientists, young scientists, and ocean drilling scientists to learn and exchange ideas and experience about the Arctic Ocean.

The full workshop report is available under www.iasc.info/index.php/home/groups/working-groups/marineaosb/publications

Workshop on the Global Terrestrial Network on Permafrost (GTN-P) User Requirements Definition

10-11 November, 2011 | Alfred Wegener Institute for Polar and Marine Research, Potsdam, Germany

Cryosphere Working Group support

The International Permafrost Association (IPA) and the IASC Cryosphere Working Group organized a workshop in November 2011 to encourage, facilitate and promote the first step in the realization of the GTN-P Strategy and Implementation Plan submitted to the Global Climate Observing System (GCOS) and the Global Terrestrial Observing System (GTOS) focusing on:

- » The definition of user requirements for an permafrost observing network based on a broader stakeholder involvement, and
- » The standardization of permafrost measurement methods at the international level.

Monitoring Essential Climate Variables

The GTN-P is the observing network for permafrost sponsored by GCOS and GTOS and managed by the

IPA. It monitors the two Essential Climate Variables (ECVs) permafrost temperature and active layer thickness through a series of sites (over 860 boreholes globally) located in all permafrost regions. GTN-P has gained considerable visibility in the science community in providing the baseline against which models are validated globally and incorporated in climate assessments. It was significantly expanded during the IPY. Yet, until now it was operated on a voluntary basis, and is now being redesigned to meet the increasing expectations from the science community. To highlight the network and deliver the best possible products to the community, the IPA organized a workshop to define the user needs and requirements for the production, archival, storage and dissemination of the permafrost data products it manages.

The workshop brought together representatives of targeted communities (field scientists, modelers and remote sensing specialists) to elaborate a set of requirements and got these communities to agree on a consolidated set of standards and products to be provided by GTN-P. In a second phase, the workshop addressed issues spanning the whole spectrum of science communities involved in the workshop: data archival, data storage, data dissemination and visualization, search tools, online vs. offline data delivery, confidentiality, compatibility with existing ISO and PIC standards, etc.

The results of this stakeholder workshop is the formation of an interim executive committee chaired by Vladimir Romanovsky (UAF, USA) that will, in partnership with the IPA secretariat, work on refining the Strategy and Implementation Plan of GTN-P and work towards the operationalization of the network.

www.gtnp.org

Arctic in Rapid Transition (ART) Polarstern Draft Meeting

November 21-22, 2011 | Geological Survey
of Denmark and Greenland, Copenhagen,
Denmark

Marine Working Group support

The Arctic in Rapid Transition (ART) Initiative is an integrative, international, interdisciplinary, pan-arctic network to study the spatial and temporal changes in sea ice cover, ocean circulation and associated physical drivers over multiple timescales to better understand and forecast the impact of these changes on the ecosystems and biogeochemistry of the Arctic Ocean. The ART Initiative was initiated by early career scientists in October 2008 and subsequently endorsed by the Marine Working Group of IASC. ART will be implemented via a three-phase approach:

Phase I: The development of an active international and multidisciplinary network of scientists sharing a common interest in improving our understanding of the implications of sea ice transitions in the Arctic Ocean.

Phase II: The coordination of dedicated, multi-country, interdisciplinary field campaigns and data collection activities that would provide input into an integrated modelling effort.

Phase III: The synthesis of knowledge including the development of robust scenarios regarding the future state of arctic marine ecosystems and their role in global processes.

Mentoring and educational programs will be integral to all three phases to help maintain the organic identity of ART as a network led by early-career scientists.

Seasonal Transitions in the Eurasian Arctic Ocean

In November 2011, the ART Executive Committee organized a meeting to discuss the draft expedition

proposal for the research vessel Polarstern. The draft was circulated before the meeting and received positive reviews. It was encouraged to submit a full expedition proposal and thereafter work on possible EU funding for a EU-ART-project. The draft proposal suggests three legs focusing on ecological and biogeochemical studies on seasonal transitions (winter-spring, fall-winter) in the Eurasian Arctic Ocean. The main objectives are to complement summer data sets and advance biological/biogeochemical process studies and modeling, calibrate algorithms used in remote sensing and proxies used to interpret sea ice and ocean circulation changes in the geologic past.

With shrinking summer sea-ice coverage in the Arctic Ocean the area of the seasonal sea-ice zone in the Arctic Ocean tends to move from shelves towards the central Arctic Ocean with possible severe consequences for ocean stratification, potential upwelling, nutrient and matter dynamics, as well as, for the biological community and productivity. Therefore, the participants decided to dedicate possible ART Polarstern expeditions to "Transitions in the Seasonal Sea Ice Zone (TRANSSIZ)" and the implications for sea ice-ocean-seafloor interactions, biogeochemical cycling and ecosystem dynamics. The scientific working program will focus on studies on the effects on:

- » Sea ice structure, physics, and biology;
- » Water column (freshening/stratification, volume fluxes and pathways, microturbulence);
- » Biogeochemical cycling (nutrient availability and matter dynamics);
- » Ecosystem changes (community composition, energy transfer, productivity quality of DOC for microbiotic community); and
- » Transitions of seasonal sea ice zone in time.

www.iarc.uaf.edu/en/ART



PHOTO: CHRISTIAN LETTNER

Approach of a DHC-6 Twin Otter at Zackenberg Research Station, Northeast Greenland. This "short takeoff and landing" utility aircraft is essential for transportation in many remote areas in the far north.

5. Relationship to other Organizations



» 5 Relationship to other Organizations

IASC has worked towards strengthening its relationship with other polar and global organization through the years. The goal is to develop and stimulate shared initiatives that are of high priority for the broader arctic research community. Different organizations are strong recurring partners in promoting arctic and bi-polar science. Organizations highlighted in this chapter include: the International Council for Science (ICSU), the International Arctic Social Sciences Association (IASSA), the World Climate Research Programme (WCRP), the Scientific Committee on Antarctic Research (SCAR) and the International Permafrost Association (IPA).

New Partnerships

Promoting Health Research in the Arctic

The International Network for Circumpolar Health Research (INCHR) and IASC have signed a Letter of Agreement (LoA) in 2011 in which they recognize their common interests in scientific research in the polar regions. Both organizations believe that there is a potential for synergy between INCHR and IASC in promoting health research in the Arctic.

Following the success of the IPY where researcher teams with expertise in health, natural, and social sciences collaborated with arctic residents in a variety

of multidisciplinary projects, INCHR and IASC agreed to seek new opportunities to combine their efforts for activities related to health sciences in the Arctic.

The INCHR is a network of individual researchers, research trainees, and supporters of research based in academic research centres, Indigenous people's organizations, regional health authorities, scientific/professional associations, and government agencies, who share the goal of improving the health of the residents of the circumpolar regions through international cooperation in scientific research.

www.inchr.com

Cooperation in Arctic Research, Education and Outreach

The University of the Arctic (UArctic), IASSA and IASC have formalized their partnership in a Letter of Agreement. All three organizations share a common interest in promoting international and multi-disciplinary cooperation in arctic research, education and outreach. Increased cooperation between the organizations is expected to be of mutual benefit, and contribute to enhancing the legacies of the IPY. The LoA was signed in 2011 at a workshop organized by the World Meteorological Organization (WMO) on the International Polar Decade (IPD) in St. Petersburg, Russia.

<http://www.uarctic.org>

Copies of the LoA's can be downloaded on the IASC website under <http://www.iasc.info/index.php/home/iasc/partners/formal-agreements>

International Council for Science (ICSU)



Polar Science in a Global Context

Since its founding in 1931, the International Council for Science (ICSU) has mobilized the knowledge and resources of the international science community in order to strengthen international science for the benefit of society. As an associate of ICSU, IASC promotes arctic and bipolar science in ICSU and advises, supports and cooperates on activities that are of importance to the whole of the polar science community. The recently concluded International Polar Year 2007-2008 is an excellent example of cooperation with ICSU. Another is the development the Polar Information Commons (PIC). IASC is one of the supporting partners in this data management project that was initiated by ICSU's CODATA, the Committee on Data for Science and Technology, to ensure long-term stewardship of and access to polar data and information coming out of the IPY. As part of its ICSU observer status, IASC is contributing to the assessment reports of the Intergovernmental Panel on Climate Change (IPCC).

Strategic Vision and Mission

IASC embraces and contributes to the strategic vision and mission of ICSU. As an example, it was actively involved in the Earth System Visioning process and shares the vision about the future Grand Challenges on Earth System Research for Global Sustainability.

Given the unique setting and rapid change of the polar environment, ICSU recognizes that it is more important than ever, to re-assert the Universality of Science principle in the Polar Regions. Bipolar opportunities were therefore important agenda points at two recent meetings that included representatives from ICSU, IASC, SCAR, the Association of Polar Early Career Scientists (APECS) and the International Association of Cryospheric Sciences (IACS).

Research Urgencies in the Polar Regions

A two-day symposium on "Research Urgencies in the Polar Regions and their Links to the ICSU Grand Challenges in Global Sustainability" was held at the University of Siena, Italy on 23-24 September 2011 and was sponsored by SCAR, IASC and IACS. The meeting endorsed the continuation of relevant polar activities as a contribution towards the ICSU Grand Challenges and as a legacy of the IPY.

The meeting concluded with a statement identifying lessons learned from the IPY that are relevant to the future of polar research and essential to addressing the ICSU Grand Challenges. These included:

- » Developing advanced, research-based, interdisciplinary, observational networks and sustaining a monitoring system supplemented with records of past changes;
- » Ensuring data preservation, exchange, availability and effective use of the capabilities of the ICSU World Data Centre system;
- » Focusing on an understanding of processes and the ability to better model the polar environment as the basis for predicting future climate;
- » Facilitating active and equal engagement of indigenous people;
- » Actively engaging and supporting the next generation of scientists in a meaningful way;
- » Nurturing and strengthening partnerships with main stakeholders;

- » Creating opportunities for wider scientific community participation; and
- » Integrating education and outreach to the wider community as a necessary component of all research projects.

ICSU General Assembly and Polar Science

At the 30th ICSU General Assembly held in Rome, Italy from the 24th of September until the 1st of October 2011, Mike Sparrow (SCAR), Jenny Baeseman (APECS) and Volker Rachold (IASC) were given the unique opportunity to address the ICSU General Assembly. In a 45-minute presentation, SCAR, IASC and APECS reflected on the past, present and future of polar science, including lessons learned from the International Polar Year. The ICSU Strategic Plan 2012-2017 proposes a review of these and other international bodies involved in polar research, with a view to preserving, and building on, the legacy of IPY.

www.icsu.org

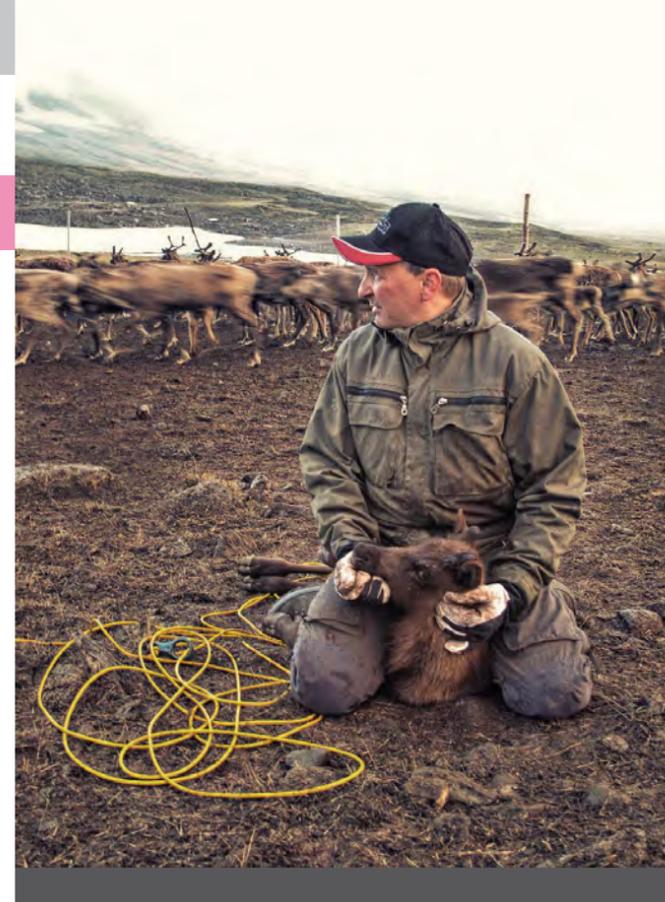
International Arctic Social Science Association (IASSA)

Written by: 
Gail Fondahl
President, International Arctic Social Science Association

The International Arctic Social Sciences Association (IASSA) was founded in 1990, to represent arctic social scientists. IASSA has six overarching objectives:

- » Promote and stimulate international cooperation and to increase the participation of social scientists in national and international arctic research;
- » Promote communication and coordination with other research organizations;
- » Promote the active collection, exchange, dissemination, and archiving of scientific information in the arctic social sciences;
- » Promote mutual respect, communication, and collaboration between social scientists and northern people;
- » Facilitate culturally, developmentally, and linguistically appropriate education in the North; and
- » Follow the IASSA statement of ethical principles for the conduct or research in the Arctic.

IASSA's membership is open to anyone who has an interest in arctic social sciences or humanities, and is willing to pay a modest membership fee. Members come mainly, but certainly not exclusively, from arctic nations, and membership has grown to approximately 600.



Gísli Pálsson, and Nikolai Vakhtin. A correspondent from National Geographic News attended, and interviewed past president Joan Nymand Larsen (<http://www.youtube.com/watch?v=XGHXwAzms-A>). Among the activities was a well-attended IASC Social and Human Working Group Roundtable on "Perceptions and Representations of Arctic Science".

New Initiatives and Partnerships

IASSA publishes a regular 'Topics in Arctic Social Sciences'. This year, No. 6: Arctic Social Sciences - Prospects for the International Polar Year 2007-2008 Era and Beyond, edited by Bigger Poppel and Yvon Csonka (2011), was published.

Working groups are relatively new to IASSA – an Extractive Industries Working Group (EIWG) has been established under IASSA's aegis. This is an interest group of members working in social sciences on some aspect of extractive industrial development in the North. IASSA looks forward to the creation of other interest groups among its members, and sees the opportunity for alignment with the priority areas of the IASC Social and Human Sciences Working Group.

This past April saw the signing of an MOU between IASSA, IASC and the University of the Arctic, recognizing the common interests of the organizations, and mutual benefits of working together, and committing to do so more closely.

<http://www.iassa.org>

IASSA is governed by a council of eight elected members, who amongst themselves choose a president. The past president also serves on the Council. The association holds a tri-annual congress. The term of the Council members and president is three years, and elections for Council members are held at a General Assembly, at the Congress. The Association's secretariat has been housed at the institution of the President (thus moving every three years), and the Congress is also held at her or his institution.

Circumpolar Perspectives in Global Dialogue

This past year (2011) marked the seventh IASSA Congress (ICASS-VII), themed "Circumpolar Perspectives in Global Dialogue: Social Sciences beyond the International Polar Year." Held in Akureyri, Iceland, the Congress attracted 450 participants. Iceland's Minister of the Environment, Svandís Svavarsdóttir, opened the conference, and keynote talks were provided by Sven D. Haakanson, Jr., Kirsten Hastrup, Igor Krupnik,

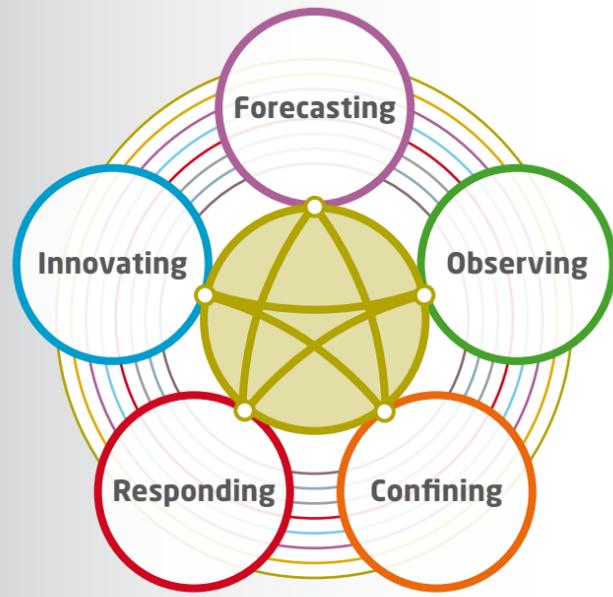


FIGURE: Grand Challenges in Earth System Science for Global Sustainability. The concentric circles represent the disciplinary research needed in the social, natural, health and engineering sciences and the humanities that must be carried out alongside interdisciplinary and transdisciplinary research in order to address the challenges. The lines linking the grand challenges show that progress in addressing any challenge will require progress in addressing each of the others.

PHOTO: SYLVIE BLANGY

Nils Torbjörn Nutti, a Sámi reindeer herder is marking the young reindeer calves. Nils owns Nutti Sámi Siida, a well established ecotourism company in Jukkasjärvi village and originated from the community of Övre Soppero. Each summer, early July, all the members of the Saarivuoma sameby (Sami village) meet on the high plateau of Norway in a place called Gáiccacacca at the foot the Gievllagáisi to mark the young reindeer calves.

World Climate Research Programme (WCRP)



Written by: Vladimir Ryabinin
Senior Science Officer, World Climate
Research Programme

The first World Climate Research Programme (WCRP) Open Science Conference (OSC) held in Denver, Colorado, USA, on 24-28 October 2011, was the WCRP highlight of the year, if not of all time. The largest meeting of climate science ever, assembled around 2000 participants from 86 countries. The participants reviewed the state of science and discussed ways climate science can help the build-up of climate services. The Conference discussions have led to a new

vision of climate science, highlighting the need for a “symbiotic” relationship between fundamental and applied aspects of science and providers and users of climate information to ensure that “actionable” (i.e. timely, accessible, easy to understand) climate information is proactively developed and efficiently used by the society. Environment and climate related issues and concerns that the public and decision makers are facing are complex and require trans-disciplinary approaches to address them. The Conference also indicated an urgent need for training and development of the next generation of scientists and decision makers who can pursue and promote the use of actionable climate and environmental information. There were sessions on polar processes, cryospheric linkages and hydrological cycle of cold climate regions at the Conference.

Grand Challenges for Climate Science

A two-day session of the Joint Scientific Committee (JCS) of WCRP held in Boulder, USA, met immediately after the Conference, reviewed its lessons and con-

tinued the discussion on the future directions and structure of WCRP after 2013. Among several decisions taken there, the JSC agreed on six Grand Challenges for climate science, on which WCRP has to deliver in the future. They are:

- » Provision of skilful future climate information on regional scales (including issues related to decadal and polar climate predictability);
- » Regional sea-level rise;
- » Cryosphere response to climate change (including ice sheets, water resources, permafrost and carbon);
- » Improved understanding of the interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity;
- » Past and future changes in water availability (with connections to water security and hydrological cycle); and
- » Science underpinning the prediction and attribution of extreme events.

A Grand Challenge is defined by WCRP as being both highly specific and highly focused, identifying a specific barrier preventing progress in a critical area of climate science. This focus enables the development of targeted research efforts with the likelihood of significant progress over 5-10 years, even if its ultimate success is uncertain. It should thus enable the implementation of effective and measurable performance metrics. By being transformative, a Grand Challenge should voluntarily bring the best minds to the table, building and strengthening communities of innovators that are collaborative, perhaps also extending beyond “in-house expertise”. It can capture the public’s imagination: teams of world-leading scientists working to solve pressing challenges can offer compelling storylines to capture the interest of media and the public.

Ice Sheet Mass Balance and Sea Level

On the last day of OSC, in an open discussion, main lessons of the Conference sessions were presented. Prof. Qin Dahe summarized the polar and cryospheric

sessions. He stated, “The cryosphere is rich on “grand challenges”. For the assessment of the past and future sea-level rise, it is essential to address large uncertainties of ice sheet mass balance. IASC, SCAR and the WCRP Climate and Cryosphere (CliC) project are moving forward in this direction by spearheading the Ice Sheet Mass Balance and Sea Level (ISMAS) initiative. Due to additional release of carbon in various forms from thawing permafrost, the Arctic may, in ten or twenty years, turning from carbon sink to source.

CliC with partners, such as the Global Carbon Project and International Permafrost Association, have developed several initiatives to assess the required information and model the involved processes. This work will continue in cooperation with several polar organisations including IASC. Finally, the assessment of the Arctic sea-ice loss, which has gained very high visibility due to well-known underestimation of its rate by the WCRP CMIP3 (Coupled Model Intercomparison Project, Phase 3) used in the IPCC Assessment Report No.4 in 2007, is on track to resolution. New research with focus on albedo feedbacks, boundary layer and ocean transport results in projections of the multi-year arctic ice, which are much closer to observations.

The IASC Working Groups are strongly contributing to this research. All the challenges mentioned above, once again, emphasize the need of long-term coordinated observations and modelling for polar regions and the cryosphere. International organisations with an interest in polar regions are therefore working towards a new long-term polar initiative that would provide a basis for sustainable observations, research and services in the polar regions and would also provide very significant value for the rest of the globe. A concept note for such an initiative will be presented at the IPY 2012 Conference in Montréal, Canada, in April 2012.

It was symbolic, fitting, and encouraging that during the WCRP OSC, which was discussing the future of climate science, the NPOESS Preparatory Project



PHOTO: BILL INGALLS/NASA
The launch of the NPOESS Preparatory Project (NPP) satellite.

(NPP) satellite was successfully launched. The satellite has started to produce data. A beautiful image captures the first second of the flight. This image was widely shown at the Conference as a background picture between presentations, once again reminding the audience about the beauty of the science and the Earth to which the attendees devote their professional interests. Some journalists, who have written about the Conference, picked up a less beautiful example, namely excessive use of acronyms in climate research. It was highlighted by Dr Peter Gleick, one of the many impressive plenary speakers, who proposed a new acronym: FHSWTBCKTOAOTA ("for heavens sake, who the bleep can keep track of all of these acronyms")!

<http://www.wcrp-climate.org/>

Scientific Committee on Antarctic Research (SCAR)



Written by: Mike Sparrow
Executive Director,
Scientific Committee on
Antarctic Research

The study of Antarctica and the Southern Ocean, and their role in the Earth system, has never been more important as the region experiences change that has global implications. The Antarctic is a "natural laboratory" for scientific research of importance in its own right and impossible to achieve elsewhere on the planet. The Scientific Committee on Antarctic Research's (SCAR) strategic vision is for a world where the science of the Antarctic and Southern Ocean benefits all, excellence in science is valued and scientific knowledge informs policy making. SCAR's mission is to be the leading non-governmental, international

facilitator and advocate of research in and from the Antarctic region, to provide objective and authoritative scientific advice to the Antarctic Treaty and other bodies, and to bring emerging issues to the attention of policy makers.

Importance of Bi-polar Cooperation

There are many common scientific interests between IASC and SCAR in the polar regions and much to be gained from developing synergies between both organizations in polar and bipolar research. SCAR and IASC are recognized by the International Council for Science as the main source of information and guidance on polar issues. Both SCAR and IASC also serve as ICSU's Observers to the IPCC to ensure that polar issues are fully considered. Areas of current and future collaboration include studies related to the cryosphere and to the roles of the polar regions in the climate system. Bipolar cooperation will continue to be explored through the joint Bipolar Action Group (BiPAG II, see <http://www.scar.org/about/partnerships/iasc/>) that is charged with identifying areas for scientific cooperation. IASC and SCAR are also jointly considering how best to preserve and build-on their stewardship responsibilities for the legacies of the IPY in observing systems, data and information management, and mentoring of students and early career scientists. Issues regarding the IPY legacies are being addressed as a joint activity of the SCAR/IASC Executive Committees.

SCAR and IASC recently produced a joint Newsletter "Polar News" (http://www.scar.org/news/newsletters/issues2011/SCAR_IASC_Newsletter_2011.pdf) outlining the importance of bipolar research. It is envisaged that the final SCAR and IASC newsletters of the year will continue to be published in this joint format. The next SCAR Open Science Conference (<http://scar2012.geol.pdx.edu/>) on 16-19th July 2012 will also include sessions on Bipolar Science. SCAR and IASC jointly co-sponsor the Association of Early Career Scientists, a relationship that is highly beneficial to all three organisations.



Next Generation of "Scientific Research Programmes"

SCAR is in the process of planning for its next generation of Scientific Research Programmes (SRPs). Four new proposals are in an advanced stage, with a possible fifth (covering past climate over geological time scales) in the planning stages. These are:

1. State of the Antarctic Ecosystem (AntEco)

Contacts: Julian Gutt (Julian.Gutt@awi.de) and
Kathleen Conlan (kconlan@mus-nature.ca)

Biological diversity is the sum of all those organisms that are present in an ecosystem, that dictate how ecosystems function, and that underpin the life-support system of our planet. This programme has been designed to focus on patterns of biodiversity

across terrestrial, limnological, glacial and marine environments within the Antarctic, sub-Antarctic and Southern Ocean regions, and to provide the scientific knowledge on biodiversity that can be also used for conservation and management. In essence we propose to explain what biodiversity is there, how it got there, what it does there, and what threatens it. A primary product of this programme would be recommendations for its management and conservation.

2. Antarctic Ecosystems: adaptations, Thresholds and Resilience (AntETR)

Contacts: Don Cowan (dcowan@uwc.ac.za) and
Kathleen Conlan (kconlan@mus-nature.ca)

AntETR will examine the current biological processes in Antarctic ecosystems, to define their thresholds

PHOTO: DAVE COLLET
Watching the C17 taxi after landing on Antarctica. Courtesy of the Antarctica New Zealand Pictorial Collection.

and thereby determine resistance and resilience to change. Such processes depend on a cascade of responses from the genomic and physiological through organismic and population to the ecosystem level. The extreme environment and marked difference in community complexity between the polar regions and much of the rest of the planet may mean that consequences of stress for ecosystem function and services, and their resistance and resilience, will differ from elsewhere. Polar ecosystem processes are therefore key to informing wider ecological debate about the nature of stability and change in ecosystems. The main goal of AntETR is to define and facilitate the science required to determine the resistance, resilience and vulnerability to change of Antarctic biological systems. In particular, the science needs to determine the likelihood of cataclysmic shifts or "tipping points" in Antarctic ecosystems.

3. Antarctic Climate Change in the 21st Century (AntarcticClimate21)

Contacts: Nancy Bertler (Nancy.Bertler@vuw.ac.nz) and Maurizio Candidi (maurizio.candidi@ifsi-roma.inaf.it)

The goals of AntarcticClimate21 are to deliver improved regional predictions of key elements of the Antarctic atmosphere, ocean and cryosphere for the next 20 to 200 years and to understand the responses of the physical and biological systems to natural and anthropogenic forcing factors. A primary form of data that we see being used by AntarcticClimate21 are the global coupled atmosphere-ocean model runs that form the basis of the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change. Palaeo-reconstructions of selected time periods, recognised as past analogues for future climate predictions, will be used to validate model performances for the Antarctic region.

4. Solid Earth Response and Cryosphere Evolution (SERCE)

Contacts: Terry Wilson (twilson@mps.ohio-state.edu) and Alessandro Capra (capra.alessandro@unimore.it)

SERCE aims to improve understanding of the solid earth response to cryospheric and tectonic forcing. SERCE will:

- » Identify and develop key disciplinary and interdisciplinary science components of a science programme aimed at advancing understanding of the interactions between the solid earth and the cryosphere, including glacial isostatic adjustment (GIA) and ice mass change and the influence of solid earth parameters (heat flow, disposition of sediments) on ice sheet dynamics;
- » Communicate and coordinate with other international groups investigating ice mass change, ice sheet contributions to global sea level rise, glacial isostatic adjustment models of Greenland and other ice caps, and other pertinent research efforts;
- » Work with SCAR action/expert groups and research programmes to promote interdisciplinary science using POLENET data; and
- » Provide an international framework for maintaining, and potentially augmenting, the remote autonomous POLENET infrastructure after the International Polar Year.

www.scar.org.

<https://www.facebook.com/groups/2514526253/>

<http://www.linkedin.com/groups/Scientific-Committee-on-Antarctic-Research-2090555>

Permafrost Association (IPA)



Written by: Hugues Lantuit
Executive Director,
International Permafrost Association

The International Permafrost Association (IPA) used the year 2011 to implement many of the recommendations put forward in June 2010 during its last Council meeting. In particular the IPA launched the first application round for Action Groups. These Action Groups are made possible through the financial resources set aside by the IPA to support international research projects. The first application round closed in October 2011 and the successful action groups were announced at the end of the year 2011.

The IPA has also worked during the year on improving its web presence, and creating a modern publishing platform for its country reports. These reports are now published online in a searchable and exportable format that is referenced with an ISSN number and fully citeable. Archived reports will progressively be input into the database, but members can already access reports dating back to 1989.

The IPA has welcomed two new members in 2010 and 2011. Kyrgyzstan and South Korea became the 25th and 26th members of the IPA. Kyrgyzstan has a long tradition in permafrost research, which relates to the fact that permafrost occurs within approximately 30% of the country's territory and is contiguous with permafrost in Kazakhstan, China and Tajikistan. South Korea has been active in permafrost research for the past 20 years, and the inception of the Korea Polar Institute has given a boost to its community of permafrost scientists who are active in both the Arctic and the Antarctic. Korea is also a member of IASC, and the IPA and IASC will explore potential synergies.

Contributing to Major Initiatives

Several members of the IPA were involved in the Climate Change and the Cryosphere: Snow, Water, Ice and Permafrost in the Arctic (SWIPA) project, which was coordinated by the Arctic Monitoring and Assessment Programme (AMAP) in cooperation with IASC, WCRP/CliC, the IPY International Programme Office (IPO) and IASSA. The permafrost chapter is more than 60 pages long in the pre-production proof. Terry Callaghan and Margareta Johansson acted as convening lead authors. Their team was strengthened by five lead authors (Oleg Anisimov, Hanne Christiansen, Arne Instanes, Vladimir Romanovsky and Sharon Smith) and 25 contributing authors. The chapter as well as an executive summary of the report, can be accessed at:

<http://www.amap.no/swipa/>

The IPA welcomed the release in April 2011 of the "State of the Arctic Coast 2010" report. This report, sponsored by the IPA, IASC, AMAP and the Land-Ocean Interactions in the Coastal Zone (LOICZ) project, was a collaborative effort by 47 lead and contributing authors from 10 nations including all those bordering the Arctic coast and others with Arctic interests. It grew from a recommendation by the Workshop on Arctic Coastal Zones at Risk, convened in Tromsø, Norway, in October 2007. The report is a milestone in the study of arctic coasts and provides the first comprehensive overview of the physical and social environment of the arctic coastal zone and puts forward recommendations for future studies. The report is available for viewing and download at www.arcticcoasts.org and is published by the Helmholtz-Zentrum Geesthacht, LOICZ International Project Office, at the Institute of Coastal Research, Geesthacht, Germany.

Global Terrestrial Network for Permafrost

The Task Force established in June 2010 by the IPA Executive Committee to create a Strategy and Implementation Plan for the Global Terrestrial Network for Permafrost (GTN-P) is close to completing its task. A plan that highlights the need for GTN-P to profes-



nalize its reporting process and to release results on the state of permafrost and of the active layer on a regular basis, will be released in 2012.

The first step in implementing the recommendations put forward in the Strategy and Implementation plan was the organization of the first GTN-P workshop to define data user requirements. The workshop, co-sponsored by the CWG of IASC, was held from November 10-11, 2011 in Potsdam, Germany. This workshop brought together stakeholders from the permafrost monitoring community, but also a wide range of users to define the needs and formats required to make the GTN-P reporting process relevant and efficient. A document on data user requirements stemming from this workshop will be released early 2012.

The organization of the Tenth International Conference on Permafrost (TICOP) is now well under way. The conference will be held from June 25-29, 2012

in Salekhard, Yamalo-Nenets Autonomous District, Russia. The core theme of the conference – “Resources and risks of permafrost areas in the changing world” - relates to changes in the permafrost but also evokes the increasing role of mankind in transforming mountain, arctic and subarctic environments. The conference will feature scientific sessions, plenary lectures, excursions and field trips on the permafrost and a series of special events geared towards the participants. The conference will also serve as a venue for the meetings of the International Permafrost Association. More information on the TICOP is available on the conference website: <http://www.ticop2012.org>

[ropa-permafrost.org](http://www.ropa-permafrost.org)

<http://www.facebook.com/pages/International-Permafrost-Association/347034918785>

<https://twitter.com/ropapermafrost>

<http://www.youtube.com/user/ropapermafrost/>

PHOTO: JORIEN VONK

A young group of students is looking at exposed Pleistocene ice wedges at Duvannyi Yar, Kolyma River, Russia. The field course excursion was part of the US-NSF funded Polaris Project “Rising Stars in the Arctic”, an international collaboration between students, teachers and scientists that has the aim to train the future generation in arctic research.

PHOTO: KOPRI
Traditional dancers from the Republic of Korea perform for the participants of the Arctic Science Summit Week 2012.



6. Arctic Science Summit Week

» 6 Arctic Science Summit Week

The Arctic Science Summit Week (ASSW) is an initiative of IASC. The purpose of the summit is to provide opportunities for coordination, collaboration and cooperation in all areas of arctic science, and to combine science and management meetings to save on travel and time. The ASSW also offers insight into arctic research undertaken by the host country.

A Science Symposium is organized as part of the ASSW every second year. These three-day symposia create a platform for exchanging knowledge, cross fertilization and collaboration and they attract scientists, students, policy makers and other professionals from IASC member countries.

The ASSW is organized by in cooperation with the:

- » Association of Polar Early Career Scientists (APECS)
- » Forum of Arctic Research Operators (FARO)
- » European Polar Board (EPB)
- » Pacific Arctic Group (PAG)
- » International Permafrost Association (IPA)
- » Ny-Ålesund Science Managers Committee (NySMAC)
- » International Arctic Social Sciences Association (IASSA)

ASSW 2011 - The Arctic: New Frontier for Global Science

The Arctic Science Summit Week (ASSW) 2011 held from 27 March to 1 April in Seoul, Republic of Korea, exceeded expectations with 334 registered participants from over 23 countries. The week in the South Korean capital combined business meetings, a 3-day science symposium, side-meetings and workshops. It created excellent opportunities to strengthen international networks and collaboration. A total of 208 abstracts were submitted for the science symposium: "The Arctic: New Frontier for Global Science" of which 157 were presented in Seoul.

Key thematic sessions ranged from atmosphere and climate processes and modeling to observations, feedbacks and modeling of arctic change in both terrestrial and marine ecosystems, including the status and change of glaciers and permafrost. The impacts and prediction of arctic change on societies in the context of past, present and future time frames was also discussed during the symposium. The need for multi-disciplinary time series observations in both

space and time to understand climate forcing and ecosystem response was highlighted during the meeting. With 92 talks and 65 posters there was a good balance in science presentations. The ASSW 2011 was organized by the Korea Polar Research Institute (KOPRI) and supported by various other departments of the Korean government, the Korea Research Council of Fundamental Science & Technology (KRCF), the Presidential Committee on Green Growth (PCGG) and the Seoul Tourism Organization.

Overview of the 2011 Science Symposium Sessions:

Disciplinary Sessions

- » Arctic Atmosphere, Climate Processes and Teleconnections
- » Arctic Change and Implications for Terrestrial Ecosystem Services
- » Arctic Marine Climate Change: Causes and Impacts on the Marine System
- » State of Glaciers and Permafrost and Associated Feedbacks to the Climate System
- » Societal Changes in the Arctic and North-South Relations

Interdisciplinary Sessions

- » Ecosystem Responses to Climate Change: Past, Present and Future
- » State and Fate of Sea Ice and Legal and Policy Consequences on the Global Community
- » Observing, Modeling and Prediction of Arctic Change

Early Career Awards

Early career scientists were well represented and awards for best poster and talk in this category were presented by the Association of Polar Early Career

Scientists (APECS) and IASC. The award for the best oral presentation went to Gijs de Boer from Lawrence Livermore Labs, in Berkeley, California, USA for his presentation entitled "The Arctic Atmosphere in CCSM4: Evaluation of key variables". The decision on the best poster was so difficult that the selection committee decided to present two awards. One went to Kazutoshi Sato from Hirosaki University, Japan for his presentation entitled "Change in cloud-base height over the ice-free Arctic Ocean during autumn" and the other to Hye Min Kim from the Korea Polar Research Institute for her presentation on "Microbial Diversity of the Active Layer Soil from the Canadian High Arctic".

Keynote Presentations

Five keynote speakers made presentations on cross-cutting topics during the plenary session covering climate change and physical forcing, ecosystem response and legal and policy consequences of changing environmental conditions on the global community. There were also invited speakers within each of the disciplinary sessions to highlight the key themes of the session. Finally, the 2011 IASC Medal recipient, Martin Jakobsson presented an invited talk on mapping of the Arctic Ocean in the plenary session.

Ecosystem Responses to Climate Change: Past, Present and Future

Keynote speaker Karin Lochte, Director of the Alfred Wegener Institute for Polar and Marine Research, Germany

The observed and predicted rapid environmental changes in the Arctic will lead to fundamentally different conditions in the polar ecosystems. Major drivers of these changes are loss of sea ice cover, melting of permafrost regions, temperature rise and acidification of ocean waters. Already, spectacular ecosystem changes are observed at the periphery of the Arctic Ocean in response to the changing ice regime. The



transformation will, amongst other responses, alter biological productivity with large consequences for the unique and charismatic arctic marine fauna. This will occur in parallel to increased anthropogenic impacts linked to the expected industrialization of the Arctic Ocean.

Summer sea ice coverage in the Arctic Ocean has been declining dramatically (around 11 % per decade) since the 1980s. It is likely that this factor will have the most fundamental impact on the arctic marine ecosystem. Sea ice change, as a key link between physics and biological systems, regulates key ecological functions through mediation of primary production (quality, quantity/magnitude, timing, and location) and changes in sea ice extent and thickness alter the habitat for consumers. Long-term observations in the Fram Strait indicate that sea ice retreat has led to shifts in plankton communities and to a reduction of organic material exported to the deep ocean. As a consequence, the warming of the surface ocean also has an impact on the underlying deep sea ecosystem.

Polar species are well adapted in their physiology and behavior to the large seasonal changes in physical conditions (light, temperature, ice cover, etc.) and are often indigenous to the polar region. Alterations in species composition and biological processes are

to be expected when physico-chemical conditions change to such an extent. Warming of ocean waters and influx of Atlantic species will favor the spread of alien species in the Arctic Ocean. Experimental investigations into acidification of polar oceans waters show that elevated CO₂ concentrations reduce the temperature tolerance of some species and/or prolongs the development of larval stage. Future acidification of the Arctic Ocean will enhance loss of species and disrupt food webs.

In permafrost regions it has been observed that short-term changes in the local moisture conditions yield transformation in the moss communities of arctic polygonal ponds. Recent studies indicate that brown mosses represent a so far unknown sink for methane. Therefore changes in arctic moss communities could have consequences for the local methane emission in tundra environments with positive climatic feedbacks.

These examples demonstrate that climate change can initiate cascading effects, regime shifts or non-linear feedbacks of physical and biological processes, which are likely to lead to major changes in the polar ecosystem and its functions. The consequences of these changes are presently poorly understood. In addition to these alterations, human impact will increase in the arctic environment. Exploitation of the

considerable deposits of mineral oil, gas and metal are suspected in the sediments of the Arctic Ocean as well as the expected use of the Northern sea routes for commercial shipping. These potential commercial uses of the Arctic Ocean require development of measures to safeguard the fragile environment of the Arctic Ocean.

Environmental State-Change of Sea Ice in the Arctic Ocean: Legal and Policy Consequences for the Global Community

Keynote speaker Paul Arthur Berkman, Head of Arctic Ocean Geopolitics Programme, Scott Polar Research Institute, University of Cambridge, UK

The Arctic Ocean is undergoing the largest environmental state-change on Earth, transforming the North Pole from a sea-ice cap that has persisted for millennia to a seasonally ice-free sea within the next few decades. This fundamental shift in the boundary conditions of the Arctic Ocean will create a new natural system with different dynamics than anything previously experienced by humans in the

region. With the diminishing ice cover – amplified by climate warming in the polar regions – interests are awakening globally to take advantage of extensive energy, shipping, fishing and tourism prospects in the Arctic Ocean. At the same time, the coastal states ringing the Arctic Ocean (Canada, Denmark / Greenland, Norway, Russian Federation and United States) are increasingly asserting their sovereignty, sovereign rights and jurisdictions seaward. Non-coastal Arctic states (Finland, Iceland and Sweden) and indigenous peoples organizations as well as non-Arctic states (including China, South Korea and the European Union) also are introducing their perspectives on Arctic sovereignty and governance. These geopolitical drivers introduce a fundamental challenge to balance national interests and common interests in the Arctic Ocean for the lasting benefit of all. Jurisdictional zones defined by law of the sea (Fig. 1), to which all of the Arctic coastal states “remain committed” as they noted in the 2009 Ilulissat Declaration, illustrate the key legal and policy elements to achieve this balance.

The path forward to integrate these legal and policy elements is revealed by the “common Arctic issues” of sustainable development and environmental pro-

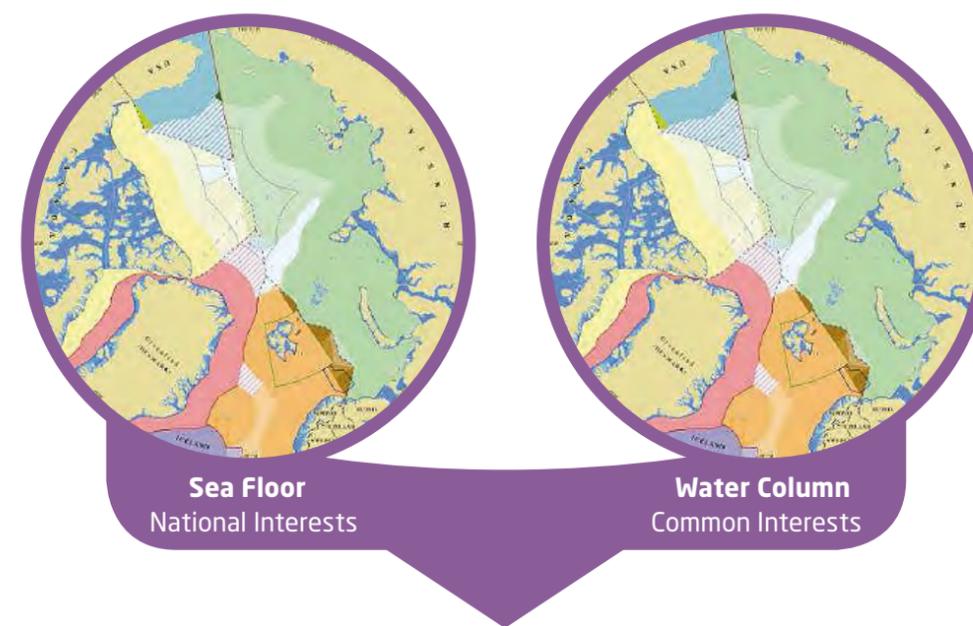


FIGURE 1: Balance of national and common interests in the Arctic Ocean with reference to jurisdictions defined by law of the sea for the: **(sea floor)** proposed continental shelf delimitations with sovereignty of the Arctic coastal states in different colors; and **(water column)** international space of the high seas surrounding the North Pole, dark blue, beyond the exclusive economic zones of the Arctic coastal states. Adapted from (Berkman, P.A. and Young, O.R. 2009. Governance and Environmental Change in the Arctic Ocean. *Science* 324:339-340).

PHOTO: KOPRI
Karin Lochte, Director of the Alfred Wegener Institute for Polar and Marine Research, Germany holds a keynote lecture on ecosystem responses to climate change at ASSW 2012.

tection, which were agreed by the Arctic states and indigenous peoples in the 1996 Ottawa Declaration that established the Arctic Council. These “common Arctic issues” underlie the critical importance of international, interdisciplinary and inclusive assessments to interpret the cultural, political, economic and ecosystem instabilities that are emerging with the environmental state-change in the Arctic Ocean. With sufficient information and shared understanding about the risks of instabilities, it then becomes feasible to establish the necessary adaptation and mitigation strategies. Science is both a key for unlocking these system assessments and a tool of diplomacy for balancing the diverse interests in the Arctic Ocean with global relevance.

Observing, Modeling and Prediction of Arctic Change

Keynote speaker Vladimir Kattsov, Director of Voeikov Main Geophysical Observatory in St. Petersburg, Russian Federal Service for Hydrometeorology and Environment Monitoring (Roshydromet)

Over past decades, observed climate changes in the Arctic have been demonstrating impressive consistency (ACIA 2005; IPCC 2007): the warming in the Arctic has been accompanied by dramatic shrinking of sea ice (with the largest trend in September – at the end of the melt season), thawing permafrost, glacier mass loss, melting of the Greenland ice sheet, increasing river discharge into the Arctic Ocean (along with changes in runoff seasonality), etc. On the other hand, the Arctic remains among the most notorious regions for poor coverage of the observational network, as well as insufficient representation and lengths of observational time series. This in particular limits possibilities for climate model evaluation and development.

The well-known observational problems in the Arctic include sea ice thickness, cloudiness, solid precipitation and permafrost characteristics. Complex and

still insufficiently understood climate processes and feedbacks, specific for the northern high latitudes, contribute significantly to the challenge that the Arctic poses from the viewpoint of physically-based climate prediction. This challenge makes itself particularly evident in the range of climate change projections for the Arctic by state-of-the-art global climate models, even for the same scenarios of anthropogenic radiative forcing. Arctic climate prediction (as well as detection and attribution of the observed climate change in the Arctic) is further complicated by the vigorous unforced natural variability inherent to the climate system in high latitudes that may amplify or mask the anthropogenic signal.

Hopes for decreasing arctic climate prediction uncertainties, as well as for better quantifying regional and global impacts of climate changes in the Arctic, are pinned on enhancing and synthesizing remote and in situ observational networks and high performance computing. Meaningful prediction/projection of the arctic climate for the coming decades and beyond requires progress in several interconnected areas of research and observations including:

- » Determining priorities of observational and modelling developments (e.g. dedicated ice thickness satellite missions, climate modelling allowing data assimilation, etc.) aimed at improving credibility of the arctic climate predictions and projections;
- » Better understanding of the predictability of the arctic climate on seasonal, inter-annual, decadal, and centennial time scales in the wider context of the polar climate predictability; and
- » Detection and attribution of the arctic climate change (i.e. quantification of the interplay of its forced and unforced aspects) and evaluation of the ability of the state-of-the-art climate models to reproduce the observed arctic climate behavior as a part of the broader climate system, with as full as possible accounting of relevant processes, interactions and feedbacks.

Rapid Transition of Pacific Arctic – Current Status and Future Perspective

Keynote speaker Koji Shimada, Department of Ocean Sciences, Tokyo University of Marine Science and Technology, Japan

The transition of arctic climate represented by sea ice reduction is accelerated by activation of both sea ice motion and ocean circulation. Figure 1 shows winter sea ice motion and following summer ocean dynamic height at 100 dbar referred to 800 dbar (geostrophic currents in the Pacific Water layer) in climatological mean and in 2008. The spatial pattern of ocean circulation is not identical to that of sea ice circulation. This discrepancy is owing to rectifications of ocean current by seafloor topography. On the slope of the eastern Beaufort Sea near Banks Island, the direction of flow is along the sea floor topography. This feature suggests that the depression of isopycnals caused by Ekman pumping could not stay there and was radiated by a topographic Rossby wave. Hence a simple interpretation to argue is that the strength of ocean

circulation by Ekman pumping or the strength of the Beaufort High is not sufficient to understand real changes. Fundamental dynamics should be recalled.

In the Chukchi Borderland (CBL) area adjacent to the Chukchi Sea, the currents in the upper ocean consisting of Pacific Water (PW) shows northward flow along bathymetry, perpendicular to the westward sea ice motion. Since IPY2007-2008 (Fig. 1b), both current speeds and volume transportation were doubled relative to climatology. As a result, the spreading pathway of the cold and nutrient rich Pacific Winter Water has completely changed after the IPY (Fig. 2). The impact of a delivery of huge warm Pacific Summer Water reduced ice growth during winter and caused spreading of thin and young sea ice from the CBL region toward the Canadian Archipelago. This ocean and ice interaction discussed earlier, diminished the sea ice and initiated the ice-albedo feedback and formed a new warm water mass called near temperature maximum water (Jackson, et al., 2010). In the Pacific Arctic Ocean, sustained interdisciplinary observing networks for the full span of the Pacific Arctic Ocean is a critical activity in current the next decade.

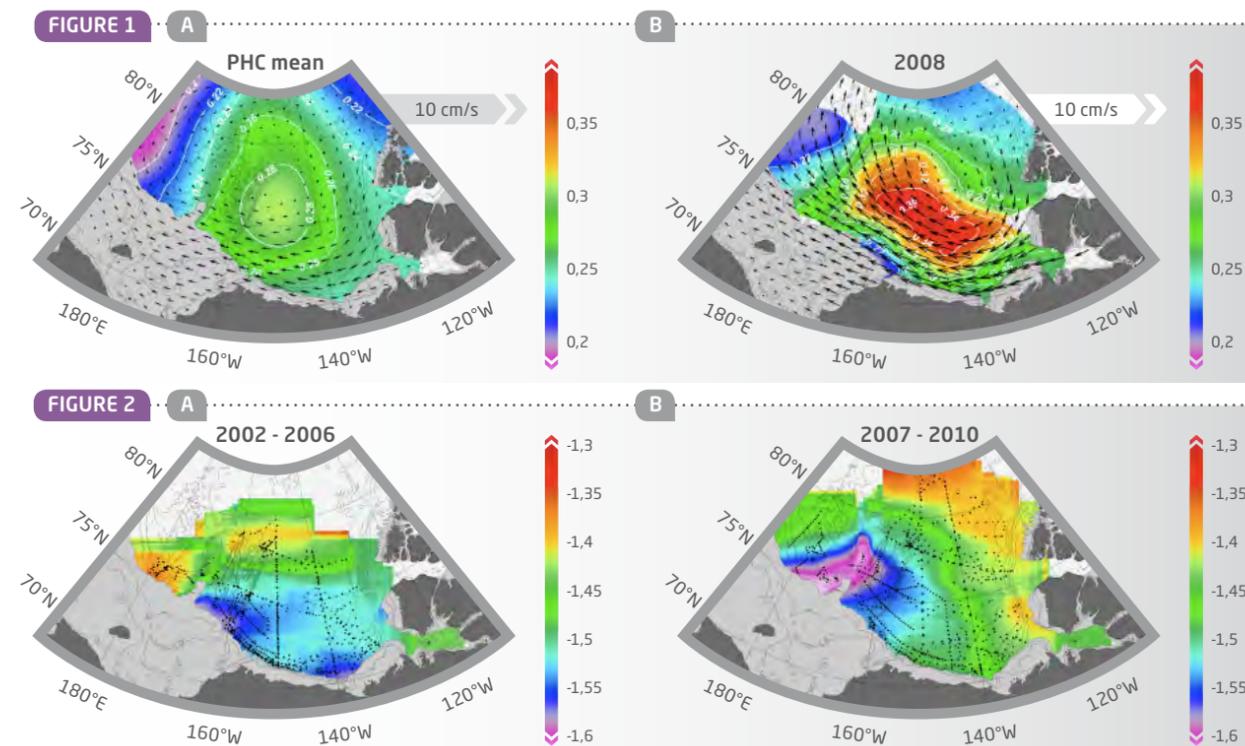


FIGURE 1: Ocean dynamic height at 100 dbar referred to 800 dbar (color) and sea ice velocities in winter (NDJFMAM)(arrow). (A) Polar science center Hydrographic Climatology (PHC), (B) 2008.

FIGURE 2: Distribution of potential temperature on S=33.1. (A) 2002-2006, (B) 2007-2010.

Linkages between Arctic Cryosphere and Climate in Mid-low Latitudes: Examples in East Asia

Keynote speaker Xiao Cunde, State Key Laboratory of Cryospheric Science, Cold and Arid Regions Environmental and Engineering Research Institute, Chinese Academy of Sciences, China

Teleconnections of arctic climate change with mid-latitudes exist in multi-timescales such as orbital, millennial, decadal and seasonal scales. Orbital and millennial scale linkages are shown in ice cores from Greenland and Tibet, as well as in loess profiles. In decadal scales, sea ice concentration (SIC) in the Arctic impacts summer rainfall in east China, with the combined impacts of both spring arctic SIC and Eurasian snow cover on the summer Eurasian wave train may explain their statistical linkage (Wu et al., 2009a,b). Such linkage also exists in inter-annual time scales.

Decay of the arctic cryosphere has positive feedback on temperature changes in the Nordic regions. Prominent warming in east Siberia decreases the temperature amplitudes between middle and high latitudes of East Asia and strengthens atmospheric baroclinicity. The consequences are: 1) a decadal transit from a wet to a dry climate in northeast China in the early 1980's; and 2) decreasing frequencies of dust storms and cold surge events in winter/spring (Zhu et al., 2008; Ding et al., 2009). North-south shifting of the axes of the westerly jet stream might also correlate with Nordic warming, corresponding to decadal changes of the East Asia climate.

Acknowledgements: Chinese COPEs projects (GYHY200706005)

Mapping of the Arctic Ocean: A Historical Review and Future Prospect

Keynote speaker Martin Jakobsson, Professor in Marine Geology and Geophysics Department of Geological Sciences, Stockholm University, Sweden

The smallest of the world's oceans, the Arctic Ocean, plays a critical role in the global climate system and tectonic history. Accurate portrayals of its seafloor morphology is however not only critical for scientists, it is also required for a broad range of applications including assessment of geo-hazards, resource management and recently the legal definition of coastal states' continental shelf limit following United Nations Convention on the Law of the Sea (UNCLOS) Article 76. The largest single step forward in the history of mapping the Arctic Ocean seafloor was when Fridtjof Nansen published his bathymetric map from the Fram expedition 1893-1896. This map was compiled from a handful of lead line soundings acquired during the drift across the Arctic Ocean with the ship Fram frozen into the pack ice.

The map revealed that the central Arctic Ocean was neither comprised of a landmass surrounding the North Pole, as showed on Gerard Mercator's map published 1595 one year after his death, nor was it a shallow epicontinental sea as Nansen himself speculated before his expedition. Instead, Nansen's bathymetric map showed one large featureless deep basin.

The decades of Arctic exploration following the Fram expedition hardly increased our knowledge on the Arctic Ocean seafloor. The next major step forward was initiated first after World War II, when the former Soviet Union begun to systematically map the central Arctic Ocean seafloor by collecting depth soundings through the pack ice from ice stations established using airplanes. These data revealed an ocean under-



lain by a morphologically complex seafloor consisting of abyssal plains interspersed between large submarine ridges.

In this presentation, a historical review was provided of efforts aimed to map the Arctic Ocean seafloor following the Fram expedition. The review was followed by a future prospect of the most recent international collaborative effort initiated in St. Petersburg 1997; the International Bathymetric Chart of the Arctic Ocean (IBCAO). To date, less than 7% of the Arctic Ocean seafloor is mapped with modern multibeam technology and only through international collaboration, coordination and sharing of bathymetric data can this number be changed sufficiently fast.

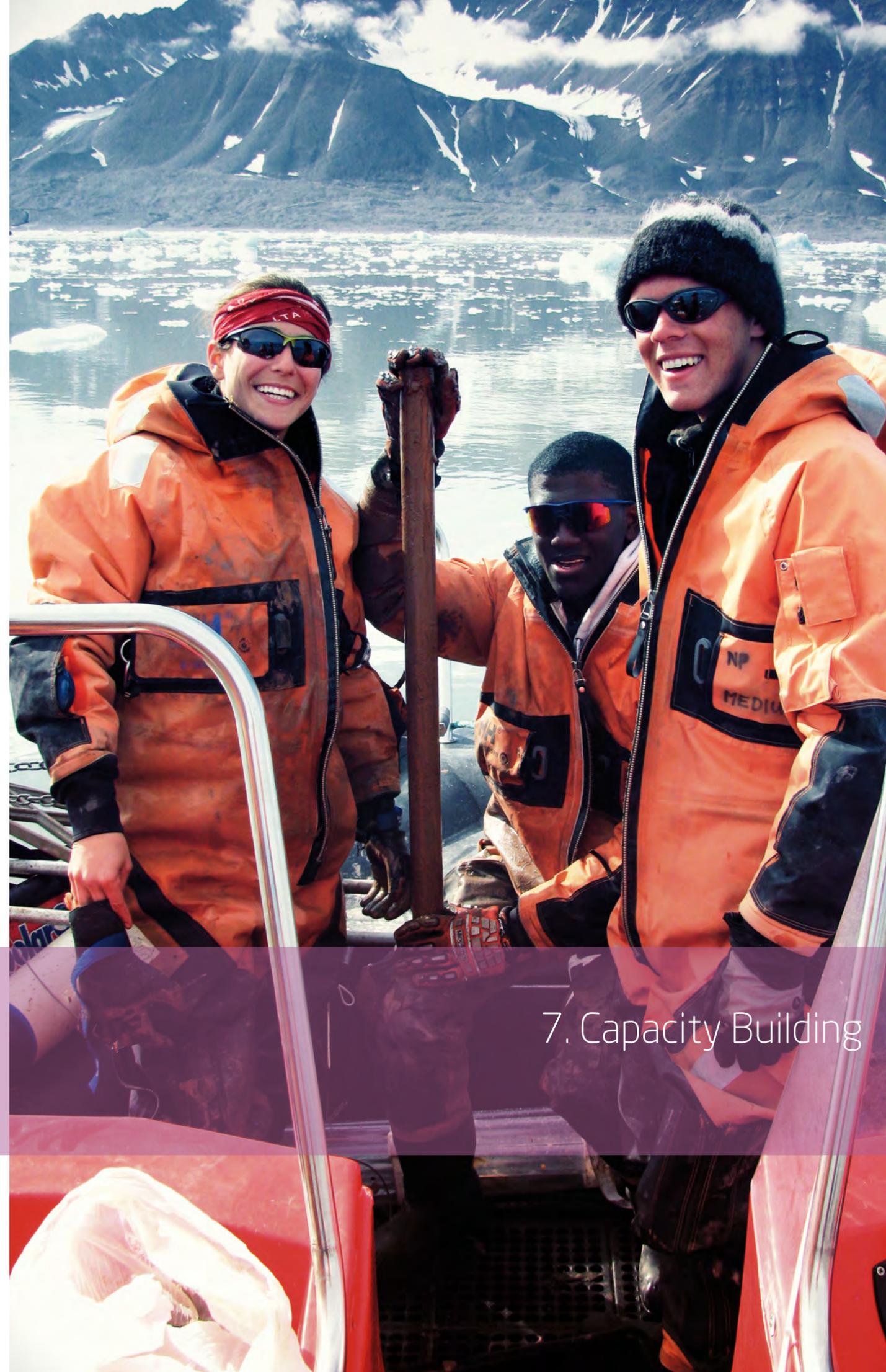
Upcoming ASSW's

The ASSW 2012 will be held in Montreal, Canada just prior to the IPY Conference "From Knowledge to Action". During the week, all the IASC WGs, the IASC Council, and all the sponsoring organizations will meet. The coming together of all the organizations provides the opportunity for collaboration and cooperation.

The ASSW 2013 will be held in Krakow, Poland from April 14-20, 2013 and will include business meetings and a three-day science symposium. The overall theme of the symposium is "The Arctic Hub - Regional and Global Perspectives". The Scientific Steering Committee is being chaired by Jacek Jania and Naja Mikkelsen.

PHOTO: KOPRI
IASC Medal Award winner, Martin Jakobsson, presents his award lecture on the mapping of the Arctic Ocean at ASSW2012.

PHOTO: JULIE BRIGHAM-GRETTE
Three undergraduate students at the head of Kongsfjord, Ny Alesund, Svalbard. They were part of a group that collected 28 gravity cores during their study of glaciomarine sedimentation and processes at the tidewater glacier margin.



7. Capacity Building

» 7 Capacity Building

IASC recognizes that the new and next generations of researchers will be faced with increasingly critical challenges due to the impacts of climate change on these regions and their global significance. The Committee therefore believes that it is of great importance to foster these young researchers and promotes and involves early career scientists working in the Arctic by:

- » Striving for representation of early career researchers in the organization;
- » Providing endorsement, support and dissemination of information on activities, projects and request for participation; and
- » Providing travel grants to early career scientist for selected conferences.

With these instruments, IASC aims to include more young researchers from the starting phase in the organization of workshops, science planning activities and research programs.

The biennial Science Symposia during the Arctic Science Summit Weeks (ASSWs) and IASC Working Group activities are successful examples of where early career scientists have been included in the development of a science programs. Providing travel support to early career scientists to selected conferences provides them with the opportunity to present their ideas and exchange information with an international

and renowned group of arctic scientists; giving both parties a chance to learn from each other.

During the IPY 2012 Montreal Conference, IASC awarded twenty travel stipends to early career scientists, enabling many to attend the final IPY (2007/2008) conference. Over the last year, IASC sponsored nine early career scientists to attend the ASSW Science Symposium in Korea. IASC also sponsors early career representation in smaller workshops and new network initiatives.

Here are some of the experiences from sponsored attendees that show how travel support can make a difference.

Arctic Science Summit Week 2011,

Jaclyn Kinney, Naval Postgraduate School

"This conference provided a great opportunity to learn from and interact with many of the most prominent researchers in the field. Participation in the ASSW 2011 contributed to my professional development in two main ways. First, it provided an outlet for presenting my PhD research to others in the field. Secondly, it was a chance for me to learn about the latest results from others and I was able to meet new people for future networking. As a young scientist, I



was able to contribute to the conference by having a unique perspective. My work in the biological and physical oceanography of the Bering Sea and Pacific-Arctic sector gave me an interdisciplinary approach to issues in that region and others."

Seventh International Congress of Arctic Social Sciences,

Svetlana G. Usenyuk, Ural State Academy of Architecture and Art, Russia

"I was inspired by the topic of the Conference "Circumpolar Perspectives in Global Dialogue." From my point of view, the congress was aimed to give the floor to multidisciplinary concepts, forecasts & case studies of how people would live in the Arctic in the near future. It was a great chance to present my PhD research findings as well as represent my University as a whole with its special department devoted to arctic studies. It also enabled me to organize the session devoted to research work of creative specialists like architects and designers, i.e. people who are able to 'shape' the future of the Arctic. The session was intended to enable knowledge-sharing activities as well as foster multidisciplinary teamwork with an eye to bringing closer the day of comfortable living in the Arctic. This was also my first experience of chairing a session, so I was quite nervous at the beginning of it.

But all those fears were in vain. The most valuable result was an efficient discussion, which gave me some perspectives and inspirational ideas of further implementation of my research. I received strong and solid feedback from senior specialists from other areas, sometimes extremely different areas, but examining the same issues 'from the opposite' point of view."

Workshop on the Global Terrestrial Network on Permafrost (GTN-P) User Requirements Definition,

Dmitry Streletskiy, George Washington University

"Chairing a session and participation in discussions on various aspects of GTN-P implementation allowed me to broaden my scientific perspectives, meet with colleagues and discuss future plans. At the end of the workshop I was elected as a member of Executive Committee of GTN-P to represent CALM and Permafrost Young Researchers Network (PYRN)."

It is because of this range of opportunities – learning platforms stimulating the exchange of knowledge, cross fertilization and collaboration – that becomes available to early career scientists who attend these meetings, that IASC hopes to keep supporting early career scientists in the future.

PHOTO: KOPRI
Lively discussions at the ASSW 2012 poster sessions.

Meeting	Name	Institution	Country
Workshop on Arctic Glaciers Colorado, February 2011 NAG	M. Blaszczyk W. Colgan A. Izykowska-P. G. Wolken	University of Silesia University of Colorado, Co. Inst. For Research in Environmental Scien. Institute of Geophysics Polish Academy of Sciences University of Alberta	Poland USA Poland USA
Polar Archeology Network Workshop Norway, February 2011	K. Westley	University of Ulster, Centre for Maritime Archaeology	UK
Automatic Measuring Systems Workshop Switzerland, March 2011	E. Bagshaw I. Gorodetrkaya J. Hult I. Lozano T. Matthews J. Young J. Laenarts	University of Bristol Katholieke Universiteit Leuven Norwegian University of Life Sciences University of the Basque Country Loughborough University University of Alaska Fairbanks Utrecht University	UK Belgium Norway Spain UK USA Netherlands
Arctic Science Summit Week 2011 Seoul, March-April 2011	V. Bednenko A. Forest K. Frey J. Kinney J. Mathis I. May M. O'Regan A. Pavlov F. Stammler	Arctic and Antarctic Research Institute Laval University Clark University Naval Postgraduate School University of Alaska Fairbanks Ludwig-Maximilians University Cardiff University Arctic and Antarctic Research Institute University of Lapland, Arctic Centre	Russia Canada USA USA USA Germany UK Russia Finland
Genetic Monitoring Workshop Cambridge, April 2011	T. Hart J. Jackson C. Le Bohec F. Leese	University of Oxford British Antarctic Survey University of Strasbourg, DEPE-IPHC-CNRS Ruhr University Bochum	UK UK France Germany
Glacier and Ice Cap Assessment Working Group Meeting Winter Park, Columbia, June 2011	V. Radic	University of British Columbia	Canada
International Congress of Arctic Social Sciences (ICASS) VII Akureyri, June 2011	S. Usenyuk K. L. Hansen	Ural State Academy of Architecture and Art University of Tromsø	Russia Norway
Shrubring Synthesis Workshop Davos, September 2011	D. Blok K. Tape A. Trant A. Naito M. Hallinger I. Myers-Smith	Wageningen University University of Alaska Fairbanks Memorial University Texas A&M University University of Greifswald University Sherbrooke/University of Alberta	Netherlands USA Canada USA Germany Canada
Kick-Off Meeting Workshop on Atmospheric Investigations on a Drifting observatory over the Arctic Ocean (AIDA) Potsdam, September 2011	C. Lundquist	Department of Meteorology, Stockholm University	Sweden
Conference on Life in Extreme Environments (CAREX) Dublin, October 2011	P. Bhadury T. Bell A. Goutte M. Cherbunina P. Wilkinson K. Cameron A. Lopatina	Indian Institute of Science Education and Research-Kolkata McGill University LOCEAN - CNRS Lomonosov Moscow State University Open University University of Washington Institute of Molecular Genetics	India Canada France Russia UK USA Russia
Site Survey Challenge Copenhagen, November 2011	I. Ilhan W. Geissler E. Bazhenowa M. Vautravers M. Forwick	University of Alaska GEOMAR GEOMAR Cambridge University University of Tromsø	USA Germany Germany UK Norway
Workshop on the Global Terrestrial Network on Permafrost (GTN-P) User Requirements Definition Potsdam, November 2011	M. Streletskiy	George Washington University	USA
DBO Workshop Victoria, November 2011	M. Kedra	UMCES/IOPAN	Poland
ART Meeting Copenhagen, November 2011	A. Nikolopoulos M. O'Regan	Aquabiota Water Research University of Cardiff	Sweden UK

TABLE: Overview of supported Early Career Scientists

Association of Polar Early Career Scientists (APECS)



Written by:

Yulia Zaika (APECS President, 2011-2012),
Allen Pope (APECS Presidents 2010-2011),
Jenny Baeseman (APECS Director) and
Jennifer Provencher

This year the Association of Polar Early Career Scientists (APECS) is celebrating its 5th anniversary and continues to grow with more than 3000 early career researchers (ECRs) from over 76 countries.

We are continuing our online virtual poster session series with several new disciplines of the month (DOM) being featured. The Antarctica Day Webinar in December featured a presentation by the Executive Directors of IASC (Volker Rachold) and SCAR (Mike Sparrow) as well as our Director Jenny Baeseman about "Polar Science in a Global Context," as well as other great presentations and drew more than 60 attendees from around the globe. In addition, the Microbial Ecology Virtual Poster Session (sponsored by IASC) was a great success thanks to the efforts of the IASC Terrestrial and Cryosphere Working Groups in starting a Polar Microbiology Network. Session recordings are available at vimeo.com/apecs.

Education and Outreach

This fall also saw the completion of the IPY Education, Outreach and Communication (EOC) Assessment, sponsored by ICSU, IASC, and SCAR, which was presented at the ICSU meeting in Italy in September. As currently the only assessment and inventory of international IPY EOC, the report highlights a number of successful activities and partnerships and puts

forward a set of lessons learned for organizations, institutions and departments that discuss how EOC efforts can be promoted and made successful within research groups and projects. Check out the catalog of more than 600 outreach projects at <http://apecs.is/education-outreach/catalogue>.

Recognizing the importance of education and outreach, APECS, together with SCAR and IASC have partnered to create the database of 'cool' speakers that are willing to share their knowledge and experiences about the most rapidly changing areas of the planet (<http://apecs.is/education-outreach/cool-speakers>).

Contributions to Meetings and Conferences

This past year APECS worked with two Arctic Council working groups, AMAP and CAFF, to have early career researchers participate in meetings, workshops and conferences. Another highlight was a mentor panel discussion 'Careers in polar extremophiles: research and opportunities' was organized by APECS at the CAREX Conference on Life in Extreme Environments, held recently in Dublin as part of the SCAR/IASC Bi-Polar Action Group efforts.

A group of APECS members met in Montreal on November 2011 for the IPY 2012 Program and Steering Committee Meeting and were involved in planning the scientific and education sessions of the conference. APECS is working with the Conference organizers to create opportunities for early career researchers and, in cooperation with the ArcticNet Student Association (ASA), will be organizing a career development workshop before the start of the Conference in conjunction with ASSW 2012. APECS is proud to be a partner for this Conference and is responsible for coordinating the travel awards program.

Soundbytes of Cool Research

As part of the great initiatives launched during the IPY 2012 From Knowledge to Action Conference, APECS

will produce FrostBytes to not only help researchers learn about colleagues' work, but to help create a legacy product for the conference that showcases the great research conducted during the IPY and the importance of communicating research. FrostBytes – 'Soundbytes of Cool Research' are 30-60 second audio or video recordings designed to help researchers easily share their latest findings to a broad audience. Anyone attending or presenting at the IPY Montreal Conference is encouraged to create a Frostbyte (<http://www.apecs.is/events/montreal2012/frostbytes>).

Looking forward to future collaborations between APECS and IASC, Julia Schmale (APECS Research Activities Committee Chair) is serving on the Scientific Steering Committee for Arctic Science Summit Week 2013, which will be held 14-20 April, 2013 in Krakow, Poland. APECS is planning to organize a career development workshop as part of ASSW 2013.

APECS was also happy to launch a fun new tradition, thanks to the help of Mare Pit, the Polar Potties Calendar fundraising project, which has generated a great deal of interest from media and polar toilet fans everywhere.

A lot of exciting events and activities are planned for this coming year – upcoming Disciplines of the Month will be Limnology, Terrestrial Ecology, Polar Pollutants; new career development webinars and Virtual Poster Sessions, a workshop in conjunction with the Arctic in Rapid Transition meeting in Poland, an APECS Mentor Panel at International Glaciological Society Symposium in Finland and much more. Check out <http://www.apecs.is/events> for more information.

APECS is looking for even more exciting activities and initiatives to be launched with IASC and our many partners to continue Shaping the Future of Polar Research.

www.apecs.is



PHOTO: JORIEN VONK
Young participants in the Polaris Project "Rising Stars in the Arctic", get a short field course, which demonstrates techniques to make above-ground vegetation carbon inventories.

PHOTO: CHRISTIAN LETTNER
Mare's tail (*Hippuris vulgaris*) in a pond near Zackenberg Research Station, Northeast Greenland.

8. Publications and Outreach



» 8 Publications and Outreach

Global warming has brought urgency to the study of the polar regions. IASC not only stimulates and supports research that increases our understanding of global warming process and the effects of climate change, but also initiates activities and contributes to publications that enable research outcomes to reach the broad public, attempting to close the gap between science and society. In this chapter we present some examples of works that were published in 2011.

State of the Arctic Coast Report 2010

Arctic Coasts on the Retreat International Study Describe Current State of the Arctic Coasts

The coastline in arctic regions reacts to climate change with increased erosion and has retreated by half a meter per year on average of the past years. This results in substantial changes for arctic ecosystems and populations living near the coasts. A consortium of more than thirty scientists from ten countries came to this conclusion in two studies published in *Estuaries and Coasts* and online on www.arcticcoasts.org. They

jointly investigated over 100,000 kilometers (a quarter) of all arctic coasts and their results have now been published for the first time.

Coastal changes are particularly dramatic in the Laptev, East Siberian and Beaufort Seas, where coastal erosion rates reached more than 8 meters a year in some cases. Since around a third of the world's coasts are located in the arctic permafrost, coastal erosion may affect enormous areas in future. In general, arctic coasts are more sensitive to global warming than coasts in the mid-latitudes. Until recently they have been protected against the eroding force of the waves by large areas of sea ice. Due to the continuous decline in sea ice, this protection is jeopardized and people living in or near the coast now have to reckon with rapid changes in a situation that has remained stable for millennia.

Two thirds of the arctic coasts do not consist of rock, but of frozen soft substrate (permafrost). It is these coasts that are hit extremely hard by erosion. As a rule, arctic regions are quite thinly populated. However, as is the case elsewhere in the world, the coasts in the far north are important axis for economic and social life. The growing need for global energy resources as well as increasing tourism and freight transport additionally intensify anthropogenic influence on the coastal regions of the Arctic. For wild animal stocks,

like the great caribou herds of the north, and the widespread freshwater lakes near the coast, progressive erosion brings about significant changes in ecological conditions.

Successful Cooperation

More than thirty scientists from ten countries were involved in preparing the 170-page status report. The study was initiated and coordinated by IASC, the international project Land-Ocean Interactions in the Coastal Zone (LOICZ), the International Permafrost Association (IPA) and the Arctic Monitoring and Assessment Programme (AMAP) working group of the Arctic Council.

<http://www.arcticcoasts.org/>

International Polar Year (IPY)

Polar Research Boosts Understanding of our Climate and Global Environment

The largest coordinated research project ever undertaken in the Arctic and Antarctic regions yielded a treasure trove of information which will shape our understanding of the polar regions, global oceans, climate and climate change for decades ahead. "Understanding Earth's Polar Challenges," was presented to the Arctic Science Summit Week in Seoul, Republic of Korea. The summary prepared by the International Council for Science (ICSU) and World Meteorological Organization (WMO) Joint Committee presents the findings from International Polar Year – a massive research effort involving some 50,000 participants from more than 60 nations between March 2007 and March 2009.

The research provided convincing evidence of the widespread effects of climate change in the polar

regions at a time when the global environment is changing faster than ever in human history. According to the summary, snow and ice are declining, affecting human livelihoods, plant and animal life, atmospheric and ocean circulation. Parts of the Arctic and the Antarctic Peninsula are warming twice as fast as elsewhere on Earth. Warming in the Antarctic is much more widespread than it was thought prior to International Polar Year. The Greenland and Antarctic ice sheets are losing mass contributing to global sea level rise. The drastic changes in the Arctic Ocean are evidenced by the record minimum summer sea ice extent in 2007, which was followed by two other low-ice summers in the Arctic, according to the summary.

"The International Polar Year invigorated polar science, led to an unprecedented level of action, and attracted global attention to the polar regions at a critical moment in the changing relation between humanity and the environment," said WMO Secretary-General Michel Jarraud and ICSU President Catherine Bréchnignac in their joint Preface to the 720-page summary. The two organizations co-sponsored the International Polar Year. Compiled by some 300 authors and reviewers, the summary reveals how the research established large-scale baseline data sets which can be used to assess and predict future change in areas including polar environments and oceans, biodiversity and ecosystem processes. It advanced coordinated satellite observations of polar ice sheets and new measurement systems for permafrost and polar atmosphere.

Some Key Findings:

- » International Polar Year studies documented key connections between the poles and global ocean and atmospheric processes. Changes in the Arctic Ocean are transmitted through the sub-arctic seas, affecting ocean circulation in the North Atlantic. Evidence revealed unprecedented large-scale interactions leading to a warmer Arctic and colder conditions in mid-latitudes (which include many populated areas).

- » The International Polar Year provided new data on the role of plate tectonics in the main polar corridors for oceanic circulation. As a result, the tectonic map of Antarctica is being redrawn.
- » Using Antarctica as a unique vantage point, based on the South Polar Telescope data, astronomers detected a previously unknown class of galaxy clusters. This discovery significantly extends our knowledge about the abundance of galaxy clusters in the universe and their age.
- » The International Polar Year increased understanding of the microbiological processes and release of greenhouse gases to the atmosphere from soils suffering permafrost degradation. This, combined with an upgraded network of stations for permafrost measurements, will improve monitoring of future changes.
- » Biological systems in both polar regions were found to be more closely linked to each other than expected. This is supported by the identification of more than 1000 previously unknown marine animal species—of which 250 were identified to be common to both polar regions—and the remarkable similarity of the microbial systems between the poles.
- » The discovery of new polar microorganisms provides fundamental insights into their polar habitats and their evolution under a changing climate.
- » In the social and human field, the polar research will provide long-term benefits to many stakeholders, including polar residents and indigenous people. It increased understanding of how indigenous knowledge could be combined with instrumental data in monitoring the changes in polar ice, snow and vegetation cover, marine and terrestrial animal migrations, behavioral patterns of polar animals, birds, and fishes. The International Polar Year created a critical momentum in the form of substantial new funding for polar research and

monitoring programs, new observational and forecast technologies. It helped consolidate a new trans-disciplinary approach that includes biology, human health, social sciences and the humanities, in addition to meteorology, glaciology, oceanography, geophysics, geology, and other traditional polar research fields. Last, but not least, the International Polar Year trained a new generation of scientists and leaders who are determined to carry this legacy into the future. It offered an inspiring window into the capabilities of modern interdisciplinary and international science.

Contact Information

Understanding Earth's Polar Challenges: International Polar Year 2007-2008

Summary by the ICSU/WMO IPY Joint Committee

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Polar Research Education, Outreach and Communication during the fourth IPY

One year after the official closure of the International Polar Year (IPY), the Education, Outreach and Communication (EOC) Assessment Project (the task of inventorying and investigating the hundreds of IPY EOC programs that occurred during the IPY 2007-08) was completed. Supported by the Association of Polar Early Career Scientists, IASC and SCAR, this

ICSU funded project is the only global examination of what happened in outreach during IPY. The latest IPY event was one of the most ambitious polar research programs to date. Tens of thousands of scientists and students participated, but IPY also set out to involve members of the general public in active polar science endeavors on a global scale. How successful was this part of the IPY plan?

With over 550 IPY EOC activities, from more than 70 countries in 25 languages, IPY EOC is one of the largest global investments in science outreach to date. The IPY EOC Assessment brought together educators, communications personnel and researchers, and the resulting report examines the success of IPY EOC efforts, and discusses why IPY EOC was able to exceed its goals. From the experience of IPY, the report also outlines a set of lessons learned on how to improve science outreach across a variety of disciplines. These lessons will be useful for other science outreach projects - large or small, regional, national or international.

IPY EOC went to new heights, depths and extremes to take people to the poles and to take the poles to the people. Now the legacy of IPY outreach is helping to shape the future of science education and outreach. Read the report or search the online Polar Outreach Catalogue where a growing inventory of these IPY projects and new outreach efforts to help educate the world about the global importance of the polar regions is being developed.

<http://apecs.is/education-outreach/catalogue>

Snow Water and Permafrost in the Arctic (SWIPA)

Recent Changes in and Trends in the Arctic Cryosphere

The SWIPA assessment utilizes information published in the peer reviewed scientific literature, data from ongoing monitoring programs, and results from relevant research including IPY studies. Approximately 200 scientists and experts were involved in the SWIPA assessment. The assessment used the ACIA 2005 as a benchmark for evaluating developments since the ACIA was published. The SWIPA work synthesized observations and research on recent changes in and across the components of the arctic cryosphere, including the Greenland ice sheet, mountain glaciers and ice-caps, snow and permafrost, frozen lakes and rivers and sea ice. The assessment discusses potential effects of changes on a local, regional and global scale.

A Comprehensive Assessment

Results of a new comprehensive assessment of changes in the arctic cryosphere launched in May 2011 year showed unexpected rapid changes in major components of the arctic cryosphere and indicate feedbacks as a contributor to the speed of change.

The Arctic Council decided to undertake the Snow, Water, Ice and Permafrost in the Arctic - SWIPA assessment as a follow up to the 2004/2005 Arctic Climate Impact Assessment. The work, involving approximately 200 scientist and experts, was conducted between 2008 and 2011 and was coordinated by AMAP in close cooperation with IASC, WCRP/CliC and IASSA. Results of the assessment were released at an International Conference in Copenhagen in May 2011, and delivered to the Arctic Council at its Ministerial Meeting in Nuuk, Greenland in May 2011.



PHOTO: KONRAD STEFFEN/CIRES

Surface melt water disappears down a moulin near the ice margin in the Ilulissat region, West Greenland.

The assessment begins by describing how, during the past decade, the Arctic has experienced its highest temperatures for the period of the instrumental record, with proxy-data showing that current arctic summer temperatures are higher than any time in the past 2000 years. It continues with documentation of the accelerated changes in major components of the arctic cryosphere, such as arctic sea ice, arctic mountain glaciers and ice caps and the Greenland ice sheet that have been observed in recent years. In addition to the direct temperature effect on the cryosphere, the assessment also focuses on feedback mechanisms between the cryosphere and other parts of the climate system that contribute to enhanced arctic warming.

The SWIPA assessment also addresses projections of future arctic cryosphere change. In particular, it points to the growing contribution and importance of arctic land-based ice as a contributor to global sea level rise, and reports a plausible estimate of global sea level rise in the range 0.9 – 1.6 m by 2100. It also highlights the potential for accelerated regional and global warming as a result of feedback mechanism, such as changes in albedo and release of CH₄ and CO₂ as permafrost thaws.

Observation of sea ice loss, both in extent and volume, support projections that the Arctic Ocean may be ice-free during the summer within the next 30-40 years. Climate change in the Arctic is also altering the distribution of water between its solid and liquid states and associated timing of phase shifts. This is revealed through, for example, changes in hydrology and snow cover duration.

The SWIPA assessment indicates the profound effects that climate change and related changes in the arctic cryosphere will have on the physical, chemical and biological conditions in the Arctic, and globally. Furthermore, it concludes that some of the projections made in the ACIA (2005) and IPCC AR4 (2007) assessments underestimate effects of climate change on the arctic cryosphere.

The reasons for some of the accelerating rates of change observed in recent years in some components of the arctic cryosphere are still not well understood. Even though satellite measurements and other remote sensing systems have improved observational capacity, improved surface based observations and further research are still needed.

The AMAP working group conclude that the speed, extent and potential consequences (at local, regional and global scales) of changes in the arctic cryosphere justify a need for global action to reduce emissions of greenhouse gases and for the development of adaptation strategies and plans to deal with effects of arctic climate change.

There is a clear need to follow the changes in the arctic cryosphere more intensively, and to improve understanding of the processes involved. This includes improving the numeric models and scenarios that are the basis for projections. Additional work is also needed to address the consequences of multiple-drivers of change on arctic ecosystems and human populations.

Publications and Media

SWIPA results are presented in a fully referenced scientific report, a shorter scientific summary report, and a simple summary for general audiences. An executive summary with recommendations has been produced for policy-makers. In addition, three films have been produced (each in 3 and 15 minute versions) to communicate the project and its results. They address the natural science aspects of arctic cryospheric change, changes in the Greenland Ice Sheet, and implications of arctic cryospheric change for human society. English versions of the films are available and versions with Danish, Faroese, Finnish, French, Greenlandic, Icelandic, Norwegian, Sami, Swedish and Russian subtitling will be available in the very near future.

Hard copy reports may be ordered from the AMAP Secretariat and all reports and films will be available from the SWIPA website: www.amap.no/swipa.

IASC Publications

The internal and external developments and initiatives of IASC are shared with the international arctic community in the IASC Newsletter, Progress, and the IASC yearbook. General information on IASC can be found in a more general brochure on the organization. An information flyer is available for students and young researchers who are interested in careers in polar science. The flyer introduces some of the major organizations in polar research and offers contact information. The publication was initiated by APECS and IASC and was printed in cooperation with the University of the Arctic, SCAR and the International Antarctic Institute. All publications are widely circulated by mail, e-mail and downloadable as electronic versions on the IASC website where you can also find more information on the Working Groups, international science initiatives and upcoming, and past activities.

www.iasc.info

<http://www.iasc.info/home/service/media/print>



PHOTO: COLE MOSZYNSKI
Landscape with an old shed just outside the Polar Continental Shelf Program (PCSP) station in Resolute, Nunavut

In Memoriam

2011 was the year in which we lost two highly valued colleagues, friends and international champions of arctic research: Steve Solomon and Marty Bergmann.

Steven Mark Solomon
1950-2011



On 20 August 2011, the arctic science community lost Steve Solomon, a valued colleague, an inspired and passionate northern scientist, and a dear friend to many in the circumpolar world. Steve's arctic career began in 1991, when he joined the Geological Survey of Canada to work on hazards to development in the Mackenzie Delta region. Over the 20 years since, Steve made an indelible impression on arctic science, through his own research and his mentoring, inspiration, and sharing of wisdom across a wide international network – he was an extraordinary communicator.

The focus of Steve's career was in the western Arctic but he made important contributions in other areas as well, including the South Pacific and the Canadian Pacific and Atlantic coasts. From 1999, Steve played a leading international role in arctic science, co-chairing many circumpolar science meetings, contributing to the Arctic Climate Impact Assessment and the State

of the Arctic Coast reports, and helping to guide development of the Arctic Coastal Dynamics project.

Steve was an impressive innovator and lateral thinker, a master cook, and the consummate field geologist, at home in a rough camp, small boat, or helicopter, persevering in the most arduous winter conditions in the Mackenzie Delta. Steve's intelligence, creativity, and enthusiasm always shone through. Above all, his honesty, integrity and generosity were fundamental to his character. This essential humanity, which touched so many, is his true legacy. Besides his family, Steve Solomon leaves many others bereft among a wide circle in the marine science and arctic research communities.

By Donald Forbes

Martin Alexander Ernst Bergmann
1956 - 2011



The arctic science community was deeply saddened by the tragic loss of Marty Bergmann in a plane crash at Resolute Bay on August 20, 2011. Marty's generosity, smile, professionalism and enduring enthusiasm for the Arctic inspired everyone he met.

During his career, Marty served the Canadian science community in many capacities, most recently as the Director of the Canadian Polar Continental Shelf Program (PCSP) and previously the National Centre for Arctic Aquatic Research Excellence. Marty also made tremendous contributions to the international community as the Chair of the Pacific Arctic Group (PAG) and subsequently the Forum of Arctic Research Operators (FARO).

Marty was a passionate advocate and supporter of arctic research and provided valued leadership, friendship and mentorship in everything he did. Marty will be missed by all who knew him.

By David Hik

Letter of Agreement

between the International Network for Circumpolar Health Research (INCHR) and The International Arctic Science Committee (IASC)

Preamble

This letter recognizes that there are common interests between INCHR and IASC in scientific research in the polar regions, and that there is much to be gained from developing a synergy between INCHR and IASC in promoting health research in the Arctic. Following the success of the International Polar Year where researcher teams with expertise in health, natural, and social sciences collaborated with Arctic residents in a variety of multidisciplinary projects, INCHR and IASC agreed to seek new opportunities to combine their efforts for activities related to health sciences in the Arctic, with the objective of raising the level of impact of both organizations in terms of making scientific advances, promoting knowledge translation, advising policy makers, as well as avoiding unproductive duplication of efforts.

1. INCHR

The INCHR is a network of individual researchers, research trainees, and supporters of research based in academic research centres, Indigenous people's organizations,

regional health authorities, scientific/professional associations, and government agencies, who share the goal of improving the health of the residents of the circumpolar regions through international cooperation in scientific research.

Membership is voluntary and defined by a set of bylaws approved when INCHR was incorporated in June 2006. INCHR is governed by an elected board of directors from its membership, with at least one member from each of the following regions: **(1)** Canada, **(2)** Denmark/Greenland, **(3)**, Finland, Norway and Sweden, **(4)** Russia and **(5)** United States. Its officers, elected from among the board members, include a President, Vice-President, and Secretary-Treasurer. There are ad hoc committees which are formed from time to time for specific activities, for example, organizing the annual summer institute in circumpolar health research.

INCHR activities include the geographic region comprising all countries bordering the Arctic Ocean, usually but not exclusively pertaining to the Arctic and Subarctic ecological zones, encompassing both Indigenous and non-Indigenous populations. Individuals conducting human health research in Antarctica are also welcome. Health research is broadly defined and is multidisciplinary in scope, encompassing basic biomedical research, clinical investigations, and research into the health of populations and health systems.

INCHR activities are focused on four main objectives;

1. Conduct, sponsor, and promote research programs and projects investigating the patterns, determinants and impact of health conditions among circumpolar peoples and the strategies for improving their health;
2. Support research training at all levels and increase capacity for circumpolar health research in communities, service delivery agencies and higher educational institutions;
3. Facilitate exchange, communication and dissemination of research data;
4. Strengthen the health information system in the circumpolar region.

INCHR organizes and sponsors annual scientific meetings and workshops held in different cities in the circumpolar region. Its members participate in the planning of the triennial International Congress on Circumpolar Health and also contribute to other Arctic scientific forums. INCHR is a co-publisher of the scientific journal *International Journal of Circumpolar Health* and the monograph series *Circumpolar Health Supplements*. INCHR provides annual travel fellowships to members and their trainees to visit and work with member in other circumpolar countries in their research centres or projects. Starting in 2010, INCHR organizes an annual summer institute in circumpolar health research on specific topics in conjunction with its annual general meeting.

2. IASC

IASC is a non-governmental, international scientific organization and affiliated to the International Council for Science (ICSU) as an International Scientific Associate. It also provides objective and independent scientific advice to the Arctic Council and other organizations on issues of science affecting the management of the Arctic region. IASC was an active member of the ICSU/WMO Joint Committee that steered the IPY process.

The IASC mission is to encourage and facilitate cooperation in all aspects of Arctic research, in all countries engaged in Arctic research and in all areas of the Arctic region. To fulfill its mission, IASC promotes and supports leading-edge multi-disciplinary research in order to foster a greater scientific understanding of the Arctic region and its role in the Earth system.

IASC was established in 1990, began operations in 1991 and today comprises 19 member countries. It is governed by a Council consisting of one delegate appointed by each of the national member organizations. The Council sets priorities and guides the work of the organization.

The core elements of IASC are its five Working Groups: Terrestrial, Atmosphere, Cryosphere, Social & Human and Marine. These international groups assist IASC in the implementation of its science mission by:

- » Identifying and formulating science plans;
- » Acting as scientific advisory boards to the Council;
- » Encouraging and supporting science-led programs;
- » Initiating conferences, workshops and events;
- » Promoting future generations of arctic scientists.

IASC draws on this structure to identify scientific priorities, open up opportunities for international science planning, promote free access to Arctic areas and provide for the freedom and ethical conduct of science.

3. Common Interests and Practices

INCHR and IASC share a number of common interests and practices, including the convening of workshops, conferences, and reports; participation in activities at Arctic Council and the AC Working Groups; the development of integrated plans for scientific research and facilitation of scientific cooperation; promoting communications to the public, providing advice to policy makers; development of observing systems; data and information management; and development of early career scientists.

4. Declaration of Intent

INCHR and IASC intend to initiate joint activities, to be decided by mutual agreement. This requires no change to the terms of reference of either organization, and carries no financial implication.

To facilitate the process, INCHR and IASC agree (this list is not exhaustive):

- (i) to encourage appropriate linkages between INCHR members and IASC Working Groups, and with other scientific organizations;
- (ii) to work together in arranging workshops, conferences, and reports on topics of mutual scientific interest;
- (iii) to exchange ideas on best practices in data and information management and the development of polar observing systems, and to support and encourage the development of SAON;
- (iv) to develop combined approaches to communicating to the wider community on the significance of research in providing solutions for societal issues, including their respective experience in giving advice to the Arctic Council;
- (v) to continue supporting the next generation of polar researchers;
- (vi) to invite each other to attend the meetings of their major bodies and facilitate the exchange of information between their respective Executive Committees;
- (vii) to exchange newsletters and advertise each other's activities and web sites on their own web sites.

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

Signed **Kue Young** President, INCHR
Date /11 April/ 2011

David Hik President, IASC
Date /11 April/ 2011

Letter of Agreement

between The international Arctic Social Sciences Association (IASSA), The International Arctic Science Committee (IASC) and the University of the Arctic (UArctic)

Preamble

This letter recognizes that there are many common interests between IASSA, UArctic and IASC in international and multi-disciplinary cooperation in Arctic research, education and outreach. Increased cooperation between the organizations will be of mutual benefit, and contribute to enhancing the legacies of the International Polar Year 2007-2008.

IASSA

IASSA is a professional association based on voluntary membership. For the purposes of the association, both the Arctic and the social sciences are defined in a broad and inclusive manner, encompassing all Arctic and Subarctic regions, and all disciplines pertaining to the humanities and the social sciences. The goal is to promote and stimulate international cooperation and to increase the participation of social scientists in national and international arctic research; to promote communication and coordination with other related organizations; and to promote mutual respect, communication, and collaboration between social scientists and the peoples of the north, while recognizing these are not mutually exclusive groups.

IASC

IASC is a non-governmental, international scientific organization whose mission is to encourage and facilitate cooperation in all aspects of Arctic research, in all countries engaged in Arctic research and in all areas of the Arctic region. IASC is an International Scientific Associate of the International Council for Science (ICSU). To fulfill its mission, IASC promotes and supports leading-edge multi-disciplinary research in

order to foster a greater scientific understanding of the Arctic region and its role in the Earth system.

UARCTIC

The University of the Arctic (UArctic) is a cooperative network of universities, colleges and other organizations committed to higher education and research in the North. UArctic's overall goal is to create a strong, sustainable circumpolar region by empowering northerners and indigenous peoples through education, training and shared knowledge. UArctic education is circumpolar, holistic and diverse in nature and draws on the combined strength of its members to address the unique challenges of the region.

IASSA, IASC and UArctic are observers to the Arctic Council.

Common Interests

IASSA, IASC and UArctic share a number of common interests, which makes it relatively easy for them to work together. Recently, they have already undertaken some limited collaboration by arranging workshops, conferences, and reports on topics of mutual scientific interest, by encouraging the development of integrated plans for scientific research, by communicating to the public, by entering research partnerships with Arctic residents, by supporting the training and education of students and early career researchers, and by providing advice to policy makers.

Declaration of Intent

IASSA, IASC and UArctic intend to combine their efforts in selected activities so as to raise the level of impact of all three organizations in terms of making advances in research, education and outreach relevant to Arctic issues, and for providing relevant advice to policy makers. A list of collaborative efforts is given in ANNEX 1, and items on this list may be updated or modified by mutual agreement at any time.

Combining efforts in selected fields and activities requires no change to the terms of reference of the organizations, and carries no financial implication.

Progress on collaborative efforts will be reviewed annually by the Executive Committees of each organization. This agreement will remain in force for 5 years, and thereafter be reviewed and continued as appropriate.

Signed **Joan Nymand Larsen** President, IASSA
Date /13 April/ 2011

David Hik President, IASC
Date /13 April/ 2011

Lars Kullerud President, UArctic
Date /13 April/ 2011

ANNEX 1: List of collaborative efforts

IASSA, IASC and UArctic agree to the following, inasmuch as the individual actions are compatible with the mission of each of these institutions (this list is not exhaustive):

1. Collaborate on forwarding-looking initiatives, including planning for a possible 3rd International Conference on Arctic Research Planning (ICARP III) and the proposed International Polar Decade;
2. Contribute to the development of synthesis reports that will provide timely assessments of emerging Arctic trends and issues, in a form that will be useful for public and governments;
3. Explore opportunities to promote the importance of fundamental research on the Arctic region with principle national and international funding agencies and advise them on shaping possible thematic calls for research proposals with an Arctic emphasis;

4. Identify issues and forces of change that will influence the state of the Arctic region over the next two decades;

5. Where feasible and appropriate, encourage collaboration between activities undertaken by IASC Working Groups and UArctic Thematic Networks;

6. Continue to support emerging scholars and assist the Association of Polar Early Career Scientists (APECS) in fulfilling its mission;

7. Support increased involvement of indigenous peoples and residents of the Arctic regions in research, education and outreach activities;

8. Provide advice to science and education ministers regarding opportunities for improved transnational support and access to innovative Arctic research and education programs;

9. Support the implementation of initiatives that will improve open access to information and information exchange (e.g. Arctic Portal and Polar Information Commons);

10. Explore opportunities to maximize the effectiveness of our respective outreach and communication efforts by maximizing the impact of our collective resources and networks.

11. Invite each other to meetings, i.e. IASSA General Assembly, IASC Council, Council of UArctic.

List of Acronyms and Abbreviations Bulletin 2012

Acronym	Full name
ABC	Arctic Biodiversity Coalition
AC	Arctic Council
ACA	Arctic Change Assessment
ACD	Arctic Coastal Dynamics
ACIA	Arctic Climate Impact Assessment
ACSNet	Arctic Climate System Network
AGU	American Geophysical Union
AHDR	Arctic Human Development Report
AIDA	Atmospheric Investigations on a Drifting observatory over the Arctic Ocean (AIDA)
AMAP	Arctic Monitoring and Assessment Programme
AntEco	State of the Antarctic Ecosystem
AntETR	Antarctic Ecosystems: Adaptations, Thresholds and Resilience
AOS	Arctic Observing Summit
AOSB	Arctic Ocean Sciences Board
APECS	Association of Polar Early Career Scientists
APEX	Arctic Palaeoclimate and its Extremes
ART	Arctic in Rapid Transition
ASI	Arctic Social Indicators
ASSW	Arctic Science Summit Week
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
AWI	Alfred Wegener Institute for Polar and Marine Research
.....	
BipAG	Bipolar Action Group
.....	
CAFF	Conservation of Arctic Flora and Fauna
CBMP	Circumpolar Biodiversity Monitoring Program
CLIC	Climate and Cryosphere Project
CMIP	Coupled Model Intercomparison Project
CPE	Comité Polar Español
.....	
DBO	Distributed Biological Observatory
.....	
ECORD	European Consortium for Ocean Research Drilling
ECV	Essential Climate Variables
EGU	European Geophysical Union
EIWG	Extractive Industries Working Group
EOC	Education, Outreach and Communication

A

B

C

D

E

E

EPB European Polar Board
 ESF European Science Foundation
 ESM Earth System Models

F

FARO Forum of Arctic Research Operators

G

GCOS Global Climate Observing System
 GDEM Global Digital Elevation Model (GDEM)
 GEUS Geological Survey of Denmark and Greenland
 GIC Glacier and Ice Cap
 GICAC Glaciers and Ice Cap Assessment Consortium
 GLACIODYN Dynamic Response of Arctic Glaciers to Global Warming
 GTN-P Global Terrestrial Network on Permafrost
 GTOS Global Terrestrial Observing System

I

IACS International Association of Cryospheric Sciences
 IAI International Antarctic Institute
 iAOOS integrated Arctic Ocean Observing System
 IASC International Arctic Science Committee
 IASSA International Arctic Social Sciences Association
 ICAM International Continental Arctic Margins
 ICARP International Conference on Arctic Research Planning
 ICASS International Congress of Arctic Social Sciences
 ICES International Council for the Exploration of the Sea
 ICSU International Council for Science
 INCHR International Network for Circumpolar Health Research
 INTERACT International Network for Terrestrial Research and Monitoring in the Arctic
 IODP Integrated Ocean Drilling Program
 IPA International Permafrost Association
 IPCC Intergovernmental Panel on Climate Change
 IPD International Polar Decade
 IPY International Polar Year
 IPY IPO International Polar Year International Programme Office
 ISAC International Study of Arctic Change
 ISMASS Ice Sheet Mass Balance and Sea Level

J

JC Joint Committee
 JSC Joint Scientific Committee

L

LoA Letter of Agreement
 LOICZ Land-Ocean-Interactions in the Coastal Zone

M

MoU Memorandum of Understanding

N

NcoE Nordic Centre of Excellence
 NAG Network on Arctic Glaciology
 NERI National Environmental Research Institute
 NRC National Research Council
 NSF National Science Foundation
 NWP Numerical Weather Prediction
 NaSMAC Ny-Ålesund Science Managers Committee

O

OSC Open Science Conference

P

PAG Pacific Arctic Group
 PAN Polar Archeology Network
 PCSP Polar Continental Shelf Program
 PI Principal Investigator
 PIC Polar Information Commons
 PONAM Polar North Atlantic Margin
 PYRN Permafrost Young Researchers Network

Q

QUEEN Quaternary Environment of the Eurasian North

R

RCM Regional Climate Model

S

SAC State of the Arctic Coast
 SAI Stefansson Arctic Institute
 SAON Sustaining Arctic Observing Networks
 SCAR Scientific Committee on Antarctic Research
 SDWG Sustainable Development Working Group
 SEARCH Study of Environmental Arctic Change
 SG Steering Group
 SPARC Stratospheric Processes And their Role in Climate
 SRP Scientific Research Programme
 SSG Scientific Steering Group
 SVALI Stability and Variations of Arctic Land Ice
 SWIPA Snow, Water, Ice and Permafrost in the Arctic

U

UArctic University of the Arctic
 UNIS The University Centre in Svalbard

W

WCRP World Climate Research Program
 WG Working Group
 WMO World Meteorological Organization
 WWF World Wildlife Fund

