



Witness The **ARCTIC**

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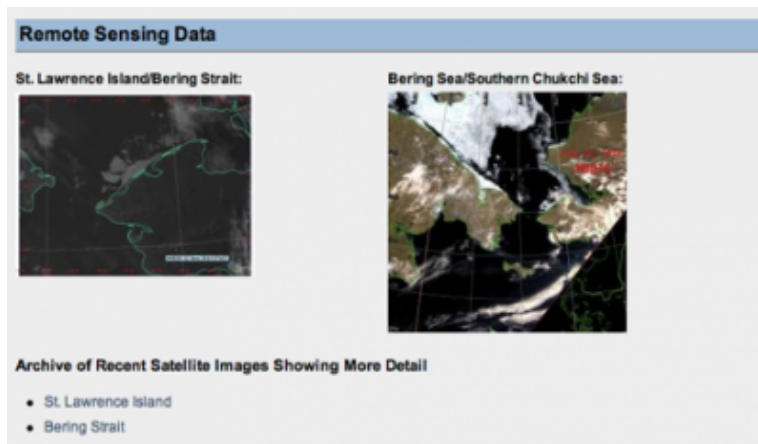
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- International Study of Arctic Change Activities
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- **A 5- and 10-day outlook of wind conditions.** Winds are important for planning walrus hunting activities because wind speeds greater than 20 knots can be dangerous for boats. NWS used numerical prediction models to forecast wind conditions. The North American Model (NAM) was used to look at conditions out to 5 days. The NOAA Climate Prediction Center (CPC) provided guidance to the 10-day timeframe by downscaling their regional monthly climate model to just the St. Lawrence Island and the Bering Strait region.
- **Up-to-date satellite imagery.** Each weekly report linked to daily real-time MODIS imagery provided by the Geographic Information Network of Alaska (GINA) at UAF. At key points in the season, high-resolution SAR images from the Japanese Advanced Land Observing Satellite (ALOS) were provided by the Alaska Satellite Facility and interpreted by the UAF team.



Satellite imagery from the SIWO website.

- **Additional data and resources on ice conditions.** Weekly reports also provided links to several additional resources, including: NOAA/NWS ice advisories, sea ice analyses, 5-day sea ice forecasts, sea surface temperatures, NOAA Bering Sea ice maps, and buoy movement data from the International Arctic Buoy Programme (IABP). IABP also provided surface ice/ocean drifters that were deployed by collaborators in Gambell and Wales to track ice movement and surface currents and improve forecasts in the region.
- **Observations of ice development and other information from Alaska Native hunters, sea-ice experts, or other researchers.** A key aspect of the SIWO was the inclusion of near real-time observations and images on weather, sea ice, and walrus locations from Alaska Native hunters in rural communities and sea ice experts in the field. This input, building in part on activities of the Arctic Observing Network, provided rich insights into ice development relevant to marine mammals and people, as well as on-the-ground assessments of the accuracy of NWS model predictions.

Applications of SIWO

The project primarily served local Alaska communities. Subsistence hunters used the wind and ice reports to avoid travel in unfavorable conditions. Curtis Nayokpuk of Shishmaref, Alaska commented that the information enabled local crews to limit trips to the best of weather and sea ice conditions, resulting in safe and successful hunting trips.

One of the challenges for SIWO was making the information in the reports available to people in rural areas. Communities lacking dependable, high speed Internet were unable to access the information through the web. To circumvent this problem, the weekly reports were also sent via facsimile or email to several interested communities, to be distributed among the local residents, and posted in public areas.

The collaborative process for developing the SIWO reports, and the integration of satellite data and numerical models with local observations, could inform and guide other multi-agency collaborations focused on creating science products with direct societal relevance.

Future Plans for SIWO

SIWO organizers are currently discussing options for continuing the SIWO in 2011, contingent on funding. Changes to the product may include a longer reporting timeframe to incorporate whale hunting season, use of higher resolution data, increasing integration of local observations, and additional methods for distributing the reports to rural communities without high-speed Internet access.

For more information, see the SIWO website: <http://www.arcus.org/search/siwo> or contact Hajo Eicken, Geophysical Institute at UAF (hajo.eicken@gi.alaska.edu); Vera Metcalf, Eskimo Walrus Commission (vmetcalf@kawerak.org); Gary Hufford, NWS (gary.hufford@noaa.gov); or Kristina Creek, ARCUS (creek@arcus.org).

Additional information on the Pacific walrus can be found at: <http://alaska.fws.gov/fisheries/mmm/walrus/nhistory.htm>.

State of the Arctic Conference Highlights Interdisciplinary , System-Scale Science

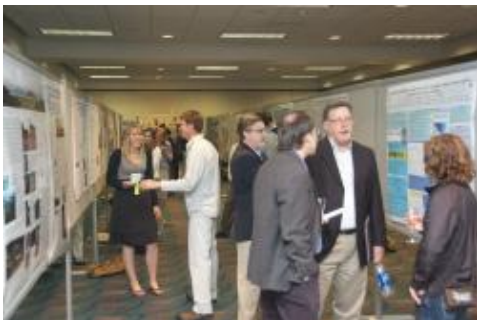
The State of the Arctic Conference: *At the Forefront of Global Change* was held 16-19 March 2010 in Miami, Florida. The main goal of the conference was to review understanding of the arctic system in a time of rapid environmental change. Topics ranged from basic understanding of the Arctic and system-wide change to developing response strategies to adapt to and mitigate change.

The conference was organized around four main themes:

1. Advances in arctic system understanding—the basic functioning of the arctic system, including its human dimensions;
2. Arctic change—rapid, system-scale changes and the capability to project future states of the arctic system under various scenarios;
3. Linkages to the Earth system—linkages and feedbacks between the arctic system and the Earth system; and
4. Translating research into solutions—informed solutions to the problems caused by environmental change.



Major funding was provided by the National Science Foundation Office of Polar Programs Division of Arctic Sciences, with 17 additional sponsors and partners (see box, below).



Conference participants discuss research during a poster session.

The three main days of the conference included 18 plenary talks, a panel on the science-policy interface, 18 interdisciplinary parallel sessions with 160 talks, and two poster sessions with 220 posters. The fourth day, organized by the International Study of Arctic Change (ISAC), focused on international collaboration and featured 21 talks and a panel discussion. The conference drew 448 on-site participants from 16 countries, including representatives from business, military, and government; non-governmental organizations; research institutions; arctic and native organizations; universities; and K-12 institutions. Approximately 200 additional participants joined via a free webcast.

The conference supported a substantial student program with 64 student participants. Twenty-six of those were at least partially supported by scholarship funds provided by the National Oceanic and Atmospheric Administration (NOAA), the Arctic Ocean Sciences Board (AOSB) / International Arctic Science Committee (IASC), and the Cold Regions Research and Engineering Laboratory (CRREL). Student activities included a pre-conference networking webinar, student meeting room, meet and greet breakfast, conversations with scientists luncheon, and a mentoring program with 36 mentor volunteers.

Conference Outcomes and Products

After the conference, members of the Organizing Committee reviewed discussions from the plenary talks, parallel sessions, and poster presentations, and identified several crosscutting themes:

- Arctic system science is increasingly being conducted in the context of a changing Arctic and in the context of global change.
- There is now general acceptance that anthropogenic change is overprinted on natural variability.
- Arctic science is increasingly interdisciplinary and the community is framing research around topics and themes rather than traditional disciplines.
- Societal needs and solution-oriented research are becoming central drivers for new science programs in the Arctic.
- The arctic science community is exploring issues of adaptation to and mitigation of change in innovative ways that may lead the way for other regions.
- The need for stakeholder involvement into the early phases of the design of research programs is apparent.
- Arctic scientists are exploring new ways of conducting multi-domain, system-scale observations of the arctic system and integrating this knowledge with synthesis and modeling activities.

During the final plenary session, participants agreed to produce a conference resolution that summarizes key science needs. After the conference, a draft resolution based on discussion during the final plenary session was sent to conference participants for review. The resolution included four key recommendations for funding agencies, arctic organizations, and the broad science community:

1. Develop research that explores solutions to the complex problems of arctic system change;
2. Fully implement a coordinated, multi-disciplinary arctic observing system;
3. Continue support for research focused on understanding and projecting future states of the arctic system; and
4. Provide open access to arctic regions and data.

Conference organizers solicited participant feedback on the draft resolution. Final publication is expected later this fall.

Conference Sponsors and Partners

- National Science Foundation
Office of Polar Programs
- National Oceanic and
Atmospheric Administration
- International Arctic Systems
for Observing the Atmosphere
- Study of Environmental Arctic
Change
- Arctic System Science
Program
- U.S. Arctic Research
Commission
- North Slope Science Initiative
- International Arctic Science
Committee
- Arctic Ocean Sciences Board
- Alaska Ocean Observing
System
- Department of Energy
- National Aeronautics and
Space Administration
- World Wildlife Fund
- Association of Polar Early
Career Scientists
- Bureau of Land Management
- International Study of Arctic
Change
- ArcticNet
- Developing Arctic Modeling
and Observing Capabilities for
Long-term Environmental
Studies

Other products in development include a peer-reviewed paper highlighting key science findings, a document for policymakers summarizing societally-relevant arctic science, special volumes and sets of papers from parallel sessions, and a DVD-compilation of the conference posters. In addition, a variety of archival materials are available online, including plenary and parallel session presentations, abstracts, digital poster files, video of plenary sessions, final attendee list, and conference photos. The conference organizers will announce the availability of additional products as they are finalized and published.

For more information on the conference, see the State of the Arctic website: <http://soa.arcus.org/> or contact Helen Wiggins at ARCUS (helen@arcus.org).

Arctic Observing Network Report Released

An AON report, "Arctic Observing Network (AON): 2009 Status Report and Key Recommendations" was released in August 2010. The report summarizes discussions from the third AON principal investigators meeting, held in fall 2009, and includes sections on AON accomplishments; network design, gaps, and needs; agency and international coordination; and data management.

AON investigators and the broader scientific community face the challenge of integrating the diverse AON projects into a broader network that is part of an overarching, international observing system. The report identifies four near-term issues that must be addressed to achieve this goal:

1. Design and optimization efforts should draw from both: (a) bottom-up approaches driven by individual projects and refinement based on data, model results, and local expertise; and (b) top-down efforts driven by rigorous approaches to observing system design and optimization such as Observing System Simulation Experiments (OSSEs) and other modeling or synthesis efforts.
2. Implementation of an effective, sustained observing network may prove challenging for existing support mechanisms that rely solely on peer review of short-duration projects that focus on individual components of the system. AON may need to look towards the methods that other large observing programs have successfully employed to build comprehensive, highly integrated networks. Approaches include reliance on steering committees for additional guidance, strong partnering with government agencies capable of supporting sustained measurements, and development of guidelines and practices that foster coordination.
3. Given the important role of agencies and other entities (e.g., arctic communities and industry) in sustaining long-term observations, progress needs to be made in developing effective approaches to foster coordination, joint planning, and partnered implementation of arctic observing systems.
4. At the international level, existing efforts such as coordination through the World Climate Research Program's (WCRP) Climate and the Cryosphere (CliC) program, or the International Arctic Systems for Observing the Atmosphere (IASOA) project, may provide important guidance and frameworks for the implementation and optimization of an observing network. In the future, activities undertaken by the International Study of Arctic Change (ISAC) will help consolidate international observing system efforts.

For more information, see the SEARCH website: <http://www.arcus.org/search/aon/> or contact Craig Lee, University of Washington (craig@apl.washington.edu).

Understanding Arctic Change Workshop Held in Seattle

An "Understanding Arctic Change" workshop was held 29 September–1 October 2010 in Seattle, Washington as a collaborative activity of the SEARCH and ARCSS programs. The workshop gathered a diverse group of scientists to develop a white paper that:

1. Identifies key unknowns and key science questions for understanding arctic system change; and
2. Identifies the next steps in synthesis activities, methodologies, mechanisms, and approaches to address the identified key science questions.

The Understanding Arctic Change Task Force, convened in late 2009 (see [Witness winter 2009](#)), is leading the final development of the white paper, which will be distributed for broad community review this fall. Final publication is expected in winter 2011.

For more information on the workshop and related activities, see the Understanding Arctic Change website: <http://www.arcus.org/search/meetings/2010/understanding-arctic-change> or contact Task Force Co-chairs Josh Schimel (schimel@lifesci.ucsb.edu) or John Walsh (jwalsh@iarc.uaf.edu), or Helen Wiggins at ARCUS (helen@arcus.org).

New SEARCH Science Steering Committee (SSC) Chair

Hajo Eicken, professor of geophysics at the University of Alaska Fairbanks, was appointed new **Study of Environmental Arctic Change (SEARCH)** Science Steering Committee (SSC) Chair in early 2010. Dr. Eicken's research interests are in the field of sea-ice geophysics. In particular, he is interested in how small-scale properties and the microstructure of sea ice impact processes on a larger scale, as well as the role of sea ice in the climate system. He is also involved in activities that examine how scientists can improve access to the vast amount of data collected during the International Polar Year and beyond in order to help different users of sea ice (local communities, indigenous populations, industry, government, and others) make better planning decisions. Peter Schlosser, Columbia University, is now serving as past chair.

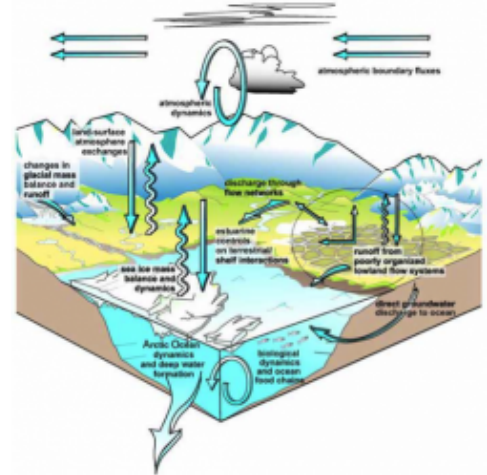
The SEARCH SSC will meet this November in Washington, D.C.

For more information, contact Dr. Eicken (hajo.eicken@gi.alaska.edu) or 907-474-7280.

Freshwater Integration (FWI) Synthesis Working Group Examines Intensification of the Arctic Hydrological Cycle

The Freshwater Integration Effort (FWI) was an Arctic System Science (ARCSS)-funded interdisciplinary program focused on the arctic hydrological cycle. FWI consisted of 22 projects, which ran from 2002-2006, on all aspects of the arctic freshwater system. The program is now undertaking final synthesis activities.

FWI has utilized synthesis working groups to advance understanding of the freshwater cycle, focused on topics including examination of terrestrial and oceanic budgets, changes and attributions in the freshwater cycle, and feedbacks among components of the arctic system. Recently, a synthesis working group has focused on the question: "Is the Arctic's freshwater cycle intensifying?" (see box below for list of members). Intensification is defined as an increase in the amount of freshwater (e.g., in precipitation, river discharge, sea ice) flowing through the atmosphere-land-ocean system. Intensification is an expected manifestation of a warming climate, related to the atmosphere's ability to hold more moisture as it warms.



Conceptual model of the arctic hydrological cycle, with key linkages among land, ocean, and atmosphere. Credit: ARCUS / Arctic-CHAMP

Freshwater cycle changes are important to understand for a number of reasons. Warming and freshwater cycle intensification have the potential to increase shrub growth and cause other vegetation changes. There are also strong linkages between water and carbon cycles; for example, methane fluxes from the landscape are closely linked with variations in the water table, which, in turn, are linked with rates of precipitation and evapotranspiration. In addition, there are connections between freshening of polar oceans and alterations to the global thermohaline circulation. Finally, continuing declines in sea ice may affect the freshwater cycle even further.

Using models and observational data, the working group compared trends in freshwater fluxes across the terrestrial pan-arctic drainage basin and the Arctic Ocean over the past several decades. Trends from coupled models provided benchmarks for future changes. The group examined terrestrial fluxes of precipitation, evapotranspiration, and river discharge averaged over the pan-arctic basin from a variety of observed data sets. For the Arctic Ocean and surrounding seas, freshwater (both liquid ocean and solid sea ice) storage and fluxes at inflow and outflow boundaries were examined from available data sources and recent publications. In addition to the observational data, trends were also determined from nine atmosphere-ocean general circulation models from the Intergovernmental Panel on Climate Change's (IPCC) Coupled Model Intercomparison Project, Phase 3 (CMIP3).

While uncertainties due to the sparse nature of observing networks and the considerable variability in the system complicate any interpretation of freshwater cycle changes, the predominance of positive trends over recent decades suggests that the freshwater system is intensifying.

For the terrestrial system, of 19 observed time series examined, 17 showed a positive trend (nine significant). The CMIP3 data also show positive trends in precipitation (P), evapotranspiration (E), and P-E, which are on par with the observed trends. Trends in the net freshwater exchange between the Arctic Ocean and more southern seas are inconclusive, largely due to a lack of available data over recent decades. For the terrestrial system, recent data suggest that river discharge may be increasing across much of the arctic drainage basin in North America. Taken together with the reported positive trend from large Eurasian rivers, this suggests that intensification of river discharge may now be pan-arctic in nature.

Results from this study will be published in the November 2010 *Journal of Climate*.

For more information, contact Michael Rawlins (rawlins@geo.umass.edu).

FWI Working Groups and Select Publications

FWI Synthesis Working Groups and Focus Topics

Budgeteers Working Group – Tasked with answering the following questions:

- What are the major stocks and fluxes?
- Where are the imbalances?
- How well can we close the water budget?

Changes and Attributions Working Groups (CAWG) – Tasked to:

- Summarize observed changes in the arctic hydrological system (CAWG-1).
- Develop a heuristic modeling framework predicting likely changes in the system state into the next century (CAWG-2).

Intensifiers Working Group – Tasked with investigating a potential intensification of the water cycle associated with climate change.

FWI Synthesis Working Group Publications

"The large-scale freshwater cycle of the Arctic" by M.C. Serreze, et al. Published in the *Journal of Geophysical Research*, 2006. Volume 111.

"An arctic hydrologic system in transition: Feedbacks and impacts on terrestrial, marine, and human life" by J.A. Francis, et al. Published in the *Journal of Geophysical Research*, 2009. Volume 114.

"Changes and impacts in the arctic freshwater cycle" by D. White, et al. Published in the *Journal of Geophysical Research*, 2007. Volume 112.

"Analysis of the Arctic System for Freshwater Cycle Intensification: Observations and Expectations" by M.A. Rawlins, et al. Published in the *Journal of Climate*, 2010. Volume 23.

"Intensifiers" Working Group Members

- Michael A. Rawlins; University of Massachusetts
- Michael Steele, Craig M. Lee, Dennis P. Lettenmaier, Mark Wensnahan, and Rebecca Woodgate; University of Washington
- Marika M. Holland; National Center for Atmospheric Research
- Jennifer C. Adam; Washington State University
- Jessica E. Cherry and Larry D. Hinzman; International Arctic Research Center
- Jennifer A. Francis; Rutgers University
- Pavel Ya. Groisman; National Climatic Data Center
- Thomas G. Huntington; U.S. Geological Survey
- Douglas L. Kane and Daqing Yang; University of Alaska Fairbanks
- John S. Kimball and Ke Zhang; University of Montana
- Ron Kwok, Kyle C. McDonald, and Erika Podest; Jet Propulsion Laboratory
- Richard B. Lammers, Jonathan W. Pundsack, and Alexander Shiklomanov; University of New Hampshire
- Bert Rudels; Finnish Meteorological Institute
- Mark C. Serreze and Tingjun Zhang; National Snow and Ice Data Center
- Oystein Skagseth; Bjerknes Centre for Climate Research
- Tara J. Troy and Eric F. Wood; Princeton University
- Charles J. Vörösmarty; City College of New York

International Synthesis Workshop Focuses on Progress and Gaps in Freshwater Science

The Freshwater Integration Effort (FWI) held a synthesis capstone workshop on 30 September–4 October 2009 in Stockholm, Sweden to tie together key findings and outcomes of the FWI effort and integrate them with other international activities.

The workshop, "Synthesizing International Understanding of Changes in the Arctic Hydrological System," was sponsored by the NSF Arctic System Science Program (ARCSS) through the **Arctic-CHAMP Science Management Office** at City College of New York / University of New Hampshire, the International Study of Arctic Change (**ISAC**), and the International Arctic Research Center (**IARC**; University of Alaska Fairbanks). The IPY **Arctic-HYDRA** program was also heavily involved in planning efforts.



'Synthesizing International Understanding of Changes in the Arctic Hydrological System' workshop participants in front of the Royal Swedish Academy.

The workshop brought together approximately 30 international participants, including experts in atmospheric science, hydrology, freshwater ecology, permafrost, satellite remote sensing, and other disciplines.

The workshop aimed to: (1) take stock of recent advances in our understanding of changes in the arctic hydrological system; (2) identify key remaining research gaps; and (3) gather insight on where to focus future national and international research efforts. Participants also discussed strategies for integration of hydrological research into broader system-science initiatives (e.g., ISAC, Second International Conference on Arctic Research Planning [ICARP-II], SEARCH). In addressing the

key research gaps, participants identified several key unknown science questions.

The overarching question identified was: Do cumulative effects of changes in the water, energy, and carbon cycles over space and time lead to new equilibrium states?

That question was broken down into several sub-questions:

- What are the abrupt changes in the water, energy, and carbon systems, and where are they likely to be located today and in the future?
- When and over what time scales do abrupt changes occur?
- What is the role of cumulative and synergistic changes in the water, energy, and carbon cycles in controlling arctic system change?
- How can changes in the water, energy, and carbon cycles be used to explain changes in other components of the arctic system such as wildlife and human societal change?
- What roles do the changing water, energy, and carbon cycles play in promoting and forcing adaptations?
- How will abrupt or "step" changes in the arctic system impact and feed back into the global system, and what is the role of water, energy, and carbon?

The core workshop Organizing Committee (see sidebar) is spearheading efforts to publish a white paper, which will outline key research and technology successes over the last decade; identify gaps and impediments to progress; and recommend future research, focusing on the nexus of water, energy, and carbon across the Arctic. The Organizing Committee expects to finalize the white paper in late 2010.

The meeting agenda and presentations from this workshop are archived on the ISAC website: <http://arcticchange.org/>.

For more information about the workshop or FWI activities, please see the FWI website: <http://arcticchamp.sr.unh.edu/projects.shtml> or contact Jonathan Pundsack (jonathan.pundsack@unh.edu).

Workshop Organizing Committee

- Larry Hinzman, International Arctic Research Center/UAF (USA)*
- Maribeth Murray, International Study of Arctic Change (Sweden)*
- Jonathan Pundsack, University of New Hampshire (USA)*
- Charles Vörösmarty, The City College of New York (USA)*
- Julia Boike, Alfred Wegener Institute for Polar and Marine Research (Germany)
- Terry Callaghan, Abisko Scientific Research Station, Royal Swedish Academy of Sciences (Sweden)
- Brent Hasholt, University of Copenhagen (Denmark)
- Terry Prowse, University of Victoria & Environment Canada (Canada)
- Markku Puupponen, Finnish Environmental Institute (SYKE) (Finland)
- Igor Shiklomanov, State Hydrological Institute (SHI) (Russia)
- Árni Snorrason, Icelandic Meteorological Office (Iceland)
- Jan-Gunnar Winther, Norwegian Polar Institute (Norway)

*Core Organizing Committee

ARCSS Seasonality Projects Meeting Held October 2010

Investigators from the 17 Arctic System Science (ARCSS) Changing Seasonality in the Arctic System (CSAS) Projects that were awarded in 2009 (see [Witness Fall 2009](#)) started a process to coordinate research efforts between projects with a Principal Investigator meeting in October 2010. The goal of the meeting, held at the University of Vermont, was to explore opportunities for cross-project integration and synthesis. The meeting's Organizing Committee included Andrea Lloyd, Middlebury College; William (Breck) Bowden, University of Vermont; Uma Bhatt, University of Alaska Fairbanks; and Judah Cohen, Atmospheric and Environmental Research, Inc. Outcomes of the meeting will be posted on a Changing Seasonality in the Arctic System website, to be launched this fall.

For more information, contact Andrea Lloyd (lloyd@middlebury.edu).

Integrated Bering Sea Project in Final Year of Field Activities

The Bering Sea is one of the most productive marine ecosystems in the world, sustaining nearly half of U.S. annual commercial fish landings and providing food and cultural value to thousands of coastal and island residents. In 2007 the North Pacific Research Board (NPRB) and the National Science Foundation (NSF) entered into a partnership to support the Bering Sea Project, a comprehensive \$52 million investigation to understand how climate change is affecting the Bering Sea ecosystem, ranging from lower trophic levels (e.g., plankton) to fish, seabirds, marine mammals, and ultimately humans. The project integrates two research programs, the NSF Bering Ecosystem Study (BEST) and the NPRB Bering Sea Integrated Ecosystem Research Program (BSIERP), with substantial in-kind contributions from the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (USFWS) (See [*Witness Spring 2007*](#)).

The six-year BEST-BSIERP study includes 43 projects and links nearly one hundred principal scientists. The investigative field studies are tied together with a fully integrated modeling program. The overall goal is to define the mechanisms that create and sustain this highly productive ecosystem, and to understand how those mechanisms may be altered as the climate changes. The study focuses on three overarching research themes:

1. *Control of Production in a Changing Environment* – Examining the timing and duration of seasonal production (i.e., generation of biomass through plants and animals) and its effect on ecosystem components (i.e., benthic [seafloor] communities versus pelagic [open ocean] communities). The extent of sea ice and the timing of its retreat is a key control in Bering Sea production.
2. *Competition Among Consumers* – Examining how major consumers (e.g., walleye pollock and arrowtooth flounder) of production compete over time, and how this competition influences the short-term (3-5 year) and medium-term (10-30 year) success of various groups.
3. *Location Matters* – Examining how climate-driven changes in the spatial distribution of production may affect place-based foragers (e.g., seabirds and fur seals) versus more mobile foragers (e.g., whales).

2010 Activities

The Bering Sea Project is currently in its third and final year of field activities, which has included integrated field sampling and process studies in an area that spans the southeastern Bering Sea shelf from the Aleutians north to St. Lawrence Island and from the shallow inner shelf (40 m depth) to the deep continental slope (2000 m depth). In 2010, from January to September, six research vessels supported 11 research cruises. Ship-based studies have included observations on populations of phytoplankton, zooplankton, ichthyoplankton (young fish); distribution of foraging sea birds; predator dynamics in relation to food supply distribution; groundfish; and hydrography.

Research Highlight: Pollock

One research topic studied this year and in previous years is the distribution and abundance of pollock in the Bering Sea.



Pollock are considered a relatively fast-growing and short-lived species, and a major biological component of the Bering Sea ecosystem.

Photo courtesy: AFSC, NMFS, NOAA.

Walleye pollock (*Theragra chalcogramma*) support the largest single U.S. commercial fishery, with the largest concentrations occurring in the eastern Bering Sea. Pollock, a groundfish, are also ecologically important as both predator upon smaller fish and zooplankton as well as prey for larger fish, whales, and sea birds. Scientists have assessed their status annually since 1977. Bering Sea Project scientists aim to understand current pollock abundance distribution and dynamics and potential future changes due to climate change.

Several coordinated projects collected data from trawl (net) surveys and acoustic technology aboard chartered fishing vessels and NOAA ships. Data collected includes distribution and abundance data on pollock and their prey, oceanographic mapping, water temperature, salinity, nutrients, oxygen, and chlorophyll. The 2010 data included activities aboard the NOAA ships *Oscar Dyson* and *Miller Freeman*, the University of Washington ship *Thomas G. Thompson*, the Coast Guard icebreaker *Polar Sea*, and the fishing vessels *Arcturus*, *Aldebaran*, and *Epic Explorer*.

Initial findings from the study include the following:

- Survival of larval pollock is enhanced during warm spring conditions, but high temperatures in late summer and fall are associated with reduced recruitment the following year, which may foretell reduced pollock abundance in the future.
- Despite overall warming trends, the Northern Bering Sea will likely remain arctic (i.e., ice-covered and cold) for the next 25-30 years. Even during the warm years from 2001-2005, temperatures were only slightly warmer in this area compared to the recent cold years from 2006-2009.
- Seabirds shift foraging locations in response to juvenile pollock abundance (<http://bsierp.nprb.org/fieldwork/2010/pollock-acoustic.html>).

Future Activities

Following the 2010 cruises, the project will transition from data collection to the synthesis phase. The final years of the project (2011-2012) will focus on data analysis, reporting on results through peer-reviewed publications, special journal issues focused on synthesis, and development of conceptual and mathematical models (<http://bsierp.nprb.org/results/publications.html>). The Bering Sea Project will also provide scientific advice to the North Pacific Fishery Management Council, which oversees management of the fisheries in the Bering Sea, Gulf of Alaska, and Aleutian Islands.

For more information, see the Bering Sea Project website: <http://bsierp.nprb.org/index.html> or contact Michael F. Sigler (Mike.Sigler@noaa.gov), H. Rodger Harvey (harvey@umces.edu), or Thomas I. Van Pelt (tvanpelt@nprb.org).



During the course of recruitment process cruises, small mesh nets are used to sample zooplankton and fish larvae. Both are the prey of larger fish seen by the echo sounders. Photo courtesy: AFSC, NMFS, NOAA.

Final BOREAS Conference: Environments, Movements, Narratives in the Circumpolar North

BOREAS is a major international and interdisciplinary research program in arctic social sciences and humanities. BOREAS was started in 2003 through collaboration between the European Science Foundation, the U.S. National Science Foundation, and the Canadian Social Science and Humanities Research Council.

Seven collaborative research projects were selected for the BOREAS program. These projects focused on relationships between humans and environments, exploring the importance of the movement of people (both seasonal and long-term) with special attention to movements associated with the creation, permanence, and dissolution of communities. Research partnerships between indigenous people and western scientists allowed BOREAS projects to explore the intersection of local and scientific models for understanding environmental, cultural, social, and economic change.

A significant feature of the BOREAS program is the series of international workshops and conferences designed to ensure networking opportunities between the collaborative research projects. Between 2006 and 2009 the program organized 13 formal activities to gather scholars representing a wide variety of humanities and social science disciplines, and drawn from a large geographic range of institutions across North America, Europe, and the Russian Federation.

The final conference was held 28-31 October 2009 at the Arctic Centre of the University of Lapland in Rovaniemi, Finland, with over 100 participants, including members of the seven funded collaborative research projects, invited speakers from outside the BOREAS and northern research communities, and 22 students from North America and Europe. The conference, supported in large part by a grant from the U.S. National Science Foundation, provided a forum to emphasize a humanities perspective in scholarship of the north, as well as a final opportunity for the BOREAS researchers to discuss their research.

A key theme of the conference was open discussion on the role of local and indigenous scholarship in northern research, and communication between the academic community and local northern residents. In addition, BOREAS researchers agreed to lead discussions with the European Polar Board to strengthen the role of humanities and social sciences in their agenda. The 2009 conference marked the conclusion of networking activities sponsored by the BOREAS Program. A final conference report will be available in summer of 2011 through the Boise State University Department of Anthropology.



Inuit hunter checking sea ice conditions offshore from Arviat, Canada. Photo courtesy: Yvon Csonka.

The BOREAS final report, "Histories from the North – Environments, Movements, Narratives (BOREAS)," was published in December 2009. The report contains a summary of the seven collaborative research projects and a final program evaluation by a BOREAS review panel. The panel identified BOREAS as the first major circumpolar-North research program to be based in humanities, arts, and social sciences. The panel also recognized the program's impact in broadening the scope of research in the region. The report recommends further development of the humanities in future arctic research efforts. To read the BOREAS Final Report, see the European Science Foundation website: <http://www.esf.org/activities/eurocores/running-programmes/boreas.html>.

For more information on the final BOREAS conference, see: <http://www.arcticcentre.org/?DeptID=10804> or contact John Ziker, Department of Anthropology, Boise State University (jziker@boisestate.edu).

ARCUS Releases Second Printing of *The Earth is Faster Now*

ARCUS announces the release of the second edition of *The Earth is Faster Now* (Krupnik and Jolly, eds. 2002) with a new 2010 forward by co-editor Igor Krupnik. The volume features ten individual studies, primarily in arctic North America, on indigenous knowledge of climate change. It includes personal observations, numerous illustrations, and photographs, as well as new recommended readings.

450 copies of the edition are now available. This reprint was funded by the NSF Office of Polar Programs Division of Arctic Sciences. The purchase price of \$25.00 USD includes all shipping and handling charges. For information on how to order a copy, see: <http://www.arcus.org/publications/EIFN/index.html>. To inquire about discounts and bulk purchases, or to place an order, contact ARCUS via email (order@arcus.org), phone (907-474-1600), or fax (907-474-1604).

Paleoclimate Project Shows Arctic Temperatures and Ecosystems Highly Sensitive to Carbon Dioxide Levels

A recent study indicates that ground surface temperatures in the Arctic may be more sensitive to the level of carbon dioxide (CO₂) than previously thought. Using three independent proxy temperature records from an early Pliocene peat deposit in the Canadian High Arctic, investigators estimate that mean annual temperature of the paleo-arctic environment was 19°C (34°F) warmer than today. While arctic temperatures were significantly warmer during the Pliocene, CO₂ levels were only slightly higher than at present. These findings indicate that arctic temperatures are highly sensitive to greenhouse gasses.

Led by a team from University of Colorado at Boulder and Principal Investigator Ashley Ballantyne, Department of Geological Sciences, this international project sought to develop robust proxy temperature indicators from the Pliocene Epoch (2.6 to 5.3 million years ago), the most recent interval in Earth's history when CO₂ levels were comparable to those of today.

The team used three independent temperature proxies obtained from a peat deposit at the Beaver Pond site on Ellesmere Island in Canada's High Arctic (N 78°, W 82°). Ellesmere Island today is one of the coldest and driest places on earth with an ecosystem that includes ice sheets, permafrost, sparse vegetation, and few mammals. Because the site is situated at such high latitude, it is shrouded by darkness six months of the year. Contemporary temperatures can range from approximately –38°C (–37°F) in winter to 9°C (48°F) in summer. During the Pliocene, however, this site was much warmer and more lush, featuring cedar trees, mosses and herbs, fish, frogs, and now extinct mammals that included tiny deer, ancient relatives of the black bear, three-toed horses, small beavers, rabbits, badgers, and shrews.



Reconstruction of the High Arctic Beaver Pond site (Strathcona Fiord, Ellesmere Island) as it may have appeared during the Pliocene, by George Rinaldino Teichmann. Reproduced with the permission of the Canadian Museum of Nature.



From left to right, Ashley Ballantyne of the University of Colorado at Boulder, Dara Finney of Environment Canada, and Natalia Rybczynski of the Canadian Museum of Nature search for fossils in a peat deposit at Strathcona Fiord on Ellesmere Island in Canada's High Arctic. Photo courtesy Dara Finney, Environment Canada.

The Beaver Pond site was ideal for proxy studies because organic materials (e.g., trees, plants, and mosses) have been extremely well preserved in the peat deposit, allowing researchers to conduct detailed and high-quality analyses. The team selected three independent proxies for arctic terrestrial surface temperatures during the Pliocene: (1) oxygen isotopes found in the cellulose of fossil trees and mosses in combination with annual growth rings in trees; (2) vegetation composition, when compared to the climate conditions of modern near-relatives; and (3) the distribution of ancient membrane lipids found in soil bacteria known as tetraethers, which correlate to temperature.

The three independent temperature proxies yielded mean annual temperature estimates that were statistically indistinguishable from each other, giving the investigators strong confidence in their estimates of Pliocene temperatures. The team constructed a composite mean annual temperature estimate of -0.4°C, suggesting that arctic temperatures were

19.3°C warmer during the Pliocene than they are today. These estimates are also 5-10°C warmer than previous estimates derived from temperature proxies or climate models.

The Pliocene is particularly interesting when compared with other ancient intervals of warm global mean temperatures because Pliocene atmospheric CO₂ levels are estimated to have been ~390 parts per million by volume, only slightly higher than pre-industrial levels. According to Ballantyne, the findings indicate that global CO₂ levels of approximately 400 parts per million by volume are sufficient to produce mean annual temperatures in the High Arctic of approximately 0°C (32°F). At this temperature it is very difficult to form and sustain perennial ice, a defining feature of the present arctic environment.

These findings suggest that current levels of atmospheric carbon dioxide may be high enough to bring about significant and irreversible shifts in arctic ecosystems. Further investigations to estimate sea surface temperature and the extent of arctic sea ice during the Pliocene could help calibrate climate models that often underestimate arctic temperatures during warm intervals.

The study, titled "The response of polar ecosystems to enhanced warming; a comparative study between modern boreal forests and Pliocene arctic forests," was funded through NSF's Office of Polar Programs at approximately \$240,000, with additional support from the Natural Science and Engineering Research Council in Canada, the Polar Continental Shelf Program of Canada, the Canadian Museum of Nature, the Netherlands Organization for Scientific Research, and the European Research Council. Results are published in the July 2010 *Geology*: "Significantly warmer arctic surface temperatures during the Pliocene indicated by multiple independent proxies," A.P. Ballantyne *et al.*

For more information contact Ashley Ballantyne (Ashley.Ballantyne@colorado.edu), Jaelyn Eberle (Jaelyn.Eberle@Colorado.edu), or Natalia Rybczynski (nrybczynski@mus-nature.ca).

Reference A.P. Ballantyne, D.R. Greenwood, J.S. Sinninghe Damsté, A.Z. Csank, J.J. Eberle, and N. Rybczynski, 2010. Significantly warmer Arctic surface temperatures during the Pliocene indicated by multiple independent proxies: *Geology* 2010 v. 38, no. 7, p. 603-606 (<http://geology.geoscienceworld.org/content/vol38/issue7/>).

National Science and Technology Council to Coordinate Interagency Arctic Research Policy Committee Activities

On 22 July 2010, the Obama Administration directed the National Science and Technology Council (NSTC) to coordinate certain activities assigned to the Interagency Arctic Research Policy Committee (IARPC). The Arctic Research Policy Act of 1984 created IARPC and the U.S. Arctic Research Commission (USARC) to provide comprehensive policy dealing with national research needs and objectives in the Arctic. This Presidential Memorandum supports the growing national focus on the Arctic by further encouraging increased collaboration and coordination among federal agencies. NSTC, an executive-level committee, can ensure that agency programs align with national science and technology priorities.

These goals will be supported by designating IARPC as an interagency subcommittee under the NSTC's committee on Environment and Natural Resources (see box, right, for IARPC member agencies). The new subcommittee's duties include: coordinating arctic research, technology, and observation programs; developing interagency plans for expansion of knowledge about the Arctic and its interaction with the ocean, atmosphere, land, and living resources as well as the societal impacts of arctic climate change; developing plans for predicting and forecasting arctic climate change; and providing advice related to ecosystem-based management and stewardship of arctic resources. As in the past, the Director of the National Science Foundation will serve as the chair for IARPC.

IARPC will continue to work with the USARC to establish an integrated national arctic research policy; to facilitate cooperation between the federal government and state and local governments in regard to arctic research; and to coordinate and promote arctic scientific research programs with other nations, subject to the foreign policy guidance of the Secretary of State.

For more information, see the [Office of Science and Technology policy blog post](#), or contact Kate Moran, Senior Policy Analyst in the Office of Science and Technology (kmoran@ostp.eop.gov).

Federal Agencies or Offices Represented on the International Arctic Research Policy Committee (IARPC)

- National Science Foundation, Committee Chair
- Department of Commerce
- Department of Defense
- Department of State
- Department of Health and Human Service
- Department of Homeland Security
- Office of Science and Technology Policy
- Department of Agriculture
- Department of Energy
- Department of the Interior
- Department of Transportation
- National Aeronautics and Space Administration
- Environmental Protection Agency
- Smithsonian Institution
- National Endowment for the Humanities

NSF Releases Solicitation to Augment Science Support on Research Cruises

The NSF Office of Polar Programs has released an announcement of opportunity entitled "Ship-based Science Technical Support in the Arctic (STARC): Augmenting Science Support on the U.S. Coast Guard Cutters *Healy* and *Polar Sea*."

The STARC solicitation is for proposals to enhance marine science and technical services provided to NSF-supported research cruises on U.S. Coast Guard (USCG) cutters *Healy* and *Polar Sea*. This solicitation is for an awardee to perform two primary functions: 1) to plan, coordinate, and deliver science technical support onboard *Healy* and *Polar Sea*, augmenting the role of the USCG marine science technicians; and 2) to coordinate with NSF, USCG, and the academic community to provide for the operation, maintenance, and upgrade of science equipment installed or used on *Healy* and *Polar Sea*.

The full proposal deadline is Monday, 8 November 2010.

For more information, read the full proposal at: <http://nsf.gov/pubs/2010/nsf10594/nsf10594.htm> or contact Renée Crain; Research Support & Logistics Manager, Arctic Sciences Division (rcrain@nsf.gov) or 703-292-4482.

NSF Solicits Bering Ecosystem Study (BEST) Synthesis Proposals

NSF has released a Dear Colleague Letter to invite synthesis proposals for data resulting from the Bering Ecosystem Study (BEST) program. BEST, initiated in 2007 by the NSF Office of Polar Programs, was designed to develop understanding of the effects of a varying sea-ice cover on the Bering shelf ecosystem, to project the potential changes in response to anticipated climate variations on decadal time scales, and to assess the vulnerability and sustainability of the local communities to such changes.

This program was coordinated with the North Pacific Research Board's Bering Sea Integrated Ecosystem Research program (BSIERP). The BEST-BSIERP collaboration concluded its final year of fieldwork in 2010 (see *[Integrated Bering Sea Project in Final Year of Field Activities](#)*, in this issue of *Witness*).

The coordinated programs have identified a series of propositions addressable with the collected field data, including:

1. **Physical forcing affects food availability:** Climate-induced changes in physical forcing modify the availability and partitioning of food for all trophic levels through bottom-up processes.
2. **Ocean conditions structure trophic relationships:** Climate and ocean conditions impact fish reproduction, survival and distribution, the intensity of predator-prey relationships, and the location of zoogeographic provinces through bottom-up processes.
3. **Ecosystem controls are dynamic:** Changes in the timing of ice retreat alter zooplankton production and ultimately the distribution of its consumers. Such changes can lead to a community controlled by either top down or bottom up processes with multiple trophic consequences.
4. **Location matters:** Domain boundaries of many consumers are driven by climate and ocean conditions. The timing and extent of these boundaries will lead to bottom up processes ultimately impacting the foraging success of marine birds and mammals.
5. **Commercial and subsistence fisheries reflect climate:** Changing climate-ocean conditions will affect the abundance and distribution of commercial and subsistence fisheries.

The BEST-BSIERP data are a valuable resource that could be used to address questions relevant to the coordinated programs. While NSF does not plan to issue a broad proposal solicitation for further exploitation of this resource, the Division of Arctic Sciences will accept proposals for short (up to two years duration) synthesis activities associated with the goals of BEST.

Proposals could, among other approaches, include workshops; modeling; or multiple intense, focused interactions of small groups of investigators. Successful proposals would enhance and develop synergies with the existing efforts, not simply continue or integrate them. In order to facilitate exploitation of these data, prospective investigators may access metadata describing the available data sets at <http://www.eol.ucar.edu/projects/best/>.

Proposals should be submitted to the next regular Arctic Division solicitation: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5521&org=ARC&from=home.

The deadline is Wednesday, 10 November 2010.

For more information, see the Dear Colleague letter: <http://www.nsf.gov/pubs/2010/nsf10067/nsf10067.jsp>
or contact William J. Wiseman, NSF Arctic Natural Sciences Program Manager (wwiseman@nsf.gov).

USCG Icebreaker Polar Sea Under Repair

This summer, the U.S. Coast Guard announced that the icebreaker *Polar Sea* experienced an engine casualty and would be unable to deploy its scheduled fall and winter 2010 cruise activities. The engine difficulty was discovered during a scheduled dry-dock maintenance period following their successful support of a spring 2010 Bering Sea Ecosystem Study (BEST) research cruise. The *Polar Sea* was commissioned in 1977 and has operated in the Arctic Ocean since 1979. As of spring 2010, *Polar Sea* had made 18 voyages to the Antarctic and 22 voyages to the Arctic. Repairs are anticipated to be complete in June 2011, readying the ship for service in August 2011.

For more information on the *Polar Sea*, see: <http://www.uscg.mil/pacarea/cgcpolarsea/default.asp> or contact the Chief of the U.S. Coast Guard Ice Operations Division, Lieutenant Commander Michael Krause (Michael.S.Krause@uscg.mil).

NSF and Arctic Research Funding to Increase Under Proposed Budget

The Administration's FY 2011 budget proposal, released on 1 February 2010, provides \$7.4 billion for the National Science Foundation. This funding level reflects the President's Plan for Science and Innovation giving NSF an 8% increase over the level enacted in the FY 2010 federal budget.

Full funding of the FY 2011 proposed budget will double the funding for multidisciplinary research focused on "next-generation" information technology; provide new funding at \$766 million to support cross-agency research on environmental and climate system processes and renewable energy technology; and provide a 14% increase in funding to broaden participation of undergraduate students in science, technology, engineering, and mathematics (STEM).

For the Office of Polar Programs, the budget request provides \$528 million, a 17% increase over FY 2010 funding levels. It continues a \$4 million investment to support transformative, high risk/high reward research, and provides \$111 million for the Arctic Sciences Division, which is a 4.8% increase over FY 2010. Additionally, the proposed budget will meet the OPP request of \$54 million for operations and maintenance of the U.S. Coast Guard polar icebreakers *Polar Sea* and *Healy*.

The Senate Budget Committee passed the FY 2011 Senate Budget Resolution on 22 April 2010. However, appropriations hearings remain in sub-committee and Congress is not expected to send appropriations bills to the President until after the mid-term elections. Congress passed a continuing resolution on 29 September 2010 before adjourning for the election season recess. The continuing resolution will keep government operations funded at FY 2010 levels until 3 December 2010, or until Congress resumes and takes action on the FY 2011 budget.

For more information, see the NSF Budget Division website: <http://www.nsf.gov/about/budget>.

National Polar-orbiting Operational Environmental Satellite System (NPOESS) Program Restructured

The White House announced a major restructuring of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) as a result of delays, cost overruns, and difficulties with the management and budget structure. NPOESS was conceived in 1994 as a multi-agency initiative to develop a constellation of polar orbiting environmental satellites that would provide global coverage on weather, atmosphere, oceans, land, and space.

The new program will remain as an interagency initiative involving NOAA, NASA, and the U.S. Air Force, but with new operating structures. Funding details will be included with the final federal FY 2011 budget.

For more information about the NPOESS program, see the NOAA Satellite and Information Service website: <http://npoess.noaa.gov/index.php>.

NOAA Developing Arctic Vision and Strategy

In April 2010, NOAA released a draft Arctic Vision and Strategy, which provides a high-level framework and strategic goals to address NOAA's highest priorities in the region. This report articulates a vision for the Arctic based on assumptions that the region will continue to experience dramatic change, become more accessible to human activities, and be a focus of increasing global strategic interest.

NOAA identified six strategic goals:

1. Forecast sea ice;
2. Strengthen foundational science to understand and observe changes in arctic climate and ecosystems;
3. Improve weather and water forecasts and warnings;
4. Enhance national and international partnerships;
5. Improve the stewardship and management of Arctic Ocean and coastal resources; and
6. Advance the development of healthy and resilient communities and economies in the Arctic.

Public comment on the draft report closed 25 June 2010. A final report will be released in November 2010. NOAA will next develop a five-year arctic action plan and budget, anticipating a \$10 million initial investment to support this strategy. Implementation of the action plan is scheduled for early summer 2011.

For more information, see: <http://www.arctic.noaa.gov/> or contact Tracy Rouleau, NOAA/National Weather Service (tracy.rouleau@noaa.gov).

Update from the U.S. Arctic Research Commission

The Arctic Research Policy Act of 1984 established the U.S. Arctic Research Commission (USARC), whose principal duties are to develop and recommend an integrated national arctic research policy and to assist in establishing a national arctic research program plan to implement the policy. USARC Commissioners facilitate cooperation among the federal government, state and local governments, and other nations with respect to basic and applied arctic research. USARC is currently working with other federal entities to implement the Presidential Memorandum of 22 July 2010, regarding the Arctic Research and Policy Act (see [***NSTC to Coordinate IARPC Activities***](#), in this issue of *Witness*).

Recent Publications

USARC contributed to or produced several publications on key issues in arctic research:

White Paper: USARC Recommends Steps to Expand U.S. Funding for Arctic/Subarctic Oil Spill Research - Provides recommendations to the federal government for an invigorated oil spill research effort in the Arctic with a funding strategy that does not require new fiscal appropriation.

Scaling Studies in Arctic System Science and Policy Support: A Call-to-Research - Provides targeted recommendations on research to improve scaling approaches across a variety of disciplines and applications in the Arctic.

SCICEX Phase II Science Plan—Part 1: Technical Guidance for Planning Science Accommodations Missions - Provides the U.S. Navy with a detailed and prioritized list of sampling recommendations to measure sea ice thickness; ocean hydrology and bathymetry; and ocean biology and chemistry.

Behavioral and Mental Health Research in the Arctic: Strategy Setting Meeting Proceedings - Proceedings from a 2009 workshop recommend that the National Academy of Science's Institute of Medicine conduct a study of behavioral and mental health research in the Arctic.

USARC Report on Goals and Objectives for Arctic Research 2009-2010 - This biennial report to the President and Congress recommends national scientific research goals.

USARC publications are available through the website at: <http://www.arctic.gov>.

For printed copies, contact: info@arctic.gov.

Commissioner News

Former Commission Chairman Mead Treadwell resigned in June 2010 to run for public office in Alaska. Commissioner Michele Longo Eder temporarily assumed duties of the Chair until the White House designated Commissioner Virgil (Buck) Sharpton as Chair in August.

President Obama appointed Mary Ciuniq Pete, of Bethel, Alaska, to the Commission in June. Mary C. Pete is a Yup'ik Eskimo, born and raised in Stebbins, Alaska. She has been selected to represent the needs and interests of arctic indigenous residents.

Since 2005, Ms. Pete has been the Director of the Kuskokwim Campus of the University of Alaska Fairbanks (UAF) in Bethel. She holds a B.A. and an M.A. in Anthropology from UAF and has extensive background and experience in subsistence issues (i.e., noncommercial, customary, and traditional uses of fish and wildlife resources).



Mary C. Pete was appointed to the U.S. Arctic Research Commission by President Obama on June 25, 2010. Photo courtesy: USARC

USARC Testimony to Congress

In March, Commissioner Warren Zapol provided written testimony to the Senate Committee on Indian Affairs during its hearings on "Youth Suicide in the Arctic." He recommended that \$1.2 million be made available to the Institute of Medicine to evaluate current scientific knowledge and strategies for the prevention and treatment of mental and behavioral health problems faced by populations in arctic regions. To read the testimony, see: <http://www.arctic.gov/testimony/zapol-03-25-10.pdf>.

In May, Executive Director John Farrell testified before the House Subcommittee on Insular Affairs, Oceans and Wildlife in support of H.R. 2864 to authorize funds for improved charting of the Arctic Ocean to provide safe navigation, extend United States territorial claims off Alaska, and better monitor changes to Alaska's coast. To read the testimony, see: <http://www.arctic.gov/testimony/farrell-05-06-2010.pdf>.

In August, Commissioner Mary Pete testified before the Senate Commerce Committee on the impacts of climate change on subsistence lifestyle during the Committee's field hearing held in Barrow, Alaska. To read the testimony, see: <http://www.arctic.gov/testimony/pete-08-19-10.pdf>.

Workshops

USARC led or participated in several workshops, including:

- A public workshop in March on the scientific research on oil spills in ice-covered waters. To read the white paper published from this workshop, see: http://www.arctic.gov/publications/oil_spill_wp.html.
- A workshop in April on arctic civil infrastructure to identify priority research needs and to develop a plan for addressing these needs. For more information and workshop results, see: <https://sites.google.com/a/alaska.edu/arctic-civil-infrastructure-workshop/>.

- A workshop on "Operating in the Arctic: Supporting U.S. Coast Guard Challenges through Research" in September, in coordination with the U.S. Department of Homeland Security's Science and Technology Directorate, to identify ways in which scientific research and development can improve the U.S. Coast Guard's ability to operate and carry out its statutory missions in the arctic region.
- The Commission co-sponsored the non-profit ICETECH 2010 Conference, "Performance of Ships and Structures in the Ice," in September. The conference was organized by the Arctic Section of the Society of Naval Architects and Marine Engineers (SNAME) and Alaska's Institute of the North. The conference addressed the growing interest in arctic shipping and oil, gas, and mineral exploration in arctic offshore regions. For more information, see the ICETECH website: <http://www.icetech10.org/>.

The Commission also holds regular meetings to discuss USARC business and relevant arctic issues which are open to the public. For information on upcoming meetings, see: http://www.arctic.gov/upcoming_meetings.html.

For more information on USARC activities, see the USARC website: <http://www.arctic.gov/> or contact John Farrell, USARC Executive Director (jfarrell@arctic.gov).

International Study of Arctic Change Activities

ISAC Welcomes New Staff

The International Study of Arctic Change (ISAC) is pleased to welcome Dr. Martin Biuw to the International Program Office (IPO) in Stockholm. Biuw is a marine ecologist and biological oceanographer with a PhD in Environmental and Evolutionary Ecology from the University of St Andrews, Scotland. Most recently, Biuw has been a research fellow at the Norwegian Polar Institute in Tromsø. Biuw played a major role in the inception and realization of large-scale international programs, developing approaches to hydrographic studies of remote ocean regions using instrumented marine animals. Biuw will be working with the Executive Director of ISAC, Maribeth Murray, and the ISAC Science Steering Group to carry out the mandate of the ISAC IPO, including expansion of information services and ISAC implementation activities. He can be contacted at: info@arcticchange.org.

Planning Commences for "Responding to Arctic Change" Workshop

ISAC is currently planning a 2011 workshop on responding to arctic change, which will advance the ISAC emphasis on developing "science for society." An initial planning meeting was held in Oslo in June 2010 to discuss the workshop scope. The workshop goals are to: (1) Develop clarity on the meaning of "responding to change" and what the role of science may be in a "responding to change" effort; and (2) Assess the extent to which arctic science priorities align with stakeholder priorities. Additional information on the workshop will be circulated as plans are finalized.

For more information on ISAC or to obtain ISAC presentations and publications, see the ISAC website: <http://www.arcticchange.org> or contact Maribeth Murray (murray@arcticchange.org).

Oslo Science Conference Marks Conclusion of IPY

The Oslo Science Conference, held 8-13 June 2010, marked the conclusion of the International Polar Year (IPY), which ran from March 2007 to March 2009. Under the auspices of the International Council for Science (ICSU) and the World Meteorological Organization (WMO), the IPY Joint Committee decided to hold an international wrap-up conference to present results and facilitate interaction between IPY participants. The conference, which represented the largest ever gathering of polar researchers, was scheduled for 2010 to allow researchers time to prepare results from their investigations.

Norway was awarded responsibility for arrangements of the IPY-Oslo Science Conference (IPY-OSC). The Research Council of Norway, the main funding agency for Norwegian IPY projects, organized the conference with Olav Orheim (Research Council of Norway) as project leader; Asgeir Knudsen (independent consultant) as project coordinator; and Kristen Ulstein (Research Council of Norway) in charge of outreach and communication. An international Steering Committee, chaired by Orheim, was established with representation from each major stakeholder (see box, above, for list of stakeholders).

Major Stakeholders

- International Council for Science (ICSU)
- World Meteorological Organization (WMO)
- Scientific Committee on Antarctic Research (SCAR)
- International Arctic Science Committee (IASC)
- IPY Joint Committee
- IPY Program Office

The conference was organized around six themes selected by the Steering Committee. The themes and their appointed chairpersons were:

- Linkages Between Polar Regions and Global Systems; Harald Loeng, Institute of Marine Research, Norway
- Past, Present, and Future Changes in Polar Regions; Valérie Masson-Delmotte, Laboratoire des Sciences du Climat et de l'Environnement, France
- Polar Ecosystems and Biodiversity; David Hik, University of Alberta, Canada
- Human Dimensions of Change: Health, Society, and Resources; Sverker Sörlin, Swedish Institute for Studies in Education and Research (SISTER), Sweden
- New Frontiers, Data Practices, and Directions in Polar Research; Chuck Kennicutt, Texas A&M University, United States
- Polar Science Education, Outreach, and Communication; Louise Huffman, Antarctic Geological Drilling (ANDRILL), United States

Proposals were solicited from the IPY community for sessions under the six themes, from which 41 sessions were selected. Co-conveners for each session included an early career scientist as part of special efforts made to attract young researchers to the conference. The science community was invited to submit abstracts and 2,200 persons responded by submitting a total of 2,650 abstracts for presentations at the conference.

Approximately 2,300 participants attended IPY-OSC from 49 different nations. The conference included 1,054 scientific presentations and roughly the same number of posters. A special session entitled 'PolarCINEMA' had almost 30 hours of continuous screening of polar films produced during the IPY. Various groups with polar interests held side events in conjunction with the conference. These included an international Polar Teachers conference attended by approximately 120 teachers from 20 countries, and an early career professional development workshop organized by the Association of Polar Early Career Scientists (APECS) for more than 400 young researchers.



The inclusion of early career scientists, teachers, and others involved in outreach was one of the major achievements of IPY-OSC 2010. Here some of them are enjoying themselves on a cruise on The Oslo Fjord. (Jon-Petter Reinertsen, SAMFOTO)

HRH Crown Prince Haakon of Norway opened the conference. Additionally, the conference was addressed by Tora Aasland, Norwegian Minister of Research and Higher Education; and HSH Prince Albert II of Monaco. Plenary lectures were given by community leaders such as Chuck Strahl, Canadian Minister of Indian Affairs and Northern Development; and Sergey Kharyuchi, the President of the Russian Association of Indigenous Peoples of the North (RAIPON). Jonas Gahr Støre, Norwegian Minister of Foreign Affairs, closed the conference. With its multitude of presentations and other activities, the Oslo Science Conference was a tribute for the many people who invested large portions of their careers in the International Polar Year.

Resources from the IPY-OSC are available online. All plenary lectures were web-streamed, and archives can be viewed on the conference website: <http://ipy-osc.no/live>. The conference program and abstracts are available at: http://ipy-osc.no/osc_programme.

One additional major IPY conference, "From Knowledge to Action," is scheduled for 22-27 April 2012 in Montreal, Canada. The 2012 conference will emphasize synthesized knowledge and the actions that should follow.

For more information, see the IPY-OSC website at: <http://ipy-osc.no/> or contact Olav Orheim (oo@rcn.no).

IPY-OSC Participant's Perspective

by Rune Storvold, ARCUS Board Member

For a polar scientist, the IPY-OSC presented the opportunities we had previously only dreamed about. After four intensive years of planning, data gathering, initial data analysis, and many small project meetings the Oslo Science Conference was a chance to put things into perspective. The span of the conference was overwhelming, but offered invaluable opportunity to observe presentations outside my immediate field of work. IPY-OSC was also an opportunity to meet and discuss the future with colleagues. Although the International Polar Year is formally over, its legacy in terms of data and new observing networks give us renewed energy to address the crucial issues of how to live with a changing climate and predict and understand the mechanisms behind the changes. In two years we'll meet again in Montreal, with new results and new ideas. Maybe there will be a Polar Decade to plan.

Perspective on the State of the Arctic Conference

The State of the Arctic Conference, held in Miami, Florida 16-19 March 2010, was a truly significant event. The Arctic is undergoing enormous changes, primarily driven by climate, but with startling socio-economic as well as ecological impacts. This conference brought together a wide range of expertise from many nations, providing an ideal opportunity to bring forth the current state of our knowledge in a broad and comprehensive sense, while at the same time addressing potential impacts through multi-disciplinary discussions. In this, it represents a major step forward.

Web-based participation greatly increased the audience throughout the world; the total conference participation was approximately 650 people. The opening comments by Dr. Arden L. Bement, Jr., Director of the National Science Foundation, led to informative and challenging days. I cannot resist reflecting on my early days in the 1960s as an arctic researcher, recalling that the only real interest and presence was military. Today, it is a far cry from those days, and the challenges are enormous. The only way to meet these challenges is against a sound background of scientific understanding, coupled with wise application to social and policy action. The products of the State of the Arctic Conference will be essential in this regard. The ARCUS Board of Directors salutes the sponsors, organizing committee, and all participants.

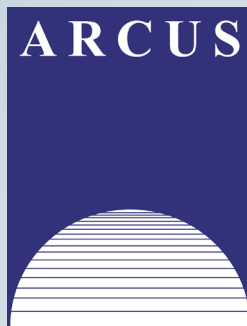
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