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SEARCH Progress and News

SSC Meeting in August Moves Forward Strategic Plan

The Study of Environmental Arctic Change (SEARCH) Science Steering Committee (SSC) met in August 2011 in Denver, Colorado to continue its strategic planning activities ([see Witness the Arctic, Volume 15, Number 2](#)). The SSC made significant progress on five-year priority science goals to guide future SEARCH activities. The draft science goals and updated SEARCH vision and mission were reviewed after the meeting by members of the [SEARCH panels](#). The SSC is currently refining the goals based on the panel input. The vision, mission, and draft goals will be distributed to the wider community for input in late 2011 and will be discussed at an American Geophysical Union (AGU) Town Hall in December 2011 (see below). More information about the August SSC meeting can be found at: <http://www.arcus.org/search/meetings/2011/ssc-august>.



Study of Environmental Arctic Change

Town Hall Scheduled for AGU Fall Meeting

A SEARCH Town Hall will be held at the AGU Fall Meeting in San Francisco, California on Tuesday, 6 December 2011 from 12:30-1:30 p.m. Pacific Standard Time. The Town Hall will provide a forum for open exchange on several issues, including the new SEARCH vision and mission statement, draft 5-year science goals, and activities of the [Arctic Observing Network Design and Implementation Task Force](#). More information about the Town Hall will be announced through the [ArcticInfo](#) email list.

Arctic Observing Network Activities

A U.S. Arctic Observing Coordination workshop will be held 20–22 March 2012 in Anchorage, Alaska. The meeting goal is to advance U.S. interagency coordination within the context of arctic observing activities. A meeting report will: (1) summarize agency missions, needs, activities, and resources; (2) draw connections with observing components; (3) provide recommendations for advancing interagency coordination; and (4) outline one or more tractable pilot coordination projects, with recommendations for short-term action. The meeting will be co-chaired by John Payne, North Slope Science Initiative; and Don Perovich, U.S. Army Cold Regions Research and Engineering Laboratory.

The AON Design and Implementation (ADI) Task Force was convened in 2009 to provide guidance on how to achieve a well-designed, effective, and robust Arctic Observing System. The ADI Task Force is currently working on a final report with recommendations for the next steps in optimizing and enhancing the existing components of an international arctic environmental observing system, with emphasis on the U.S. Arctic Observing Network (AON). The final report will be completed in 2012.

Another Successful Season for the Sea Ice Outlook and Sea Ice for Walrus Outlook

The SEARCH Sea Ice Outlook, supported by NSF, the National Oceanic and Atmospheric Administration (NOAA), and through volunteer efforts, provides community projections of the September arctic sea ice minimum. This year, 27 groups contributed to the monthly pan-arctic and regional Outlook reports using a variety of methods. The National Snow and Ice Data Center's value for the minimum this year—using the average September 2011 ice extent—was 4.61 million square kilometers, the second lowest in the satellite record. The Outlook organizers and contributors will release a post-season

report this fall that evaluates the outlook predictions, methodologies, and lessons learned.

The Sea Ice for Walrus Outlook (SIWO) provided weekly reports April–June on sea ice and weather conditions as a resource for Alaska Native subsistence hunters, coastal communities, and others interested in sea ice and walrus. The weekly reports integrated ice and weather forecasts, satellite data, and local observations, and were made available through the SIWO website, a Facebook page, and faxes to local communities.

For more information about the Sea Ice Outlook, go to: <http://www.arcus.org/search/seaiceoutlook/>.

For more information about the Sea Ice for Walrus Outlook, go to: <http://www.arcus.org/search/siwo>.

SEARCH Contact Information

For more information about SEARCH activities, visit the SEARCH website at: <http://www.arcus.org/search/> or contact Helen Wiggins, ARCUS, at helen@arcus.org.

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NSF's New Data Management System for Arctic Research Programs

Building on the Cooperative Arctic Data and Information Service (CADIS; <http://www.aoncadis.org/>), the NSF- funded Advanced CADIS (ACADIS) system is being developed to address the growing and increasingly diverse data management needs of the NSF arctic research community. In July 2011, NSF awarded a four-year continuing grant to the team of ACADIS investigators from the National Snow and Ice Data Center (NSIDC), the University Corporation for Atmospheric Research (UCAR), and the National Center for Atmospheric Research (NCAR). The new ACADIS system will foster scientific synthesis and discovery by providing a service that makes data available to NSF investigators for access and analysis across multiple disciplines. ACADIS will also provide the community with data archival services to preserve data into the future, and value-added products to make the data more useful to more people.

The ACADIS system expands on the capabilities of the CADIS system, which was designed to serve the specific needs of the Arctic Observing Network (AON). ACADIS is being developed to handle the much larger number and wider range of datasets generated by all NSF-funded arctic investigations. Continual upgrades to the user interface will assist users in authoring metadata, and uploading and accessing datasets. The system will also allow for sharing metadata to improve transparency and interoperability between ACADIS and other data systems.

To meet the community's need for greater integration of research data with other data, ACADIS will provide improved visualization capabilities. These services will allow investigators' datasets to be organized in conjunction with other related datasets on the same display—for example, combining point measurements of sea ice conditions from buoys with gridded fields from remote sensing imagery.

Another goal of the ACADIS team is to improve the usability and interdisciplinary reuse of the data. One facet of this involves developing integrated datasets that can serve a wide range of investigators. Another issue is ensuring that key functions of a project's website remain available after project funding ends. Datasets that are assigned a high level of service will receive extended metadata and documentation to make the data more useable for a broader community. Not all datasets will receive the same level of service; criteria for determining the level of service will be developed with input from principal investigators (PIs), the ACADIS advisory committee, and NSF management.

The ACADIS PI team, led by Mark Serreze of NSIDC and Jim Moore of NCAR, has identified ongoing activities and milestones for each quarter of the project's first year, which address project planning and oversight, data acquisition and ingest, data access, and data preservation. New staff, including two data curators, have been hired, and the core of an advisory committee is in place (see sidebar box). The advisory committee had its first conference call on 21 October. The ACADIS team has also developed a data management plan template and posted it on the CADIS website. It includes accompanying guidelines for investigators seeking NSF funding under the new requirement that all proposals include a

Current Data Advisory Committee Members

Andrew Slater, NSIDC, land surface processes

Dave Bailey, NCAR, global climate modeling

Larry Hamilton, representing SEARCH and the social sciences

Mary-Louise Timmermans, Yale University, deep-water oceanography

Craig Tweedie, University of Texas at El Paso, terrestrial ecology

Carin Ashjian, Woods Hole Oceanographic Institution, ocean ecology

viable management plan for data collected or generated by the proposed project. The ACADIS team will work with investigators to fully develop their data management plans; offer continued support for data providers and users; and communicate the standards for observations, data formats, and metadata vocabularies.

The ACADIS PIs will rely on an advisory committee and NSF management to help set priorities and support functions. The PIs communicate these priorities and functions to the data curators and project specialists across the NISDC/UCAR/NCAR team.

An interview with ACADIS PIs Mark Serreze and Jim Moore is included in this issue of *Witness*. To read the interview, please go to: <http://www.arcus.org/witness-the-arctic/2011/3/article1773>.

For further information about ACADIS, please go to: <http://www.aoncadis.org> or contact Mark Serreze (serreze@nsidc.org), or Jim Moore (jmoore@ucar.edu).

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A Conversation with Mark Serreze and Jim Moore, Principal Investigators for the Advanced Cooperative Arctic Data and Information Service (ACADIS)

Witness the Arctic (WTA) had the opportunity to talk with Mark Serreze of the National Snow and Ice Data Center (NSIDC; <http://nsidc.org/>) and Jim Moore of the National Center for Atmospheric Research (NCAR; <http://ncar.ucar.edu/>) who lead the Advanced Cooperative Arctic Data and Information Service (ACADIS) team. We asked each of them a few questions about the new data management service. Here are excerpts from those conversations.

(Further information about ACADIS is available in this issue of Witness, see: <http://www.arcus.org/witness-the-arctic/2011/3/article/1774>.)

WTA: What are some of the highlights of the new ACADIS system?

Serreze: This level of data management is relatively new for NSF. We have an opportunity now to start providing some services that can really benefit the community.

One of the services we will provide is a range of value-added products, in other words, taking the datasets out there and combining them in ways that will serve a much broader community. An example might be for the borehole data from arctic monitoring permafrost temperatures—our job would be to bring all those disparate datasets together so that investigators can make greater use of them. Which of these value-added products we need to focus on is something to be determined in collaboration with the ACADIS Advisory Committee and NSF management.

Moore: The fundamental initial improvement is to expand on the capabilities of the Cooperative Arctic Data and Information System (CADIS) (<http://www.aoncadis.org/>) to handle different data and formats from all the different types of programs funded by NSF's Arctic Sciences Division. This requires some improvement to the user interface that we use for creating metadata, for uploading datasets, and to improve visualization capabilities.

The user interface allows principal investigators to build the metadata file for each and every dataset they have and provides a way for them to upload the data into the archive so we can get it into a permanent facility. The website offers any user the chance to come in and look for the data they're interested in and then download the data directly to their computer.

Another opportunity here is with the development of a standardized metadata scheme that matches international standards. In matching the standards used by global data archive centers, we are going to open the opportunity to share data across archive sites. We have done some trials already with projects in Germany, Norway, and the U.K. The hope is that in the long run, arctic scientists can sit down at the ACADIS user interface and find data they are looking for from any of the major archive sites around the world.

WTA: What are you currently working on and what are the next steps for ACADIS?

Serreze: The next step is to transition to ACADIS Version 1, which is close on the horizon. In the meantime, any investigator who needs to place data with us can do so. One of the things we need to be determining fairly quickly is the level of service for each dataset. Each dataset doesn't necessarily get the same level of service—it depends on things like the perceived value of the data and how much we think it is going to be used. The high-value, integrated datasets would

get a high level of service, while other datasets may get less. We have to come up with a good system to deal with that right off the bat. We're going to need very open communication. Those are the types of things we will be deciding with the principal investigators and also our Advisory Committee.

Moore: There is no higher priority than making sure the Arctic Observing Network (AON) community can continue to get their data and metadata into the archive. We've got to make sure we don't take a step backwards and that the tool continues to be operational—and for some projects that's easier said than done. It's one thing to develop a new tool and quite another to keep the current system running and making it robust and reliable while trying to make improvements. There are some new hires at NSIDC, including data curators, to make sure data inventory is properly organized and that we are providing the proper levels of service to the data that we have now and will acquire in the future.

It is important to note that both CADIS and ACADIS have been very strong team efforts between the groups at NSIDC and the NCAR groups: Earth Observing Laboratory (EOL); the Cyber Infrastructure Laboratory (CISL); and Unidata, which is within University Corporation for Atmospheric Research (UCAR). The point is that the team working on this project involves 20 people who have lent their expertise and unique perspective to the development of the original system and now continue to work in ACADIS. Developing and keeping a team like this together is very unique. We are really proud of that.

WTA: *Tell us about the Data Advisory Committee.*

Serreze: The core group of the committee is in place and includes:

- Andrew Slater, NSIDC, land surface processes;
- Dave Bailey, NCAR, global climate modeling;
- Larry Hamilton, representing SEARCH and the social sciences;
- Mary-Louise Timmermans, Yale University, deep-water oceanography;
- Craig Tweedie, University of Texas at El Paso, terrestrial ecology; and
- Carin Ashjian, Woods Hole Oceanographic Institution, ocean ecology.

We still need to broaden the perspective, for example, with representation from the paleoclimate community. The committee must have a wide range of arctic researchers who come with different perspectives on data. We are really interested in knowing what their stories are and their frustrations in dealing with data, finding the data, and using the data. Without getting that information, it's going to be difficult for us to move forward.

Moore: The committee has a group of great people on it and we're very optimistic about their participation to make ACADIS more useful as a community resource. I think it's a work in progress to see what kind of advice and coordination they will be providing and how we address these things in ACADIS.

WTA: *What are some of the challenges related to developing ACADIS?*

Serreze: The next issue to address is data inventory. Working with the managers at NSF, we need to inventory what data has been collected by arctic researchers, where that data is being stored, and what condition it is in. Basic information like this is needed before we can really get the ACADIS system working. There's a ton of data out there and there are other homes that people have been using for their arctic data. We need to discover where they are so we can at least point to them. One of the goals from NSF is to establish greater access to historical datasets so that investigators doing modeling

work aren't limited to a few individual datasets scattered all over the place in different locations.

Moore: Our system needs to be able to protect the datasets of the PI while making sure they are easily accessible in the long run for the whole community. What we will do in the cases where the data needs to be protected is offer the ability to password-protect it from premature use by other groups. The PIs make the decision about what data will be available to the public and when that will happen. PIs should not be fearful about submitting their data to the archive. All datasets are made public eventually as required by the NSF data policy.

WTA: What can the arctic research community do to support ACADIS?

Serreze: Simply get involved in the process. For many arctic investigators, the issue of data management is an afterthought. We have to change the way we're thinking about data—we have to realize that the data always needs to be accessible.

Moore: Talk to us! Tell us what your needs are and how we can help you. Keep us informed if there is something not going right, and let us know when things are going right.

WTA: What is your vision of how ACADIS will enhance support for arctic science?

Moore: We are pretty excited about things ACADIS can offer over its lifetime: long-term stewardship of incredibly rich sources of information on the current condition of the Arctic and how the Arctic is changing; a user interface that allows the data provider to easily put data, metadata, and documentation into the system; and as easily allows users—the young scientist, the graduate student, the person doing synthesis or integration of data—to peruse what datasets are out there, either in our system or others around the world, and access and use it. We hope to offer some visualization tools, and offer the data in common formats that would permit an increased ability to see multiple datasets and multiple data types to help with the interpretation of the changes going on in the Arctic.

Serreze: Interdisciplinary data discovery will enable people to integrate data better than they can today. Arctic science is becoming increasingly interdisciplinary. When we think about the challenges of understanding climate change, it means different disciplines working together. So the data management end of that really needs to follow suit. That's the really big picture.

Website Launched for “Changing Seasonality in the Arctic System” Projects

There now exists abundant evidence that pervasive changes are underway in the patterns of seasonality in the Arctic. Shifts in the timing, length, and pattern of individual seasonal events are occurring throughout the arctic system, including physical events (e.g., ocean and atmospheric circulation and fluxes, precipitation, sudden thaws, presence of ice and snow), biological events (e.g., plant phenology, animal life history events) and human activities (e.g., resource use, industrial activities).

To explore these changes, NSF's Arctic System Science Program (ARCSS) funded 40 awards totaling \$14.3 million on 17 interdisciplinary projects, including field studies, retrospective investigation, modeling, and synthesis. More than 85% of the funding was provided through the American Recovery and Reinvestment Act. Two additional related projects were funded through other programs in the NSF Arctic Sciences Division, giving a total set of 19 projects on "Changing Seasonality in the Arctic System."

The Arctic Research Consortium of the U.S. (ARCUS) has developed a website for the projects at: <http://www.arcus.org/projects/csas>. The website includes comprehensive and searchable information about each project, including project overview, education and outreach activities, products, findings, photos, and other resources.

For questions regarding the website, please contact Judy Fahnestock, ARCUS, at judy@arcus.org.

For questions regarding the CSAS projects, please contact Neil Swanberg, NSF, at nswanber@nsf.gov.

For more information about the ARCSS program, see: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13426 and <http://www.arcus.org/arcss/index.html>.



Changing Seasonality in the Arctic System

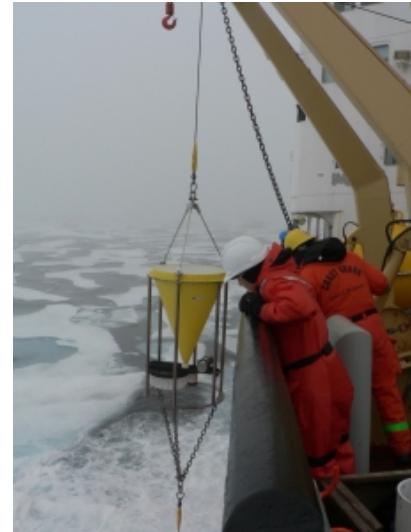
Carbon Export to the Deep Arctic Ocean

Introduction

Mobilization of carbon from permafrost soils and a reduction in sea-ice cover are two major manifestations of a warming Arctic. Both have the potential to perturb the Arctic Ocean carbon cycle, with attendant ramifications for the marine ecosystems and human populations that depend on them. Despite evidence that rapid changes are underway, our understanding of current biogeochemical processes within the central Arctic Ocean, and when and how they will respond in the future, remains limited. This lack of understanding hinders our ability to predict whether the Arctic will serve as a net carbon dioxide (CO_2) source or sink for atmospheric carbon as well as how coastal and pelagic ecosystems will be perturbed in response to climate change.

Funded by the NSF Arctic Natural Sciences (ANS) Program, research scientists Steve Manganini of Woods Hole Oceanographic Institution (WHOI); Tim Eglinton of WHOI and the Eidgenossische Technische Hochschule (ETH) in Zürich, Switzerland; and Roger Francois of the University of British Columbia, Canada are seeking to bridge this information gap through examination of biogeochemical fluxes in seasonally and permanently ice-covered regions of the Canada Basin. In particular, they are investigating the nature and effectiveness of the "biological pump" in removing carbon from the surface ocean and sequestering it in deep waters and underlying sediments. The biological pump is the process by which organic matter—produced as a result of photosynthetic carbon fixation by phytoplankton—is exported vertically to depth on settling particles. The research team is addressing two specific questions in this context:

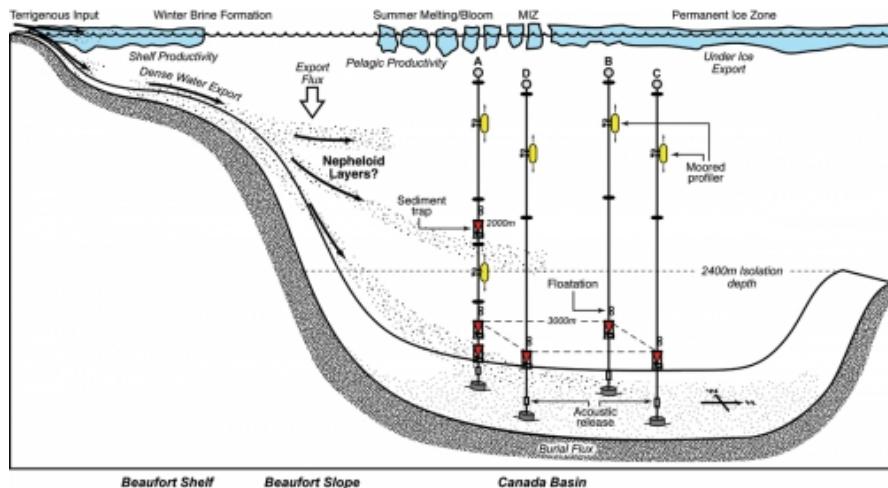
1. How do biogeochemical fluxes to the deep Arctic Ocean vary in response to sea-ice and hydrographic conditions?
2. What are the sources of particulate organic carbon, and what are the mechanisms of supply to the deep Arctic Ocean?



A time-series sediment trap being deployed in July 2010 as part of a mooring for the Beaufort Gyre Exploration Program cruise aboard the Canadian Coast Guard vessel Louis St. Laurent. Image courtesy: Daniel Montlucon, ETH Zurich.

Investigation of Carbon Fluxes in the Canada Basin

In collaboration with a team of U.S., Canadian, and Japanese research scientists, Eglinton, Manganini, and Francois deployed time-series sediment traps under seasonally and permanently ice-covered regions of the Canada Basin as part of the ongoing Beaufort Gyre Exploration Project (<http://www.whoi.edu/beaufortgyre/>). The traps are integrated into bottom-tethered moorings and configured to intercept particles reaching the basin interior at depths of 2,000 meters and greater. Despite the extreme challenges of mooring deployment and recovery in ice-laden waters, several years of hydrographic data and sediment trap samples were recovered. Multiple geochemical tracer approaches, including carbon 14 (^{14}C) and uranium series measurements, were combined with biogeochemical flux data and synchronous hydrographic measurements to delineate mechanisms that govern carbon export to the deep basin and establish the provenance of this carbon. The resulting data yielded new information into biogeochemical processes operating within the basin.



Potential modes of particle transport as suggested by a sediment trap pilot study in 2004-2005 and moored instrumentation deployed in the marginal ice zone of the deep Canada Basin at 4 sites (A, B, C, D); moored profilers highlighted in yellow, sediment traps in red. Image courtesy: Kack Cook, WHOI.



Sea Ice concentrations during ice minimum in September 2005, 2007, and 2008; and BGOS mooring locations A, B, C, D. The magenta line indicates the minimum extent of the ice cover for 1979-2000.
(Adapted from National Snow and Ice Data Center website)

A Dormant Biological Pump in the Central Arctic Ocean?

Initial results from a sediment trap deployment at 3,000 meters below the seasonally ice-free waters of the Southwest Canada Basin in 2004-2005 revealed two key observations. First, the overall fluxes of biogenic materials to the deep basin are extremely low. Second, old particulate organic ^{14}C ages and high proportions of lithogenic material indicate that 80% of the flux reflects re-suspended sediments emanating from the flanks of the basin and being transported laterally into the basin interior (Hwang et al., 2008).

Subsequent deployments and measurements expanded these investigations to encompass (a) intervals with markedly different ice coverage, (b) additional depths on the mooring in the southwest Canada Basin, and (c) other moorings currently under seasonal or perennial ice cover that are maintained as part of a Beaufort Gyre Observation System (BGOS). The new observations confirm that low particle fluxes are a widespread phenomenon in the central Canada Basin, and that recent changes in sea ice cover, including the record minimum sea ice extent in 2007, did not have a measurable influence on biogenic fluxes to the deep basin. Flux data from different moorings suggests that lateral particle supply is most pronounced in the southwest Canada Basin.

These and related observations collectively imply that the central Canada Basin is presently characterized by a very weak biological pump, which results in minimal export of particulate organic carbon and other biogenic materials from surface to deep waters (Honjo et al., 2010). It remains unclear how, when, and where environmental changes associated with arctic warming will influence the efficiency of the arctic biological pump. It seems likely that it may be invigorated if certain critical conditions change, such as an increased availability of nutrients in surface waters, or shifts in phytoplankton and

zooplankton community structure. More observations are needed to document and better understand the underlying processes, and to detect changes in the biological pump of the Arctic Ocean and its marginal seas.

For more information, contact Steve Manganini (smanganini@whoi.edu) or Tim Eglinton (teglinton@whoi.edu).

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Hwang, J., Eglinton, T.I., Krishfield, R.A., Manganini, S.J., and Honjo, S. 2008. Lateral organic carbon supply to the deep Canada Basin. *Geophys. Res. Lett.*, 35, L11607, doi:10.1029/2008GL034271.

Honjo, S., Krishfield, R.A., Eglinton, T.I., Manganini, S.J., Kemp, J.N., Doherty, K., Hwang, J., McKee, T.K., and Takizawa, T. June 2010. Biological pump processes in the cryopelagic and hemipelagic Arctic Ocean: Canada Basin and Chukchi Rise. *Progress In Oceanography*, Volume 85, Issues 3-4, pages 137-170.

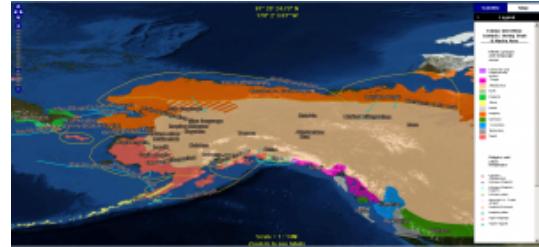
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Digital Language Research in the Arctic

The Arctic is home to over 40 indigenous languages from at least six unrelated language families: Uralic, Altaic, Chukotko-Kamchatkan, Eskimo-Aleut, Dene-Yeniseian, Yukagir, and Nivkh. Rapid change in the Arctic has led to the endangerment or extinction of these indigenous languages and the relative geographic isolation of the Arctic makes it difficult to track the languages and their changes.

Digital mapmaking tools have created new opportunities for integrated interdisciplinary research in linguistics. These advances allow investigators to focus on tracking not only the languages and their locations, but also their relevant history, climatology, and ethnography. At Eastern Michigan University's Institute for Language and Information Technology (ILIT), researchers are developing geolinguistic datasets for the Arctic as part of Integrating Cartographic Elements (ICE), a project supported by the Arctic Social Science Program in NSF's Division of Arctic Sciences. The data is then used to generate maps in combination with another NSF-funded ILIT project, Language and Location: A Map Annotation Project (LL-MAP).

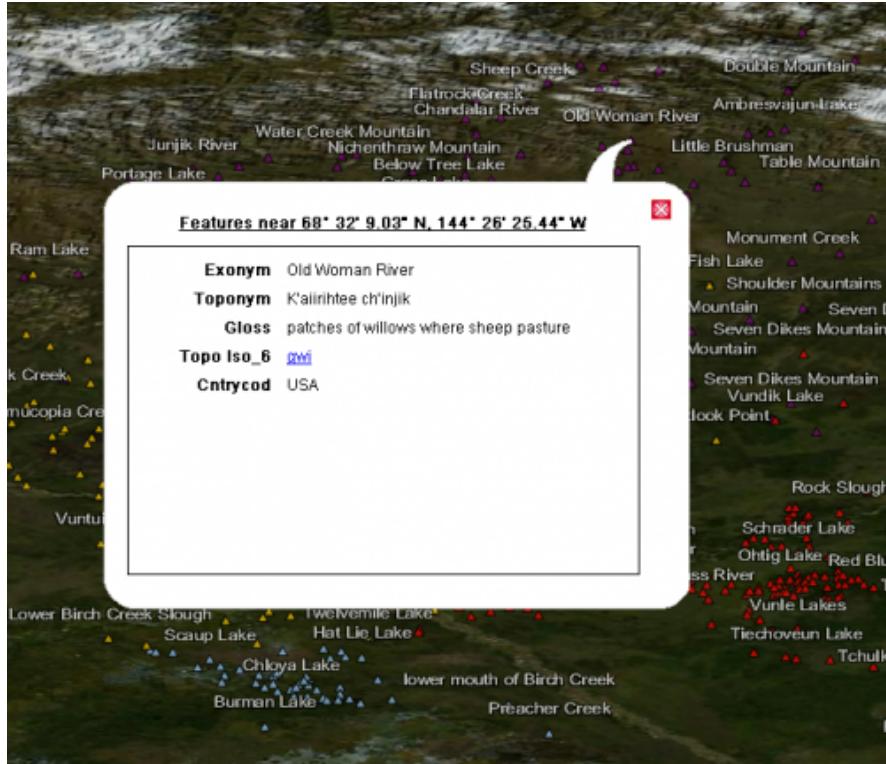
The maps provide a transparent way to organize and analyze diverse, cross-disciplinary data. ICE and LL-MAP researchers have converted over 500 static paper maps and other stand-alone data into interoperable digital datasets represented on a single base map. The collection is constantly being expanded through the digitization of new paper maps and other stand-alone datasets. Current projects include climatological maps from the Red Book of the People, which provides historical information about the languages of Siberia; and a set of Pleistocene paleogeographic maps, which cover global changes in sea-level dating back 100,000 years.



LL-MAP digitization of 'Eskimo Interethnic Contacts: Bering Strait and Alaska Area'. Image Courtesy: Language and Location: A Map Annotation Project.

During the research process, the ICE team discovered that some lesser-documented languages were not included in a system developed by the International Organization for Standardization (ISO) to provide a comprehensive list of codes for all living, extinct, ancient, and constructed languages. Whenever an unlisted language is encountered, ICE researchers submit a request for a new code to the ISO. This encourages scholarly recognition for the minority languages of the Arctic, and is in keeping with ILIT's mission of encouraging interoperability between language data and data from other fields.

Maps on specific topics can be located through searching (<http://llmap.org/search.html>) or browsing (<http://llmap.org/maps.html>) by country or language. Multiple maps can be layered in order to compare different datasets, such as the historical and modern locations of various languages.



Legend from 'Gwich'in Placenames: Variants of Placenames from neighbouring Alaskan village'. Image Courtesy: Language and Location: A Map Annotation Project.

In addition to the ICE and LL-MAP teams, the map collection is being expanded by users. The site includes a login feature called "Scholar's Workbench" (<http://llmap.org/account/login.html>), which allows users to create new maps by uploading geocoded data, or by layering existing maps.

For further information, please contact Helen Aristar-Dry, at hdry@linguistlist.org.

NSF Arctic Research Support and Logistics Contract Awarded

On 28 September 2011, NSF awarded CH2M HILL Constructors the Arctic Research Support and Logistics Contract to provide research support and logistics services for NSF-sponsored research in the Arctic. Since 1999, CH2M HILL has teamed with subcontractors Polar Field Services and SRI International to form CH2M HILL Polar Services (CPS). A new partner, UMIAQ, will join the CPS team for the contract period beginning in October 2011.

CPS will deliver pre-proposal fieldwork estimates, risk assessments, logistics and operational plans, transportation, communications, safety training, telemedicine, engineering, design and construction, maintenance, field camp operations, and personnel to groups working in the Arctic.

UMIAQ is a subsidiary of the Ukpigvik Inupiat Corporation (UIC), the Barrow village corporation established under the Alaska Native Claims Settlement Act (ANCSA) of 1971. UMIAQ will provide local support to researchers working in Barrow, Alaska and surrounding communities, including operation of UIC-owned facilities and the Barrow Environmental Observatory. UMIAQ understands the politics, culture, land use, regulations, and engineering and design conditions in arctic and subarctic Alaska and provides local knowledge and expertise.

For further information about CPS, please go to: <http://www.polar.ch2m.com/> or contact Mike McKibben, CPS Program Manager, at mike.mckibben@ch2m.com.

Implementation of the National Ocean Policy in the Arctic Region

In July 2010 the National Policy for the Stewardship of the Ocean, our Coasts, and the Great Lakes was established by President Obama through Executive Order to improve coordination of federal efforts and communication with state, local, and tribal governments in the management of ocean, coastal, and Great Lakes resources. Also known as the National Ocean Policy (NOP), it provides stewardship principles to guide resource management and establishes a flexible framework for effective coastal and marine spatial planning. The NOP identifies nine priority objectives to address the most pressing challenges facing these resources. The priorities are organized into two areas:

- How the Federal government does business:
 - Ecosystem-based management
 - Coastal and marine spatial planning
 - Inform decisions and improve understanding
 - Coordinate and support
- Areas of special focus:
 - Resiliency/adaptation to climate change and ocean acidification
 - Regional ecosystem protection and restoration
 - Water quality and sustainable practices on land
 - Changing conditions in the Arctic
 - Ocean, coastal, and Great Lakes observations and infrastructure

The "Changing conditions in the Arctic" priority is unique in that it is the only one that identifies a single region as an area of special focus.

The President also created the National Ocean Council in July 2010 to provide sustained high-level interagency coordination to advance the new national policy and to oversee development of implementation strategy plans for each of the nine priority objectives. These plans will identify specific and measurable near-, mid-, and long-term actions to be taken; include smaller-scale efforts to build on existing activities, as well as more complex, larger-scale actions; identify lead and participating agencies; identify gaps and needs in science and technology; and determine resource requirements including steps for integrating and coordinating budgets. Content outlines for each plan were drafted in spring 2011 and opened for public comment from 2 June–2 July 2011.

The objective of the arctic component of the implementation strategy is to address environmental stewardship needs in the Arctic Ocean and adjacent coastal areas in the face of climate-induced and other environmental changes. To meet this objective the draft outline presents six actions:

1. Improve arctic environmental response management;
2. Observe and forecast arctic sea ice;
3. Establish a distributed biological observatory;
4. Improve arctic communication;
5. Advance arctic marine mapping and charting; and

6. Improve coordination on Arctic Ocean issues.

The first full draft of the National Ocean Policy implementation strategy is expected to be made available for public review later this year. For more information about the policy, please go to: <http://www.whitehouse.gov/administration/eop/oceans>. For more information about the upcoming public comment period, and to read the full content outline of all nine plans, please go to: <http://www.whitehouse.gov/administration/eop/oceans/sap>.

Arctic Research Federal Funding Update for FY 2012

The Obama Administration's fiscal year (FY) 2012 budget request, released on 14 February 2011, would provide \$7.8 billion for NSF, an increase of 13% above the 2010 enacted level. This request includes \$477.41 million for NSF's Office of Polar Programs and \$112.94 million for the Arctic Sciences Division, 5.8% and 6.2% increases respectively over the level enacted for FY 2010. (*Note: a full-year continuing appropriations act, enacted on 15 April 2011, funded NSF at \$6.8 billion for FY 2011, a 1.5% reduction from the FY 2010 enacted spending level. FY 2011 ended on 30 September 2011.*)

The President's proposed budget for NSF's Division of Arctic Sciences would include funds for the new Discovery and Understanding in Polar Oceans program; the NSF-wide Science, Engineering, and Education for Sustainability (SEES) activities; and the NSF-wide Cyber-Infrastructure Framework for the 21st Century (CIF21) initiative. Also included are investments to enhance the efficiency, safety, and environmental footprint of activities at Summit Station in Greenland.

The polar icebreaking program operates under the Department of Homeland Security. The President's FY 2012 budget includes \$39 million to support operation and maintenance of the Coast Guard Cutter (CGC) *Healy* and to prepare for the operational reactivation of CGC *Polar Star*. The Coast Guard plans to decommission CGC *Polar Sea* in FY2011 and transition her crew to the *Polar Star* facilitating her return to operations in FY 2013.

On 6 September 2011 the Senate Committee on Appropriations forwarded to the Senate floor their FY 2012 appropriations bill for the Department of Homeland Security, which includes \$39 million for the U.S. Coast Guard icebreaker program. On 15 September 2011 the same committee passed a recommendation to fund NSF with \$6.698 billion, approximately \$162 million less than the level enacted for FY 2011 and \$1.069 billion below the Administration's budget request.

In June 2011 the House of Representatives approved its appropriations committee's FY 2012 Homeland Security bill, which included \$39 million for the Coast Guard's polar operations. In July 2011 the same committee recommended funding NSF at approximately the same level as enacted for FY 2011. The report's authors noted, "Compared to the amount requested by NSF for FY 2012, the funding level in the bill would lead to 2,200 fewer NSF grants and 26,000 fewer graduate students, undergraduate students, and teachers supported."

On 4 October 2011 Congress passed a second continuing appropriations act to keep government operations funded at FY 2011 levels until 18 November 2011 while it completes action on all appropriation bills for FY 2012. As of 3 November 2011, the Senate committee has completed work on 11 of the 12 bills required to fund federal agencies during FY 2012 and the House of Representatives had completed work on 9 of the 12 appropriation bills, recommending them for further action.

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

U.S. Arctic Research Commission: An Update from Fran Ulmer, Chair

In March 2011, I was appointed Chair of the U.S. Arctic Research Commission (USARC), which is a great honor and an opportunity to help achieve the goals of the Arctic Research and Policy Act of 1984—to advise both the President and Congress on national research policy and priorities for the Arctic. The Commission also offers recommendations to the Interagency Arctic Research Policy Committee (IARPC) and assists in developing agency plans to achieve improved arctic research programs. The Commission has identified five research goals, which are now evolving into a five-year Arctic Research Program Plan (the first since 2006) to be developed by IARPC. The research goals are:

- Environmental Change of the Arctic, Arctic Ocean, and Bering Sea;
- Arctic Human Health;
- Civil Infrastructure;
- Natural Resource Assessment and Earth Science; and
- Indigenous Languages, Cultures, and Identities.

In order for the USARC to become better informed about international efforts in the pursuit of the fifth goal, the Commission met in Iceland this summer at the Seventh International Congress of Arctic Social Sciences, organized by the International Arctic Social Sciences Association. We heard a wide variety of research presentations that provided inspiration for both the social scientists in attendance and our commissioners. Many of the key questions about human adaptation to climate change (e.g., subsistence food gathering, health, social organization, cultural disruption, resilience) reminded me of the importance of social science research and the need for more collaboration between social and climate scientists.

At the University of Alaska's Institute of Social and Economic Research, where I spent several years before becoming Chancellor at the University of Alaska Anchorage, we conducted pioneering research on the economics of infrastructure degradation due to climate change in Alaska. There is more work to be done throughout the Arctic if the four million people who live there are going to be better prepared socially, economically, and culturally for the changes ahead.

For that reason, among others, we are seeking more opportunities to work with other entities that have similar missions. An example is the Canadian Polar Commission (CPC), which is responsible for arctic and Antarctic research policy for Canada. The USARC will meet with the CPC for the first time in January 2012 in Washington, D.C. and subsequently in Montreal at the International Polar Year conference, "From Knowledge to Action," in April 2012. We hope to develop a productive partnership to benefit research in both countries.

Major initiatives are underway at the federal level to focus attention and effort on the Arctic, and to better integrate information and results into the decisions facing policy makers. In addition to a re-invigorated IARPC under the leadership of both NSF and the White House Office of Science and Technology Policy, an example is the new National Ocean Policy announced by President Obama. This policy calls for nine strategic action plans to implement the policy, and one of these is focused on "Changing Conditions in the Arctic." The Arctic is the only geographic region that warrants a specific action plan. The USARC's executive director, John Farrell, co-chaired the writing team that has worked hard to bring the local, state, federal, and public comments together in a balanced plan of action. The first full draft of the plan will be available for public review in late 2011. The latest information on the National Ocean Policy can be found at:

<http://www.whitehouse.gov/administration/eop/oceans>

Arctic-related information about other initiatives, programs, conferences, and news items are available in the USARC's Arctic Daily Update. If you are interested in subscribing to it, please do so at: <http://www.arctic.gov>. An archive of updates is also maintained at this site.

The USARC is a unique federal entity with the opportunity to bring more clarity to the conversation about the emergence of the Arctic as an area of tremendous potential. The Arctic is both valuable and vulnerable, and as such, needs intentional policymaking, which can best be shaped and informed by relevant timely research. As chair, I hope to help bring more people, more ideas, and more energy to that synthesis of need and opportunity.

For more information, see the USARC website: <http://www.arctic.gov> or contact Frances Ulmer (fran.ulmer@arctic.gov).

Editor's note: More information on the IARPC Arctic Research Program Plan is expected following the 7 November 2011 IARPC Principals meeting.

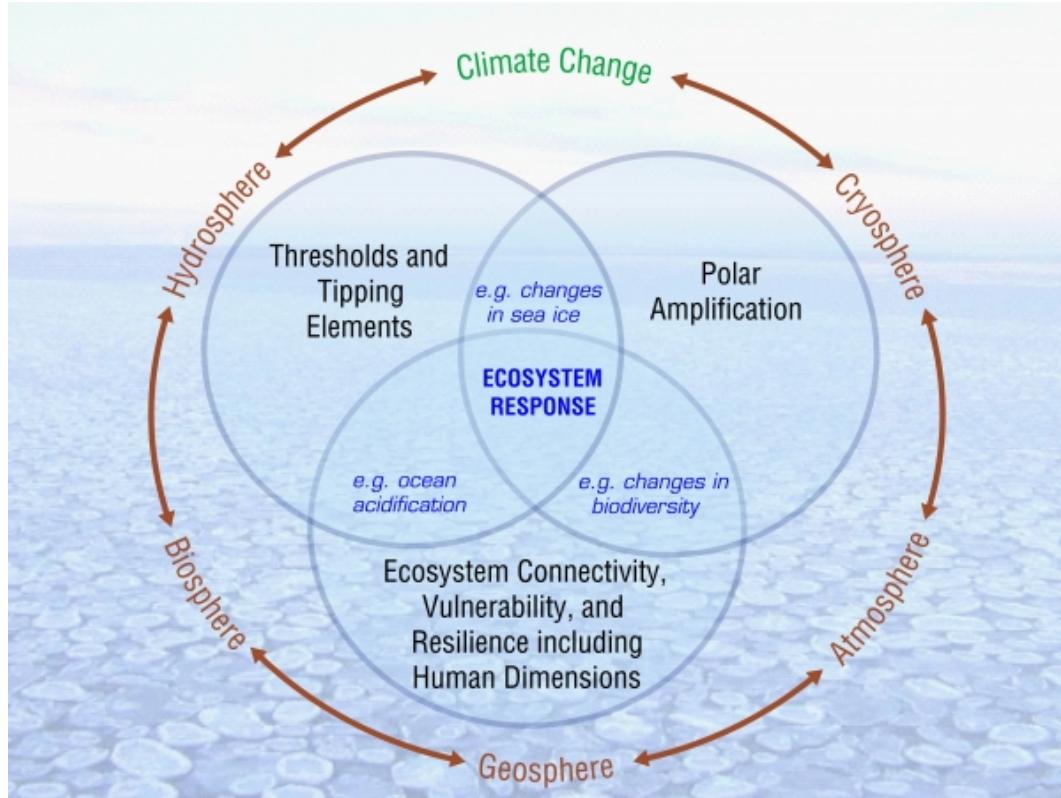
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Polar Research Board Releases Report on Frontiers in Climate Change and Polar Ecosystems

In May 2011, the Polar Research Board (PRB) of the U.S. National Academy of Sciences issued a workshop report that identifies a set of frontier research questions intended to help scientists better understand the impacts of climate change on polar ecosystems. The report, *Frontiers in Understanding Climate Change and Polar Ecosystems*, illustrates many of the observable impacts of climate change already occurring in the polar regions and builds on this knowledge to highlight the major topics in polar ecosystem science to be addressed in the coming decades.

The PRB workshop was held in August 2010. It brought together scientists from academic institutions, federal agencies, and other organizations to identify and address frontiers in climate change and polar science. Speakers presented case studies and examples of recent changes in arctic and Antarctic marine and terrestrial ecosystems. Participants were asked to use this information and identify areas of research needed to advance scientific understanding of the rapid changes occurring in polar ecosystems. Participants considered the five interdisciplinary frontier questions that emerged from workshop discussions to be globally significant, relatively unexplored, challenging, urgent, and at the forefront of this expanding field of knowledge. The frontier questions are:

- ***Will a rapidly shrinking cryosphere tip polar ecosystems into new states?*** The loss of cryosphere is recognized as an important indicator of change in the polar regions and could have significant implications around the globe. Declining ice sheets and sea ice are critically important when considering (potentially irreversible) tipping points and thresholds that may alter ecosystems and push them into new states.
- ***What are the key polar ecosystem processes that will be the "first responders" to climate forcing?*** Understanding the linkages and interactions among components of polar ecosystems is crucial in the development of climate models that accurately predict future change. Perturbations to one part of the system can cause a cascade of impacts throughout the system.
- ***What are the bi-directional gateways and feedbacks between the polar and the global climate system?*** Complex connections and feedbacks in ecosystem processes require research and collaboration among many disciplines to improve scientific understanding of the bi-directional gateways of connectivity among ecosystem components in the global system. Examples of bi-directional gateways that need additional research include sea level rise, ocean circulation, the albedo effect, and biome shifts and migration patterns.
- ***How is climate change altering biodiversity in polar regions and what will be the regional and global impacts?*** Rapid changes in the polar regions associated with shifting climate patterns present serious complications for both marine and terrestrial organisms. Changes in productivity and migration could threaten biodiversity in ways that we do not yet understand.
- ***How will increases in human activities intensify ecosystem impacts in the polar regions?*** Increased access to the polar regions as a result of climate change will result in increased human activity (e.g., fishing, tourism, and resource extraction). Human presence in these regions can mean additional risk in the form of oil spills, invasive species, and disturbances to wildlife.



This figure illustrates the connectivity among earth system components and climate change in the context of three themes developed for the workshop. Image courtesy: Frontiers in Understanding Climate Change and Polar Ecosystems: Report of a Workshop.

In addition to identifying the frontier questions, participants also considered various methods and technologies that will be useful to advance future research in polar ecosystem science. An effective approach to answering the questions includes a holistic, interdisciplinary systems understanding of ecosystem responses to change. Research needs include:

- Emerging technologies such as improvements in genomics, remote sensing, and in situ instrumentation;
- Sustained long-term observations including in situ observations, monitoring impacts on people, biological sentinels and proxies, biotic community composition, and a marine Long Term Ecological Research program (LTER) in the Arctic;
- Data synthesis and management such as international coordinated efforts and a Polar Systems Institute; and
- Data dissemination and outreach.

Workshop participants emphasized the importance of these key methods and noted that in many cases they represent enhancements to existing tools. Using developing technologies, observations, and data management systems to address the frontier questions, this report suggests a way forward in the coming decades at the intersection of polar ecosystems and global climate change.

The workshop report is available at: http://www.nap.edu/catalog.php?record_id=13132. To purchase paper copies, please contact the National Academies Press at: 888-624-8373.

The PRB is a unit within the National Academies and is responsible for studies related to the Arctic, Antarctic, and cold regions in general. More information about the PRB and other related activities can be found at: <http://dels.nas.edu/prb/>.

International Study of Arctic Change (ISAC) Updates

International Collaboration Meeting Report

The International Study of Arctic Change (ISAC), in partnership with the Study of Environmental Change (SEARCH) and supported by the International Arctic Research Center (IARC), held a meeting 30 May-1 June 2011 focused on international collaboration and cooperation in arctic environmental change programs. A report on this meeting, with recommendations for the development of an Arctic Observing Summit and a series of Responding to Change workshops, is available at: <http://www.arcticchange.org>.



International Study of Arctic Change

2012 Responding to Change Workshop Opportunity

The International Study of Arctic Change (ISAC, www.arcticchange.org), in partnership with the School of Policy Studies at Queen's University, announces a Responding to Arctic Change Workshop, to be held 30 January–1 February 2012 at Queen's University in Kingston, Canada. This workshop is the first in a planned series, the aim of which is to collectively shape and coordinate initiatives for applied arctic research. The long-term objective is to enable local people, arctic nations, and the wider global community, including the scientific community, to better respond to a changing Arctic. Participation is open to all interested, with participant numbers capped at 100. In preparation for this first workshop, two open international planning meetings were recently held to solicit input on topics and emphasis. These reports are available for download at www.arcticchange.org. More workshop details will be made available through [ArcticInfo](#) and at the ISAC website in the next weeks.

New International Partnerships

As part of a growing portfolio of partnerships, ISAC recently signed a letter of cooperation with the International Network for Terrestrial Research and Monitoring (INTERACT; <http://www.eu-interact.org/>) to work together on common goals of observing, understanding, and responding to arctic change. ISAC continues to grow and the International Program Office in Stockholm will be hiring new staff in the coming months.

For further information about ISAC, please go to: <http://www.arcticchange.org> or contact Maribeth Murray, ISAC Executive Director (murray@arcticchange.org).

ARCUS Welcomes New Education Project Manager

In September 2011 Sarah Crowley joined the ARCUS staff as Education Project Manager. Sarah replaces Kristin Timm, who received a fellowship to pursue her graduate studies at the University of Alaska Fairbanks.

Selected from a highly competitive field of applicants, Sarah stood out as uniquely qualified for the position. She has a teaching career in experiential education, a graduate residency in environmental education, and for the past three years worked as a science educator at the Murie Science and Learning Center in Denali National Park and Preserve. While there she trained staff on park science and climate change programs and developed teacher-training courses integrating classroom teaching and polar science topics.

At ARCUS she will team with Janet Warburton in guiding the development and management of the PolarTREC program. We are fortunate to have Sarah's talents, energy, and intelligence as an addition to our already highly talented and efficient staff. I know you will enjoy interacting with her as much as we enjoy working with her. Welcome, Sarah!