

Arctic Observing Summit 2013

1st Biennial Arctic Observing Summit
Vancouver, British Columbia, Canada
Hyatt Regency, 30 April – 2 May 2013



Hosted by the International Study of Arctic Change (ISAC)
Fairbanks, Stockholm, Qingdao



TABLE OF CONTENTS

Conference Agenda	p. 3
Poster Abstracts	p. 6
Sponsors	p. 23
Organizing Partners	p. 24
Floor Plan	p. 25

CONFERENCE AGENDA

TUESDAY, 30 APRIL 2013	
08:00-08:45	Poster set up (<i>Regency A/B</i>)
09:00-09:10	Welcome and Introduction (<i>Regency C</i>) <i>Martin Jakobsson</i> , Stockholm University
09:10-09:20	Motivation and expected outcome of the AOS 2013 <i>Craig Lee</i> , University of Washington; <i>Jinping Zhao</i> , Ocean University of China
09:20-10:20	Keynotes 1: Motivation for establishment and coordination of an international Arctic Observing Network Moderator: <i>Jean Claude Gascard</i> , Université Pierre et Marie Curie (09:20) - <i>Tom Armstrong</i> , Director, National Coordination U.S. Global Change Research Program, White House Office of Science and Technology Policy (SAON) (09:35) - <i>Peter Schlosser</i> , Deputy Director and Director of Research, Earth Institute, Columbia University (09:50) - <i>Martin Visbeck</i> , Professor, Ocean Circulation and Climate Dynamics, GEOMAR/Helmholtz Centre for Ocean Research, Kiel (Future Earth)
10:20-10:45	Coffee Break (<i>Regency Foyer</i>)
10:45-11:00	<i>Paul Holthuis</i> , World Ocean Council
11:00-12:00	Panel 1: Perspectives on Arctic Observing Needs (<i>Regency C</i>) Moderator: <i>Volker Rachold</i> , International Arctic Science Committee <i>Carolina Bebe</i> , Inuit Circumpolar Council - Alaska, USA <i>Hiroyuki Enomoto</i> , National Institute of Polar Research, Arctic Environmental Research Centre, Japan <i>Justin Hack</i> , Socio-Economic Monitoring Analyst, Nunavut General Monitoring Plan, Aboriginal Affairs & Northern Development Canada <i>Eva Krummel</i> , Inuit Circumpolar Council - Canada <i>Hyoung Chul Shin</i> , Chief International Cooperation Officer, KOPRI, Korea <i>David Stanners</i> , Head of International Cooperation, European Environment Agency
12:00-12:30	AOS Themes, Draft Findings and Recommendations from White Papers <i>Craig Lee</i> , University of Washington - Introduction to Themes <i>Hajo Eicken</i> , UAF Status of the Observing System <i>Martin Jakobsson</i> , Stockholm University <i>Maribeth Murray</i> , University of Alaska Fairbanks <i>Craig Lee</i> , U of Washington, Observing System Support and Data
12:30-13:30	Lunch (<i>Regency D</i>)

Arctic Observing Summit 2013 - Conference Program and Abstracts

TUESDAY, 30 APRIL 2013	
13:30-13:45	Working Sessions - Organization and Charge for Working Session 1 and 2 (<i>Regency C</i>) <i>Hajo Eicken</i> , University of Alaska Fairbanks
13:45-14:45	Working Session (<i>Breakout rooms as assigned</i>)
14:45-15:15	Coffee Break (<i>Regency Foyer</i>)
15:15-16:30	Working Session (<i>Breakout rooms as assigned</i>)
16:30-17:30	Plenary (<i>Regency C</i>) Moderator: <i>Martin Fortier</i> , ArcticNet (Network of Centres of Excellence Canada) (16:30) Reports from Working Session 1 and discussion. (17:00) Reports from Working Session 2 and discussion.
17:30-19:30	Reception and Poster Session (<i>Regency Foyer, Regency A/B</i>)
WEDNESDAY, 1 MAY 2013	
09:00-09:10	Introduction to Day 2 and Recap of Day 1 (<i>Regency C</i>) <i>Martin Jakobsson</i> , Stockholm University
09:10-09:50	Keynotes 2 – Stakeholder and Agency Perspectives on Building Observing Networks Moderator: <i>Jean Claude Gascard</i> , Université Pierre et Marie Curie (09:10) <i>Vera Metcalf</i> , Director, Eskimo Walrus Commission, Alaska, USA (09:30) <i>Yuichi Inoue</i> , Director, Ocean and Earth Division, Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology, Japan
09:50-11:00	Panel: Agency Perspectives on Arctic Observing, Coordination and International Collaboration Moderator: <i>Leif Anderson</i> , University of Gothenberg <i>Cynan Ellis-Evans</i> , National Environmental Research Council, Arctic Office, British Antarctic Survey, UK <i>Franz Immler</i> , Arctic Portfolio, Climate Change and Natural Hazards, EU Commission <i>Erica Key</i> , Arctic Division, National Science Foundation, USA <i>Danielle Labonté</i> , Aboriginal Affairs and Northern Development Canada/Canada High Arctic Research Station, Can. <i>Cmd. Blake McBride</i> , Office of Naval Research Global, USA <i>Cheryl Rosa</i> , US Arctic Research Commission, USA <i>Jostein Sundet</i> , Special Adviser Research Council of Norway, Dept. for Polar and Climate Research
11:00-11:15	Coffee Break (<i>Regency Foyer</i>)
11:15-11:30	Charge for Working Sessions 3 and 4 (<i>Regency C</i>) <i>Hajo Eicken</i> , University of Alaska Fairbanks
11:30-12:30	Working Session (<i>Breakout rooms as assigned</i>)
12:30-13:30	Lunch (<i>Regency D</i>)

Arctic Observing Summit 2013 - Conference Program and Abstracts

WEDNESDAY, 1 MAY 2013	
13:30-14:10	<p>Keynotes 3. Lessons on Network Design (<i>Regency C</i>)</p> <p>Moderator: <i>Jean Claude Gascard</i>, Université Pierre et Marie Curie</p> <p>(13:30) <i>Terry Callaghan</i>, Professor, Department of Plant and Animal Sciences, University of Sheffield, UK (SCAN-NET/INTERACT)</p> <p>(13:50) <i>Martin Fortier</i>, ArcticNet (Network of Centres of Excellence, Canada)</p>
14:10-15:00	Working Session (<i>Breakout rooms as assigned</i>)
15:00-15:15	Coffee Break (<i>Regency Foyer</i>)
15:15-16:45	Working Session (<i>Breakout rooms as assigned</i>)
16:45-17:30	<p>Plenary - Reports from Working Sessions (<i>Regency C</i>)</p> <p>Moderator: <i>Martin Fortier</i>, ArcticNet (Network of Centres of Excellence Canada)</p>
THURSDAY, 2 MAY 2013	
09:00-09:15	<p>Plenary - Introduction to Day 3 and Recap (<i>Regency C</i>)</p> <p><i>Peter Schlosser</i>, Columbia University</p>
09:15-09:45	<p>Short talks on Network Design and Implementation</p> <p>Moderator: <i>Hanne Sagen</i>, Nansen Centre</p> <p>(09:15) <i>Jun Inoue</i>, National Institute of Polar Research, Japan</p> <p>(09:30) <i>Mike Gill</i>, Circumpolar Biodiversity Monitoring Program, Canada</p>
09:45-10:00	<p>Charge for Working Session (<i>Regency C</i>)</p> <p><i>Hajo Eicken</i>, University of Alaska Fairbanks</p>
10:00-10:45	Breakout
10:45-11:00	Coffee Break (<i>Regency Foyer</i>)
11:00-11:30	Working Session 5
11:30-12:00	<p>Reports from Working Session 5 (<i>Regency C</i>)</p> <p>Moderator: <i>Martin Fortier</i>, ArcticNet (Network of Centres of Excellence Canada)</p>
12:00-13:00	Lunch (<i>Regency D</i>)
13:00-14:00	<p>Plenary Discussion (<i>Regency C</i>)</p> <p>Moderator: <i>Craig Lee</i>, University of Washington</p>
14:00-15:00	Wrap up and directions for AOS 2014. Adopt findings and recommendations. Closing.
15:30-17:00	AOS Report writing teams convene (<i>Oxford Room</i>)

Poster Abstracts

MULTI-PLATFORM MONITORING OF PHYTOPLANKTON IN THE ARCTIC OCEAN

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Recent studies based on the use of ocean color remote sensing data suggest that, at least in some parts of the Arctic Ocean, primary production is currently increasing because of the decrease in the extent of the ice pack during summer. Most of annual primary production is achieved by phytoplankton during the spring bloom, a highly transient event in Arctic that happens both under the ice pack and at the ice-edge. Our understanding of the dynamics of this phenomenon remains limited. Therefore, one cannot predict how the spring bloom will evolve over the next decades. In this poster, we present an overview of various autonomous platforms and sensors that can be used to better monitor the Arctic phytoplankton spring bloom and the physical and chemical properties that control it. We also discuss the limitations and capabilities of new technologies, and identify the critical needs for improvements.

THE CPR AS A MONITORING TOOL FOR LOWER TROPHIC LEVELS IN THE ARCTIC

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CPRs have been towed in several of the world's oceans for multiple decades; the North Atlantic for over 80 years, Southern Ocean for over 20 years and North Pacific for over 12 years. It is a tried and tested, cost-effective, robust sampling system ideal for towing behind commercial ships or research ships travelling between distant stations. Instrumentation can also be added to the CPR to record

in situ physical variables. Data from CPR sampling have led to new insights in plankton species distributions and lower trophic level response to variability in ocean climate forcing at several time scales. One relevant example was the discovery in the late 1990s that a diatom common in the North Pacific was now found in the North Atlantic for the first time in 800,000 years. Movement of species between oceans is likely to become more common as an ice-free North West passage becomes both more persistent and more increasingly used. The CPR was towed in the Arctic in 2012 as part of an ocean acidification study and is scheduled to be deployed later this year, towed behind the yacht Tara, on a circumpolar Arctic voyage for the first time. SAHFOS would welcome an opportunity to have a role in establishing regular monitoring of Arctic plankton.

RECENT POLAR INSTRUMENTATION DEVELOPMENTS USING LOW COST, NEW ACCESS METHODS VIA IRIDIUM SHORT BURST DATA (SBD)

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Recent advances in low-power communications using the new Iridium data capabilities now available (SBD, SMS) has allowed the development of systems that can stream transmit data (and receive commands) reliably in real time from very remote locations. This has allowed the development of sites or systems where one can put up instruments (cameras, gps, weather monitors, etc.) to collect data and not need to return to the site for data download. This has then expanded the possibilities where sites can be located by either removing the logistical costs of returning or being able to put sites where it would be too dangerous to return (tip of surging glaciers, crevasse locations, volcanoes, etc.).

POLISH RESEARCH ACTIVITIES IN THE SVALBARD REGION, NORDIC SEAS AND ARCTIC OCEAN

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Although not an Arctic country, Poland has a long history of active participation in Arctic research. Most of modern Polish observational activities are focused in the Svalbard region and Nordic Seas. The land based science is led by the operating year-round Polish Polar Station located in Horsund, the southernmost fjord of the West Spitsbergen, and supported by several seasonal field stations in the Svalbard region. A wide range of geophysical and environmental studies is carried on, including the long-term atmospheric, space physics, seismic, glaciological, hydrological, biochemical, and geomorphological observations. In the ocean domain, for over 20 years the annually repeated summer surveys of RV Oceania, operating in the open ocean and along the marginal ice zone in the Nordic Seas, Fram Strait and southern Nansen Basin, have been providing long-term observational data for physical oceanography, marine physics, air-sea interactions, biochemistry, marine ecosystem and climate studies. Additionally, land-based fieldwork has been carried out to study oceanography and ecosystems of the west Spitsbergen fjords. The poster will review the up-to-date status of Polish observational activities in the Svalbard region, Nordic Seas and Arctic Ocean, and their links to international Arctic observing networks.

ARCTIC THROUGH A NEW EYE: INTEGRATING AND VISUALIZING ARCTIC DATA

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Although advances in ocean observing continue to increase our understanding of Alaska's marine environment, a concerted effort is needed to integrate and maximize the benefits of existing data, which is often unavailable or underused in planning and decision-making processes. The Alaska Ocean Observing System (AOOS) is actively developing and refining interactive online data tools to assist researchers, coastal managers, mariners, regulators, and the general public. This poster

will highlight: (1) a Real-time Sensor Map streaming data from over 4,500 sensors statewide; (2) a Model Explorer displaying circulation and other operational models and remote sensing products on a single interface; (3) a Research Assets Map showing the location and type of instruments and monitoring transects conducted by multiple entities; (4) the AOOS Arctic Portal, allowing the overlay of GIS layers, satellite imagery, real-time sensors, and forecast models; (5) the Cook Inlet Response Tool, similar to the Arctic Portal but incorporating special layers such as ShoreZone imagery, videography, and response-specific information; and (6) the Research Workspace, a web-based collaborative tool to aid integration efforts within research communities. The applications for these types of tools are numerous – for researchers as well as community or agency managers, planners or other marine users.

COMMUNITY-BASED MONITORING OF CLIMATE CHANGE IMPACTS ON BERRY PRODUCTIVITY IN THE ARCTIC: INTEGRATION OF SCIENCE AND LOCAL KNOWLEDGE

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Berry shrubs are important circumpolar species that possess high nutritional value, which benefits both animals and northerners. Berry picking is a significant traditional activity in modern Inuit communities across the Canadian Arctic. Little is known about the impact of ongoing environmental changes on the productivity and the availability of culturally important berry shrubs. In order to fill this gap, a network of community researchers was developed as part of an International Polar Year project to maintain a sustainable community-based environmental monitoring program assessing climate change impacts on vegetation, particularly on berry productivity and shrub growth, using scientific studies and Inuit traditional knowledge. Since 2008, high school science classes in 10 communities and researchers in 3 field stations have monitored berry productivity following a standard

protocol. Interviews with elders in each community were conducted to determine changes in berry production and environmental variables. In September 2012, the berry-monitoring program was integrated into the high school science curriculum for all schools in Nunavik. The goal of the project is to maintain a sustainable monitoring program involving students and communities for a better understanding of Arctic vegetation and environmental change and the integration of science and local knowledge.

THE ARCTIC COMMITTED CLIMATE CHANGE PLANETARY EMERGENCY

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This poster presentation shows the link between committed global warming, loss of Arctic albedo cooling, Northern hemisphere extreme heat and drought, and Arctic methane emissions. All sources of Arctic albedo are rapidly melting. Some research concludes the Arctic summer sea ice past its ice free tipping point in 2007. The Arctic is warming three times as fast as the global average warming. Global warming is committed to increase several times today's warming. All Arctic sources of methane are emitting more methane as the Arctic warms rapidly. This presents two emergency situations. Increasing Northern hemisphere extreme weather, as the Arctic snow and sea ice melts, threatens the planet's best food best producing regions in the Northern hemisphere. Atmospheric methane, having increased two and a half times with industrialization, since the 2007 has been on sustained renewed increase due to planetary feedback emissions, with at least a significant contribution from the Arctic. Thawing permafrost is releasing methane, carbon dioxide and nitrous oxide. The assessment of this planetary emergency is hampered by a lack of Arctic monitoring of all the above factors, particularly Arctic greenhouse gas emissions.

EVALUATION OF MODIS SNOW AND LST IN ARUNACHAL PRADESH, OF EASTERN HIMALAYA: HEAT PUMP OR FREEZER

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Moderate Resolution Imaging Spectroradiometer (MODIS) is a key instrument aboard the Terra (EOS

AM) and Aqua (EOS PM) satellites. Terra's orbit around the Earth is timed so that it passes from north to south across the equator in the morning, while Aqua passes south to north over the equator in the afternoon (<http://modis.gsfc.nasa.gov/about/>). Terra MODIS and Aqua MODIS are viewing the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands, or groups of wavelengths. These data will improve our understanding of global dynamics and processes occurring on the land, in the oceans, and in the lower atmosphere. MODIS is playing a vital role in the development of validated, global, interactive Earth system models able to predict global change accurately enough to assist policy makers in making sound decisions concerning the protection of our environment. MODIS will be launched as part of the first Earth Observing System (EOS) platform in 1998 with a capability to study geophysical features globally (Salomonson and Toll, 1991), including mapping the areal extent and reflectance of global snow cover on a daily basis. The NSIDC (National Snow Information Centre) archives and snow cover and sea ice data products from the MODIS sensor on NASA's EOS Aqua and Terra satellites. Many areas of the world rely on snowmelt for irrigation and drinking water and must monitor snow packs closely throughout the winter and spring for assessment of water supply (Carroll et al., 1989). The mapping of snow covered area (SCA) is important for the prediction of snow melt and flooding. The Land Processes Distributed Active Archive Center (LP DAAC) also a component of NASA's Earth Observing System Data and Information System (EOSDIS). LP DAAC processes, archives, and distributes land data and products derived from the EOS sensors. The LP DAAC (<https://lpdaac.usgs.gov/about>) handles data from three EOS instruments aboard two operational satellite platforms: ASTER and MODIS from Terra, and MODIS from Aqua. ASTER data are received, processed, distributed, and archived while MODIS land products are received, distributed, and archived. Both data sets are vital contributors to the inter-disciplinary study of the integrated Earth system. To evaluate the MODIS snow and LST characteristics, a time interval covered a period of 6 years from 2003 to 2011 were utilised.

USING TRADITIONAL KNOWLEDGE AND SCIENTIFIC APPROACHES TO ENGAGE YOUTH IN COMMUNITY-BASED MONITORING IN KUGLUKTUK, NUNAVUT, CANADA

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Integration of Traditional Ecological Knowledge (TEK) with scientific data provides a more complete understand the changing environment in the Canadian Arctic. There is great opportunity to sustain community-based monitoring initiatives by collaborating with Territorial education systems. Culturally important berry species are influenced by seasonal conditions such as temperature, precipitation, and soil moisture. Thus, berry productivity can be used as an indicator for environmental change making it an ideal subject for a long-term monitoring program. The main objectives for this study are to: (1) maintain a community-based monitoring program using the annual productivity of *Vaccinium vitis-idaea* (Kingminat, Cranberry), *Empetrum nigrum* (Paun'ngait, Crowberry), *Vaccinium uliginosum* (Kigutaginak, Blueberry) and *Rubus chamaemorus* (Akpik, Cloudberry); (2) engage youth in environmental education by delivering and evaluating outdoor science courses that focus on environmental monitoring; and (3) compile TEK data regarding Inuinaqtun berry vocabulary, usages and stories into bilingual educational material. This collaborative research will help to monitor and further our understanding of the effects of environmental change and has the potential to increase the capacity of youth to engage in culture, science and technology.

SIZONET: INDIGENOUS AND GEOPHYSICAL OBSERVATIONS OF ARCTIC SEA-ICE VARIABILITY AND CHANGE

Eicken, Hajo¹ (hajo.eicken@gi.alaska.edu), Mette Kaufman¹, Igor Krupnik², Peter Pulsifer³, Leonard Apangalook⁴, Paul Apangalook⁴, Winton Weyapuk, Jr.⁵, Joe Leavitt⁶, Matthew Druckenmiller³

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Over the past three decades, the Pacific Arctic sector has experienced some of the most pronounced changes in sea-ice cover anywhere in the Arctic. We analyze community-based observations by Alaskan indigenous ice experts, satellite data and ground-based measurements to

begin assessing impacts of ice-cover changes on coastal communities and ecosystems on seasonal to decadal timescales. Observations are based on ice uses and information about ice conditions, weather, ocean state and animal behavior that is relevant to hunters and community members. Daily logs kept during the ice season have been archived since 2006, with key variables extracted for sub-categories pertaining to weather and ice observations, ice-related activities and wildlife. The poster discusses aspects of data management and multiple uses of such observations as relevant to the aims of the Arctic Observing Summit.

NEW MOVEMENT OF JAPANESE ARCTIC RESEARCH ACTIVITY

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Japan has started new Arctic research activities recently. GRENE-Arctic project is a new initiative of Arctic study by more than 30 Japanese universities and institutes as the flame work of GRENE (Green Network of Excellence) of MEXT (Ministry of Education, Culture, Sports, Science and Technology, Japan). The new Arctic Climate Change Research Project "Rapid Change of the Arctic Climate System and its Global Influences" has started in 2011 with strategic research targets: - Understanding the mechanism of warming amplification in the Arctic - Understanding the Arctic system for global climate and future change - Evaluation of the effects of Arctic change on weather in Japan, marine ecosystems and fisheries - Prediction of sea Ice distribution and Arctic sea routes. Japanese Arctic resaxhers has established Japan Consortium for Arctic Environmental Research (JCAR) since 2011. Almost 300 researchers join JCAR are excahging information for Arctic study and discussing long-term program for Arctic research.

IISPACS - ISOTOPIC INVESTIGATION OF SEA ICE AND PRECIPITATION IN THE ARCTIC CLIMATE SYSTEM

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iisPACS is a pan-Arctic, storm-by-storm study of stable isotopic ratios in precipitation. The objective is to investigate and quantify how sea ice changes on various time and spatial scales affect the Arctic hydrological cycle, predominantly evaporation and precipitation, and how that may affect future climate change. Currently, nine Arctic stations are active, including Barrow, Atkasuk and Fairbanks, Alaska; Cherskii and Tiksi, Russia; Cambridge Bay, Canada; Ny Alesund, Norway; and Ikerasaarsuk and Summit, Greenland. The project is designed to investigate the hypothesis that opening of sea ice results in increases in northern sea surface evaporation, and in turn precipitation in the Arctic, possibly leading to increase in albedo and cooling. Given the difficulty of measuring evaporative fluxes and precipitation amounts in the Arctic environment, this project seeks to quantify them indirectly using stable isotopic variations in precipitation, which is controlled, among other variables, by moisture source conditions, such as temperature, humidity, wind, and sea ice concentration. This pan-Arctic, storm-by-storm sampling design allows integrated analysis of moisture sources over different time and spatial scales. Temporally, information over inter-storm, seasonal, and interannual time scales can be extracted. Spatially, the pan-Arctic coverage allows analysis along storm tracks and under different atmospheric circulation modes.

TRACKING THE BIOLOGICAL CARBON PUMP IN A CHANGING ARCTIC OCEAN THROUGH OPTICAL PROFILERS AND SEDIMENT TRAPS

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The biological pump is the process by which organic carbon derived from marine productivity is transported from the ocean surface to depth, primarily via the sinking of phyto-aggregates and zooplankton detritus. This downward export creates an indraft of CO₂ from the atmosphere to the ocean, while the sinking flux serves as the main food source for benthic animals. Understanding how the Arctic biological pump responds to warming, sea ice decline and increased terrigenous inputs is a critical issue for our comprehension of ecological and biogeochemical shifts in the Arctic Ocean. This poster presents a complementary methodological approach to monitor the biological pump in the Arctic in rapid transition, which enables tracking both long-term trends and transient events in particle fluxes. The seasonal variability in vertical carbon flux is assessed with sediment traps attached to mooring arrays, which represent a powerful approach to capture the inter-annual signal of the Arctic biological pump (cf. Forest et al., white paper submitted to AOS 2013); whereas hourly-to-daily fluctuations and spatial heterogeneity are detected with an Underwater Vision Profiler – an optical instrument specifically designed to record large sinking particles. An overview of the upcoming ArcticNet and Tara-Arctic expeditions within which these approaches are used will be presented.

THE POLAR ARCHAEOLOGY NETWORK: OBSERVING NEEDS FOR ARCTIC HERITAGE AND PALEOECOLOGICAL RESOURCE CONSERVATION MANAGEMENT

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Archaeological sites in the Arctic and Subarctic hold a critically important record of historical data in two categories. First, are cultural materials associated with a wide range of peoples inhabiting the region, from the Pleistocene to the twentieth century. Much of this record is irreplaceable; and in conjunction with modern peoples' traditional knowledge, it can be used to reconstruct the cultural and social histories of the circumpolar Arctic. Moreover, for northern peoples, a strong connection to history and traditional culture is an important element of identity and well-being. Second, over millennia, northern peoples accumulated and concentrated zoological, botanical, and microbial organisms in their settlements. These biological materials do not survive in most other contexts, but dry and cold conditions, and incorporation into permafrost in arctic archaeological sites, allows their preservation. These biological data are useful for the reconstruction of paleoclimate, and of marine and terrestrial ecosystem structure and function. However, this important record is at risk from a host of climate-related changes including rising sea levels, melting permafrost, and increased shipping and economic development. This poster outlines these factors, and describes the role of the Polar Archaeology Network in mitigating their most severe impacts on the arctic archaeological record.

ARCTIC CULTURAL HERITAGE AT RISK (ARCTIC CHAR): CLIMATE-CHANGE IMPACTS ON THE ARCHAEOLOGICAL RECORD IN THE MACKENZIE DELTA, NORTHWEST TERRITORIES

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The long-term history of the circumpolar North is preserved largely in the archaeological record, in the form of material remains such as dwelling structures, artifacts,

and animal bones. However, this record is currently under direct threat from changing climates – northern history is literally melting, decomposing, and being washed out to sea every year. This is particularly true in the Mackenzie Delta region, home to the Inuvialuit, who were the largest and most complex Inuit population in the Canadian Arctic, yet whose history is poorly understood. The threats to Inuvialuit culture history are amplified by the fact that their largest and most permanent settlements were located on sea coasts; it is precisely these coasts that are most seriously impacted by climate change. Many of the most important sites in the region are already gone, washed out to sea over the last few decades. To address these problems, Arctic Cultural Heritage At Risk has developed as a partnership between university-based researchers specializing in archaeology and permafrost studies, and the Inuvialuit Cultural Resource Centre which represents the heritage interests of Inuvialuit. This project will identify regions most at risk, and then excavate the most important sites, as determined in collaboration with Inuvialuit stakeholders.

ARCTIC FRESHWATER BIODIVERSITY MONITORING PLAN: INTEGRATED CIRCUMPOLAR MONITORING TO IMPROVE DETECTION, UNDERSTANDING AND RESPONSE TO CHANGES IN ARCTIC RIVER AND LAKE ECOSYSTEMS

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The Circumpolar Biodiversity Monitoring Program (CBMP) of the Conservation of Arctic Flora and Fauna (CAFF) is working with partners to harmonize and enhance long-term Arctic biodiversity monitoring efforts

in order to facilitate more rapid detection, communication and response to significant trends and pressures. To this end, a Freshwater Expert Monitoring Group (Freshwater EMG) was formed to develop a Freshwater Integrated Monitoring Plan (Freshwater IMP) that details the rationale and framework for improvements related to the monitoring of freshwaters of the circumpolar Arctic, including ponds, lakes, their tributaries and associated wetlands, as well as rivers, their tributaries and associated wetlands. The monitoring framework aims to facilitate circumpolar assessments by providing Arctic countries with a structure and a set of guidelines for initiating and developing monitoring activities that employ common approaches and indicators. The Freshwater IMP presents a list of priority parameters and indicators that will be used for the assessment of the state of Arctic freshwater biodiversity. The Freshwater IMP also outlines biotic and abiotic sampling approaches for lakes and rivers that were designed to establish high-quality, long-term data that can be used to detect the impact of stressors on freshwater diversity. An initial status and trends assessment will evaluate existing (contemporary and historical) monitoring data and traditional knowledge, while subsequent assessments will make use of data from continuing coordinated biomonitoring activity. The collection of data and analysis of status and trends will be completed by national Freshwater Expert Networks (FENs) established in each country. In addition to international bodies of the Arctic Council, other groups involved in the implementation of the Freshwater IMP will include national, sub-national and local jurisdictions across the Arctic that already undertake biodiversity monitoring. Ultimately, it will be the responsibility of each Arctic country to implement the Freshwater IMP in order for the program to succeed.

NORTH SLOPE LONG-TERM MONITORING SUMMARY LIST TO SUPPORT GAP ANALYSIS

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An interactive, online summary of long-term monitoring studies across the North Slope of Alaska have been compiled by the North Slope Science Initiative (NSSI) and are available on the NSSI web portal (www.northslope.org/monitoring/). This summary effort is being conducted by the NSSI to inventory existing long-term monitoring

studies on the North Slope in order to identify gaps in monitoring and to support scenario development. Listed studies must meet the criteria of long-term monitoring defined as multiple collections of the same variable over a period of 10 years or longer by comparable methodology on the North Slope of Alaska and in adjacent waters. Studies meeting this criterion may be added through the interactive web portal referenced above. Corrections and additions to listed studies are also encouraged. We will present the interactive web portal and the functionality to view individual study details and interactively sort and create summary statistics.

SATELLITE-BASED DETECTION AND MONITORING OF FIRE AND FIRE EFFECTS IN THE NORTH AMERICAN TUNDRA

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Warming and modifications to climate has led an increase in fire occurrence in the tundra, a biome not known for broad-scale fire. The overarching question we are addressing is: If fire increases in landscapes where fire is neither currently nor historically of great importance, what impacts will this have on ecosystems and ecosystem services? Current satellite-based methods for mapping fire at northern latitudes are focused on algorithms tuned to forested landscapes rather than treeless tundra types. Therefore our current accounting of recent fire for the circumpolar arctic is incomplete. We will present three activities that have used remote sensing methods to better understand fire in this region. We have developed a semi-automated mapping methodology to detect potential fire areas. Second, we will review a study to assess temporal trends in spectral signatures of burned areas at the Noatak National Preserve in Alaska. The analysis showed the signature of burned areas deteriorates rapidly, and that common mapping methods were inferior to other spectral methods for mapping burned areas and assessing burn severity. We also review an analysis of Synthetic Aperture Radar (SAR) imagery to assess the temporal dynamics of fire-disturbed sites as detected in SAR and the variables driving this signature.

MEASUREMENTS OF THE ICE SURFACE ELEVATION OF GLACIERS IN ICELAND WITH LIDAR

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Detailed mapping of the surface of glaciers and ice caps in Iceland was initiated during the International Polar Year 2007–2009 and essentially completed in the summer of 2012. An airborne laser scanning method (lidar) has been employed, covering the entire surface of each glacier/ice cap surveyed and thus yielding accurate maps of crevassed areas and other regions that are hard to access in ground-based surveys. The vertical accuracy of the surveys is better than 0.5 m and Digital Elevation Models (DEMs) with a resolution of 5x5 m are produced. All glaciers in Iceland >10 km² in area have now been mapped with lidar, in total ~11000 km² of ice-covered areas. The total surveyed area is >15000 km², including proglacial areas and repeated mapping of some areas with rapid changes due to subglacial eruptions and emptying of subglacial water bodies. These new surface maps/DEMs will serve as a benchmark for future evaluation of changes in the areal extent and volume of all major glaciers and ice caps in Iceland. The project has already produced results on the volume decrease of some ice caps in Iceland over the past few decades, by comparison with older maps and satellite data. The lidar maps will be in the public domain, open for use in map production and scientific research.

LONG-ENDURANCE, ICE-CAPABLE AUTONOMOUS SEAGLIDERS

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Autonomous Seagliders capable of extended (multi-month) operation in ice-covered waters have been developed and successfully employed as part of the US Arctic Observing Network. Seagliders operate routinely in lower-latitude oceans for periods of up to 9 months to

provide persistent sampling in difficult, remote conditions, including strong boundary currents and harsh wintertime subpolar seas. The Arctic Observing Network calls for sustained occupation of key sections within the Arctic Ocean and across the critical gateways that link the Arctic to lower-latitude oceans, motivating the extension of glider technologies to permit operation in ice-covered waters. When operating in open water, gliders rely on GPS for navigation and Iridium satellite phones for data and command telemetry. Ice cover blocks access to the sea surface and thus prevents gliders from using these critical services. When operating under ice, ice-capable Seagliders instead navigate by trilateration from an array of RAFOS acoustic sound sources and employ advanced autonomy to make mission-critical decisions (previously the realm of the human pilot) and identify and exploit leads in the ice to allow intermittent communication through Iridium.

OBSERVATIONS OF SEA ICE THICKNESS USING GROUND PENETRATING RADAR IN THE CANADIAN ARCTIC SHELF

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GPR measurements of sea ice thickness, including undeformed ice and ridged ice were carried out in the Canadian Arctic shelf in spring 2010. Results shown there has a significant spatial inhomogeneity of sea ice thickness across the shelf. The undeformed multi-year fast ice of 2.05±0.09 m thick was investigated southern inshore zone of Borden island located at middle of the observational section, which was the observed maximum thickness in the field work. The less thick sea ice was sampled across a flaw lead with the thicknesses of 1.05±0.11 m for the pack ice and 1.24±0.13 m for the fast ice. At the northernmost spot of the section, the undeformed multi-year pack ice was 1.54±0.22 m thick with a ridged ice of 2.5–3 m, comparing to the multi-year fast ice with the thickness of 1.67±0.16 m at the southernmost station in the Prince Gustaf Adolf Sea. For the impulse of 250MHz in frequency, the dielectric constants of new first-year ice were 12.2 for the pack ice and 13.1 for the fast ice, while those of the multi-year ice were 4.87 and 4.66. An extreme permittivity of 1.66 was observed from the undeformed multi-year fast ice with the maximum thickness due to the brine drainage.

STRATEGIC ASSESSMENT FOR ARCTIC OBSERVING, AND THE NEW ARCTIC OBSERVING VIEWER

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Although a great deal of progress has been made with various Arctic Observing efforts, it can be difficult to assess that progress. What data collection efforts are established or under way? Where? By whom? To help meet the strategic needs of SEARCH-AON, SAON, and related initiatives, a new resource has been released: the Arctic Observing Viewer (AOV; <http://ArcticObservingViewer.org>). This web mapping application covers the “who”, “what”, “where”, and “when” of data collection sites – wherever marine or terrestrial data are collected. Hundreds of sites are displayed, providing an overview as well as details. Users can visualize, navigate, select, search, draw, print, and more. This prototype application currently showcases a subset of observational activities and will become more comprehensive with time. The AOV is founded on principles of interoperability, with an emerging metadata standard and compatible web service formats, such that participating agencies and organizations can use the AOV tools and services for their own purposes. In this way, the AOV will complement other cyber-resources, and will help science planners, funding agencies, PI's, and others to: assess status, identify overlap, fill gaps, assure sampling design, refine network performance, clarify directions, access data, coordinate logistics, collaborate, and more to meet Arctic Observing goals.

DRAMATIC INCREASES IN TEMPERATURE AND RUNOFF ON THE GREENLAND ICE SHEET: THE ROLE OF SHIFTING ATMOSPHERIC CIRCULATION PATTERNS

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The Greenland Ice Sheet has experienced dramatic warming, an expanding melt area, and increased meltwater runoff in recent years, with a new melt record for the ‘satellite era’ established in 2012. Meltwater runoff from the Greenland Ice Sheet is now one of the most significant components of global sea level rise, and it is important to understand the causal mechanisms behind recent warming in Greenland. Is this part of an atmospheric warming signal that is likely to continue or accelerate, amplified by positive feedback effects such as lowered ice sheet albedo and Arctic sea ice loss? Or are recent trends associated with shifts in atmospheric circulation, which may be transient? Increased warm air advection to Greenland from the North Atlantic region may be part of a broader climate change response, or it could be episodic, i.e. short-lived ‘heat wave’ events that can be attributed to meteorological variability. We examine longterm (1948-2012) patterns of warm air advection to the Greenland Ice Sheet based on 500-mb ridging frequency and intensity. Circulation changes in Greenland do not exhibit a longterm trend, nor do they appear stochastic. Rather, there appears to have been a regime shift to increased warm air advection in the last decade, which may reflect a persistent response to changing ocean surface temperatures (i.e. via the Atlantic Multidecadal Oscillation) or a shift in location and strength of the Arctic vortex. It is difficult to judge whether this will persist.

KLUANE LAKE FIELD STATION, YUKON TERRITORY

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Kluane Lake Research Station (KLRS), operated since 1961 by the Arctic Institute of North America, is one of a handful of northern research stations that has survived and thrived over the past 50 years. One of the most highly-used research stations in northern Canada, KLRS serves as a gateway to subArctic and high alpine ecological and

Earth system processes. It is an entry-point to the Icefield Ranges of the St. Elias Mountains, which contain Canada's highest mountains and largest glaciers. The field station supports a broad range of long-running research projects in the fields of glaciology, geomorphology, geology, geography, ecology, botany, zoology, hydrology, limnology, climatology, high-altitude physiology, anthropology, and archaeology. KLRs also hosts a number of field schools and serves as a fabulous training ground for graduate students and young faculty members. At a time when governments, industry and the public are looking north for answers to many questions that a rapidly changing world is bringing, KLRs has a major role to play as a key node in the sparse network of northern infrastructure devoted to scientific investigation and education.

TOWARDS COORDINATED MONITORING OF WATER STABLE ISOTOPES IN ARCTIC VAPOR

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Due to the role of water vapor and clouds in positive feedback mechanisms, water vapor is a key player in the future of Arctic climate. Ecosystems and human societies are vulnerable to climate change through even minor changes in precipitation patterns, including the occurrence of extreme events. It is therefore essential to monitor, understand and model correctly the mechanisms of transport of moisture, at the regional scale. Water vapor isotopes – the relative abundance of heavy and light water in the atmosphere – hold the key to understanding the physical processes influencing future Arctic climate. Water vapor isotope observations in the atmosphere are a modern analog to the Rosetta Stone for understanding the processes involved in evaporation, moisture transport, cloud formation and to track moisture origin. This is illustrated by data recently obtained in Iceland, south Greenland,

northwest Greenland and Siberia through national or bi-national initiatives. Indeed, technological progress now allows continuous, in situ or remote sensing monitoring of water vapour isotopic composition. In parallel, a growing number of atmospheric circulation models are equipped with the explicit modeling of water stable isotopes, allowing evaluation at the process scale. We argue here for an international coordination of the network of water vapor isotope monitoring in the Arctic.

DEVELOPING AN ARCTIC OCEAN OBSERVING SYSTEM FOR ALASKA: A CONCEPTUAL DESIGN

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The Alaska Ocean Observing System (AOOS) has developed a conceptual Arctic coastal ocean observing system that builds upon the national Integrated Ocean Observing System (IOOS) and existing observing platforms and products in the Beaufort and Chukchi Seas, Alaska's (and the U.S.) Arctic. Existing assets and products are primarily funded by federal government agencies and private oil and gas companies. However, information gaps remain, especially those relying on real-time information and long time series data for an ecosystem that is rapidly changing. The conceptual design describes a "bare-bones" system that could be "enhanced" with additional components. The core components would be funded by AOOS as part of its commitment to increasing ocean and coastal observations to meet stakeholder needs in Alaska. Those needs include increased ocean and coastal observations to improve marine navigation safety; monitor and mitigate coastal hazards such as increased extreme weather events; and track climate and ecosystem trends and change. AOOS is seeking comment on this product from the scientific community, as well as other stakeholder and user groups in Alaska.

BIOMAP ALASKA: CITIZEN SCIENCE FOR ALASKA'S OCEANS

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BioMap Alaska is an online, multilingual, GIS and Google Maps-based citizen science tool for collecting observations on marine species that is useful for management, research and education. At present, information on 11 marine species is available in both English and Iñupiat, and the system allows people to volunteer their observations on-line through a simple web form. Participants can also submit photographs, and are asked for information on location, weather and environmental conditions at the time of observation. Information/observations are accumulated in the BioMap database, vetted by experts on regional fauna, and made publicly available in a standardized data format for researchers, managers, educators and the general public. BioMap is designed to improve monitoring of marine species and may provide information on changing conditions including species range extensions and introduced species using a consistent yet flexible format. Future versions of BioMap will integrate with social media such as Facebook in order to strengthen the community component of our users, and will be rolled out to additional geographic areas with the goal of achieving pan-arctic coverage.

BACKGROUND AND POLLUTED TROPOSPHERIC COMPOSITION OVER CENTRAL AND NORTHERN SIBERIA FROM THE YAK-AEROSIB INTENSIVE AIRBORNE CAMPAIGNS

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Despite the unique characteristics of the Siberian air shed, including lack of large local anthropogenic emissions, its vast forest expanse, and its position as a gateway for Eurasian emissions transported toward the Arctic, there are very few regionally-relevant observations of the tropospheric composition over this region. During the YAK-AEROSIB program we collect high-precision measurements of the vertical distribution of CO₂, CH₄, CO, O₃, black carbon and ultrafine particles distribution in the Siberian troposphere, on a 4000-km aircraft transect.

Campaigns are performed annually on similar itineraries. A special campaign was designed to additionally sample the troposphere along the Russian Arctic coast for the International Polar Year. We show the background tropospheric composition obtained from these surveys, the variability and the impact of large-scale transport of anthropogenic emissions from Europe and Asia, as well as the transport of biomass burning plumes from regional sources in Siberia and elsewhere in Asia. Long range transport of anthropogenic emissions is shown to have a discernible impact on O₃ distribution, although its lower-tropospheric variability is largely driven by surface deposition. Regional sources and sinks drive the lower troposphere CO₂ and CH₄ concentrations. Generally, the YAK AEROSIB provide unique observations over Siberia, documenting both direct impact of regional sources and aged air masses experiencing long range transport toward the high Arctic.

AUTONOMOUS OBSERVATIONS OF THE SPATIAL VARIABILITY AND TEMPORAL EVOLUTION OF ARCTIC SEA ICE MASS BALANCE

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Observations indicate that the Arctic sea ice cover is undergoing significant decreases in both its thickness and areal extent. The sea ice mass balance provides insights into understanding these changes by attributing them to variations in ice growth, melt season length, snow depth, surface melt, and bottom ablation and thus relating them to atmospheric and ocean forcing. As part of an Arctic Observing Network, we deployed over 30 autonomous buoys (IMB) to observe the sea ice ice mass balance. The IMBs have been collocated with instruments measuring atmosphere and ocean parameters providing insight into the changing Arctic ocean/ice/atmosphere system and the processes driving those changes. Results show considerable spatial variability across the Arctic in a given year. The largest amount of melting has been observed in the Beaufort Sea, while the smallest is observed in ice north of the Canadian Archipelago. There has been major thinning of ice in the Beaufort Sea primarily due to increases in bottom melting, with peak ocean heat fluxes exceeding 100 W m². There is interannual variability at a given location. For example, buoys deployed at the North Pole show year to year values of surface ice melt ranging from 0 to 55 cm.

THE DR. NEIL TRIVETT GLOBAL ATMOSPHERE WATCH OBSERVATORY AT ALERT, NU

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Environment Canada's Dr. Neil Trivett Global Atmosphere Watch Observatory at Alert, Nunavut is the most northerly research facility in the world. With measurement records dating back to 1975, it also possesses one of the longest GHG and atmospheric pollution records in the arctic. Continued research and support for atmospheric monitoring initiatives will provide multi-decadal observations to improve our understanding of physical climate change in the Arctic.

THE MCGILL ARCTIC RESEARCH STATION: 50+ YEARS OF ARCTIC SCIENCE

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McGill University has a long history of polar research, including over five decades of field research at the McGill Arctic Research Station (MARS) on Axel Heiberg Island (79°24'56.27"N; 90°44'46.29"W) in the Canadian High Arctic. Long-term research programs at remote Arctic field stations like MARS represent valuable archives of baseline and changing environmental conditions and are key elements of any SAON. MARS is located on the west side of Axel Heiberg Island in a mountainous area dominated by ice caps, outlet/valley glaciers, polar desert, arctic tundra and permafrost. The mean annual air temperature is -17°C and average annual precipitation is ~180 mm. Regional permafrost thickness is between 400-500 m. Ice wedges, patterned and ground ice are common. Axel Heiberg lies within the Sverdrup Basin and the regional geology consists of folded and faulted Mesozoic sedimentary rocks intruded by evaporite diapirs. The primary mission of MARS is the investigation of high latitude cold polar desert ecosystems and processes. Initially created to support fundamental research on high Arctic climate, glaciology, geology, geomorphology and biology more recent research includes planetary analogues and astrobiology. The current Mission is to (a) provide baseline data for the early detection of

climate change in the north, (b) characterize unique polar ecosystems and their susceptibility of environmental change, and (c) provide opportunities for student training and research. Current research includes ongoing work in glaciology, geology, climatology, hydrology, geocryology, microbiology, astrobiology, remote sensing, geophysics and analogue studies. In addition to fundamental science, research includes various aspects of technology and communications.

THAWING GROUND ICE: LANDSCAPE DYNAMICS IN THE EUREKA SOUND LOWLANDS, CANADIAN HIGH ARCTIC

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Ground ice plays a major role in the evolution of landscapes underlain by continuous permafrost. Thawing permafrost, widespread terrain instability and resulting infrastructure problems are often cited as serious problems facing Polar Regions. Information about ice content and distribution is extremely variable across the Arctic. Several studies have alluded to increased thermokarst as an outcome of climate change, however little is known about the potential pattern and magnitude of thermokarst because of the patchy nature of information on near surface ground ice. This presentation documents landscape dynamics and ground ice in the Eureka Sound lowlands in central Ellesmere in the Canadian High Arctic. The Eureka area (~80N) is characterized by cold polar desert conditions (mean air temperature of -19.7°C) and permafrost up to 600 m thick. Over the past 2 years a dramatic increase in the frequency and magnitude of thermokarst have been documented as well as the detection of increased thaw related to ice wedges. In 2012 more than 200 active retrogressive thaw slumps were mapped, representing a 27% increase from 2010. Repeat surveys of headwall positions have provided both short and long-term retreat rates. Over 20 years of observation the average retreat for all sites is 6.9 m/yr, the highest annual retreat was 23 m. Beginning in 2005 ice wedge polygons in the vicinity of the monitoring sites began to exhibit thaw degradation and deepening of ice wedge troughs. A new focus of our work is the characterization of changes related to ice wedge subsidence and modeling their stability relative to surrounding permafrost.

LAUNCHING XCTD FROM HELICOPTER

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A operational method of launching XCTD (eXpendable Conductivity-Temperature-Depth profiler) probe from helicopter is presented. The method provides a new way to observe vertical temperature and salinity profiles in polynyas and other openings surrounded by sea ice that obstructs research vessels to enter. Several experiments conducted in partially ice-covered regions, including the Canada Basin in the Arctic Ocean, have confirmed the applicability of this method. Although comparative tests of ship-board CTD and helicopter-launched XCTD show very limited errors, the effect of extremely high launching altitude on the depth accuracy of helicopter-launched XCTD still needs to be investigated in future.

SEARCH: STUDY OF ENVIRONMENTAL ARCTIC CHANGE – A SYSTEM-SCALE, CROSS-DISCIPLINARY ARCTIC RESEARCH PROGRAM

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The Study of Environmental Arctic Change (SEARCH) is an interdisciplinary and interagency program based in the U.S. SEARCH works with academic and government agency scientists to plan, conduct, and synthesize studies of arctic change. The SEARCH vision is to provide scientific understanding of arctic environmental change to help society understand and respond to a rapidly changing Arctic. Toward this end, SEARCH: (1) Generates and synthesizes research findings and promotes arctic science and scientific discovery across disciplines and among agencies; (2) Identifies emerging issues in arctic environmental change; (3) Provides information resources to arctic stakeholders, policy-makers, and the public to help them respond to arctic environmental change; (4) Coordinates with national arctic science programs integral to SEARCH goals; (5) Facilitates research activities across local-to-global scales, incorporating stakeholder concerns; (6) Represents the U.S. arctic environmental change science community in international and global change research initiatives. The Arctic Observing Network

is a critical part of the SEARCH portfolio. SEARCH's Observing Change Panel focuses on building a coordinated international observing system. For more information, see: <http://www.arcus.org/search>.

ARCTIC PROJECT SUPPORT AND DATA MANAGEMENT ACTIVITIES AT NCAR'S EARTH OBSERVING LABORATORY

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The NCAR Earth Observing Laboratory provides multi-disciplinary international field project support to the scientific community. This support includes all aspects of Data Management activities including the development of a strategy for projects of all sizes, web services and the collection, processing, quality control, integration, and archival of project datasets (both research and operational) as well as the long-term data access and stewardship. EOL also provides customized data visualization tools to projects such as the Geographic Information System (GIS) Mapserver and the Field Catalog. The MapServer is an Open Source development environment for building spatially-enabled internet applications. The MapServer can display and overlay geo-located stations and data, images, and vector data tracks interactively on a web-based map. The EOL Field Catalog is a web-based application that allows the project participants to post (and access) operations and mission/scientific reports, operational and preliminary research imagery/products (e.g. satellite, surface, upper air, radar, oceanographic observations), model output fields, and project documentation. The Field Catalog supports real-time data ingest and operational decision making in the field (including aboard ship) as well as providing a "browse" tool and project summary during the analysis phase of a project. An overview of EOL's project support and data management activities and Arctic research projects will be presented

POLLUTION FROM TRANSIT SHIPPING AND OIL/GAS EXTRACTION: IMPLICATIONS FOR FUTURE ARCTIC DEVELOPMENT

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Transit shipping through the Arctic via the Northern Sea Route, along the northern coast of Scandinavia and Russia, is already occurring. In addition, Arctic oil/gas extraction is being explored due to large oil and gas reserves under the Arctic Ocean. In the future, development of these anthropogenic activities will increase emissions of air pollutants (aerosols, ozone, and their precursors) into the Arctic lower troposphere. Even at mid-latitudes, emissions from oil/gas activities and shipping have large uncertainties, making future projections of Arctic shipping emissions even more difficult. As part of the EU ACCESS project, an aircraft campaign was conducted in July 2012 to study shipping and oil/gas extraction emissions based in Andøya, Norway. The campaign focused on studying ships in transit from Murmansk, Russia off the coast of Norway and oil/gas platforms in the Norwegian Sea. The main focus of the campaign measurements was to investigate the role of current and future anthropogenic activities in and near the Arctic on regional air pollution and investigate potential connections to Arctic climate. To compliment the measurements, we use a regional chemical transport model, WRF-Chem, to study the regional impacts of these local anthropogenic emissions. The model simulates emissions, transport, mixing, and chemical transformation of trace gases and aerosols simultaneously with meteorology. The model is used to examine ozone and aerosol formation in fresh and aged plumes.

OBSERVING THE EVOLVING CENTRAL ARCTIC OCEAN WITH ICE-TETHERED PROFILERS (2004-2013)

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Since 2004 nearly 60 Ice-Tethered Profiler (ITP) instruments have been deployed in the Arctic Ocean with

the major goal of sampling the upper ocean water properties through all seasons. While the base design includes only a CTD sensor package, additional physical, bio-optical and biogeochemical sensors have been implemented on a number of units. In conjunction with companion instrument systems sampling meteorological, sea ice and ocean mixed layer parameters, this combined Ice-Based Observatory monitoring program represents a major contribution to the Arctic Observing Network. Studies conducted over the last decade indicate that the Arctic is both a sensitive indicator of climate change and an active driver of climate variability. As evidenced by the strikingly low summer sea ice extent estimates recorded since August 2007 and large anomalies in liquid fresh water content (manifested by upper-ocean salinity), significant Arctic Ocean changes are underway now. It is critical that we continue to observe the Arctic using proven instrumentation like the ITP during this time of rapid evolution to quantify the physical changes that are occurring, to better understand their causes, and to assess their impacts on the Arctic Ocean climate system and associated ecosystem.

THE CEN NETWORK OF ARCTIC OBSERVING STATIONS AND A NEW JOURNAL FOR DATA DISSEMINATION: NORDICANA D

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The Centre for Northern Studies (CEN – Centre d'études nordiques) studies geosystems and ecosystems (terrestrial, freshwater and coastal) in the changing Arctic. The CEN Network is composed of 9 research stations and 80 automated climate stations, and extends across a 3500 km gradient of ecozones, from boreal forest to extreme polar desert environments in the Canadian High Arctic. Established over many years through close collaborations with aboriginals, government agencies, and universities, the Network has been a key element in developing formal accords with other nations for joint research activities. The CEN Network is a substantive and unique contribution

by Canada to the pan-Arctic SAON initiative, particularly with its insertion into the circumpolar program INTERACT (<http://www.eu-interact.org/>), and collaborations via ADAPT (<http://www.cen.ulaval.ca/adapt/>) and PAGE21 (www.page21.org). To archive and disseminate environmental data from this network and from other Arctic research and monitoring activities, CEN has established Nordicana D (<http://www.cen.ulaval.ca/nordicanad/>), a formatted, peer-reviewed, online data journal series. Produced only in electronic form, the raw data and derived values (daily, month and annual means) are freely and openly accessible. Each issue is indexed via an assigned Digital Object Identifier (DOI), is cross-referenced in Polar Data Catalogue (www.polardata.ca), and contains extensive metadata, photographic documentation and citation details.

THE ARCTIC SCIENCE AND TECHNOLOGY INFORMATION SYSTEM (ASTIS)

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The Arctic Science and Technology Information System (ASTIS) is Canada's national northern database. ASTIS contains 77,000 records describing publications and research projects about northern Canada. The database includes all subjects and covers the three territories, the northern parts of seven provinces and the adjacent marine areas. ASTIS records contain abstracts, detailed subject and geographic indexing terms, and links to 20,600 online publications. With a mandate to make information about northern Canada more accessible to all, ASTIS is available for free from a bilingual website at www.aina.ucalgary.ca/astis. It has been in operation since 1978 and is funded through contract work and donations. ASTIS is a project of the Arctic Institute of North America (AINA) at the University of Calgary. Canada needs a comprehensive national northern database to provide a single point of access to the thousands of publications about northern Canada being produced each year, and to the hundreds of northern research projects being licensed each year. ASTIS provides good coverage of these two types of information now and, with additional funding, could become comprehensive.

CIRCUMPOLAR BIODIVERSITY MONITORING PROGRAM (CBMP)–MARINE PLAN INTEGRATED PAN-ARCTIC BIODIVERSITY MONITORING TO STRENGTHEN DECISION-MAKING

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Arctic biodiversity is under growing pressure from both climate change and resource development, yet existing circumpolar monitoring programs remain largely uncoordinated. This limits our ability to effectively monitor, understand and respond to biodiversity trends at the circumpolar scale. The maintenance of healthy Arctic ecosystems is a global imperative as the Arctic plays a critical role in the Earth's physical, chemical, and biological balance. Maintaining the health of Arctic ecosystems is also of fundamental economic, cultural, and spiritual importance to Arctic residents, many of whom maintain close ties to the land and sea. Arctic Council Ministers formally endorsed the Circumpolar Biodiversity Monitoring Program (CBMP)-Marine Plan at their May 2011 meeting in Nuuk, Greenland. The overall goal of the CBMP-Marine Plan is to improve our ability to detect and understand the causes of long-term changes to the composition, structure, and function of Arctic marine ecosystems, as well as to develop authoritative assessments of key elements of Arctic marine biodiversity (e.g., key indicators, ecologically pivotal and/or other important taxa). The objective of the CBMP-Marine Plan is to integrate existing circumpolar monitoring datasets and models to improve the detection and understanding of changes in Arctic marine biodiversity, and inform policy and management responses to these changes. The CBMP-Marine Plan has completed its first year of implementation. This presentation will provide an overview of what has been accomplished as well as plans for the coming year.

ARCTIC IN RAPID TRANSITION (ART): A CROSS-CUTTING NETWORK INTEGRATING PAST, PRESENT AND FUTURE TO STUDY BIOGEOCHEMICAL CYCLING AND ECOSYSTEM FUNCTION IN THE ARCTIC OCEAN

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The Arctic in Rapid Transition (ART) Initiative (<http://www.iarc.uaf.edu/ART/>) is an international, multidisciplinary, pan-Arctic network from the International Arctic Science Committee (IASC) that aims to improve our ability to predict the biogeochemical and ecological implications of changing sea-ice conditions in the Arctic. ART was initiated and remained steered by early career scientists (ECS) since its inception in 2009. ART provides an integrated scientific framework and a robust platform to support Arctic science development through: (1) the development and implementation of pan-Arctic research and dissemination activities, such as workshops, collaborative papers, and field projects; (2) training in interdisciplinary science development and implementation through ART's scientific focus and complementary background of ART members; (3) capacity building, including professional development and multidisciplinary training for ECS; (4) pan-Arctic networking activities with mentoring for ECS at a critical time in their career, fostering transition from ECS to professional positions in Arctic science and management. As such, the ART network will result in a strong international, interdisciplinary, pan-Arctic community of ECS and more senior scientists collaborating on the consequences of climate change and increasing human pressure on Arctic marine ecosystem. An overview of ART upcoming science and training activities for 2013-2015 will be presented in this poster.

ARCTIC SOCIAL SCIENCE RESEARCH: A CALL FOR COLLABORATORS IN THE DEVELOPMENT OF THE SUSTAINABLE FUTURES PROTOCOL

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Knowledge and innovation in science and technology for sustainability only has as much utility as the willingness of people to implement it (Parris & Kates, 2003). Similarly, the objective of observing the impact of climate change on culture must shift from documentation to enacting consensus agreements for adaptive actions (Ford, 2013). Human motivation, behavior, attitudes, and cognition form the foundation of that willingness, consensus, and adaptive action; and are all topics of scholarship in psychology. From engineers to anthropologists, there is increasing recognition across disciplines that psychological research in all its various forms must be a key contributor in the necessary multidisciplinary multistakeholder collaborative communities leading initiatives toward sustainability across cultures. The Sustainable Futures Protocol (SFP) is a psychological sociocultural research based vehicle to help identify, assess and develop those attributes of human behavior and attitudes most equitable with working in collaborative communities for sustainability (CCS). I am currently researching the SFP with individuals taking part in initiatives for sustainability in Arctic, Caribbean, and American communities. I seek your help in this post-doc research. From non-local researchers to members of the local Arctic community; I would like to interview you so that I can explore and delineate the best practices of community and key individual competencies of attitude and behavior necessary to forward adaptation and transition strategies for sustainability.

TOO MANY DATA SITES? TRY THE ARCTIC DATA EXPLORER BY ACADIS

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The Arctic Data Explorer is a web-based search tool that advances Arctic research through one-stop data

discovery. Rather than going to each repository website individually, in the Arctic Data Explorer you can search many data repositories with one click. You can find data from diverse disciplines, whether you are interested in regional sea ice data sets or data from a specific reindeer herd. Local in-situ observations are available alongside satellite data. We are adding new Arctic data repositories frequently, check back for more complete data coverage. The Advanced Cooperative Arctic Data and Information Service (ACADIS) team is building the Arctic Data Explorer tool to maximize data discovery across organizations, research groups, funding agencies, and countries.

HEALTH DISPARITIES IN ARCTIC REGIONS: ROLE OF THE CIRCUMPOLAR HEALTH OBSERVATORY

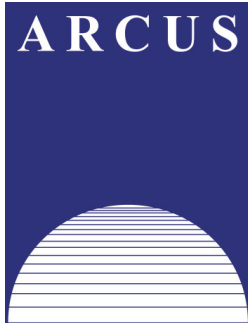
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Objectives: To review existing data systems on measuring health status, health determinants and health care among circumpolar regions and demonstrate the extent and scope of disparities. Method: Retrieving from publicly available international/national/regional statistical databases/publications, supplemented by special custom tabulations; graphical presentations of key findings; use of colour maps to highlight regional differences. Results: Disparities in key health indicators are pervasive in North America between residents of the northern Canadian territories (especially Nunavut), Greenlanders, and Alaska Natives and their respective national/southern populations. In Scandinavia, being 'north' or 'indigenous' is not associated with significant disparities, whereas Russia appears to be in a health crisis whether nationally or regionally. The proportion of Aboriginal people in the population is a significant determinant of some health measures but not others. The impact of health care resources and economic development on health status is mixed. Circumpolar regions and countries can learn from each other in terms of what works in redressing disparities. Significant gaps still exist in health information, which is partially addressed through the creation of the Circumpolar Health Observatory, a SAON task. Information presented in this poster is also available from the Circumpolar Health Atlas [University of Toronto Press, 2012]. Where feasible, live demonstration of the Circumpolar Health Observatory will be provided at the poster session.

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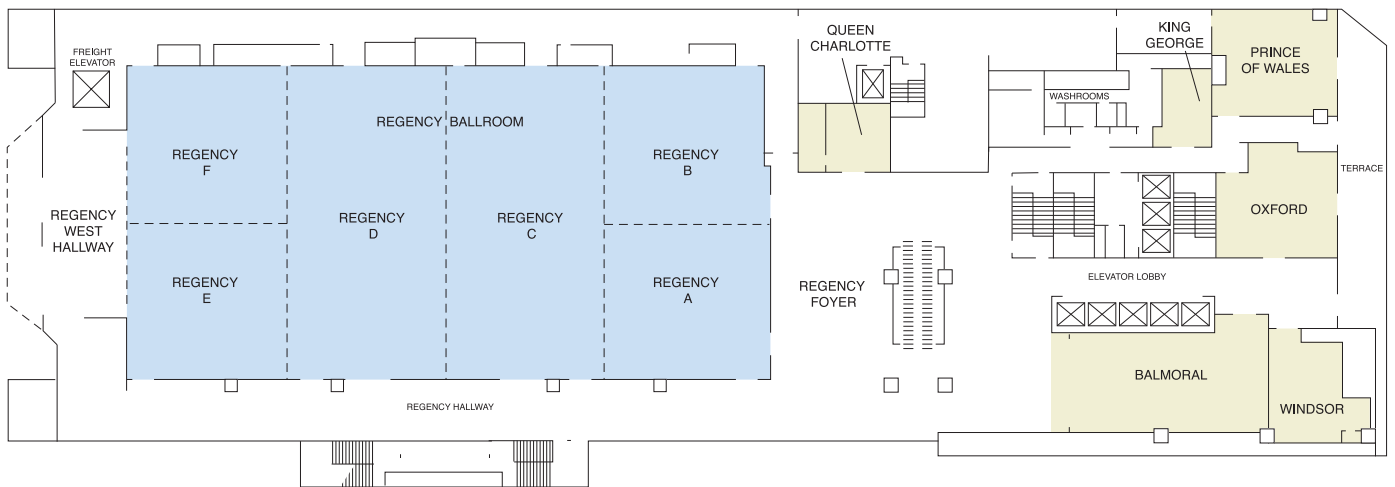


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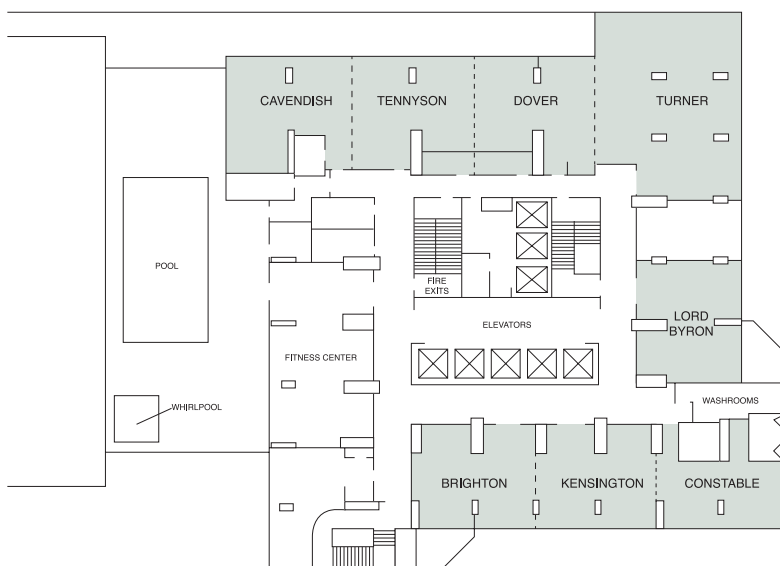


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