

SAON COASTAL BREAK-OUT GROUP

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Introduction

The coast is a key interface in the Arctic environment, a locus of human activity, a rich band of biodiversity, critical habitat, and high productivity, and among the most dynamic components of the circumpolar landscape. A very large proportion of Arctic residents live on the coast and many derive their livelihood from marine resources. The coast is a region exposed to natural hazards and particularly sensitive to climate change; it is thus a high priority for change detection and awareness through the development of appropriate and effective coastal observatory and monitoring networks.

This is not a new observation. Key finding #5 of the Arctic Climate Impact Assessment (ACIA, 2005) was that: "Many coastal communities and facilities face increasing exposure to storms" and the main report identified numerous aspects of climate change with potential impacts on Arctic coasts and coastal communities. The complementary Arctic Human Development Report (AHDR, 2004), commissioned by the Arctic Council in 2002, identified similar challenges. Noting that "The impacts of climate change, in such forms as the retreat of sea ice, the erosion of beaches in storm surges, and increased depth of the active layer of permafrost, are now clearly in evidence in the circumpolar North," the AHDR report called for long-term monitoring of human development issues including impacts of environmental change. An international meeting on Arctic Coastal Zones at Risk was convened in Tromsø in 2007. The workshop report endorsed the need for an update to the ACIA and AHDR reports focusing on Arctic coasts. Recognition of the need for updated assessments of environmental change, impacts on physical and ecological systems, and human responses highlights the need for ongoing observations and monitoring of coastal change.

As part of the Second International Conference on Arctic Research Planning (ICARP II), WG3 (one of 11 working groups established in preparation for the conference) presented Science Plan 3 on Arctic coastal processes. This plan noted the extreme vulnerability of the Arctic coastal zone to ongoing and anticipated environmental change and identified the need for coastal monitoring. As a primary objective, the plan proposed the establishment of "an internationally coordinated network of coastal observatories." Through the initiative of the Arctic Coastal Dynamics Project (a joint IASC-IPA-IHDP-LOICZ activity), this proposal ultimately led to the creation of ACCOnet, the Arctic Circumpolar Coastal Observatory Network, a fully endorsed initiative under the IPY. This forms the framework for proposed long-term coastal change detection and monitoring under SAON. While the resources and institutional infrastructure to support the operation and potential of ACCOnet remain as ongoing challenges, a preliminary

pan-Arctic network has nevertheless been established and monitoring activities are underway as resources and capacity allow. Strong representation throughout the circumpolar North, including Russia, is a noteworthy achievement of ACD and ACCOnet. This coastal observatory network is a central component of the ACD project's Science and Implementation Plan, which identified a series of science initiatives to guide activities through 2011. The plan lays out a strategy for monitoring critical coastal parameters and coordinating the management of observational data through the ACD Secretariat. It considers changes in natural processes (e.g., permafrost, sea ice, coastal morphology, environmental stressors) as well as changes in human activities (e.g., subsistence hunting and fishing, shipping, mineral and hydrocarbon exploitation, construction of infrastructure).

Break-out Group Members

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Corresponding participants

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Summary of Break-out Group Discussion

This section summarizes the discussion that took place in Edmonton, supplemented by comments submitted to the co-chairs in follow-up correspondence.

The session chairs opened the discussion noting that coastal observation networks were not addressed during the first SAON workshop in Stockholm in November 2007. For the purpose of this break-out group, the definition of the coast is the same as that adopted in WG3 of the ICARP II process, viz., "...the nearshore marine areas in both benthic and pelagic zones, and the near-shore terrestrial areas that act as drivers to the marine systems or are under a distinct marine influence" (ICARP II – WG3, 2005).

The chairs noted that almost all Inuit communities are located on the coast. While there were no aboriginal participants in this session, but we know that many northern communities have an interest in coastal monitoring, as evidenced in discussions of the break-out group on community-based monitoring. There is also strong support for existing monitoring efforts in or near a number of northern communities.

Participants highlighted a number of key issues. There is obvious interest in the coast for biological resources and access to these resources through hunting and fishing. Integrity of sea ice is a major concern as it is critical for winter travel and access to hunting and fishing resources as well as providing important breeding habitat for ringed seal and hunting habitat for polar bear. With rising sea levels, coastal flooding and erosion are concerns, particularly in areas with poorly lithified, ice-bonded deposits and massive ground-ice exposures at the coast. In areas of isostatic uplift, rapid coastal change can occur through emergence and coastal progradation. Coastal erosion can be an issue in such areas if the rate of sea-level rise exceeds the uplift rate, or where there is sufficient wave energy, particularly if the open-water fetch or the seasonal duration of wave action increase with reduced sea ice. Hinterland lakes and rivers supporting anadromous fish are important components of the coastal system. Changing acidity or salinity of lakes due to changing precipitation or seawater infiltration (in areas of rising sea level) may result in lost habitat for char. Coastal community infrastructure, navigation aids and structures, industrial facilities, and cultural heritage resources, among others are affected by rising sea levels and other environmental changes. These are examples from a large array of coastal issues for which environmental monitoring and change detection is a key requirement for sustainability (Figure 1).

Discussion then turned to the circumpolar coastal observatories network, ACCONet, and a map was presented showing the 41 proposed sites (Figure 2). The density of stations varies and depends on funding. Many of the ACCONet sites are based on ACD key sites where observations and monitoring have been ongoing for a number of years or decades. Although some sites are physical observatories, in many cases, they represent observation programs that are maintained by the dedication of individual researchers. Community interest drives others. The question was posed whether existing monitoring at ACD sites includes physical, chemical, socio-economic, and ecological monitoring and whether it is sustainable. At present, most sites are primarily monitored for physical change and carbon fluxes or other contributions from the land to the ocean. Sustainability varies from country to country and region to region.

The ACD key sites were selected primarily with respect to physical processes ten years ago and it was later that the ICARP working group created the ACCONet project which expanded the scope of the desired observations. In reality, ACCONet is a concept that is not yet fully in place and establishing the full network is the next step. In some cases, existing key sites or other monitoring sites may become ACCONet observatory sites. In addition, observatories may incorporate local networks of sites or more dispersed observations over a small region. It is also necessary to raise awareness of observation activities at the community level, including dissemination of results.

At this point, we noted the need for an inventory of existing coastal monitoring networks and activities in the Arctic. In Canada, for example, two government agencies (Natural Resources Canada and Fisheries and Oceans Canada) jointly maintain five co-located GPS and tide-gauge sites (Nain, Qikiqtarjuaq, Alert, Ulukhaktok, Tuktoyaktuk). The Geological Survey of Canada, in partnership with other agencies and universities, has undertaken intermittent surveys at 282 Arctic coastal sites established at various times from 1912 to 2007 (185 sites in Nunavut, 83 in the Northwest Territories, 14 in Yukon). Many are in or near communities and some are in national or territorial parks. The surveys support scientific understanding of coastal dynamics, environmental assessments, engineering design, oil-spill response planning, and advice to park managers, co-management boards, or territorial governments and communities on erosion hazards, threats to ecological integrity and archeological sites, coastal infrastructure design, and climate-change adaptation. Coastal change analyses using historical aerial photography and satellite imagery have been undertaken in some areas. Funding to support this work has been intermittent or ad hoc in the context of other programs and the Canadian component of ACCOnet (CANCO) was not funded under the Canadian IPY program, but opportunities for limited coastal monitoring may emerge with development of the planned Canadian Arctic research station or other initiatives.

The representative from Parks Canada noted that they are developing a monitoring strategy for national parks in the north and the coast is considered to be a critical component in all coastal parks. The monitoring strategy is still evolving and could be linked to SAON initiatives. From a park management perspective, coastal monitoring is critical. It was also noted that AMAP transects could be incorporated as additional sites within the network, since the marine environmental monitoring of the OSPAR Commission extends to the coast. Some of these sites have a ten-year record, others longer. The importance of furthering an understanding of estuarine processes for AMAP monitoring was also noted.

The question was posed whether there should be a standard protocol of things to be measured, a minimum data set. A number of parameters have already been identified for measurements at current ACCOnet sites, but further discussion is needed to ensure that this core set of monitoring parameters meets the needs of all potential users. In addition, different monitoring may be required at different sites (e.g. if no one lives near a site, there is no requirement for socio-economic observations). It is very important that we not work in isolation but coordinate efforts on a circumpolar basis and across the disciplines for which coastal processes are important.

Karen Kraft Sloan, former MP and Canadian Ambassador for the Environment, suggested looking at national coastal and ocean policies. She emphasized that it is important strategically to be aligned with national governments and the Arctic Council. The break-out group chairs agreed that operational networks sponsored by national governments are more likely to be funded for sustained time intervals.

The question was raised as to what proportion of observation stations are in communities? A participant suggested forming a coalition with Inuit groups to push their

issues forward. Another noted that community issues are most prevalent in North America, but circumpolar coastal monitoring cannot be tied to communities or community objectives. The majority of ACD and ACCOnet sites are located where active research is taking place. Another point about communities is that they can be broad by definition (e.g. an oil and gas exploration camp is a community). Also, North American Arctic communities are a recent phenomenon. Inuit and other northern peoples typically identify a relatively large surrounding area as their community land.

It may be most effective to start with what is currently achievable or being done in locations where we have existing observing capabilities. There was some discussion of adding coastal monitoring objectives to existing networks that are terrestrial and marine oriented. It is important to raise awareness of coastal observational efforts among other groups who may be interested in similar data or processes. This is especially critical because the coastal zone overlaps both terrestrial and marine areas, and serves as an integrator for issues that are of concern to all three domains. Similarly, observations and monitoring specific to coastal issues likely constitute a part of other programs, so links should be explored with what exists elsewhere and how it can be connected to coastal networks.

How do we move forward to make something happen? Several points were made in response to this challenge from the chairs:

- Building an inventory of existing stations, actors, and networks in the field is a clear step we need to take.
- Building awareness of the coast as a distinct and common entity can be supported by use of the term ‘coastal’ as a keyword in all relevant metadata.
- The existing ACD circum-Arctic coastal GIS provides a common mapping tool.
- Finding agencies that have a mandate to do these things is very important. This may be a challenge because the coast is often a jurisdictional grey area, but agency support will be critical to allocation of resources to support coastal monitoring.
- Where present, coastal communities represent an important source of demand and potential capacity to support monitoring efforts.

Key SAON Questions

1. What Arctic observing sites, systems and networks currently exist?

A number of international networks (notably ACD and ACCOnet) currently exist, supplemented by numerous national, regional, or academic efforts with varying objectives, resources, time-lines, and focus. An inventory of existing activities and capacity is clearly required.

2. What spatial, temporal and disciplinary gaps exist?

The inventory noted above will address this issue.

3. How will gaps be filled and the entire effort sustained?

This is, of course, the key issue. It is hoped that the Arctic Council will endorse the need for broad monitoring objectives encompassing all SAON break-out groups. The coast, as a key interface and zone of interaction, should be recognized as a critical component of the Arctic system and a locus of human activity that should be a priority for monitoring and management.

4. How can these activities be coordinated and integrated?

For coastal monitoring, the ACD network and ACCOnet are existing international initiatives that provide a core framework for circum-Arctic coordination and integration of results.

5. How can free, open and timely access to data be achieved?

As an IPY legacy, free, open, and timely access to data will be an important objective in all observation activities linked to SAON. A number of existing activities provide potential opportunities for management and coordination of coastal observations, but a concerted effort will be required to ensure this objective is met.

Additional SAON-2 Questions

• *What is the interplay between modeling and monitoring?*

The objective of a coastal observing program is to detect change as it occurs, measure the extent and impacts of past changes, and support prediction of future change as a basis for sound and sustainable policy choices. Therefore modeling and monitoring are complementary tools that need to be employed together for maximum benefit. Because of the range of disciplines with an interest in Arctic coastal systems, no simple program of modeling can address the needs. Various initiatives are underway to enhance modeling capacity, including workshops planned for the summer of 2008. The SAON process needs to embrace the modeling community and place a priority on recognition of the contributions of monitoring to model development and applications.

• *What are the technology and R&D components required for sustaining Arctic observations and information systems?*

These components will be identified in conjunction with development of core observation standards and protocols. As the question implies, it is essential to consider both observation technology and information systems. Much reliance is likely to be placed on automated systems and remote sensing, but opportunities for more hands-on approaches should not be overlooked, particularly where involvement of northern communities and residents can provide an eyes-on-the-ground perspective and a capacity for observatory maintenance and data management.

Future

Coastal systems in the Arctic incorporate terrestrial, marine, atmospheric, cryospheric, and human aspects of change. No single lens can provide the holistic vision required for an understanding of coastal change. At the same time, a coastal monitoring network is well placed to enhance the scope and impact of monitoring programs in each of these spheres. Because of the necessity for an integrated approach to coastal systems, a coastal monitoring network provides an ideal vehicle for multidisciplinary exchange and coordination. Strong links already exist to research programs in climate and weather, sea ice, coastal oceanography, freshwater hydrology, permafrost and ground ice, terrestrial and marine ecology, contaminants, and human communities. All of the foregoing require monitoring programs, many of which are already in place, but rarely in a coordinated fashion.

We propose a revisioning of ACCOnet as a pragmatic and modular framework for integrated monitoring of environmental change and impacts on human communities in the circumpolar Arctic coastal zone. In this approach, coastal observatories would be developed in a progressive fashion as resources permit, incorporating components of other networks or even adopting existing limited-purpose sites for broader monitoring purposes. A core set of objectives and measurements has already been defined as a minimum standard for ACCOnet sites, with protocols for data management and dissemination, but this will need to be reviewed to ensure its ongoing appropriateness for the new network. The international network will require oversight by an appropriate board or committee and a dedicated coordinator. Close links will be established with other groups managing terrestrial, marine, community, and other relevant networks. Where existing networks have infrastructure already positioned or operating in coastal areas, opportunities will be sought to share, enhance, or expand these facilities.

New technologies, including satellite-based remote sensing and airborne systems such as topographic and bathymetric LiDAR, provide new opportunities for rapid, timely, and extensive observation and quantification of many aspects of coastal systems. These newer observation systems will be exploited wherever possible and useful. At the same time, it is important to respect and acknowledge the wisdom and experience of Arctic coastal residents, through consideration of local and traditional knowledge including Inuit Qaujimatuangit.

Partnerships with appropriate organizations will be critical to the success of this vision. Partners need to be entities with a mandate for long-term data collection or monitoring, most often government agencies. The support of the Arctic Council would therefore be highly desirable as a catalyst for coordinated action among all Arctic nations.

Relevant web sites

ACCONet – Arctic Circumpolar Monitoring Network

<http://www.arcticportal.org/acd/acconet>

Arctic Climate Impact Assessment Key Findings (ACIA, 2005)

<http://www.taiga.net/acia/findings.html>

Arctic Coastal Dynamics (ACD) Project

<http://www.arcticportal.org/acd>

Arctic Coastal Zones at Risk Workshop Report, Tromsø, Norway, November 2007

<http://coast.gkss.de/events/arctic07/docs/proceedings.pdf>

Arctic Human Development Report (AHDR, 2004)

http://hdr.undp.org/en/reports/regionalreports/other/arctic_2004_en.pdf

CoastWeb: Geological Survey of Canada (Natural Resources Canada)

http://gsc.nrcan.gc.ca/coast/coastmon_e.php

ICARP II - Science Plan 3: Arctic Coastal Processes (ICARP II – WG3, 2005)

http://arcticportal.org/uploads/aK/jI/aKjILkWDNnY50dJ8IAP8dw/ICARP_II_Science_Plan_03.pdf

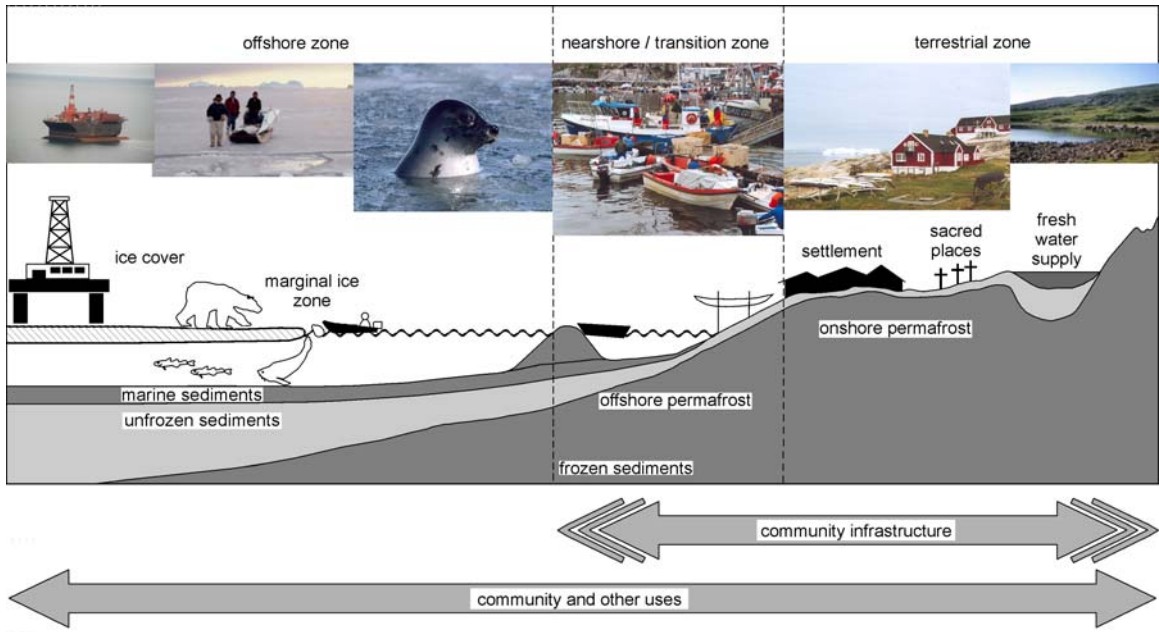


Figure 1. Changes in the coastal zone impact on a variety of human, physical and biological systems.

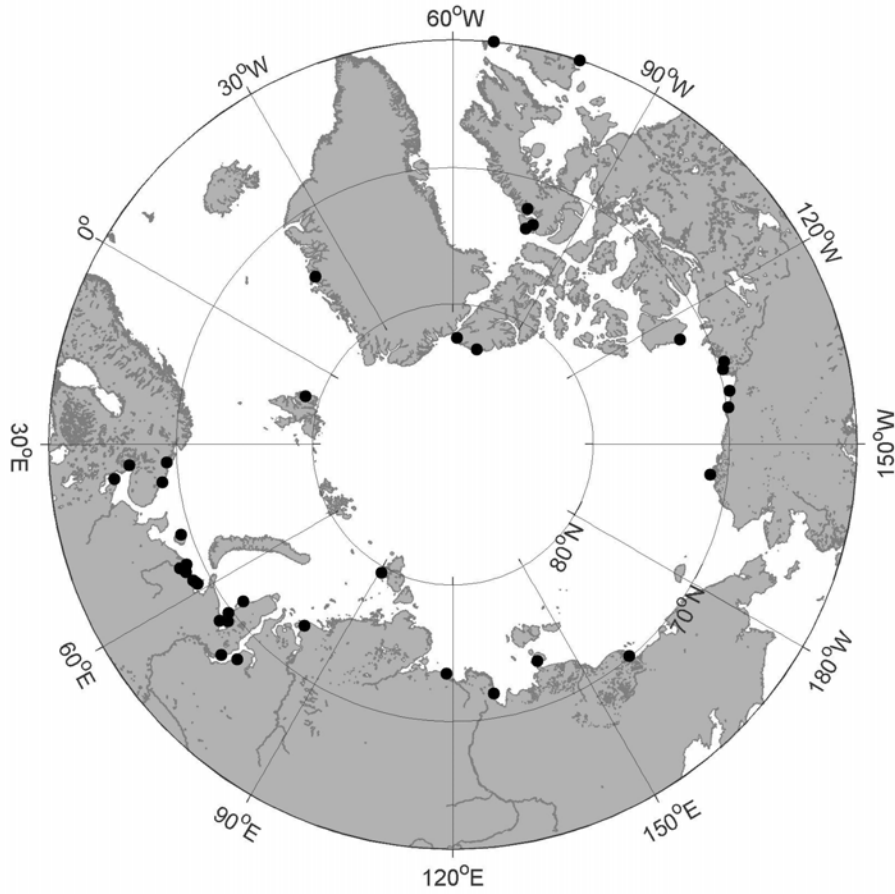


Figure 2. ACD key sites and ACCO-Net candidate sites. These will serve as the starting points for a circum-Arctic network of coastal observatories to monitor physical, ecological, biogeochemical, and socio-economic parameters.