Arctic Observing Summit 2020

“Observing in Support of Adaptation and Mitigation” synthesis of white papers and short statements

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Overview of subtheme

The Arctic has experienced unprecedented environmental changes during the past decade (2010-2019) (Whiteman, Hope and Wadhams, 2013; Bliss et al., 2019). Increases in atmospheric and ocean warming over the Arctic Basin (Stroeve et al., 2012; Overland et al., 2019) coupled with drastic reductions in the thickness and extent of summer sea ice (Screen et al., 2013) present new challenges to the human and natural systems of this region. These physical changes which are concurrent with globalization, growing urbanization in some regions, proposed and underway resource developments, changing transportation routes, and ecosystem shifts, emphasize the need to continually improve understanding of the Arctic System and its bio-physical and human components. Improved understanding of system components, essential variables and processes will support our ability to project the longer-term trajectory of the system and plan for the future. However, there is also a real need to improve data and information flow about the system on shorter-term and near real-time frames. Near-real-time data can be vital to decision makers from individuals to national governments and will support adaptation and mitigation. This is currently exemplified by the John Hopkins Coronavirus Resource Centre interactive near real-time data visualization of the distribution of coronavirus cases globally (https://coronavirus.jhu.edu/map.html). Easily understood graphical data drawn from multiple observing/monitoring systems provides necessary information to help to minimize risk and inform planning and adaption to a crisis situation.

This ability to plan for, adapt to and mitigate change in the Arctic, as elsewhere, requires the sustained and iterative design and implementation of a pan-Arctic, internationally supported and maintained network of observing systems. We are not starting from scratch, many elements of the system are already in place (for example, Radarsat, ocean arrays, community-based monitoring programs, etc.) but there are gaps to be identified and filled if we are going to maximize benefits to society. Coordination and interoperability of people and systems are necessary to ensure that data and information flowing from this Arctic Observing System of Systems (AOSS), is available, accessible and useable. The AOSS will support decision making across time and space, people and organizations, the development of policy options, real-world solutions to existing and emerging issues, and the implementation of actions in support of strategic adaptation initiatives and mitigation efforts.

Summary of contributions received

Twelve white papers and short statements were received for the sub-theme “Observing in support of adaptation and mitigation”. The submissions covered an amalgamation of topics and proposals related to the successful use of observing technologies and multidisciplinary approaches to improve decision support and risk management. Several papers emphasized the urgency of expanding the reach of observing systems to support the scaling up of mitigation and adaptation strategies during the next decade given projections of near-term climate change. Authors also stressed the need for continued and improved engagement with members of Arctic communities, and the need for multi-directional communication to facilitate the gathering, interpretation and dissemination of observational information to more effectively inform adaptation actions.

Highlights of contributions

Here we take a closer look at each submission to tease out trends and opportunities in support of adaptation and mitigation:

1) Monitoring and surveillance systems in the Canadian Arctic

In this paper, Gilmour presents an overview of the suite of existing technologies and planned efforts focused on Canadian Arctic surveillance capabilities that could be leveraged for search and rescue, and also help with informing non-state threat informational needs.

2) The use of multi-criteria decision analysis in understanding Arctic change in a cryosphere context

Abdel-Fattah et al. describe a decision-risk analysis framework to understand what can be mitigated in relation to glacial lake outburst floods. Key aspects of observing should include criteria from local experts and perhaps community monitors that contribute observations about these hazards for downstream communities. Local knowledge and research criteria should inform an analysis to identify the criteria that can be mitigated in the event of a natural disaster. They emphasize the need for local experts to be involved in all phases of research, and stress that including local knowledge throughout the decision analysis will lead to the realisation of more robust and feasible strategies regarding glacial lake outburst flood mitigation.

3) Observing in support of mitigating atmospheric pollution

This short statement details difficulty of communicating concerns about observable environmental changes that could affect human health and wellbeing disciplinary boundaries. There is a need for enhanced multi-directional communication and collaboration between researchers and community members. Key aspects related to use of observing technologies are the inclusion of citizens as observers and monitors on research teams and projects, especially related to reducing risks that speak to local priorities and societal concerns.

4) Monitoring system to the energy security threats of the Arctic region

Ruiga and Burmenko suggest that the current global political and environmental climates are creating security and resource risks as well as opportunities in the Arctic. The socioeconomic development of the Arctic and energy security are interrelated. Some local communities are seeking economic advantages from Arctic energy resources, extractions, and maritime transport to improve local socio-economic circumstances. Depending on their global partnerships, local interests in Arctic energy resources, extractions, and maritime transport could increase competition among global interests.

5) Statement to the Arctic Observing Summit (AOS) on the circumpolar biodiversity monitoring programme (CBMP)

Barry et al. provide an update on the Circumpolar Biodiversity Monitoring Programme, and monitoring of Arctic Focal Ecosystem Components (FECs) across the different Arctic nations. These monitoring efforts link Indigenous communities, researchers and decision-makers in identifying key observing needs for biological resources in coastal, marine and terrestrial ecosystems. There is a clear need for observing to be expanded to support scaling up of strategies for observing biodiversity and key indicator species both of which provide obvious society benefit.

6) Improving and expanding the environmental monitoring efforts of expedition cruise ships in the Arctic

Poulsen et al. describe an opportunity for improved Arctic monitoring by leveraging the presence of cruise operators (with a pilot project in Svalbard) as partners for engaging in citizen science, enabling better collection of physical ocean, atmospheric, pollution and biological data. These initiatives could produce new information and contribute to improved oversight of management interventions.

7) Towards an increased use of local knowledge in international management bodies advisory services

Danielsen et al. highlight the need to narrow the gap between local knowledge, observations and resource-management-level decision making while emphasizing some of the current challenges with incorporating local knowledge into international policies. While there are online platforms to share observations and community-based management proposals that utilize Indigenous and local knowledge, relatively few management agencies base decisions and policies on Indigenous and local knowledge sources. More meaningful collaboration among small-scale resource users, scientists and management bodies is advised.

8) Arctic Air Pollution and Society

Air quality and air pollution at high latitudes is a major concern, from both anthropogenic (e.g. fossil fuel burning, electrical use, mining/drilling activities) and from natural sources. Law et al. present a trans-disciplinary approach to connect northern communities with natural/social scientists and to use community-based observations, technological developments and local knowledge to assess air pollution risks and find sustainable solutions. According to the authors, this is a valuable approach for increasing the number and types of observations while providing critical information on health effects from air pollution.

9) Bridging organizations to support researcher recommendations, and tackle unresolved societal value assessments for sustainable Arctic observing

While disciplinary approaches to Arctic observing have been the norm, Lee et al. emphasize that interdisciplinary approaches are an important lens for long-term observing, and must be supported by the research community. According to the authors, the latter method is challenging in the absence of bridging organizations that can contribute to the organization of the diverse constituents that make up the Arctic observing community. Bridging organizations can be well-positioned to link scientists, decision-makers and service providers addressing climate change issues, to engage the public and the private sectors in observing, and provide spaces for engagement activities.

10) Toward Advances and Applications for Landscape-Scale Coordinated Monitoring Networks in Alaska and Northwest Canada

Druckenmiller et al. emphasize the role of communities in observing networks and the benefits of synthesizing information for coordinated monitoring across a landscape scale. According to the authors, efforts to build cross-boundary collaborations across a broad community of practioners is expected to support a range of interests including sustainable development and hazards forecasting. Facilitation among researchers and community decision makers is needed for applied research solutions across regional and political boundaries, especially for risk reduction (e.g., Arctic Risk Management Network) about all hazards.

11) Arctic Risk Management Network: Linking Regional Practitioners and Researchers to Improve Mitigation Through Participatory Action Research by Community Monitors about Erosion and Surges to Improve Forecasting

Garland et al. employ a risk-assessment framework to assess coastal hazards through community-based monitoring and state-supported efforts to collect observations that meet erosion, storm surge hazard information and future planning needs. A variety of community-based technical, environmental and meteorological observations being made at an observation station in Utqiagvik, Alaska are described.

12) _Leveraging existing sites for meteorological observations to support Search and Rescue operations in the Arctic_

Gascon et al. focus on meteorological observations that are responsive to immediate information needs for search and rescue and other weather-related decision-making. The authors propose integrating existing Arctic weather forecasts, sea ice information and traditional Indigenous knowledge to inform communities about safe travel and to assist search-and-rescue teams.

Identification of common themes

Papers submitted to the Observing in support of the Adaptation and Mitigation sub-theme for the Arctic Observing Summit 2020 (*Appendix 1 below)* highlighted three major areas with common threads that will inform discussion at the 2020 Summit and beyond.

1. There is increasing awareness that existing global monitoring initiatives can and should be leveraged to support adaptation and mitigation in the Arctic. Additionally, leveraging global interests to support mitigation should also fundamentally consider the issue of energy security in the Arctic. With the length of the open water season increasing as a result of reduced summer sea ice, increased marine vessel traffic in response to opportunities for resource transportation, energy extraction and tourism warrant improved environmental monitoring. The need for near-real time data derived from multiple sources is ever more apparent.
2. Indigenous knowledge experts and various stakeholder communities (e.g. citizen science) play an integral role in advancing the use of observing technologies to facilitate effective adaptation initiatives. Authors consistently make the case that the successful use of observing technologies in aiding climate adaptation and mitigation efforts is linked to an inclusive participatory process that weaves Indigenous and local expertise with scientific knowledge.
3. There are a number of observing needs to be filled quickly or expanded to support scaling up of strategies for adaptation and mitigation during the next decade. These identified needs vary depending upon the perspective but there is an opportunity to fill gaps and build consensus around societal benefit areas and the use of Essential Arctic Variables in helping to define priorities for observation.

References:

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Overland, J., Dunlea, E., Box, J. E., Corell, R., Forsius, M., Kattsov, V., ... & Wang, M. (2019). The urgency of Arctic change. *Polar Science*, *21*, 6-13.

Screen, J. A., Simmonds, I., Deser, C., & Tomas, R. (2013). The atmospheric response to three decades of observed Arctic sea ice loss. *Journal of Climate*, *26*(4), 1230-1248.

Stroeve, J. C., Serreze, M. C., Holland, M. M., Kay, J. E., Malanik, J., & Barrett, A. P. (2012). The Arctic's rapidly shrinking sea ice cover: a research synthesis. *Climatic change*, *110*(3-4), 1005-1027.

Whiteman, G., Hope, C., & Wadhams, P. (2013). Climate science: Vast costs of Arctic change. *Nature*, *499*(7459), 401.

Appendix 1 – List of Submitted White Papers and Short Statements

Author(s)	Title	Type of Submission
Davis, K.K.	Observing for Action: A Narrative	Short Statement
Gascon, G., Mariani, Z.,, Melo, S., Mills, B. and Wheeler, M.	Leveraging existing sites for meteorological observations to support Search and Rescue operations in the Arctic	White Paper
Abdel-Fattah, D., Ekenberg, L. and Larsson, A.	The use of multi-criteria decision analysis in understanding Arctic change in a cryosphere context	Short Statement
Law, K., Arnold, S., Schmale, J., Petaja, T., Kostantinov, P. and Baklanov, A.	Arctic Air Pollution and Society	White Paper
Lee, O., Wiggins, H. and Little, J.	Bridging organizations to support researcher recommendations, and tackle unresolved societal value assessments for sustained Arctic observing	White Paper
Garland, A., Seemann, H., Ravens, T. and Overbeck, J.	Arctic Risk Management Network: Linking Regional Practitioners and Researchers to Improve Mitigation Through Participatory Action Research by Community Monitors about Erosion and Surges to Improve Forecasting	White Paper
Druckenmiller, M., Mutter, E. and Divine, L.	Toward Advances and Applications for Landscape-Scale Coordinated Monitoring Networks in Alaska and Northwest Canada	Short Statement
Ruiga, I.R., and Burmenko, T.A.	Monitoring System to the Energy Security Threats of the Arctic Regions	Short Statement
Barry, T., Christenses, T., Coone, C., Fannar-Larusson, K., Fletches, S. and Marissink, M.	Statement to the Arctic Observing Summit on the Circumpolar Biodiversity Monitoring Programme (CBMP)	White Paper
Poulsen, M.K., Iversen, L., Cheeseman, T., Damsgård, B., Davies, I., Jennings, I., Jørgensen, F., Meraldi, V., Mikkelsen, N.E., Sokolíčkova, Z., Sørensen, K., Tatarek., A., Penelope Wagner, P., Sandven, S. and Danielsen, F.	Improving and expanding the environmental monitoring efforts of expedition cruise ships in the Arctic	Short Statement
Danielsen, F., Akearok, J., Lyberth, B., Tengö., M and Enghoff, M.	Towards the increased use of local knowledge in international management bodies' advisory services	Short Statement
Gilmour, J.	Monitoring and Surveillance Systems in the Canadian Arctic	White Paper