Recommendations from the AOS 2013 and 2014

AOS 2013 – Themes

1. Status of the Current Observing System
2. Observing System Design and Coordination
3. Stakeholder Perspectives on Observing System Design and Integration
4. Mechanisms for Coordination of Support, Implementation and Operation of a Sustained Arctic Observing System.

AOS 2014 Themes

1. Stakeholders and Arctic Observations
2. Coordination for Improved Arctic Observing
3. Technology and Innovation
4. Remote Sensing Solutions
5. Data Management and Sharing

Recommendations made in both 2013 and 2014 in RED
2013 Recommendations in BLUE
2014 Recommendations in GREEN

Recommendations in **BOLD** have been taken up by entities as indicated.

THEMATIC AREA	
Status of the Current Observing System	**RECOMMENDATION**
Tasks for System Inventory	**Prepare a synthesis of observing systems, programs, and infrastructure to inform on existing strengths and gaps (ISAC).**
	Develop matrix of future AOS tasks and include information on observations (where, who, what, when, how).
	Develop an inventory of community based monitoring efforts (ICC Canada).
	Build needed cyber-infrastructure for communicating who is doing what, where, when, how (maximum amount of metadata).
Closing Gaps	Improve coverage of the Russian and European Arctic.
	Promote continuity in remote sensing programs. Link these to ground-based observations filling gaps in time and space.
	Improve diversity of observations and coverage from local to larger scales, and include community-based monitoring.

Closing Gaps (cont.)	Review other similar programs and implementation processes.
	Identify networks that can contribute to data, funding, and better engagement.
	Evaluate how community-based observing efforts can benefit gain access to and benefit from observing technology (AINA).
	Fill observational gaps by balancing effort and resources by region, type, including community based monitoring programs.
	Address knowledge gaps *vis a vis* priorities (spatial and temporal scales, what to observe, how to observe, most useful observations, etc.).
Observing System Design	
Stakeholder Perspectives on Design, Implementation and Operation	With stakeholders, establish the key questions that a mature Arctic Observing System must address.
	Engage stakeholders at all stages (question and issue identification, design, applications, data gathering and analysis, communication, dissemination, etc.).
	Link observing programs to science and stakeholder needs by developing engagement tools.
	Foster engagement of the private sector & academia (e.g., the European Strategy Forum on Research Infrastructures, ESFRI).
	Design systems with real-world application needs in mind – these needs should be identified through stakeholder collaboration.
	Use formal research methods to evaluate stakeholder needs.
	Link scientific knowledge with local and traditional knowledge, and evaluate for agreements and/or discrepancies.
	Deploy systems that can facilitate real-time dissemination of data that is relevant to local needs.
Other Design Considerations	Improve participation of logistics providers in system design activities. Consider what data can be collected (e.g. bathymetry
	As part of a system design process, assess existing observational systems for information useful for decision-making.
	Develop technology for real-time data capture, transmission, and processing.
	Create a stakeholder advisory group to provide advice on observational needs to the AOS.
	Better utilize and adopt modern technologies for of Observing System design. (Observing System Design Experiments)
	More closely cooperate with global systems observation initiatives during the design phase.
	Sustain and strengthen multipurpose flagship platforms and convert many to supersites.
Improvements to Existing Infrastructure	Continue building from existing platforms by adapting these for new uses.
	Create an inventory of infrastructure currently available or scheduled
	Expand/sustain observing systems as early-warning systems.
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Stakeholders and Arctic Observations	
Communication	SAON should encourage broader engagement. Improve communication with and engagement of partners in industry, northern and aboriginal communities, the social, engineering and health sciences, sciences, government agencies, operational agencies, and policy and decision-makers.
	Establish demonstration sites and meetings on how engagement can work in practice (scientists and stakeholders, based on needs).
	Communicate stakeholder needs to World Meteorological Organization panel on polar observations research and services
	Identify and or train communicators to 'translate the science' so it is useful for stakeholders because poor communication can translate into bad decision-making.
	Networks need to identify their target audiences and stakeholder communities. These will vary.
	Improve participation and engagement of Russia in the AOS.
	Establish a network of on the ground 'environmental change
	Develop a survey for networks engaging with stakeholders and who working with addressing stakeholder needs for information to help identify best-practices.
	Create more inclusive and iterative communications platforms for planning Arctic Observations.
	Develop best practices for community/stakeholder engagement and evaluate success (AINA).
Capacity Building	Explain models versus observation, uncertainty, etc. to stakeholder groups.
	Respect northern communities' desires and needs.
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Coordination for Improved Arctic Observing	
Mechanisms for Coordination	Build partnerships & strengthen collaborations with Russia
	Facilitate research in Arctic environments (reduce administrative barriers).
	SAON should support improved access to infrastructure, field stations and data and funding streams;
	Coordinate field, shipping and other activities to benefit multiple parties, programs, data collection efforts, etc.
	Create an international body with long-term funding and infrastructure investments with a mandate to support coordinated observing systems and flexibility to accommodate future and unforeseen needs.
	Improve presence of logistics providers (e.g. ships, etc.) and discuss what data can be collected (e.g. bathymetry from ships, etc.) from the activities and platforms they support.

Funding	Establish internationally coordinated funding with common calls for and common review of proposals.
	Use the Belmont Forum as pilot for multi--nation project funding.
	Establish funding mechanisms for supporting research and stakeholder observing activities
	Funding agencies should support all components of projects and programs through (inter---agency and international coordination, within nations).
	Improve coordination, access, archiving of data collected through private sector, and vice---versa (e.g. IPY data outcomes with industry).
	Funding for sustainability - countries should consider charging fees to industry to support observing systems as part of the countries' obligation to surveillance operations such as search and rescue, oil spill recovery, etc. (Arctic Council countries).
	Identify funding sources for sustained operational observations
	International funding agreements need accurate estimates of total cost for long-term observing system.
Technology and Innovation	Develop and adopt new technologies and expand automated and remote data collection sites and networks (e.g. buoys, recording devices, etc.).
	Make some high-risk investments in technology – there has to be room for failure.
	Enhance cooperation between industry and the scientific community for technology development.
	Share technology and tech development to reduce costs.
Data	
Data Management and Sharing	Enable open access of real--time data soon after capture.
	Improve coordination and collaboration - use standardized methods and terminology at validation sites; use same variables and indicators where possible.
	Work on establishing, recommending, and building capacity for standardised methodology, instrumentation, data collection and analysis – improved interoperability.
	Improve cross-sectoral and collaborative approaches to the collection and maintenance of data.
	Develop an annual reporting process (international and cross sector) for observing activities culminates in an iterative catalogue

Data Management and Sharing (cont.)	Improve access to international data collected within national EEZ's; explore role of SAON, International Maritime Organization, Arctic Council's Search & Rescue group with respect to this issue.
	Improve tele and cyber-communications in northern communities to enable accessibility to data and information.
	Improve Arctic Research community representation at GEOSS. (i.e. link through SAON may not be sufficient).
	Develop knowledge translation, applications.
	Integrate industry platforms for data capture & dissemination; evaluate what opportunities exist for gathering & sharing data (e.g including infrastructure such as ships).
	Improve pre---planning, coordination of data---gathering, acquisition and archiving of ship---based data collection; create or 'empower' a coordinating body (e.g. Pacific Arctic Group(e.g. train graduate students in program, e.g. U of Arctic?)
	Enable accessibility of data by/from Eurasian sector (including Russia as one priority_
	Create platforms for data packages (i.e., processed data products, not raw data) for specific users and based on needs assessment.
	World Ocean Council should lead an initiative with industry partners and academia to explore data sharing, coordination, and joint data collection programs.
	WOC and AOS participants should identify successful case studies of industry data sharing, collection, coordination and infrastructure support examples.
	Improve coordination, access, archiving of data collected through private sector, and vice---versa (e.g. IPY data outcomes with
	Open access is not entirely sufficient – data uptake should be increased through appropriate easy-to-use data interfaces.
	A mechanism is needed to connect data system designers with data holders and users so that data systems are informed by needs.
	Inventory and then build on preexisting knowledge and data systems.
Data Rescue	Develop a graduate training program for various kinds of data rescue that would include teaching methods for finding, standardizing, manipulating, and sharing data products. Engage University of the Arctic in this activity.
	Prioritize and support data rescue efforts through the creation of a coordinating body to centralize portals, decision-making, and communications.
Data Products	Identify and prioritization of useful data and information products.
	Develop reliable products for public consumption and reliable source designation.
	Identification and prioritization of useful data products
	Coordinate creation of body to review information, blogs, data for 'quality control' purposes.

Data Products (cont).	An environmental change 'atlas' for the Arctic is a desired data product.
	Produce an annual catalogue of available data products that make processed data available and useable to a broad range of users.
White Papers	
Process and Need	White papers are key to a critical to a productive AOS – for informing participants and ensuring a useful outcome. They should be a regular part of the AOS process.
	Priorities, based on AOS findings, should be set for white papers. For example, future papers should address health and infrastructure observing needs, status of the Global Cryosphere Watch, etc.
	Develop a process for setting priorities for white papers
	White papers should also address extensive knowledge gaps (for example lack of on baseline data including near-shore bathymetry, landcover, etc.).
Other Recommendations	
Publications	**Publish white papers and reports in peer-reviewed venue (AINA/*Arctic* journal).**
	Seek community input on draft recommendations from AOS 2013 and 2014.
	Publish AOS reports and recommendations biannually (ISAC program office).
Policy	Evaluate policies that can be impacted by climate change and consider ways in which policies can be made adaptable to new
	Include policy statement to integrate "the Arctic" into all of the existing global research programs (GEO, WMO, GOOS, GCOS, GTOS, etc.).