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# Sustaining Arctic Observing Networks (SAON): Data policy, activities, services, and deliveries

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## Background

### The SAON Vision is that “users should have access to free, open and high quality data that will realize pan-Arctic and global value-added services and provide societal benefits” (*SAON, 2009*). Several initiatives have been taken in the past to define SAON’s data policy, activities, services, and deliveries. The most important are summarized in Appendix A.

### The recommendations given to SAON on Arctic data management can be summarized under these headings:

1. Establish a data policy/data charter in order to support the concept of free, open access to data. This should recognize that funding for data management should be an integral part of funding for all data collection activities. It should encourage publication (of data) in open access journals.
2. Establish interoperability, supported by data and metadata standards and protocols.
3. Create a detailed inventory of Arctic observing systems and projects.
4. Establish data oriented criteria for the recognition of SAON Networks.
5. Establish an Arctic data management body to coordinate community building, system design, and general activity planning and execution.
6. Establish a data portal.
7. Mobilize funding for data management activities.
8. Promote efforts to ensure that data are archived in sustained long-term data archives.
9. Provide assistance to various observing networks, data systems, and individuals to help them expose their data and metadata in ways that can be discovered, accessed, and translated across different web services.
10. Conducting training in data management and identification of best practices and “cookbooks” for data and metadata standards, tools, etc.

## 2 SAON and the management of arctic observational data

SAON should have a strong role in data management. As described in section 1, many recommendations have been given over the years on how SAON should be involved in this area, including comments like “coordinating the data availability might be the only useful thing that could be done”. It should be noted that there are many initiatives in this area already, and as for any other activity, SAON should build its effort on existing resources. It should also be noted that some of the recommendations above have a defined scope, while other are more open-ended, and will take years or even decades to accomplish. It is recommended that priority is given to the first five recommendations in section 1. Their implementation in a SAON context is discussed in the next sections. It should also be noted that the activities suggested have a scope that is wider than the existing SAON Tasks.

### 2.1 Establish a SAON data policy/charter

There is a political aspect of the SAON vision that “users should have access to free, open and high quality data”. The IASC working group on IASC Data Policy Group: is working to would develop and recommend a data policy, and SAON should review this with the aim of adopting it.

### 2.2 Establish interoperability, supported by data and metadata standards and protocols

There is a wide spread expectation to SAON to be involved in ensuring that data collected in the arctic can be utilized for purposes beyond the project/program where they were originally collected. As an example, Young et al (2013) states that “SAON offers the potential to link vastly different data systems across disparate scientific disciplines, and enables important scientific and policy questions to be addressed. For example, can one establish a causal chain from climate change, through wildlife population, to food insecurity, by linking and correlating data on precipitation, hunting harvests and nutrient intake?”

#### 2.2.1 SAON should organize arctic observational metadata

In *SAON (2011b)* it is stated that “there is a need to fill spatial, temporal and disciplinary gaps in observing records, to strengthen the sustainability of observing programs, and make data more readily available.”

SAON should take initiatives to organize arctic observational metadata. A collection of metadata is a tangible asset, and allows for the production of ‘easy to digest’ outputs like maps, tables, graphics, etc. More importantly a collection of metadata will

* Be a tool for SAON to identify gaps in observational capacity;
* Enable an analysis of current and past observational activities against societal needs;
* Enable an analysis of data access against a SAON data policy and serve as basis for a structured dialogue with the underlying data providers on data access;
* Act as an integrator across those Tasks that have observational activities;
* Enable further research in how to address ‘interoperability’: “Interoperability can be defined as the ability for diverse systems and organizations to work together (interoperate) on many levels. Establishing compatible formats provides some level of interoperability but does not guarantee effective sharing across disciplines or knowledge domains. Structural interoperability, including building, updating and maintaining networks of data systems across diverse technologies, standards, requirements, and funding schemes is even more challenging. Arguably the single biggest challenge to data management is semantic interoperability, or translating the knowledge embedded in data across contextual boundaries (*Pulisifer et al, 2013*)
* Serve as input to a discussion of a SAON ‘Data Portal’. SAON’s involvement in organizing underlying data is a long-term task.

Two SAON Tasks (no 2 and 8) are already addressing the question of metadata (*SAON 2011a, 2011c*), and these Tasks should form the basis for this initiative. There are several arctic metadata initiatives ongoing, and Appendix C lists some of these.

#### 2.2.2 Which metadata?

The initiatives listed in Appendix C are mainly organizing information about data collections that are stored elsewhere. Most of the initiatives are at least to some extend basing their work on internationally recognized standards like ISO 19155. This standard “provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data". Meanwhile, the standard is not suited for the description of projects, and metadata of projects should also be the target for SAON. The “Alaska Data Integration Working Group” (ADIwg, Appendix C) was formed to examine and address this. *SAON (2011c)* describes that the British Arctic Survey is also working in this area, but this has to be confirmed.

To make metadata available for brokering/harvesting is not a trivial task. There will be institutions/project that will not have the technical capability to do it. SAON may need to build a platform where smaller initiatives can register and maintain their metadata.

#### 2.2.3 What about the ‘real data’

For SAON to work in the area of ‘real data’ is ambitious at least in the short- and mid-term. In order to understand if and how SAON should be involve in real data, the nature of the ‘real data’ in the Arctic must be understood. Good inventories of observing systems, projects, and data collections are prerequisites for this. SAON should be involved in organizing and analyzing metadata and let the outcome of this be the driver for new initiatives with ‘real data’.

### 2.3 An inventory of Arctic observing systems and projects

Many of the SAON recommendations are focused on the creation of a detailed inventory of Arctic observing systems and projects. The activities proposed in section 2.2 will organize such inventories. SAON has already created its first inventory of this kind, based on reporting from countries and organizations. The weakness of the existing inventory is that it is not based on standard, and there are is no technical platform for users to maintain the contents.

### 2.4 Establish data oriented criteria for the SAON governance structure

The SAON governance structure is seen in figure 1, and the relationship between the different components can (also) be defined in terms of data oriented criteria. There is an ongoing discussion in SAON on what a SAON Task, project or program is, and the process for approval of these. SAON activities that collect or organize data should fulfill certain basic data oriented criteria. Appendix D formulates such criteria, and suggests that there should be a two-level entry for Tasks to SAON. As an overall criterion, SAON Tasks, Networks, and Partners should 1) have plans for and ensure that their data are accessible and stored safely, and 2) ensure that their metadata can be subject to brokering/harvesting. The following sections discuss how these principles should be applied against SAON Tasks, Networks, and Partners.

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#### Figure 1: The structure of SAON (from SAON 2011b)

The SAON Tasks are by nature diverse, but Tasks that collect or organize data should meet certain criteria. A proposal that covers this aspect is found in Appendix D.

#### The concept of a SAON Network has to be better defined. Until now, all SAON activities have been named ‘Tasks’. It is time to make a distinction between projects with a defined scope and limited duration, and more continuous networks like GTN-P, INTERACT, and IASOA. Meanwhile, from the perspective of organizing data, such networks should meet the same criteria as the Tasks, i.e. ensure that 1) their data are accessible and stored safely, and 2) their metadata can be subject to brokering/harvesting. There are upcoming networks that may want to be associated with SAON (like Svalbard Integrated Arctic Earth Observing System (SIOS), and Global Cryosphere Watch (GCW)), and their relationship with SAON can be defined through these criteria.

There is not a good definition of what a SAON Partner is, but at least a sub set of these are involved in doing observations and organizing data arising from these (like CAFF, CBMP, CliC, EEA, EU, ICES, WMO). Such partners should meet the same criteria as the Tasks, i.e. ensure that 1) their data are accessible and stored safely, and 2) their metadata can be subject to brokering/harvesting.

The National SAON Coordinating Committees (NSCCs) will play an important role in ensuring that nationally coordinated arctic observation activities meet the criteria that also apply to the Tasks, Networks, and Partners: Ensure that 1) data are accessible and stored safely, and 2) metadata can be subject to brokering/harvesting. The NSCCs can support this effort by requiring that nationally funded observational programs meet the listed basic data oriented SAON criteria. Many nationally funded programs already require that projects have a data management plan, but these requirements may have to be further developed.

2.5 Establish an Arctic Data Management Group

SAON should establish an Arctic Data Management Group. It should be an Expert Group under the SAON Board with a 3-year mandate to

1. Review past recommendations to the SAON IG and SG on arctic data management
2. Formulate a SAON data policy.
3. Review new and existing SAON Tasks from the Data Management Perspective
4. Give guidance to the SAON Board on the development of data and metadata protocols
5. Provide guidance on the relevance of establishing a ‘SAON Metadata Portals’ and/or a ‘SAON Data Portals’

The group should be in active cooperation with SCAR/SCADM. The Expert Group may be the vehicle that can mobilize funding from SAON’s parents, i.e. the Arctic Council and IASC. The SAON Secretariat can serve as the Secretariat for the Expert Group.

## 3 Summary

SAON should develop operational activities within these data oriented areas:

* A data policy/data charter in order to support the concept of free, open access to data should be developed. The ongoing activities of IASC should be reviewed.
* Establish interoperability, by supporting the development of new and existing metadata harvesting/brokering.
* Based on existing initiatives and platforms, create a detailed inventory of Arctic observing systems and projects. It will mainly be the responsibility of existing national structures to provide input to such an inventory initiative.
* Establish data oriented criteria for the recognizion of SAON Tasks, Projects, Networks, and Partners.
* Establish an Arctic Data Management Group, with the aim of initiating and coordinating the activities above, and to give the SAON Board advice on these topics.

## Appendix A: SAON Data Related activities

### Several initiatives have been taken in the past to define SAON’s data policy, activities, services, and deliveries. The most important are summarized in the following.

### 1 The SAON Initiating Group Workshops

### The SAON Initiating Group (IG) arranged a workshop in Stockholm in 2007 (*SAON, 2007*). The report from the workshop states that “ideally all data should be freely available “, and “when making data available it is important to build on existing meta- databases and data centres”. The report further states that “a problem associated with data access is that funds are usually allocated for collecting data but not for processing and posting the data. In order to assure that data are made freely available it is important to allocate funds also for processing and posting of data”.

### A second SAON IG workshop was held in Edmonton in 2008 (*SAON, 2008a*). The ‘Operational Community Group’ “discussed the concept of a ‘data portal’ as a key activity that would enable communication and eventually coordination. There was a comment that coordinating the data availability might be the only useful thing that could be done. There was discussion of the need for data standards so that data from diverse sources could be easily integrated. There were views that the Secretariat might be the proper body to undertake the data portal function, with each nation designating some sort of lead agency to feed information to the portal”. At the same workshop, the ‘Terrestrial Observation Network’ states that “data management design should also go beyond passive data collection and management to also include interpretation functions. (…) Existing and new cyber-infrastructure technologies should be employed to streamline data archiving, data formatting, and data access. The biological sciences, in particular, would benefit from data archiving, formatting and access technologies as biological data comes in a variety of forms and media. Streamlining would include developing distributed, interoperable single-entry data portals that allow simple and efficient discovery and access to current metadata and data. These portals should be compatible with existing and planned global data portals and should include a searchable meta-database of existing Arctic monitoring networks, monitoring protocols in use and existing data. The development of this meta-database would be directly supported by an inventory of current monitoring programs, protocols and data”.

### At the third SAON IG workshop (In Helsinkik, *SAON, 2008b*), the ‘Coordination and Funding Breakout Group’ describes “possible early projects” that would include “demonstration of the value of the ‘data portal’; perhaps with emphasis on high level products with the ability to drill down to actual data”. At the same workshop, a data management break-out group discusses how “data‐relevant building blocks” should be developed to a) derive a list of data centers and portals used by arctic observing entities, b) establish a framework for the development of a portal, c) develop incentives for archiving of data (and metadata), d) develop community of practice for liaising with GEO, and e) improve allocation of resources to data management, cyber-infrastructure and portal maintenance.

### 2 The SAON Data Management Workshop

In June 2010, a SAON Data Management Workshop was held (*SAON, 2010*). Prior to the workshop, a questionnaire had been circulated, and the respondents had been asked to identify suggestions for what the SAON process might do in relation to data management that could help meet/serve their program/network needs. Many of the suggestions could be grouped under the general categories of:

* Enhancing and promoting standardization in data management operations (including calls for SAON metadata standards and initiatives relating to ‘data policies’);
* Enhancing shared use of data, including viewing SAON as a vehicle for publicizing and promoting awareness of existing data holdings;
* Promoting best practices, especially in relation to open and free data sharing;
* Use of SAON as a means of mobilizing funding for data management activities.

The recommendations from the workshop to the SAON Steering Group (SG) state that SAON should focus on data sharing; interoperability; preservation of data through sustainable, long-term archiving that has dedicated funding; and governance. Additionally, the SAON SG should identify national points of contact for participating SAON network affiliations that will be accountable for coordinating national data. The meeting summarizes their work under these headings:

* A statement outlining the principles/guidelines for SAON data management should be developed. The statement could take the form of a charter or something similar; SAON should not attempt to define a ‘SAON data policy’;
* The statement should support and promote the concepts of “free, open, and timely (i.e. shortest possible time for) access to high-quality data” at the same time recognizing legitimate restrictions and practicalities;
* SAON should acknowledge the need for sustained long-term data archives; promote efforts to ensure that data are archived in these repositories. If such archives do not exist, SAON should promote efforts to establish (and fund over the longer-term) such archives. Every SAON network must have one or more long-term sustained data archive;
* The SAON data management strategy should acknowledge that different data types require different solutions;
* SAON should recognize that affiliated networks/program have their own established data policies that apply to providers of data and users of data. SAON should endeavor to ensure that, as they are developed over time, the data policies operated by SAON partner programs/networks aspire to and are compatible with the general SAON data management principles as stated above;
* Funding for data management should be an integral part of funding for all data collection activities;
* SAON should support standardization of metadata and could attempt to define its own;
* SAON should encourage publication (of data) in open access journals;
* SAON could consider a data dissemination protocol based around the member states and national SAON implementation approaches;
* SAON needs to conduct additional work to gain perspectives relating to data management associated with social-economic sciences as these groups were under-represented at the data management workshop.

### 3 The Arctic Data Coordination Network

During The International Polar Year 2007-2008 (IPY), researchers and data managers around the world began to establish some of the structures and relationships necessary to address the diversity of interdisciplinary Arctic data but they were hampered by limited funding and very ad hoc or non-existent data systems. *Parsons et al* (*2012a*) recommend that an Arctic Data Coordination Network is established. Activities of such a group could include:

* Creation of a detailed inventory of Arctic observing systems and projects, especially those involving community based monitoring (CBM) and local and traditional knowledge (LTK).
* Assistance to various observing networks, data systems, and individuals to help them expose their data and metadata in ways that can be discovered, accessed, and translated across different web services.
* Conducting hackathons or training to demonstrate one or more integrative data access systems by brokering services from multiple data providers with a goal towards illustrating a model for a broader Arctic data “marketplace”.
* Further data management and related training courses in collaboration with the Federation of Earth Science Information Partners (ESIP).
* Identification of and publication of best practices and “cookbooks” for data and metadata standards, tools, OpenSearch XML schema, XSLTs, open rights badging, etc.
* Small focused workshops around topical issues such as developing shared controlled vocabularies, community agreement on protocols and formats, training on metadata formats and tools, basic ontology development, special considerations around local and traditional knowledge, etc.

In 2012, the initiative suggested these definitions of the requirements to a SAON network (*Parsons et al, 2012b*):

* There is an identified data resource person
* The network or data centre meets the requirements for World Data System certification
* The network/data centre adheres to the IPY data policy
* The network/data centre uses standard metadata that meets the needs of the discipline(s)
* The network/data centre harmonize with relevant broad international data systems

### 4 SAON Board Meeting in Potsdam

A break-out group at the SAON Board meeting in 2012 (*SAON, 2012*) focused on the criteria for certifying SAON membership, and gave these recommendations to the SAON Board:

* The SAON Board should define multi-tiered certification criteria to formally recognize SAON member observing networks and help ensure they are sustained and broadly useful.
* The Board should develop a review mechanism for certifying and (decertifying) member networks, perhaps in a manner similar to how they currently review and approve tasks.
* The SAON Board and membership should help Arctic observing networks advance and sustain toward providing ethically open, well-described, useful, well-preserved data.
* The Board should consider data center certification as well as network certification, building from the ICSU World Data System certification.

### 5 “Data Management for Arctic Observing”

*Peter L. Pulsifer et al* (*2013*) discuss data management for arctic Observing, and gives recommendations under these four headings:

- Existing Arctic data management coordination efforts:

* Leverage investments made in past and current data management coordination efforts and operational systems to work towards linking various programs in ways that can more effectively support the needs of the Arctic observing community in meaningful ways.
* Through the Arctic Observing Summit and other venues, make the Arctic observing community aware of, and encourage engagement in, observing data inventory initiatives. This can be driven by members of the data management community but will require participation by the broader community.

- Observing System Design and Coordination:

* Establish an Arctic data management body to coordinate community building, system design, and general activity planning and execution. Build on existing communities, activities, projects, and other efforts across the Arctic.
* Leverage existing funding mechanisms that support community development (e.g. U.S. National Science Foundation’s Research Collaboration Network program).

- How does data management address the universe of user needs?

* Engage system users and other stakeholders early and often when designing systems.
* When establishing an Arctic data management body, include formal representation of key user groups. For example, if a committee is established, this committee should include representatives from the sciences, Indigenous groups, policy makers and possibly others groups.

- Who are the funding organizations and other interested parties that support data management?

* The Arctic observing community, including data managers, must continue to work together with funders, legislators, and other stakeholders to provide international funding opportunities.
* When establishing an Arctic data management body, task this body with developing international, coordinate funding appeals.

When establishing an Arctic data management body, include formal representation of funders.

## Appendix B: Background documents

GEOSS (2012): “GEOSS Common Infrastructure (GCI) Architecture Design Document”. Version 1.0. 15th November 2012. Prepared by: IN-03 Task Team (non-published draft)

Manley, William F., Allison G. Gaylord, Ari Kassin, David H. Lin, Ryan Cody, Mike Dover, Roberta Score, and Craig E. Tweedie (2013): “Strategic Assessment for Arctic Observing, and the New Arctic Observing Viewer”. A Community White Paper Prepared for the Arctic Observing Summit 2013 (<http://www.arcticobservingsummit.org/pdf/white_papers/strategic_assessment_arctic_obs_viewer.pdf>)

Parsons, Mark A., Peter Pulsifer, David Carlson, and Shari Gearheard in collaboration with many partners (2012a): “A Research Coordination Network for Very Interdisciplinary Arctic Data and Information” (<http://www.arcticobserving.org/images/stories/SAON_BOARD_TROMSO/a4/rcn_summary.doc>)

Parsons, Mark A. and more (2012b): “[Minutes from workshop in Montreal, Canada 27APR2012](http://www.arcticobserving.org/images/stories/Tasks/TN2/adcn_april_2012_minutes.doc)” (<http://www.arcticobserving.org/images/stories/Tasks/TN2/adcn_april_2012_minutes.doc>)

Pulsifer, Peter L., Lynn Yarmey, Øystein Godøy, Julie Friddell, Warwick F. Vincent, Taco DeBruin, Mark A. Parsons (2013): “Data Management for Arctic Observing”. A Community White Paper Prepared for the Arctic Observing Summit 2013 (<http://www.arcticobservingsummit.org/pdf/white_papers/data_management.pdf>)

SAON (2007): “1st workshop, held in Stockholm 12-14 November 2007” (<http://www.arcticobserving.org/index.php?option=com_content&view=article&id=38&Itemid=47>)

SAON (2008a): “2nd IPY workshop on Sustaining Arctic Observation Networks April 2008” (<http://www.arcticobserving.org/index.php?option=com_content&view=article&id=45&Itemid=57>)

SAON (2008b): “3rd IPY workshop on Sustaining Arctic Observation Networks October 2008” (<http://www.arcticobserving.org/index.php?option=com_content&view=article&id=51&Itemid=66>)

SAON (2009): “The SAON Brochure” (<http://www.arcticobserving.org/images/stories/files/Final_Updated_SAON_Brochure.pdf>)

SAON (2010): “SAON Data Management” (<http://www.arcticobserving.org/images/stories/DRAFT_REPORT_-_SAON_Data_Management_Workshop_Report_FINAL_GBL0818101.pdf>)

SAON (2011a): “Coordination of existing Arctic relevant Meta-databases and Project Directories” (<http://www.arcticobserving.org/index.php?option=com_content&view=article&id=109&Itemid=100016>)

SAON (2011b): “Plan for the Implementation Phase of SAON” (<http://www.arcticobserving.org/images/stories/SAON_Reports/SAON_Report_February_20112.pdf>)

SAON (2011c): “Polar Metadata Profile and Recommended Vocabularies” (<http://www.arcticobserving.org/index.php?option=com_content&view=article&id=98&Itemid=100016>)

SAON (2012): “Board Meeting Minutes, Potsdam” (<http://www.arcticobserving.org/images/stories/Board_Meeting_Potsdam/Minutes/SAON_Board_Meeting_October_2012.docx>)

Young, Kue, Susan Chatwood, Peter Bjerregaard (2013): “Observing the Changing Health of Circumpolar Peoples”. A Community White Paper Prepared for the Arctic Observing Summit 2013 (<http://www.arcticobservingsummit.org/pdf/white_papers/young_et_al_observing_changing_health.pdf>)

## Appendix C: Ongoing arctic metadata initiatives

(Some of the content is copied from Pulsifer *et al* (2013))

### [Alaska Ocean Observing System Board](http://www.aoos.org) (AOOS) and Alaska Data Integration Working Group (ADIwg)

AOOS is developing a conceptual build-out plan for an Arctic Ocean Observing System for the U.S./Alaska Arctic. The goal of this plan is to prioritize core monitoring platforms and activities to meet stakeholder needs for safe marine operations, improved storm and other hazard response, and integrated data products for ecosystem assessments and climate trends. ADIwg was formed to examine and address the technical barriers to efficiently integrate and share data within and among participating organizations. From the outset, ADIwg divided its broad mission into three phases: 1) manage and exchange ‘project’ metadata; 2) manage and exchange ‘data’ metadata; and 3) exchange data.

### Canadian Program

The Canadian IPY Program leveraged existing government and academic resources to make significant progress in the area of polar data management (http://www.apiipy.gc.ca/pg\_ipyapi\_016eng.html). Specifically, data management capacity developed through ArcticNet (http://www.arcticnet.ulaval.ca) was further developed with support from the federally funded IPY program and the formation of the Canadian IPY Data Assembly Centre Network (now the Canadian Polar Data Network). A flagship result is the Polar Data Catalogue (PDC, http://www.polardata.ca), cofounded by the Canadian Cryospheric Information Network and ArcticNet. The PDC is a database of metadata and data that describes, indexes and provides access to diverse data sets generated by Arctic and Antarctic researchers. The recent work has added data access and archival functions, and this resource is now being adopted by other programs within Canada (e.g. the Northern Contaminants Program) and internationally (e.g. the Circumpolar Biodiversity Monitoring Program).

### Norwegian Program

In Norway, IPY data management was implemented as a distributed system to which the Norwegian Polar Institute, the Institute of Marine Research, and the Norwegian Meteorological Institute contributed. The linkage between catalogues at these institutions continues after IPY, both in support of the existing IPY datasets, but also in new national scientific infrastructure projects funded by the Research Council of Norway. In the development of the Svalbard Integrated Arctic Earth Observing System (SIOS) which is supported by the European Strategy Forum on Research Infrastructures (ESFRI), the IPY metadata exchange has also been used to set up a demonstrator including the previously mentioned Norwegian institutions and PANGAEA in Germany.

### Swedish Program

Environment Climate Data Sweden, ECDS, is a Swedish service facilitating the searching, publication and long-term accessibility of data for research in the fields of environment and climate. ECDS will be the central access point to decentralized data resources. ECDS is a gateway to environment and climate data. Through the portal and the underlying metadata catalogue users will be guided to datasets hosted by contributors (<http://www.smhi.se/ecds>)

### ACADIS

Advanced Cooperative Arctic Data and Information System (ACADIS) Metadata Brokering Effort: The ACADIS Arctic Data Explorer is an example of a metadata brokering system, meant to allow users to search across many different data repositories with a single query. Given the large number of Arctic data repositories, metadata brokering helps those looking for data by reducing the number of portals they need to know about, visit, and search. From an infrastructure perspective, metadata brokering offers the benefits of a data clearinghouse while allowing the participating repositories to maintain their specialized focus. Partnering with NSF’s Earthcube and the Italian Earth and Space Science Informatics Lab (IESSIL), the initial launch of the Arctic Data Explorer offers keyword, temporal, and spatial search across multiple data catalogs including the ACADIS partners, National Snow and Ice Data Center (NSIDC), the National Center for Atmospheric Research (NCAR) Computational and Information Systems Laboratory’s ACADIS gateway, and the NCAR Earth Observing Laboratory (EOL) Computing, Data and Software Facility. The Norwegian Meteorological Institute (NMI) and the US National Oceanographic Data Center (NODC) are additional data catalogs accessible through the initial release of the brokered search (<http://nsidc.org/acadis/search>).

Circumpolar Biodiversity Monitoring Program (CBMP)

The Circumpolar Biodiversity Monitoring Program has adopted the IPY data policy in developing their Arctic Biodiversity Data Service (ABDS). The ABDS portal aims to help users explore biodiversity data from across the Arctic. The system has started work with a pilot project looking at integrating data from the Seabird Information Network and the Seabird Expert Group of the Conservation of Arctic Flora and Fauna (CAFF). The portal focuses on connecting taxonomic and geospatial search elements and will be incorporating social science data including linguistic and population data (http://www.abds.is**)**

### IPYDIS

The International Polar Year Data and Information Service (IPYDIS) was a distributed cooperation between data centres, archives and networks. The main aim of IPYDIS was to track the data flow for IPY. To achieve this, information on standards, data access mechanisms, archives, and services had to be provided. IPYDIS activities were guided by the IPY Data Policy and Management Subcommittee. The most important data management document of IPY was the IPY data policy. To be recognised as an IPY project, projects had to adhere to the policy. In brief, the contents of the IPY data policy are best summarised by the words “fast” and “open” data access. The intention of this policy was to promote scientific cooperation and interdisciplinary science. This was achieved by providing searchable metadatabases and online access to data sets. IPYDIS lacked funding at the international level, however, a linkage of archives and systems at the metadata level was achieved utilising the standard metadata sharing protocols and descriptions. This was a low cost, easily implemented solution that has been used in support of WMO Global Cryosphere Watch (GCW) as well as national projects after IPY. NASAs Global Change Master Directory served as the central IPY catalog harvesting metadata for national sub nodes.

### Arctic Portal: The SAON Data Interface

The intention of this initiative is, in co-operation with SAON and the different tasks, to design and facilitate a SAON scalable and inter-operable meta-data interfacing and consequently interpretation and data accessing tools which would provide the following principal service of:

1. Thematic, across theme and databases / services, collection of meta data – cataloging
2. Adaption of data to standard
3. Standardizing input and output formats for various data services
4. Providing Query possibilities and tools across themes
5. Development of illustration and comparison tools
6. Data hosting for those who need a home

<http://www.arcticobserving.org/images/stories/Board_Meeting_Potsdam/Meeting_documents/54_Arctic_Cooperation_and_Data_Square-092012.pdf>

### The WMO Integrated Global Observing System (WIGOS)

WIGOS is an integrated, comprehensive, and coordinated system which is comprised of the present WMO global observing systems, in particular of the *in situ* and space-based components of the Global Observing System (GOS), the Global Atmosphere Watch (GAW), the Global Cryosphere Watch (GCW), and the World Hydrological Cycle Observing System (WHYCOS).

WIGOS is not in itself an observing system, but a framework to enable the existing observing systems to provide more efficiently and effectively the data required for delivery of services across WMO's application areas, and for all regions of the world. WIGOS will focus on the integration of governance and management functions, mechanisms, and activities to be accomplished by contributing observing systems in relation to the resources allocated on global, regional, and national levels. Together with WMO Information System (WIS), it will enable stakeholders to work better together to make, gather, store, access, exchange and interpret the observations they need for the effective delivery of improved services to their communities

(<http://www.arcticobserving.org/images/stories/Board_Meeting_Potsdam/Meeting_documents/18_saon-board%202nd%20mtg_data%20access_wmo.ppt>)

### Group On Earth Observations – System of Systems (GEOSS)

According to *GEOSS (2012)*, the organization “has been designed to serve the nine Societal Benefit Areas (SBA) of disasters, health, energy, climate, water, weather, ecosystems, agriculture and biodiversity”. GEOSS needs data to do this, and is setting up a “registration service where data providers can register their datasets providing all the associated information necessary for further discovery”

The GEOSS work is based on a 10-year implementation plan, and introduced in 2005 the GEOSS Common Infrastructure (GCI). It offers the following capabilities:

* A Web Portal that provides GEOSS users with a “one-stop” discovery and access function to all GEOSS resources;
* A brokering-based architecture to discover and access registered resources;
* A set of registries of GEOSS components, services, standards, requirements and best practices.

In addition, GCI offers that “other systems can be linked to the GCI using its exposed service interface nodes under the SoS engineering framework with the goal to share functionalities and expand discoverable resources”. Moreover “GEOSS architecture defines also another type of portal service mainly focusing on specific communities and referred to as *Community Portals*. Community Portals provide a user interface for a specific community serving a specific research interest, SBA (Social Benefit Areas), etc”. Such a facility may be used to build a proper “SAON metadata portal”, which is the ambition underlying SAON Task 8 *(SAON, 2011a)*.

## Appendix D: Data oriented requirements for SAON networks

(From *SAON Board Meeting Minutes, Potsdam, 2012*)

Participants at the Arctic data coordination workshop in Montreal (Parsons *et al*, 2012b) defined a recommended set of criteria to be a successful observing network:

1. The network identifies a data point of contact and resource person.
2. The network has at least one associated data center which must meet the requirements for ICSU World Data System certification (<http://icsu-wds.org/wds-members/join-icsu-wds/criteria-membership-certification>)
3. The network/data center must adhere to the IPY data policy
4. The network and data center must use standard metadata that meets the needs of the discipline(s)
5. The network and data center must coordinate with relevant international data systems in their domain.

The group thought these are good criteria but recognized that not every network will be able to achieve this immediately (…) The criteria defined in Montreal may serve as the initial high-level certification. The base level certification should consist of at least the following:

1. The network specifically defines what relevant data currently exists and what is to be collected.
2. The network has a designated point of contact for data issues.
3. The network has a plan to move toward a higher level of certification as appropriate.
4. The network has some indication of how it can be sustained over time.