Introduction to the Arctic Observing Summit WG 4

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AOS Working Group 4
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Review of Recent Activities
Data Sharing: Cooperation from Local to Global

- Significant progress made since International Polar Year
- Framework for cooperation exists
- Recent collaboration being leveraged to establish concrete “architecture”
- All perspectives and actors must be included
Indigenous Knowledge and Information Systems

• Growing group actively working to share Indigenous Knowledge, information and data

• Progress needed on bridging worldviews, concepts and semantics represented in information systems

• Indigenous Peoples must lead engagement and work with their knowledge – information sovereignty important

http://www.inuitknowledge.ca/
http://www.arcticbm.org/index.html
http://nunaliit.org/
http://www.arcticcbm.org/index.html
http://ittaq.ca/
http://eloka-arctic.org/
http://nunaliit.org/
http://www.smartice.org/
http://trailmarksys.com/
Mapping the Polar Data Ecosystem

Understanding the Arctic and broader polar environmental and social systems requires constant monitoring and access to the best available sources of data and information. This is particularly challenging in the Arctic region due to the complexity of the region in the face of significant environmental, economic and societal change. Identifying, documenting and, understanding the Arctic component of the global information system will allow us to target gaps in information resources, as well as guide the ongoing development of the increasingly interconnected global information system in support of governance, research, livelihoods and myriad other applications.

The Mapping the Arctic Data Ecosystem project aims to use the established conceptual framework of info tool to help organize ideas and comprehend complexity of the Arctic Data Ecosystem. Here we define a data-connected and interdependent human actors, institutions, norms and practices (including standards), the relationships and the broader socio-technical environment in which it exists. This website provides internal elements of the Arctic and Antarctic data ecosystem(s). This initial prototype allows users to filter and visualize relationships in the data ecosystem. As the database grows, additional analysis functions will be added.

Task lead: Peter Pulsifer, NSIDC/ECOD, University of Colorado, USA

Information Ecology to Map the Arctic Information Ecosystem

Peter L. Pulsifer, Yekaterina Kontar, Paul Arthur Berkman, and D. R. Fraser Taylor

Visualization & data courtesy Arctic Data Committee; P. Pulsifer; Polder; R. Duerr

https://lod-cloud.net/
## Analysis of Community Reports

- **Report 1:** IPY Data Management Workshop (2006)
- **Report 3:** IPY Arctic Data Coordination Network Workshop minutes (2012)
- **Report 5:** IPY Arctic Data Coordination Network Workshop minutes (2012)
- **Report 6:** Report on Workshop on Cyberinfrastructure for Polar Sciences (2013)
- **Report 10:** Response to the Open Geospatial Consortium Request for Information on Arctic Spatial Data by the Polar Data Community (2016)

**Non-Technical Themes**

- Community Building
- Data Management
- Education, Outreach, and Culture Change
- Inclusion
- Shared Terminology
- Best Practices
- Understanding Stakeholder Needs

**Technical Themes**

- Interoperability
- Standards
- Data Access
- Data Archiving
- Data Discovery
- Metadata
- Data Publication and Attribution
- Data Integration
- Data Quality and Integrity
- Data Access
- Detailed Specifications and Implementation
- Architecture
- Data Platforms
- Data Visualization
- Data Processing and Storage

**IPY DIS Reports pending analysis**
Key Themes Identified

Social and Organizational
- **Community Building and Coordination** (includes sub-themes, e.g. Data Managers, Mediators, Coordinators)
- **Funding**
- **Engaging Arctic Indigenous Peoples**
- **Governance**
- **Education, Outreach, Culture Change**

Technical
- **Interoperability**
- **Standards**
- **Data Discovery (federated search)**
- **Emergence of Data Platforms and E-Science**
- **Data Access**
- **Data Archiving**
Current Activities
Many Partners

- WMO/GCW
- ArcticSDI
- Indigenous organizations
- Arctic Council WGs
- EU Arctic Cluster
- GEO (CRI, ArcticGEOSS)
- OBIS/GBIF (e.g. domain/disciplinary)
- WDS, RDA, CODATA
- CCADI
- SIOS
- US AON, NSF and related
- ...
- ENTITIES NOT YET CONNECTED!
Many Movements: “FAIR” Data

- Findable
- Accessible
- Interoperable
- Reusable
- “FAIR” principles

https://commons.wikimedia.org/wiki/File:FAIR_data_principles.jpg
https://www.force11.org/group/fairgroup/fairprinciples
Many Movements: CARE Principles

The CARE Principles for Indigenous Data Governance can be downloaded here in summary or full.

CARE Principles for Indigenous Data

The current movement toward open data and open science does not fully engage with Indigenous Peoples' rights and interests. Existing principles within the open data movement (e.g. FAIR: findable, accessible, interoperable, reusable) primarily focus on characteristics of data that will facilitate increased data sharing among entities while ignoring power differentials and historical contexts. The
Many Funded Projects and Programs

https://arcticdata.io/

https://ccadi.ca/

https://catalog-intaros.nersc.no/

https://nsidc.org/

Many others…
Activities: Community Building and Broader Context
Activities: POLDER (Federated Search)  

POLDER: Polar Data Discovery Enhancement Research

Polder (Dutch verb): to work collaboratively to achieve a common goal.

Federated metadata search for the polar regions will dramatically simplify data discovery for polar scientists. Instead of searching for data across multiple organizations, POLDER seeks to come to a single search page.

This is a rapidly moving field and POLDER is working to find the best path forward for our community. POLDER is a collaboration between the Arctic Data Committee, and Standing Committee on Antarctic Data Management.

https://ccadi.ca/third-canadian-polar-data-workshop

https://polar-data-forum.org/workshops-hackathons/enhancing-polar-federated-search-hackathon/
Activities: Semantics

ADC-IARPC-SCADM Vocabularies and Semantics Working Group

Details
Published: 31 July 2017

Help map terminology resources
The Vocabularies and Semantics Working Group is running a survey to identify relevant terminology resources for the polar community. Please help by responding to the survey at
https://tinyurl.com/PolarVocabs
and circulate the survey to potential respondents.

Group Summary
The Vocabularies and Semantics Working Group brings together people who are interested in semantics and vocabularies relevant to the polar regions. Originally established as a joint effort between the Arctic Data Committee and the Arctic Data Sub Team of the Interagency Arctic Research Policy Committee, the group is open to all individuals and organizations with an interest in this topic.

Group activities include:
- Promote awareness of existing vocabularies and semantics initiatives to increase effectiveness and reduce or eliminate redundancy
- Coordinate vocabularies and semantics development activities across the polar information community
- Enable and organize regular communication within the community
- Help members of the community connect to useful and interoperable vocabularies
- Inform the polar community about broader activities (e.g. ESIP, RDA), and act as ambassadors from the polar community to other initiatives

Status
The group is now active with regular virtual meetings using Zoom. As a general rule, the group meets for virtual meetings every 3rd Tuesday of the month at 17:00 UTC, i.e. 11:00 MDT and 19:00 CEST (during Daylight Savings time, one hour later else). Send an email to polarsemantics (at) gmail.com if you want to be involved and aren't yet on the polarsemantics email list.

Meeting Minutes:
- 2020
  - 2020-04-21 (Planned)
  - 2020-03-17 (Minutes pending approval)
  - 2020-05-18
  - 2020-01-21
Key Outcomes from PDF III

• Need for continued community building:
  • Preparation for AOS; engagement in ROADS process etc.

• Federated search
  • Advancement of concrete technical outputs.
  • Refinement of papers

• Semantics
  • Connection to federated search
  • Continued work of Semantics Working Group

• Platforms and model-based science
  • Situate these platforms within the data ecosystem
Next Steps
Arctic Observing Summit - Sub-Theme 4

- https://arcticobservingsummit.org/aos-2020

**Theme: Observing for Action**

**CALL FOR COMMUNITY WHITE PAPERS AND STATEMENTS**

The Arctic Observing Summit (AOS) is an international biennial forum that aims to provide knowledge-based guidance for the design, implementation, coordination and operation of a sustained, long-term international network of Arctic observing systems. It is a task of the Sustaining Arctic Observing Networks (SAON) initiative and supports key elements of SAON, such as its Roadmap for Arctic Observing.

The 5th biennial AOS will be held in 2020 in Akureyri, Iceland (31 March - 2 April) as part of ASSW 2020 (27 March - 2 April) (www.assw2020.is). The overarching theme of the 2020 Summit is “Observing for Action”. Based on recommendations and priorities identified at previous Summits (AOS 2018 report), AOS2020 will be structured along the following sub-themes.

Sub-Theme 1: Design, Optimization and Implementation of the Observing System

Sub-Theme 2: Observing in Support of Adaptation and Mitigation

Sub-Theme 3: Observing in Support of Indigenous Food Security and Related Needs

Sub-Theme 4: Data Interoperability and Federated Search

Sub-Theme 5: Arctic Observations in the context of Global Observing Initiatives

In the Fall of 2020, Japan and Iceland will cohost the third Arctic Science Ministerial Meeting (ASM3) in Tokyo. AOS 2020 will provide an opportunity to collect inputs from the Arctic observing community, Indigenous organizations, local Arctic communities, the private sector and others to prepare the ASM3 Joint Statement.
AOS Sub-theme 4 Objectives

1. Review and confirm priorities based on past/current activities
2. Integrate submitted white papers (WPs)
3. Discuss and establish strategies and methods to address WP sub-themes – prime activity in WG 4 sessions
4. Draft statement similar to AOS 2018
Sub-Theme 2: Implementing and Optimizing a Pan-Arctic Observing System

Working Group 4: Participants of this group will focus on the role of data management in system implementation.

Co-chairs: Dr. Peter Pulsifer (National Snow and Ice Data Center); Dr. Oystein Godøy (Norwegian Meteorological Institute)

Rapporteur: Dr. Anja Rosel (Norwegian Polar Institute); Ms. Shannon Christoffersen (University of Calgary).

Thematic Working Group members: Dr. Paul Berkman (Tufts University); Dr. Maribeth Murray (University of Calgary); Dr. Roberta Pirazzini (Finnish Meteorological Institute); Ms. Sarah Marie Strand (The University Centre in Svalbard); Mr. Mikko Strahlendorff (Finnish Meteorological Institute); Dr. Taneil Uttal (National Oceanic and Atmospheric Administration).

Title: Developing an architecture for an international, interconnected arctic data system

Funding Programme and/or Organisation

Sustaining Arctic Observing Networks (SAON)

Coordinating organisations and main contact person

- The Arctic Data
- Standing Comm
- Southern Ocean

Main contact perso
Colorado, Boulder,

Arctic societies, science and services are entering a new era that increasingly require cross-cultural, interdisciplinary integration of data to provide critical understanding and products. These needs require an integrated Arctic data system that is not only part of the global system, but which also allows exchange and usage of data between disparate data systems. Such a data system will allow enhanced understanding that is critical for mitigating risk to humans and infrastructure, reducing costs of adaptation and development, and supporting much needed research that spans disciplines and knowledge systems, including science and Indigenous Knowledge.

Data are an integral element in the observing system value chain. Without a data system that makes well documented data accessible, many kinds of observations are ephemeral and their value is limited. As such, we must ensure that the overarching observing
SUB-THEME: DESIGNING END-TO-END SYSTEMS

- Autonomous sea ice mass balance observation instrument - SIMB3
- Directly and independently measure sea snow/ice surface, bottom position, air temperature and barometric pressure, vertical temperature profile from the air, through the snow/ice, and into the ocean (2 cm resolution), and GPS location are also included
- Data transmission at user defined intervals (usually one hour) is achieved anywhere in the world via the Iridium satellite network
- Creates a CSV file, and hosts it to a web-accessible server for access by the end user.
- How do we optimize our data hosting framework to be maximally accessible, standardized, and efficient? What form should the data be in for maximum efficacy? Should these data be integrated in a larger data framework, and if so, which one?
The Arctic Biodiversity Data Service (ABDS) – ensuring archiving and access to biodiversity data

Tom Barry, Holmgrímur Helgasson, Tom Christensen, Kari Fannar Larusson

SUB-THEME: ENSURING CONNECTION TO DOMAIN-BASED SYSTEMS

• Online, interoperable data management system for biodiversity data generated via the Conservation of Arctic Flora and Fauna (CAFF)

• Facilitate access, integration, analysis and display of biodiversity information for scientists, practitioners, managers, policy makers and others working to understand, conserve and manage the Arctic's wildlife and ecosystems.

• Facilitates data discovery and access, increased understanding; more informed and rapid decision-making; and ongoing research.
Copernicus needs for Arctic In Situ data

Henrik Steen Andersen

SUB-THEME : DOCUMENTING DATA SYSTEM ; ESTABLISHING STABLE PROGRAMMES

• Copernicus Services and Space Component deliver a wide range of data and products with relevance for the Arctic region

• Includes related in-situ

• Requires timely, available, high quality data

• Study of available to Copernicus programme

• Identification of gaps; existing but unavailable data; do not fit requirements (timeliness, quality, metadata)
Integrating Artificial Intelligence and Modeling for investigation of permafrost disturbance in the Arctic

[Withdrawn but available] SUB-THEME : INCORPORATING MODEL OUTPUT & NEW TECHNOLOGIES AND METHODS

• Artificial Intelligence (AI) in the form of machine learning is providing novel approaches for studying systems undergoing critical transitions

• Algorithms need to move beyond data mining

• AI sensors are analyzing remote sensing and field data and feeding the data to a stochastic ecosystem model

• Model predicts critical transitions and sends the information back to AI to evaluate a risk of collapse in the complex soil system
A fundamental challenge exists for IAON assessment, planning, integration, and synthesis: documenting the system. Gap analysis? Nature of sensors? Capabilities? Requires consistent, system level metadata at: 
  - Network-level; project-level; site-level
Different but complementary to metadata describing data
Vocabularies (semantics) required
AOS Sub-theme 4 Objectives

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Please join us at AOS 2020!

https://aos2020agenda.org/

DISCUSSION: FEEDBACK AND SUGGESTIONS WELCOME