Peter’s Research Program

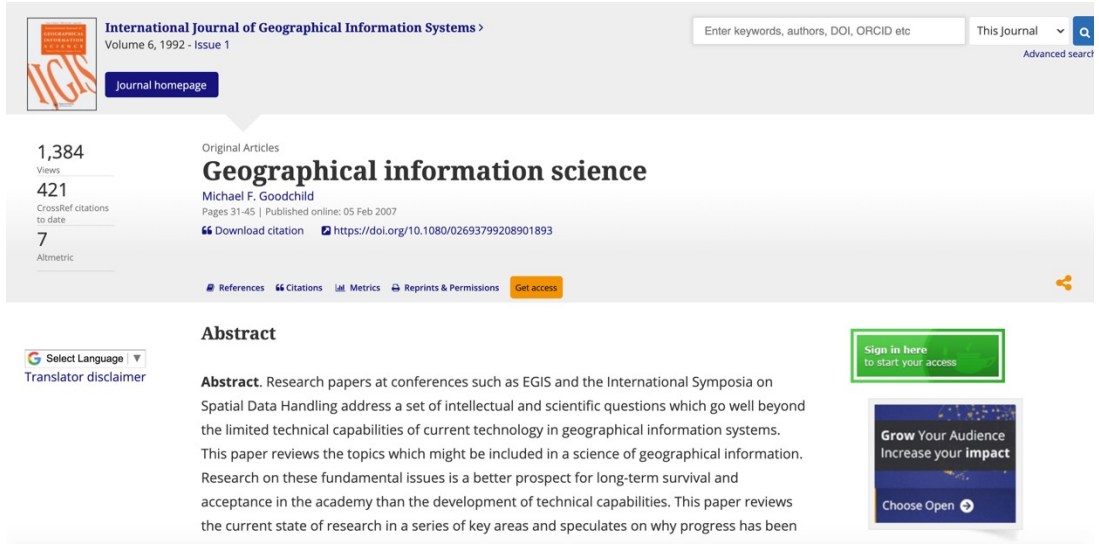
GEOG 5803

January 16th, 2024

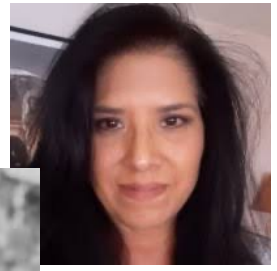
Online

Theoretical Approach

- GIS vs. GiScience
- Map Making vs. Cartography



Collaboration Approach















Core Concept of Program: Interoperability

Interoperability

- Simple definition: the ability of (geographic) information systems to readily share information and operations.

- Syntactic (e.g character sets)
- Schematic (e.g. database structure)
- Semantic (e.g. terminology, classification systems, meaning)

Evolution of Perspective

Ortho-Image Production for a Small Municipality GIS Using a Standard Digital Frame Camera and Low Cost Software

by

Peter Pulsifer

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfillment of
the requirements for the degree of

Master of Arts

Department of Geography and Environmental Studies

Carleton University
Ottawa, Ontario
April, 2002

An Ontological Exploration of Antarctic Environmental Governance: Towards a Model for Geographic Information Mediation

by

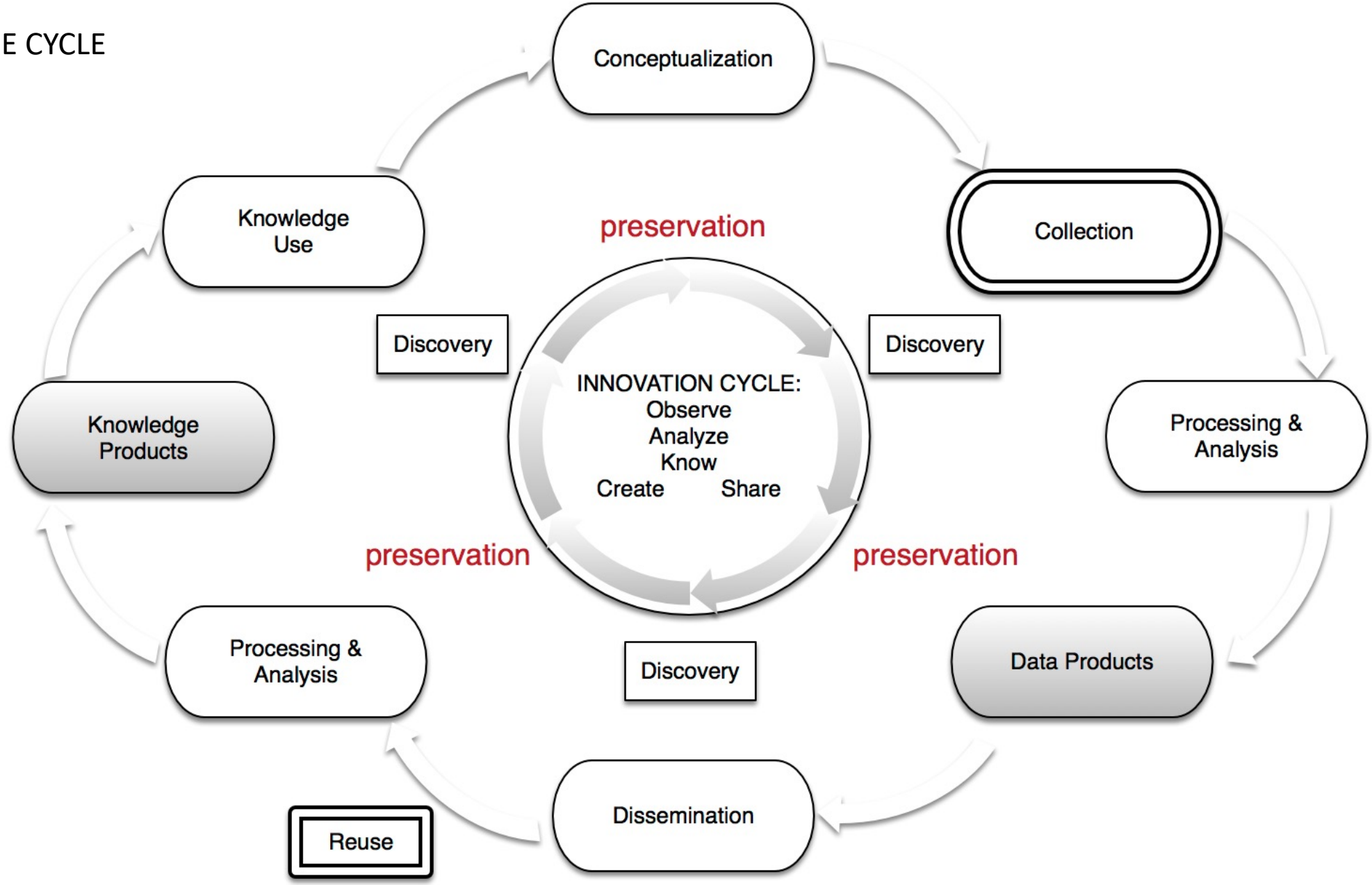
Peter L. Pulsifer

A thesis submitted to
The Faculty of Graduate Studies and Research
in partial fulfillment of
the requirements for the degree of

Theme 1: Data Management

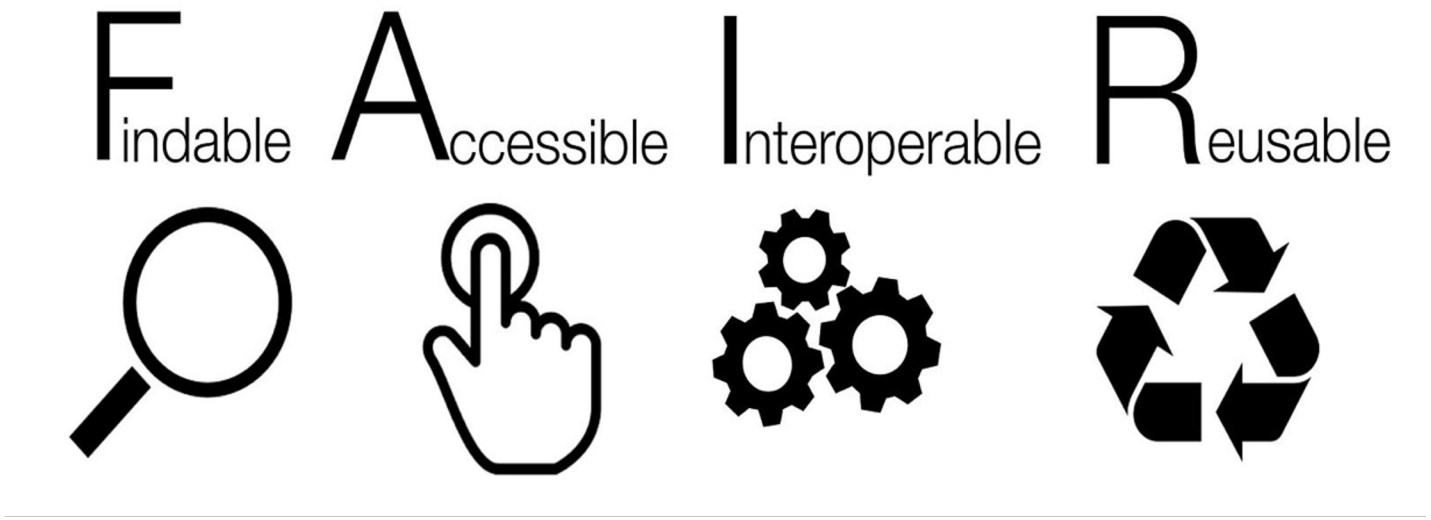
Foundation of interoperability and geomediation

DATA LIFE CYCLE



Grounding the Lifecycle Approach

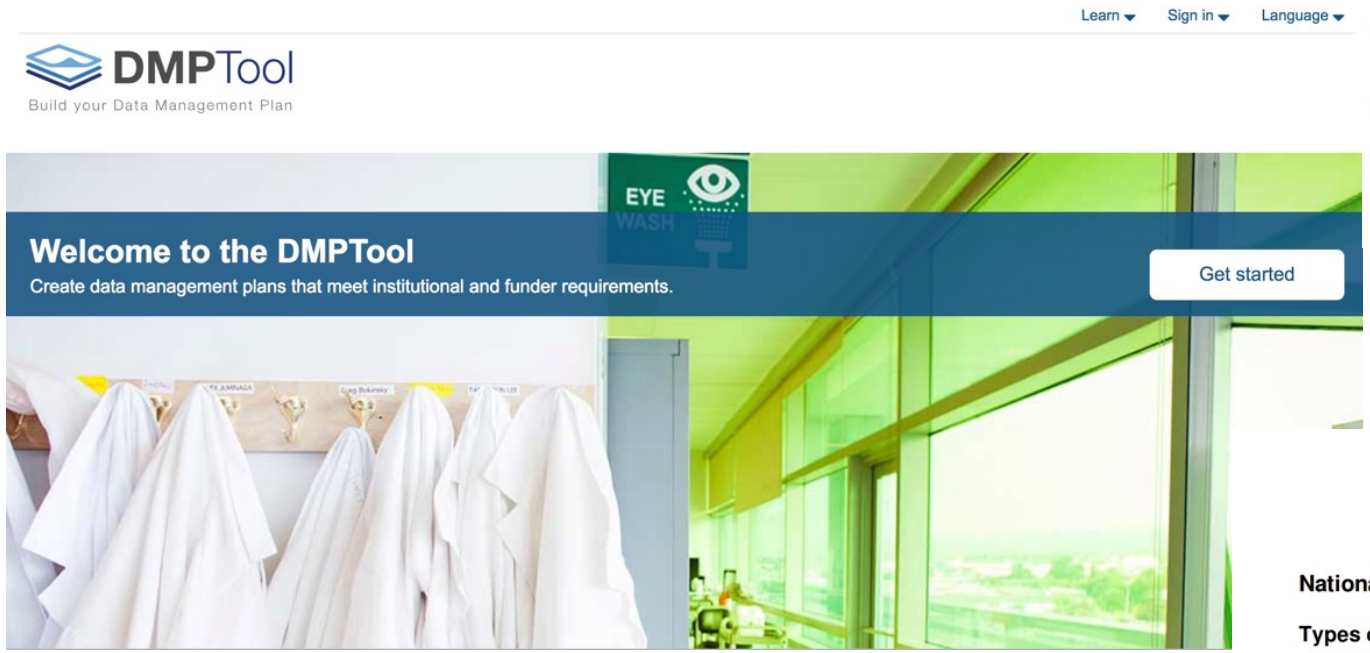
- **F**indable
- **A**ccessible
- **I**nteroperable
- **R**eusable
- “FAIR” principles



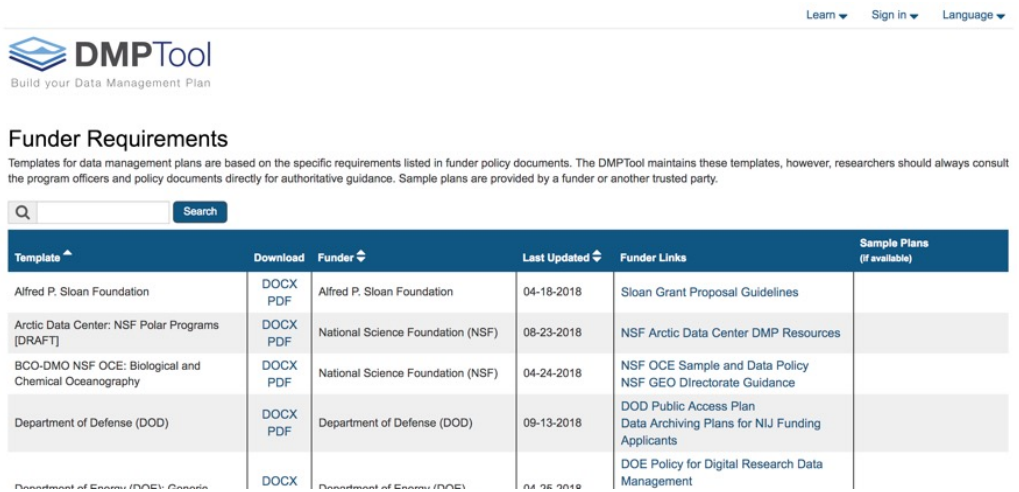
https://commons.wikimedia.org/wiki/File:FAIR_data_principles.jpg

https://www.force11.org/group/fairgroup/fairprinciples

Data Management Planning



https://dmptool.org/



https://dmptool.org/public_templates

National Science Foundation (NSF): NSF-GEN: Generic

Types of data produced

The types of data, samples, physical collections, software, curriculum materials, and other materials to be produced in the course of the project.

Guidance:

- NSF Proposal & Award Policies & Procedures Guide (PAPPG)
- NSF plans for data management and sharing of the products of research (PAPPG)
- NSF Dissemination and Sharing of Research Results
- NSF Frequently Asked Questions (FAQs) for Public Access

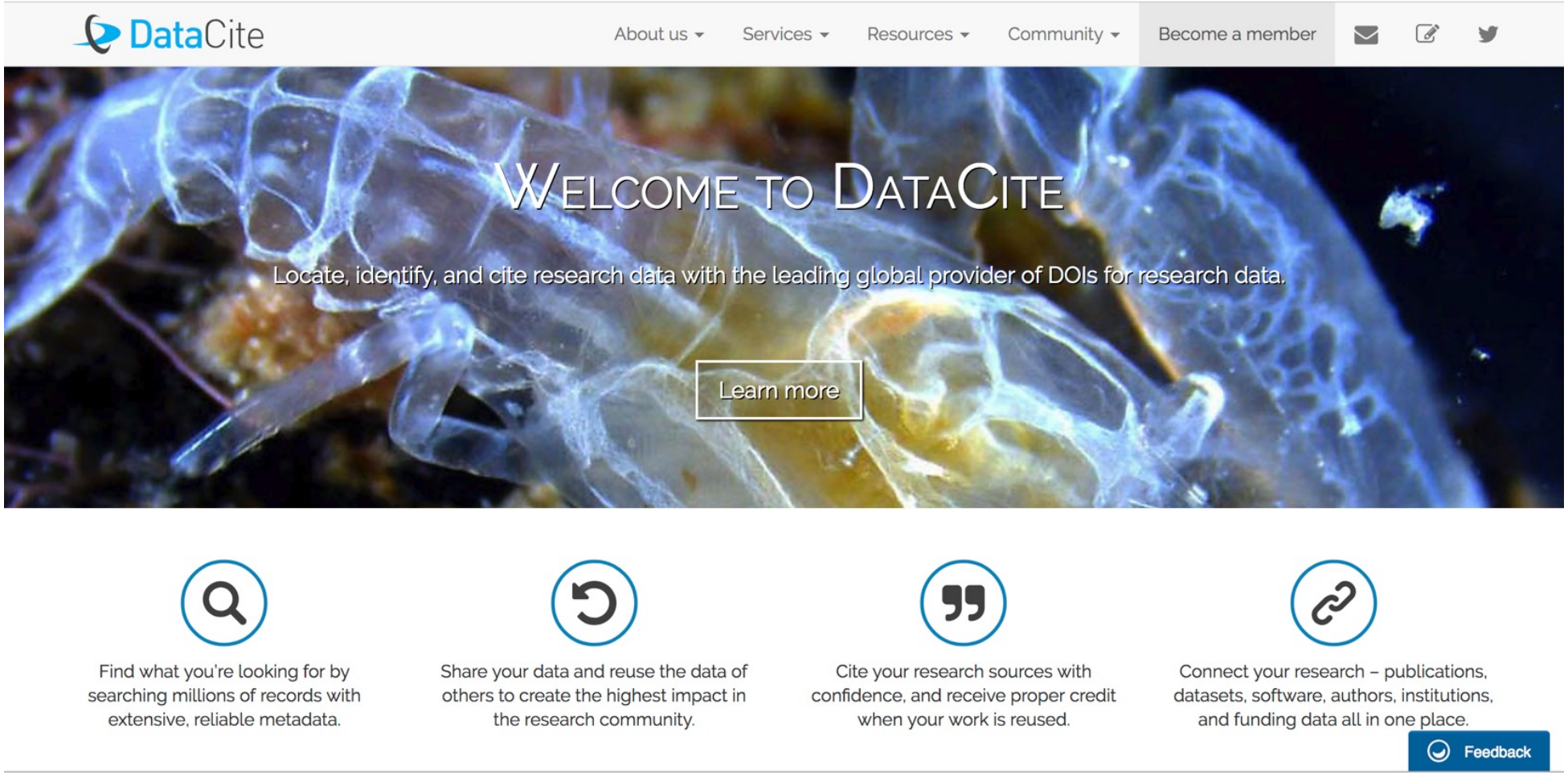
Data and metadata standards

The standards to be used for data and metadata format and content (where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies).

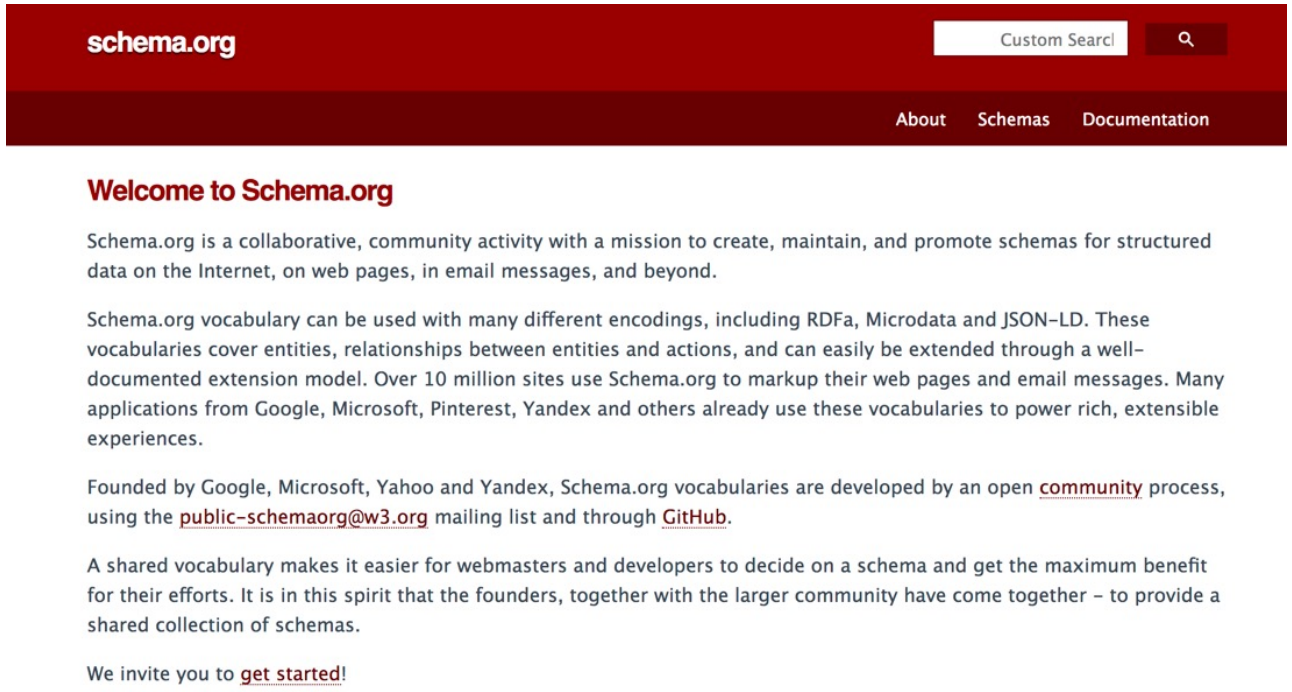
Guidance:

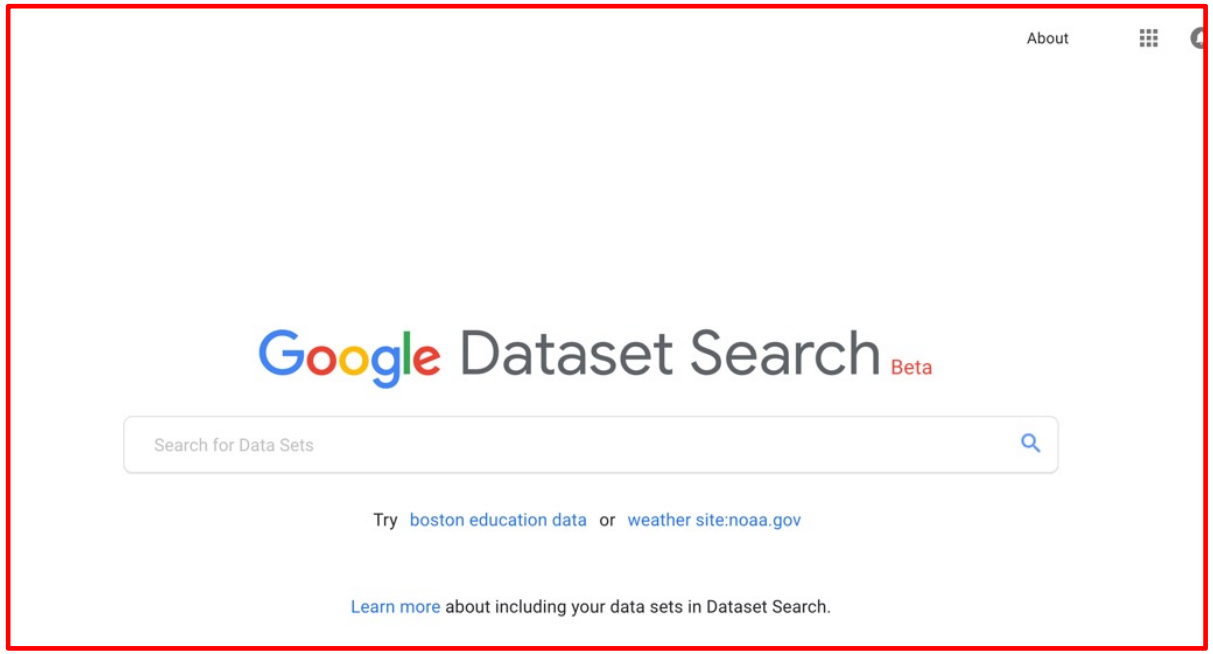
Data Publication

https://www.datacite.org/



Schema.org + Google Data Search

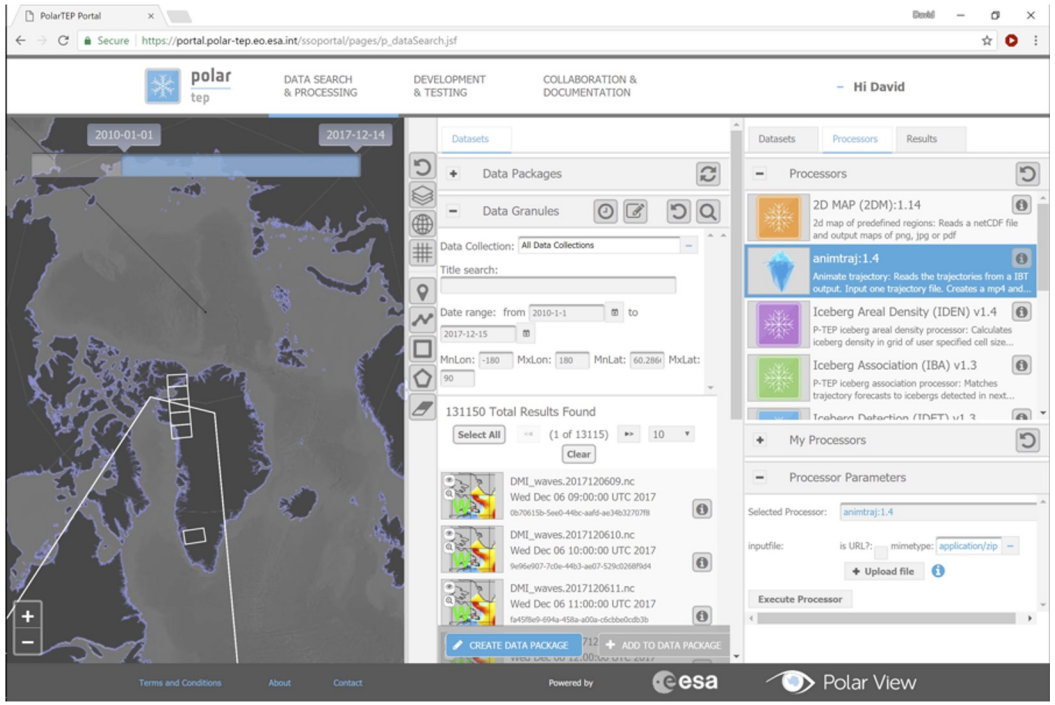




https://toolbox.google.com/datasetsearch

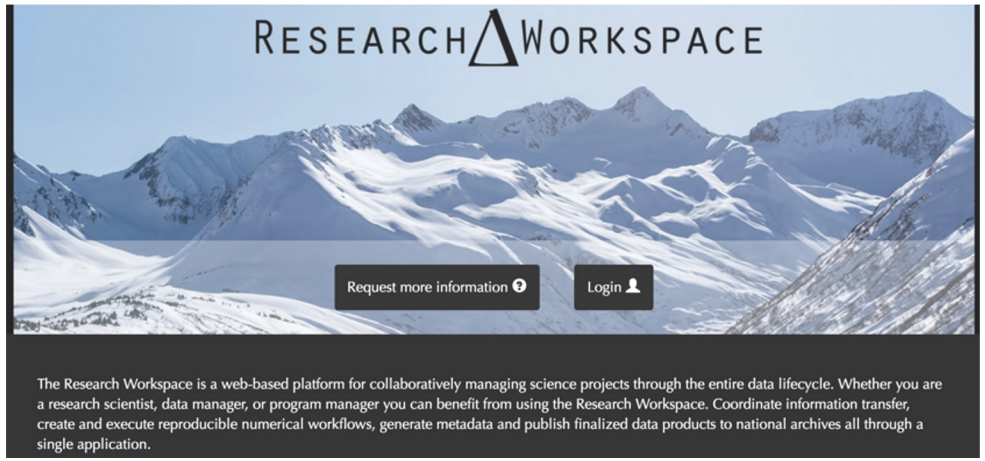
Cloud Platforms/Virtual Research Environments

https://portal.polar-tep.eo.esa.int

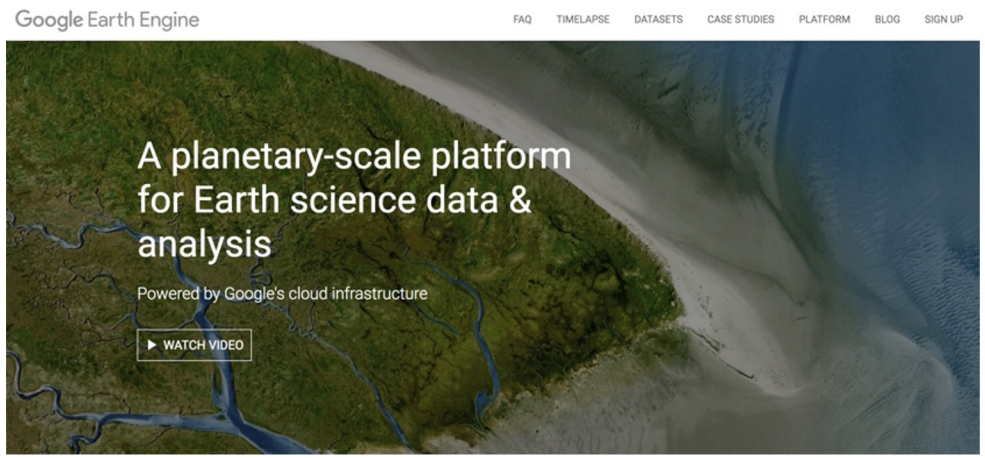


Polar Thematic Exploration Platform

https://researchworkspace.com



https://earthengine.google.com



Google Earth Engine

Theme 2: Building Communities of Practice

TOWARDS AN INTERNATIONAL POLAR DATA COORDINATION NETWORK

P L Pulsifer[1]*, L Yarmey[1], Ø Godøy[2], J Friddell[3], M Parsons[4], W F Vincent[5], T de Bruin[6], W Manley[7], A Gaylord[8], A Hayes[9], S Nickels[10], C Tweedie[11], J R Larsen[12], and J Huck[12]

[1]National Snow and Ice Data Center, University of Colorado, 449 UCB, University of Colorado, Boulder, CO 80309-0449, USA
**Email:* pulsifer@nsidc.org
[2]Norwegian Meteorological Institute, Henrik Mohns plass 1, 0313 Oslo, Norway
[3]Canadian Cryospheric Information Network, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L 3G1, Canada
[4]Research Data Alliance, Rensselaer Polytechnic Institute, Troy, NY 12180, USA
[5]CEN: Centre d'Etudes Nordiques, Laval University, Quebec City, G1V 0A6, Canada
[6]NIOZ Royal Netherlands Institute for Sea Research, Texel, The Netherlands
[7]Institute of Alpine and Arctic Research, University of Colorado, Boulder, CO 80309-0450, USA
[8]Nuna Technologies, PO Box 1483, Homer, AK 99603, USA
[9]Geomatics and Cartographic Research Centre, Carleton University, 1125 Colonel By Dr., Ottawa, ON, K1S 5B6, Canada
[10]Inuit Quajisarvingat, Suite 1101, 75 Albert St., Ottawa, Ontario, K1P 5E7, Canada
[11]Biology and the Environmental Science and Engineering Program, University of Texas at El Paso, El Paso, TX 79968, USA
[12]University of Alberta Libraries, University of Alberta, Edmonton, Alberta, T6G 2J8, Canada

ABSTRACT

Data management is integral to sound polar science. Through analysis of documents reporting on meetings of the Arctic data management community, a set of priorities and strategies are identified. These include the need

IASC Data Statement

Statement of Principles and Practices for Arctic Data Management
April 16, 2013

All IASC-endorsed scientific results shall be verifiable and reproducible through ethically open access to all data necessary to produce those results. Data shall be preserved, accessible, and used in accordance with scientific norms of fair attribution and use.

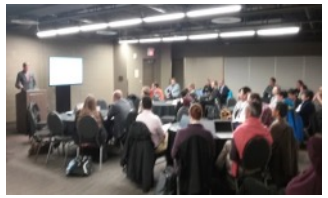
To this end, IASC Council approves the following actions:

1. Endorsement of the Statement of Principles and Practices for Arctic Data Management;
2. Establishment of an IASC Data Standing Committee;
3. To undertake measures towards adoption of national data policies consistent with the principles and practices described below.

Introduction

IASC seeks to "encourage and facilitate cooperation in all aspects of Arctic research, in all countries engaged in Arctic research, and in all areas of the Arctic region."[1] This mission is increasingly important in a time of very rapid Arctic change and to sustain the increase in

Arctic Data Committee



- Formed Nov ‘14
- IASC-SAON partnership
- National and voluntary members + Indigenous (2017)
- Promote and enable:
  - **Understanding the system**
  - **Effective data policy**
  - **Infrastructure**
  - **Ethically open access**
  - **Attribution**
  - **Standards and interoperability**

http://arcticdc.org

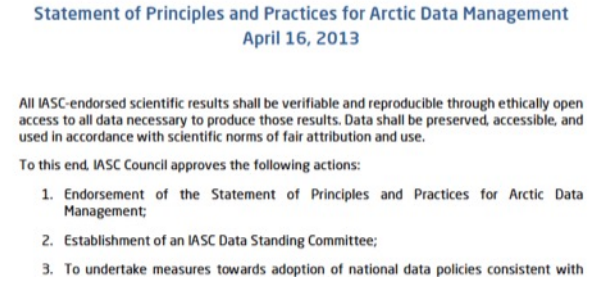
Report of the 1st Meeting of the Arctic Data Committee

Meeting Details

Meeting: 1st Meeting of the IASC Data Standing Committee (IDSC) and SAON Committee on Data and Information Services (CDIS)

Time: 10 November 2014, 14:00 – 18:00 ; 11 November 08:30 – 13:00 (CET)

Location:
Mercure Hotel Potsdam City
Lange Brücke
14467 Potsdam
Germany
Room: Studio 1+2.



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“Polar Data Planning Summit”

22-24 May, 2018, Boulder, Colorado

PDPS 2018

Details

Published: 23 August 2016

Page 3 of 6

Registered Participants

Name	Affliation	Country
David Arthurs	Polar View	Denmark
Pip Bricher	Southern Ocean Observing System	Australia
Andreas Cziferszky	British Antarctic Survey / Polar View	United Kingdom
Taco de Bruin	NIOZ Royal Netherlands Institute for Sea Research	The Netherlands
Eric Coplin	Battelle-NEON	United States
Ruth Duerr	Ronin Institute for Independent Scholarship	United States
Florence Fetterer	NSIDC	United States
Daniel Gibson	Government of Northwest Territories	Canada
Øystein Godøy	Norwegian Meteorological Institute	Norway
Sarah Inman	University of Washington	United States
Christopher Jones	National Center for Ecological Analysis and Synthesis, UC Santa Barbara	United States
Peter Kirsch	Polar Data Centre; British Antarctic Survey	United Kingdom
Christine Laney	Battelle-NEON	United States
Ellsworth LeDrew	University of Waterloo, Polar Data Catalogue	Canada
Corrado Leone	Italian National Research Council	Italy
Simona Longo	CNR	Italy
William Manley	University of Colorado, INSTAAR	United States
Heidi McCann	CIRES/NSIDC	United States
Maribeth Murray	Arctic Institute of North America, University of Calgary	Canada
Mark Parsons	Rensselaer Polytechnic Institute	United States
Peter L. Pulsifer	University of Colorado at Boulder	United States
Yubao QIU	Institute of Remote Sensing and Digital Earth	China
Simon Riopel	Canada Centre for Mapping and Earth Observation / Natural Resources Canada	Canada
Hannele Savela	Thule Institute, University of Oulu	Finland
Serge Scory	Royal Belgian Institute of Natural Sciences	Belgium
Donna Scott	National Snow and Ice Data Center	United States
Aleksandr Smirnov	Arctic Portal	Iceland
Sandy Starkweather	NOAA-ESRL/CIRES	United States
Don Stott	National Center for Atmospheric Research	United States
Colleen Strawhacker	National Snow and Ice Data Center	United States
Shane St Savage	Axiom Data Science (Alaska Ocean Observing System)	United States
Marten Tacoma	NIOZ Royal Netherlands Institute for Sea Research	The Netherlands
Chris Torrence	NSIDC	United States
Taneil Uttal	NOAA	United States
Thomas Vandenberghe	Royal Belgian Institute of Natural Sciences	Belgium
Naomi Whitty	Polar Field Services	United States
Ann Windnagel	NOAA@NSIDC	United States
Lynn Yarmey	Research Data Alliance	United States

Award 1749243

Arctic Observing Summit – Davos, June 2018

Sub-Theme 2: Implementing and Optimizing a Pan-Arctic Observing System

Arctic Observing Summit (A
Au

Foreword

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

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

Rapporteur: Dr. Anja Rosel (Norwegian Polar Institute); Ms. Shannon Christofferse

Thematic Working Group members: Dr. Paul Berkman (Tufts University); Dr. Mari Calgary); Dr. Roberta Pirazzini (Finnish Metorological Institute); Ms. Sarah Marie St Centre in Svalbard); Mr. Mikko Strahlendorff (Finnish Meteorological Institute); Dr. T Oceanic and Atmospheric Administration).

Arctic observing.

2nd ARCTIC SCIENCE MINISTERIAL

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

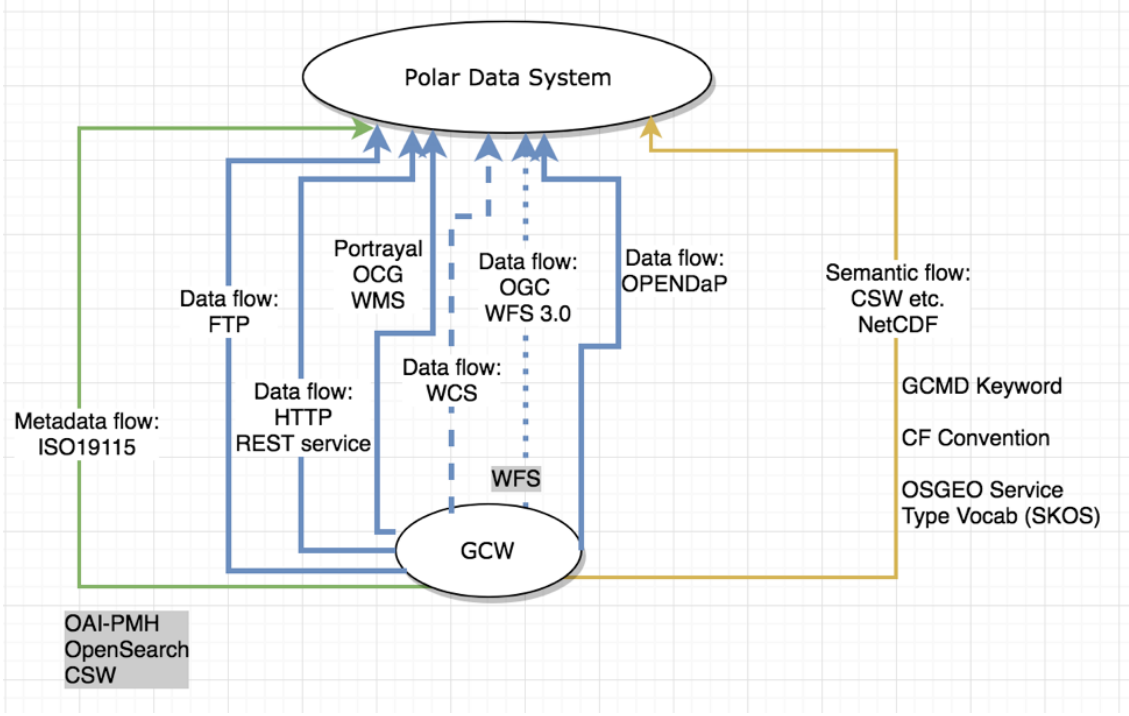
- The Arctic Data Committee
- Standing Committee on Antarctic Data Management
- Southern Ocean Observing System

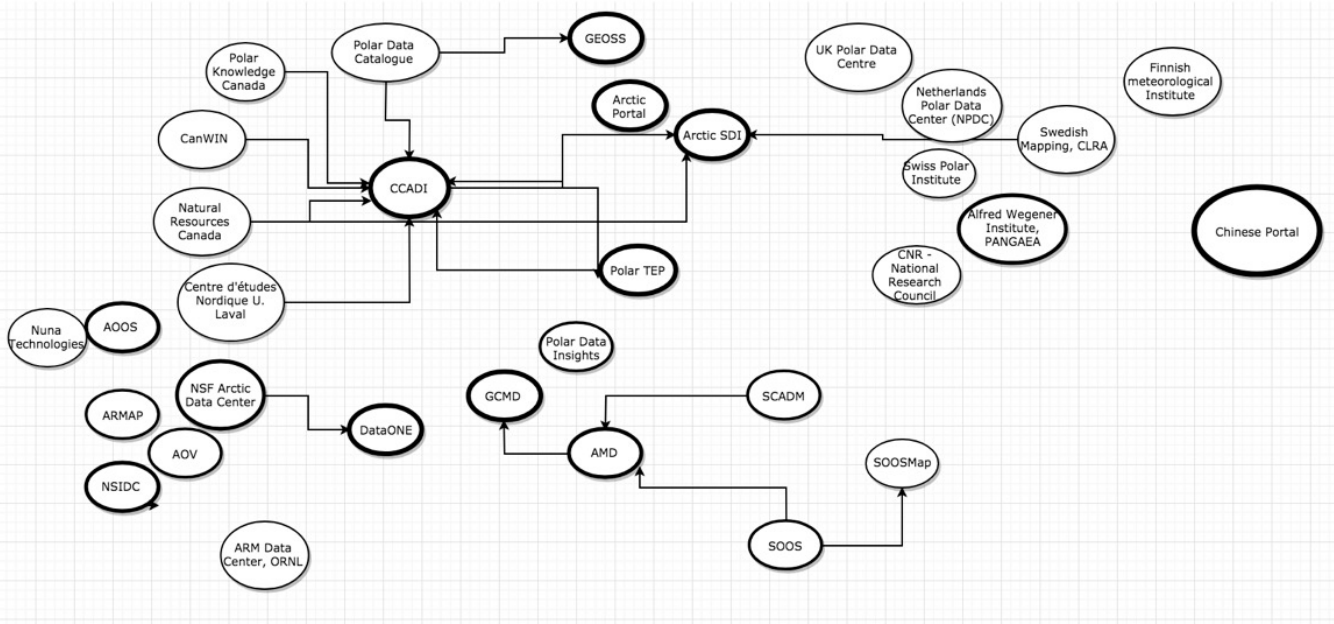
Main contact person: Peter L. Pulsifer, National Snow and Ice Data Center, University of Colorado, Boulder, USA; e-mail: peter.pulsifer@colorado.edu

Description of the deliverable

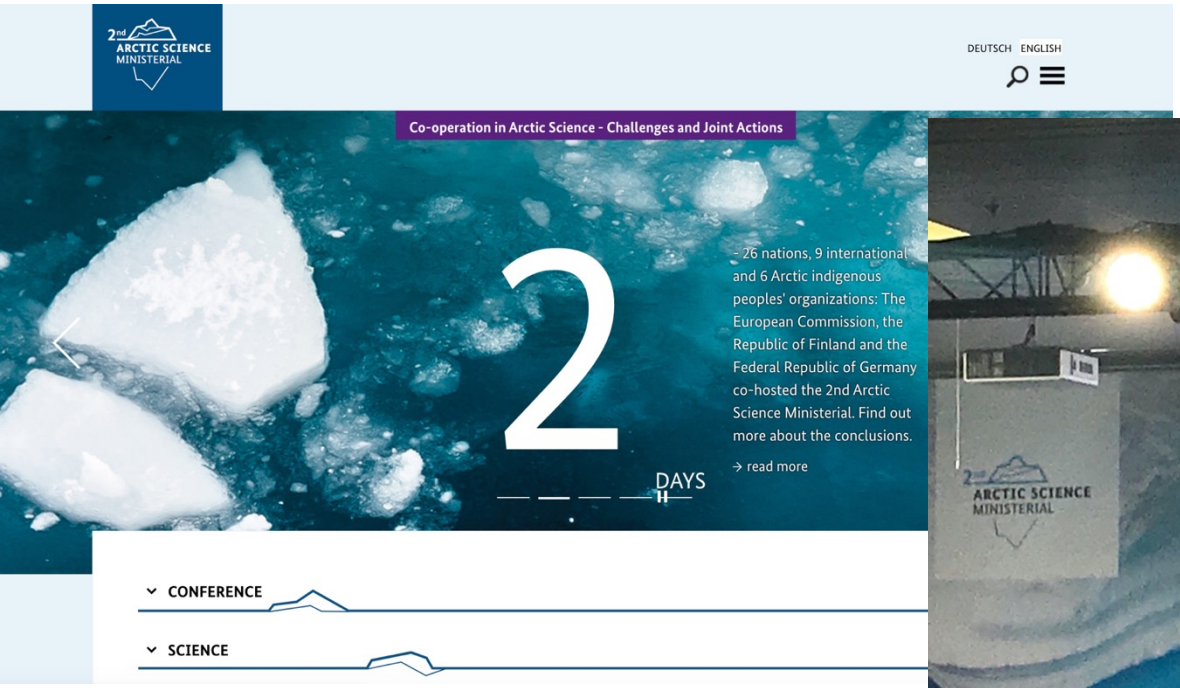
Polar Data and Systems Architecture Workshop

28 – 30 November 2018, Geneva

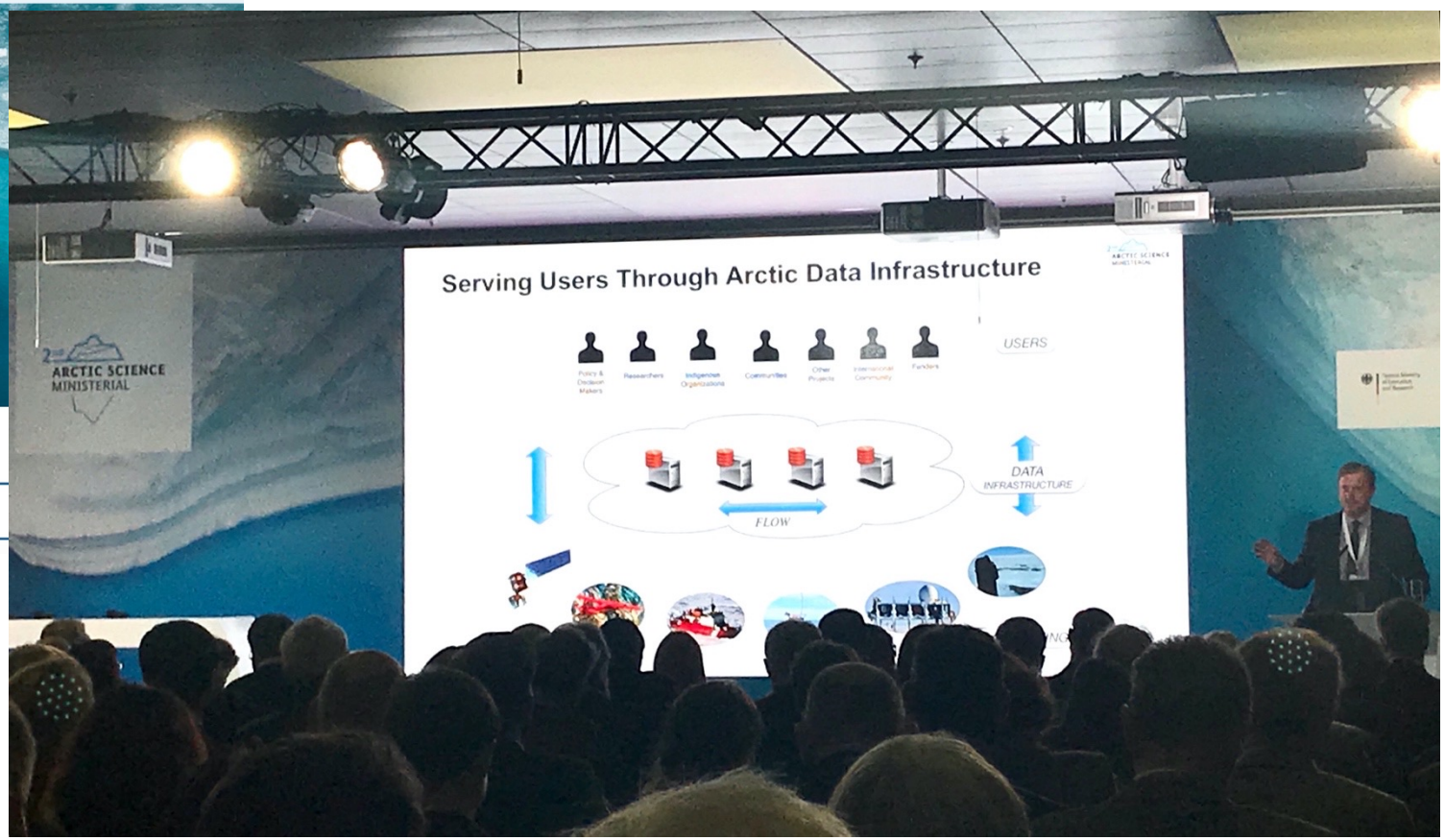


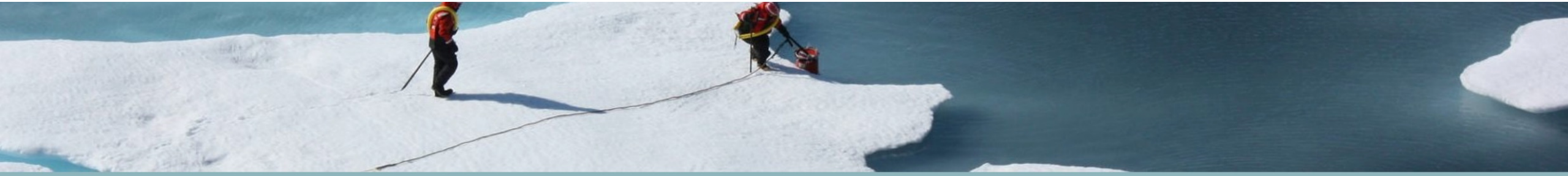


2nd Arctic Science Ministerial Science Forum (26 Oct 2018, Berlin): policy dimensions



https://www.arcticscienceministerial.org/en/





Polar to Global Online Interoperability and Data Sharing Workshop/Hackathon 21st January 2021

Details

Published: 21 December 2020

21st January 20:00-23:00 UTC

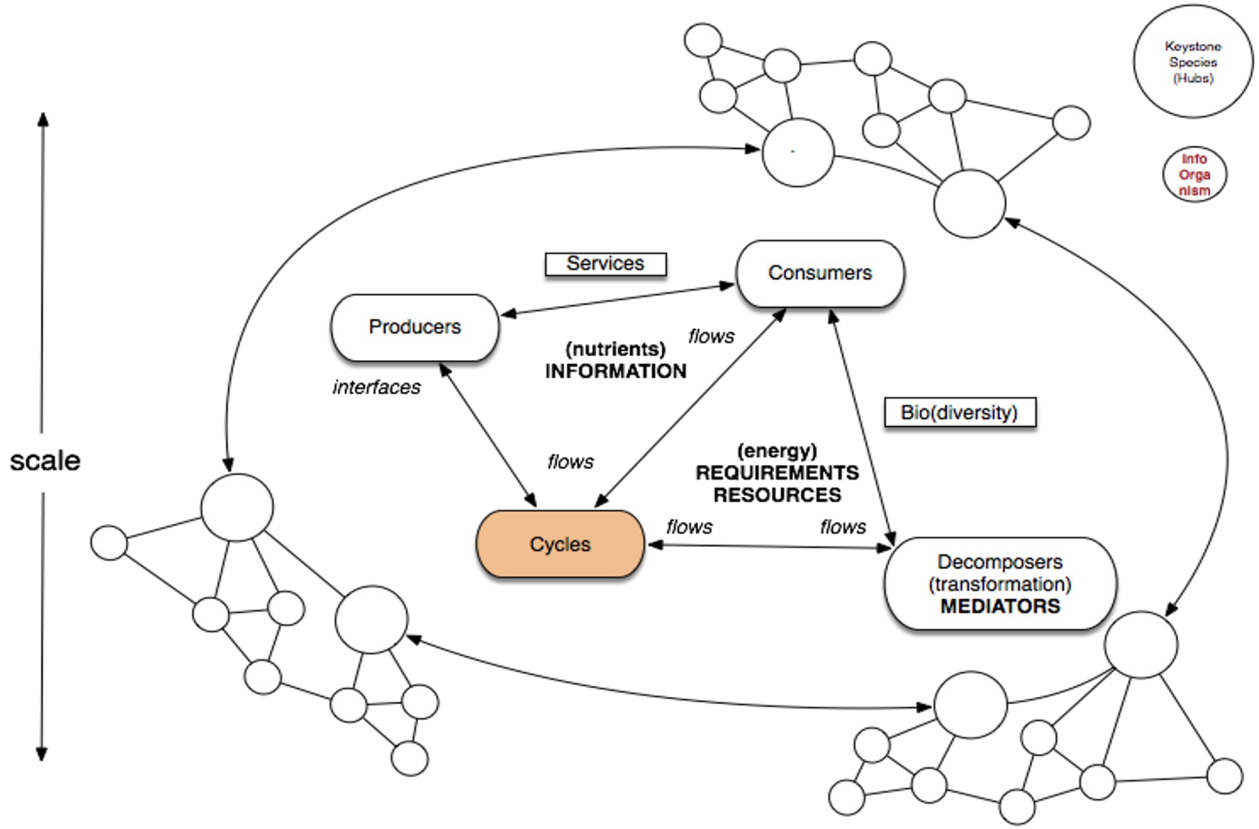
During the Third Polar Data Forum (PDF) held in Helsinki in November of 2019, members of the Polar Data Community gathered to share information and knowledge and to make practical progress towards greater data sharing and interoperability. PDF III followed on a series of meetings that have resulted in continuing advancements in the areas of federated search, identification and development of shared vocabularies and formal semantics, data policy, community building and other topics. Since PDF III, the dialogue has continued. In March and early April, the Arctic data community met during the online Arctic Observing Summit (https://aos2020agenda.org/). The Standing Committee on Arctic Data Management (SCADM) and members of the Southern Ocean Observing System (SOOS) Program have met regularly. There is broad agreement between these groups and the IASC-SAON Arctic Data Committee (ADC) that meeting more frequently will help us to continue making practical progress on our shared goals.

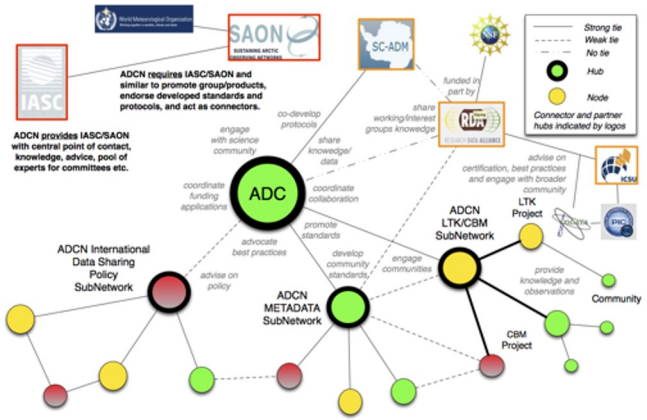
During these challenging times, meeting in person is not feasible. However, recent online events have demonstrated that we can successfully collaborate using virtual tools.

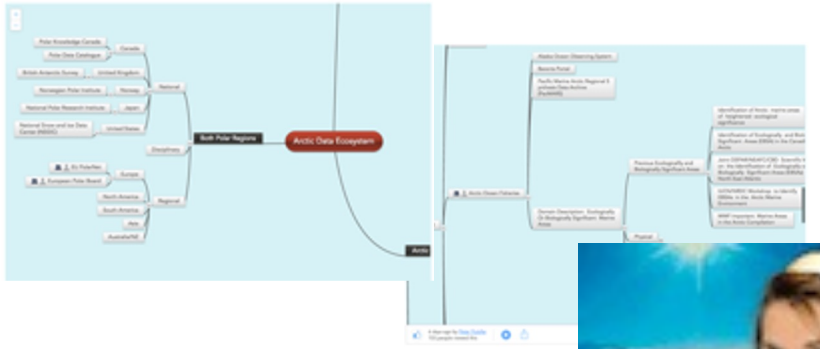
We would like to invite you to join us online on **21st January 20:00-23:00 UTC** to continue our efforts to enhance polar data sharing and interoperability. This is an online workshop in a planned series of bi-monthly online workshops convened by the ADC, SCADM, SOOS, the Arctic Observing Summit Working Group 4, the Global Cryosphere Watch, and the World Data System on behalf of the polar data community.

Data Service or Science?

Using Systems Science and Domain Visualization to Model & Understand the System







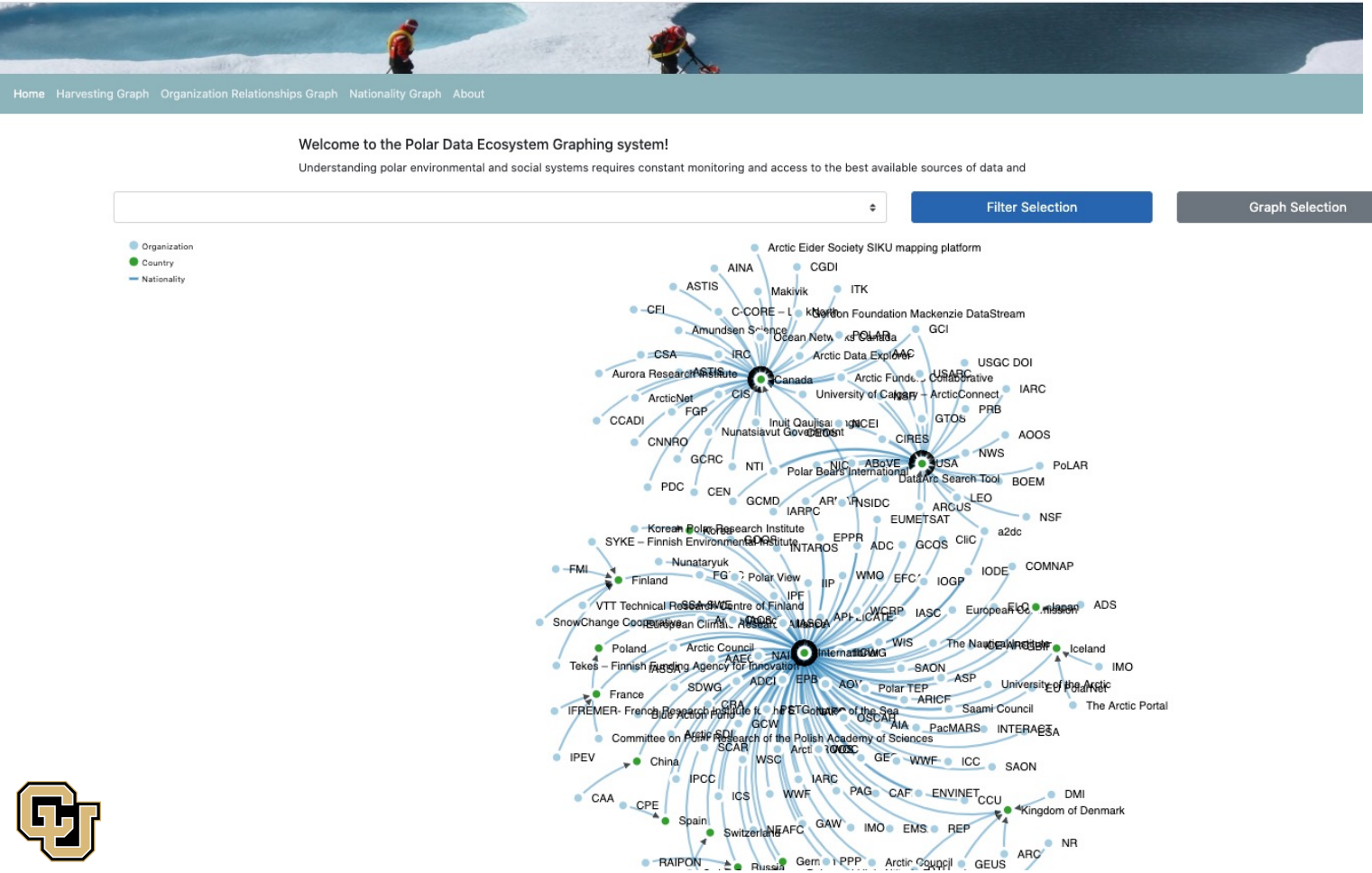
Dr. Katia Kontar

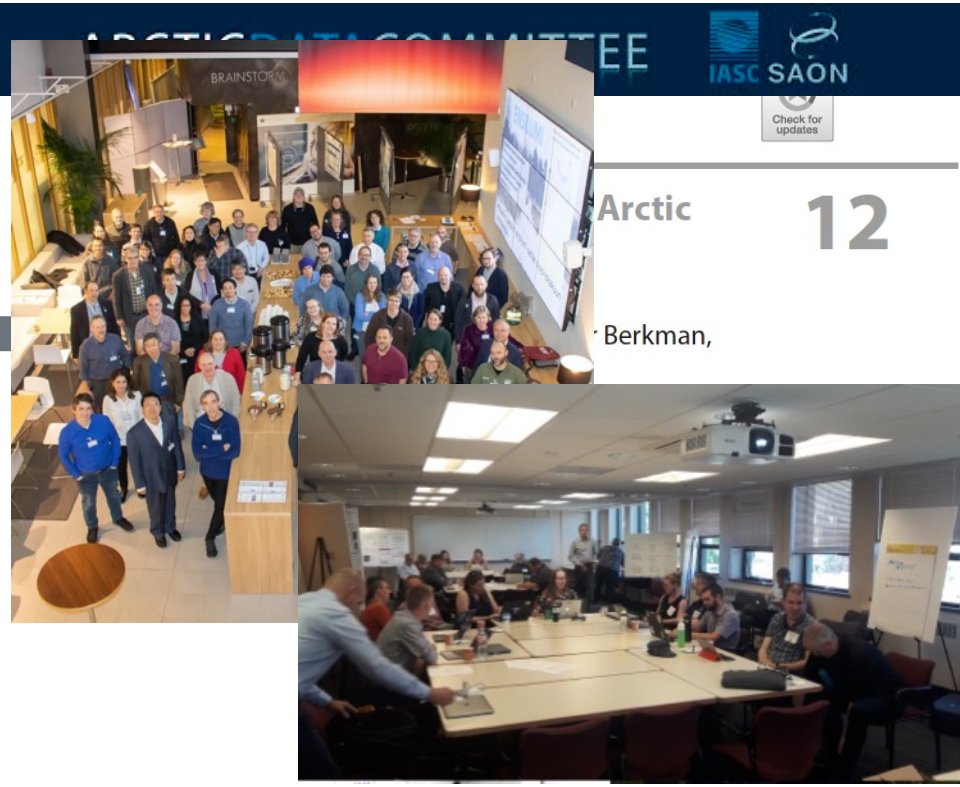
ARCTICDATACOMMITTEE IASC SAON

PAN-ARCTIC OPTIONS
Holistic Integration for Arctic Coastal-Marine Sustainability

BELMONT FORUM

A Complex, Diverse Socio-Technical Polar Information Ecosystem

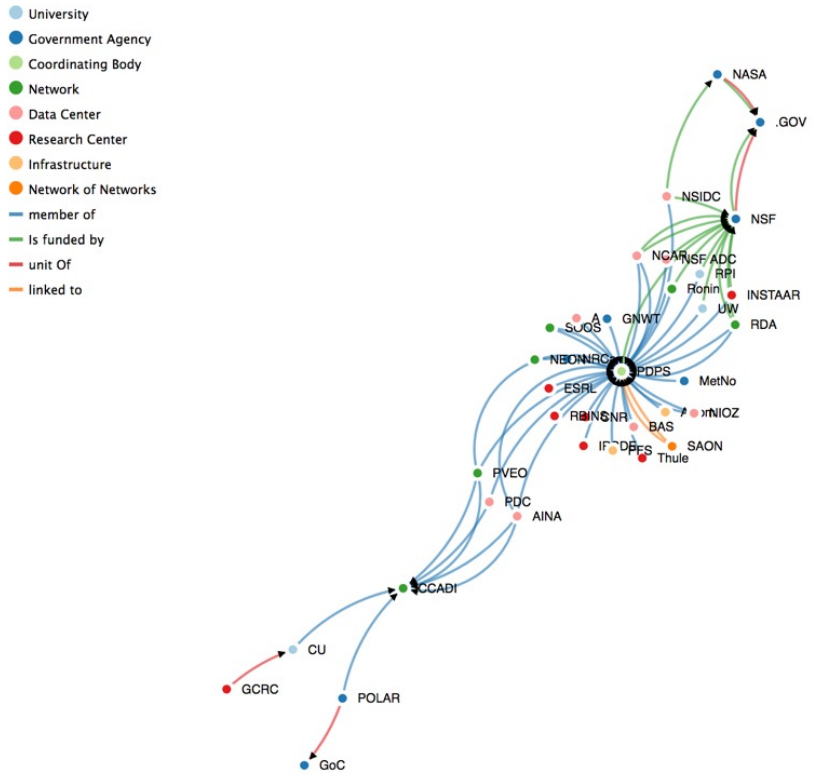


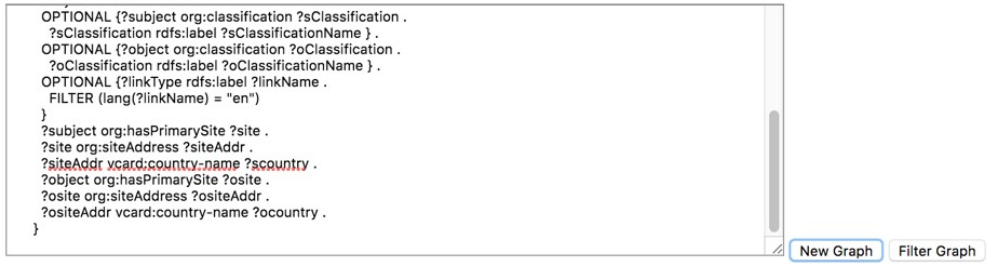


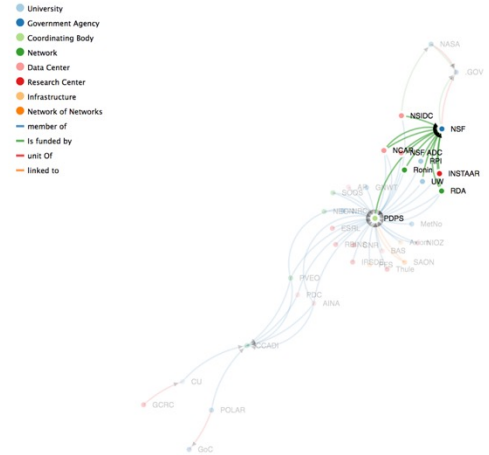
: Data Committee; P. Pulsifer; Polder ; R. Duerr

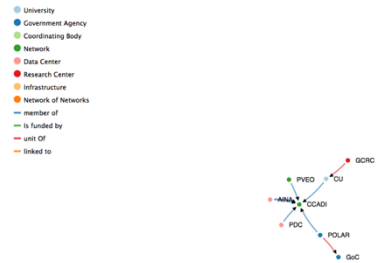
Pulsifer, P.L. Kontar, Y., Berkman, P.A., Taylor, D.R.F. (2019). Chapter 12. Information Ecology to Map the Arctic Information Landscape. In Sustainability of Shared Marine Regions. Volume 1. Governing Arctic Seas: Regional Lessons from the Bering Strait and Barents Sea, edited by Oran R.Young, P.A. Berkman, P.A. and Alexander N. Vylegzhanin. Springer.

Modeling Networks



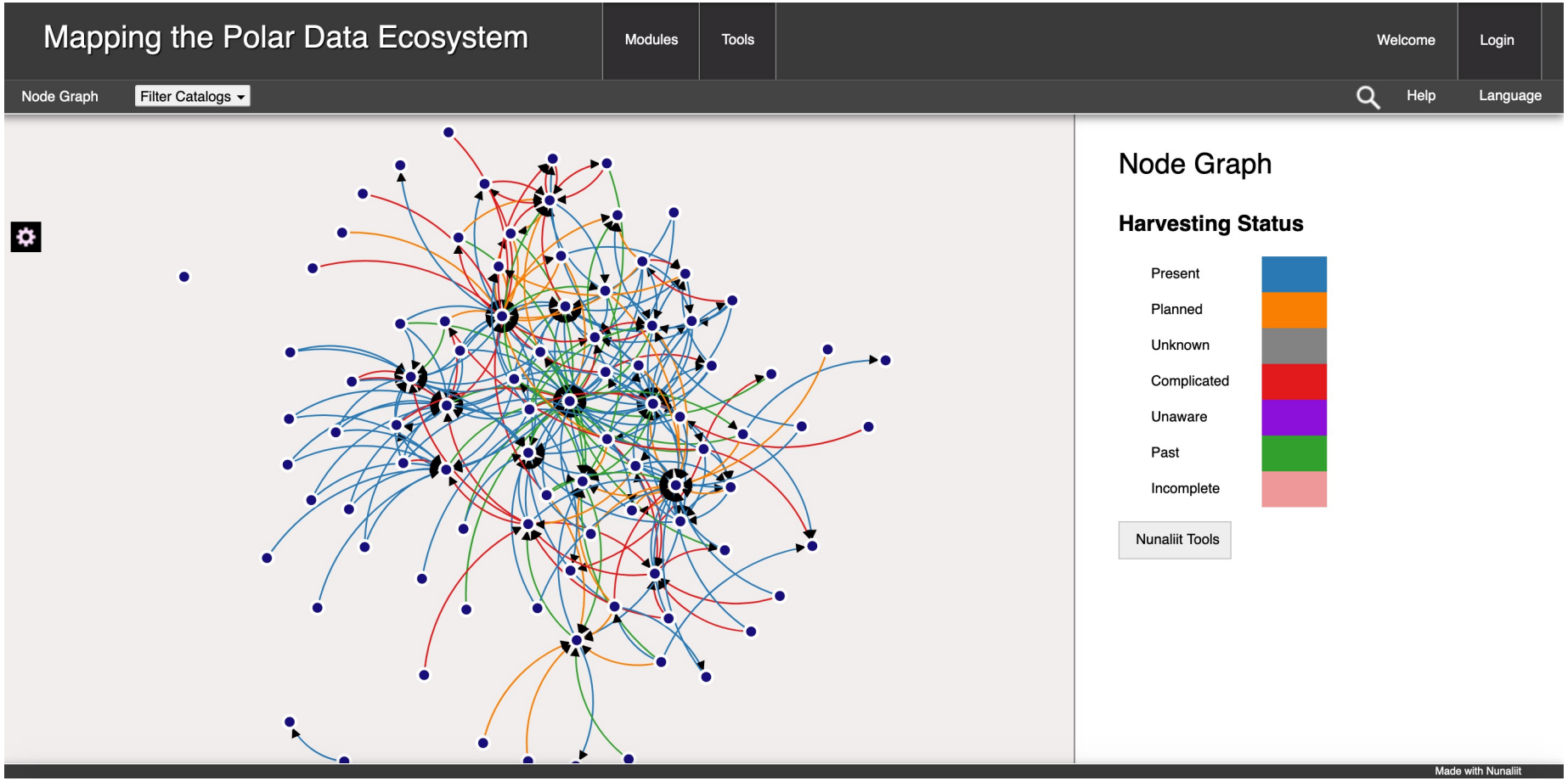






http://staging.arctic-data-ecosystem.apps.nsidc.org/

Prototype Demonstration



https://develop.gcrc.carleton.ca/mdpe/index.html

Themes 1 & 2 Summary

- Fundamental research in the areas of data management methods, standards, and technology is enabling the next generation of (geographic) analysis tools
- Next generation tools are emerging from the intersection of many different areas of expertise and disciplines
- Communities of practice are an integral part of the system
- We need to increase our understanding of how these communities form and thrive

- Berez-Kroeker, Andrea L, Lauren Gawne, Susan Smythe Kung, Barbara F Kelly, Tyler Heston, Gary Holton, Peter Pulsifer, et al. “Reproducible Research in Linguistics: A Position Statement on Data Citation and Attribution in Our Field.” *Linguistics* 56, no. 1 (2018): 1–18.
- Brown, Nicholas, Stephan Gruber, Peter Pulsifer, and Emilie Stewart-Jones. “Permafrost Data Workshop 2020,” 2020.
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- Pulsifer, P, L Yarney, Øystein Godøy, Julie Friddell, W Vincent, Taco DeBruin, and M Parsons. “Data Management for Arctic Observing.” *Arctic Observing Summit, White Paper*, 2013.
- Pulsifer, Peter L. “Enhancing a Socio-Technical Data Ecosystem for Societally Relevant, Sustained Arctic Observing.” *AGUFM* 2017 (2017): C11C–0924.
- Pulsifer, Peter L. “The Cartographer as Mediator: Cartographic Representation from Shared Geographic.” *Cybercartography: Theory and Practice*, 2006, 149.
- Pulsifer, Peter L, Yekaterina Kontar, Paul Arthur Berkman, and DR Fraser Taylor. “Information Ecology to Map the Arctic Information Ecosystem.” In *Governing Arctic Seas: Regional Lessons from the Bering Strait and Barents Sea*, 269–291. Springer, 2020.
- Pulsifer, Peter L, Sandra McCubbin, Stein Sandven, and Mark A Parsons. “Developments in Polar Data Management 2006-2019 and Beyond: Standardization and Community-Building in Support of Enhanced Interoperability.” In *EGU General Assembly Conference Abstracts*, 22498, 2020.
- Pulsifer, Peter L, and DR Fraser Taylor. “The Cartographer as Mediator: Cartographic Representation from Shared Geographic Information.” In *Modern Cartography Series*, 4:149–179. Elsevier, 2005.
- Tanhua, Toste, Sylvie Pouliquen, Jessica Hausman, Kevin M O’Brien, Pip Bricher, Taco De Bruin, Justin James Henry Buck, et al. “Ocean FAIR Data Services.” *Frontiers in Marine Science* 6 (2019): 440.

Despite the available data resources, structures and technologies, we are still unable to easily, efficiently and quickly use arctic data for interdisciplinary research or complex applications…

… we lack effective data mediation (mediators)

Theme 3: Geographic Information Mediation

Simple Definition of Geographic Information Mediation

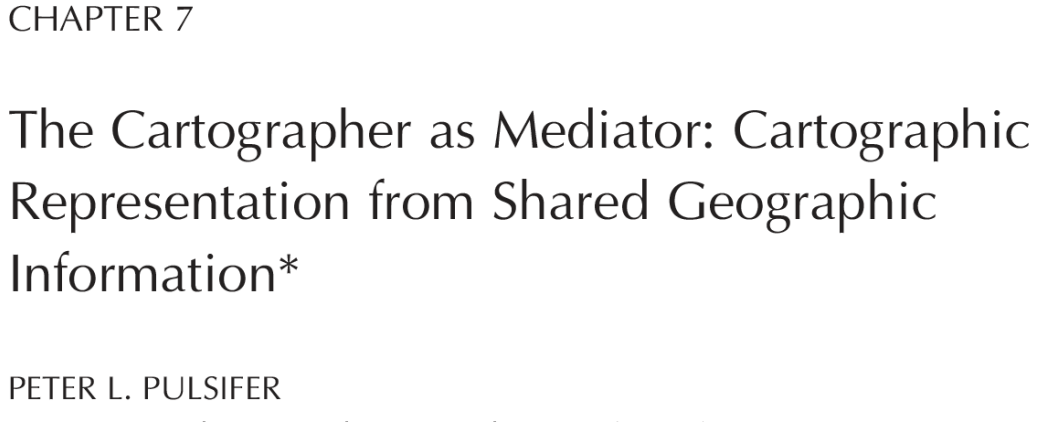
“The process of sharing geographic information across differences.”

(Pulsifer, Parsons)

Note: sharing implies understanding between parties

Selected Dimensions of Geographic Information Mediation

- Many kinds of mediation
  - (Geo)Informatics: “middleware”
  - Cartography: sensory mediation
  - Communications and media studies, critical theory: social construction of information
  - Cognitive research: knowledge models
  - Legal, diplomacy: dispute resolution
  - Linguistics: translation


CHAPTER 7

The Cartographer as Mediator: Cartographic Representation from Shared Geographic Information*

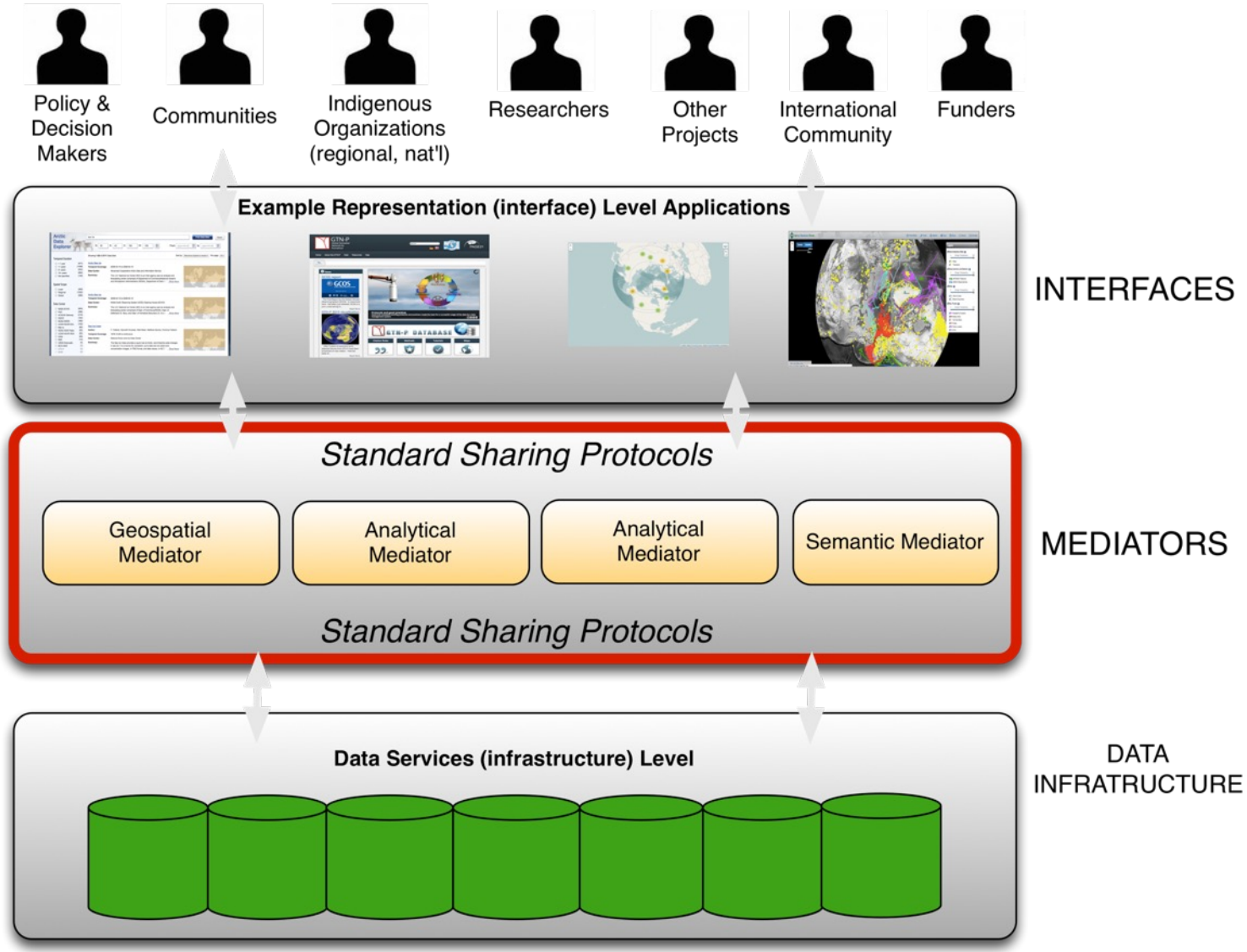
PETER L. PULSIFER

Technical Mediators

- Full standardization across communities is difficult
- **Mediators** can aggregate, transform, re-distribute
- **Mediators** use infrastructure and can be developed and funded separately
- **Brokering** is emerging as a potential solution to some interoperability issues

http://gtnp.arcticportal.org/
http://www.esrl.noaa.gov/psd/iasoa/
http://www.arcticobservingviewer.org
https://ace.arsc.edu/
http://eloka-arctic.org

Mediation for Serving Multiple Audiences



Community Mediators

- Frascati 2016 workshop result:

Key current challenges are social and organizational rather than technical : supporting human networks, promoting standards, and aligning policy with implementation

Interdisciplinary Research Approach

Researching mediation requires collaboration and participation:

- **Geographers**
- Indigenous knowledge holders
- Indigenous knowledge scholars
- Social scientists
- Physical scientists
- Computer scientists, Human Computer Interaction
- Linguists
- Science diplomacy, public policy researchers
- Anthropology
- Archaeology

Influences

- Many Indigenous scholars (e.g. Daniel Wildcat, Jay Johnson, Renee Pualani Louis, Deborah McGregor)
- Susan Leigh Star
- George Lakoff
- Mark Parsons
- Geosemantics (e.g. Barry Smith, Frederico Fonseca, Mark Gahegan)
- Mei Po Kwan
- Fraser Taylor
- Nadine Schuurman
- Daniel Sui
- Arun Agrawal
- Jeremy Crampton
- Nigel Thrift
- …

Case Study: Linking Documented Indigenous Knowledge & Science

Geo-Semantic Mediation

https://gcrc.carleton.ca

GCRC | About | Research Areas | Output | Welcome | Login

Atlases | Create Document | Help | Language

Atlases

Active Project Atlases

Residential Schools Land Memory Atlas

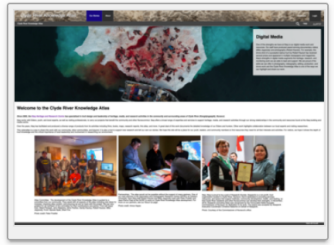
The work to develop this atlas is based on earlier work on the prototype Residential Schools and EF Wilson Maps with the Shingwauk Residential Schools Centre (Algoma University) and the Geomatics and Cartographic Research Centre (Carleton University), which began in May 2011 under the Lake Huron Treaty Atlas Project (2009-2012, SSHRC Standard Research Grant; 2012-2014 SSHRC Outreach Grant).

In May 2015, the GCRC began working in collaboration with others on the Residential Schools Land Memory Mapping Project (RSLMMP; SSHRC Insight Grant, 2015-2020) to expand the Residential Schools component of the Lake Huron Treaty Atlas into an atlas of its own. The Residential Schools and EF Wilson Maps were moved to this atlas space, and they are being updated as part of the RSLMMP.

We are working in collaboration with others on developing additional maps that reflect a broad view of Residential Schools and reconciliation. This includes mapping digital media, exhibitions, gatherings, sketch mapping of Survivor stories, and news stories reflecting a diverse array of dimensions.

As our work progresses, we will be updating the content in this atlas.

https://residentialschoolsatlas.org



Clyde River Atlas

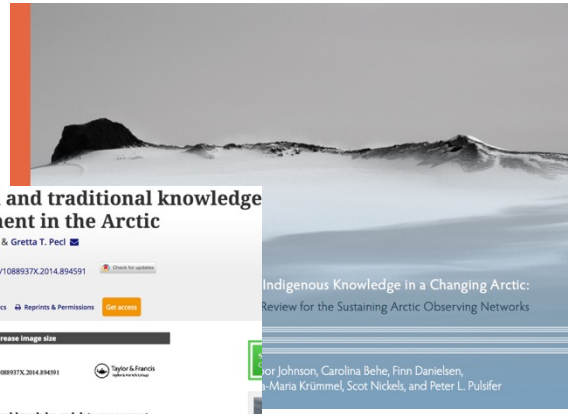
In the words of the community, "This cyberatlas is a way to share this work with our community, other communities, and beyond. It is also a tool to support new research and tell our own our stories. We hope this site will be a place for our youth, leaders, and community members to find resources they need for all their interests and activities. For visitors, we hope it shows the depth of Inuit knowledge and the critical importance of local leadership and involvement in researching our environment."

http://clyderiveratlas.ca

inuitplaces.org

inuitplaces.org is an interactive, multi-media atlas that is bringing together the traditional place names of Inuit peoples

ELOKA
http://eloka-arctic.org/

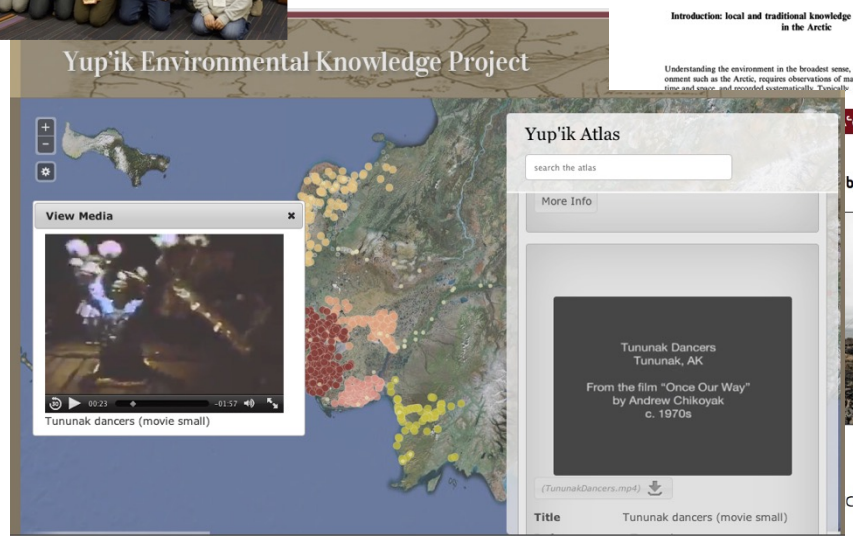


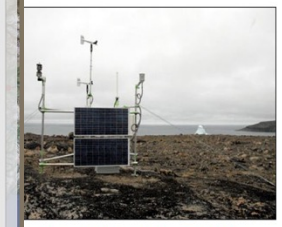
Introduction: local and traditional knowledge and data management in the Arctic

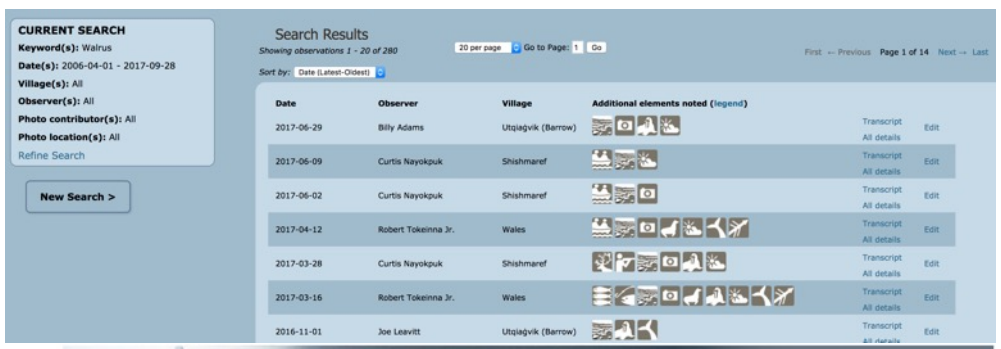
Peter L. Pulsifer, Henry P. Huntington & Gretta T. Pecl

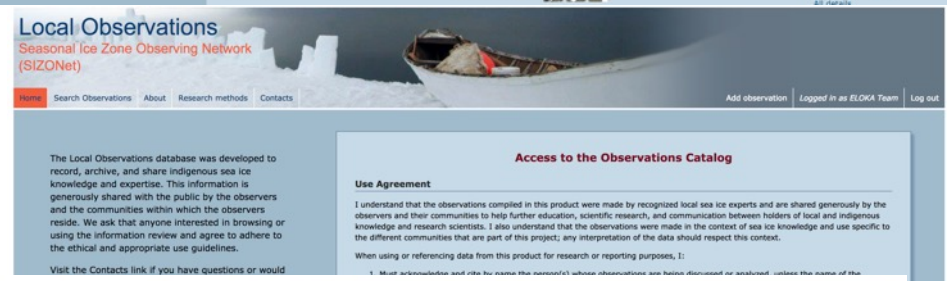
Introduction: local and traditional knowledge and data management in the Arctic

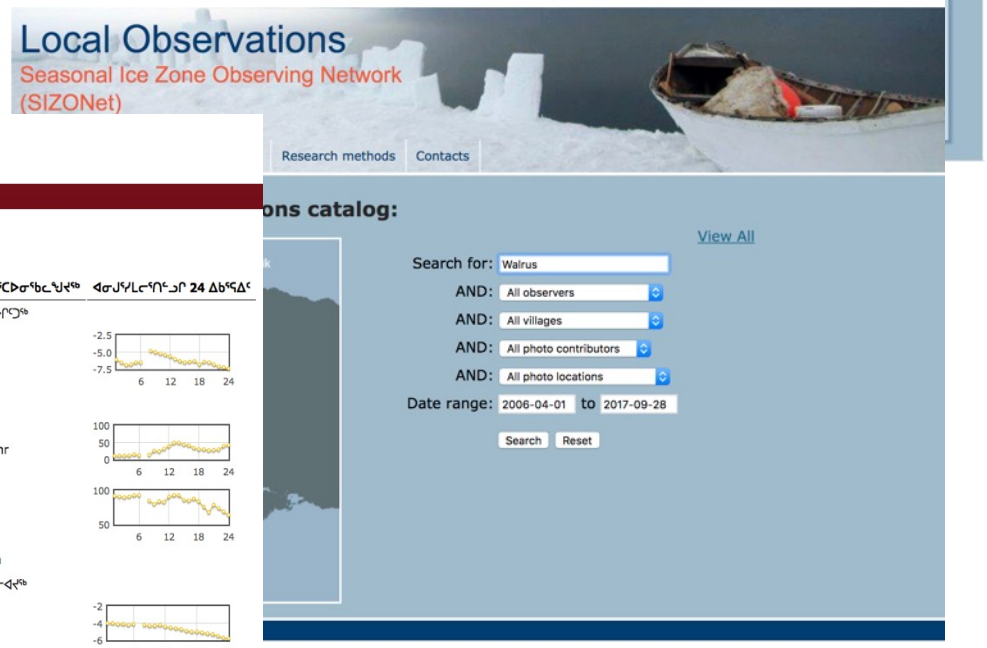
Understanding the environment in the broadest sense, especially a changing environment such as the Arctic, requires observations of many phenomena, spread over time and space, and recorded systematically. Typically, observations must be a part











Geosemantic Mediation Research and Application Opportunities

Communicating Inuit Muskoxen and Environmental Knowledge

Challenges of Sharing Knowledge

Language

Omingmak

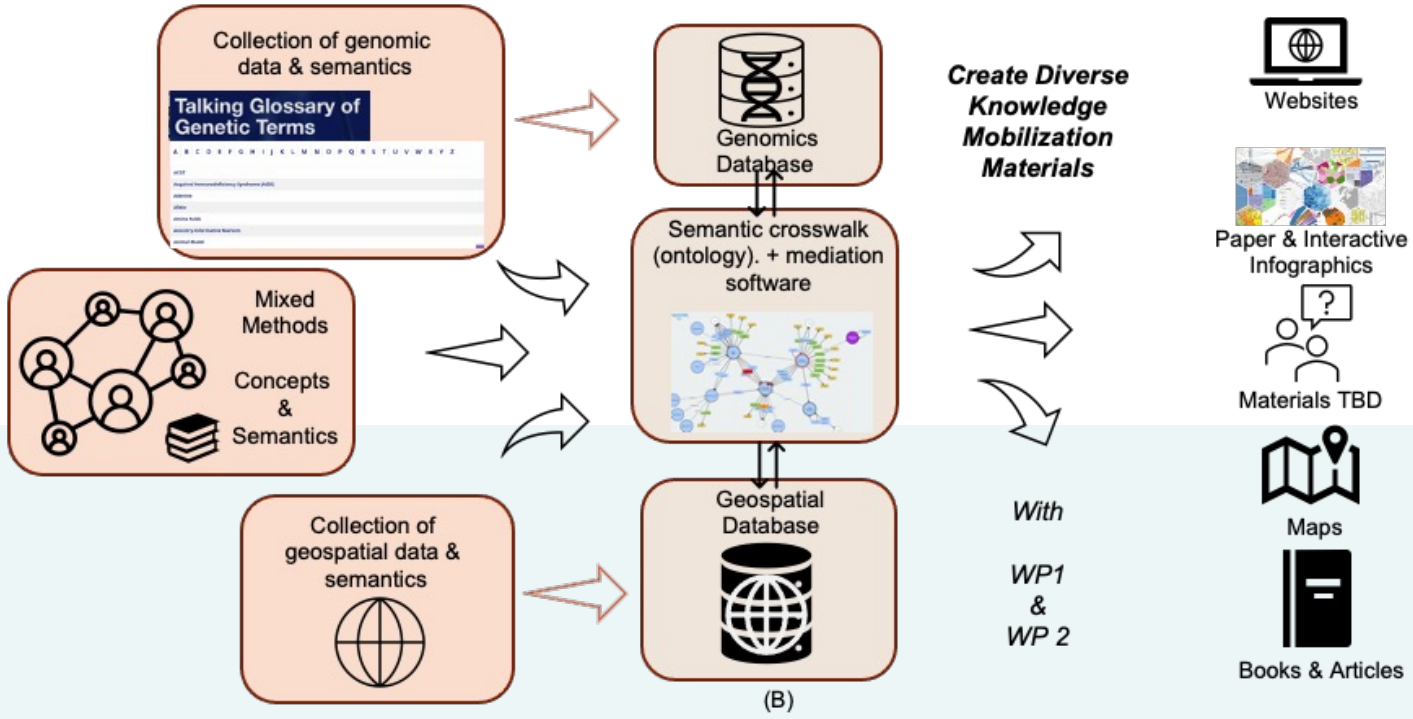
Tariungmiutaq

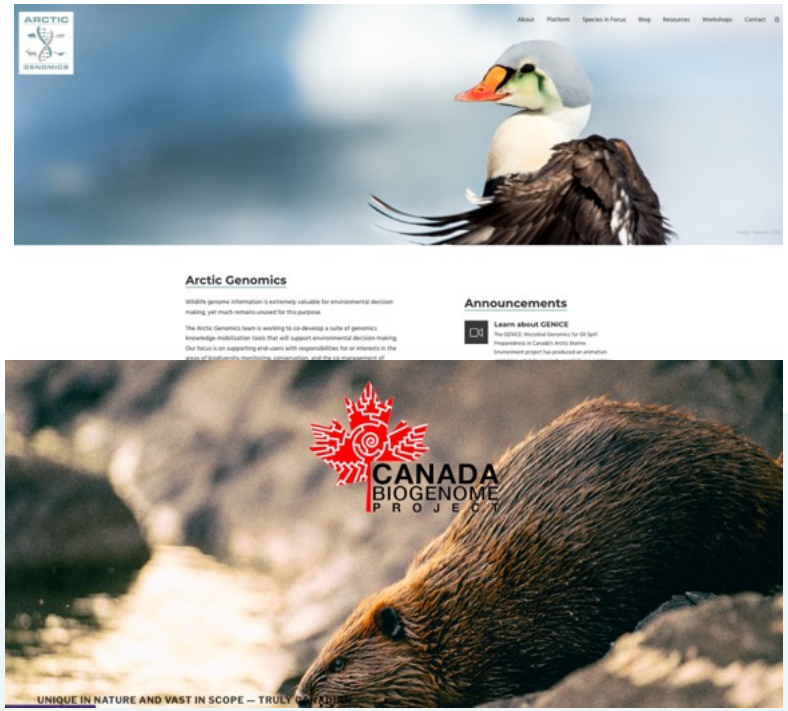
Muskox

Arctic Char

Ovibos moschatus

Salvelinus alpinus





One of our project activities and outcomes is to mobilize genomics and Indigenous Knowledge for decision making

ARCTIC GENOMICS

Cyber tools for information translation for and with end users

GenomeCanada

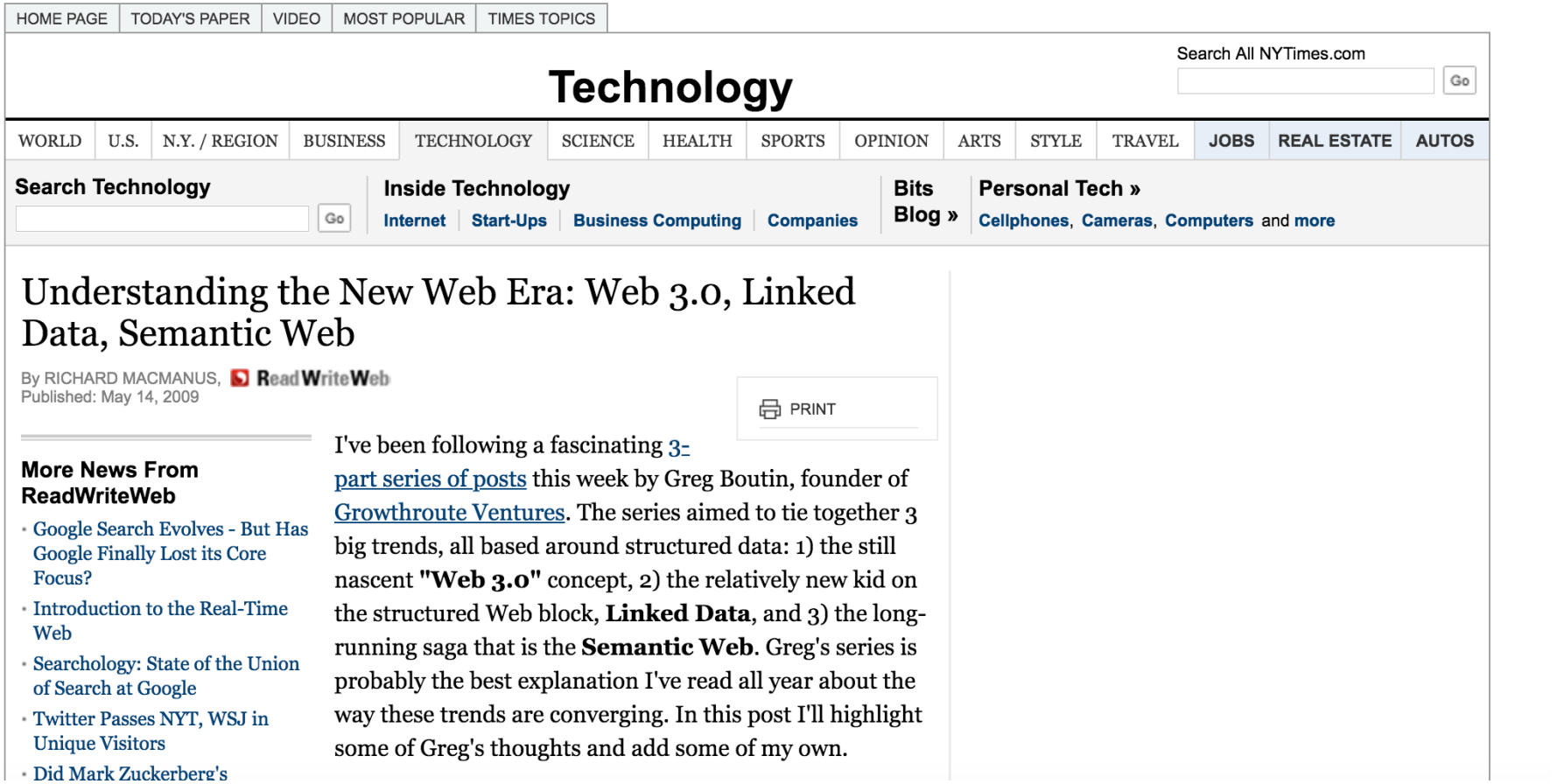
Considering the potential practical, economic, legal and ethical issues of mobilizing genomics for decision making

– including those pertaining to Indigenous perspectives and rights, Indigenous data sovereignty

and national and international frameworks and commitments that may influence policy at different levels of government

Linked Open Data and Semantic Solutions

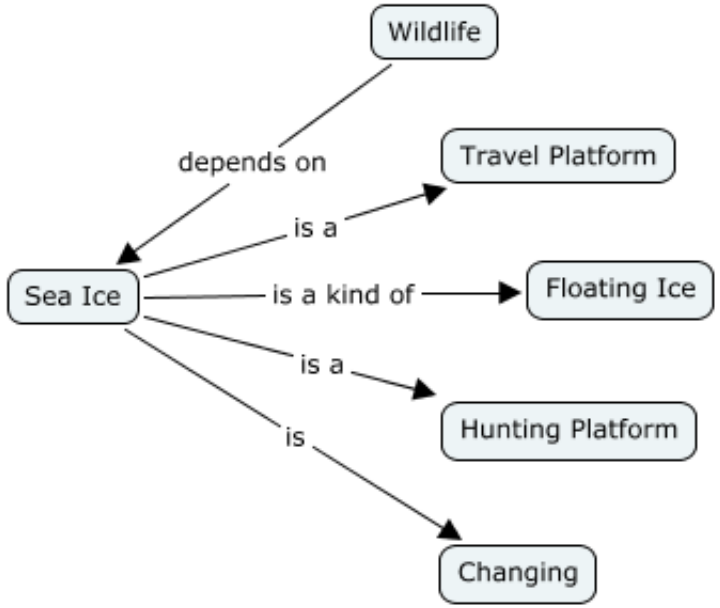
Semantic Methods and Technologies

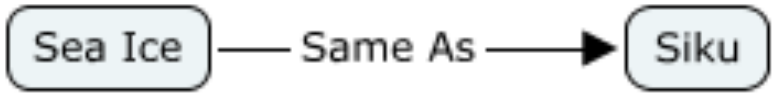


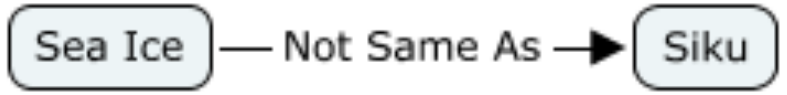
Triples


Sea Ice
is a kind of
Floating Ice


wmo:Sea Ice
is a kind of
wmo:Floating Ice


Wildlife
depends on
Travel Platform
is a
Sea Ice
is a kind of
Floating Ice
is a
Hunting Platform
is
Changing


Sea Ice
Same As
Siku


Sea Ice
Not Same As
Siku

Linked Open Data & Semantic Web

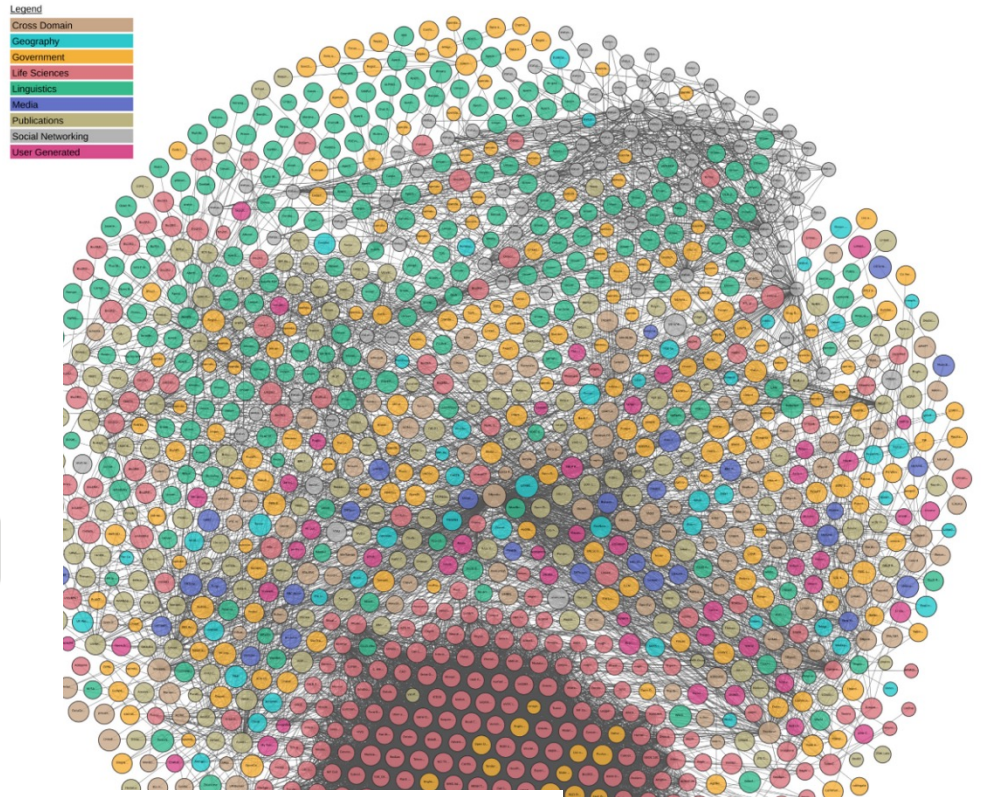
Google Dataset Search Beta

Search for Data Sets

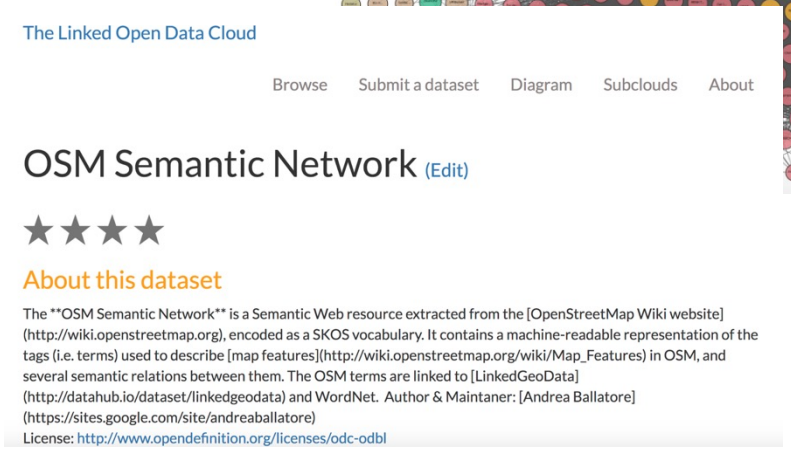
Try boston education data or weather site:noaa.gov

Learn more about including your data sets in Dataset Search.

https://toolbox.google.com/datasetsearch



https://lod-cloud.net/

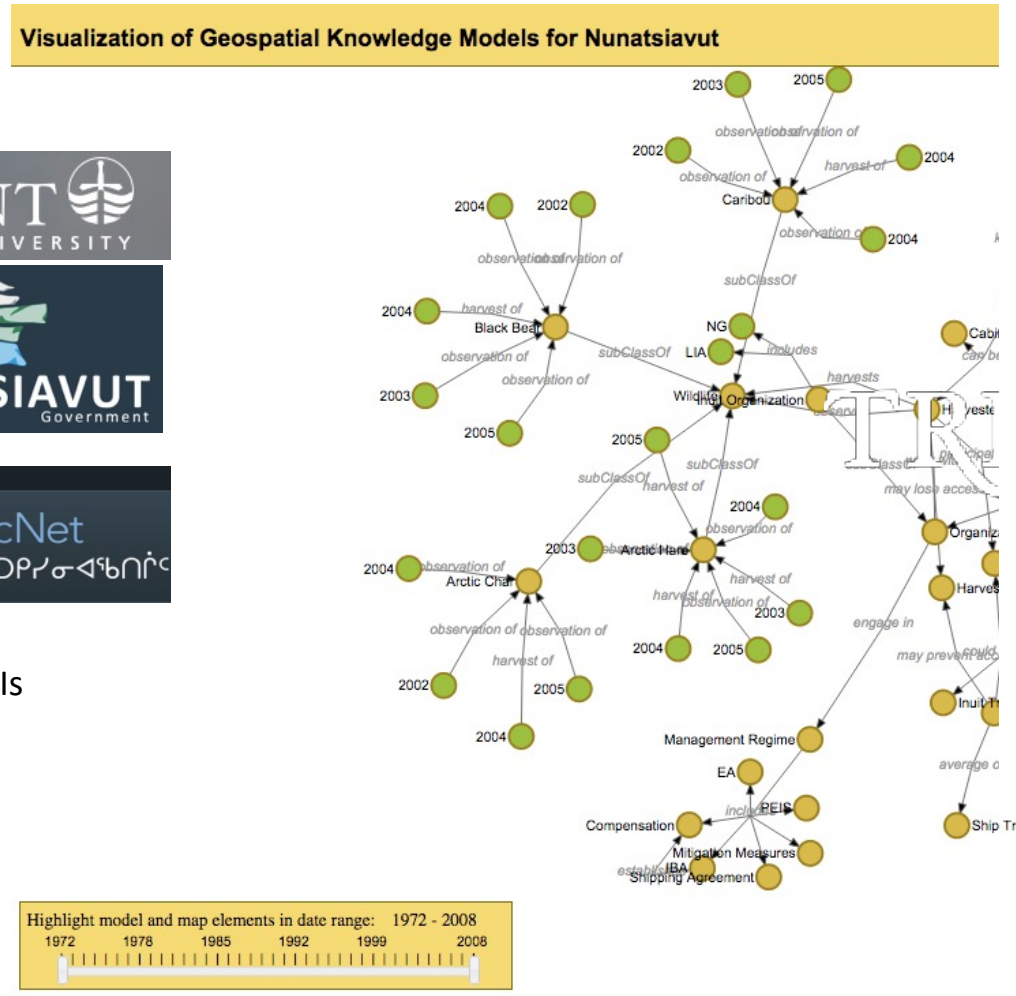


http://wiki.openstreetmap.org/wiki/OSM_Semantic_Network

Opportunities

- Reduced effort in knowledge modeling
- Ability to expand and share representations (models)
- Search, analysis, support of advanced application development
- Powerful linking capabilities across domains
- Potential to infer new knowledge through reasoning

Communicating Geo Knowledge from Nunatsiavut



C. Furgal,
T. Sheldon PIs

13 Geo-Semantic Web

Peter L. Pulsifer
Glenn Brauen

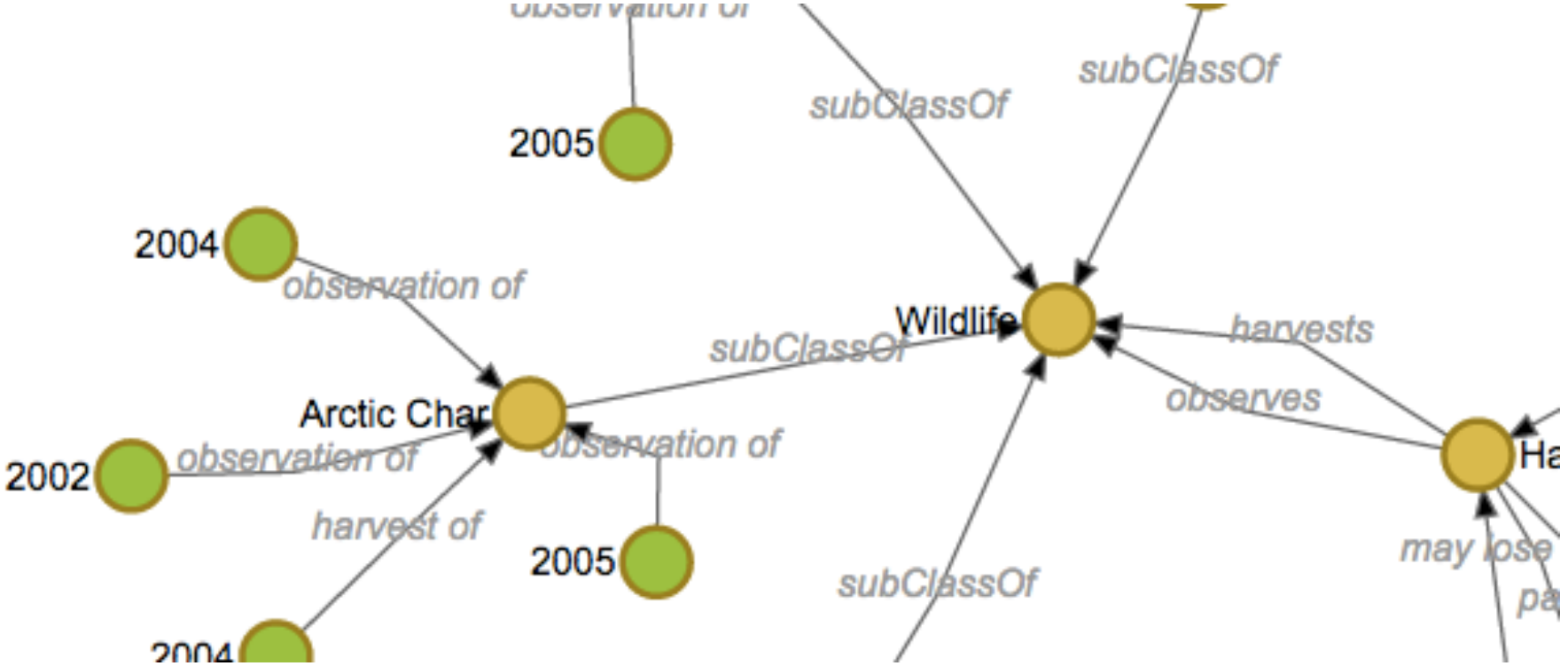
Introduction

The internet, and the World Wide Web (the web) in particular, have revolutionised how humans share information. Massive volumes of data are now shared through the internet, with an estimated throughput of 60 exabytes per month (one exabyte = 1 billion gigabytes) and over 14 billion devices (as of 2014) (CISCO Systems, 2015). While information exchange is pervasive, interoperability between networked systems is not universal. In a very general sense, interoperability refers to the ability to readily share information and/or operations for a particular purpose across information products or systems,

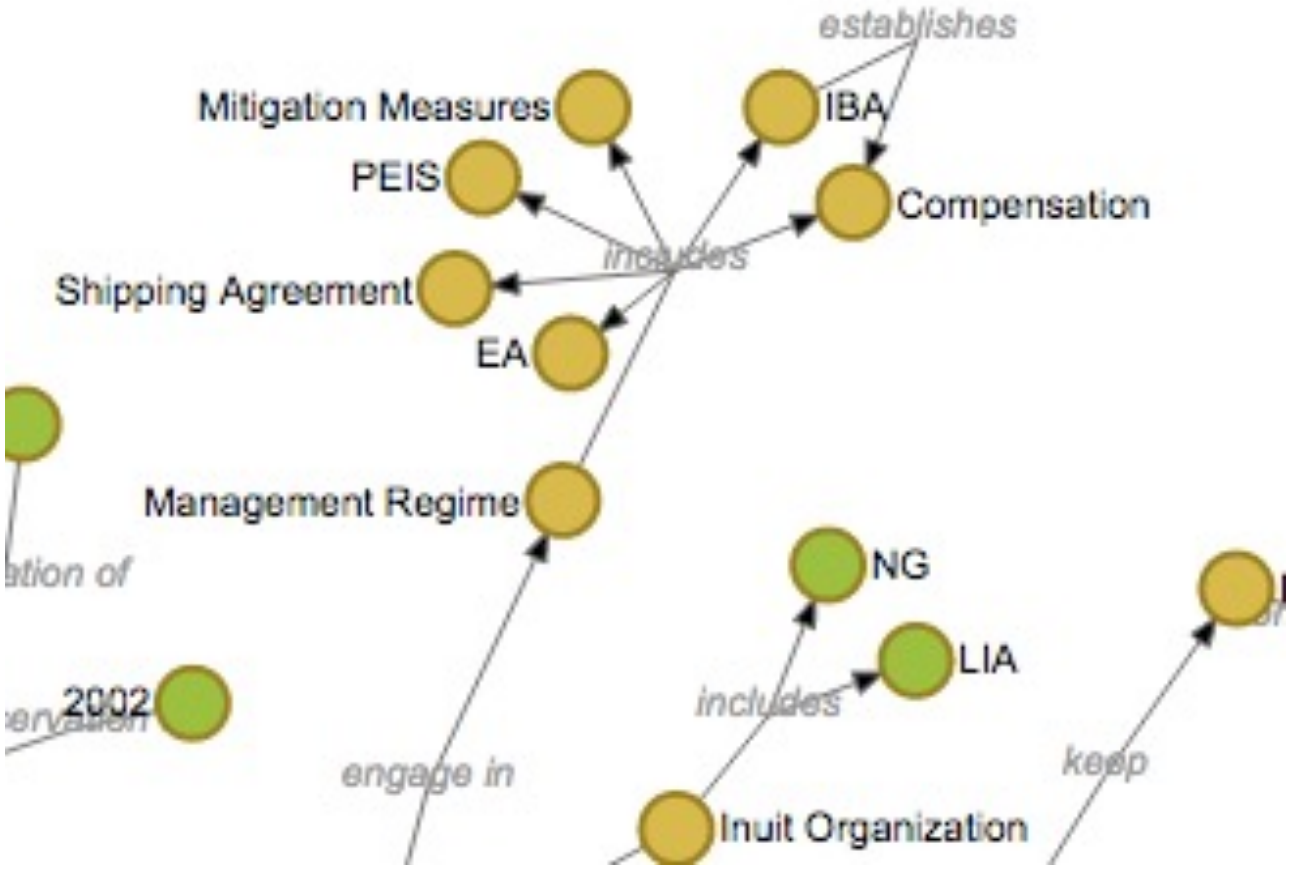
Pulsifer, P.L., Brauen, G. (2017). Geo-Semantic Web. In Understanding Spatial Media, edited
by Kitchin, Rob Lauriault, Tracey P. Wilson, Matthew W., Sage , 136-148, Art No. 13, isbn:
9781473949683

Prototype from http://www.arcticnet.ulaval.ca/research/summary.php?project_id=72

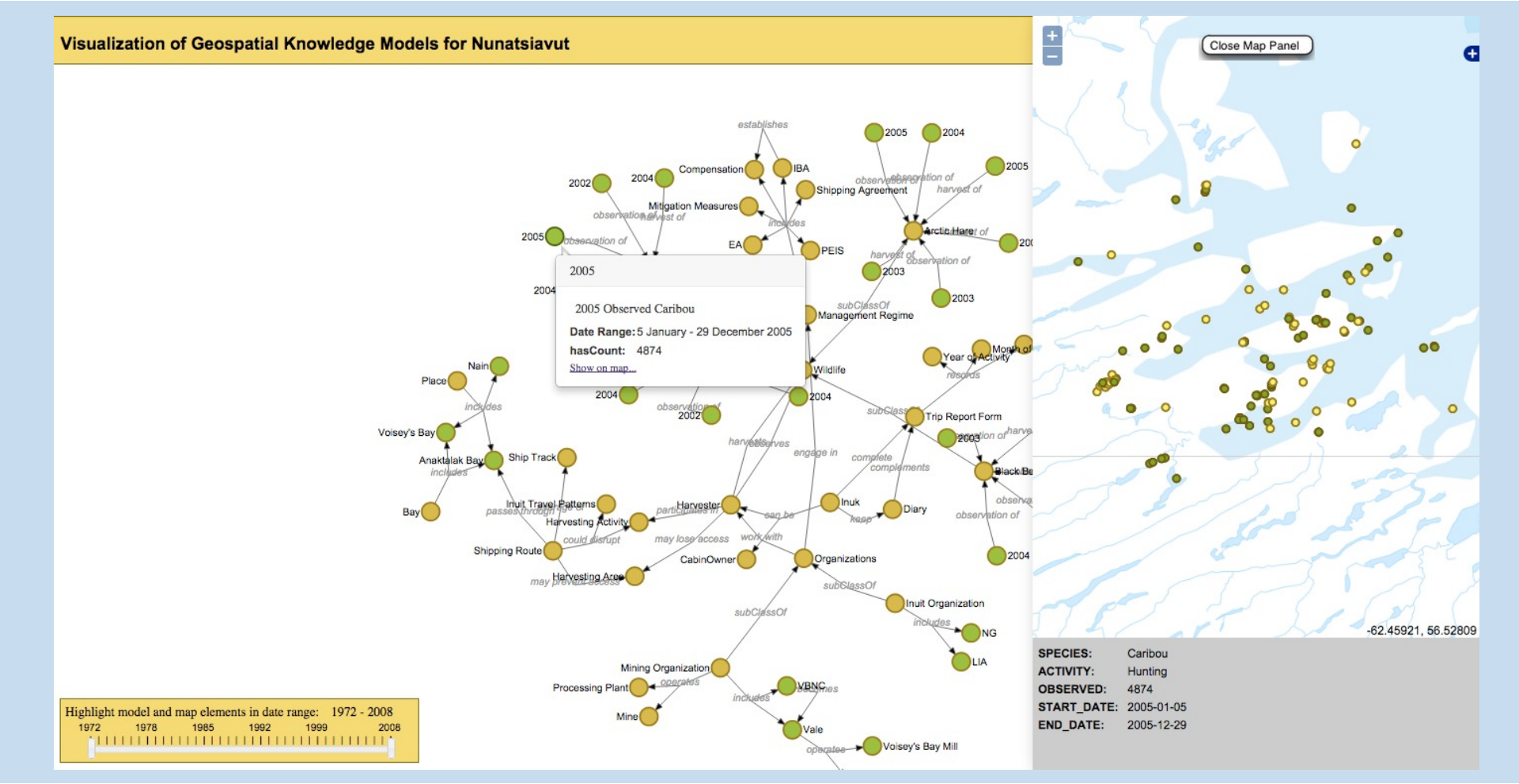
Wildlife and Subsistence (tangible)



Policy Frameworks (less tangible)



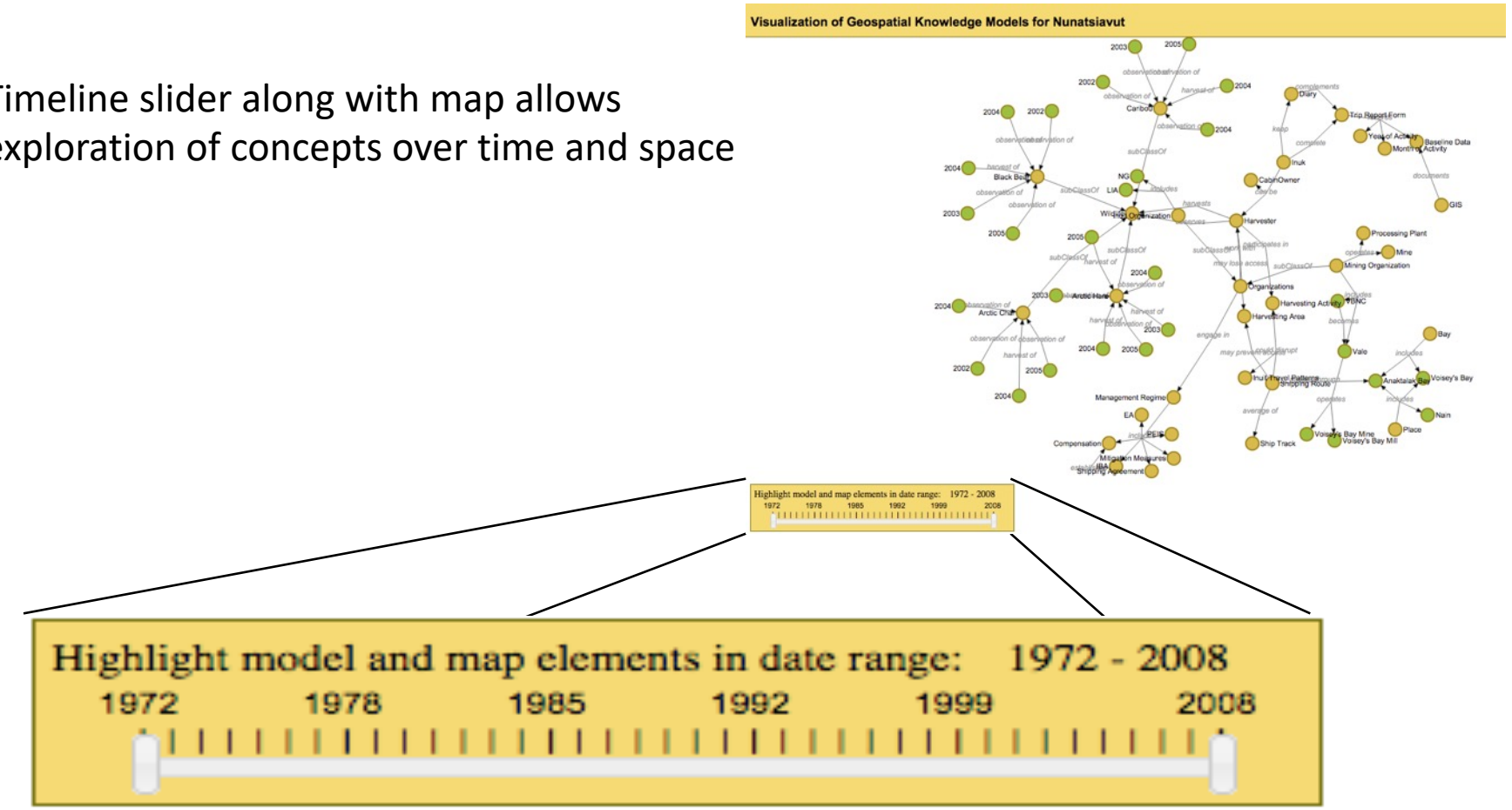
Communicating Geo Knowledge



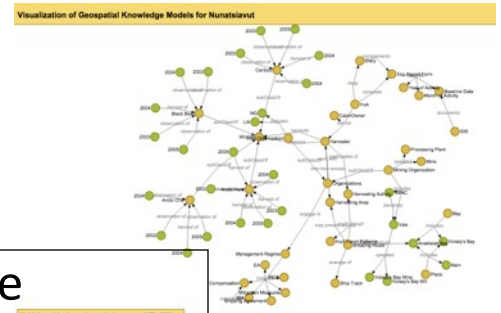
Integrated map allows user to explore real world instances of a particular concept (e.g. Caribou)

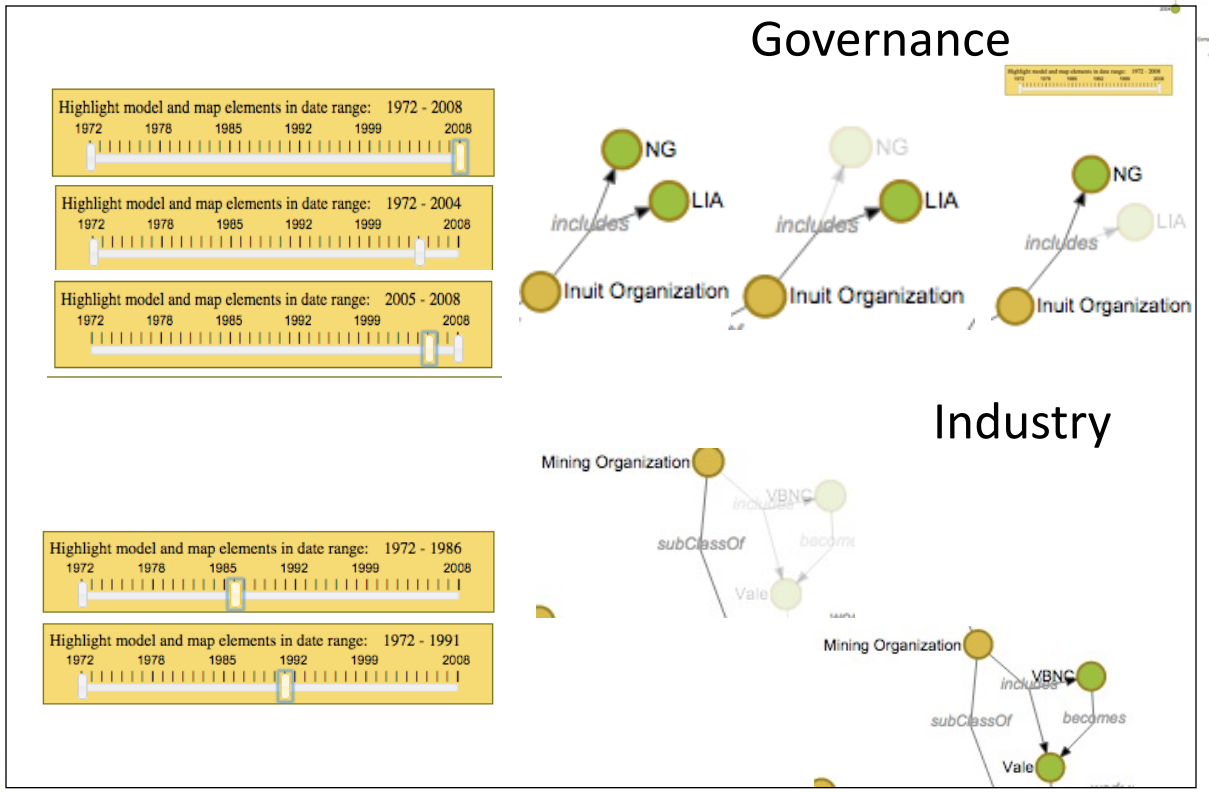
Space and Time

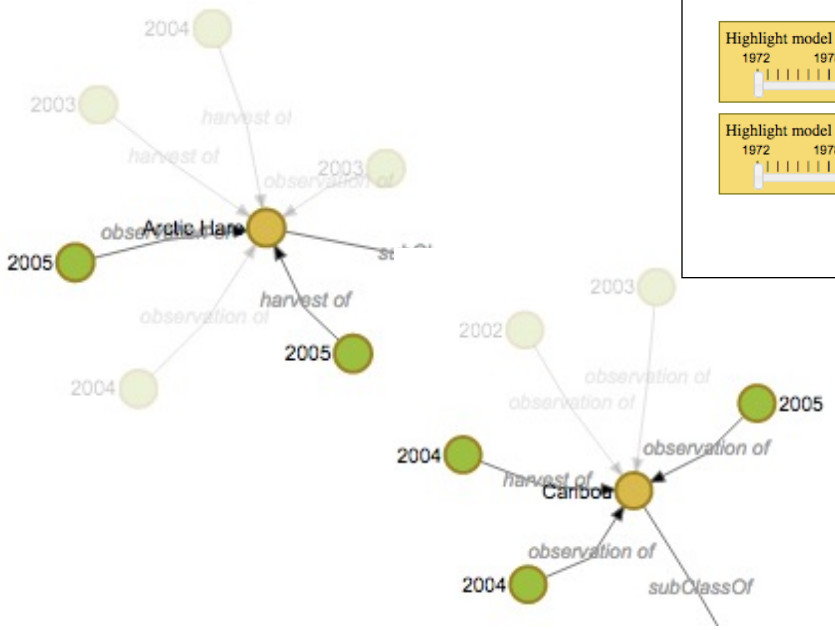
Timeline slider along with map allows exploration of concepts over time and space



Temporal Filtering







Understanding change over time is critical, and thus the tool includes the ability to filter results on both the concept and geographic maps based on when a concept or geographic feature existed.

Understanding Iñupiat Sea Ice Knowledge

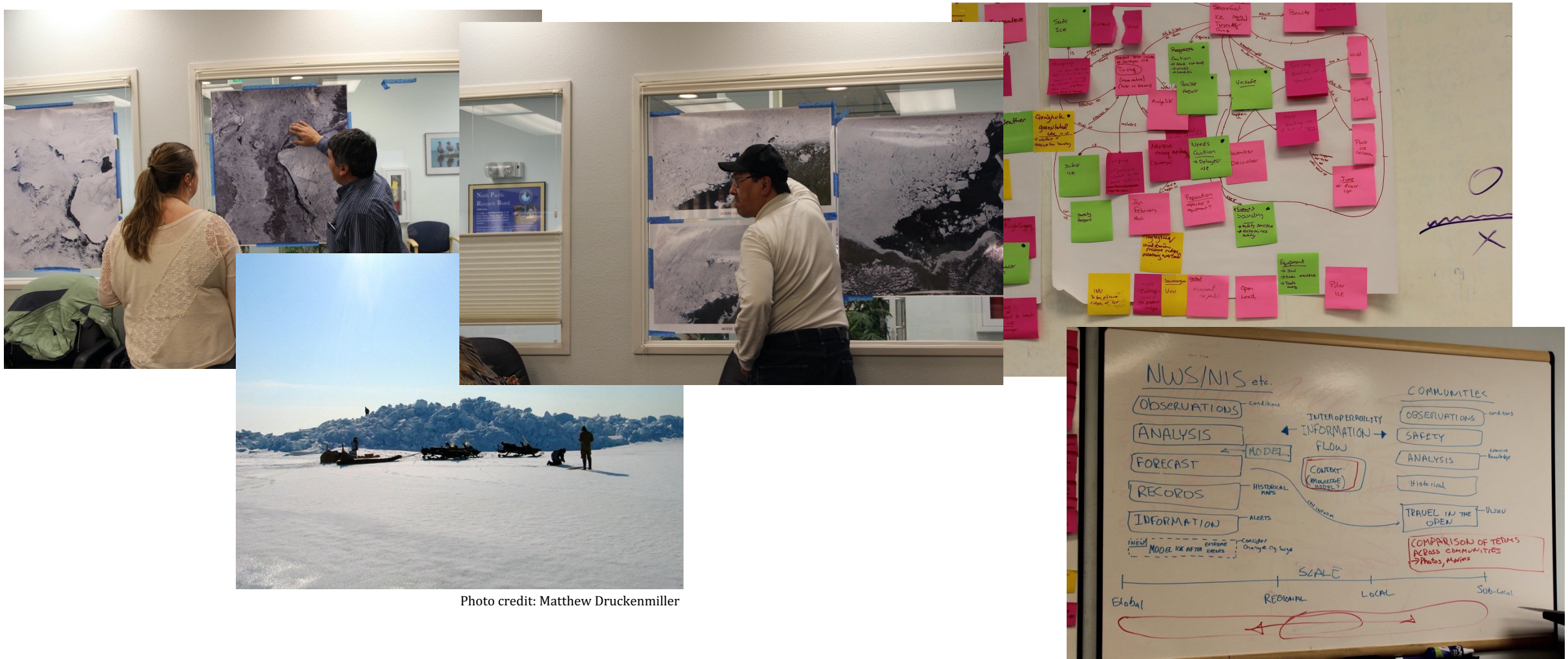
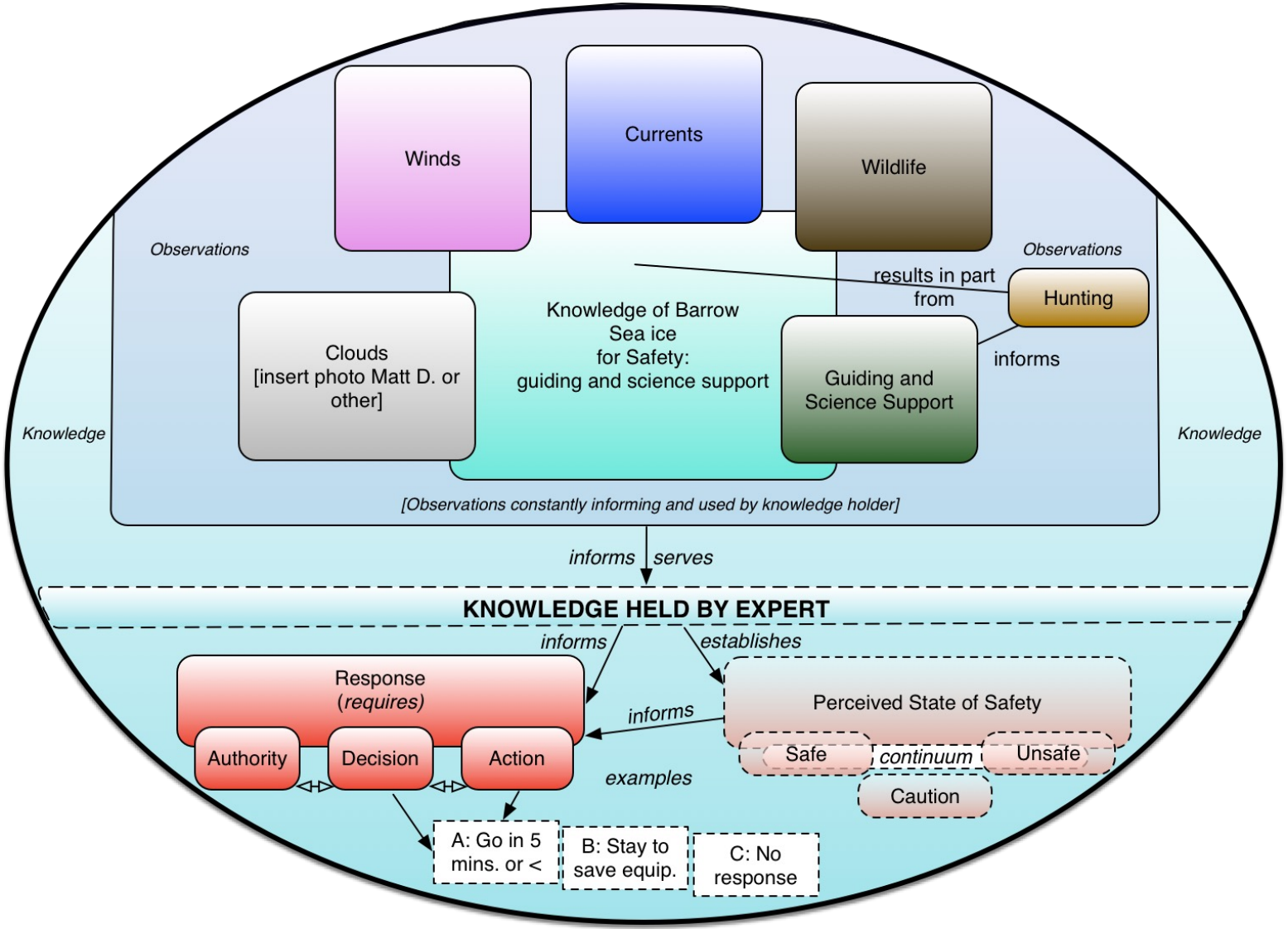


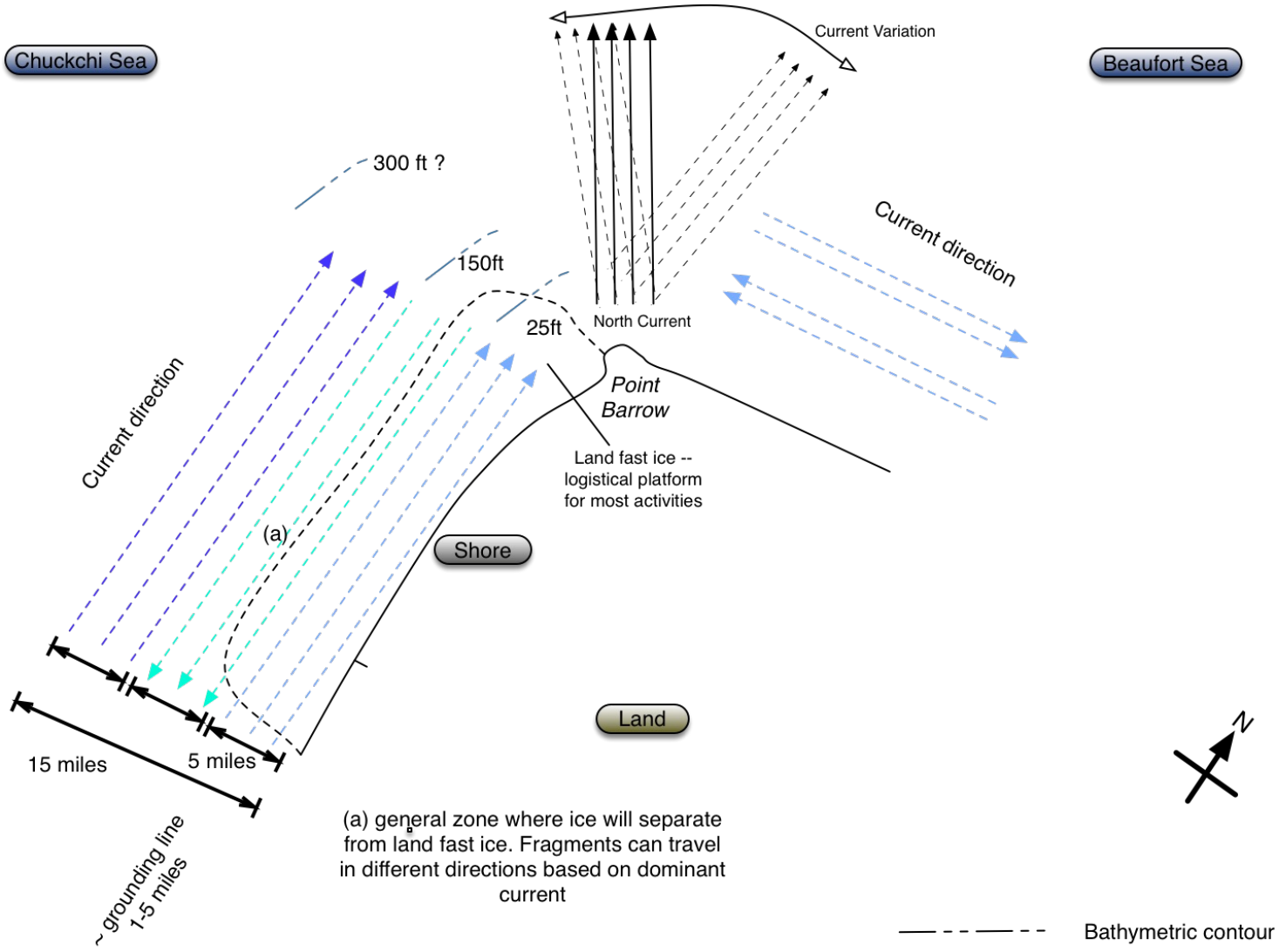
Photo credit: Matthew Druckenmiller

Concept Mapping with Iñupiat Sea Ice Expert



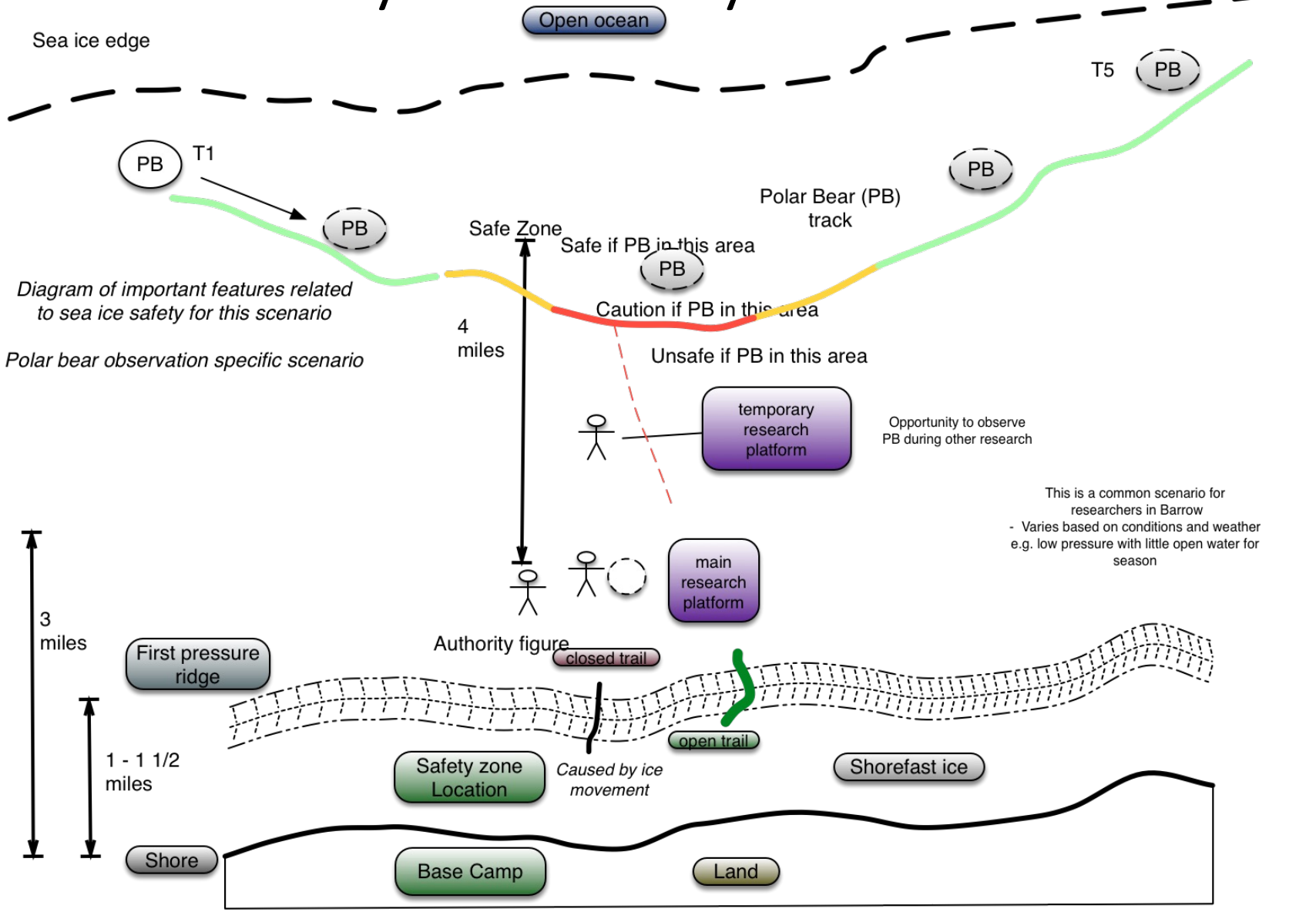
Lewis Brower
Utqiagvik, Alaska

Focus on Processes

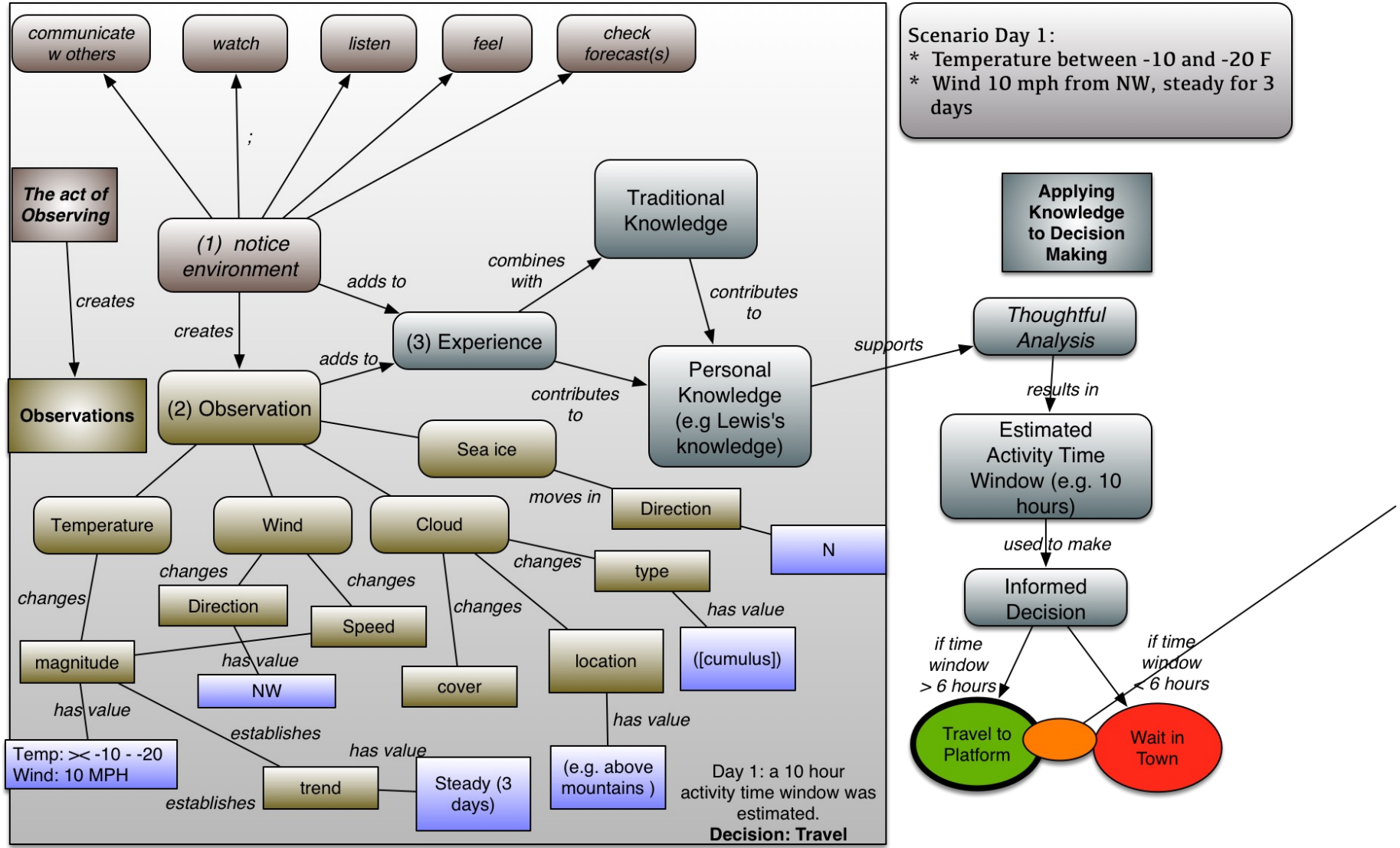


(a) general zone where ice will separate from land fast ice. Fragments can travel in different directions based on dominant current

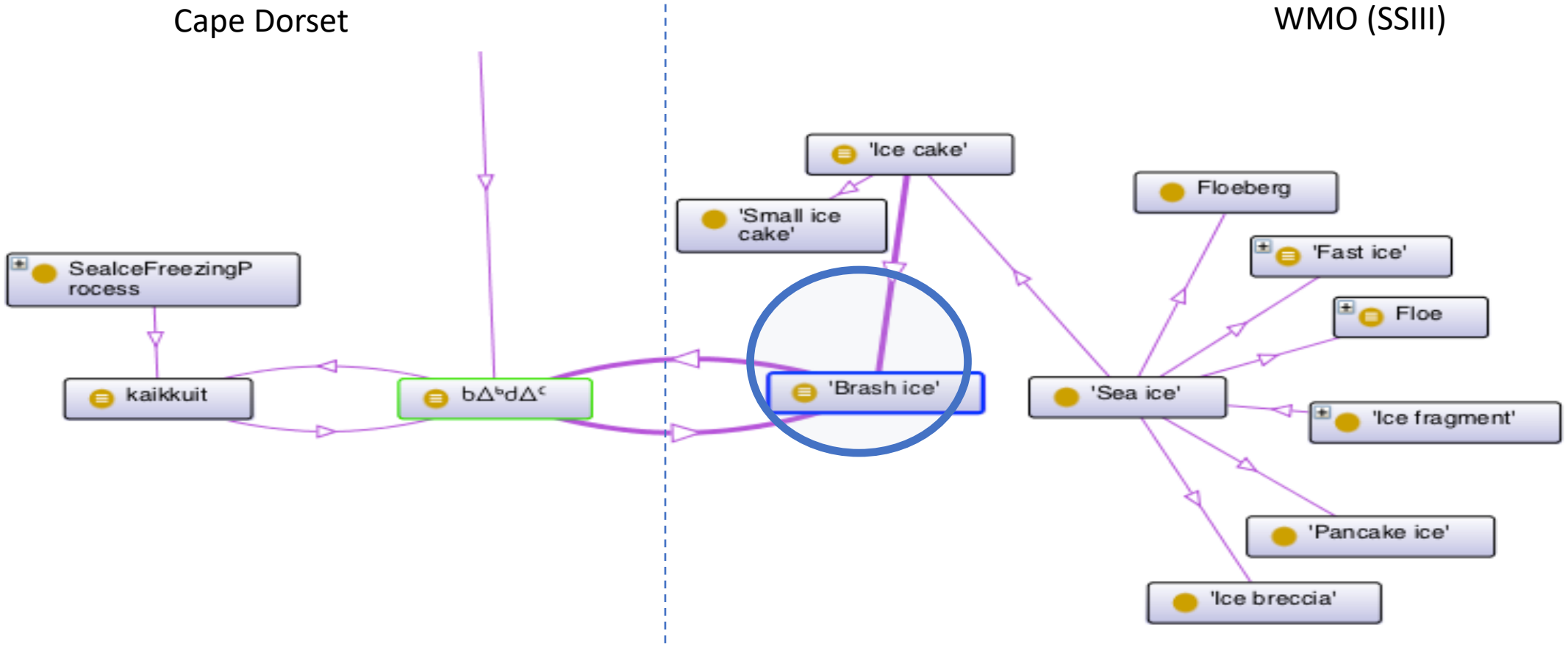
Function: Safety a Priority



Intricate Environmental Observing Process



Goal: Geo-Semantic Mediation Across Knowledge Domains (ideal)



https://sikuatlas.ca/index.html

WMO Nomenclature

Semantic Challenges

Iñupiaq:

Siguliaq
Young ice, gray or gray-white in color

SameAs

WMO:
Young ice: Ice in the transition stage between nilas and first-year ice, 10- 30 cm in thickness. May be subdivided into grey ice and grey-white ice.

Iñupiaq:

Siguliaq
Young ice, gray or gray-white in color, in the transition stage between nilas and first-year ice, that is 10-30 cm in thickness

Iñupiaq:

Siguliaq
Young ice, gray or gray-white in color

~~SameAs~~

WMO:
Young ice: Ice in the transition stage between nilas and first-year ice, **10- 30 cm in thickness**. May be subdivided into grey ice and grey-white ice.

Critical Ontology Questions

- The development of new knowledge modeling and representation techniques raises important questions

Implications of Translating Knowledge to Code


```
– <Ontology xml:base="http://www.semanticweb.org/ontologies/2012/3/capedorsetseaiceontology.owl" ontologyIRI="http://www.semanticweb.org/ontologies/2012/3
  /capedorsetseaiceontology.owl">
    <Prefix name="rdf" IRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#"/>
    <Prefix name="rdfs" IRI="http://www.w3.org/2000/01/rdf-schema#"/>
    <Prefix name="xsd" IRI="http://www.w3.org/2001/XMLSchema#"/>
    <Prefix name="owl" IRI="http://www.w3.org/2002/07/owl#"/>
    <Import>http://purl.org/wmo/seaice#</Import>
  – <Import>
      file:/Users/pulsifer/Dropbox/DB_Desktop/Cape%20Dorset%20Sea%20Ice%20Terminology.owl
    </Import>
  – <EquivalentClasses>
      <Class IRI="http://ca.carleton.gcrc/capedorsetseaice#sijja"/>
      <Class IRI="http://purl.org/wmo/seaice/form#FastIce"/>
    </EquivalentClasses>
  – <EquivalentClasses>
      <Class IRI="http://ca.carleton.gcrc/capedorsetseaice#ᖃᑭᓂ"/>
      <Class IRI="http://purl.org/wmo/seaice/development#FrazilIce"/>
    </EquivalentClasses>
  – <EquivalentClasses>
      <Class IRI="http://localhost/default#ᑲᐃᖏᑯᐃᖅ"/>
      <Class IRI="http://purl.org/wmo/seaice/form#BrashIce"/>
    </EquivalentClasses>
  – <AnnotationAssertion>
      <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
    – <IRI>
        http://ca.carleton.gcrc/capedorsetseaice#aggutippalliajuq
      </IRI>
    – <Literal xml:lang="en" datatypeIRI="http://www.w3.org/1999/02/22-rdf-syntax-ns#PlainLiteral">
        The process of ice forming in against the wind, freezing progresses in the opposite direction that the wind is blowing, resulting in the formation of agguttituq
      </Literal>
```

Reflexive Approach to Mediation Research

- Are these methods appropriate for modeling all kinds of knowledge (e.g. Indigenous)?
- How might modeling in this way affect knowledge access and control?
- What are the risks of misrepresentation?
- Will linking to other knowledges ‘dilute’ or negatively transform different kinds of knowledge?
- Increased risk of knowledge appropriation?

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- Eicken, Hajo, Finn Danielsen, Matthew Druckenmiller, Maryann Fidel, Donna Hauser, Lisbeth Iversen, Noor Johnson, et al. “Community-Based Observations Help Interface Indigenous and Local Knowledge, Scientific Research, and Education in Response to Rapid Arctic Coastal Change.” In EGU General Assembly Conference Abstracts, 12248, 2020.
- Eicken, Hajo, Mette Kaufman, Igor Krupnik, Peter Pulsifer, Leonard Apangalook, Paul Apangalook, Winton Weyapuk Jr, and Joe Leavitt. “A Framework and Database for Community Sea Ice Observations in a Changing Arctic: An Alaskan Prototype for Multiple Users.” Polar Geography 37, no. 1 (2014): 5–27.
- Eicken, Hajo, Sandy Starkweather, Henry W Loescher, Raychelle Daniel, Peter Pulsifer, Matt Jones, Will Ambrose, Alice Bradley, and Craig Lee. “A Roadmap from Coordination to Implementation–Actions in Support of Sustained Coordinated Observations of Arctic Change White Paper Outline, v. 5–3 May 2019,” n.d.
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Theme 4: GCRC

Research Team

Some of the Geomatics and Cartographic Research Centre team (from left to right: Stephanie Pyne, Amos Hayes, Jean-Pierre Fiset, Kumiko Murasugi, Jason Wong, Leah Ronayne, Robert Oikle, Fraser Taylor, Tracey Lauriault, Adam Stone, Romola Trebilcock, Tara McWhinney, Peter Pulsifer, Opoku Asenso)

ITK National Inuit Strategy on Research (NISR) 2018

https://www.itk.ca/wp-content/uploads/2020/10/ITK-National-Inuit-Strategy-on-Research.pdf

NISR Priority Area 4: Ensure Inuit access, ownership, and control over data and information

Actions:

4.1 Advocate for the consistent production and sharing of Inuit-specific and Inuit-relevant indicators and data, including the Inuit Health Survey

4.2 Invest in culturally-relevant, community-based technology to facilitate access to and management of data and information

4.3 Develop Inuit-specific guidelines on data accessibility, ownership, and control

4.4 Create and invest in digital Inuit Nunangat data repositories that are inclusive of Inuit knowledge in ways that are respectful of its distinctive forms as well as the Inuit norms that govern its use and sharing

Nunaliit

- Collect, organize, present, preserve, collaborate
- Multiple representations (oral histories, maps, graphs, timelines, spoken features, custom visualizations, etc.)
- Relate qualitative and quantitative data
- Multiple simultaneous uses from single system
- Distributed architecture
- Co-developed with communities
- Open Standards, Open Source

Nunaliit Distributed Data Management Network for Local And Traditional Knowledge

Relationships

Partner with Nunaliit data centre

Geomatics and Cartographic Research Centre
Exchange for Local Observations and Knowledge of the Arctic (ELOKA)
CentroGeo

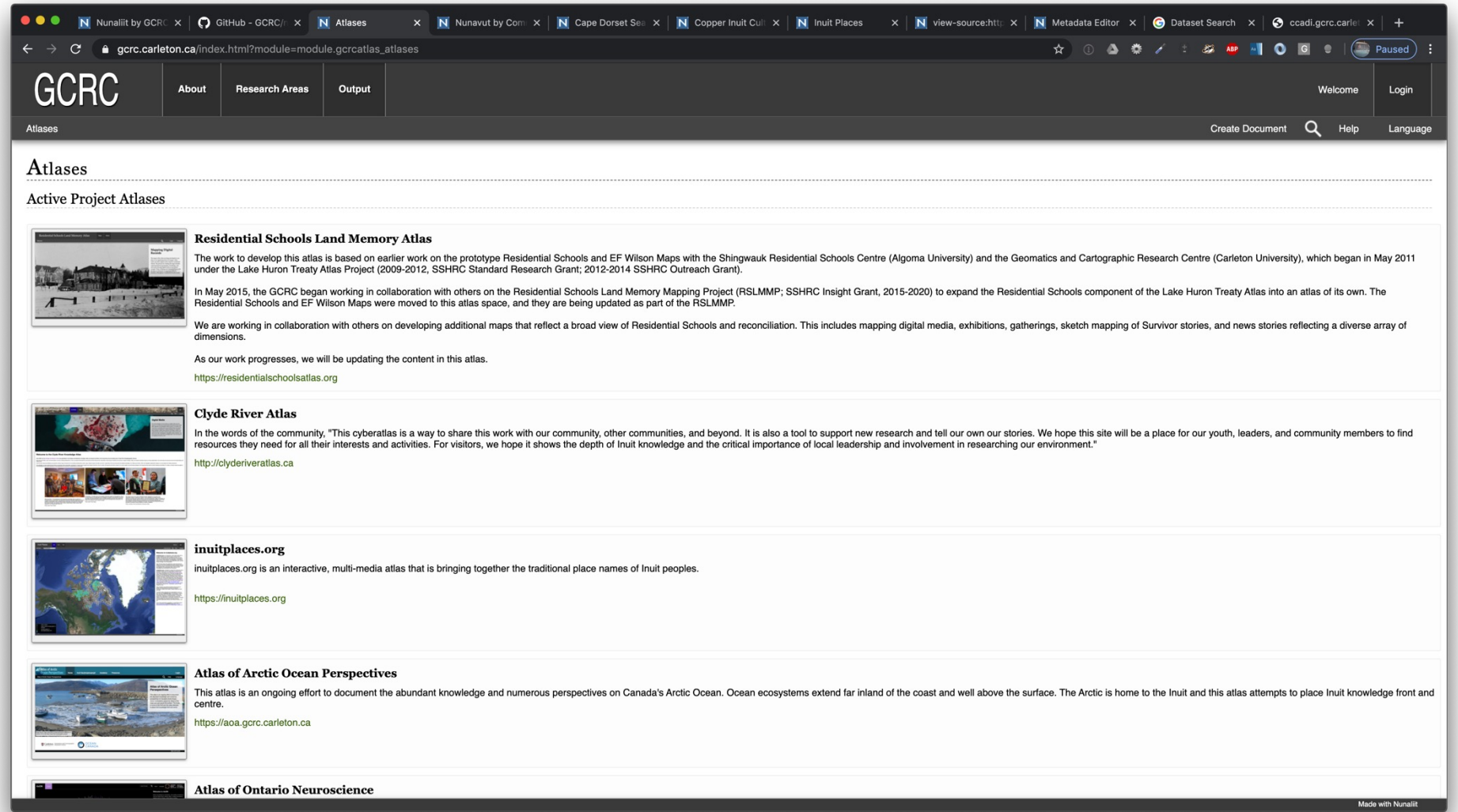
Partner with local Nunaliit server

Kitikmeot Heritage Society
University of São Paulo
University of São Luís
Gjoa Haven Hunters and Trappers Association

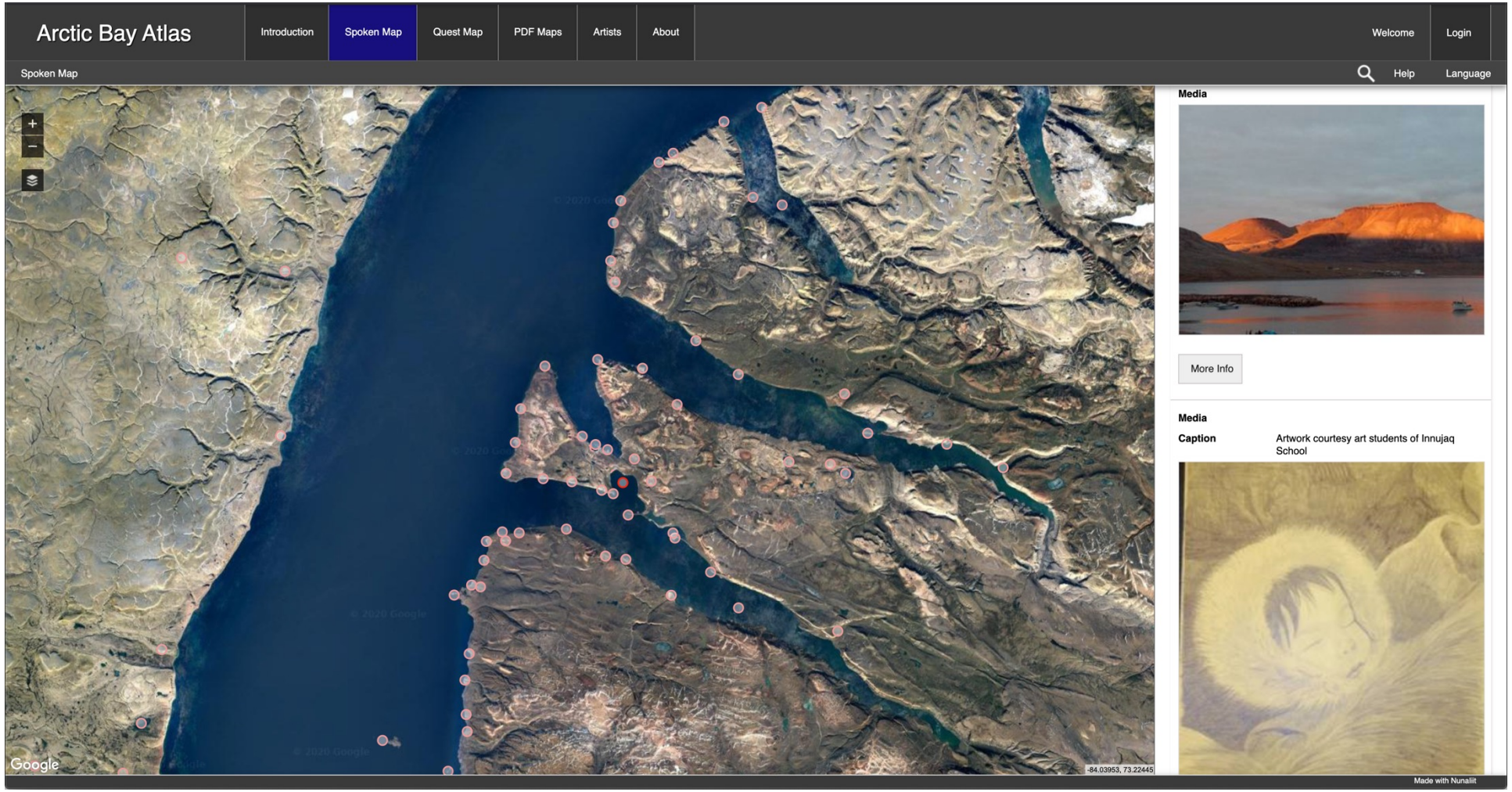
Network hosted partners and projects

Government of Nunavut
Ittaq Heritage and Research Centre
Sahtú Renewable Resources Board
Nunavut Tunngavik Inc.
National Museum of Denmark
Inuit Circumpolar Council
Slave River Coalition
Inuit Tapiriit Kanatami
Robertson Huron Signatories
Terrar Peninsular
University of Alaska Fairbanks
Inuit Places Atlas
Thule Atlas
Towards a Sustainable Fishery for Nunavummiut Atlas
Nunavut Coastal Resource Inventory Atlas
Clyde River Knowledge Atlas
Residential Schools Land Memory Mapping Project
Pan Inuit Trails Atlas
Lake Huron Treaty Atlas
Views from the North
Atlas of the Languages of Iran
Inuktut Lexicon Atlas
Paipai Atlas
Kumeyaay Atlas
Lençois Maranhenses Atlas
Community Knowledge Bank Project
Chesterfield Inlet Atlas
Naryn Atlas
Gwich'in Place Names Atlas (CA)
Gwich'in Place Names Atlas (US)
Yu'pik Environmental Knowledge Project
Alaska Native Placenames Project
Atlas of Community-Based Monitoring in a Changing Arctic
Local Observations from the Seasonal Ice Zone Observing Network (SIZONet)
PISUNA-Net
Nunaput: Our Land, Community Atlas for Chevak, Alaska
Deg Hit'an Dingan' Atlas
Koyukuk River Traditional Place Names Atlas
Evenki Atlas

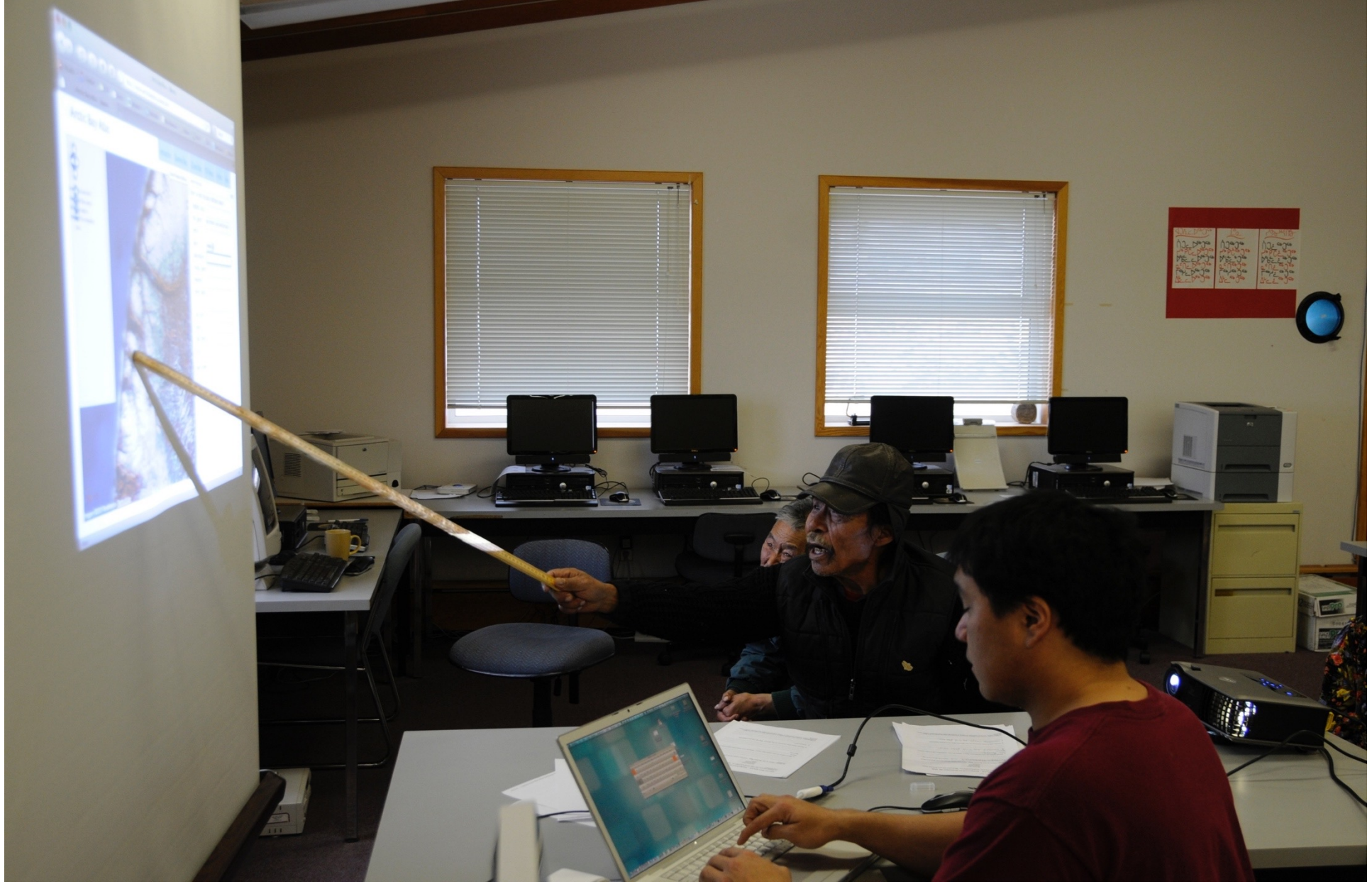
GCRC and its partners around the world are using and hosting instances of Nunaliit. This map highlights the network of Indigenous and local knowledge initiatives making use of the framework and contributing to its development as of 2019.



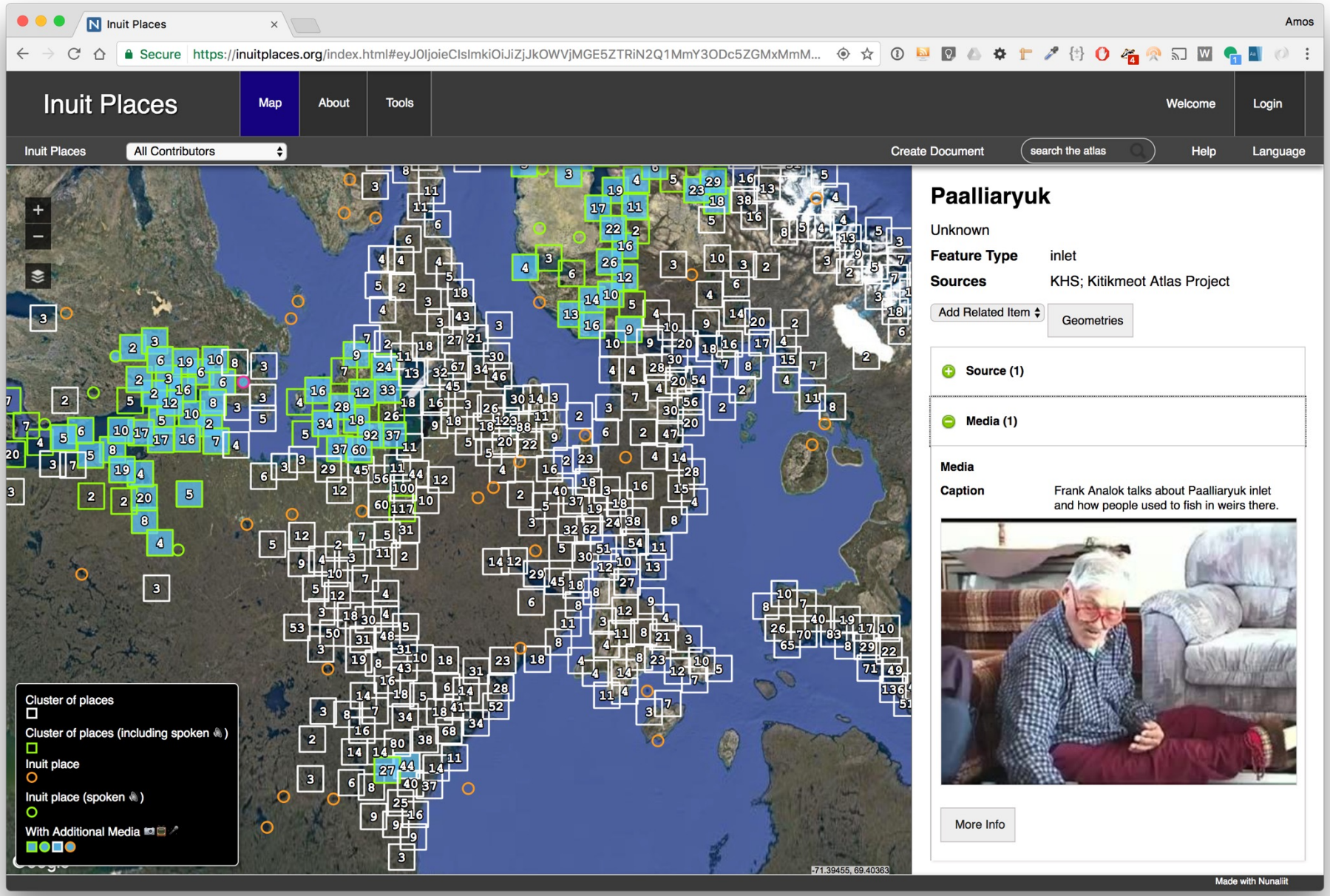
Atlas examples:
http://gcrc.carleton.ca/atlases/



The Arctic Bay Atlas spoken map contains local place names collected from Elders by youth in the community. You would also record the pronunciation of the place names and add them to the atlas along with photos, video, and artwork.

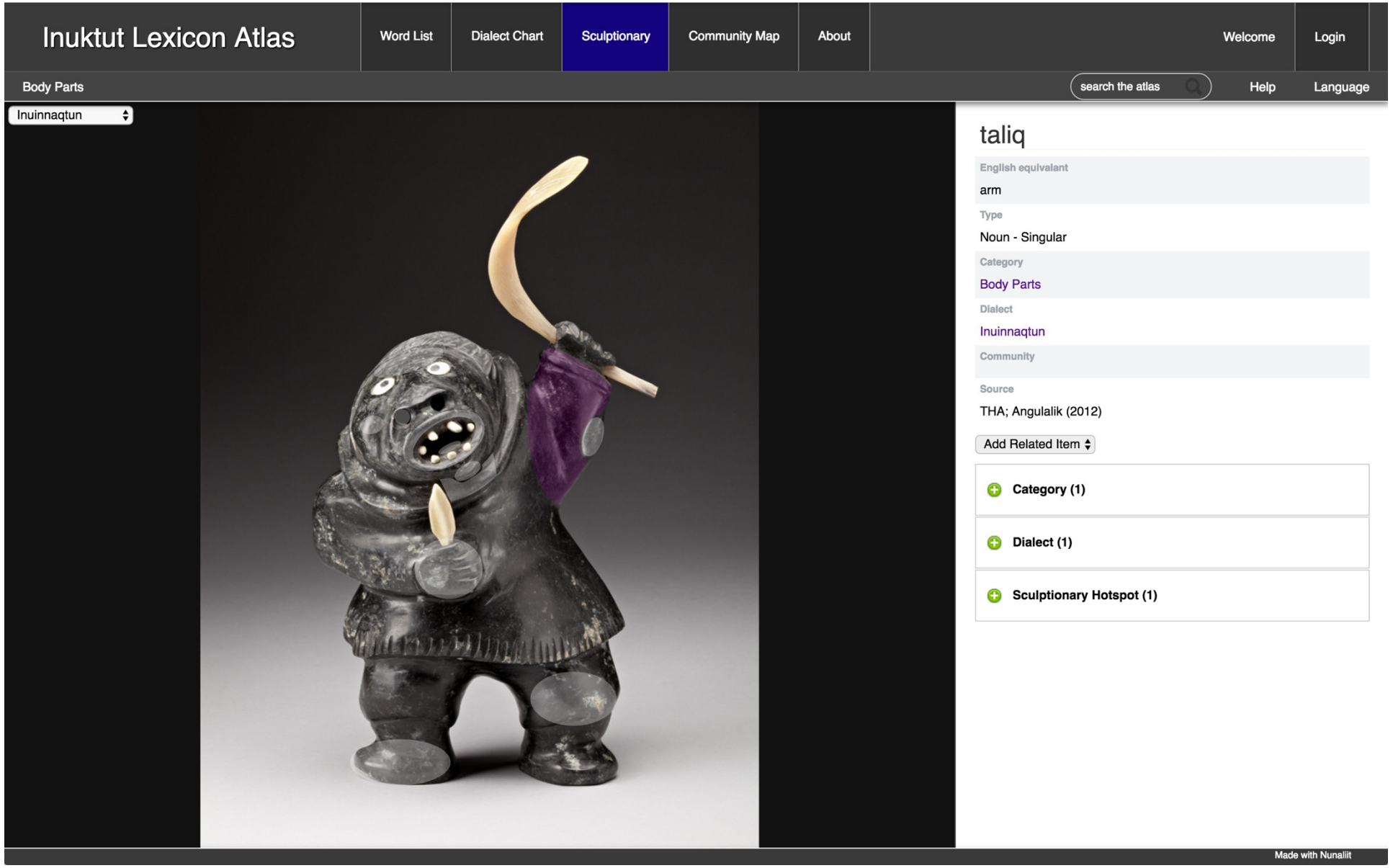


Arctic Bay Elders work with Rex Willie to edit the spoken place names map, now also a part of inuitplaces.org

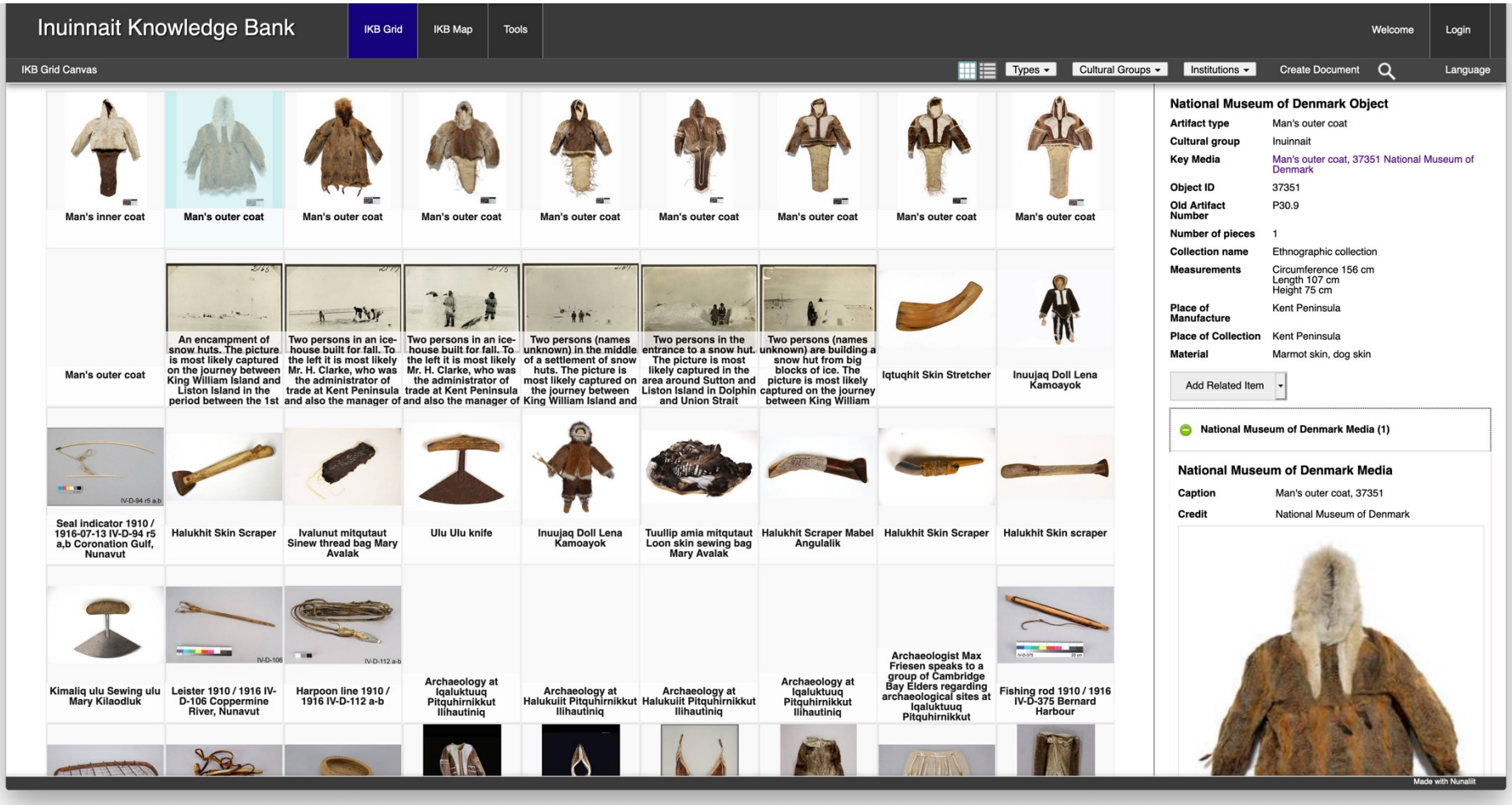


Frank Analok describes Inuit places in the inuitplaces.org atlas, a joint effort between the Kitikmeot Heritage Society, the Geomatics and Cartographic Research Centre, and several knowledge holders to offer a comprehensive view of Inuit places without national or territorial boundaries.

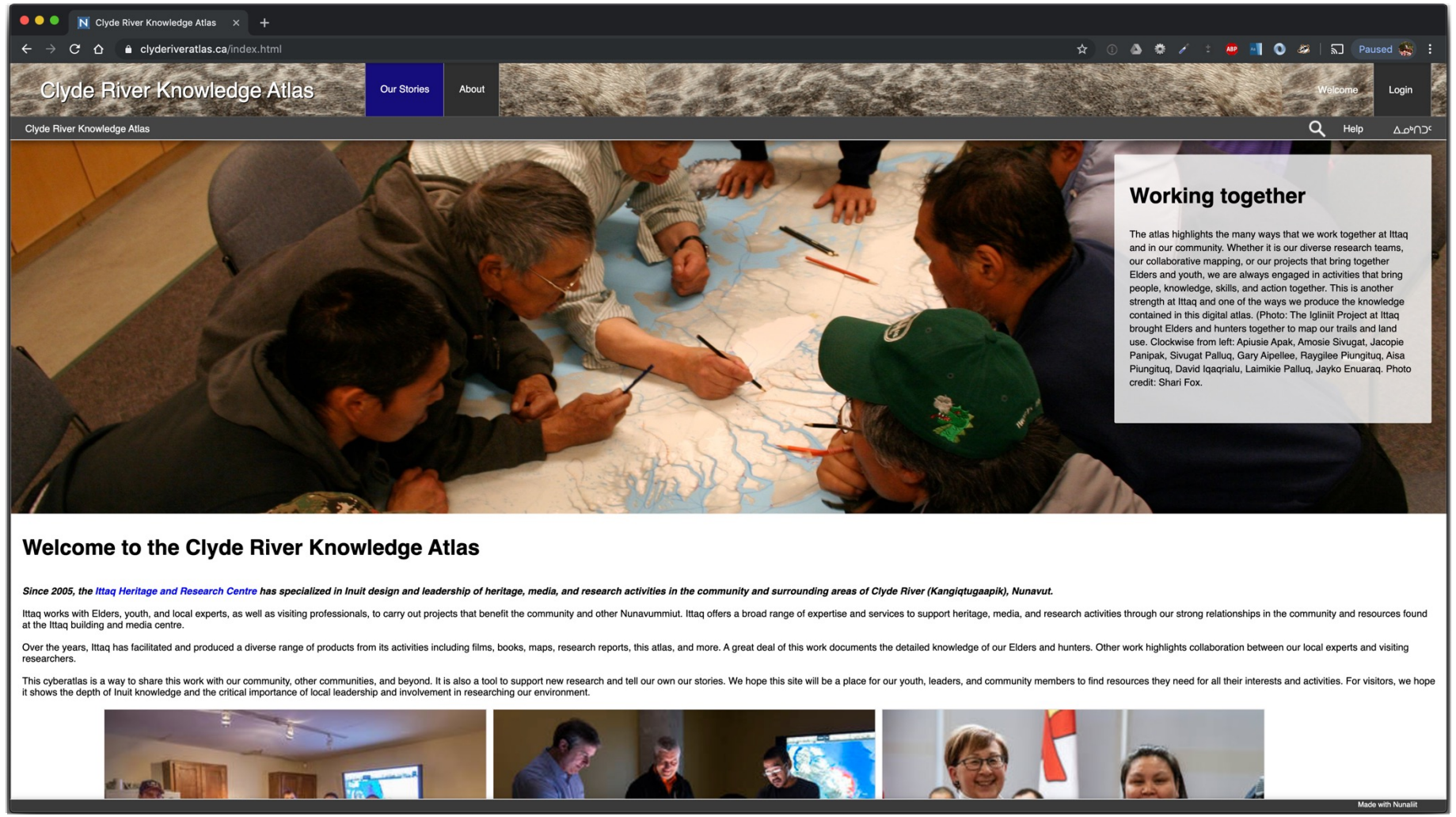
Kitikmeot Heritage Society researcher Darren Keith works with board members Margaret Ohina, Jimmy Ohina, and Doris Koihok on the Inuit Places atlas using a touch screen connected to their local Nunaliit server installed in Cambridge Bay.



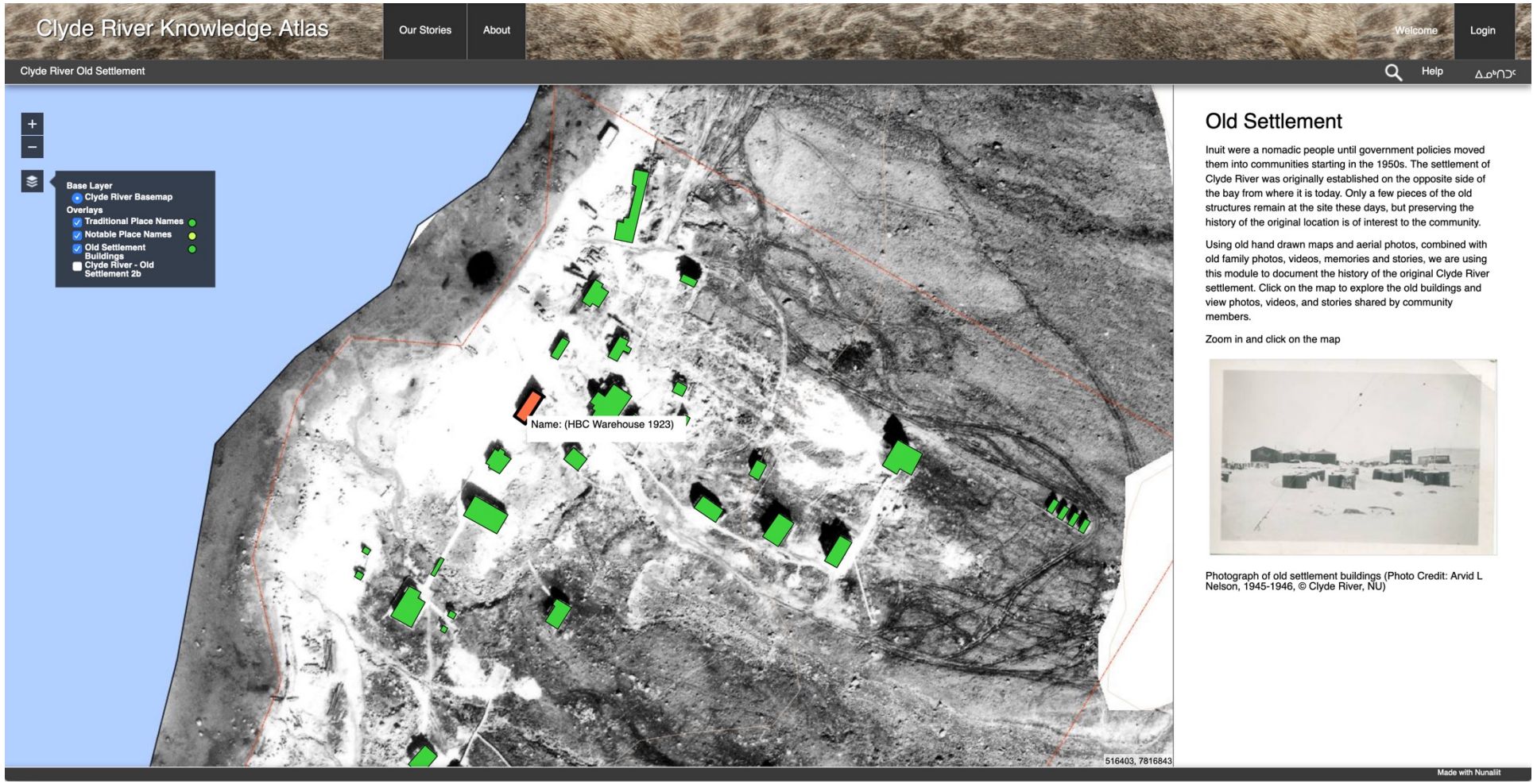
The Inuktut Lexicon Atlas has several modules designed to help document and explore Inuktut dialects. The Sculptionary (pictured) uses an Inuit carving by Nelson Takkiruq (1930-1999) of Gjoa Haven to teach words for body parts in twelve Inuit dialects.



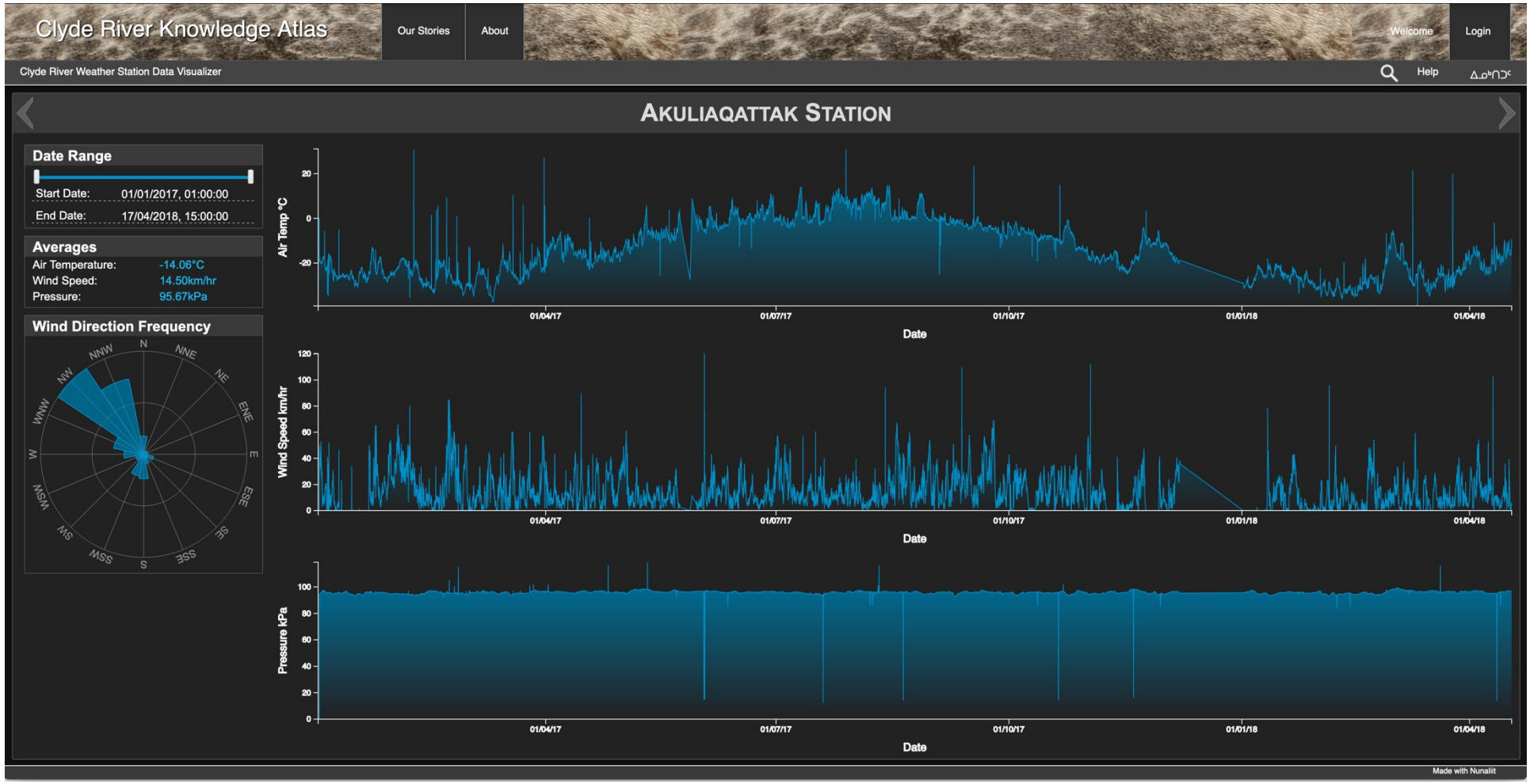
The Inuinnait Knowledge Bank is being built to house digital records retrieved from dozens of museums and cultural institutions around the world



clyderiveratlas.ca

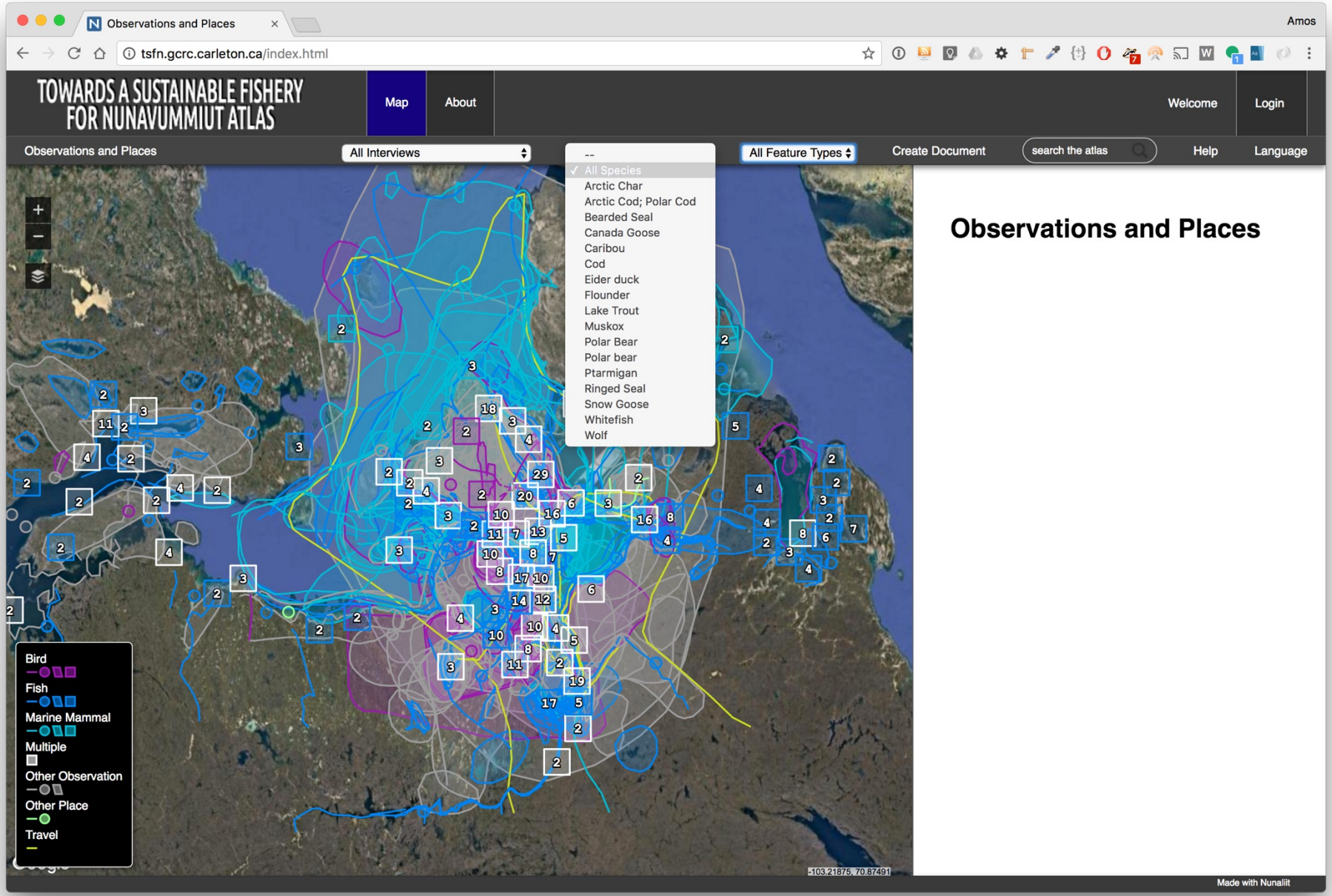


Using old hand drawn maps and aerial photos, combined with old family photos, videos, memories and stories, Ittaq are using this module to document the history of the original Clyde River settlement.



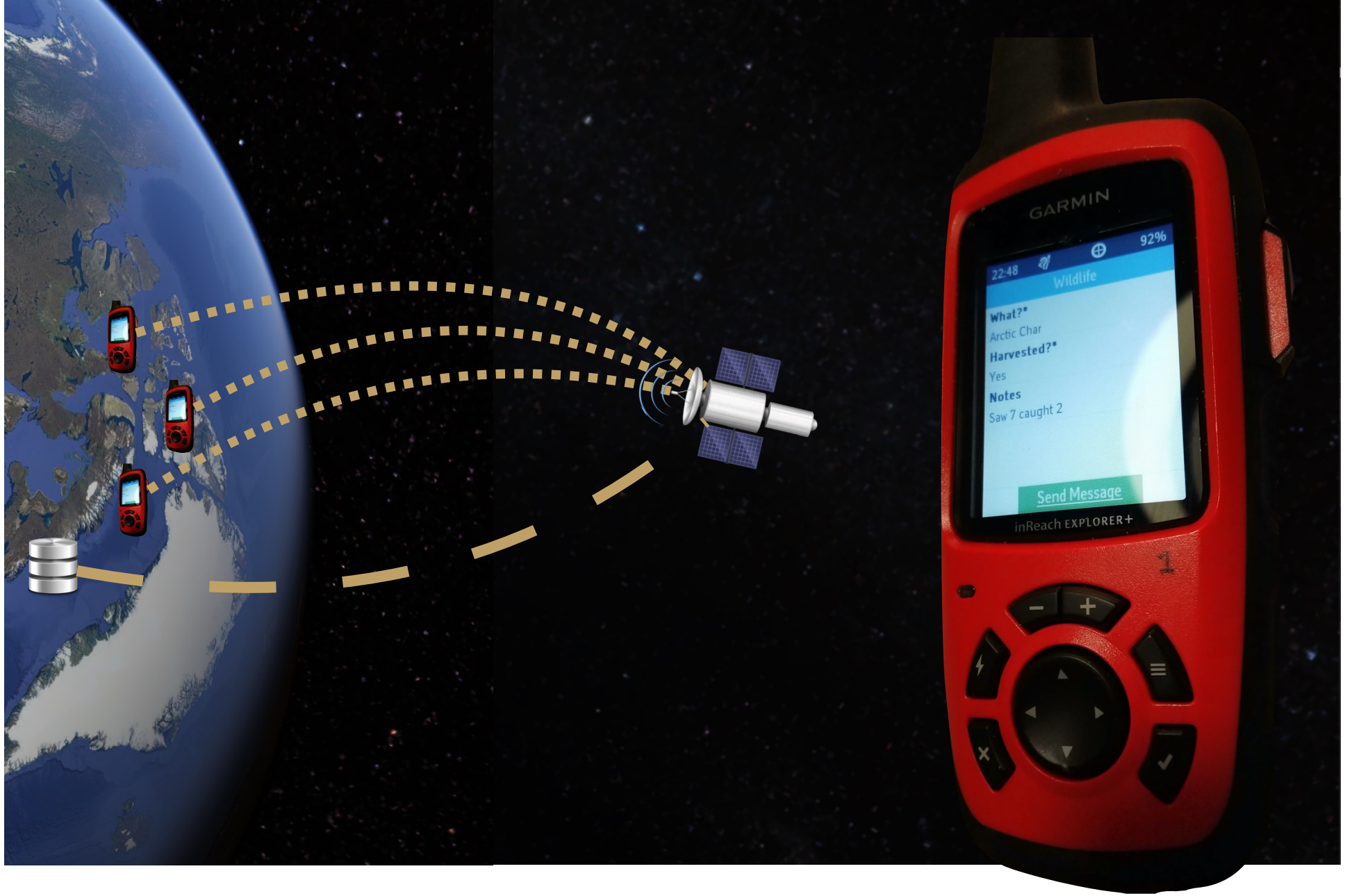
Clyde River Weather Station Data Visualizer
https://clyderiveratlas.ca/index.html?module=module.clyderiver.weatherstationdatavisualizer

Members of the Clyde River Atlas team (clockwise from left: Peter Pulsifer, Jean-Pierre Fiset, Mike Jaypoody, and Robert Kautuk) explore local knowledge about marine habitats available in the atlas thanks to support from Tides Canada and a partnership between the Ittaq Heritage and Research Centre, the Nunavut Coastal Resource Inventory team at the Government of Nunavut, ELOKA, and the Geomatics and Cartographic Research Centre at Carleton University.

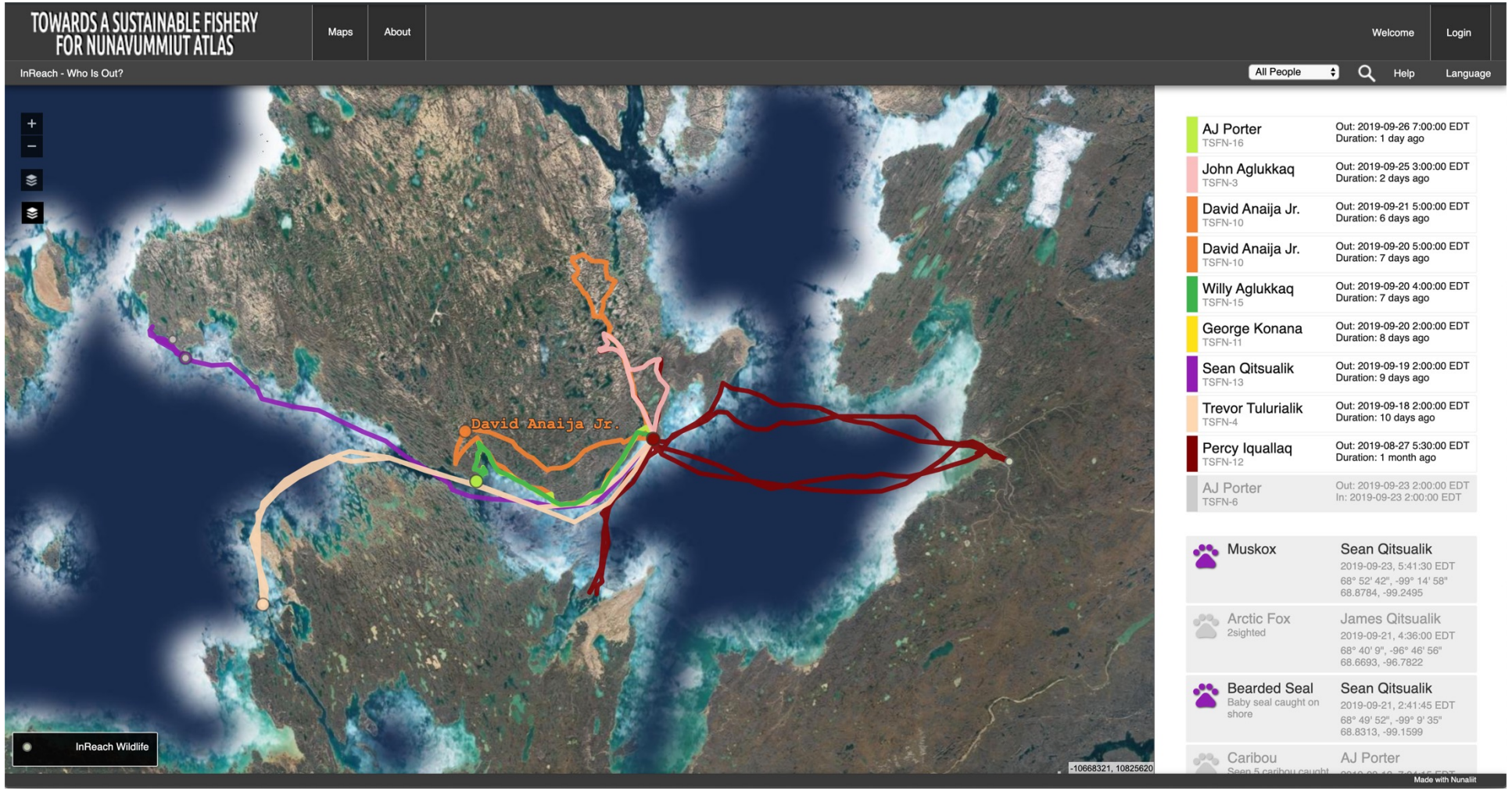


The atlas created for the "Towards a Sustainable Fishery for Nunavummiut" project uses the model developed by the Nunavut Coastal Resource Inventory to document local knowledge of species locations and behaviours as well as points of interest for hunters.

Allen Kaloon, Jordan Takkiruq, Brent Puqiqnak, and Simon Okpakok update the Gjoa Haven harvest study atlas with their observations from the land. The device sends data via the Iridium satellite network and Qiniq into the community's Nunaliit-based atlas to be stored and immediately displayed for local use. *(Photo: Stephen Wolfe, Geological Survey of Canada)*



Custom forms co-designed with hunters allow reporting of geolocated wildlife and vessel sightings, harvests, places of interest, weather conditions, equipment troubles, and safety issues in a standardized format that ends up in systems owned by Inuit organizations.

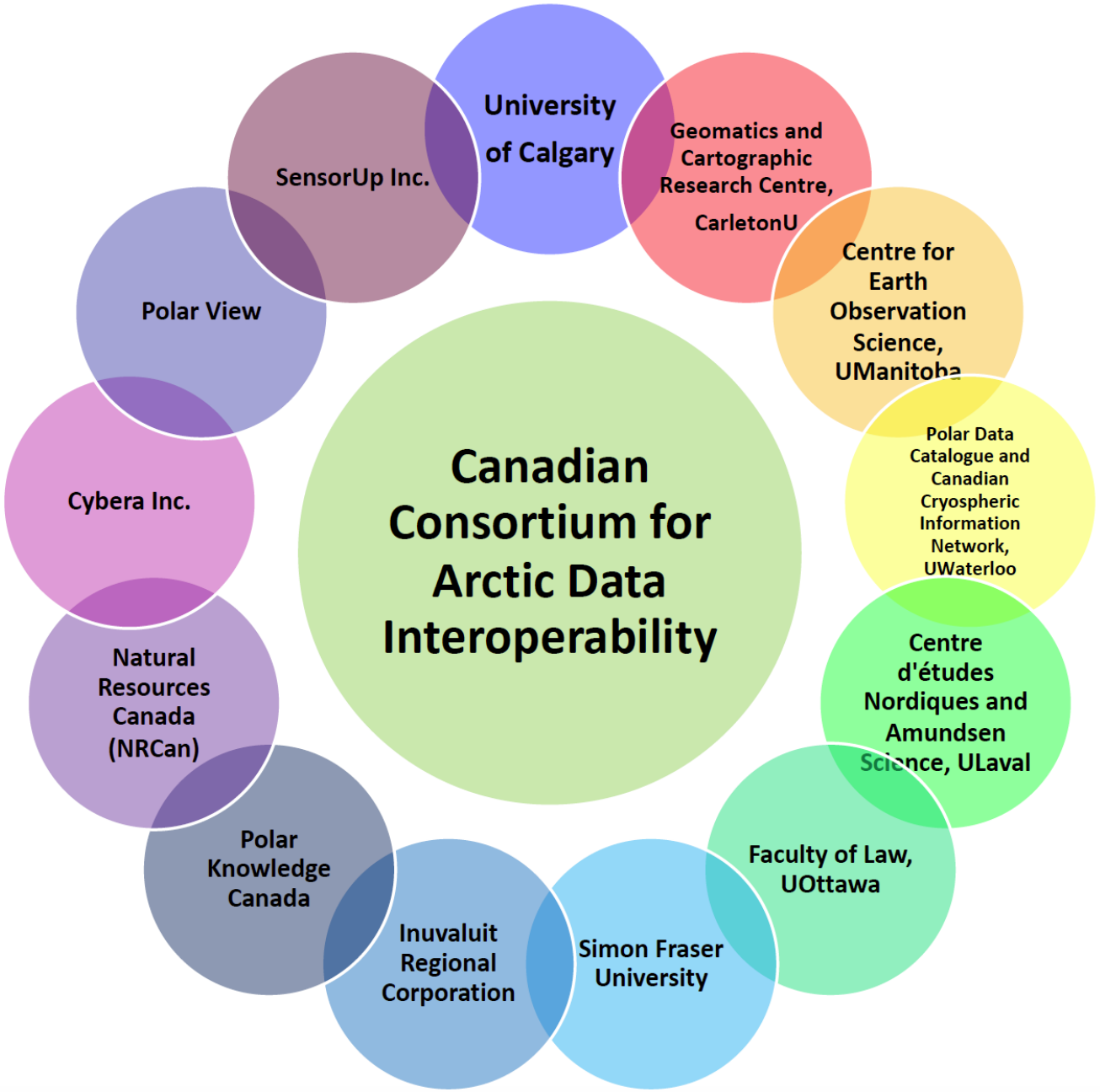


The "Who Is Out" module in the atlas provides up to the minute locations and status reports sent by hunters in the field who sign out customized devices from the association.

David Anaija Jr., Willy Aglukkaq, Joseph Gee, Amos Hayes, and Jordan Takkiruq celebrate the installation of the Nunaliit-based "Who Is Out TV" system in the Gjoa Haven Hunters and Trappers Association office. The screen provides up to the minute locations and status reports sent by hunters in the field who sign out customized devices from the association.

Theme 5: CCADI

Current Membership



Socio-technical System

CCADI

Requirements

Science Team

Management Team

Tech Team

Governance Team

Engagement Team

Broader Data Community

http://staging.arctic-data-ecosystem.apps.nsidc.org/

Content credit: POLDER

Communications

Document Management

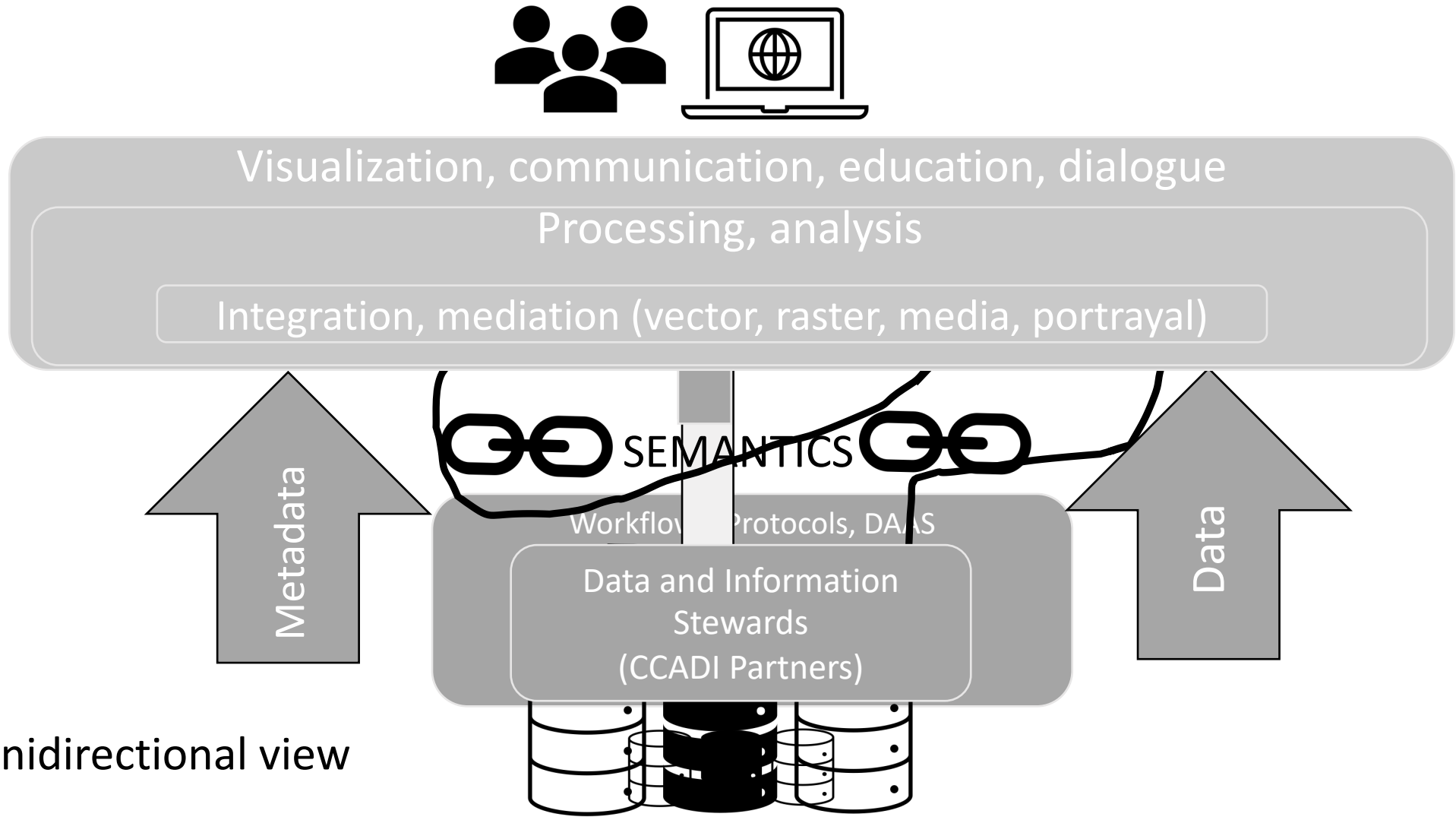
Documentation

Source control

Online Meetings

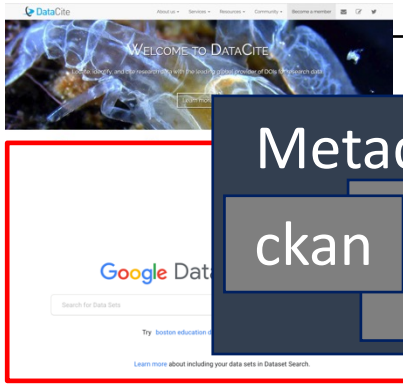
Data and Information Resources

Serving Applications through Interoperability and Mediation: data and information flows



Simplified, unidirectional view

Findable: CCADI Metadata Interoperability



Findable

Mediation & Integration

Metadata
ckan
GN

Vector

Raster

Map

Media

DOI: http, handle etc.

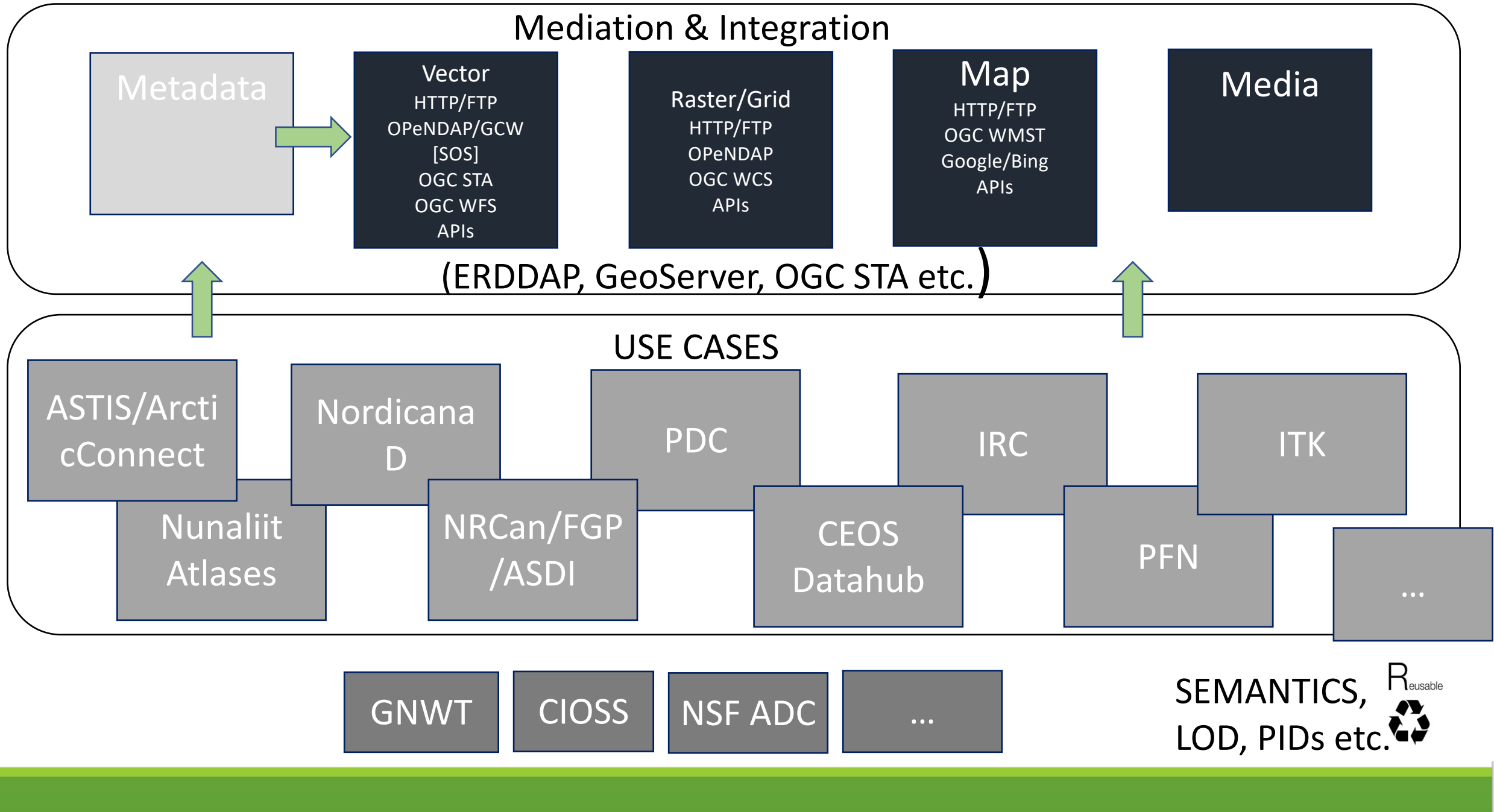
Schema.org JSON-LD

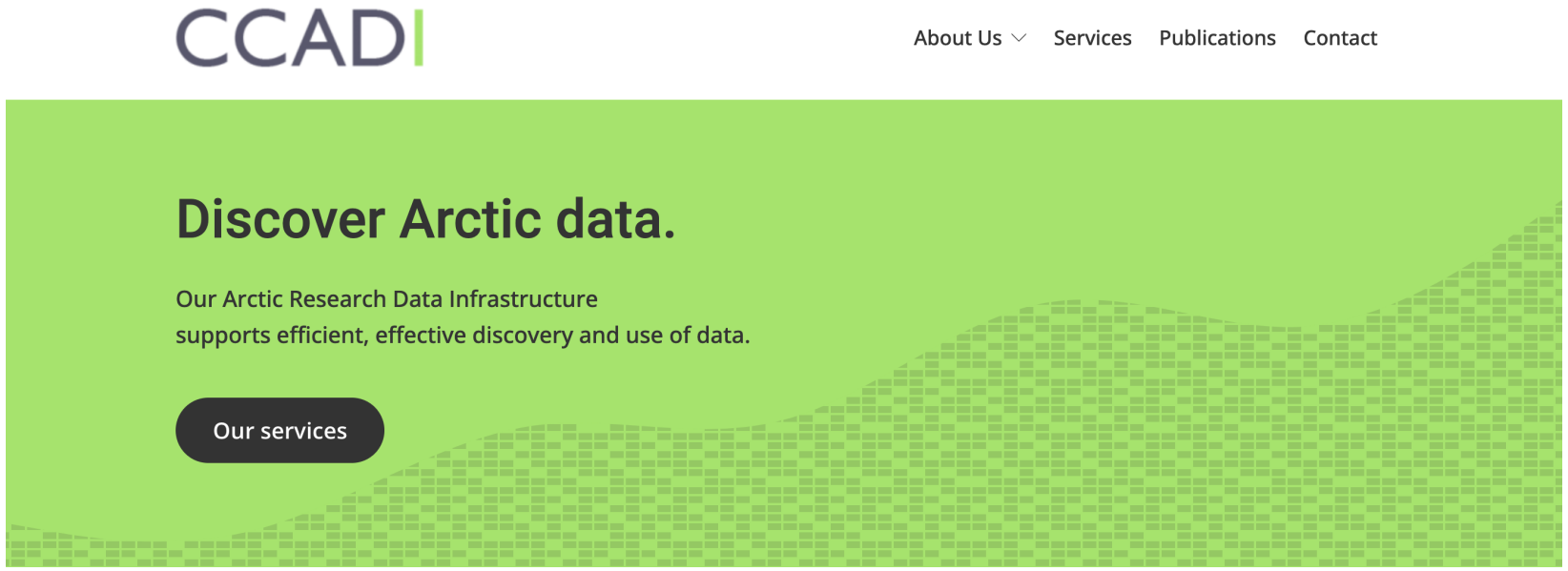
XML ISO19139

Profiles/schemas: under active development

OGC CSW	OGC CSW	OGC CSW	OGC CSW	OGC CSW
schema.org	schema.org	schema.org	schema.org	schema.org
DOI	[roadmap]	DOI	DOI	DOI
ASTIS/ArctiConnect	Nunaliit Atlases	Nordicana D	PDC	CEOS Datahub

NRCan/FGP/ASDI | IRC | PFN | GNWT | CIOOS | NSF ADC | …


Mediation & Integration
Metadata
Vector
HTTP/FTP
OPeNDAP/GCW
[SOS]
OGC STA
OGC WFS
APIs
Raster/Grid
HTTP/FTP
OPeNDAP
OGC WCS
APIs
Map
HTTP/FTP
OGC WMST
Google/Bing
APIs
Media
(ERDDAP, GeoServer, OGC STA etc.)
USE CASES
ASTIS/Arcti cConnect
Nordicana D
PDC
IRC
ITK
Nunaliit Atlases
NRCan/FGP /ASDI
CEOS Datahub
PFN
...
GNWT
CIOSS
NSF ADC
...
SEMANTICS, LOD, PIDs etc.
Reusable



Welcome

https://ccadi.org/