CCADI

The Canadian Consortium for Arctic Data Interoperability

Presentation to RDA GORC WG, August 25th, 2022

Peter Pulsifer, CCADI Technical Lead, Associate Professor, GCRC/DGES, Carleton University

with Contributions from
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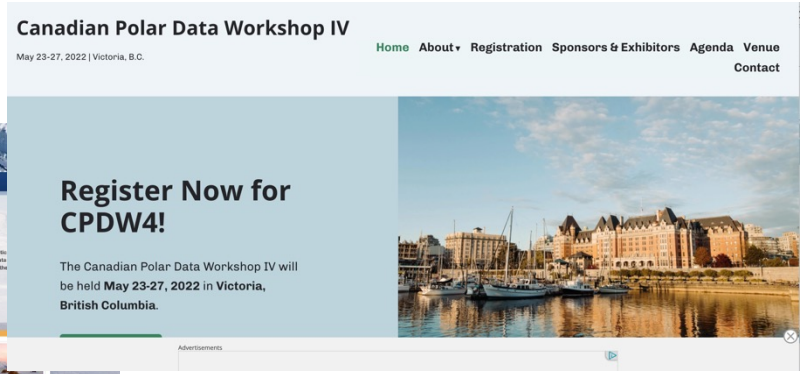
Project Manager, CCADI, and Manager, Data and Information Services, Arctic Institute of North America

CCADI History

Canadian Polar Data Community



Canadian Polar Data Workshop Reports

CPDW3 was held in Banff, February 2020.

The final report of the Third Canadian Polar Data Workshop is due for release in January 2022.

CPDW2 was held in Ottawa, May 2017.

CCADI/CCIN/PDC (2018) Final Report of the 2nd Canadian Polar Data Workshop: A Roadmap to the Future of Polar Data Management in Canada.

CPDW1 was held in Ottawa, May 2015.

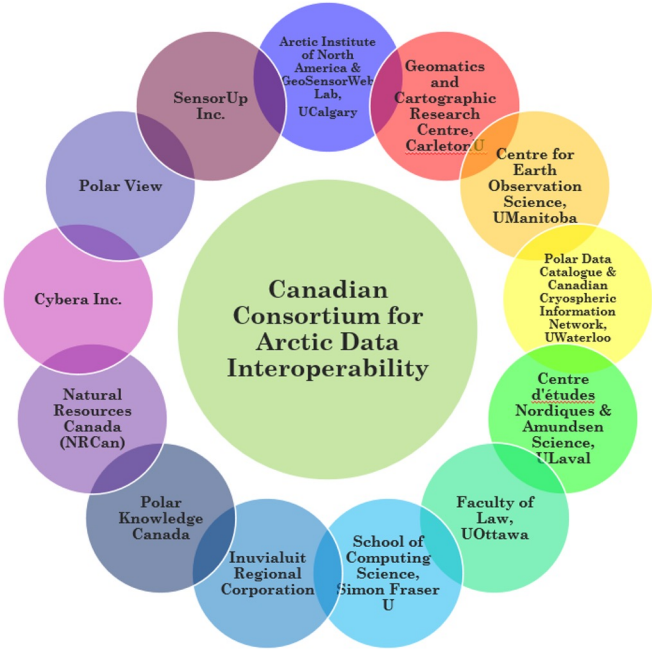
CCIN/PDC (2016) Final Report of the First Canadian Polar Data Workshop: Canadian and international polar/Arctic research data management – Context and avenues to enhance collaboration. (For the full report with appendices click here)

CCADI

CCADI

Founded in 2015, The **Canadian Consortium for Arctic Data Interoperability (CCADI)** is an initiative to develop an integrated Canadian arctic data management system that will facilitate information discovery, establish sharing standards, enable interoperability among existing data infrastructures, and that will be co-designed with, and accessible to, a broad user base.

Priority on the Canadian “long tail” community



CCADI

Members

- Carleton University (Geomatics and Cartographic Research Centre)
- Inuvialuit Regional Corporation
- Simon Fraser University (School of Computer Sciences)
- **University of Calgary (Arctic Institute of North America & GeoSensor Web Lab)**
- Université Laval (Centre d'études nordiques)
- University of Manitoba (Centre for Earth Observation Science)
- University of Ottawa (Faculty of Law)
- University of Waterloo (Canadian Cryospheric Information Network and Polar Data Catalogue)

Partners

- Cybera
- Inuit Tapiriit Kanatami
- Natural Resources Canada
- PermafrostNet
- Polar Knowledge Canada
- Polar View
- Sensor-Up Inc.

CCADI

CCADI has received funding from the Canadian Foundation for Innovation (CFI) to develop an Arctic Research Data Infrastructure (ARDI) that will facilitate data discovery and description, enabling data to be shared across systems for upload, analysis, and visualization.

The ARDI will support:

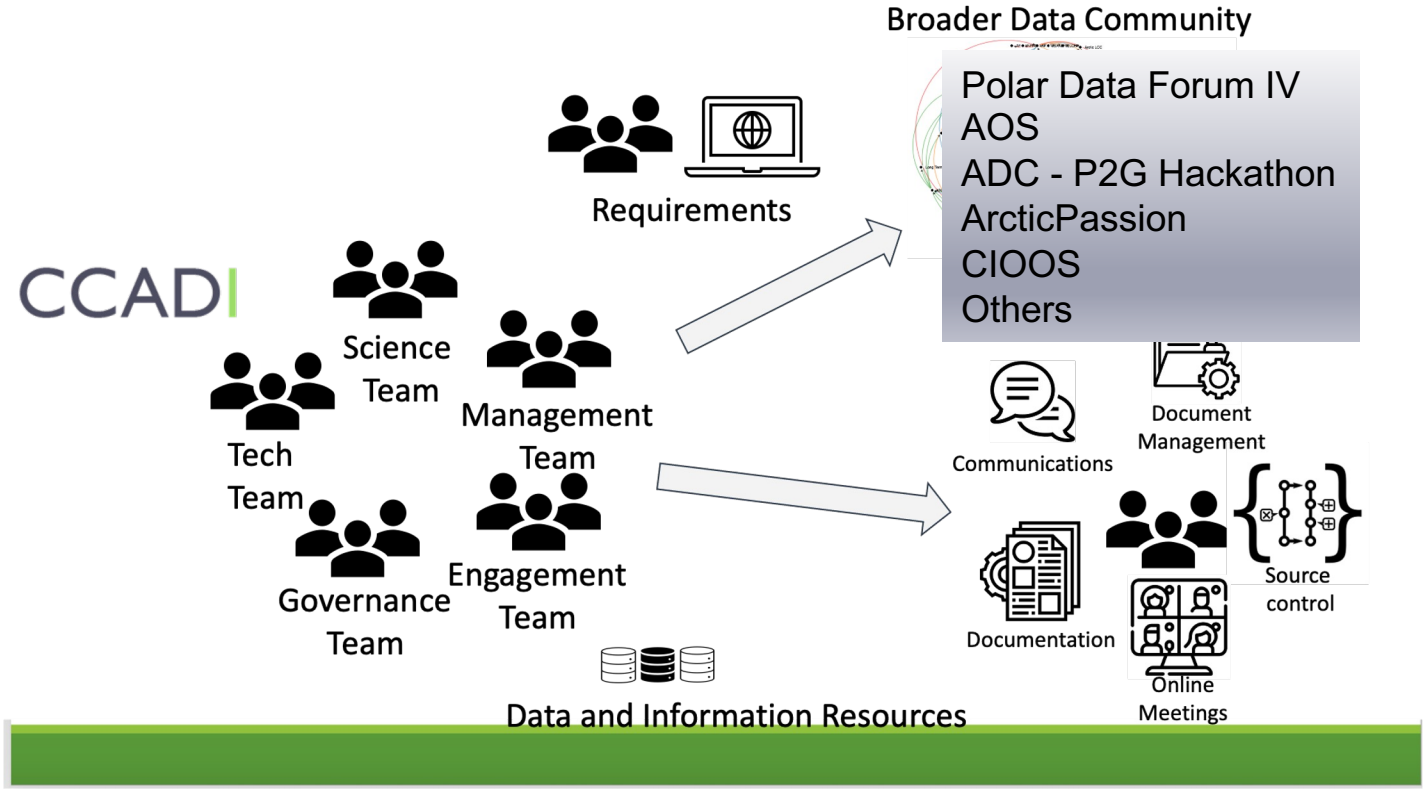
Efficient, Effective Data Usage

Operational Activities

Inuit Self-Determination

Policy Development

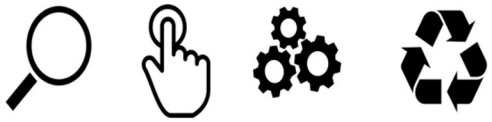
CCADI : human interoperability



CCADI Principles, Standards and Approaches

CCADI Principles, Standards and Approaches

Findable Accessible Interoperable Reusable



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

OCAP | PCAP
OWNERSHIP CONTROL ACCESS AND POSSESSION
PROPRIÉTÉ CONTRÔLE ACCÈS ET POSSESSION
FNIGC.CA

https://fnigc.ca/ocap

National Inuit Strategy on Research

https://www.itk.ca/wp-content/uploads/2018/03/National-Inuit-Strategy-on-Research.pdf

Manifesto for Agile Software Development

http://agilemanifesto.org/

CARE Principles for Indigenous Data Governance

https://www.gida-global.org/care

Information Ecology

Human Centred Design

Use-Case Driven

Global

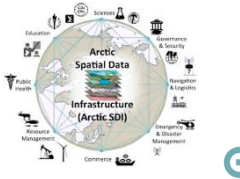
Local

OGC® Making location count.

netCDF

ISO

W3C®



GCW Global Cryosphere Watch

OPeNDAP

GEO GROUP ON EARTH OBSERVATIONS

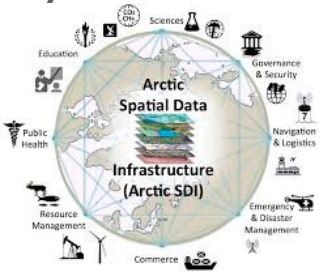
ARCTICDATACOMMITTEE IASC SAON

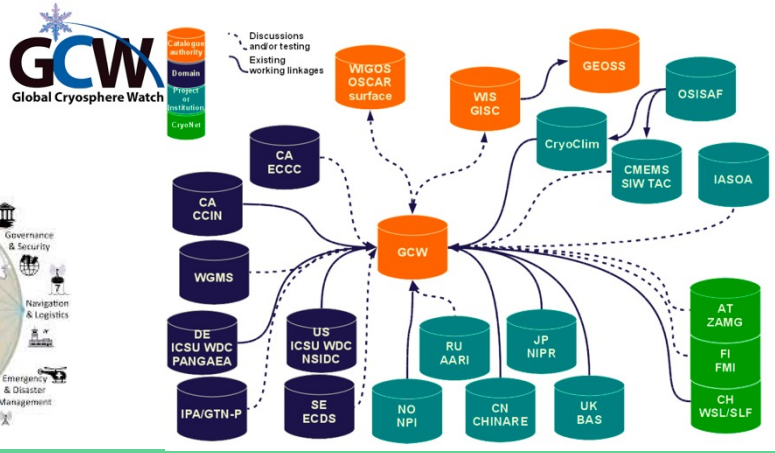
Data Interoperability

- “Live” data sharing between and among systems
- Standards and specifications
  - Discovery standards
  - Data standards
  - Semantic standards

- “Services” (**Data as a Service**) use standards to make the data widely available “**on demand**”

OAI-PMH





Indigenous Knowledge and Information Systems

- A growing group actively working to share Indigenous Knowledge, information and data + use other DIK
- Progress needed on bridging worldviews, concepts and semantics represented in information systems
- Indigenous Peoples must lead engagement and work with their knowledge – information governance important

http://www.arcticcbm.org/index.html

http://ittaq.ca/

http://www.inuitcircumpolar.com/community-based-monitoring.html

ELOKA

http://eloka-arctic.org/

SMARTICE

https://www.smartice.org/

SIKU

https://arcticeider.com/siku

OCAP | PCAP

https://fnigc.ca/ocap

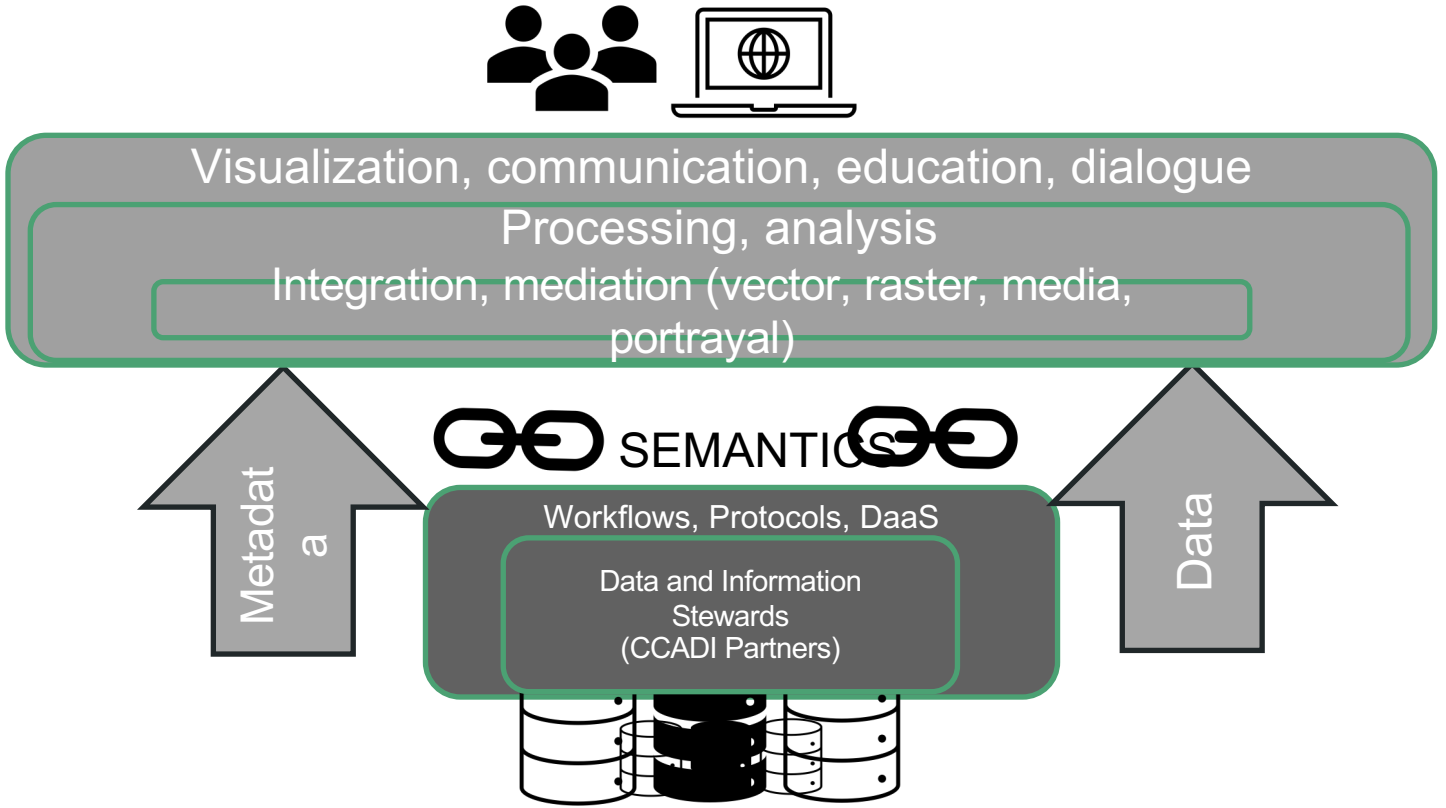
CARE Principles for Indigenous Data Governance

https://www.gida-global.org/care

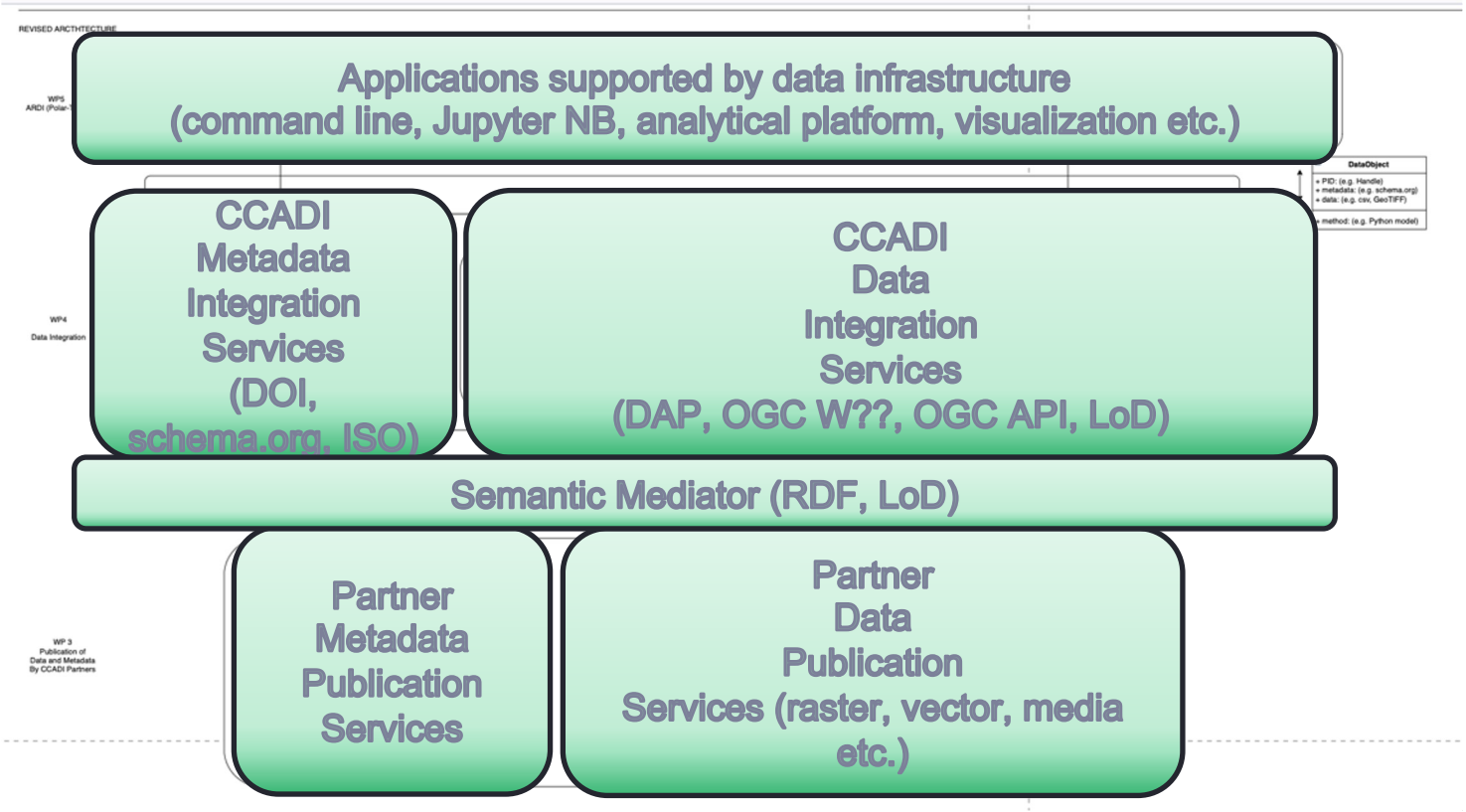
GIDA
Global Indigenous Data Alliance

CCADI Architecture

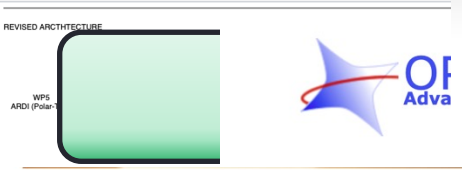
Serving Applications through Interoperability and Mediation: data and information flows

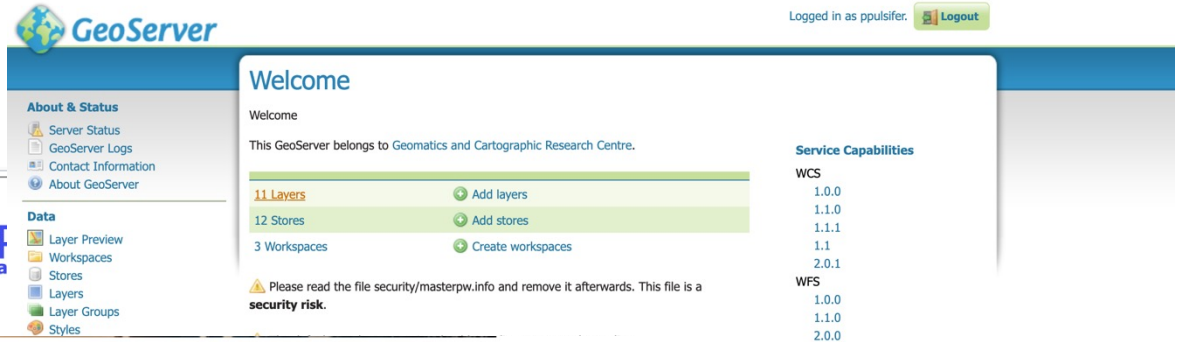


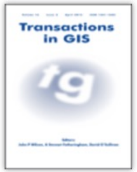
CCADI Architecture



CCADI Tools







Volume 16, Issue 2
April 2012
Pages 249-265

Full Access

A Comparison between WCS and OPeNDAP for Making Model Results and Data Products Available through the Internet

Fedor Baart, Gerben de Boer, Wim de Haas, Gennadii Donchyts, Marc Philippart, Mark van Koningsveld, Maarten Plieger,

First published: 13 April 2012 | https://doi.org/10.1111/j.1467-9671.2012.01312.x | Citations: 1

SECTIONS PDF TOOLS SHARE

Figures References Related Information

Recommended

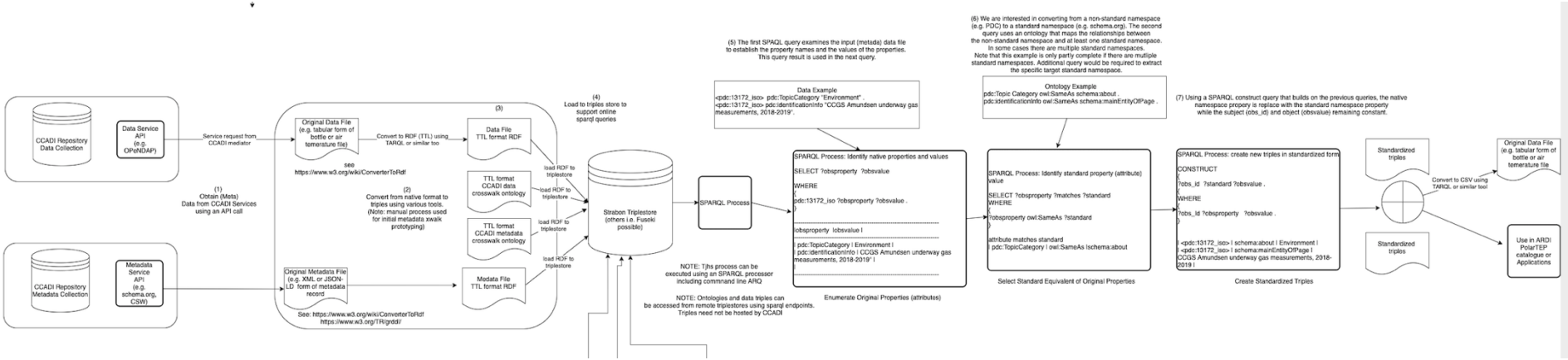
Interoperable and network-aware service ...
Pradeeban Kathiravelu, Peter Van Roy, ...
Concurrency and Computation: Practice and Experience

Data analytics for internet of ...
Chun-Wei Tsai, Pang-Wei Tsai, ...
WIREs Data Mining and Knowledge Discovery

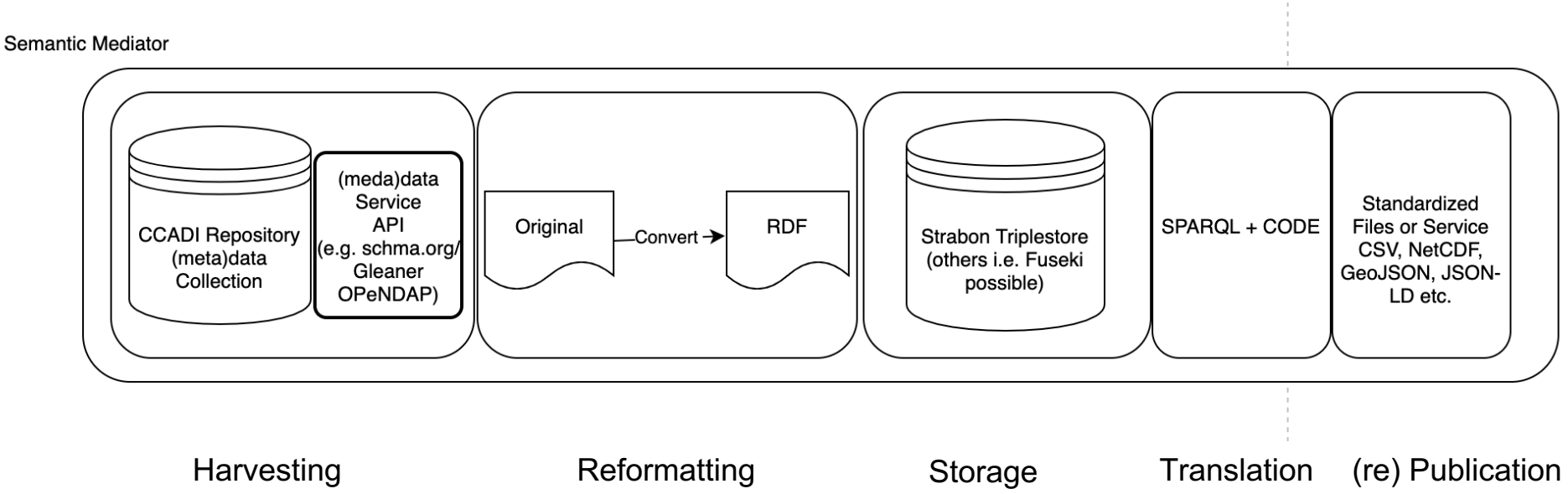
Abstract

Numerical models produce output with a large number of variables, grid cells and time steps. The same applies to algorithms that produce gridded datasets from sparse or abundant raw data. Further use of the resulting data products has been challenging, especially for dissemination outside the institute of origin. Due to the gradually increasing size of data products, simply downloading copies of them is becoming

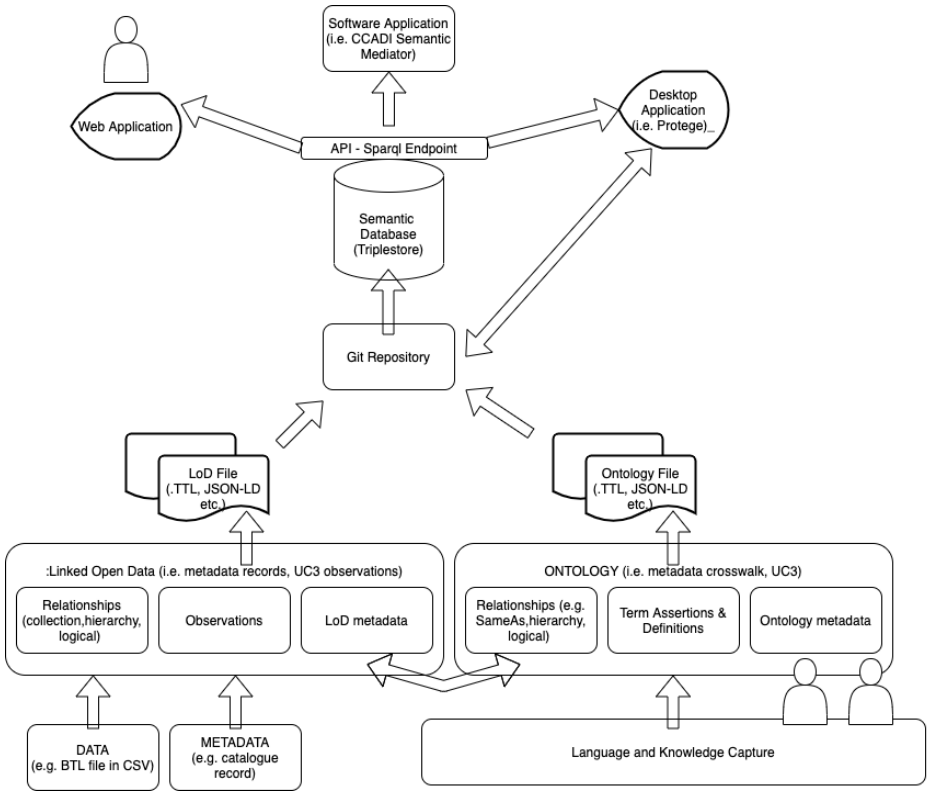
Semantic Mediator (Detailed View)



Semantic Mediator (Generalized View)



Semantics Workflows



Semantics

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        amds:amds:latitude_degrees_north "50.340668";
        amds:longitude_degrees_east "-58.5175";
        amds:Pres_Z "191.665";
        amds:CTDTmp90       "5.1463";
        amds:P_sal_CTD      "34.0867";
        amds:CTD_Sound_Vel  "1473.3";
        amds:Sigma_T       "26.9343".

<3> amds:filename       "GreenedgeFile2";

<4>

<5>

        amds:CTD_Sound_Vel "1473.29";
        amds:Sigma_T "26.9337".
```

Data Represented as Linked Open Data

```
@prefix :  <http://localhost/default#> .
@prefix amundsen:  <http://localhost/amundsen#> .
@prefix bodc:  <http://localhost/bodc#> .
@prefix CF:  <http://localhost/CF#> .
@prefix owl:  <http://www.w3.org/2002/07/owl#> .
@prefix xsd:  <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs:  <http://www.w3.org/2000/01/rdf-schema#> .
@prefix daml:  <http://www.daml.org/2001/03/daml+oil#> .
@prefix BODC:  <http://localhost/BODC#> .
@prefix ex:  <http:
@prefix rdf:  <ht
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@prefix RDFS:
@prefix SKOS:
@prefix sdn:  <
@prefix SDN:  <

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        ex:obje                                                    nt/PE001223" .

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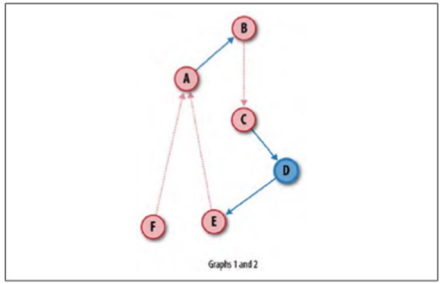
Ontologies for Semantic Mediation



CCADI Use Cases and Products

CCADI

Currently, the ARDI supports three use cases centred on:

1. Vulnerability Assessment of Coastal Archaeological Sites in the Western Canadian Arctic
2. MOD-AAT (Merged Observatory Data for Arctic Air Temperature): mobilizing records of air temperature from station operators in the circumpolar Arctic
3. Ocean Acidification in the Surface Layer - South Beaufort Sea

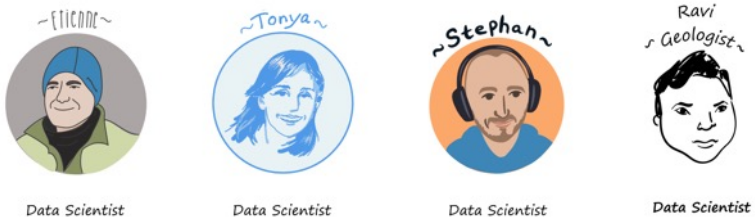
Additional use cases in development through CFI funding include…
Sea ice chart distribution
Ground-air temperature modeling
Community-based atlases

CCADI

SERVICE PRODUCTS:

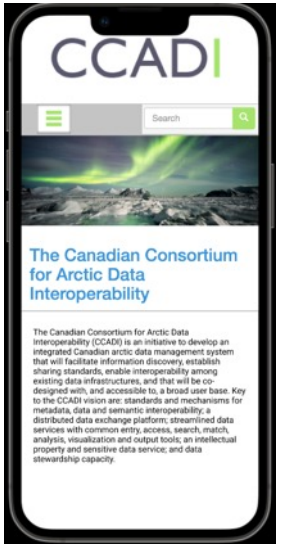
- Institutional CCADI Metadata API(s)
- PDC/CCADI Federated Metadata Catalogue APIs
- CCADI Semantic Mediator APIs
- CCADI Data Service Endpoints
- CCADI WP5 “platform” service endpoints

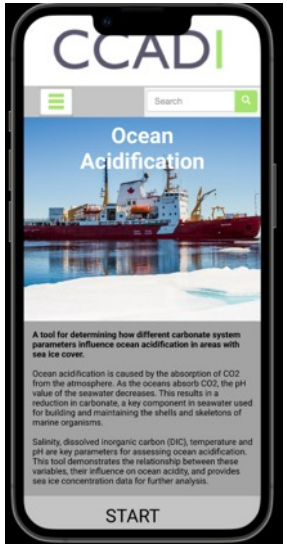
CCADI



APPLICATION PRODUCTS:

- Coastal Erosion Application
- CCADI Client-side Map Visualization App
- CCADI Ocean Acidification Web Application
- MODAAT/CCADI Application
- PDC/CCADI Federated Metadata Catalogue
- CCADI Data Buffet



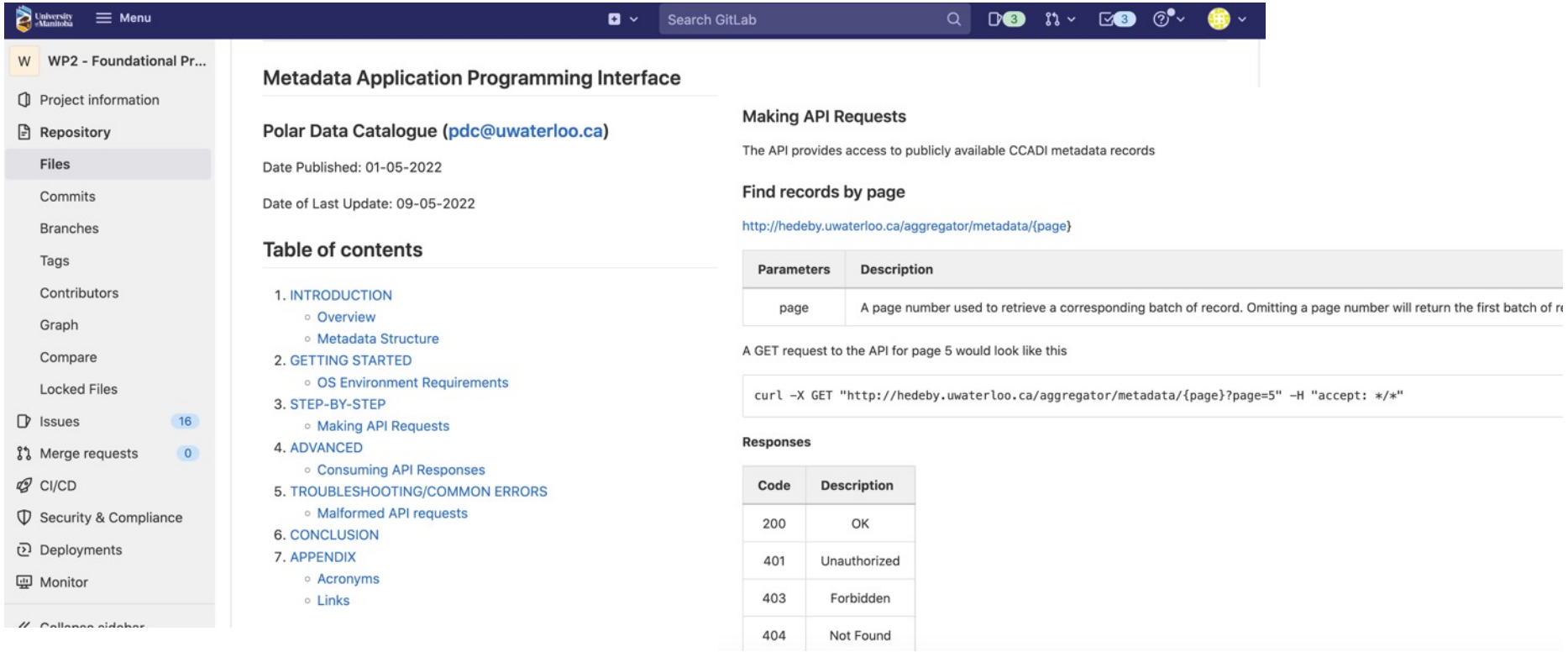


CCADI

DOCUMENTATION PRODUCTS:

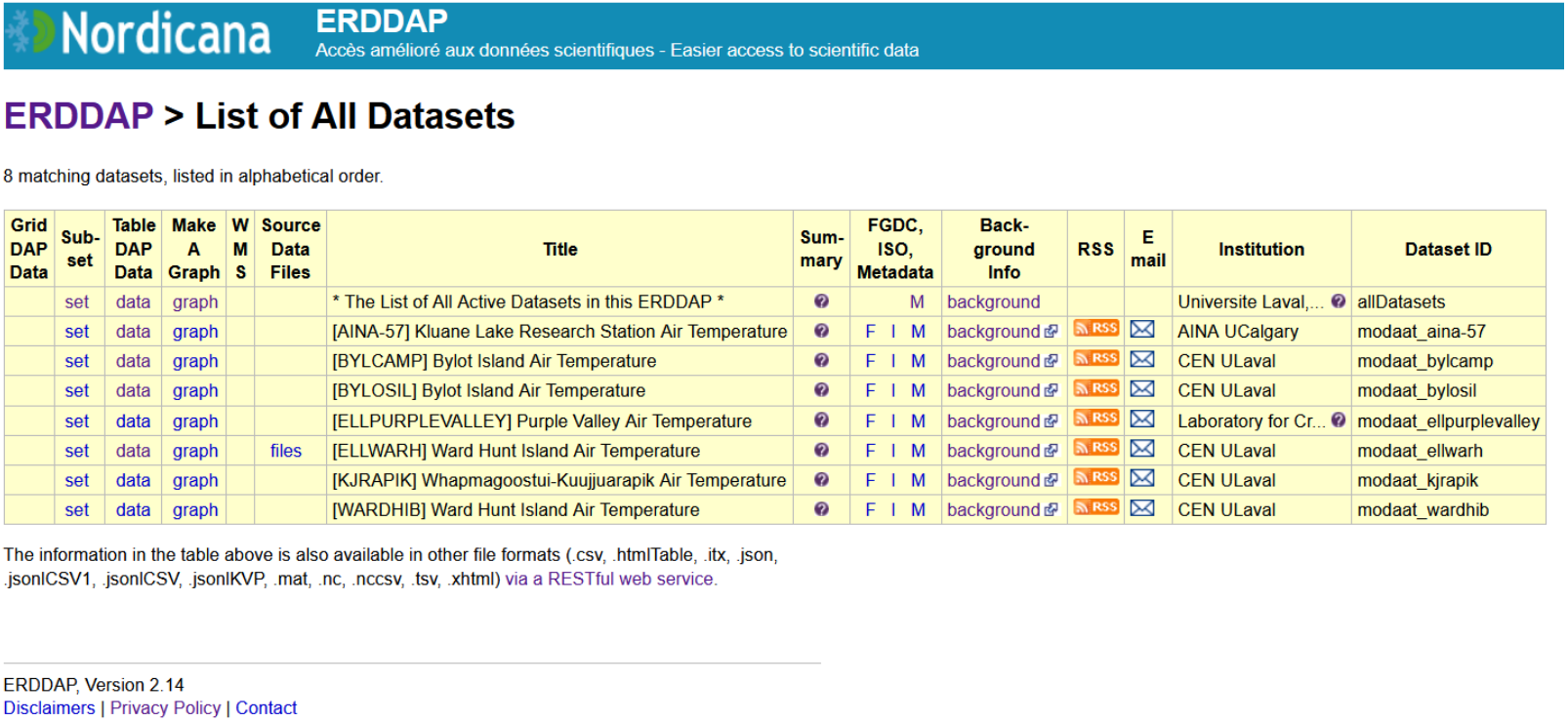
- CCADI MOD-AAT Command Line Cookbook
- CCADI Ocean Acidification Command Line Cookbook
- CCADI Ocean Acidification Jupyter Notebook
- General documentation for Service and Application Products

Metadata Aggregator: Metadata Integration Service



Content Author: Greg Vey

Use Case 2: MODAAT Data Publication Service



Nordicana ERDDAP
Accès amélioré aux données scientifiques - Easier access to scientific data

ERDDAP > List of All Datasets

8 matching datasets, listed in alphabetical order.

Grid DAP Data	Sub-set	Table DAP Data	Make A Graph	WMS	Source Data Files	Title	Sum-mary	FGDC, ISO, Metadata	Back-ground Info	RSS	E mail	Institution	Dataset ID
	set	data	graph			* The List of All Active Datasets in this ERDDAP *		M	background			Universite Laval,...	allDatasets
	set	data	graph			[AINA-57] Kluane Lake Research Station Air Temperature		F I M	background	RSS		AINA UCalgary	modaat_aina-57
	set	data	graph			[BYLCAMP] Bylot Island Air Temperature		F I M	background	RSS		CEN ULaval	modaat_bylcamp
	set	data	graph			[BYLOSIL] Bylot Island Air Temperature		F I M	background	RSS		CEN ULaval	modaat_bylosil
	set	data	graph			[ELLPURPLEVALLEY] Purple Valley Air Temperature		F I M	background	RSS		Laboratory for Cr...	modaat_ellpurplevalley
	set	data	graph		files	[ELLWARH] Ward Hunt Island Air Temperature		F I M	background	RSS		CEN ULaval	modaat_ellwarh
	set	data	graph			[KJRAPIK] Whapmagoostui-Kuujjuarapik Air Temperature		F I M	background	RSS		CEN ULaval	modaat_kjrapik
	set	data	graph			[WARDHIB] Ward Hunt Island Air Temperature		F I M	background	RSS		CEN ULaval	modaat_wardhib

The information in the table above is also available in other file formats (.csv, .htmlTable, .itx, .json, .jsonlCSV1, .jsonlCSV, .jsonlKVP, .mat, .nc, .nccsv, .tsv, .xhtml) via a RESTful web service.

ERDDAP, Version 2.14
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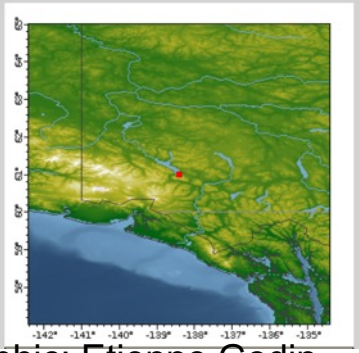
Graphic: Etienne Godin

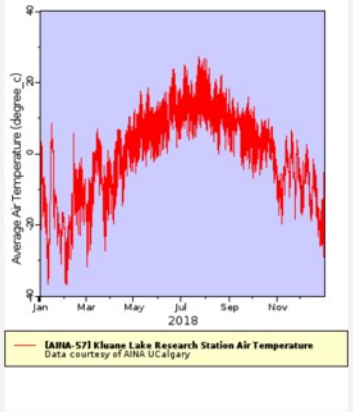
https://sig-gis.cen.ulaval.ca/erddap/index.html

Use Case 2: MODAAT Application

Graphic: Etienne Godin

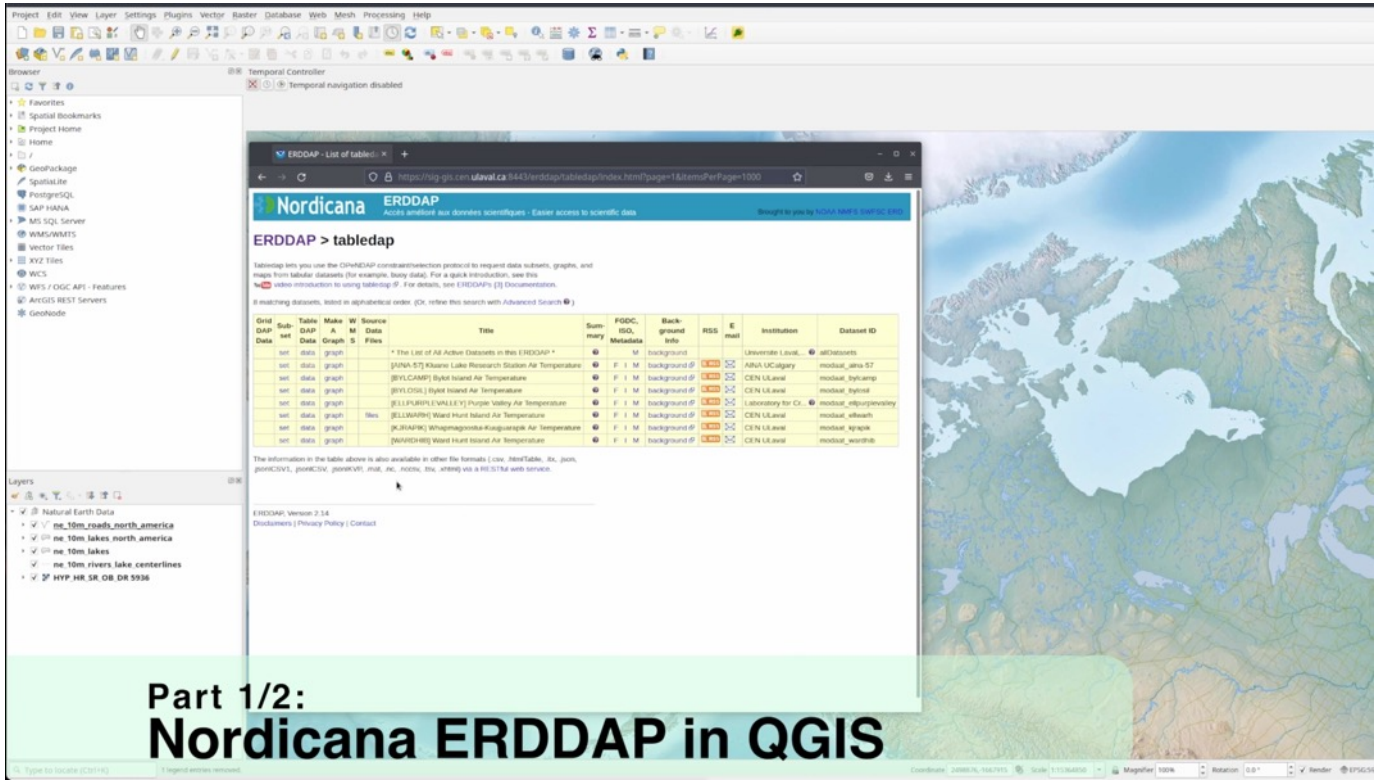
https://sig-gis.cen.ulaval.ca/modaat/

Title:	AINA-57
Description:	Kluane Lake
Dataset ID:	modaat_aina-57
DOI:	10.5885/modaat/aina-57
Available time coverage:	From 2017-11-07T19:30:00Z to 2019-04-20T19:00:00Z
Maintainer name:	University of Calgary, Arctic Institute of North America
Maintainer email:	klrs@ucalgary.ca
Summary:	KLRS was established in 1961. It is managed by the Arctic Institute of North America at the University of Calgary. KLRS suports research in the physical, biological and social sciences. KLRS provides infrastructure for a variety of research and monitoring services on a year round basis to the Canadian and International communites.
Keywords:	america, arctic, calgary, code, data, identifier, institute, kluane, lake, latitude, longitude, measured, measuredData, network, networkId, north, quality, qualityCode, research, station, stationCode, sub, subStationCode, time, university
Coordinates:	61.02759208 degrees_north, -138.4104501 degrees_east, 793.0 m up
Regional Map for AINA-57:	

2018 temperature record for AINA-57:	
Field view of AINA-57:	
Conventions:	COARDS, CF-1.6, ACDD-1.3
Standard name vocabulary:	CF Standard Name Table v55
License:	https://www.ucalgary.ca/legal-services/university-policies-procedures/acceptable-use-electronic-resources-and-information-policy
Download AINA-57:	• 10 day sample data from 2018-01-01 to 2018-10-01. Format is csv. • 1 full year: from 2018-01-01 to 2018-12-31. Format is csv. • The whole dataset. Format is csv. • Custom downloads (time interval, variable, file format).

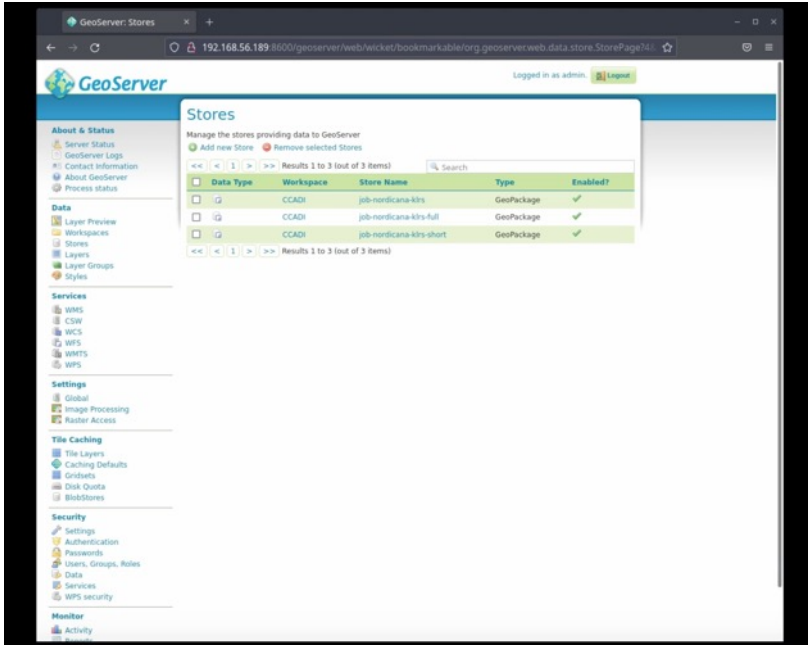
Graphic: Etienne Godin

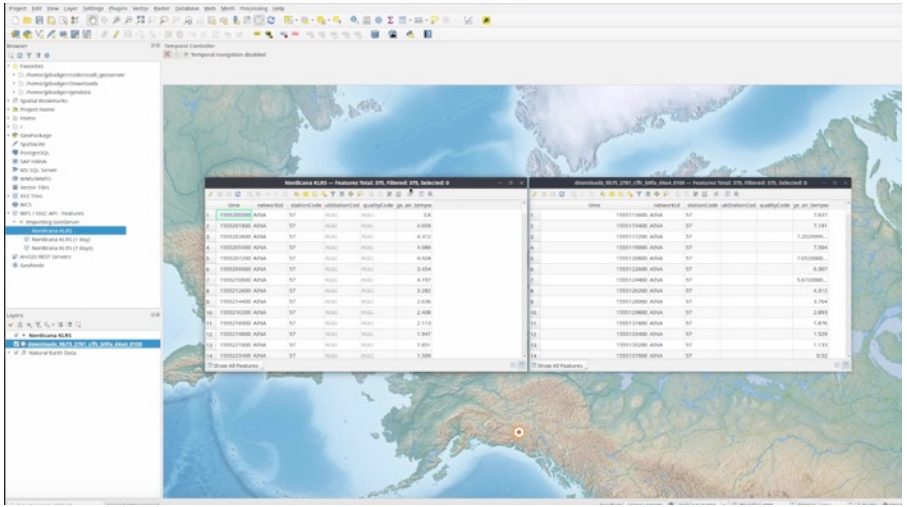
Using Data Services



Graphic: James Badger

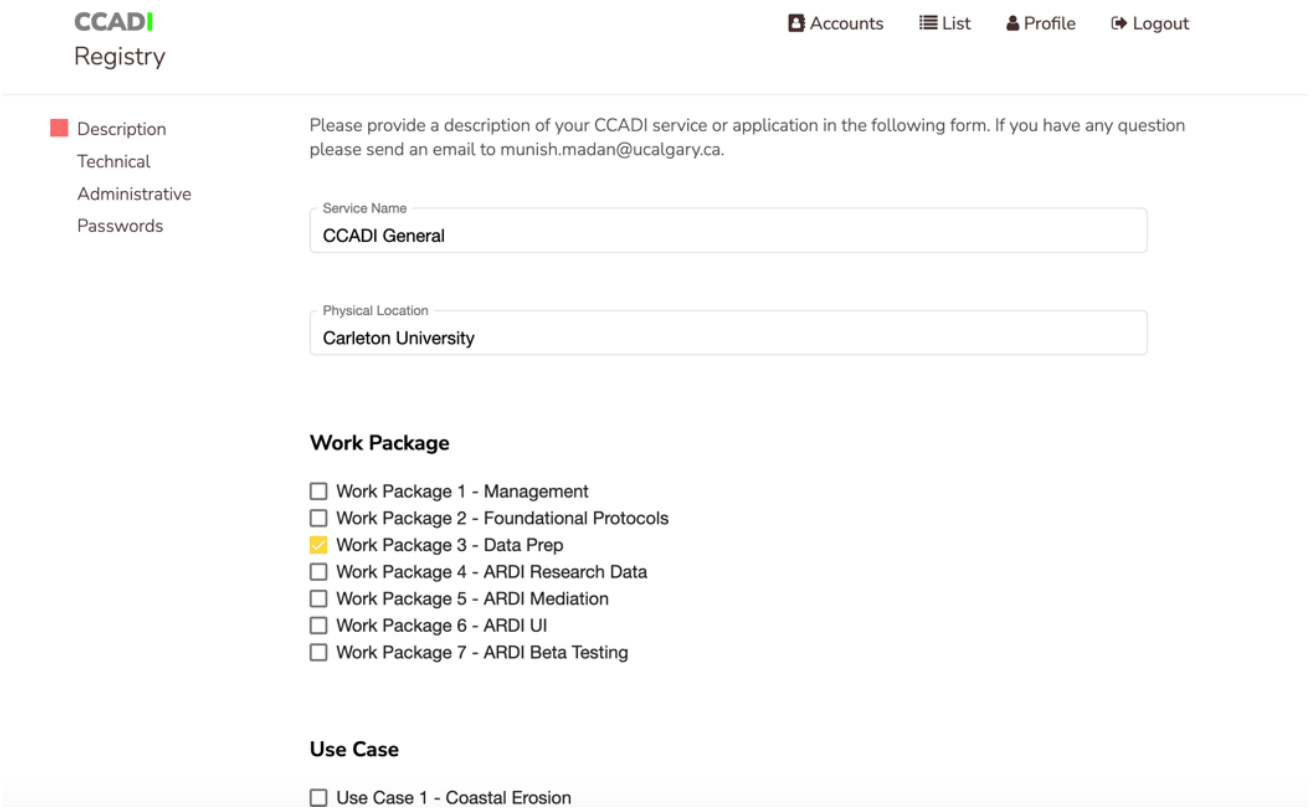
Cascading Services





Graphic: James Badger

Meta Services: CCADI Registry

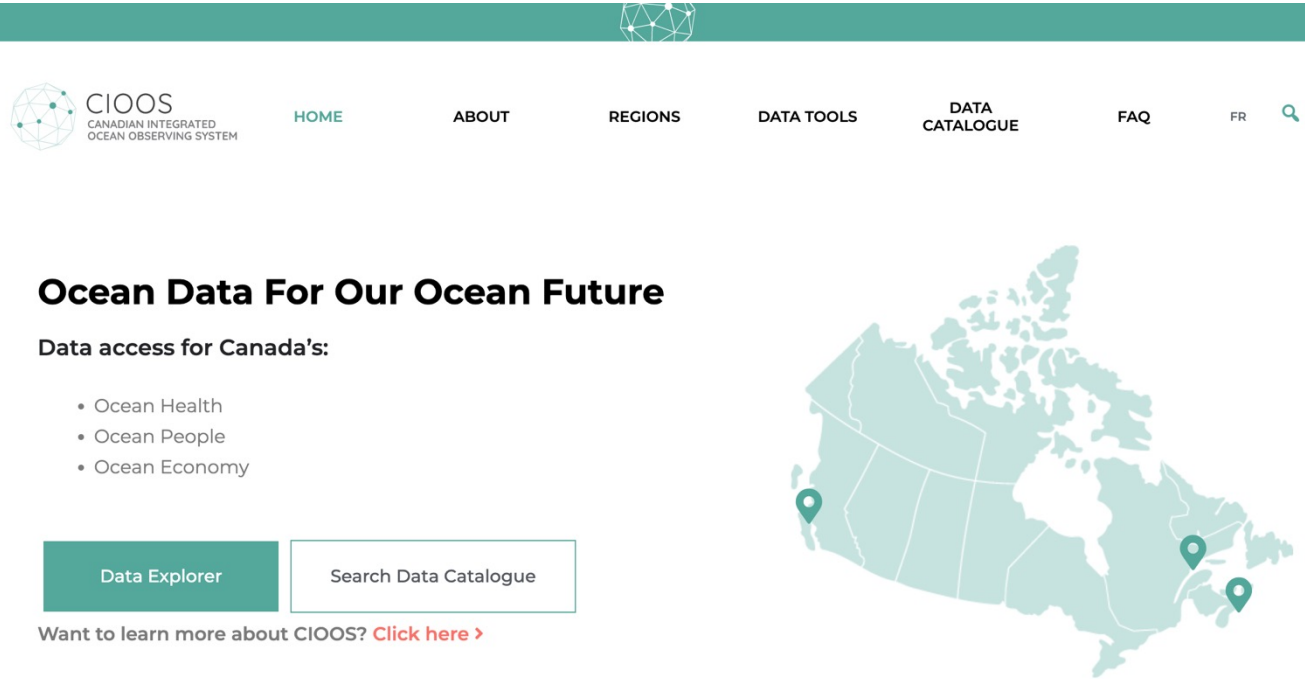


Development by Munish Madin

CCADI Partnerships

Thawing permafrost increases risk for ecosystems and people. Permafrost underlies more than a third of Canada and a warming world will drastically change the environment. Thawing permafrost directly impacts

CIOOS


CIOOS
CANADIAN INTEGRATED OCEAN OBSERVING SYSTEM
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REGIONS
DATA TOOLS
DATA CATALOGUE
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Ocean Data For Our Ocean Future
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Polar Knowledge Canada

Polar Knowledge Canada (POLAR) is responsible for advancing Canada's knowledge of the Arctic, strengthening Canadian leadership in polar science and technology, and promoting the development and distribution of knowledge of other circumpolar regions, including Antarctica. POLAR operates the Canadian High Arctic Research Station (CHARS) campus and conducts world-class cutting edge Arctic research out of this extraordinary facility.

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ABOUT

About the Arctic Research Foundation

tic Research Foundation (ARF) is a private, non-profit organization creating a new kind of entific infrastructure for the Canadian Arctic, through our operation of efficient, cutting-edge earch vessels and self-powered mobile labs.

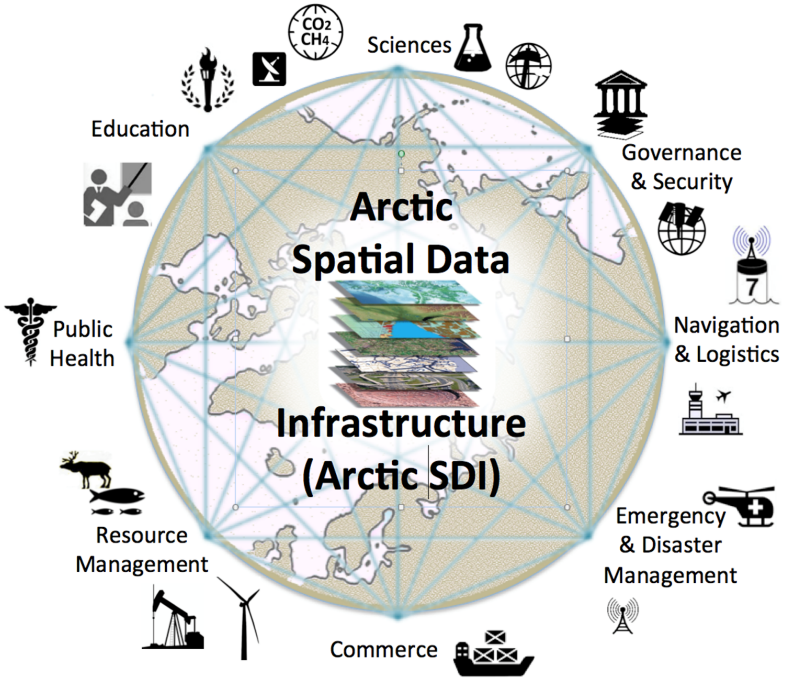
coordinate and catalyze scientific, cultural and economic research in the Arctic. We partner h governments, universities and other research institutions that require access to innovative rastructure to conduct program initiatives in the Arctic. We build relationships with Arctic Indigenous peoples to advance the understanding of the region with traditional knowledge.

ARF is the proud host of Arctic Focus, a collaborative, online platform where Arctic explorers, researchers and communities converge to share stories of the Arctic. At Arctic Focus, ARF and its partners share perspectives about the most critical, understudied and unknown regions of the North directly from the people who are on the ground (or at sea!).

ARCTIC SDI Arctic Spatial Data Infrastructure

arctic-sdi.org

A Cooperative Model in the Arctic SDI



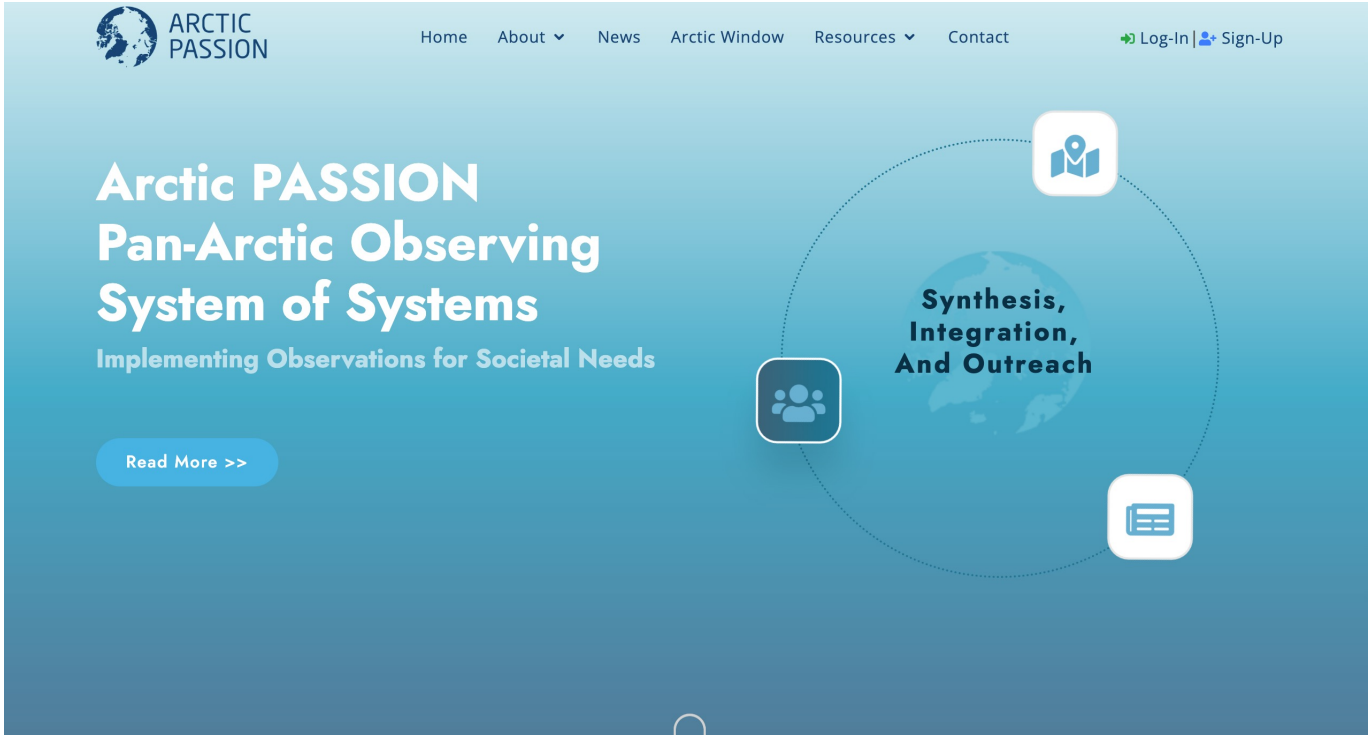
The Arctic SDI is focused on:

- Working with organizations to make their data available,
- Understanding the needs and requirements stakeholders
- Information Management best practices (lifecycle of geospatial data),
- Open data standards and provision of authoritative data,
- Helping users and data contributors understand how to participate.

From Heli Ursin, Jani Kylmäaho, Fredrik Persäter, Simon Riopel, Cameron Wilson. Arctic Spatial Data Infrastructure Enabling Access to Arctic Location-Based Information,Presented at Polar Data Forum III, Helsinki, Nobember, 2019

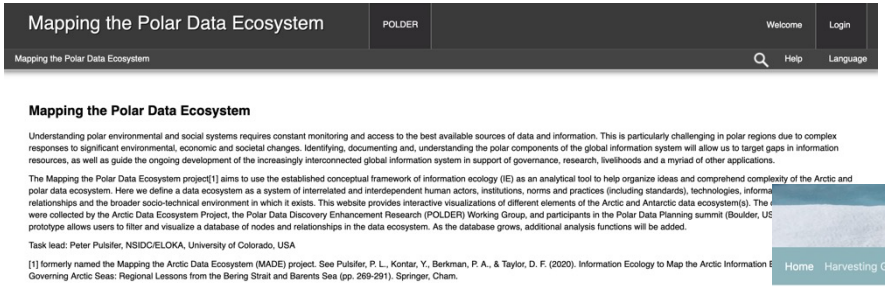
CCADI

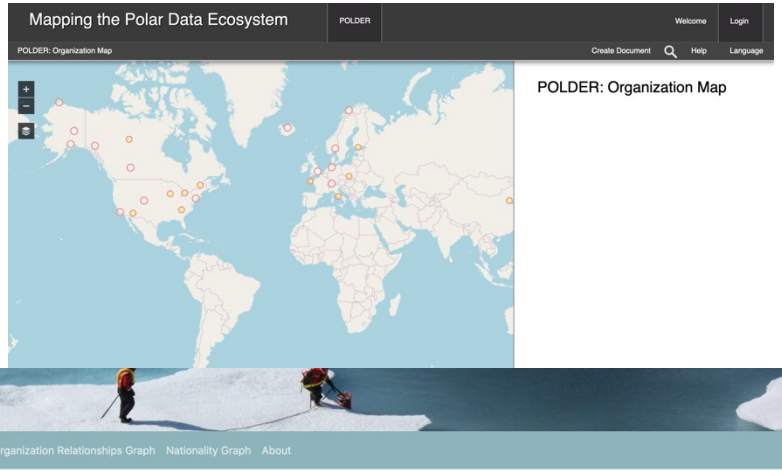
ArcticPASSION

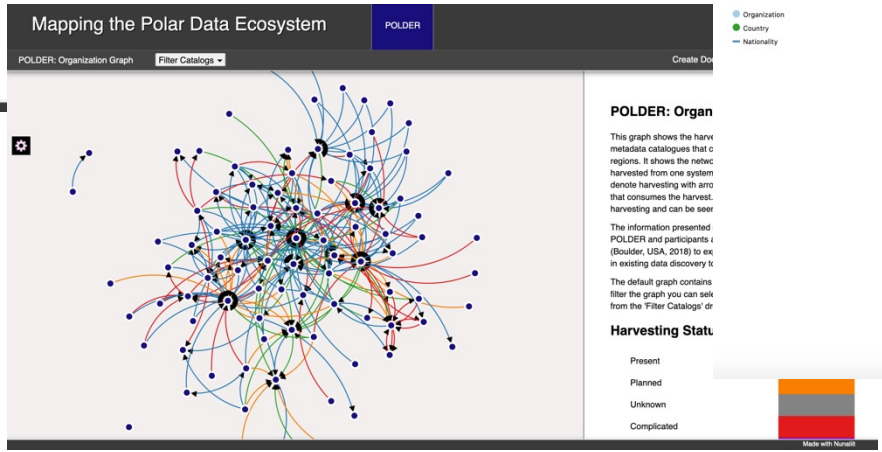


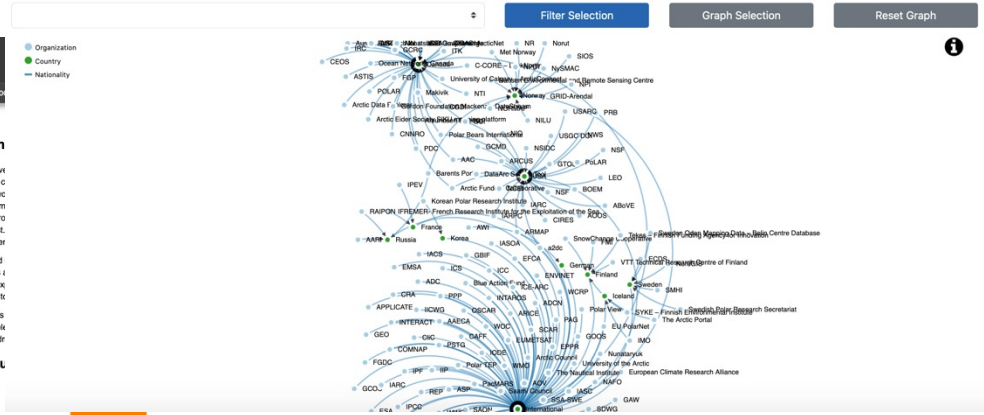
ADC (P2G, POLDER, SVWG etc.)

MPDE


Mapping the Polar Data Ecosystem
POLDER
Welcome
Login
Mapping the Polar Data Ecosystem
Help
Language
Mapping the Polar Data Ecosystem
Understanding polar environmental and social systems requires constant monitoring and access to the best available sources of data and information. This is particularly challenging in polar regions due to complex responses to significant environmental, economic and societal changes. Identifying, documenting and, understanding the polar components 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 a myriad of other applications.
The Mapping the Polar Data Ecosystem project[1] aims to use the established conceptual framework of information ecology (IE) as an analytical tool to help organize ideas and comprehend complexity of the Arctic and polar data ecosystem. Here we define a data ecosystem as a system of interrelated and interdependent human actors, institutions, norms and practices (including standards), technologies, informa
relationships and the broader socio-technical environment in which it exists. This website provides interactive visualizations of different elements of the Arctic and Antarctic data ecosystem(s). The
were collected by the Arctic Data Ecosystem Project, the Polar Data Discovery Enhancement Research (POLDER) Working Group, and participants in the Polar Data Planning summit (Boulder, US
prototype allows users to filter and visualize a database of nodes and relationships in the data ecosystem. As the database grows, additional analysis functions will be added.
Task lead: Peter Pulsifer, NSIDC/ELOKA, University of Colorado, USA
[1] formerly named the Mapping the Arctic Data Ecosystem (MADE) project. See Pulsifer, P. L., Kontar, Y., Berkman, P. A., & Taylor, D. F. (2020). Information Ecology to Map the Arctic Information
Governing Arctic Seas: Regional Lessons from the Bering Strait and Barents Sea (pp. 269-291). Springer, Cham.


Mapping the Polar Data Ecosystem
POLDER
Welcome
Login
POLDER: Organization Map
Create Document
Help
Language
POLDER: Organization Map
Home
Harvesting Graph
Organization Relationships Graph
Nationality Graph
About


Mapping the Polar Data Ecosystem
POLDER
POLDER: Organization Graph
Filter Catalogs
POLDER: Organ
Harvesting Statu
Present
Planned
Unknown
Complicated
Made with Nunaliit

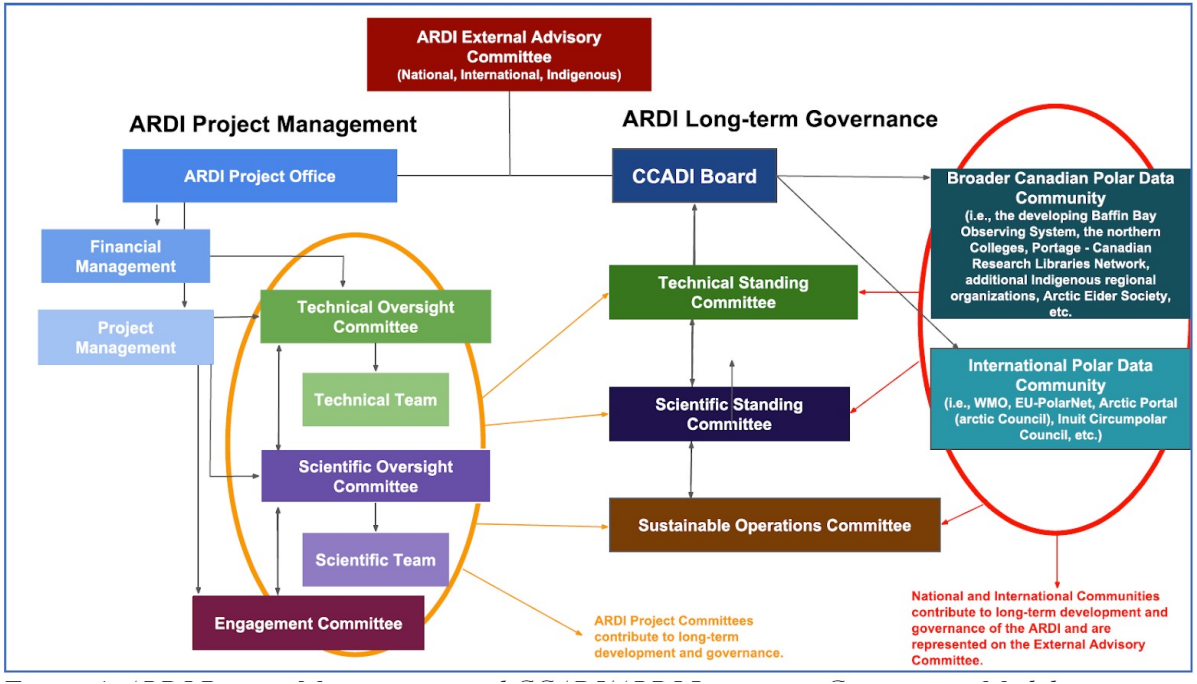

Organization
Country
Nationality
Filter Selection
Graph Selection
Reset Graph

Partnership Development Model

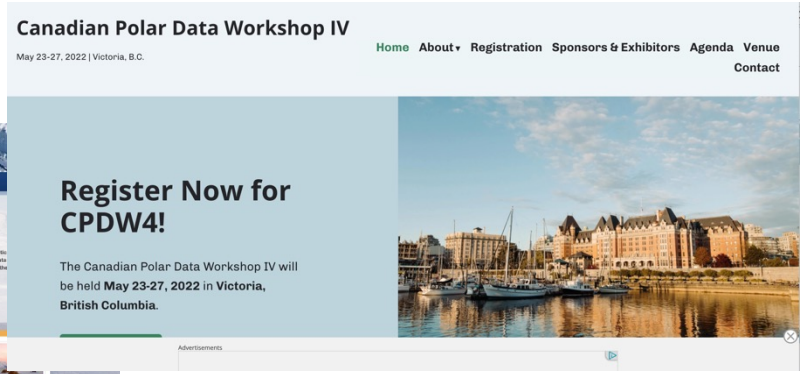
- Currently informal
- Developing through CPDW and related activities with broader community
- Priority on funded, targeted activities

CCADI Community Building

CCADI Governance



Canadian Polar Data Community



Canadian Polar Data Workshop Reports

CPDW3 was held in Banff, February 2020.

The final report of the Third Canadian Polar Data Workshop is due for release in January 2022.

CPDW2 was held in Ottawa, May 2017.

CCADI/CCIN/PDC (2018) Final Report of the 2nd Canadian Polar Data Workshop: A Roadmap to the Future of Polar Data Management in Canada.

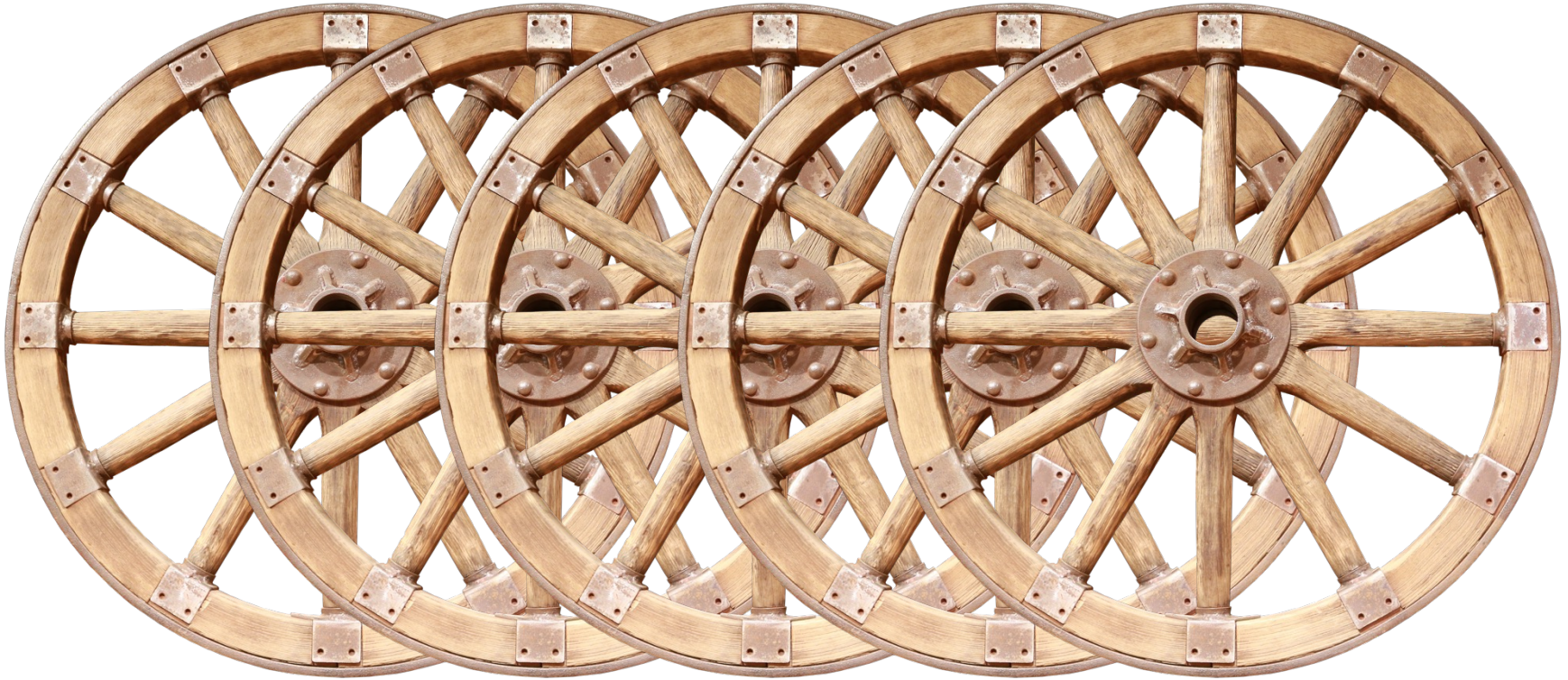
CPDW1 was held in Ottawa, May 2015.

CCIN/PDC (2016) Final Report of the First Canadian Polar Data Workshop: Canadian and international polar/Arctic research data management – Context and avenues to enhance collaboration. (For the full report with appendices click here)

Riding Together

The Peloton:

Individual leadership and shared effort (and recognition) for collective good



NEWS AND VIEWS | 07 April 2021

Adding is favoured over subtracting in problem solving

A series of problem-solving experiments reveal that people are more likely to consider solutions that add features than solutions that remove them, even when removing features is more efficient.

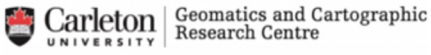
Tom Meyvis & Heeyoung Yoon

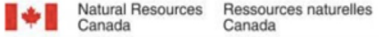
Next Steps

- Completion of architecture components
- Migration to production environments
- Documentation
- **Sustainability plan (governance + technical (e.g. system wide security, hosting etc.)**
- New projects...

CCADI

The Canadian Consortium for Arctic Data Interoperability



Thank You