ARCTIC SDI
Arctic Spatial Data Infrastructure

Arctic Spatial Data Infrastructure

→ Enabling Access to Arctic Land and Marine Data Across Borders, Across Time

Simon Riopel, GeoConnections
Canada Centre for Mapping and Earth Observation

Outline

- Arctic SDI – Definition
- Components:
  - Governance
  - Stakeholders requirements and technical support
  - **Data** and **standards**
  - Operational policies
  - Applications (i.e. Geoportal)
- Catalogues and Spatial Web Services Harvesting
- User Needs Assessments

Video:

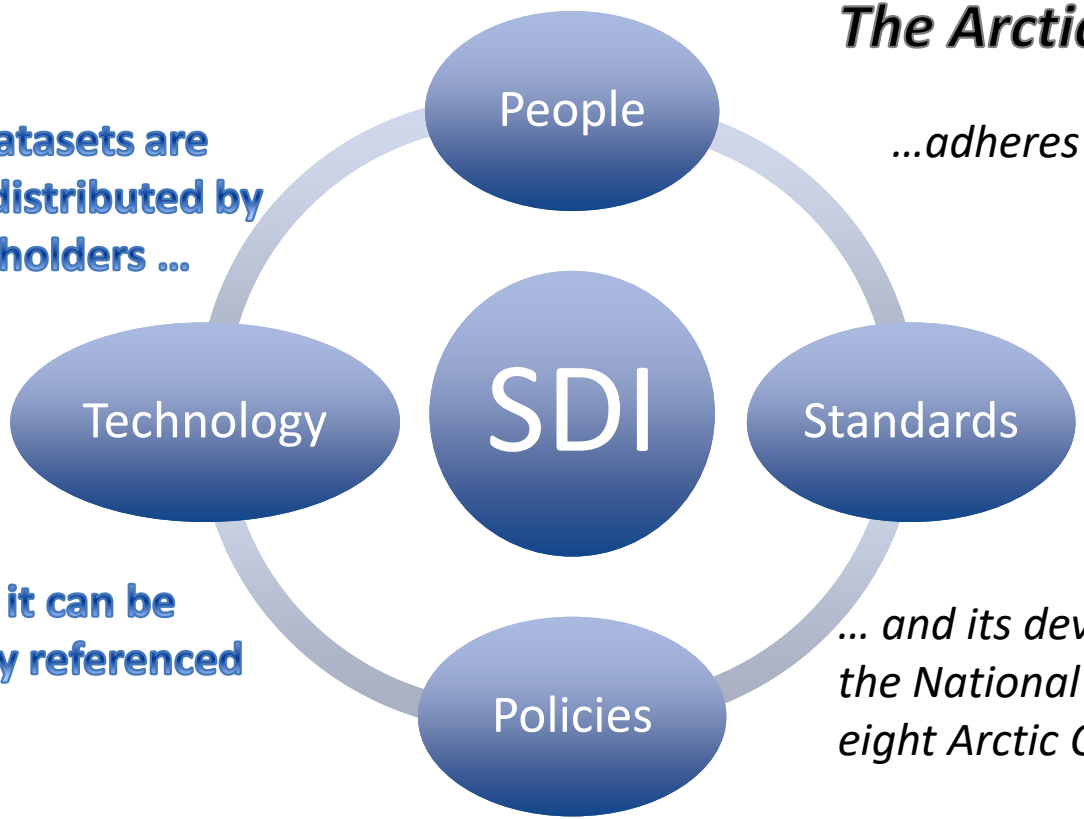
https://www.youtube.com/watch?v=VtlTedwelAk

ARCTIC SDI Arctic Spatial Data Infrastructure

A Spatial Data Infrastructure

Allows sharing geospatial data in an efficient and flexible way

Important datasets are produced and distributed by many stakeholders …



The Arctic SDI …

…adheres to Open Data Standards

… most of it can be geographically referenced

… and its development is facilitated by the National Mapping Agencies of the eight Arctic Countries.

A Cooperative Model in the Arctic

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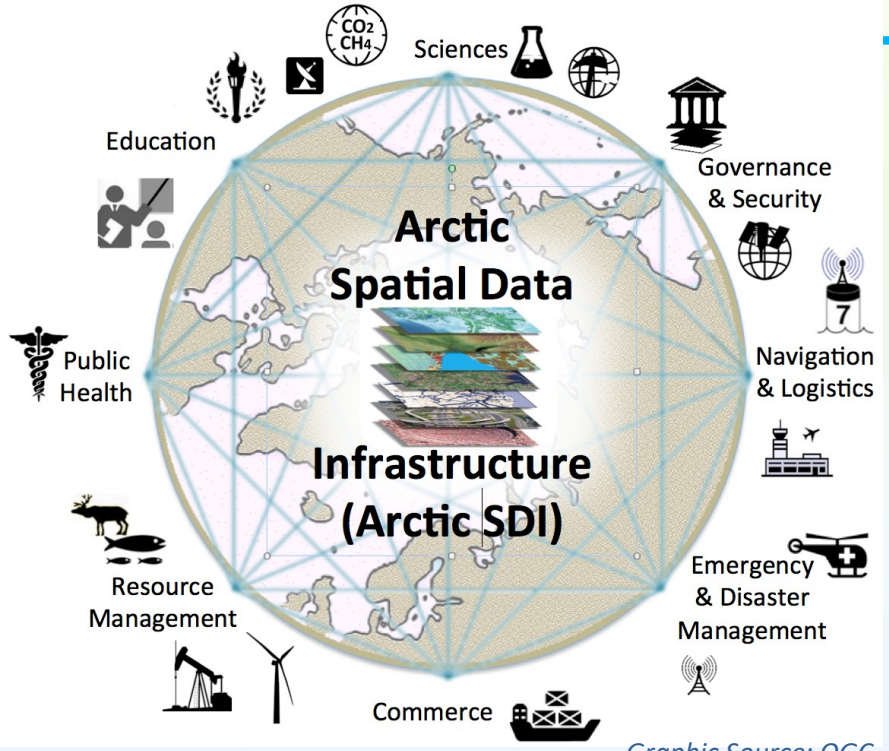


Graphic Source: OGC

The Arctic SDI is focused on:

- Working with organizations to make their data available, with a focus on the Arctic Council,
- Understanding the needs and requirements of 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.

Arctic SDI Strategic Plan 2015-2020: 6 Objectives

Objective	Objective Description	Primary Arctic SDI Working Group
Objective 1	Address Needs of Arctic Council and Other Users	Strategy Working Group
Objective 2	Provide Reference Datasets	Data Working Group
Objective 3	Facilitate Access to Thematic Datasets	Data Working Group
Objective 4	Data and Technical Interoperability	Technical Working Group
Objective 5	Spatial Operational Policies	Operational Policies Working Group
Objective 6	Communications	Communication Working Group

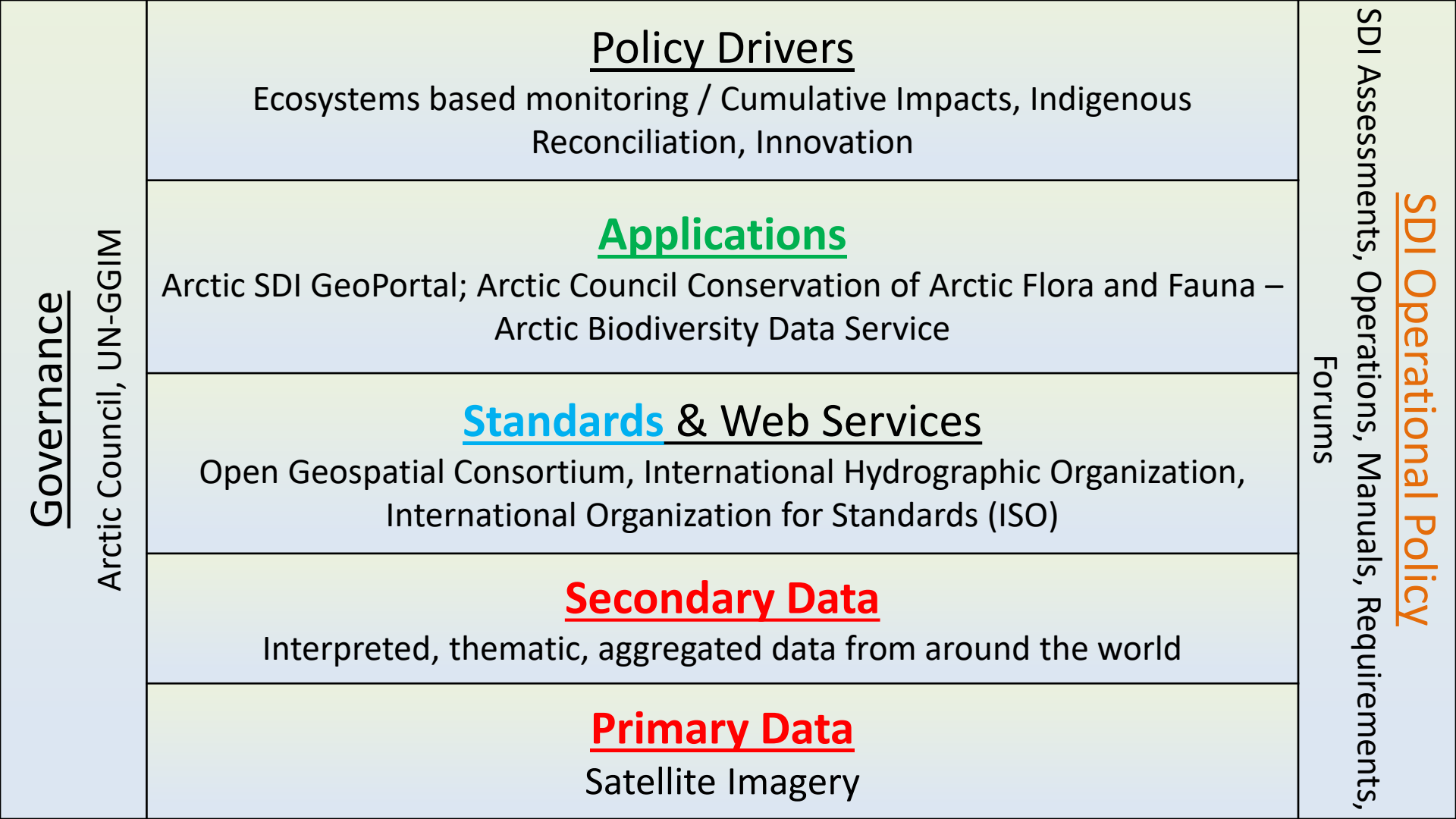
Arctic SDI Data Working Group

The Data WG is a sub-group of the Technical Working Group with Terms of Reference approved Jan. 2018. Areas of interest include:

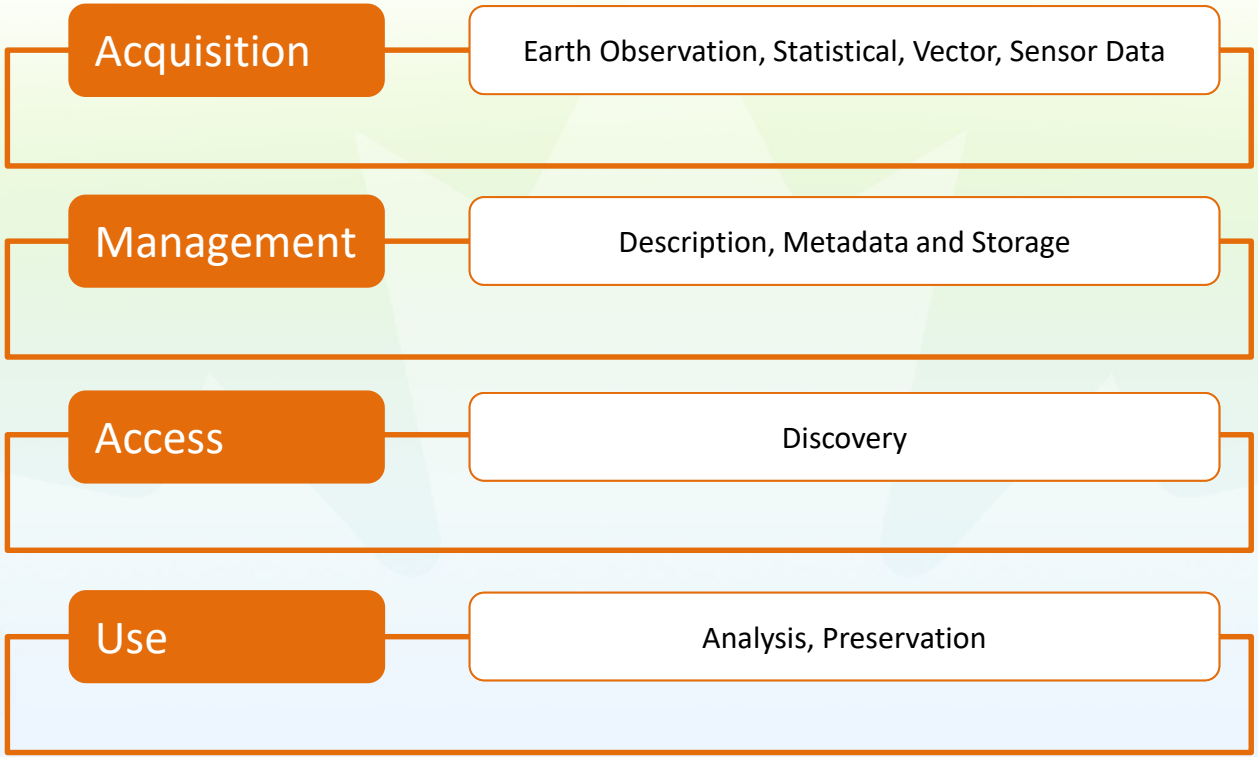
- Focus on Arctic issues by evaluating spatial data requirements,
- Advise and engage in Geoportal related data activities, and
- Engage in outreach and communication activities.

Proposed Activities 2018/19

- Arctic SDI high level data flows diagram
- Process for thematic data separation and prioritization
- Arctic Council data priorities
- Marine Data Infrastructure: Collaborating with International Hydrographic Organization - Arctic Marine Spatial Data Infrastructure Working Group (ARMSDIWG)
- **Academic and scientific data**


Governance
Arctic Council, UN-GGIM
Policy Drivers
Ecosystems based monitoring / Cumulative Impacts, Indigenous Reconciliation, Innovation
Applications
Arctic SDI GeoPortal; Arctic Council Conservation of Arctic Flora and Fauna – Arctic Biodiversity Data Service
Standards & Web Services
Open Geospatial Consortium, International Hydrographic Organization, International Organization for Standards (ISO)
Secondary Data
Interpreted, thematic, aggregated data from around the world
Primary Data
Satellite Imagery
SDI Operational Policy
SDI Assessments, Operations, Manuals, Requirements, Forums

Data Lifecycle and Standards



Arctic SDI

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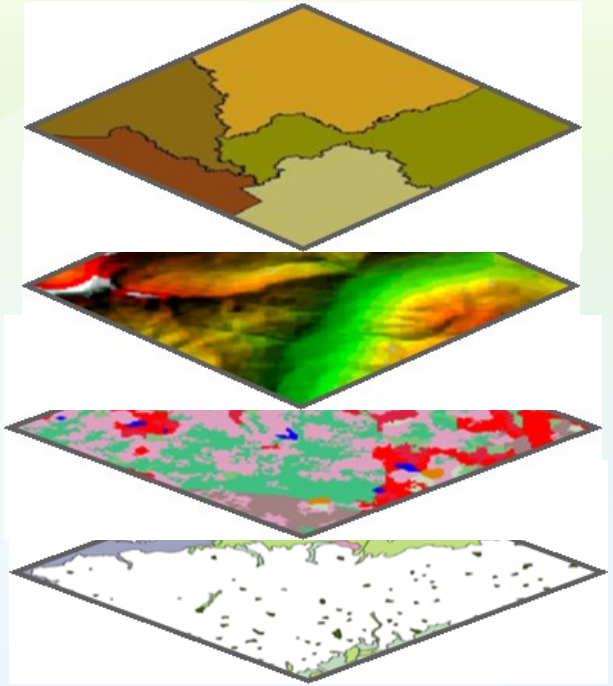
Arctic Spatial Data Infrastructure

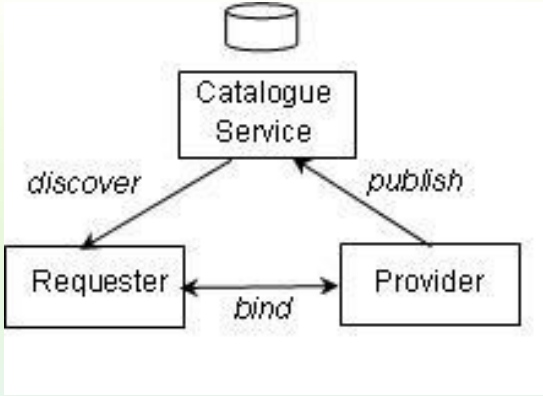
The Arctic SDI provides, via a web portal, easy access to:

- A searchable metadata catalogue
- Authoritative reference data as a Web Map Service (WMS) 1:250,000
- Thematic data (birds, ice cover, ship routes, land cover change, flora etc.)
- A geoportal for geospatial data viewing and discovery



Arctic SDI Metadata Catalogue

The Metadata Catalogue for Arctic SDI is built on GeoNetwork 2.6. It provides a machine to machine Discovery Service API (**OGC CSW**) but also a GUI (Graphical User Interface) for administration (e.g. configuration of harvesting metadata from other metadata catalogues). The official UI for the Metadata search is the Arctic SDI Geoportal.



Essential interactions in a service-oriented architecture

Responsibilities

The service is operated by the Swedish Mapping, Cadastral and Land Registration Authority in the Arctic SDI cloud environment hosted by the Norwegian Mapping Authority.

Standards Compliance

The Catalogue is compliant with the OGC CSW API version 2.0.2 and ISO 19115/19139 metadata profiles.

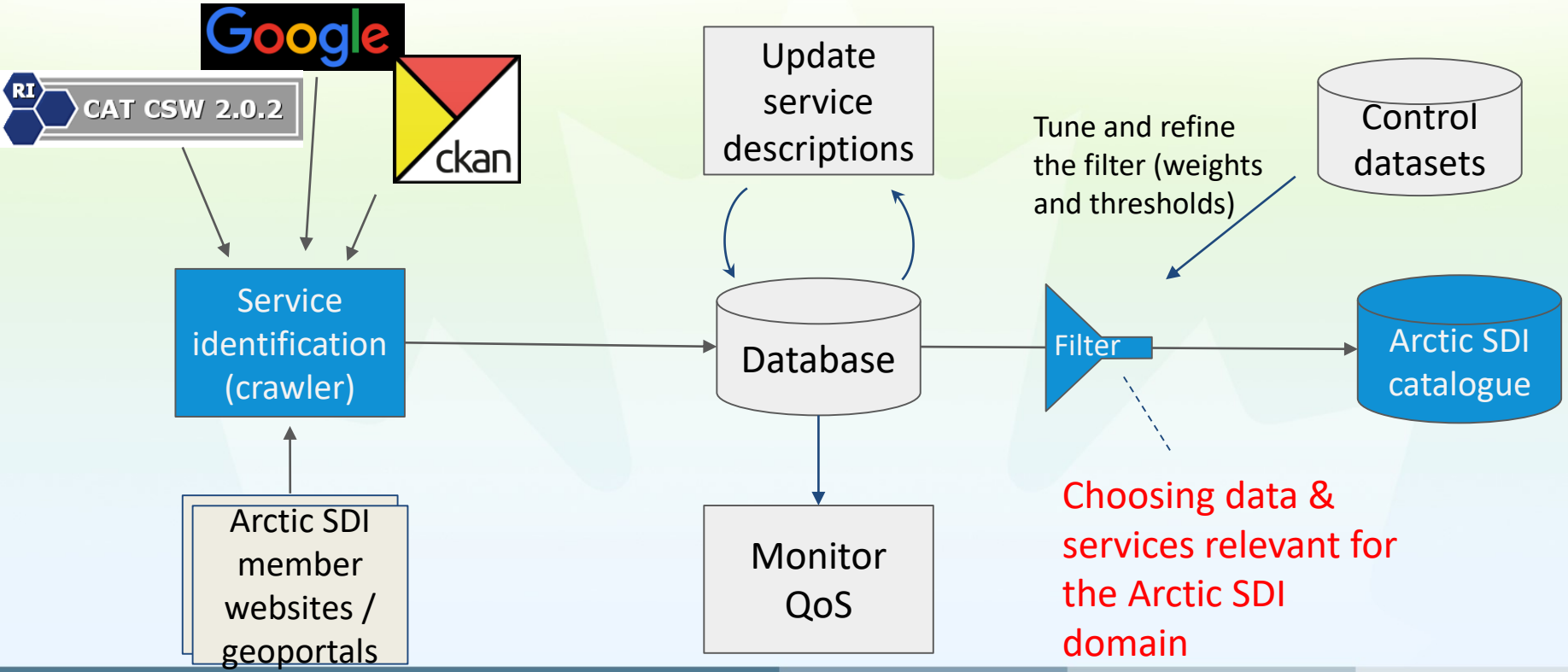
Access Information

The metadata catalogue can be openly accessed through the Search tab -> Metadata Search tab in the Arctic SDI Geoportal.

Link to Catalogue Service API (Capability file):
http://arcticsdi.lm.se/geonetwork/srv/en/csw?service=CSW&request=GetCapabilities

Arctic Web Services Harvesting

An Evergreen Catalogue Approach



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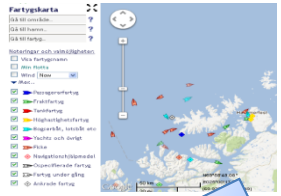
Data Flows

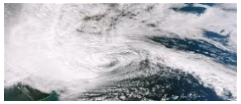
Action

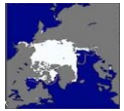
Arctic SDI Geoportal



Added value

Data Collection





WCS

WFS

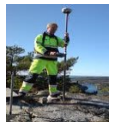
WMS-T

Services

WMTS

WMS

Data Storage



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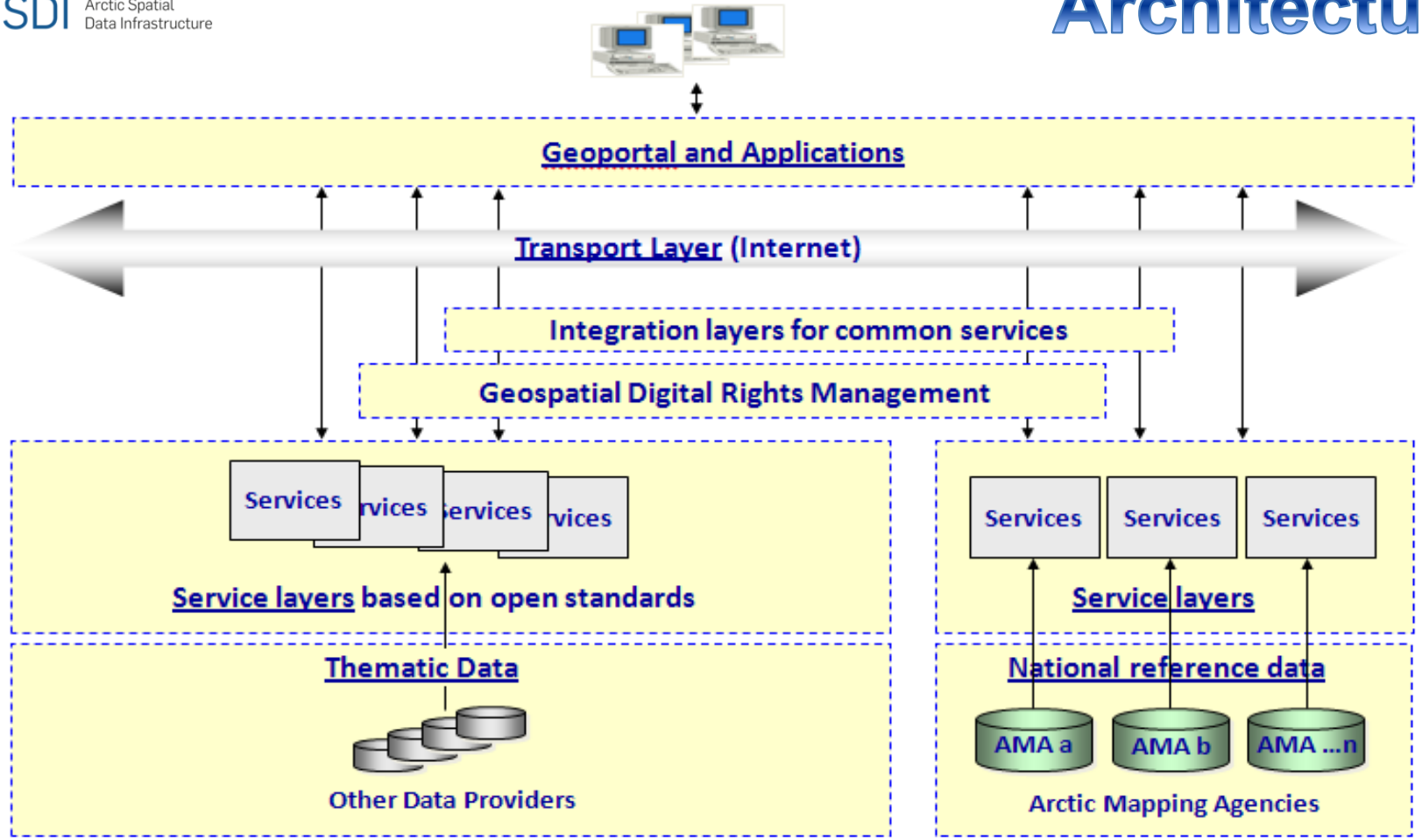
Architecture



Arctic SDI Topographic Basemap Service

ARCTIC SDI Arctic Spatial Data Infrastructure

WMS
NATIONAL DATA

WMS
NATIONAL DATA

WMS
NATIONAL DATA

Apply common portrayal(SLD) Rules created by project group

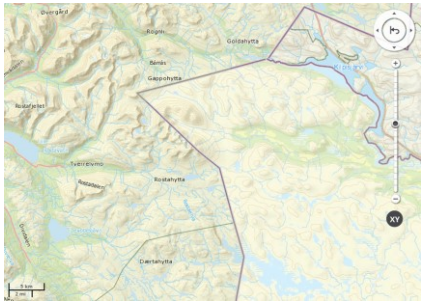
WMS
Customised VMAP0 Data for small scales

Cascaded WMS National Data Larger scales

WMTS

GeoWebCache
WMTS Server Tile Cache
- GeoWebCache
- centOS

Tile Cache



OSKARI

National Data and Service Layer

ASDI Service Integration Layer

Application Layer

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Authoritative Topographic Basemap

Provided Directly from the **8 Arctic National Mapping Agencies**

- **Common Cartographic Specification**
- **A Trusted Source of Detailed Information**

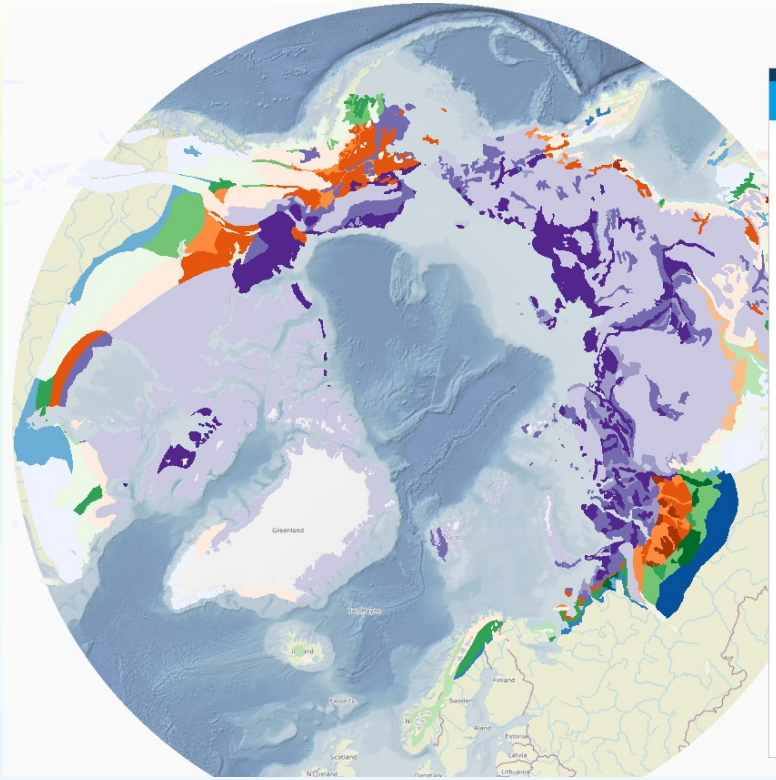
Southern Svalbard: Arctic SDI Basemap vs. Google Maps

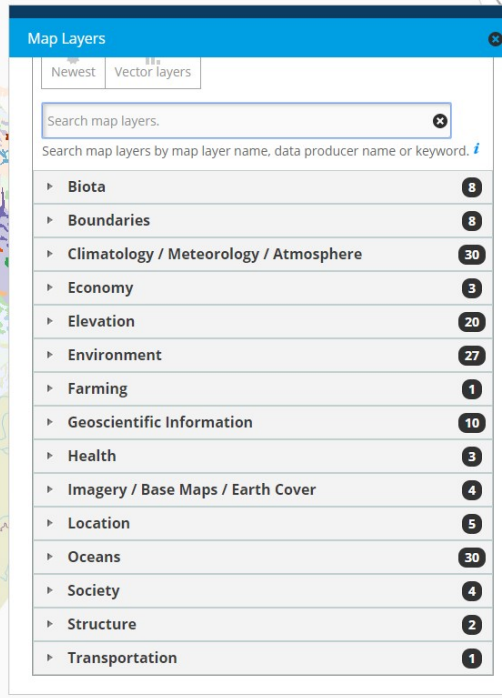
Arctic SDI Geoportal / Arctic-SDI.org

ARCTIC SDI Arctic Spatial Data Infrastructure

Functionalities

- Location Search
- Metadata Search
- Map Layers & Coordinate Tool
- Time Series (WMS-T)
- Embedded Maps Wizard
- Your Own Maps
- Geoportal Administration

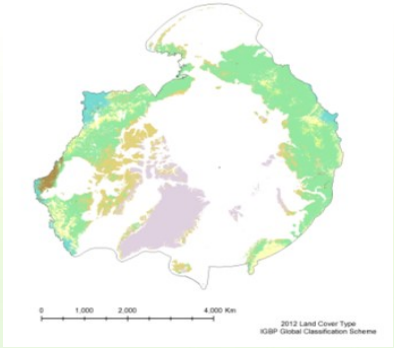




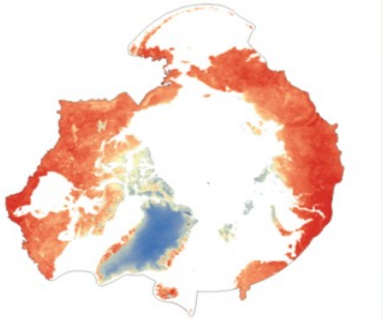
Technical Support

- Assisting CAFF with thematic data services
- MODIS satellite data derived products:
  - Vegetation Indices (incl. NDVI)
  - Land Cover Type
  - Snow Covered Area
  - Sea Surface Temperature (SST)
  - Marine Chlorophyll-a
- Time-Series Migratory Bird Index
- …

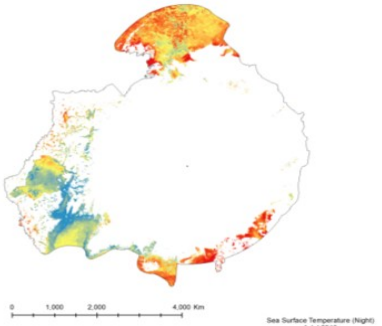
2012 Land Cover Type



Land Surface Temperature



Sea Surface Temperature



ARCTIC SDI Arctic Spatial Data Infrastructure

Embedded Maps

CAFF Conservation of Arctic Flora and Fauna

About Monitoring Assessments Strategies Policy Expert Groups Data Publications Press

ARCTIC COUNCIL

Home / CAFF_Webb / caff.is / Press Centre / Press Releases_New / 2012 Arctic Report Cards describe dramatic changes in the Arctic (December 4, 2012)

Search CAFF

Search ... Go

Search location

2012 Arctic Report Cards describe dramatic changes in the Arctic (December 4, 2012)

December 4, 2013, U.S.A.- The Arctic Council, through the Arctic Monitoring and Assessment Programme (AMAP) and the Conservation of Arctic Flora and Fauna's (CAFF) Circumpolar Biodiversity Monitoring Programme (CBMP), has contributed to the Arctic Report Card, an annual report released today by the National Oceanic and Atmospheric Administration (NOAA) that monitors the often-quickly changing conditions in the Arctic.

The peer-reviewed report contains contributions from 141 authors from 15 countries. For this year's issue CAFF's CBMP developed and edited the terrestrial and marine ecosystem chapters in cooperation with others, while AMAP organized an independent peer-review process involving international experts.

The Arctic region continued to break records in 2012—among them the loss of summer sea ice, spring snow cover, and melting of the Greenland ice sheet. This was true even though air temperatures in the Arctic were unremarkable relative to the last decade, according to the report.

Major findings include:

- ***Snow cover***: A new record low snow extent for the Northern Hemisphere was set in June 2012, and a new record low was reached in May over Eurasia.
- ***Sea ice***: Minimum Arctic sea ice extent in September 2012 set a new all-time record low, as measured by satellite since 1979.
- ***Greenland ice sheet***: There was a rare, nearly ice sheet-wide melt event on the Greenland ice sheet in July, covering about 97 percent of the ice sheet on a single day.
- ***Vegetation***: The tundra is getting greener and there's more above-ground growth. During the period of 2003-2010, the length of the growing season increased through much of the Arctic.
- ***Wildlife and food chain***: In northernmost Europe, the Arctic fox is close to extinction and vulnerable to the encroaching Red fox. Additionally, massive phytoplankton blooms below the summer sea ice suggest estimates of biological production at the bottom of the marine food chain may be ten times too low.
- ***Ocean***: Sea surface temperatures in summer continue to be warmer than the long-term average at the growing ice-free margins, while upper ocean temperature and salinity show significant interannual variability with no clear trends.
- ***Weather***: Most of the notable weather activity in fall and winter occurred in the sub-Arctic due to a strong positive North Atlantic Oscillation. There were three extreme weather events including an unusual cold spell in late January to early February 2012 across Eurasia, and two record storms characterized by very low central pressures and

Login

Operational Policies

Arctic-SDI.org:

- SDI Manual for the Arctic
- Data Sharing Agreements
- Guidelines for Data Providers (under creation)
- Geoportal Disclaimer (Terms of Use):

"This Arctic SDI Geoportal is intended to provide free and open access for any user. Some data available through this Geoportal may have usage restrictions. Using some features of the Geoportal may require registering and signing in as an authenticated user. **The Arctic SDI incorporates data from multiple, distributed providers and each data set has a specific license.** Arctic SDI's Geoportal Metadata Catalogue links to these data licenses as supplied by the respective data providers and it is the responsibility of the user to comply with these licenses, disclaimers, and/or copyright notices…"

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SDI User Needs Assessments

ARCTIC SDI Arctic Spatial Data Infrastructure

The objective of this project is to conceptualise, document, frame and develop detailed user needs assessments (UNAs) that will gather the requirements of Canadian stakeholders and the international Arctic community in terms of:

- data and services (land and marine),
- standards
- technologies (e.g. applications)
- operational policies
- collaboration, and
- leadership & governance.

Specifically, this project will consist of researching and detailing the SDI requirements of different communities:

- Canadian stakeholders (CGDI),
- International Arctic Community, and
- Indigenous Communities (First Nations, Inuit, Métis).

Data Providers, Platforms and Facilitators

- Arctic Spatial Data Infrastructure (**Arctic SDI**) Geoportal
- Polar Thematic Exploitation Platform (**Polar TEP**)
- **GEOSS** Portal
- Observing Systems Capability Analysis and Review Tool (**OSCAR**)
- Global Change Master Directory (**GCMD**)
- Polar Data Catalogue (**PDC**)
- Exchange for Local Observations and Knowledge of the Arctic (**ELOKA**)
- Atlas of Community-Based Monitoring in a Changing Arctic

Data Access and Use Issues

ARCTIC SDI Arctic Spatial Data Infrastructure

Access/Use of required data is impeded by a number of data issues

- Missing Metadata for OGC Web Services
- Proprietary/custom data formats
- Lack of styling for Vector Data
- Incorporating temporal characteristics into data
- Vendor Specific Solutions
- Openness and Accessibility of Data
- Poor Interoperability
- Inefficiencies of un-aggregated data
- Limited resources and capacity

Arctic Spatial Data Pilot - Climate Change Scenarios

- Sponsored by NRCan and USGS, in collaboration with the Arctic SDI participants, this Open Geospatial Consortium Arctic Spatial Data Pilot:
  - Defined land and sea climate change scenarios to break down *information management silos* with technical piloting activities:
    - Improved access to reliable data for monitoring, management, emergency preparedness and decision making in the Arctic,
    - Produced videos to showcase how standards and common approaches to data management are deployed.
  - Addressed technology issues to meet the realities of Arctic frontier economies, such as in zero/low bandwidth Internet.

  http://www.opengeospatial.org/projects/initiatives/arcticsdp

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Arctic Spatial Data Pilot - Videos

VIDEOS

Case Studies by Pilot Participants

OGC / 7:46 MIN

The Arctic Spatial Data Pilot Summary

This video highlights essential elements that have been addressed by the Arctic Spatial Data Pilot, an initiative of the OGC Innovation Program

LUCIAD / 2:56 MIN

New Shipping Routes in the Arctic

The Arctic encompasses a number of shipping routes, grouped into a Northwest Passage and a Northeast Passage. Each passage crosses a ...

COMPUSULT / 4:50 MIN

Search & Rescue in the Hudson Strait

The Canadian Coast Guard receives a distress message from an oil tanker in the Hudson Strait. Coast Guard initiates a search and ...

PYXIS / 7:03 MIN

Modeling, Forecasting & Complex Data Analysis

Analysis of scientific data to project thawing of permafrost Modeling Land Susceptibility to Failure due to Permafrost Loss.

ECERE / 9:18 MIN

3D Data Visualization & Temporal Patterns

The Porcupine caribou herd's migration patterns have been overlaid with topographic and climatic information in a 3D environment.

ESRI CANADA / 6:56 MIN

Food Security in the Arctic

Building a Web Platform on Food Security: Governments and NGOs are continually assessing and monitoring the situation to ensure ...

ARCTIC SDI / 5:32 MIN

ArcticSDI: Functionality & Sustainability

Demonstration of the Arctic SDI Geoportal, a cooperative effort between the National Mapping Agencies of the eight Arctic Council Member countries.

PYXIS / 5:56 MIN

Landslide Susceptibility Mapping

NRCan completed a pilot study on a region within the Mackenzie Valley to test a method of mapping slope stability in a permafrost environment.

LUCIAD / 3:11 MIN

Sea Ice Age Evolution: Beaufort Gyre

Arctic Sea Ice Age measurements show that the sea ice is becoming younger. Since the 1980s, the amount of multiyear ice has declined ...

DATA SPECIFICATIONS - ARCTIC SDI

- Thematic datasets:
  - Data used in climate change modelling (e.g. ground/cloud albedo, sea-surface temperature, ice thickness, 30 year averages of snow/temperature, ice extent and thickness, glaciers …)
  - Wetlands and permafrost
  - Coastline and near shore data
  - Data related for flora or fauna and/or their habitat
  - Paleoclimatological data
  - Black Carbon
  - Greenhouse gases (e.g. Methane)
  - Ozone

STANDARDS - ARCTIC SDI

Supported standards in Arctic SDI Geoportal

- WMS 1.3
- WMS-T (temporal)
- WMTS (tile)
- WFS 2.0 (GML 3.2)
- ESRI REST services
- CSW (if you can create one with NSIDC Arctic metadata)
  - ISO 19115, 19139, etc.
- Support for the following projections (amongst others)
  - EPSG 3571 - 3576 (polar projections)
  - Web Mercator

Standards that we are working towards and need further support include:

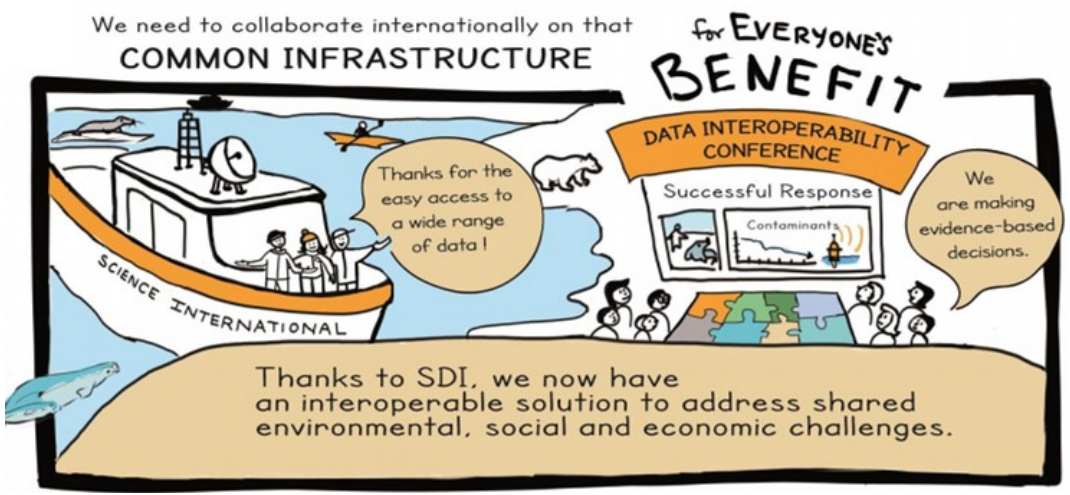
- WCS 2.0
- WPS and/or DGGS to support analytical and modelling exercises or, alternatively, existing models that can be instantiated with distributed data via WPS/DGGS standards (service chaining)
- SOS for near real time monitoring (e.g. currents, physical chemistry, pollutants, temperature, etc.)
- Marine standards (e.g. OGC Marine DWG, IHO)
- APIs that respect standardization efforts
- SLD and improving cartography

Reference: SDI Manual for the Arctic with its Glossary of Terms.

ARCTIC SDI Arctic Spatial Data Infrastructure

In Summary

- Improved access to geospatial data can help us better to predict, understand and react to changes in the Arctic.
- Responding to the impact of climate change and human activities in the Arctic requires accessible and reliable data to facilitate monitoring, management, emergency preparedness and decision making.
- Important datasets are produced and distributed by many stakeholders – public and private sector – and most of it can be geographically referenced.



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