Norwegian Meteorological Institute

ArcRCC
Web and Data Services

Arctic Regional Climate Centre Network

Foto: Hanneke Luijting

Eivind Støylen

ArcRCC-N Coordination meeting

St.Petersburg, 25.02 2019

Separation of responsibilities

NATIONAL		REGIONAL		CIRCUMPOLAR
Countries	**Meteorological Organizations**	**Regional Climate Centres (RCCs)**		**Arctic Regional Climate Centre**
United States	NOAA	North American Node	Forecasting	
Canada	ECCC			
Denmark	DMI	Northern European / Greenland Node	Data Services	
Iceland	IMO			
Norway	NMI			
Sweden	SMHI			
Finland	FMI			
Russia	AARI	Northern Eurasia Node	Monitoring	

Background

From the implementation plan:

Cross-node provision of operational data services:

- **Norway** (NMI) will host operational data services for the PRCC-Network domain, subject to all relevant data having the appropriate WIS-designed metadata, noting that no data would be archived in Norway, and that all datasets would be discoverable where housed.

DS: All countries in the domain have extensive and well-managed databases (with all appropriate QA/QC applied. Some work on data homogeneity, and some datasets are in gridded formats. Although not a mandatory function, it should be noted that most PRCC contributors have achieved, or are working towards WIS compliance. The Russian Federation and the USA host World Data Centres and manage regional or global datasets. Norway will provide the operational data services for the network.

Single web portal for the Arctic PRCC: TBD. Normally the lead agency for the entire Network would host the Arctic PRCC-Network web portal (which could be a basic web page with links to the other Arctic PRCC-Network Nodes and to the web pages for pan-Arctic products for content).

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We rely on existing data
Focus on providing access via a common portal

Single web portal for the Arctic PRCC: TBD. Normally the lead agency for the entire Network would host the Arctic PRCC-Network web portal (which could be a basic web page with links to the other Arctic PRCC-Network Nodes and to the web pages for pan-Arctic products for content).

This is established

Status of the web sites

- arctic-rcc.org is established
- Sections for LRF, Climate monitoring (CM), Data services, Documentation, PARCOF, Regional Node pages, and Forum for registered users
- CM and LRF include products presented in the consensus statement, historic products as well as updates where relevant (e.g. late winter LRF)

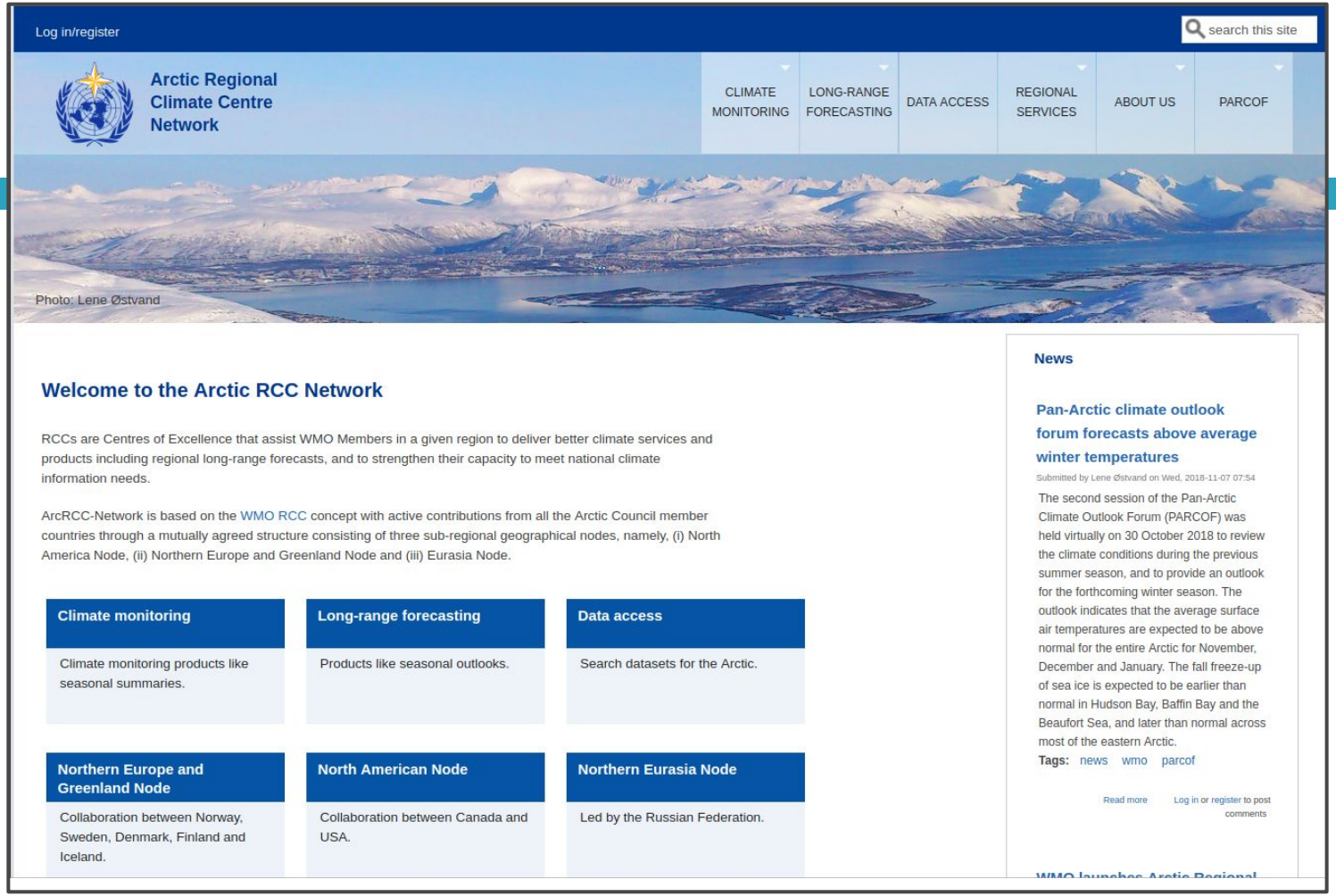
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Photo: Lene Østvand
Welcome to the Arctic RCC Network
RCCs are Centres of Excellence that assist WMO Members in a given region to deliver better climate services and products including regional long-range forecasts, and to strengthen their capacity to meet national climate information needs.
ArcRCC-Network is based on the WMO RCC concept with active contributions from all the Arctic Council member countries through a mutually agreed structure consisting of three sub-regional geographical nodes, namely, (i) North America Node, (ii) Northern Europe and Greenland Node and (iii) Eurasia Node.
Climate monitoring
Climate monitoring products like seasonal summaries.
Long-range forecasting
Products like seasonal outlooks.
Data access
Search datasets for the Arctic.
Northern Europe and Greenland Node
Collaboration between Norway, Sweden, Denmark, Finland and Iceland.
North American Node
Collaboration between Canada and USA.
Northern Eurasia Node
Led by the Russian Federation.
News
Pan-Arctic climate outlook forum forecasts above average winter temperatures
Submitted by Lene Østvand on Wed, 2018-11-07 07:54
The second session of the Pan-Arctic Climate Outlook Forum (PARCOF) was held virtually on 30 October 2018 to review the climate conditions during the previous summer season, and to provide an outlook for the forthcoming winter season. The outlook indicates that the average surface air temperatures are expected to be above normal for the entire Arctic for November, December and January. The fall freeze-up of sea ice is expected to be earlier than normal in Hudson Bay, Baffin Bay and the Beaufort Sea, and later than normal across most of the eastern Arctic.
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SUMMARY FOR JUNE-AUGUST 2018

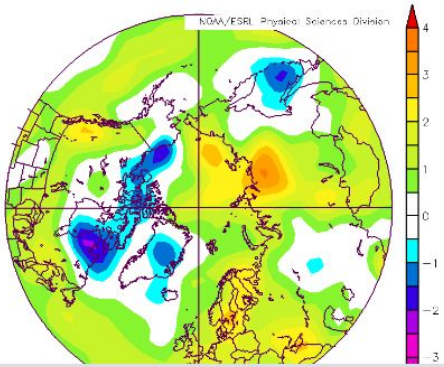
SUMMARY FOR OCTOBER 2017- MARCH 2018

Photo: Lene Østvand

Climate Summary for June-August 2018

This is the main result from the climate summary stated in the PARCOF-2 Consensus statement, for temperature, precipitation and sea ice. View the full climate summary presentation for more details.

The June to August 2018 average surface air temperature anomalies were above average for most of the Arctic domain, with the exception of parts of the Canadian Arctic and central Greenland, which experienced colder than normal temperatures. Precipitation between June and August 2018 was slightly below average over the Arctic region. The summer 2018 minimum sea ice extent was the 6th lowest on record, tied with 2008, since 1979. There were large regional differences observed in sea ice conditions between the Canadian and Eurasian Arctic during summer 2018. Above normal ice extent in the eastern Beaufort Sea and throughout the North West Passage had a major impact on the 2018 shipping season resulting in the North West Passage remaining blocked for ice free navigation.



ttps://arctic-rcc.org/climate-summary-jja-2018

February, March and April 2019
November, December and January 2018-19
June, July and August 2018
About forecasts

Seasonal outlook for February, March and April 2019

The images below show seasonal outlooks for February to April 2019, for temperature and precipitation.

Temperature FMA 2019 Outlook:
For the February March April 2019 (FMA19) period, there is probability of 50% or more that temperatures will be above normal in the Alaskan region (red areas in Figure 1) and over most of the continental Canadian Arctic. Canadian Archipelago has similar probability expectations for temperature, around 50% or more for the next FMA19 season.

Over the eastern part of the Russian continental Arctic, the forecast was not conclusive (white areas on the Fig. 1). This means that the forecasting system predicts the same probabilities for the three possible outcomes, below, above or near normal. Western Russian Arctic has at least 40% probability for an above normal FMA19.

Over the European continental Arctic, the highest probability that the temperature will be above normal (50% or more) is seen over Island. There is also at least 40% probability for an above normal FMA19 over some isolated regions of Norway, Finland and Sweden. For other regions of the continental European Arctic, the forecasting system was not conclusive and therefore all possible temperature outcomes are possible.

About forecasts

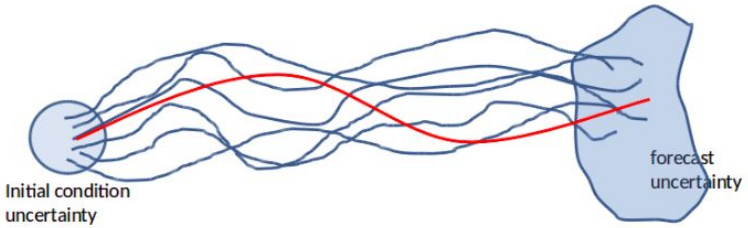
The **weather forecast range** can be from 6 hours (now casting) to up the two weeks in advance (long range weather forecast). A **weather forecasting model** and the current/initial state of the atmosphere at the time the forecast is performed, are used.

If we take a **weather forecasting model** and we add to it an **ocean forecasting model** we will obtain a **climate forecasting model**. **Seasonal Forecast** is a climate forecast ranging up to 1 year ahead. **Seasonal Outlook** represents a 90-day average of the seasonal forecast's daily realizations.

Skill is a measure of the forecast's accuracy. The skill is very low beyond two weeks, and not very useful in terms of daily forecasts. Seasonal forecasts can still be skillful, but this skill mostly depends on the geographical location of the region of interest.

Ensembles are climate forecasts with slightly changed initial conditions. Ensembles are very helpful in seasonal forecasting:

- Error cancellation when averaging ensemble members.
- Enabling us to assess a chance (probability) for a certain result (e.g. how many members say that it will be colder than normal).



Ensemble prediction

The results of the seasonal forecast are compared to the **normal climate** of the 90-day period. To define the normal climate, we have to take 30 years of temperature data. As an example, we can look at the normal climate for June, July and August (JJA) in Ottawa. Thirty summers = thirty numbers, is used. The climatology is 20℃. We select a threshold of ~33% of all summers. If the forecast for temp is higher than 20.5℃, we declare it above normal. Lower than 19.5℃ is below normal. In between is near normal.

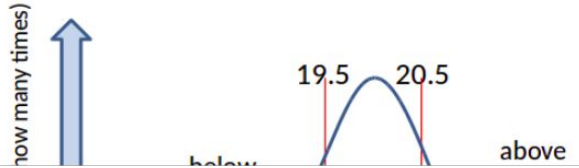


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Photo: Lene Østvand

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- Reports
- Experimental products

About us

World Meteorological Organization (WMO) Regional Climate Centres (RCCs) are centres of excellence that operationally generate regional climate products including climate monitoring and prediction in support of regional and national climate activities and thereby strengthen the capacity of WMO members in a given region to deliver better climate services to national users. While all WMO RCCs are required to fulfill certain mandatory functions, the RCC concept includes flexibility to accommodate specific regi
concept also provides options to implement a single multi-functional entity or a distributed-func
a number of interested hosts. Under the RCC concept service delivery to national clients rema
is designed to assist with their mandate.

Mandatory and recommended functions of WMO RCCs and the relevant designation criteria ar
and other related information are also described at http://www.wmo.int/pages/prog/wcp/wcasp/

Mandatory Functions

- operational activities for long range forecasts (LRF);
- operational activities for climate monitoring;
- operational data services to support LRF and climate monitoring; and
- training in the use of operational RCC products and services.

Highly Recommended Functions

- climate prediction and climate projection;
- non-operational data services;
- coordination functions;

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PARCOF >

First Session of Pan-Arctic Regional Climate Outlook Forum (PARCOF-1)

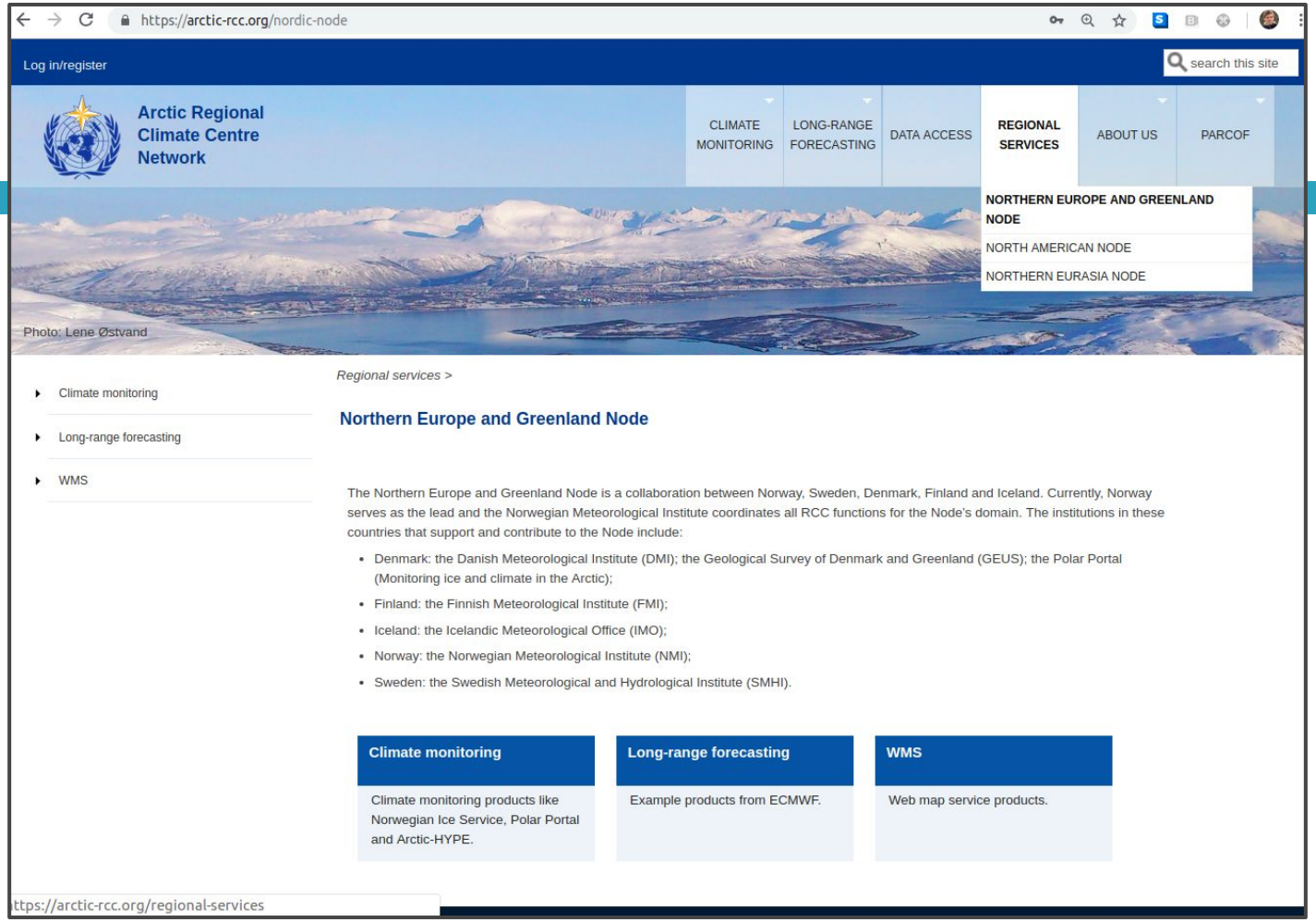
Ottawa, Canada, 15 to 16 May 2018

Background

Climate change in the Arctic is affecting the entire Earth system. Northerners, Indigenous communities, industry and wildlife are experiencing significant and direct impacts. For example, temperature increases have led to significant reductions of sea ice, thawing permafrost and coastal erosion. To meet the Arctic adaptation and decision-making needs, substantial progress has been made towards the establishment of an Arctic Regional Climate Centre Network (ArcRCC-Network). ArcRCC-Network is based on the WMO RCC concept with active contributions from all the Arctic Council member countries through a mutually agreed structure consisting of three sub-regional geographical nodes, namely, (i) North America Node, (ii) Northern Europe and Greenland Node and (iii) Eurasia Node.

The Pan-Arctic Regional Climate Outlook Forum (PARCOF) is a flagship activity of the ArcRCC-Network, following the well-known Regional Climate Outlook Forum (RCOF) concept supported by WMO and its partners around the world.

PARCOF Inaugural Session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NORTH AMERICAN NODE
NORTHERN EURASIA NODE
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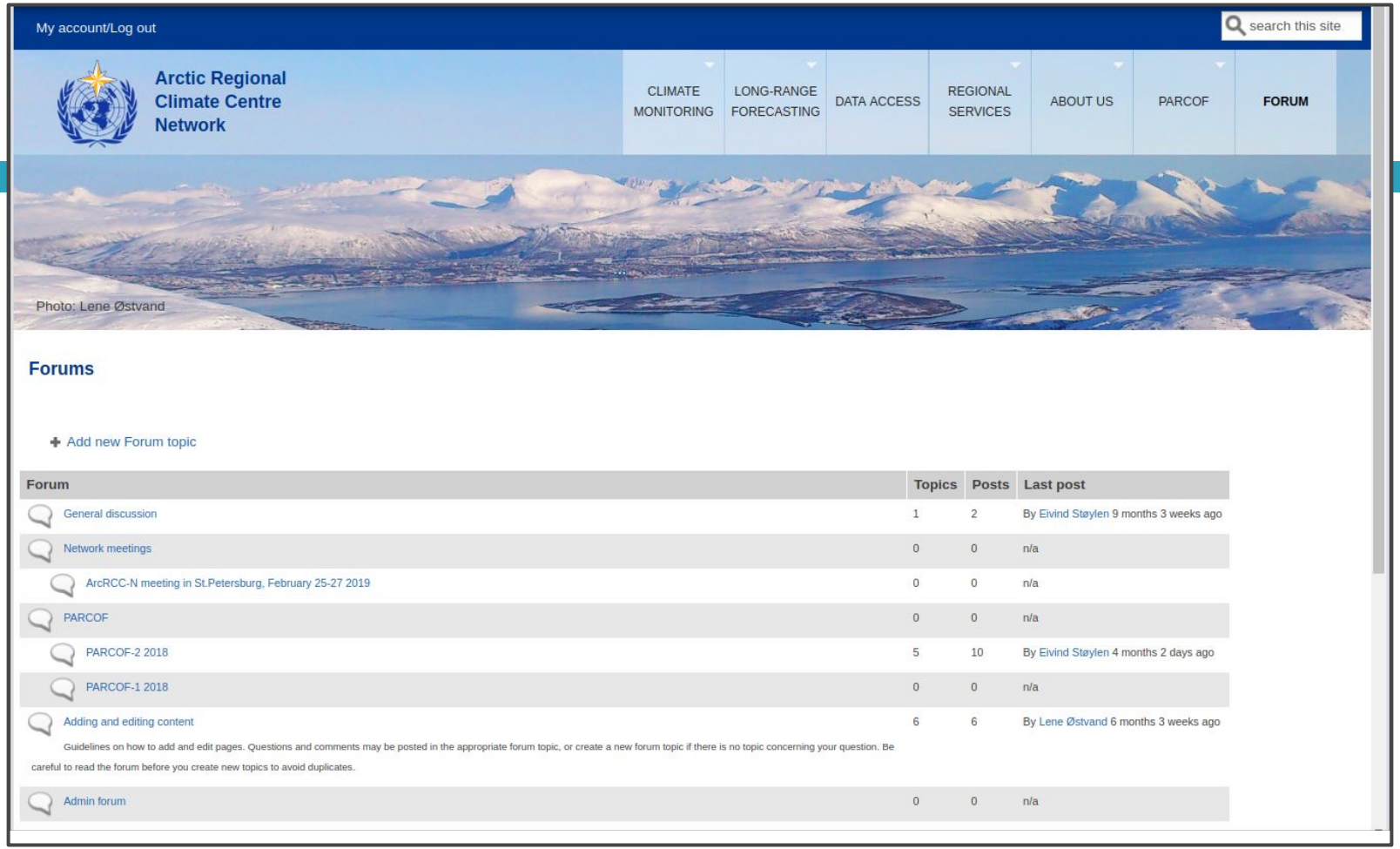
Long-range forecasting
WMS
Regional services >
Northern Europe and Greenland Node
The Northern Europe and Greenland Node is a collaboration between Norway, Sweden, Denmark, Finland and Iceland. Currently, Norway serves as the lead and the Norwegian Meteorological Institute coordinates all RCC functions for the Node's domain. The institutions in these countries that support and contribute to the Node include:
Denmark: the Danish Meteorological Institute (DMI); the Geological Survey of Denmark and Greenland (GEUS); the Polar Portal (Monitoring ice and climate in the Arctic);
Finland: the Finnish Meteorological Institute (FMI);
Iceland: the Icelandic Meteorological Office (IMO);
Norway: the Norwegian Meteorological Institute (NMI);
Sweden: the Swedish Meteorological and Hydrological Institute (SMHI).
Climate monitoring
Climate monitoring products like Norwegian Ice Service, Polar Portal and Arctic-HYPE.
Long-range forecasting
Example products from ECMWF.
WMS
Web map service products.
https://arctic-rcc.org/regional-services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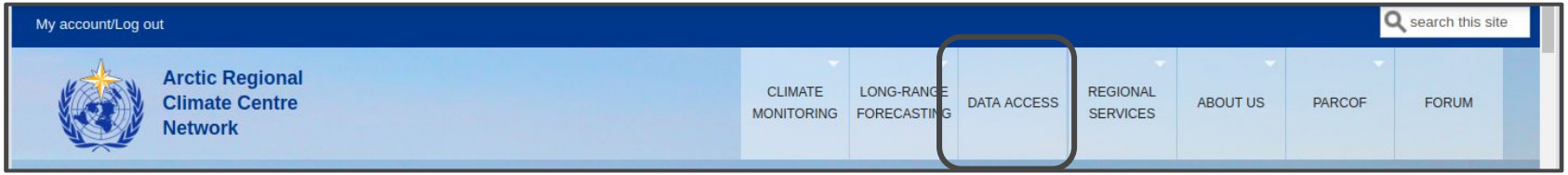
General discussion 1 2 By Eivind Støylen 9 months 3 weeks ago
Network meetings 0 0 n/a
ArcRCC-N meeting in St.Petersburg, February 25-27 2019 0 0 n/a
PARCOF 0 0 n/a
PARCOF-2 2018 5 10 By Eivind Støylen 4 months 2 days ago
PARCOF-1 2018 0 0 n/a
Adding and editing content 6 6 By Lene Østvand 6 months 3 weeks ago
Guidelines on how to add and edit pages. Questions and comments may be posted in the appropriate forum topic, or create a new forum topic if there is no topic concerning your question. Be careful to read the forum before you create new topics to avoid duplicates.
Admin forum 0 0 n/a

Data portal



Cross-node provision of operational data services:

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Strategy:

Utilize existing expertise and experience from other projects

MET Norway runs data management systems/portals for:

GCW, YOPP, NBS, NORDMAP, NMDC, NorDataNet, SIOS, AeN, GeoAccess,

Data Collection or Production Centres (DCPCs)

Many contact points established or in progress

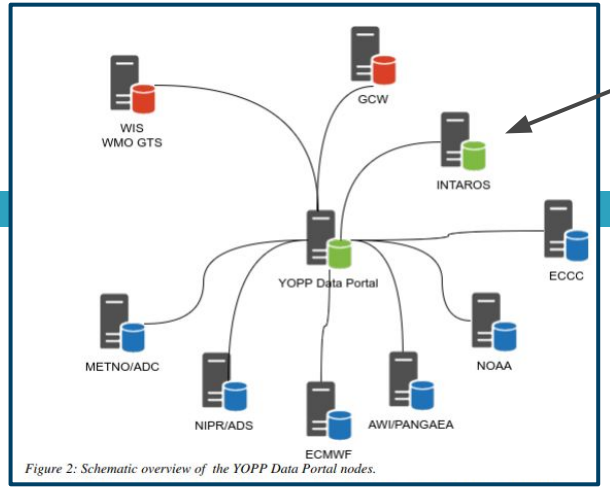
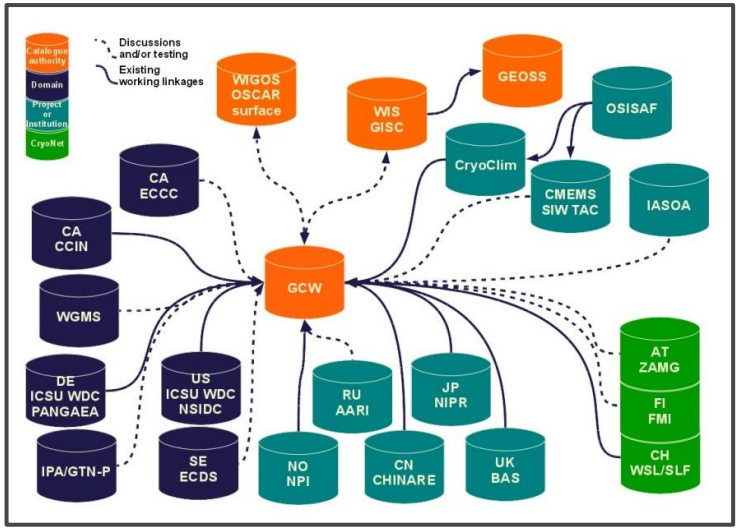
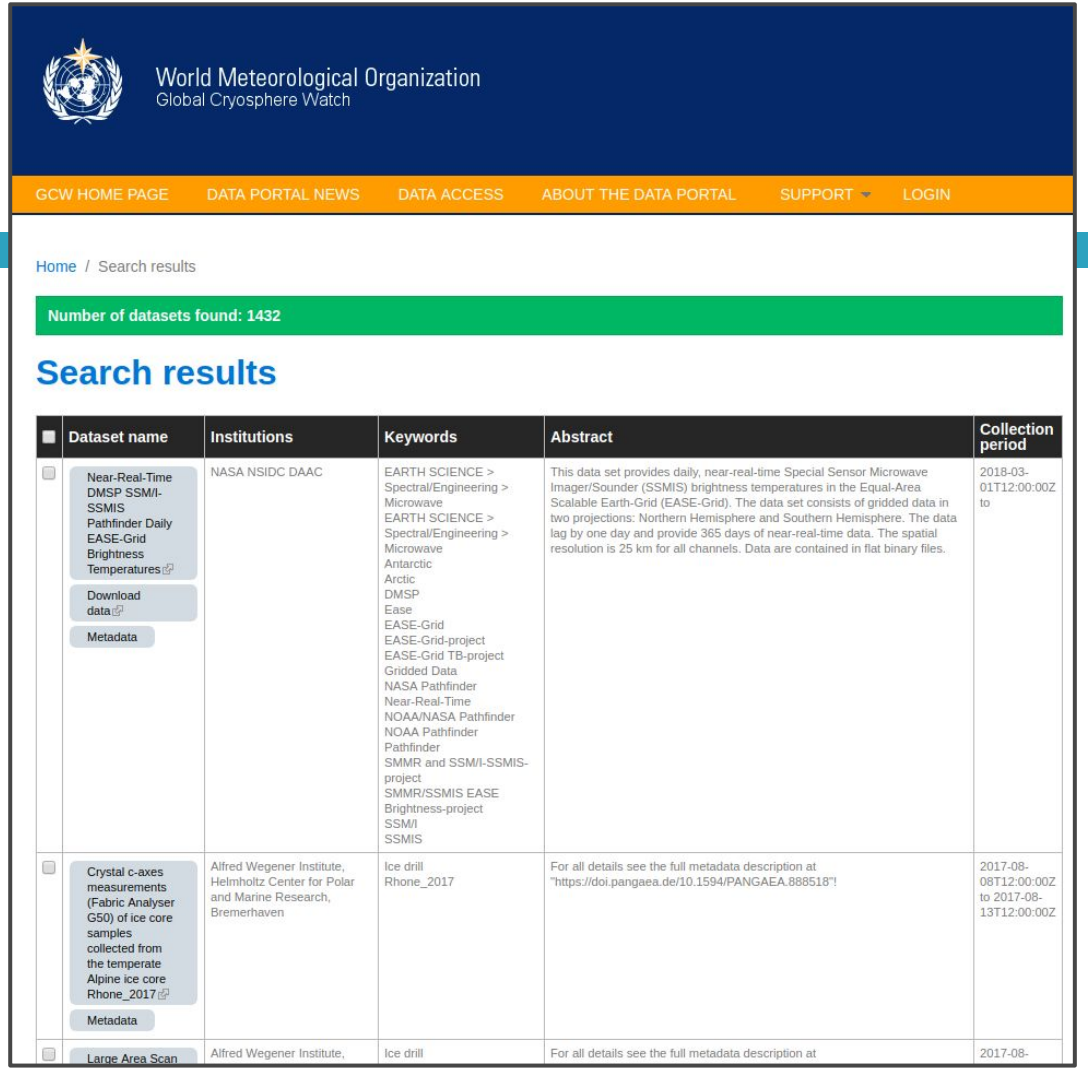


Figure 2: Schematic overview of the YOPP Data Portal nodes.



Some examples



World Meteorological Organization
Global Cryosphere Watch

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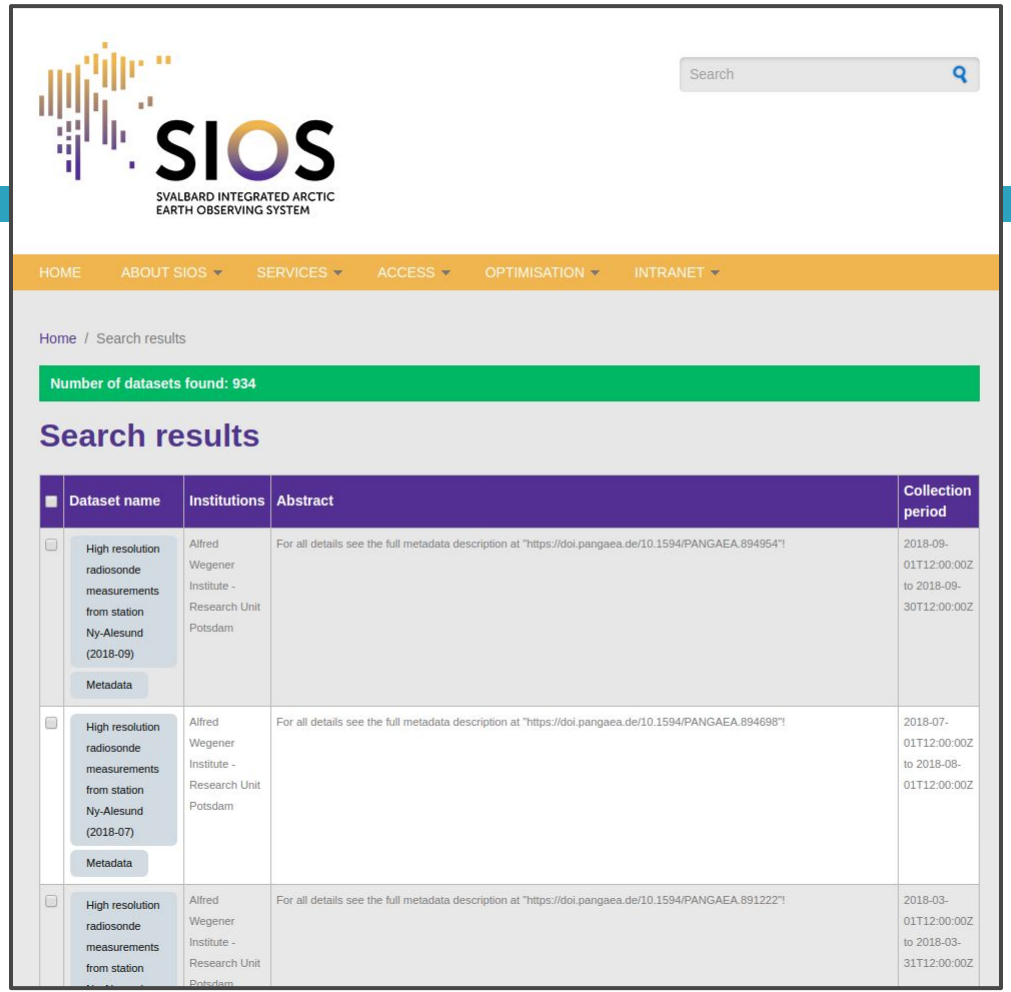
Number of datasets found: 1432

Search results

Dataset name	Institutions	Keywords	Abstract	Collection period
Near-Real-Time DMSP SSM/I-SSMIS Pathfinder Daily EASE-Grid Brightness Temperatures Download data Metadata	NASA NSIDC DAAC	EARTH SCIENCE > Spectral/Engineering > Microwave EARTH SCIENCE > Spectral/Engineering > Microwave Antarctic Arctic DMSP Ease EASE-Grid EASE-Grid-project EASE-Grid TB-project Gridded Data NASA Pathfinder Near-Real-Time NOAA/NASA Pathfinder NOAA Pathfinder Pathfinder SMMR and SSM/I-SSMIS-project SMMR/SSMIS EASE Brightness-project SSM/I SSMIS	This data set provides daily, near-real-time Special Sensor Microwave Imager/Sounder (SSMIS) brightness temperatures in the Equal-Area Scalable Earth-Grid (EASE-Grid). The data set consists of gridded data in two projections: Northern Hemisphere and Southern Hemisphere. The data lag by one day and provide 365 days of near-real-time data. The spatial resolution is 25 km for all channels. Data are contained in flat binary files.	2018-03-01T12:00:00Z to
Crystal c-axes measurements (Fabric Analyser G50) of ice core samples collected from the temperate Alpine ice core Rhone_2017 Metadata	Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven	Ice drill Rhone_2017	For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.888518"!	2017-08-08T12:00:00Z to 2017-08-13T12:00:00Z
Large Area Scan	Alfred Wegener Institute,	Ice drill	For all details see the full metadata description at	2017-08-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SERVICES
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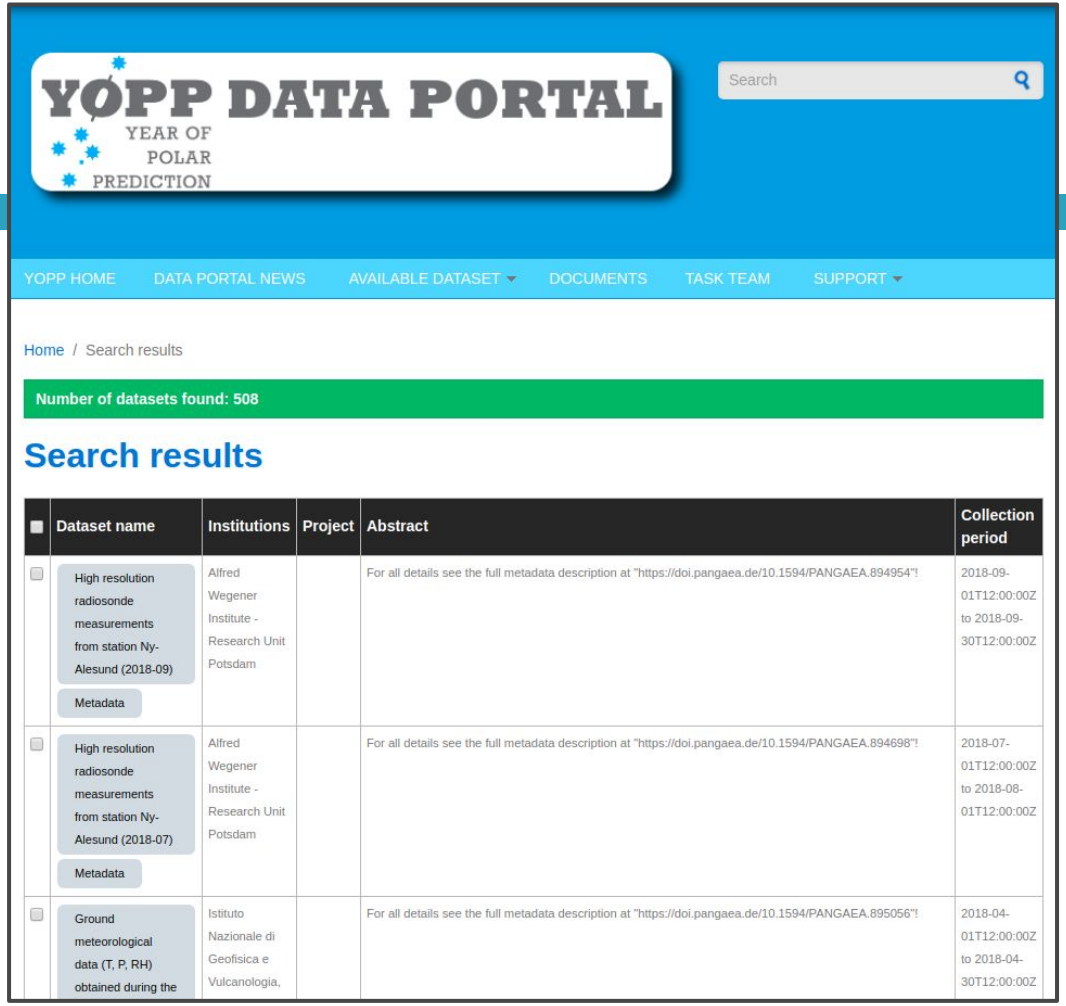
OPTIMISATION
INTRANET
Home / Search results
Number of datasets found: 934
Search results
Dataset name
Institutions
Abstract
Collection period
High resolution radiosonde measurements from station Ny-Alesund (2018-09)
Metadata
Alfred Wegener Institute - Research Unit Potsdam
For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.894954"!
2018-09-01T12:00:00Z to 2018-09-30T12:00:00Z
High resolution radiosonde measurements from station Ny-Alesund (2018-07)
Metadata
Alfred Wegener Institute - Research Unit Potsdam
For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.894698"!
2018-07-01T12:00:00Z to 2018-08-01T12:00:00Z
High resolution radiosonde measurements from station
Alfred Wegener Institute - Research Unit Potsdam
For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.891222"!
2018-03-01T12:00:00Z to 2018-03-31T12:00:00Z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Dataset name
Institutions
Project
Abstract
Collection period
High resolution radiosonde measurements from station Ny-Alesund (2018-09)
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2018-09-01T12:00:00Z to 2018-09-30T12:00:00Z
High resolution radiosonde measurements from station Ny-Alesund (2018-07)
Metadata
Alfred Wegener Institute - Research Unit Potsdam
For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.894698"!
2018-07-01T12:00:00Z to 2018-08-01T12:00:00Z
Ground meteorological data (T, P, RH) obtained during the
Istituto Nazionale di Geofisica e Vulcanologia,
For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.895056"!
2018-04-01T12:00:00Z to 2018-04-30T12:00:00Z

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	Dataset name	Institutions	Project	Abstract	Collection period
	High resolution radiosonde measurements from station Ny-Alesund (2018-09) Metadata	Alfred Wegener Institute - Research Unit Potsdam		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.894954"!	2018-09-01T12:00:00Z to 2018-09-30T12:00:00Z
	High resolution radiosonde measurements from station Ny-Alesund (2018-07)	Alfred Wegener Institute - Research Unit Potsdam		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.894698"!	2018-07-01T12:00:00Z to 2018-08-01T12:00:00Z

So how does the system work?

Overview of the Data Portal components and services

→ Metadata-driven approach

https://yopp.met.no/node/4
"YOPP Data Portal Concept Document"

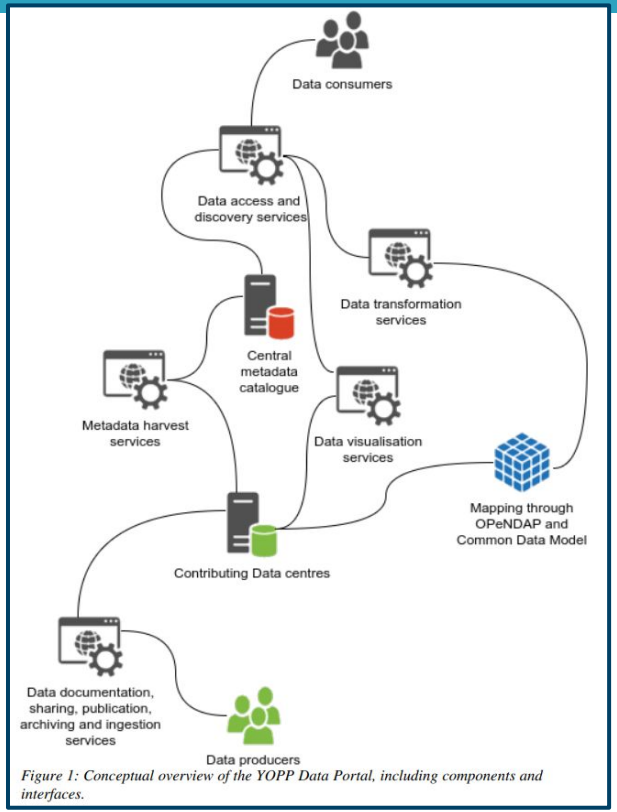


Figure 1: Conceptual overview of the YOPP Data Portal, including components and interfaces.

The metadata-driven approach

Provide **index metadata** - GCMD DIF or ISO 19115; e.g. WIS metadata

Interface to expose metadata - OAI-PMH recommended, CSW more expensive

Data access - OPeNDAP recommended, and/or WMS for visualisation. Http/ftp ok for smaller files. WFS/WCS are NOT supported

File formats - NetCDF-CF is recommended. WMO Grib and BUFR suitable for real time GTS exchange. JSON/XML NOT recommended

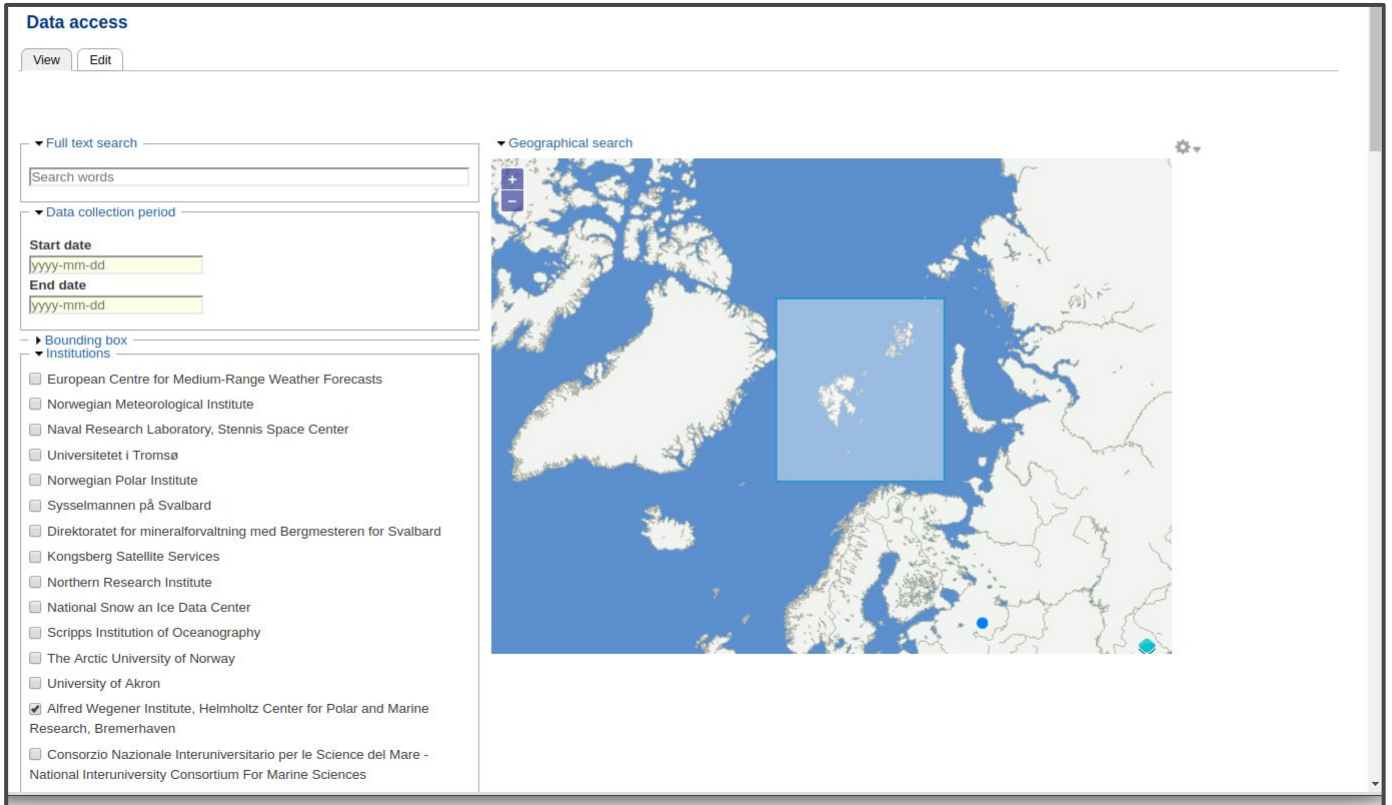
https://yopp.met.no/node/4

“Guidance for data centres contributing to YOPP”

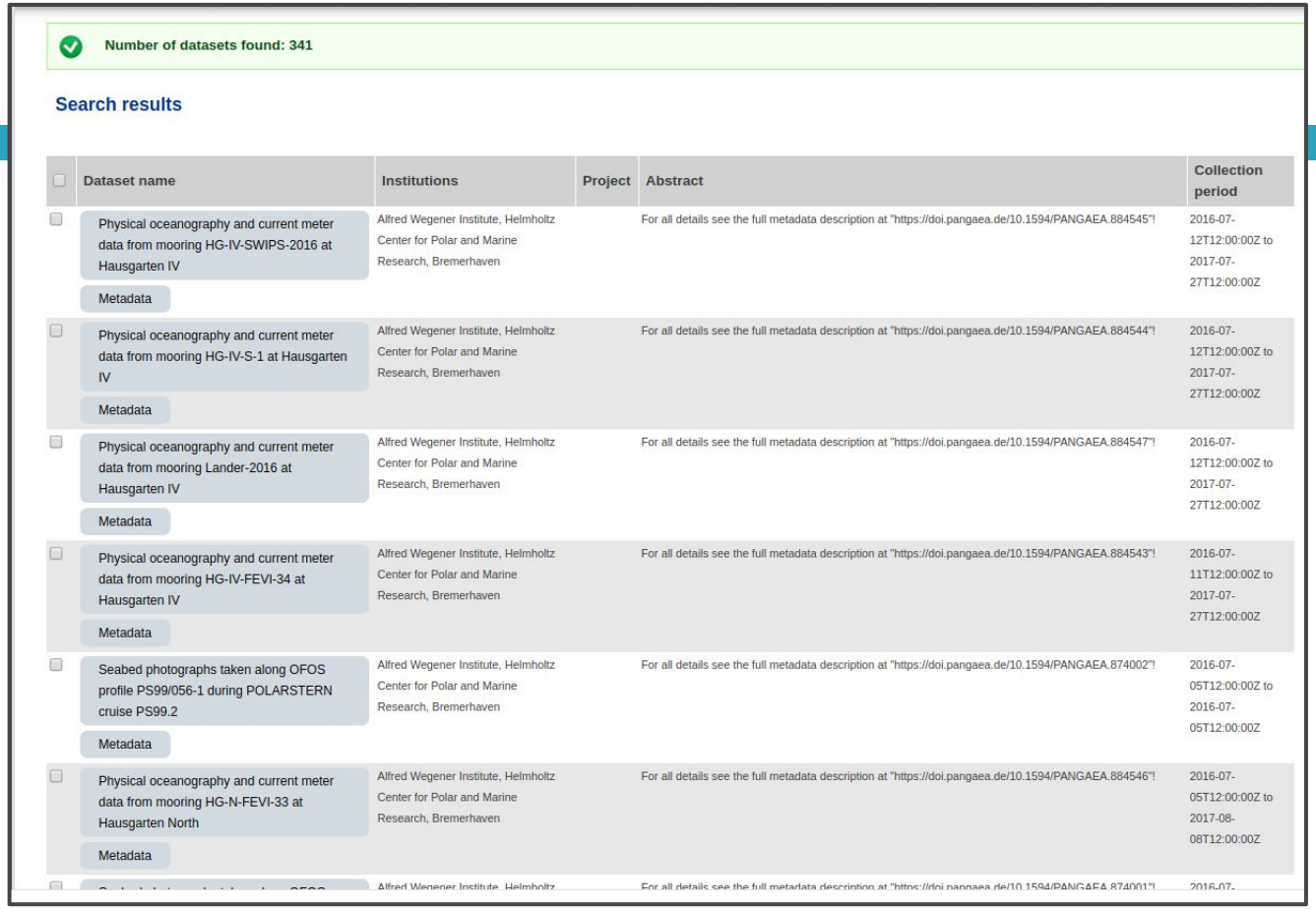
Utilizing the metadata in search:

Example:

Geographic search and institute



Result:



Number of datasets found: 341

Search results

Dataset name	Institutions	Project	Abstract	Collection period
Physical oceanography and current meter data from mooring HG-IV-SWIPS-2016 at Hausgarten IV Metadata	Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.884545"!	2016-07-12T12:00:00Z to 2017-07-27T12:00:00Z
Physical oceanography and current meter data from mooring HG-IV-S-1 at Hausgarten IV Metadata	Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.884544"!	2016-07-12T12:00:00Z to 2017-07-27T12:00:00Z
Physical oceanography and current meter data from mooring Lander-2016 at Hausgarten IV Metadata	Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.884547"!	2016-07-12T12:00:00Z to 2017-07-27T12:00:00Z
Physical oceanography and current meter data from mooring HG-IV-FEVI-34 at Hausgarten IV Metadata	Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.884543"!	2016-07-11T12:00:00Z to 2017-07-27T12:00:00Z
Seabed photographs taken along OFOS profile PS99/056-1 during POLARSTERN cruise PS99.2 Metadata	Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.874002"!	2016-07-05T12:00:00Z to 2016-07-05T12:00:00Z
Physical oceanography and current meter data from mooring HG-N-FEVI-33 at Hausgarten North Metadata	Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Bremerhaven		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.884546"!	2016-07-05T12:00:00Z to 2017-08-08T12:00:00Z
[illegible]	Alfred Wegener Institute, Helmholtz		For all details see the full metadata description at "https://doi.pangaea.de/10.1594/PANGAEA.874001"!	2016-07-

What to do with metadata record

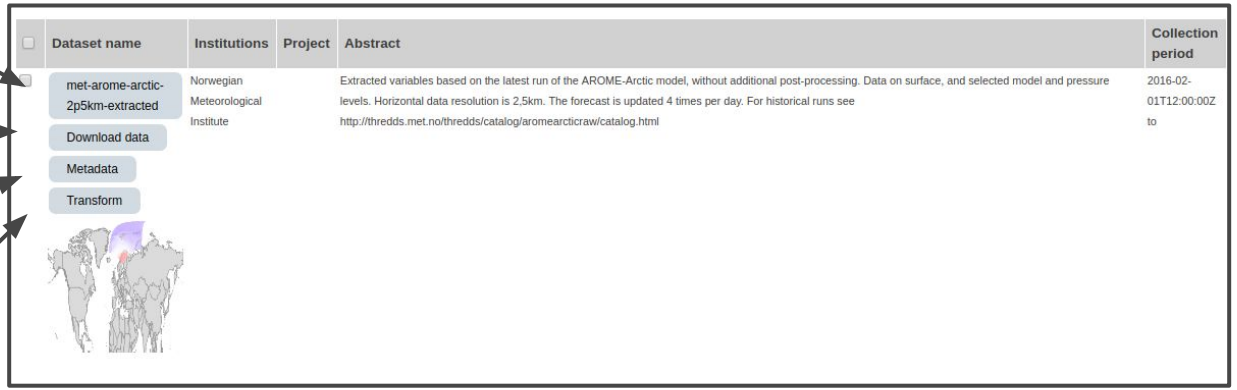
Point to the data "landing page"

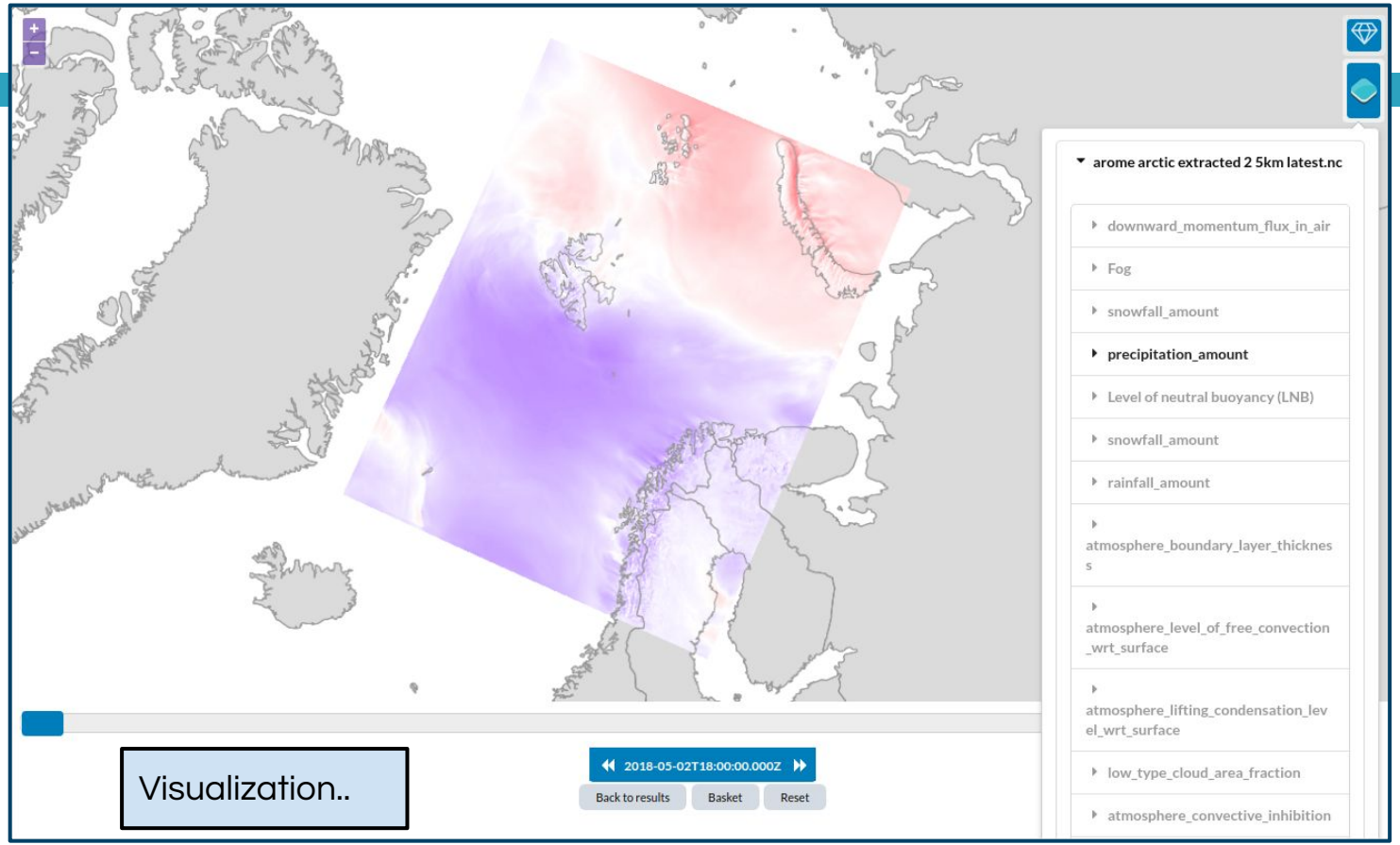
Download directly (requires access)

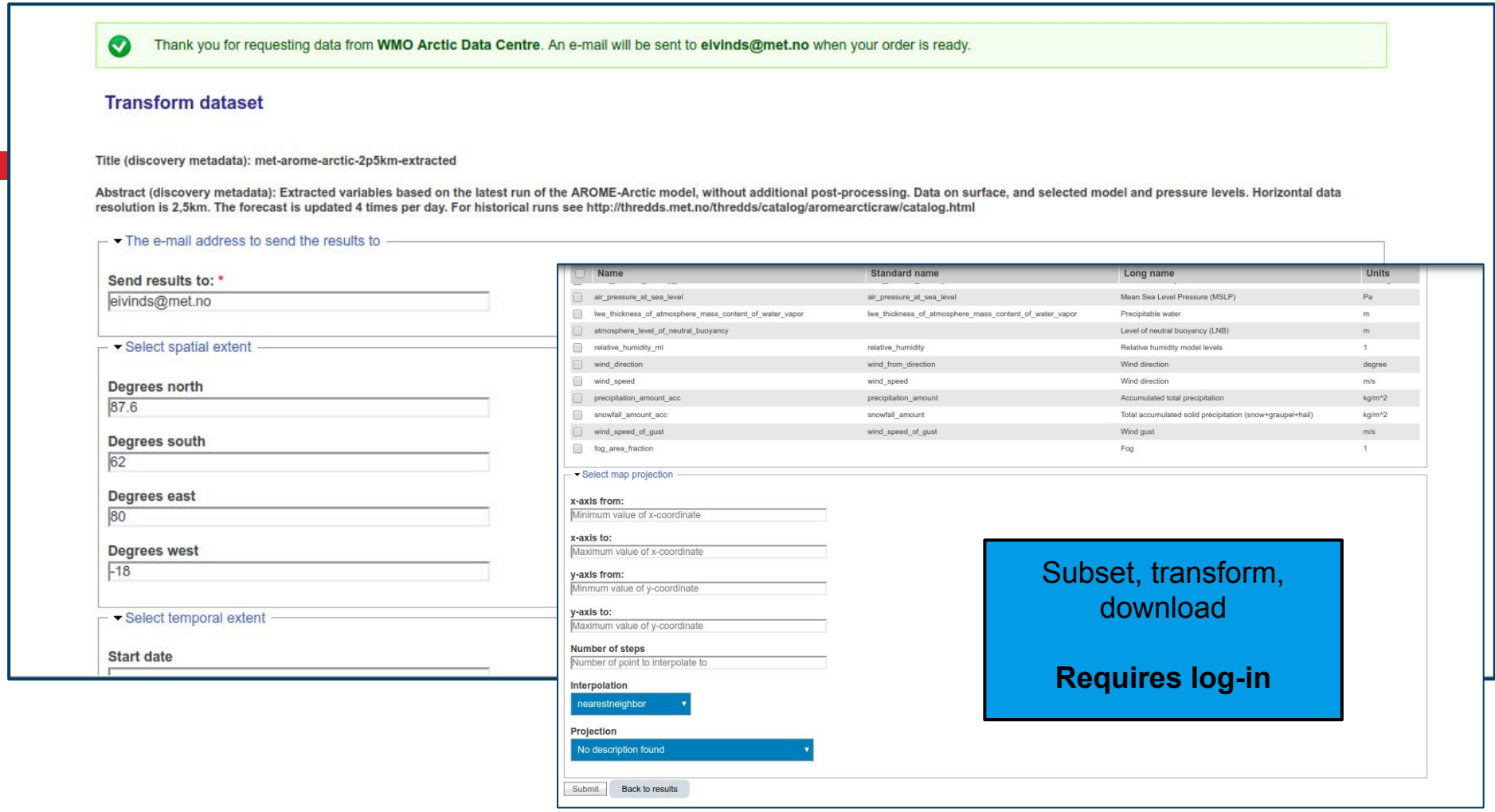
Inspect metadata

Transform, subset, extract..
(Requires OpenDAP)

Visualize
(Requires wms access)




arome arctic extracted 2 5km latest.nc
downward_momentum_flux_in_air
Fog
snowfall_amount
precipitation_amount
Level of neutral buoyancy (LNB)
snowfall_amount
rainfall_amount
atmosphere_boundary_layer_thickness
atmosphere_level_of_free_convection_wrt_surface
atmosphere_lifting_condensation_level_wrt_surface
low_type_cloud_area_fraction
atmosphere_convective_inhibition
2018-05-02T18:00:00.000Z
Back to results
Basket
Reset
Visualization..


Thank you for requesting data from WMO Arctic Data Centre. An e-mail will be sent to eivinds@met.no when your order is ready.
Transform dataset
Title (discovery metadata): met-arome-arctic-2p5km-extracted
Abstract (discovery metadata): Extracted variables based on the latest run of the AROME-Arctic model, without additional post-processing. Data on surface, and selected model and pressure levels. Horizontal data resolution is 2,5km. The forecast is updated 4 times per day. For historical runs see http://thredds.met.no/thredds/catalog/aromearcticraw/catalog.html
The e-mail address to send the results to
Send results to: *
eivinds@met.no
Select spatial extent
Degrees north
87.6
Degrees south
62
Degrees east
80
Degrees west
-18
Select temporal extent
Start date
Name
Standard name
Long name
Units
air_pressure_at_sea_level
air_pressure_at_sea_level
Mean Sea Level Pressure (MSLP)
Pa
lwe_thickness_of_atmosphere_mass_content_of_water_vapor
lwe_thickness_of_atmosphere_mass_content_of_water_vapor
Precipitable water
m
atmosphere_level_of_neutral_buoyancy
Level of neutral buoyancy (LNB)
m
relative_humidity_ml
relative_humidity
Relative humidity model levels
1
wind_direction
wind_from_direction
Wind direction
degree
wind_speed
wind_speed
Wind direction
m/s
precipitation_amount_acc
precipitation_amount
Accumulated total precipitation
kg/m^2
snowfall_amount_acc
snowfall_amount
Total accumulated solid precipitation (snow+graupel+hail)
kg/m^2
wind_speed_of_gust
wind_speed_of_gust
Wind gust
m/s
fog_area_fraction
Fog
1
Select map projection
x-axis from:
Minimum value of x-coordinate
x-axis to:
Maximum value of x-coordinate
y-axis from:
Minmum value of y-coordinate
y-axis to:
Maximum value of y-coordinate
Number of steps
Number of point to interpolate to
Interpolation
nearestneighbor
Projection
No description found
Submit
Back to results
Subset, transform, download
Requires log-in

Web/Data services open issues

- Produce metadata records for flagship products (Pri 1)
- Ingest metadata for other relevant products
- Node web pages progress
- Do we need a data management plan?
- Other thoughts?

Thank you

eivinds@met.no

NOTES

About the GCW Data Portal

The GCW Data Portal, or catalogue, is dedicated to data management and to providing specific information on datasets. The data management component is an enabling service in the sense that it identifies relevant datasets and their locations and provides an interface that can be used in the evaluation of GCW data and products. The portal will support simple visualization (generation of maps or diagrams like time series) and transformations such as reformatting and re-projection of data, *if the data are served through the appropriate interfaces and forms*.

GCW data management shall integrate datasets and provides access to data and information on past, present, and future cryospheric conditions. To achieve these results, the data portal must be attached to real-time and near-real-time data management systems and to data archives. While interfacing with existing data management systems, GCW respects partnership and ownership. GCW itself will rely on distributed data management technologies and partners (e.g. CryoNet stations) to establish the GCW catalogue. This process will create a unified interface to datasets in an otherwise fragmented terrain. No information on data (discovery metadata) will be kept in the GCW catalogue without an agreement with the data producer/data owner.

GCW data management follows a metadata driven approach in which datasets are described through discovery metadata exchanged between contributing data centers and the GCW catalogue.

In the GCW context, at least two types of metadata are relevant. One is “discovery” or index metadata identifying general characteristics of a dataset, including what was measured where and when, potential restrictions on data use, data custodians, and the available interfaces to the actual dataset. This is the type of metadata that will be exchanged within GCW. Another type, “use” metadata, is required when a user has accessed a dataset and begins to use it. Such metadata typically include a specification of variables, units used, how missing values are encoded, and other details on the

How to connect your data centre

The GCW Data Portal is a metadata driven data portal. This implies that data are hosted and served by contributing data centres which expose discovery metadata on the datasets. Once initiated, the GCW Data Portal regularly (once daily) harvests discovery metadata from the contributing data centres and ingests this in the GCW Data Catalogue which is integrated in this site. Provided the data is provided in the appropriate form (encoding) the GCW Data Portal is developing software to transform and combine datasets as well as extracting the most recent observations for ingestion into WMO GTS if required by the GCW community.

In order to connect your data centre to the GCW Data Portal an OAI-PMH end point serving either GCMD DIF or ISO19115 discovery metadata is required. If ISO19115 is used, discovery metadata should include GCMD Science Keywords to describe the parameters measured. If your data centre is hosting much data and GCW relevant data is mixed between other data, a dedicated OAI-PMH set is welcome to simplify the harvest process for the portal. When you serve GCMD DIF discovery metadata this is quite straightforward if the standard is used. If you use ISO19115 we require to add GCMD Science Keywords to describe the content of a dataset. Furthermore we require URLs to be identified using the OSGeo keywords for catalogue Interoperability.

Other technologies (OGC CSW and OpenSearch) are explored and to a certain extent support, but the simplest way forward is to use OAI-PMH.

For data we build services that rely on data encoded according to the Climate and Forecast Convention. This can be NetCDF file, but preferable data served through OPeNDAP as OPeNDAP allows us to do data streaming without downloading files. When preparing NetCDF (or other data) we recommend that the Attribute Convention for Dataset Discovery (ACDD) is used to include discovery metadata in the files. If you prepare NetCDF/CF files with ACDD we offer a compliance checker that you can access through this site at https://gcw.met.no/dataset_validation/form. Discovery data

The concept of metadata

GCW Portal metadata are divided in 4 categories which are briefly described in Table 1. Among these 4 categories, data providers or supporting data centres are supposed to provide 3 of them. Further below in this document, there are recommendations on how to provide these.

Table 1: Brief introduction to different types of metadata.

Type	Purpose	Description	Examples
Discovery metadata	Used to find relevant data	Discovery metadata are also called index metadata and are a digital version of the library index card. It describes who did what, where and when, how to access data and potential constraints on the data. It shall also link to further information on the data like site metadata. GCW is required to expose this information through WMO Information System as well. Discovery metadata are thus WIS metadata, although the GCW portal can translate to WIS for those not using WMO standards directly.	ISO19115 GCMD DIF
Use metadata	Used to understand data found	Use metadata are describing the actual content of a dataset and how it is encoded. The purpose is to enable the user to understand the data without any further communication. It describes content of variables using standardised vocabularies, units of variable, encoding of missing values, map projections etc.	Climate and Forecast Convention BUFR GRIB
Configuration metadata	Used to tune portal services for datasets for users.	Configuration metadata are used to improve the services offered through a portal to the user community. This can be e.g. how to best visualise a product. This information is maintained by the GCW portal and is not covered by discovery or use metadata standards.	
Site metadata	Used to understand data found	Site metadata are used to describe the context of observational data. It describes the location of an observation, the instrumentation, procedures etc. To a certain extent it overlaps with discovery metadata, but more so it really extends discovery metadata. Site metadata can be used for observation network design.	WIGOS OGC O&M