

# **Data systems in the Arctic**

## **Results from INTAROS and plans for further development**

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# Outline

1. Main achievements
2. Expected impact
3. Plans for future development

# Main achievements

- Data value chain

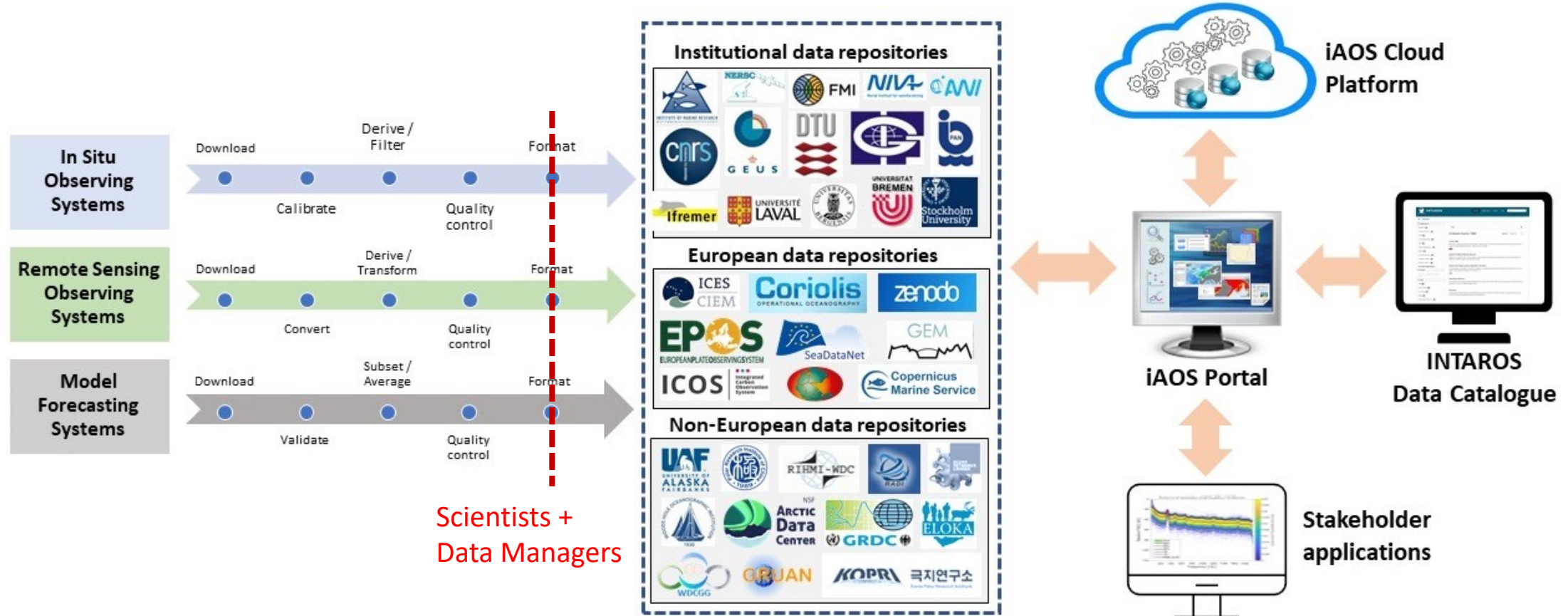
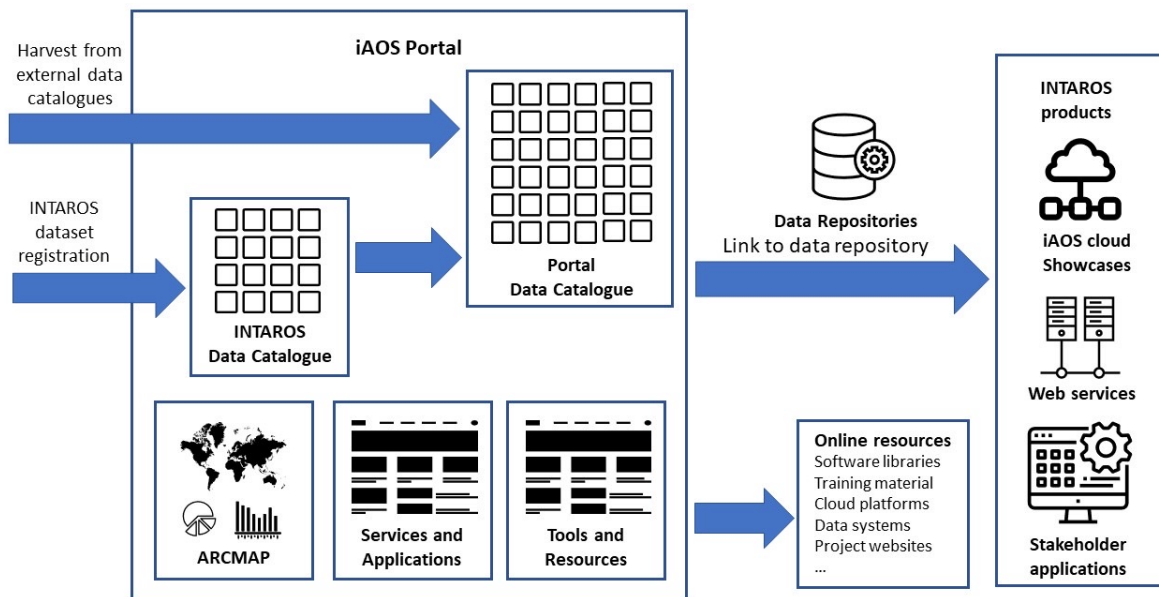


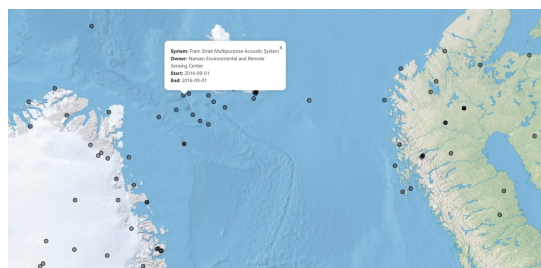
Figure 1. Data value chains for integrating INTAROS data into the various iAOS subsystems, overlaid the competences of SDMG in different parts of the data value chain (source: INTAROS Deliverable D5.12).

# Main achievements

## • Data catalog and portal platform

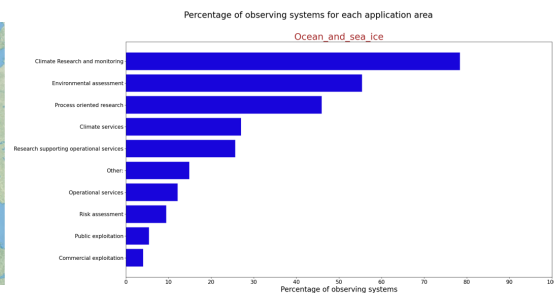


## Major components of the iAOS Portal and their interconnections.

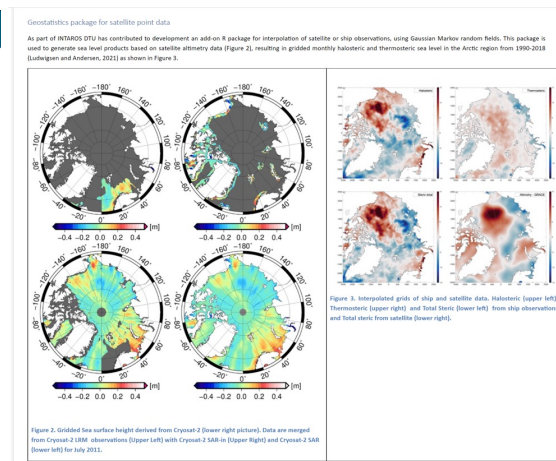
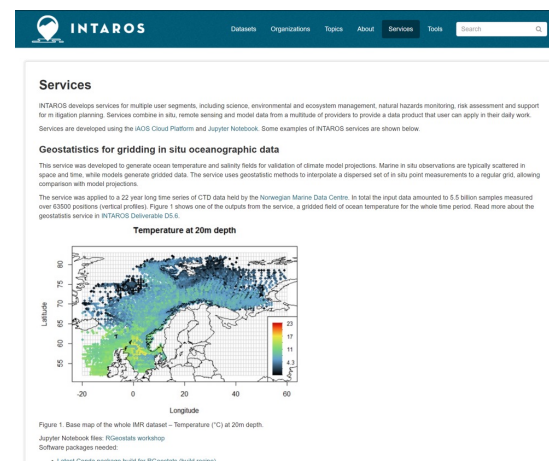
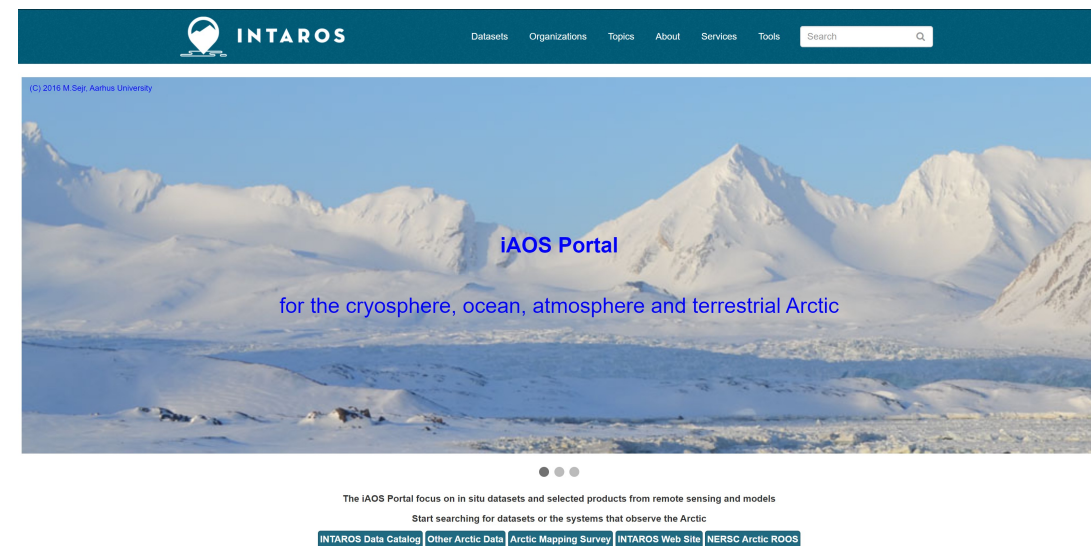


INTAROS

ARCMAP



<https://intaros-portal.nersc.no/>



Promotion of services and tools

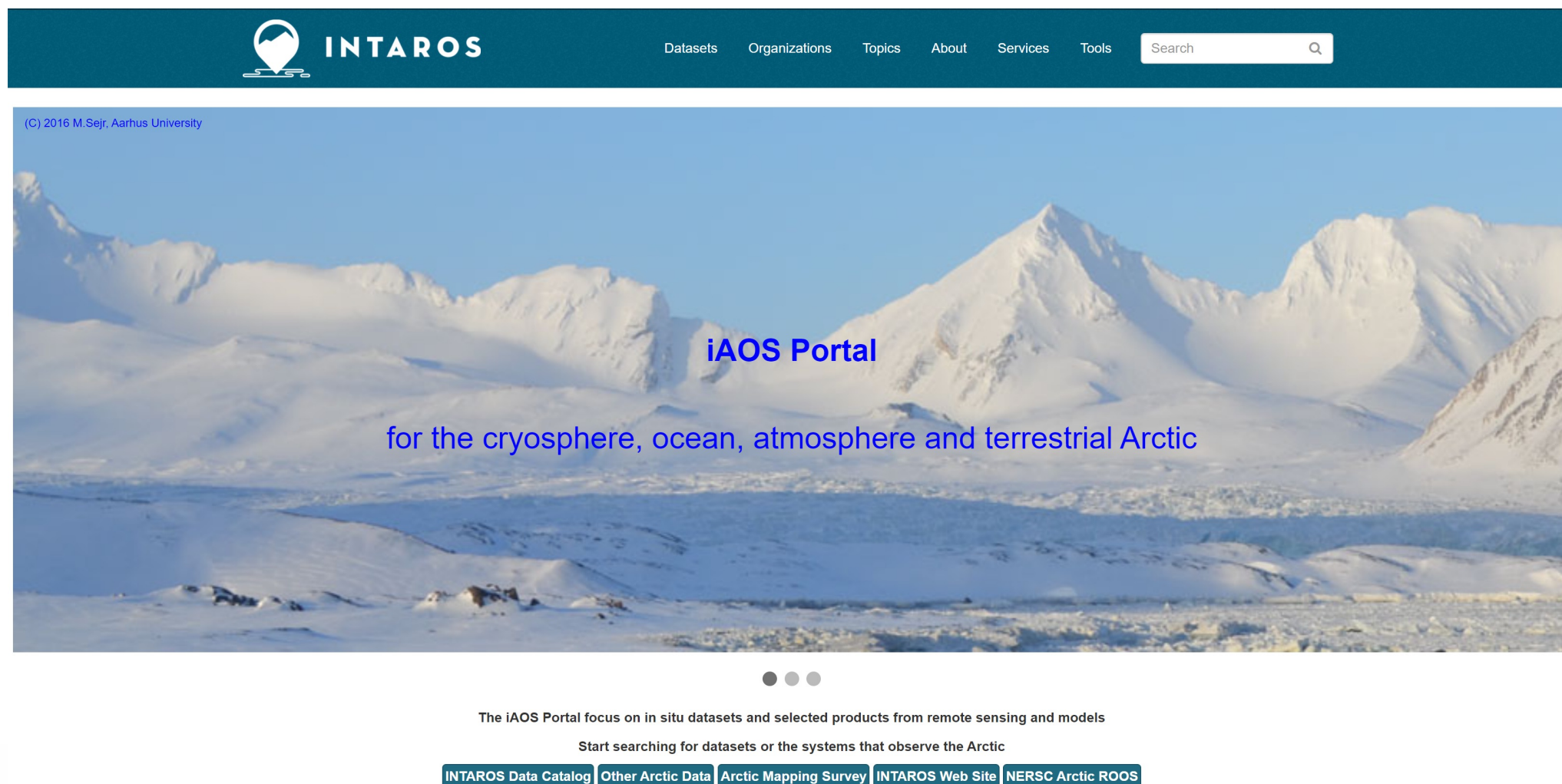




# Main achievements

- **Data catalog and portal platform**

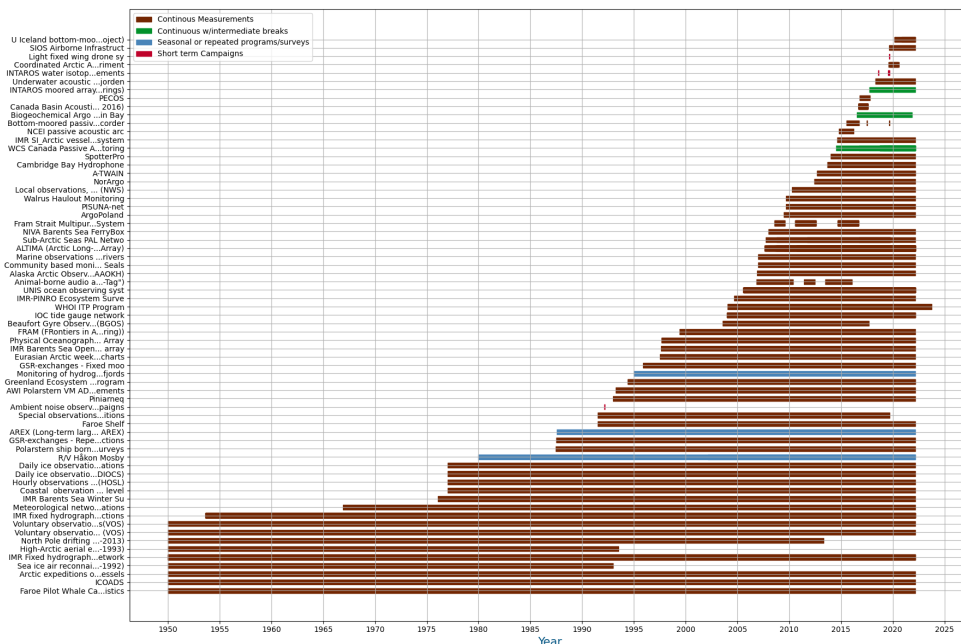
<https://intaros-portal.nerisc.no/>



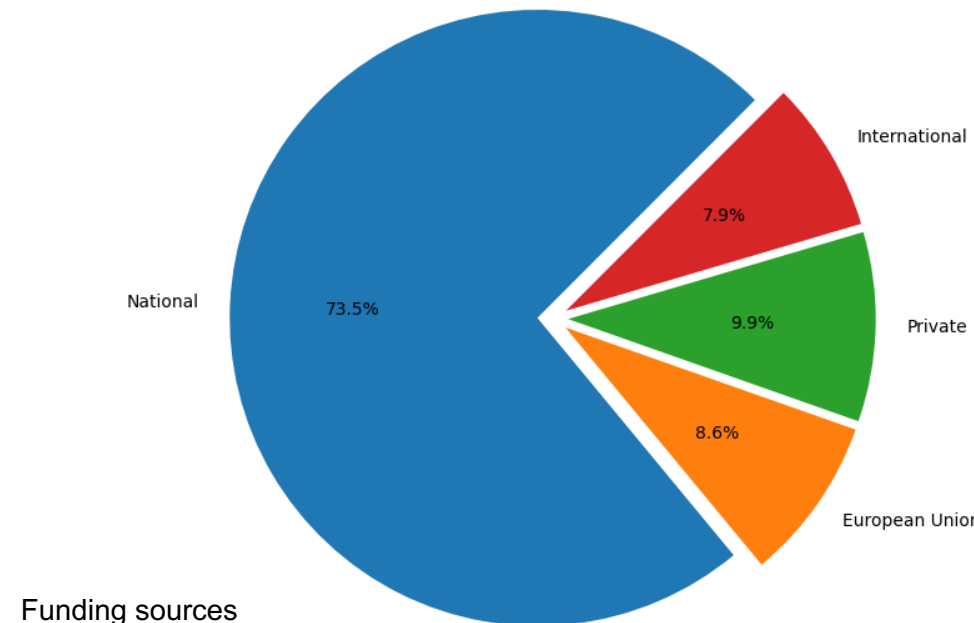
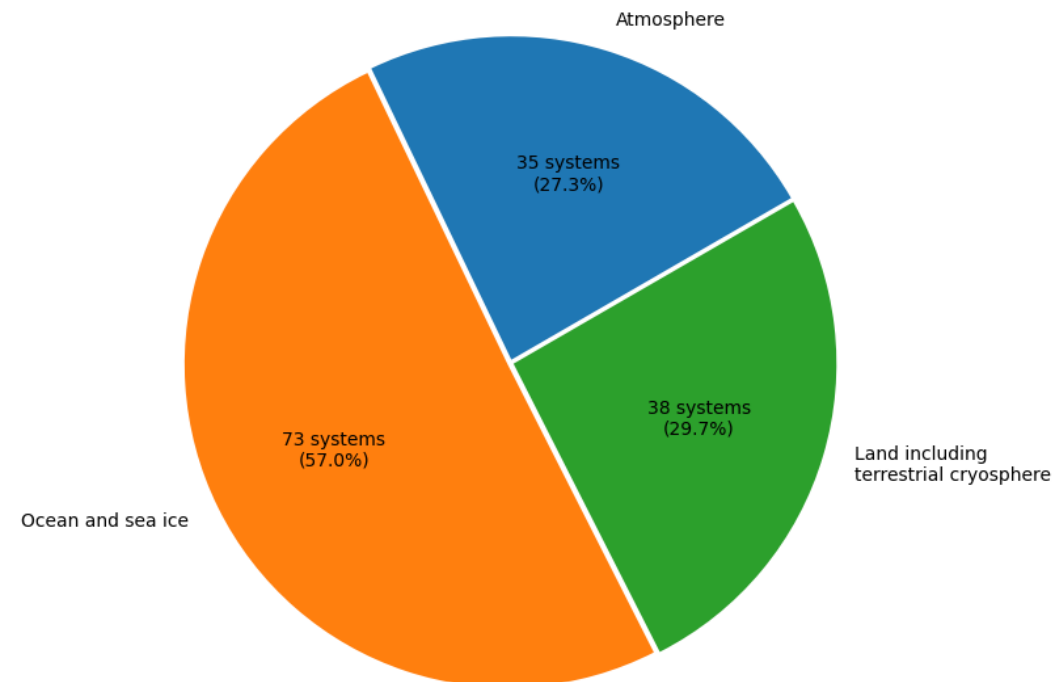
# Main achievements

- Number of observing systems is steadily increasing
  - 2018: 49
  - 2020: 105
  - 2022: 128
- Thanks to all respondents!
- And to the ARCMAP support team!
- Daily plots at <https://ci.nerisc.no/client/plots.html>
- Maintained by NERSC

Observing  
regularity



Total number of systems registered : 128

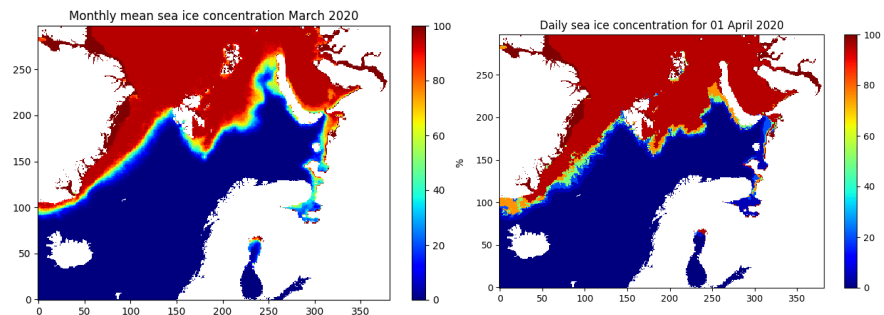


Funding sources

# Main achievements

## • Data catalog and portal platform

- Promotion spaces for
  - Showcases/Applications
  - Cloud services
  - WPS services
  - Geostatistics libraries
- Open for new entries
- Marketplace for future iAOS developments
- Maintained by NERSC



## Services

INTAROS develops services for multiple user segments, including science, environmental and ecosystem management, natural hazards monitoring, risk assessment and support for mitigation planning. Services combine in situ, remote sensing and model data from a multitude of providers to provide a data product that user can apply in their daily work.

Services are developed using the iAOS Cloud Platform and Jupyter Notebook. Some examples of INTAROS services are shown below.

### Geostatistics for gridding in situ oceanographic data

This service was developed to generate ocean temperature and salinity fields for validation of climate model projections. Marine in situ observations are typically scattered in space and time, while models generate gridded data. The service uses geostatistic methods to interpolate a dispersed set of in situ point measurements to a regular grid, allowing comparison with model projections.

The service was applied to a 22 year long time series of CTD data held by the Norwegian Marine Data Centre. In total the input data amounted to 5.5 billion samples measured over 63500 positions (vertical profiles). Figure 1 shows one of the outputs from the service, a gridded field of ocean temperature for the whole time period. Read more about the geostatistics service in INTAROS Deliverable D5.6.

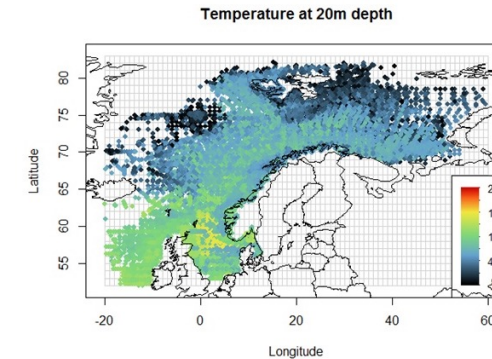


Figure 1. Base map of the whole IMR dataset - Temperature (°C) at 20m depth.

Jupyter Notebook files: RGeostats workshop

Software packages needed:

- Latest Conda package build for RGeostats (build recipe)
- Latest Conda package build for Rintaros (build recipe)

Developer: ARMINES

### Analysis of passive acoustic data

This service processes and characterizes passive acoustic data, and produces spectrograms and noise statistics plots that can be used for analysis in combination with time series of satellite remote sensing derived parameters. It is implemented using the R version of the open source PAMGuide software package, and has extended support for new data formats (NetCDF) and data access through the OPeNDAP protocol.

The service has been tested with datasets from several sources (NERSC, CNRS, PANGAEA). Figure 2 shows an example of passive acoustic collected by CNRS in Kongsfjorden, Svalbard, as part of the INTAROS field campaigns. The spectrum is dominated by low-frequency noise below 10 Hz. Local peaks around 10 Hz and 80 Hz are also seen, which could be mammal vocalization. Intermittent broad-band signals are also seen in the spectrogram. Read more about the passive acoustic service in INTAROS Deliverable D5.7.

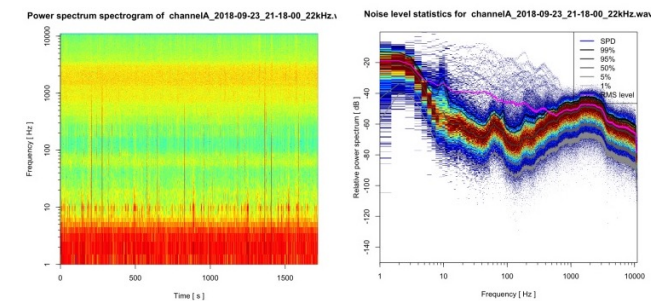


Figure 2. Examples of power spectrum spectrogram (left) and noise statistics plot (right) generated by the passive acoustic service when analysing acoustic data collected in Kongsfjorden, Svalbard, during the INTAROS project.



# Main achievements

- **Data catalog and portal platform**

- Window to INTAROS datasets
- Currently: 147 datasets
  - WP2: 60
  - WP3: 27
  - WP4: 15
  - WP5: 12
  - WP6: 10
  - Russian partners: 23

From 38 organisations

- Same platform as iAOS portal
- Share metadata schema
- Multi-faceted search
- Maintained by NERSC

The screenshot shows the INTAROS Data Catalogue website. The header is dark blue with the INTAROS logo and navigation links: Datasets, Organizations, Topics, About, and a search bar. Below the header, there's a 'Search data' section with a search bar containing 'E.g. environment' and a magnifying glass icon. Below the search bar are 'Popular tags' for CBM, citizen science, and ocean temperature. A section titled 'INTAROS Data Catalogue statistics' shows 147 datasets, 38 organizations, and 0 topics. Below this is a section titled 'Community Based Monitoring datasets and programs' with text about INTAROS's work with local communities and citizen science programs in the Arctic. At the bottom of this section is a map showing seismic activity with a color scale for ground motion. To the right of the main content is a large map of the Arctic region with concentric circles labeled 'Land and atmosphere', 'Ocean and sea ice', and 'Coastal Greenland'. The map also shows various basins and straits like the Canadian Basin, Eurasian Basin, Kara Sea, Barents Sea, Fram Strait, and Norwegian Sea.

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

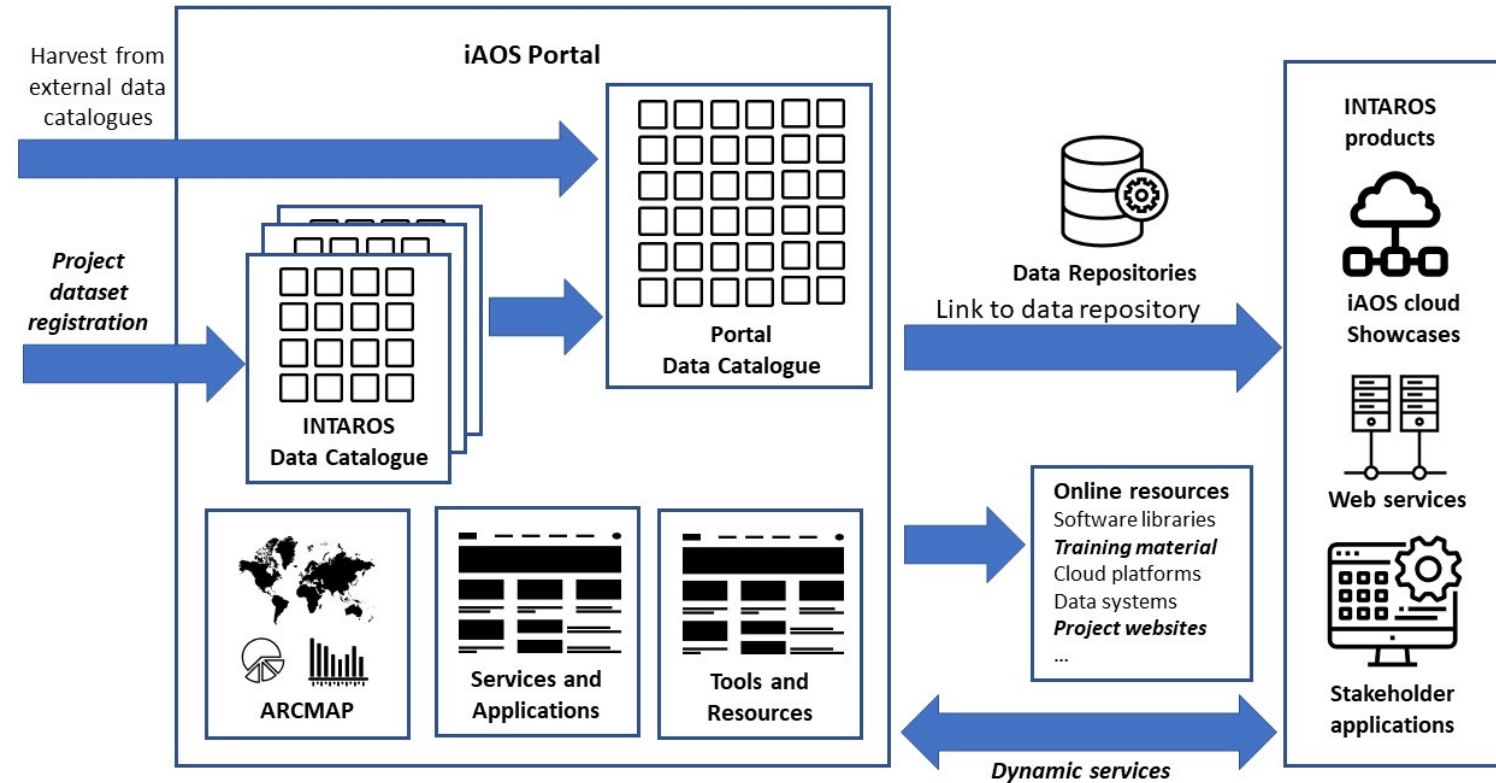


# Expected impact

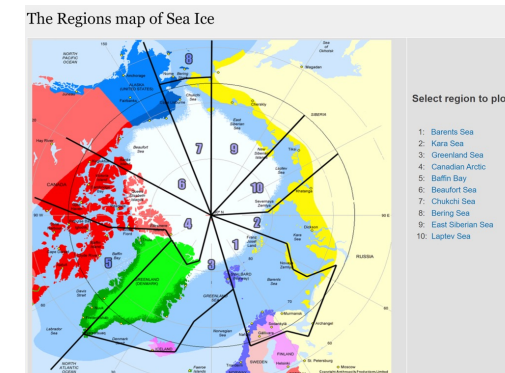
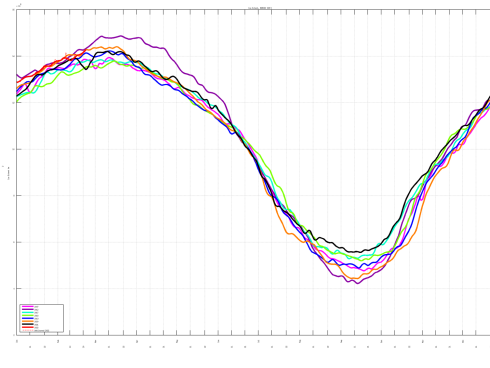
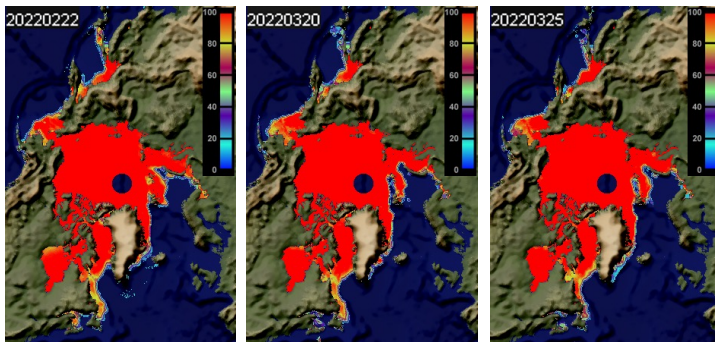
- iAOS portal and INTAROS data catalogue offers a way to promote datasets, services, applications and other resources
  - Open, accessible through a common web browser
  - Standard API for metadata harvesting
- Portal and data catalog platform will sustain the iAOS portal and INTAROS Data Catalog
  - Open-source framework with large user community
  - Modular architecture allows for extension
  - Many plugins ready for use (e.g. metadata harvesting)
  - New plugins can draw upon well documented APIs and support from user community
- ARCMAP provides a unique system for assessing Arctic in situ observing capacity
  - Supports open APIs for data sharing (according to FAIR, licensed)
  - Adaptable for other areas

# Plans for future development

- Extending the iAOS portal
  - Open up for new projects and initiatives
  - Make more datasets visible
  - Support capacity building
  - Promote new services, applications, tools and other resources
  - Offer dynamic services



## NERSC Arctic Sea Ice Observing System – contribution to Arctic ROOS



# Plans for future development

The iAOS Portal focus on in situ datasets and selected products from remote sensing and models

Start searching for datasets or the systems that observe the Arctic

INTAROS Data Catalog iAOS Portal Catalog ARCMAP Survey NMDC

Test selected services and applications

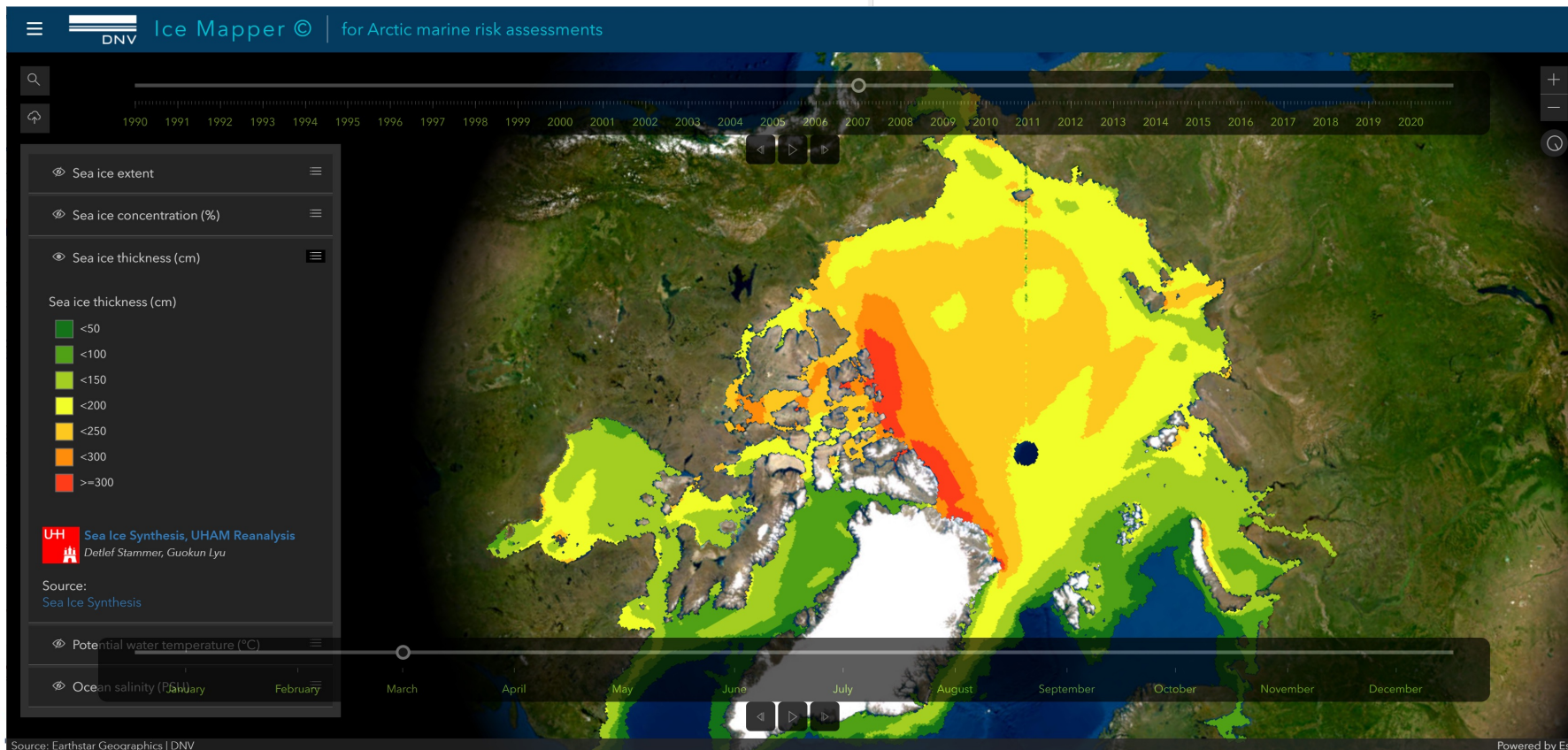
NERSC WPS DNV IceMapper NERSC IceObs

Projects and initiatives linked to iAOS

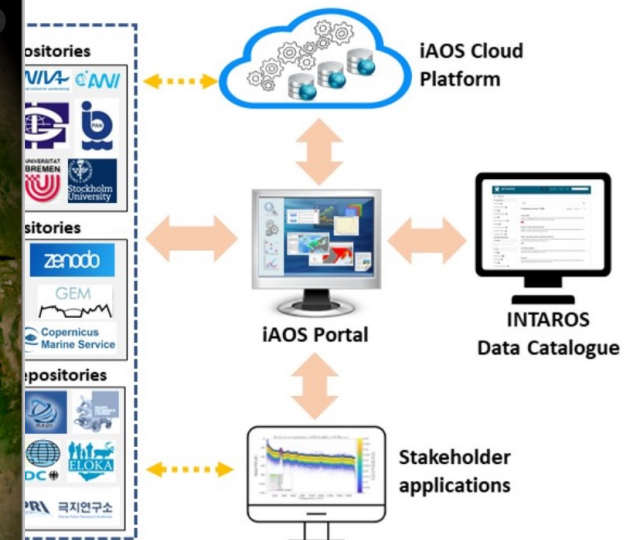
INTAROS CAATEX CAPARDUS DAS FloatYourBoat UAK

- Extending the iAOS portal
  - Promote new services, applications tools and other resources

## DNV IceMapper



and other datasets of relevance to our targeted stakeholders. We build services for the public and private sector.

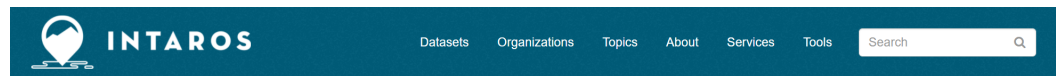




# Plans for future development

- Extending the iAOS portal
  - Offer dynamic services

## NERSC WPS



WPS services

### What is NERSC WPS

Nersc WPS offers 4 services:

- CMEMS ice statistics for 1 month: produces a minimum, mean and maximum ice cover image, a mean ice cover NetCDF file and a gif video showing the daily ice cover.
- University of Bremen ice statistics for 1 month: produces a minimum, mean and maximum ice cover image, a mean ice cover NetCDF file and a gif video showing the daily ice cover.
- CMEMS ice development for 3 months: produces a gif video showing the daily ice cover for the month chosen and the next 2 months.
- University of Bremen ice development for 3 months: produces a gif video showing the daily ice cover for the month chosen and the next 2 months.

Services are based on CMEMS daily ice charts for the Svalbard region, and daily ice concentration data from the University of Bremen.

The Bremen University data does not start until July 2012.

### NERSC WPS process form

Service: CMEMS Ice development for 3 months

Year: 2019

Month: December

Send WPS request

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### NERSC WPS process form

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Send WPS request

WPS services

### NERSC WPS Results page

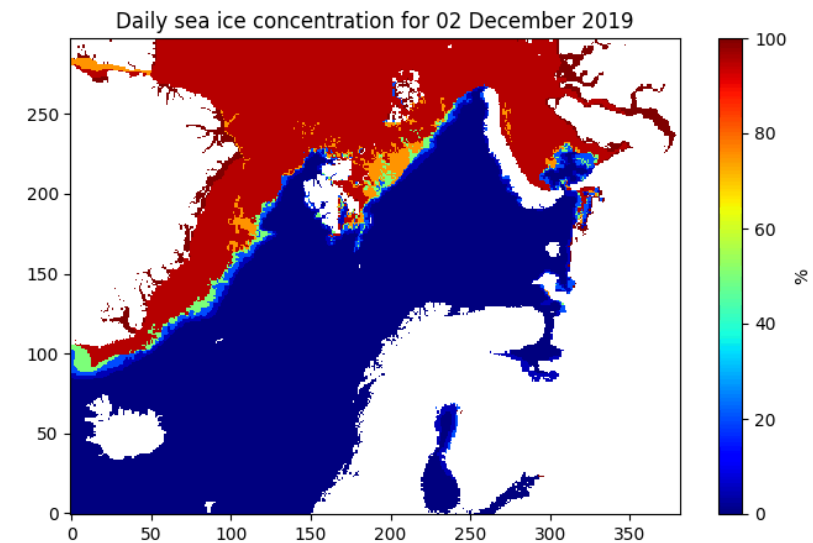
- slides is a gif video showing the daily ice cover for the time period (1 month or 3 months)
- tssic-max is a picture showing the maximum ice cover per area during the month.
- tssic-min is a picture showing the minimum ice cover per area during the month.
- tssic-mean is a picture showing the mean ice cover per area during the month.
- tssic-mean is a NetCDF file containing information about the mean ice cover per area during the month.

### NERSC WPS service

Results

- [http://wps.ad.nersc.no:8080/47817540-aaa2-11ec-9a6d-0242ac110002/slides\\_vrmg89mm.gif](http://wps.ad.nersc.no:8080/47817540-aaa2-11ec-9a6d-0242ac110002/slides_vrmg89mm.gif)

Back to the form page





# Thank you!

