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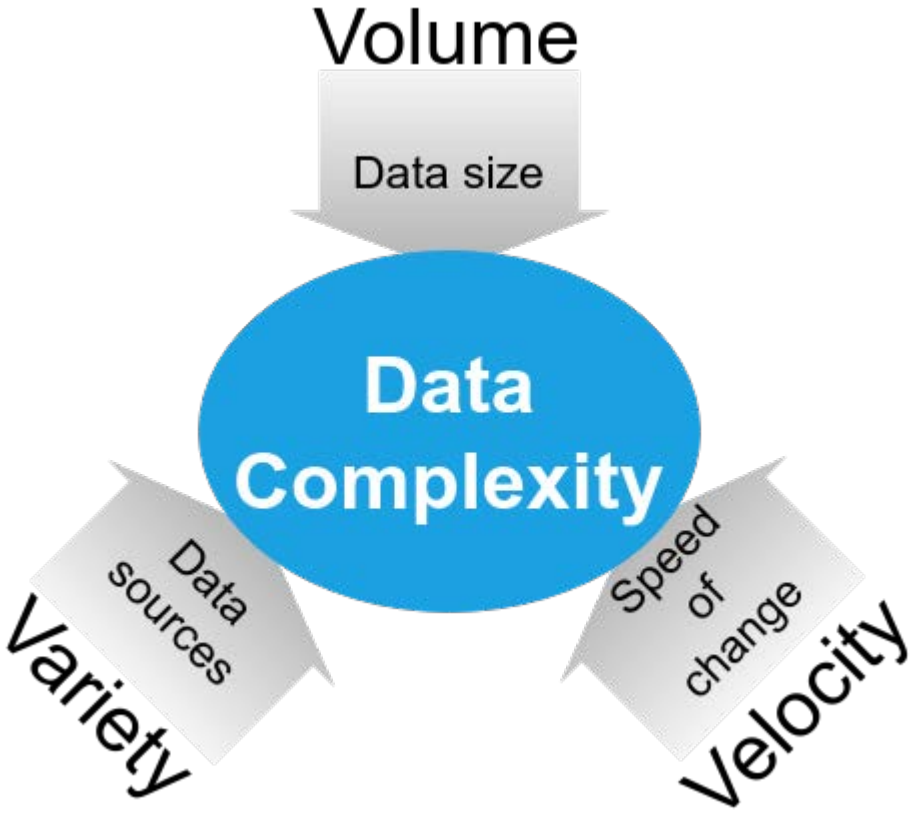
GCW Global Cryosphere Watch

Arctic data management
Emphasising the operational aspects

Øystein Godøy

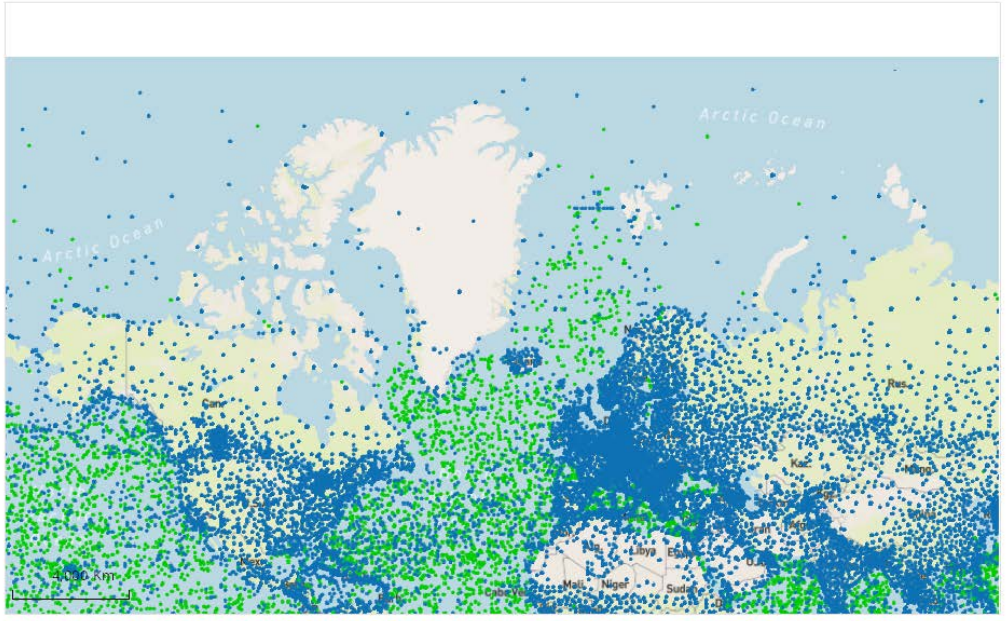
Operational versus scientific data

- Scientific data
  - Process study oriented
  - No harmonisation across sources
  - Timeliness of “no interest”
- Operational data
  - Monitoring
  - Long term
  - Timeliness
  - Harmonisation across sources for
    - Encoding
    - Quality control



What is Arctic Data Management

- The same as all other data management
  - Although often more interdisciplinary
  - with less data is available
- In the Arctic the difference between scientific and operational data is small
  - Much of the monitoring is done by scientific efforts
    - Especially in the ocean



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In situ and remote sensing

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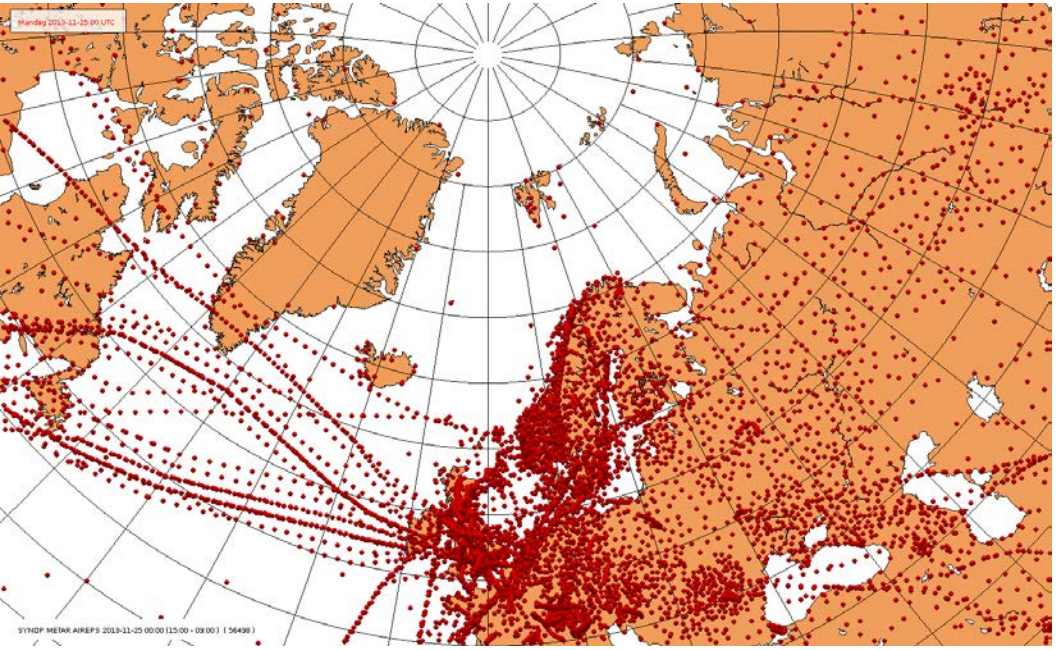

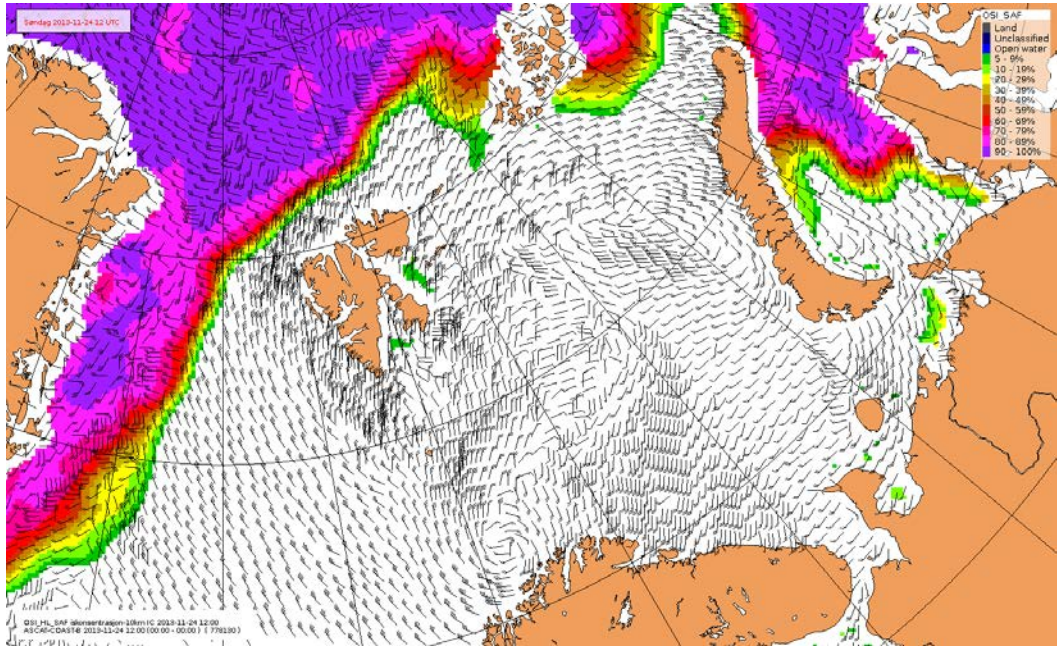

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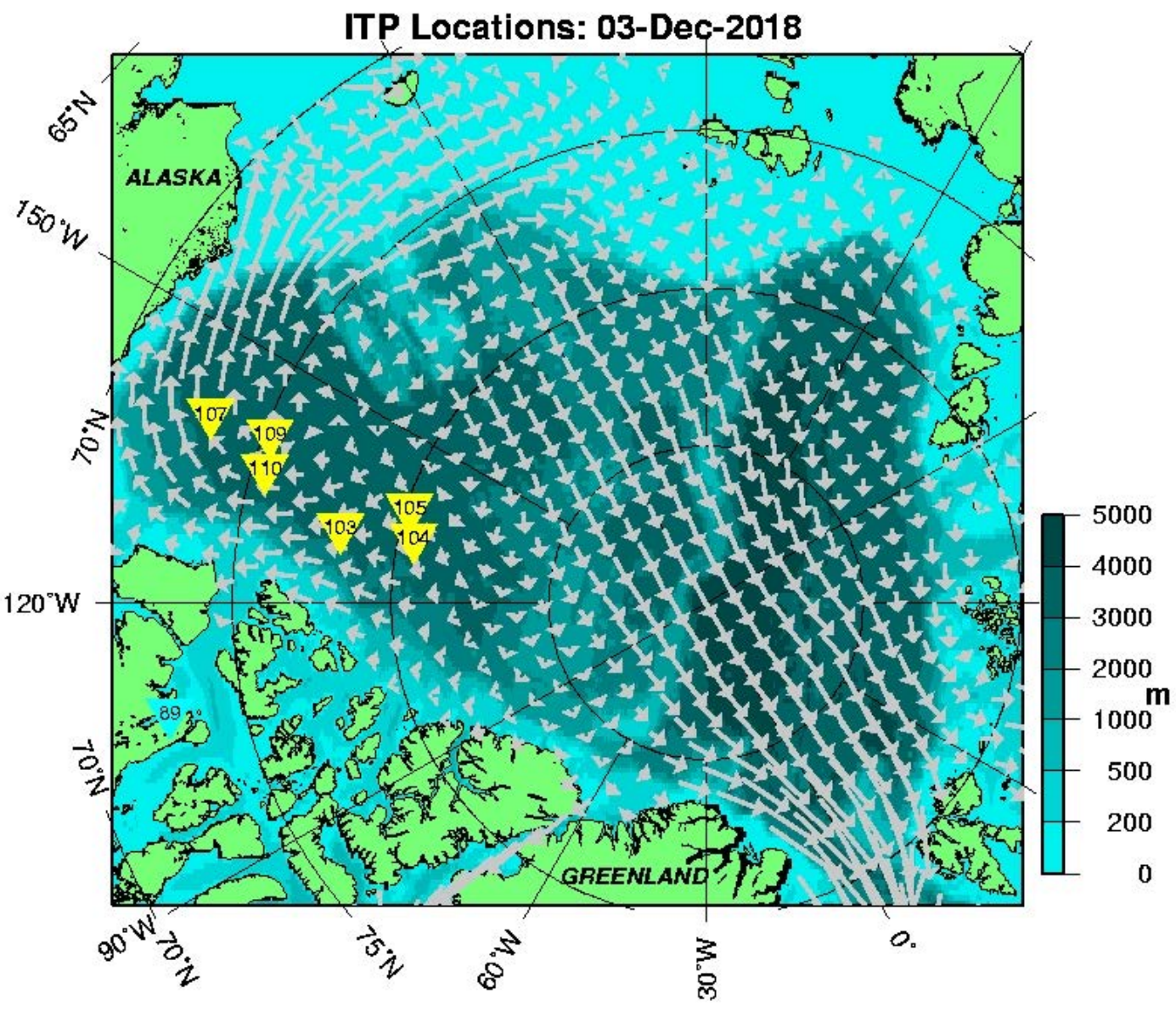

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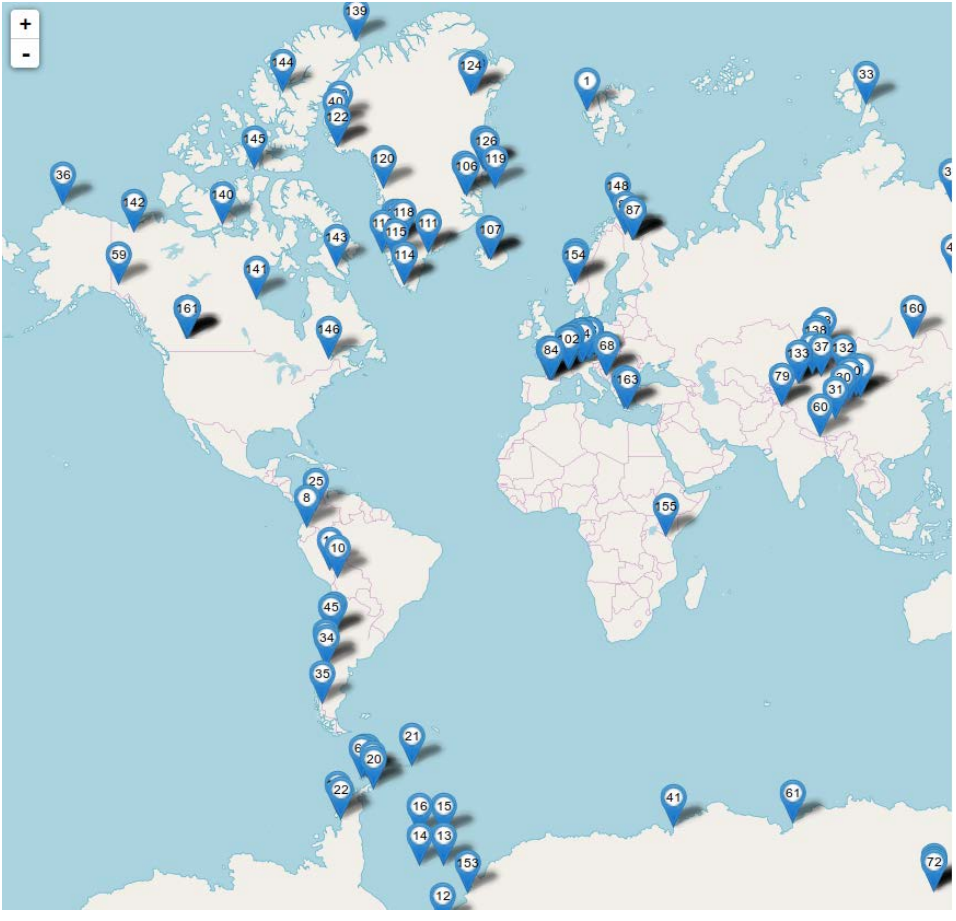
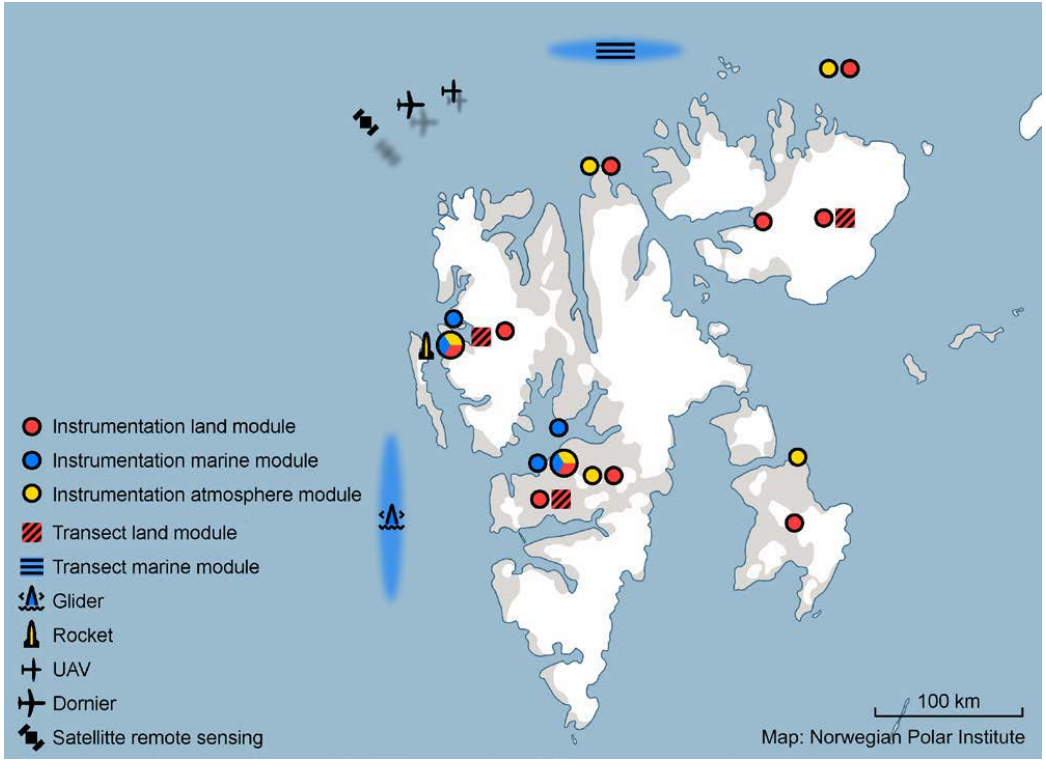
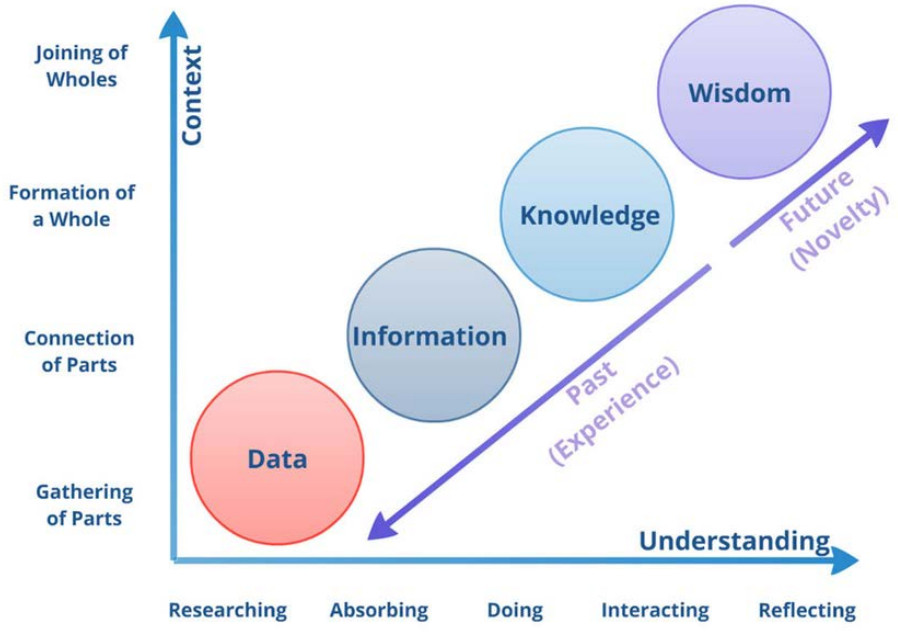




DIKW chain

- How to transition from data to knowledge and understanding...
  - The illustration is a common redrawing of Russ Ackoff “From Data to Wisdom”
    - Journal of Applied Systems Analysis, Volume 16, 1989 p 3-9
- Take home...:
  - Take care of data for the future
  - Data is the basis for knowledge
    - Now and in the future
  - Knowledge based management depends on national, regional and global interaction



http://www.easterbrook.ca/steve/2012/09/what-is-climate-informatics/

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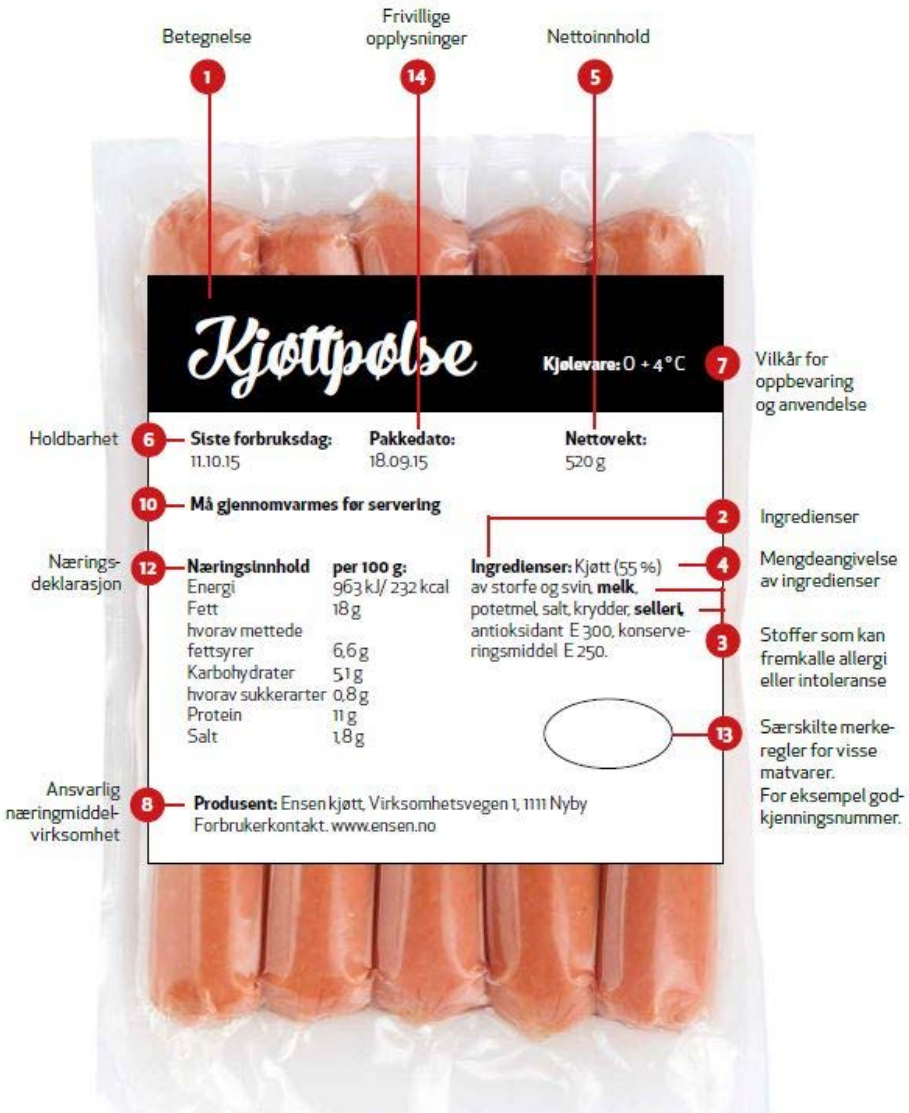
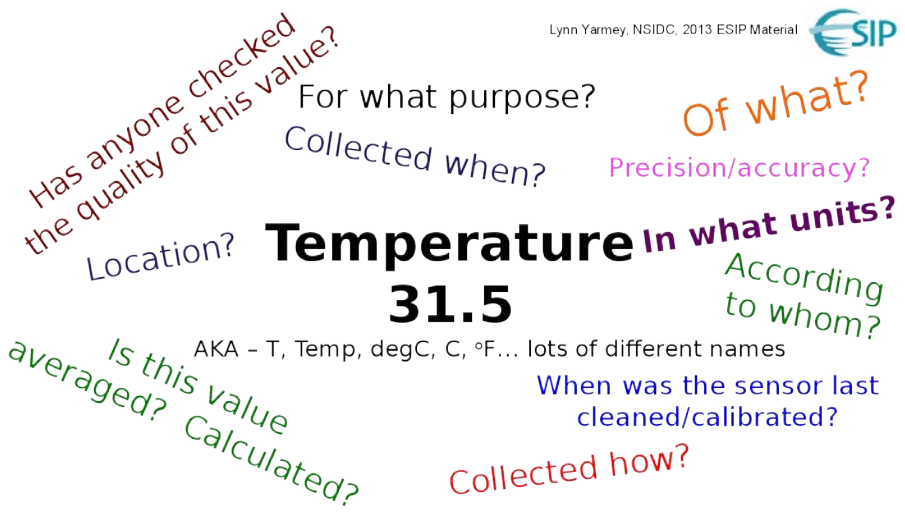
Eksempel på merking



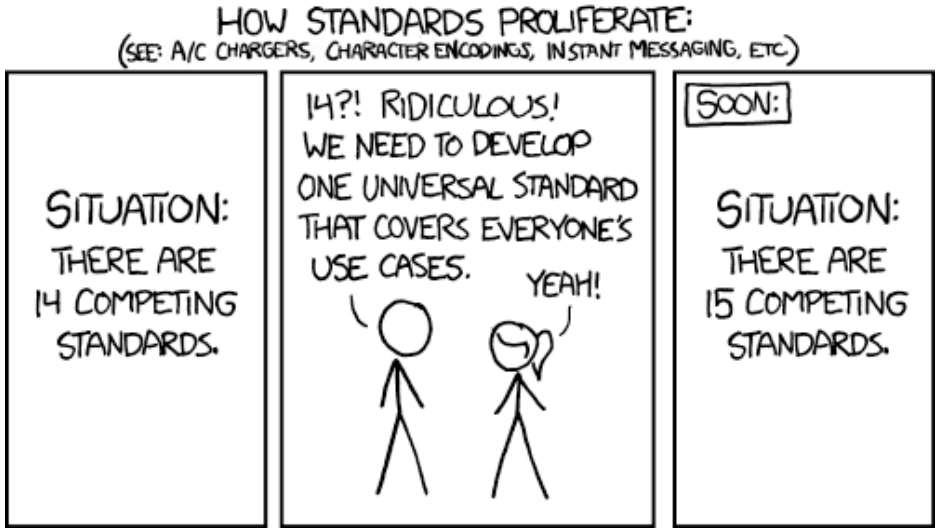
Data in context



- Make data “talk”
  - Standardised documentation
    - e.g. Climate and Forecast convention
- What is a number?
  - Use metadata is required to efficiently reuse data
  - Describe the context of observations using e.g. WIGOS metadata

Use standards

- If you try to develop your data format from scratch, you will forget something.
- Build on the experience and improvements built into the community standards over years of use.
- Tools and analysis software natively support reading community standard data.
- Reduce development effort and support reuse.
- Positive feedback – they are more likely to be adopted by others.



Curt Tilmes, NASA, 2013 ESIP Material

http

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Use self describing data formats

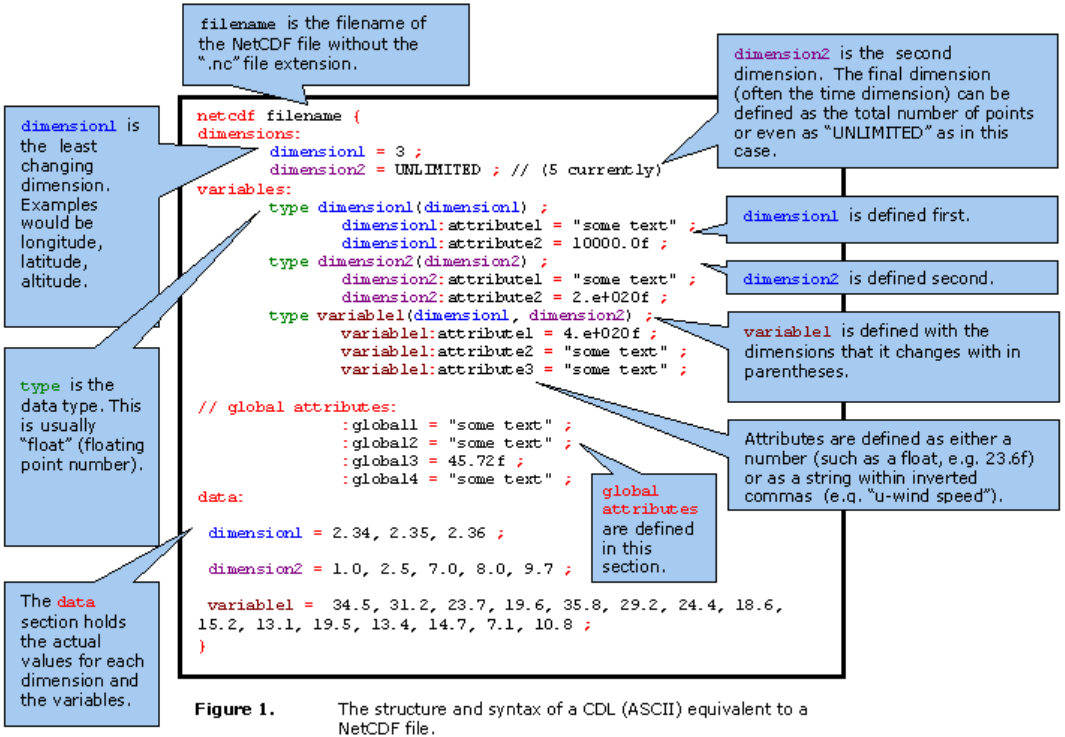

Figure 1. The structure and syntax of a CDL (ASCII) equivalent to a NetCDF file.

- Self-describing data formats have become a well accepted way of archiving and disseminating operational and scientific data.
- Before self-describing data formats became widely used, each project often invented their own data formats, often raw binary or even ASCII.
- These approaches had a number of problems:
  - Machine dependent byte ordering or floating point organizations
  - Required a 'key' to be able to open the file and read the right data.
  - A new custom reader is needed for each different data organization. Working in a new language could be very difficult since you have to redevelop the reader anew.

Curt Tilmes, NASA, 2013 ESIP Material

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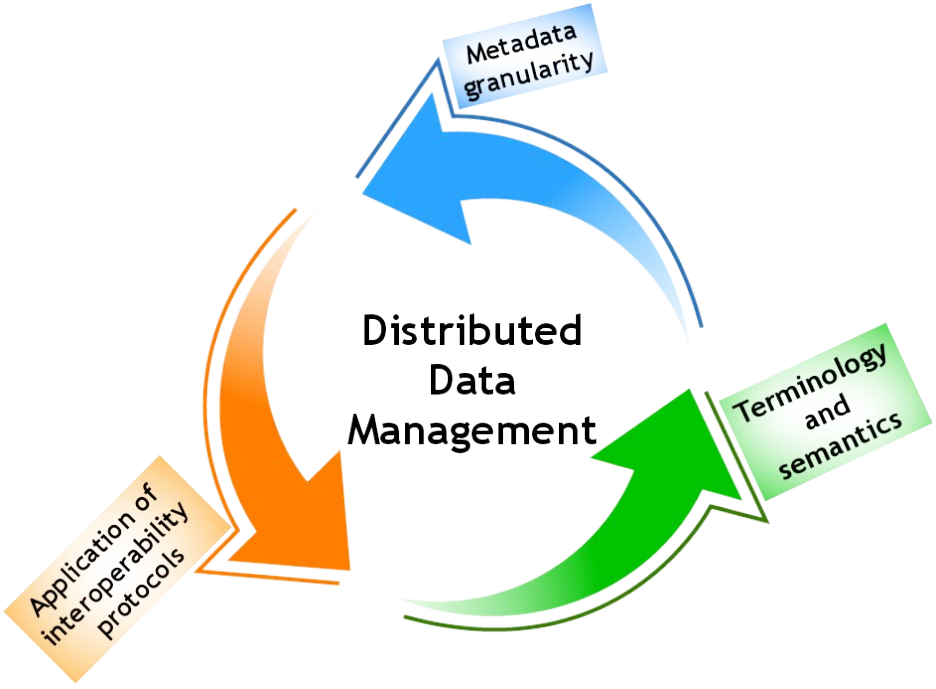
Types of metadata

Type	Purpose	Description	Examples
Discovery	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.	ISO19115 GCMD DIF
Use	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	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	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

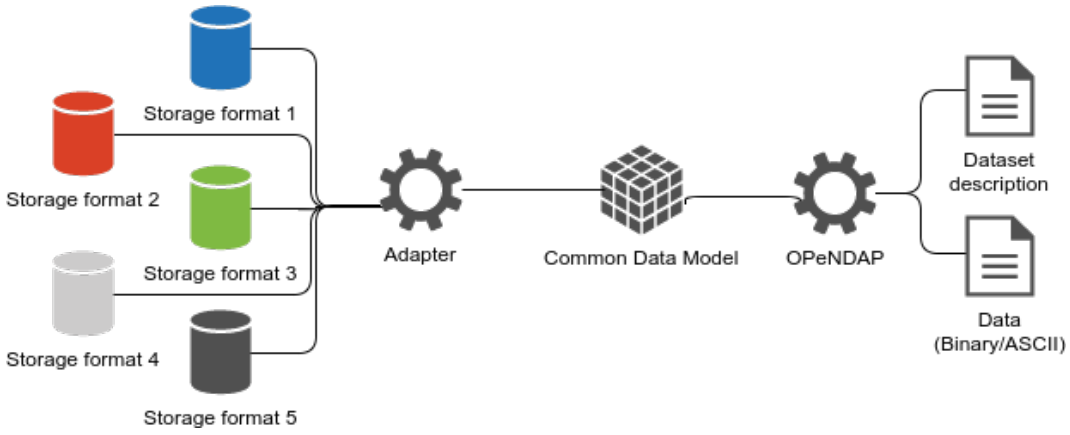
Challenges

- Interoperability
  - Metadata
    - Protocols (✓)
    - Structures (✓)
    - Semantics/terminology (-)
  - Data
    - Protocols (✓)
    - Formats (-)
    - Semantics/terminology (-)
    - Common data model (-)



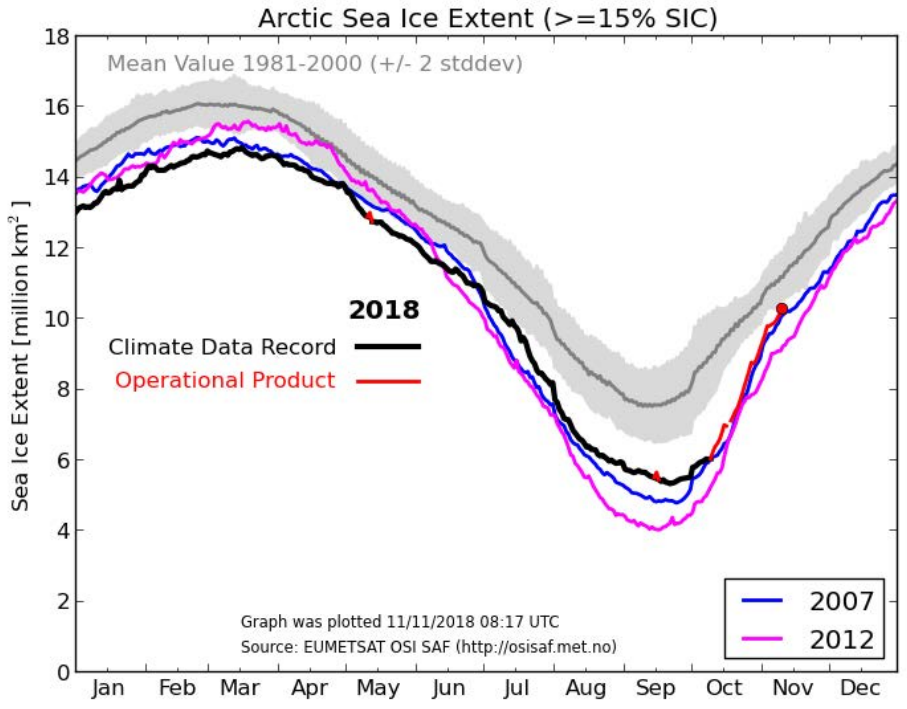
GCW Interoperability with CryoNet stations

- Dedicated effort with WSL/SLF
  - Software for discovery and data interoperability developed in Davos
  - Solution capable of integration a wide range of input streams, including RDBMS
- Takes care of data from measurement to published data where it can be picked up by services



Versioning of operational data

- Different datasets
- But connected
  - Through identifiers



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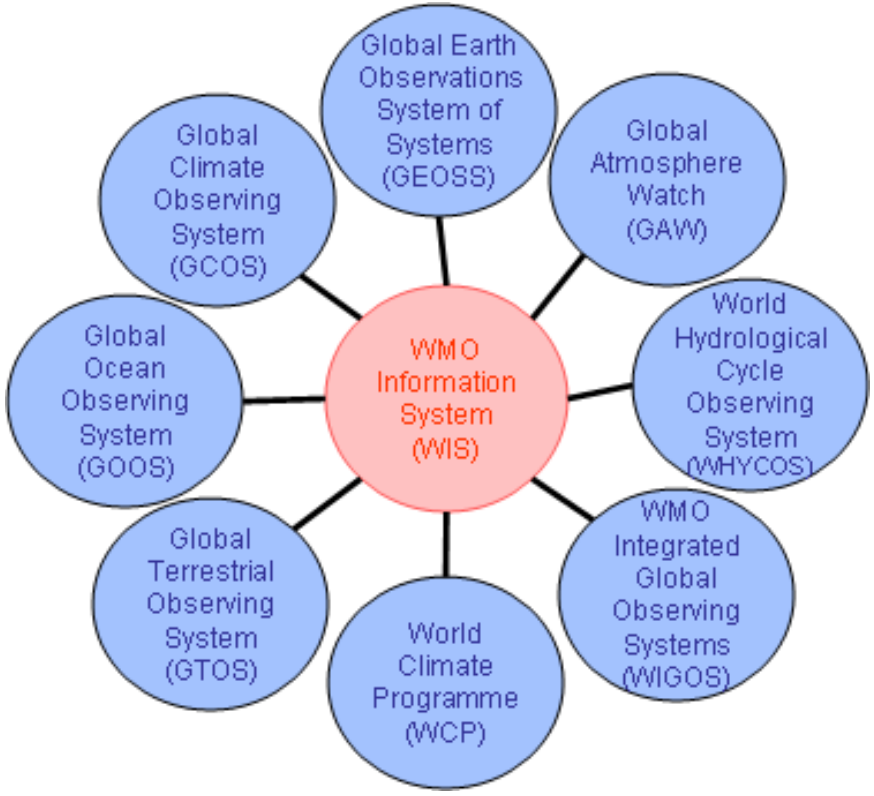
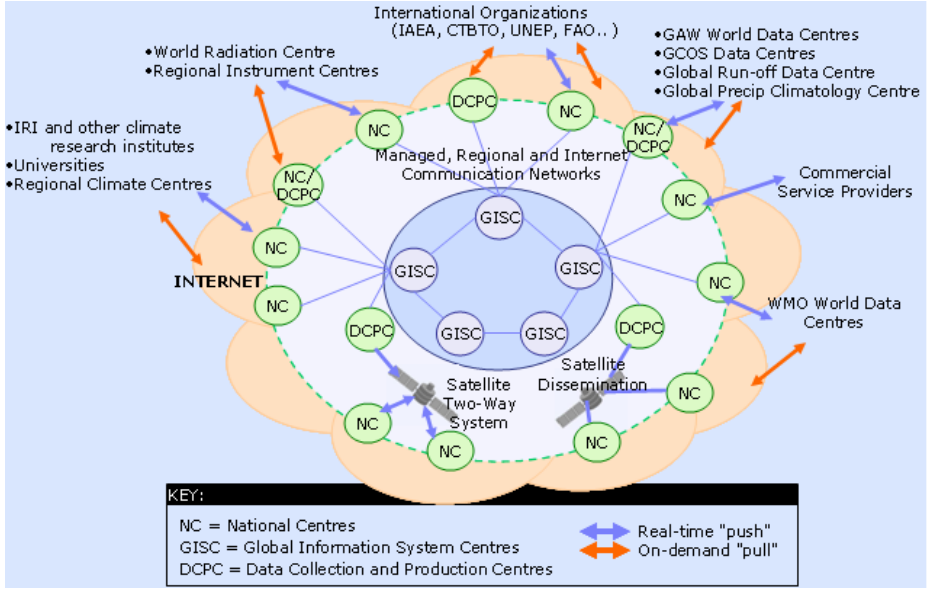
WMO Information System





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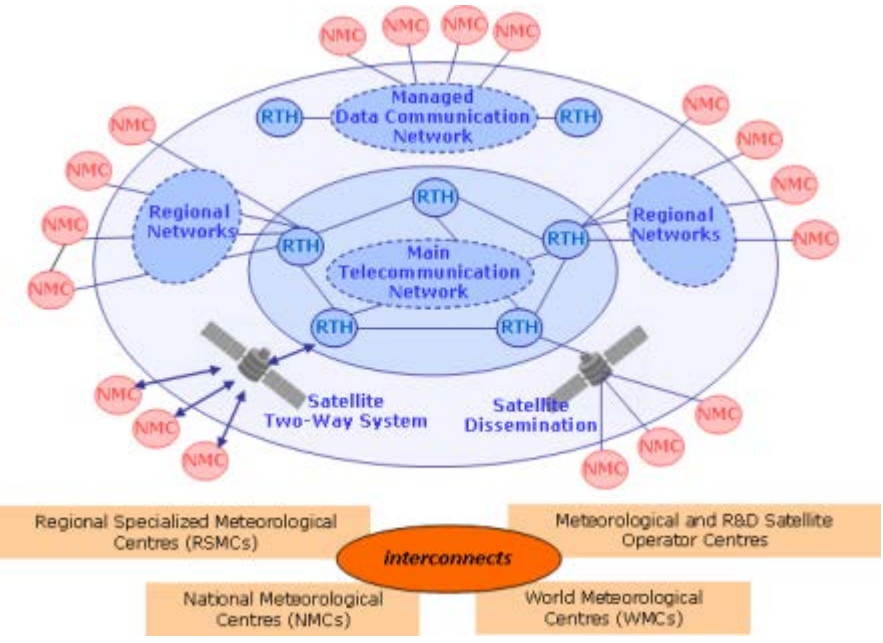
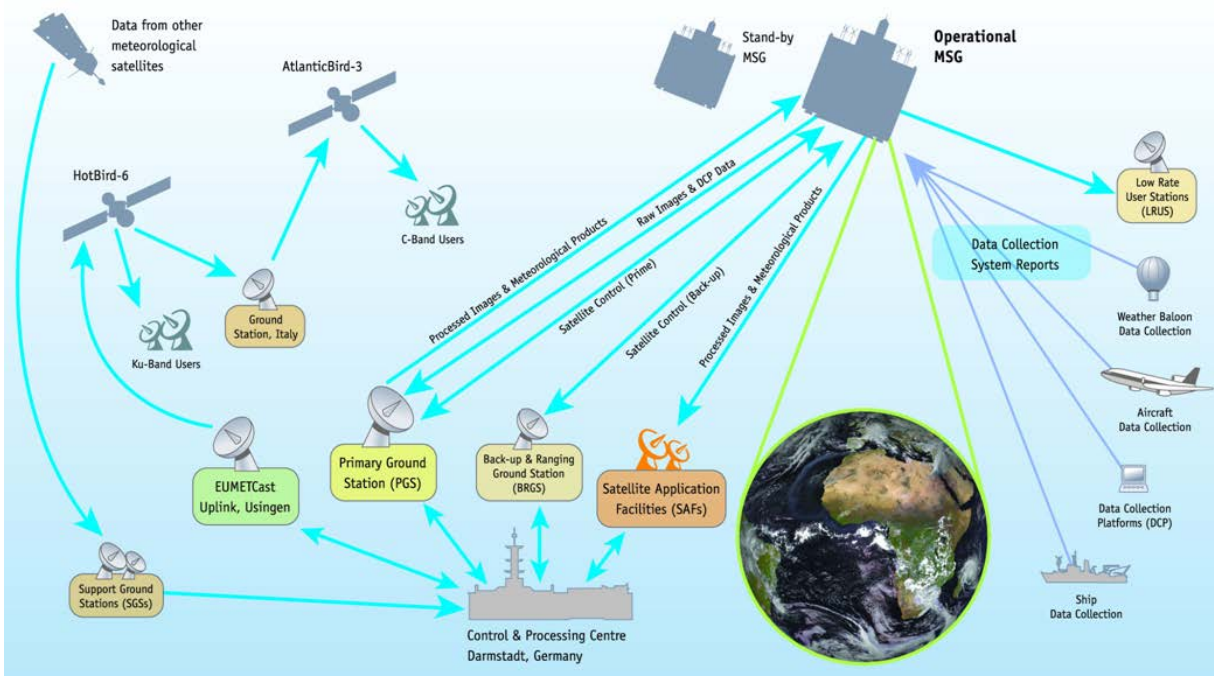
Operational data dissemination





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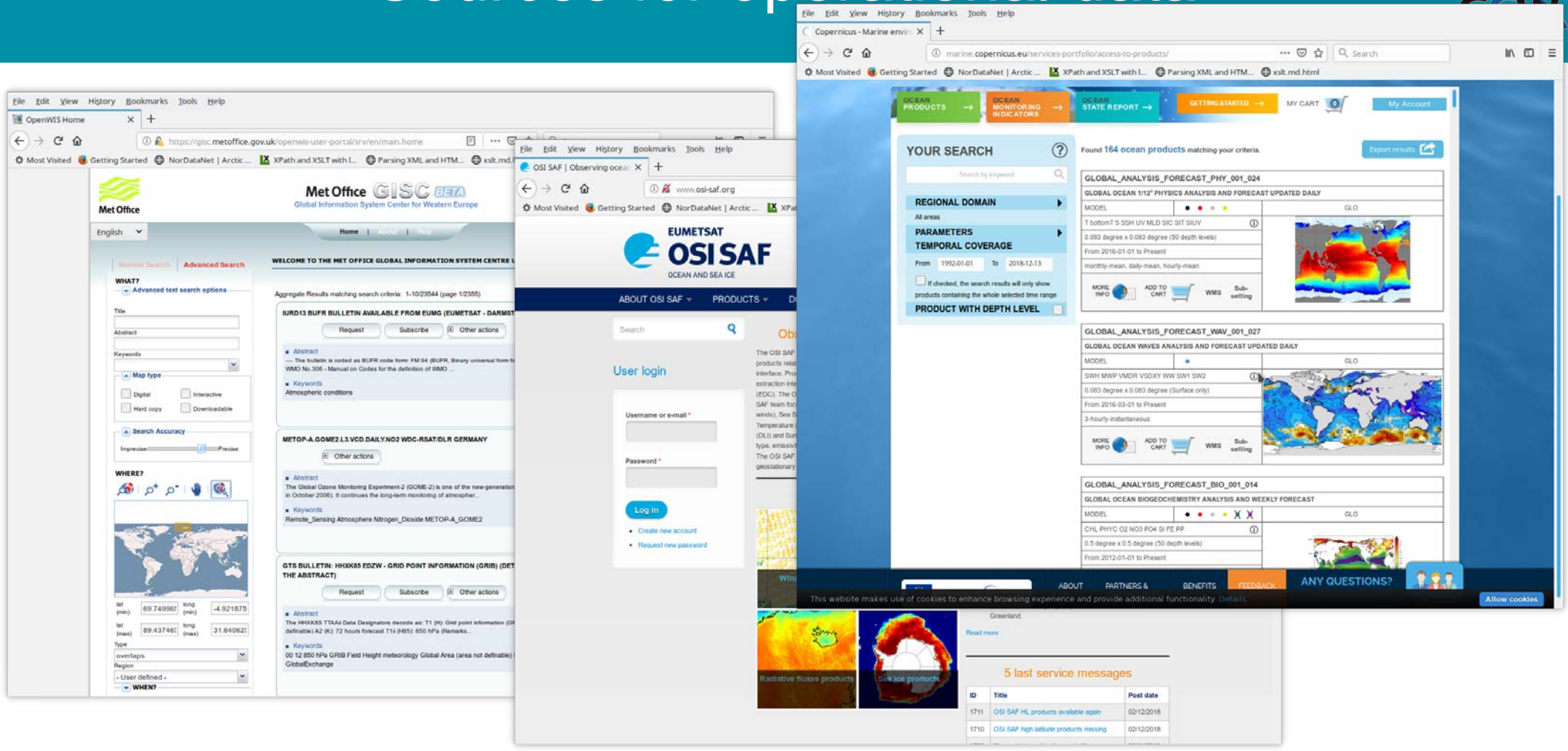
Sources for operational data



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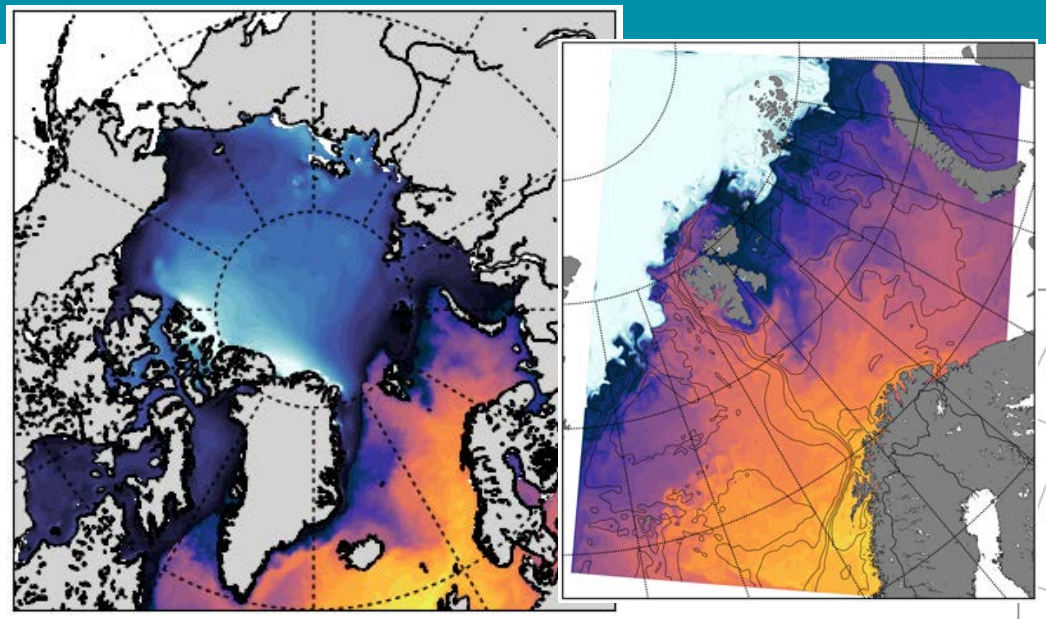
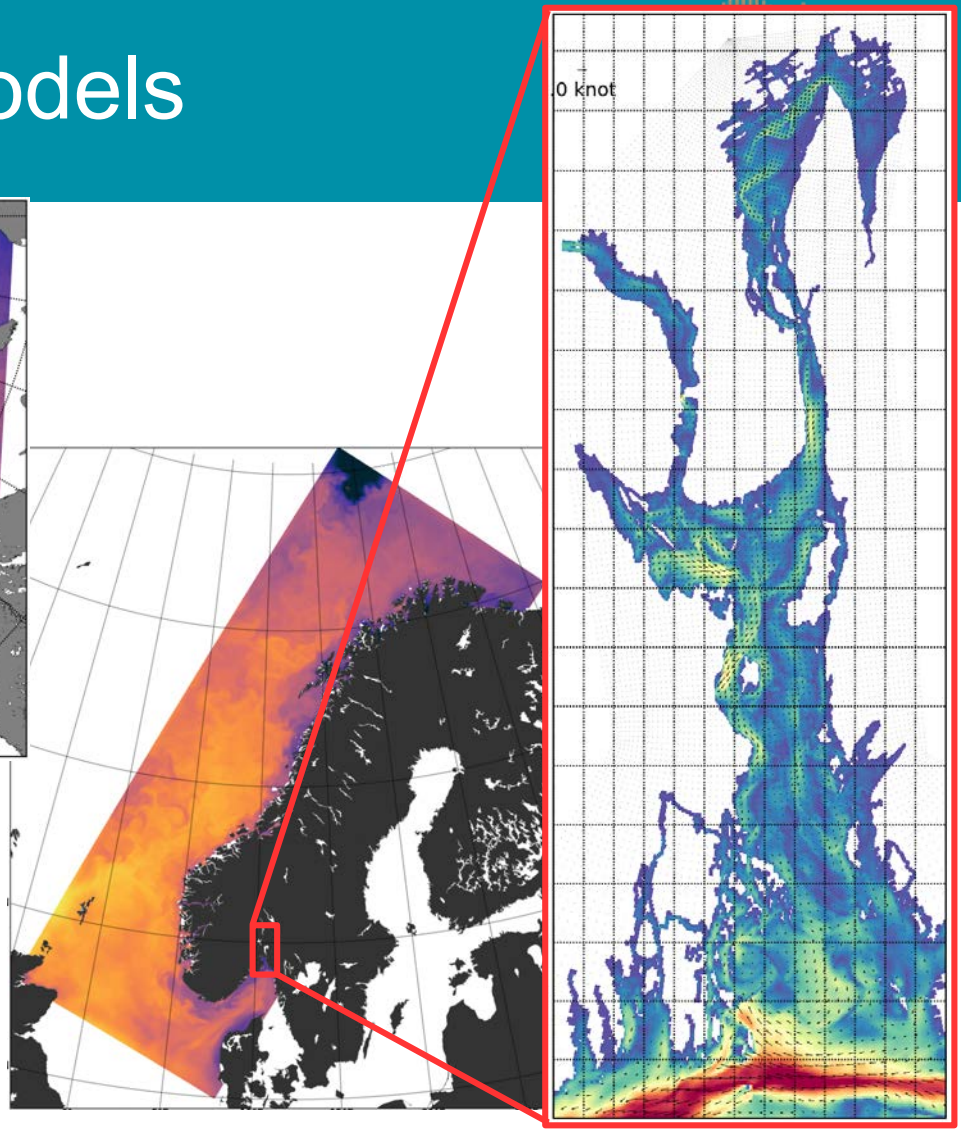
Ocean models





Scale 1: ocean basins (~5-10 km)
Scale 2: sokkelen og Barentshavet (0.8-2.5 km)
Scale 3: fjords (~160 m)

Courtesy of Kai H. Christensen

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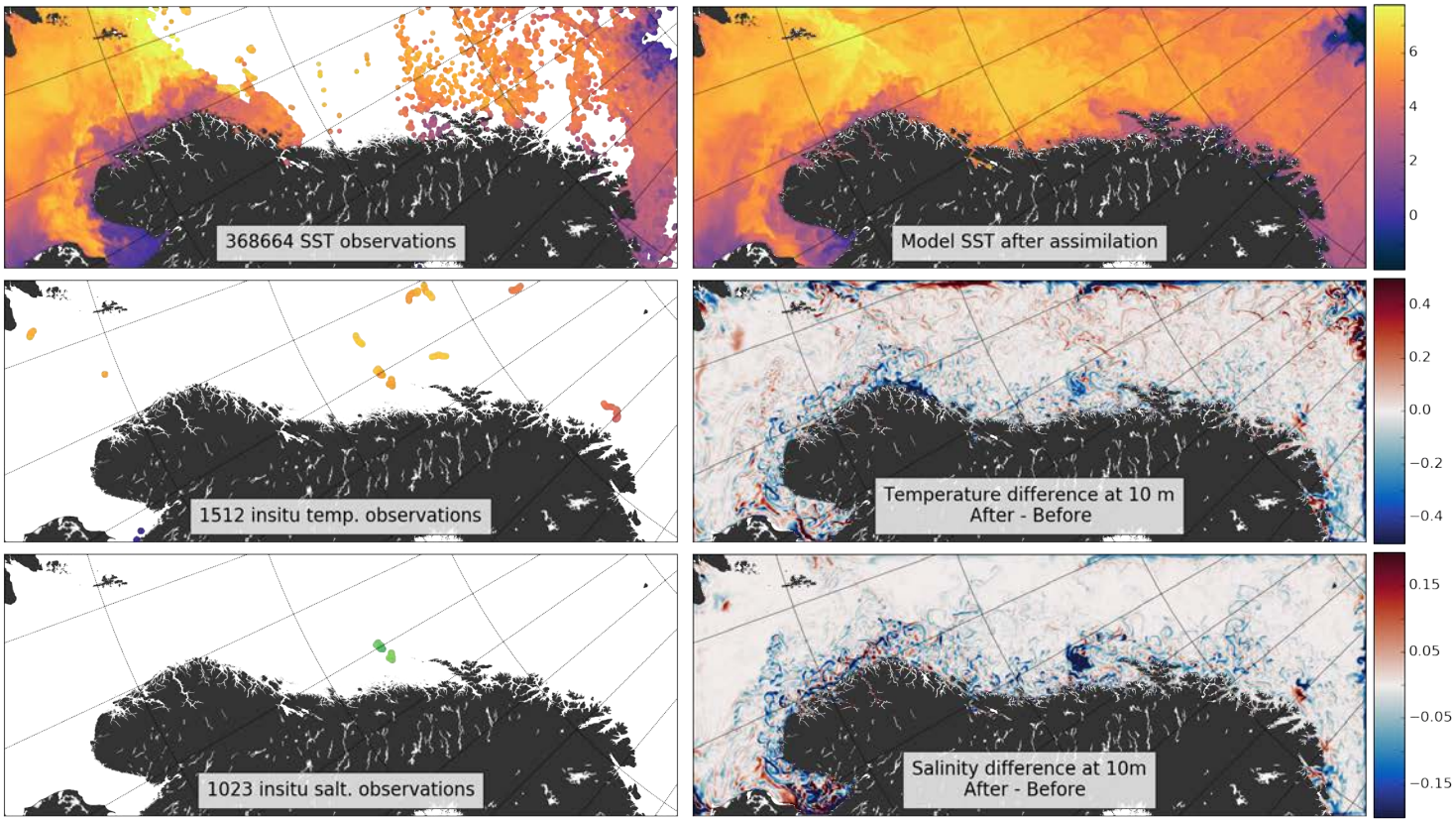
Ocean models

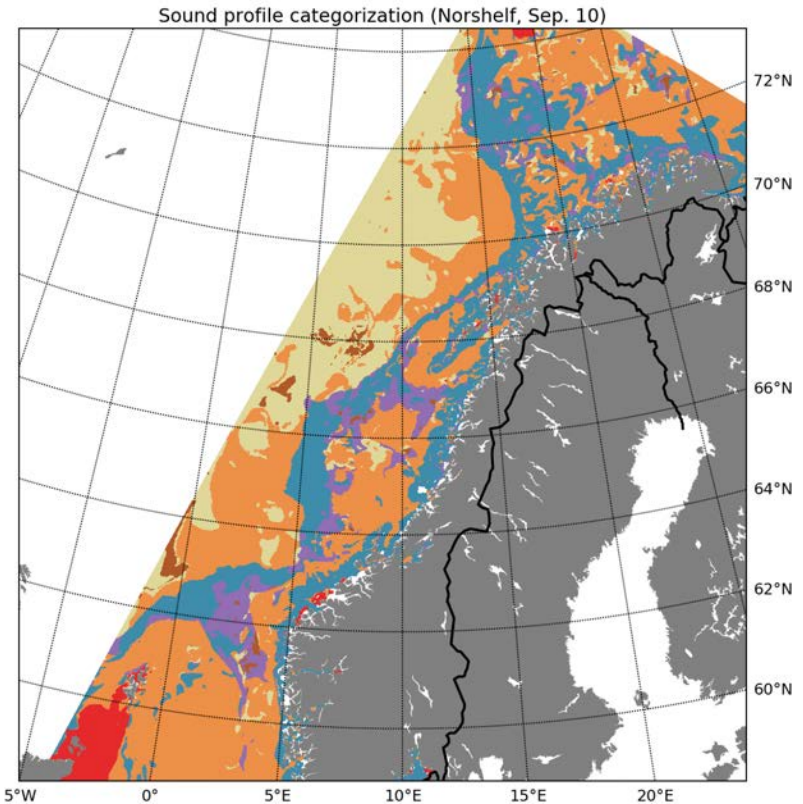
NorShelf Data Assimilation System 2018-03-19



Courtesy of Kai H. Christensen

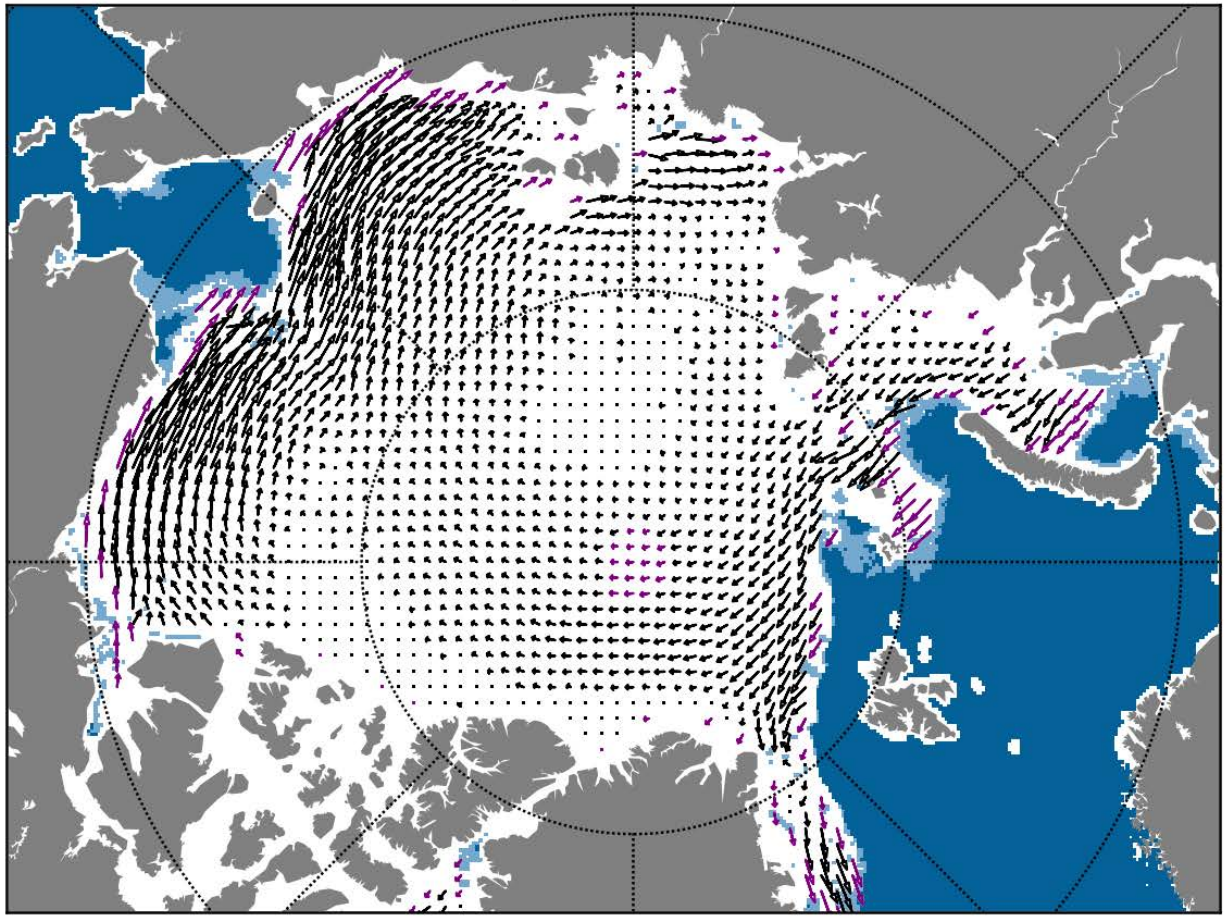
Ocean models

- Speed of sound (3D), depth of layer, categories of sound profiles can be estimated using modelled salinity and temperature
- Hydrographic observations are beneficial for the best possible forecast
  - But must be near real-time



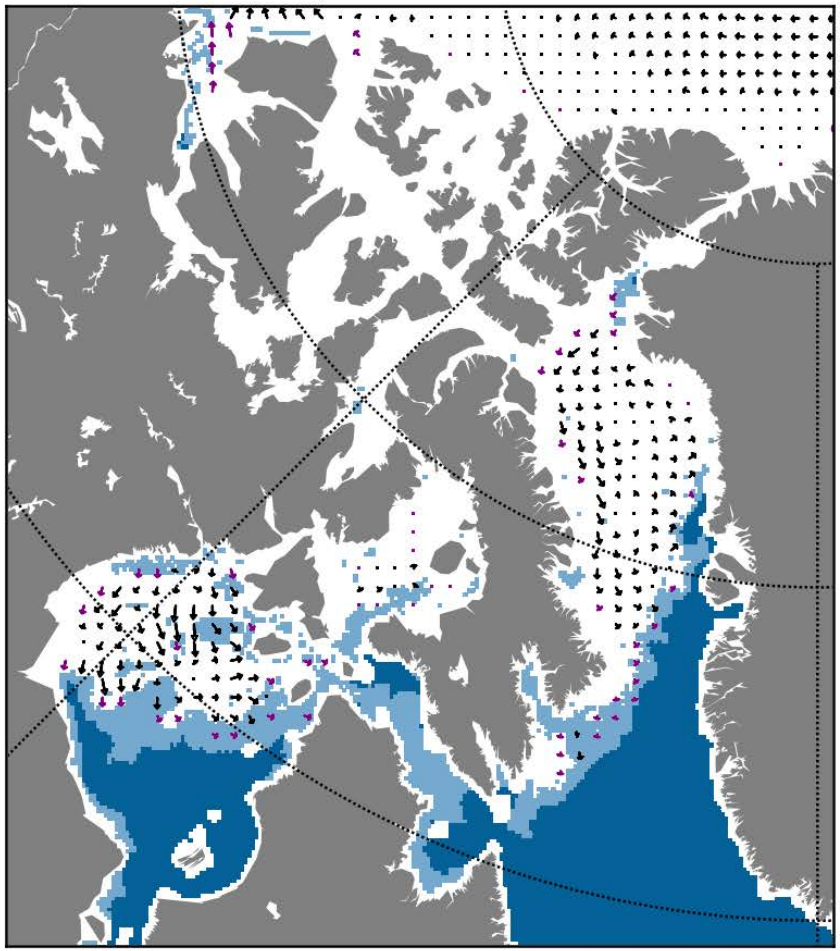
Courtesy of Kai H. Christensen

MULTI-OI / 2018-11-30 to 2018-12-02



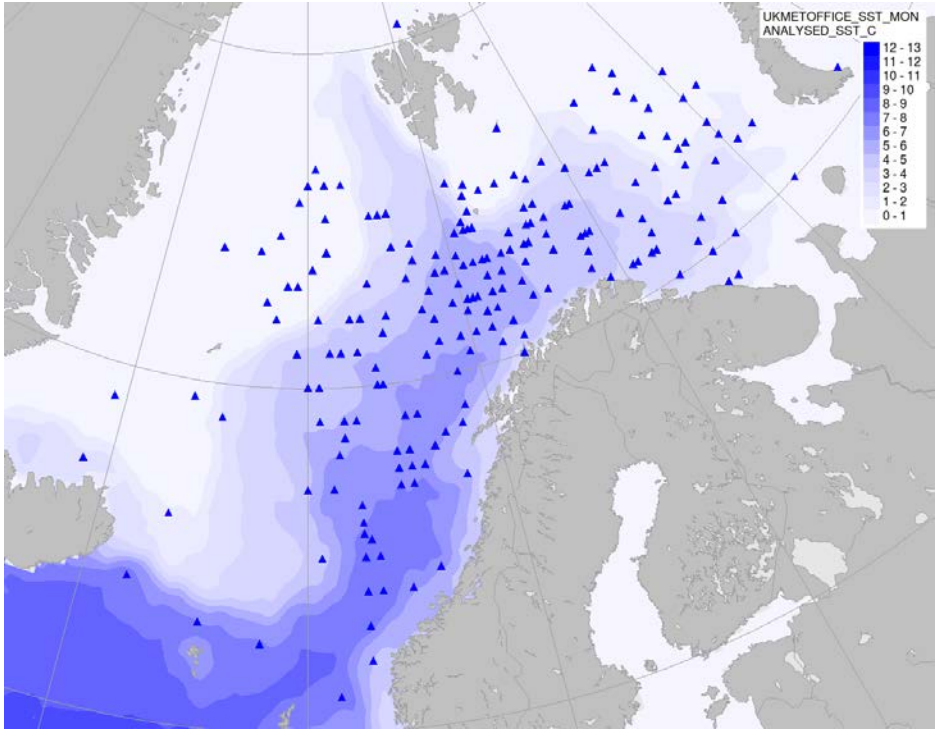
Zone: Arctic Ocean / Image: Copyright (2018) EUMETSAT

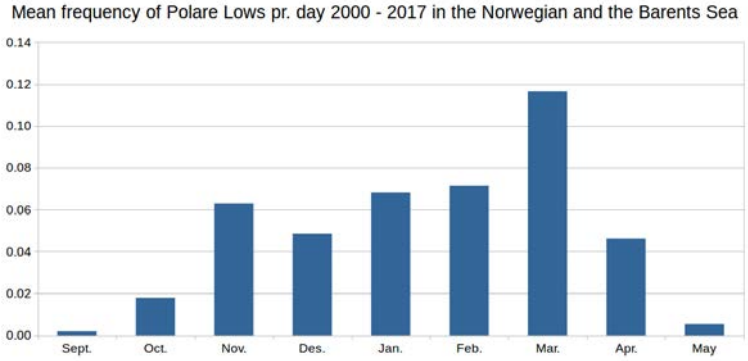
MULTI-OI / 2018-11-30 to 2018-12-02



Zone: West Greenland and Canada / Image: Copyright (2018) EUMETSAT

Polar Low climatology





Polar low genesis area 2000 - 2017. SST in blue shading.

- Season from October till May
  - max in Dec. to March
- On average 14 events pr. year with one or more low centres in the Norwegian and Barents Sea
- Large interannual variation, especially at the start and end of the season
- Little or no trend in occurrence or intensity from 2000 til present

Courtesy of Gunnar Noer