INTAROS – Integrated Arctic Observation System

A project funded by EC - H2020

Coordinator: Stein Sandven, NERSC

Overall objective: to develop an efficient integrated Arctic Observation System by extending, improving and unifying existing and evolving systems in different regions of the Arctic

INTAROS includes more than 200 scientists from 49 organisations and 20 countries

See also poster session: HE34A-1990 - Enhancement of ocean and sea ice *in situ* observations in the Arctic under the Horizon2020 project INTAROS

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Second Arctic Science Ministerial – Berlin October 2018

26 countries, EU, WMO, UNEP, IACS, ICC and many other organisations

THEME 1 STRENGTHENING, INTEGRATING AND SUSTAINING ARCTIC OBSERVATIONS, FACILITATING ACCESS TO ARCTIC DATA, AND SHARING ARCTIC RESEARCH INFRASTRUCTURE

THEME 2 UNDERSTANDING REGIONAL AND GLOBAL DYNAMICS OF ARCTIC CHANGE

THEME 3 ASSESSING VULNERABILITY AND BUILDING RESILIENCE OF ARCTIC ENVIRONMENTS AND SOCIETIES

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Call for action to the Arctic Science Ministerial

- There is an urgent need to progressively shift key observing system components – including community-based observations – from short-term research funding to sustained, operational infrastructure support.
- A properly resourced, comprehensive effort is needed to identify strengths and gaps in the current set of systems, sensors, networks, and surveys used to observe the Arctic.
- Observing and data systems, at different spatial and temporal scales, should emerge from co-design, co-production, and co-management processes with relevant stakeholders and rights holders embracing free, ethical, and open data sharing, adhering to the FAIR data principles (Findable, Accessible, Interoperable, Reusable).
- To build an Arctic observing system that is comprehensive, coordinated, sustainable, and fills current observational gaps, all existing assets and activities, including indigenous knowledge, must be leveraged to the greatest extent.

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Data collection supported by INTAROS

INTAROS field activities in 2017-2019

Measurements of CO_2 and CH_4 fluxes and soil temperature profiles in Alaska (USFD and Uni Exeter)

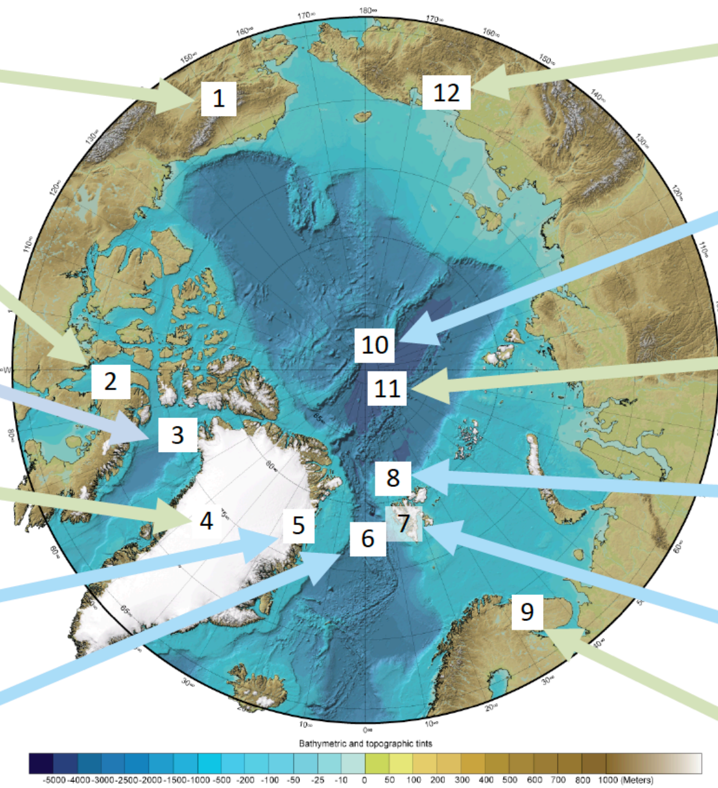
Meteorological, snow and soil data from 4 location in Eastern Canadian Arctic (CNRS Takuvik)

Oceanographic and marine ecosystem data from BioArgo floats in Baffin Bay (CNRS Takuvik)

PROMICE weather station data from Greenland Ice Sheet (GEUS)

Oceanographic measurements on moorings in Young Sound and shipborne sections in the coastal Greenland waters (AU)

Biogeochemical (AWI) and seismic (UiB) observations in Fram Strait



Observations of atmospheric CO_2 and CH_4 in Siberia and Alaska (MPG)

Oceanographic, sea ice and snow measurements in the central Arctic from autonomous ice buoys (FMI, PRIC, IOPAN)

Atmospheric profiles and surface measurements in the central Arctic from icebreaker ODEN (Stockholm Uni)

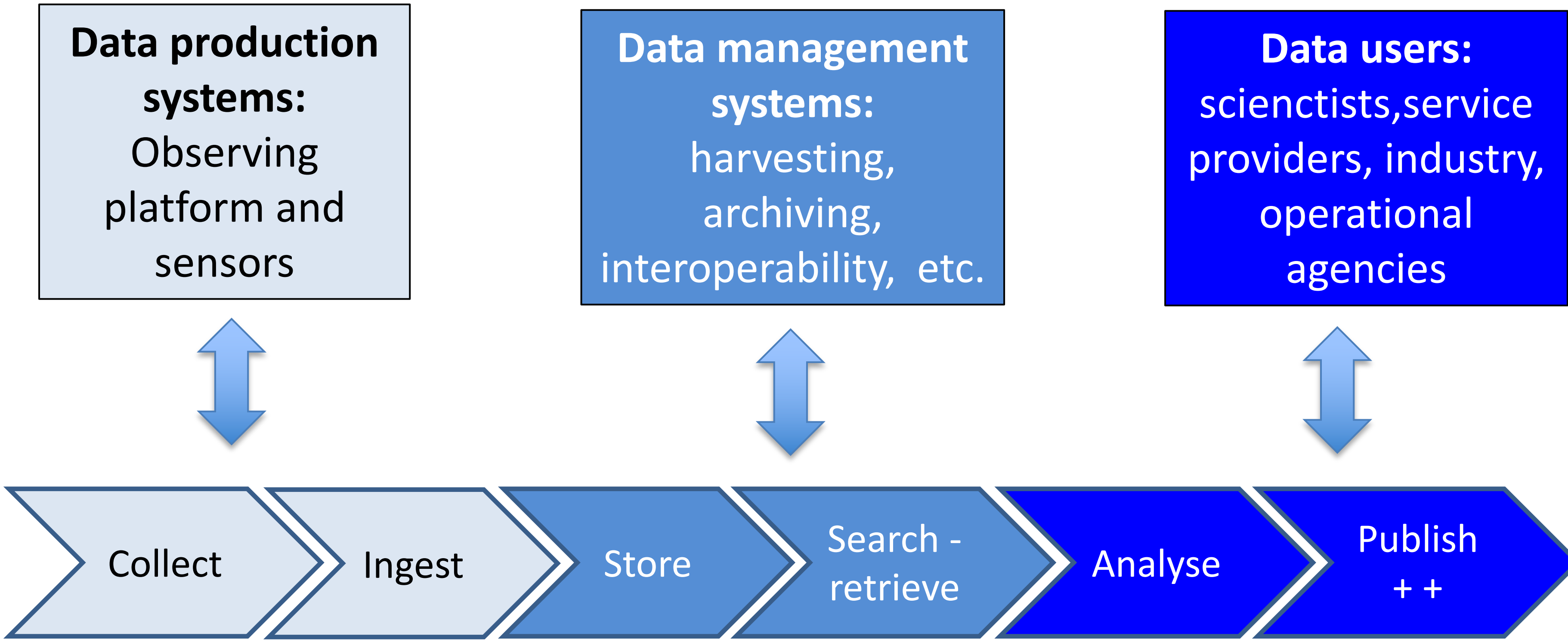
Oceanographic, biogeochemical, and sea ice measurements at moorings north of Svalbard (NERSC, UIB, IOPAN and LOCEAN)

Biogeochemical (CNRS LOV) and acoustical (CNRS UIEM) measurements in Kongsfjorden

Soil temperature and snow measurements from stations in northern Finland (FMI)

INTAROS collaborates with a number of national and international research projects and monitoring programmes across the Arctic region

Data value chain



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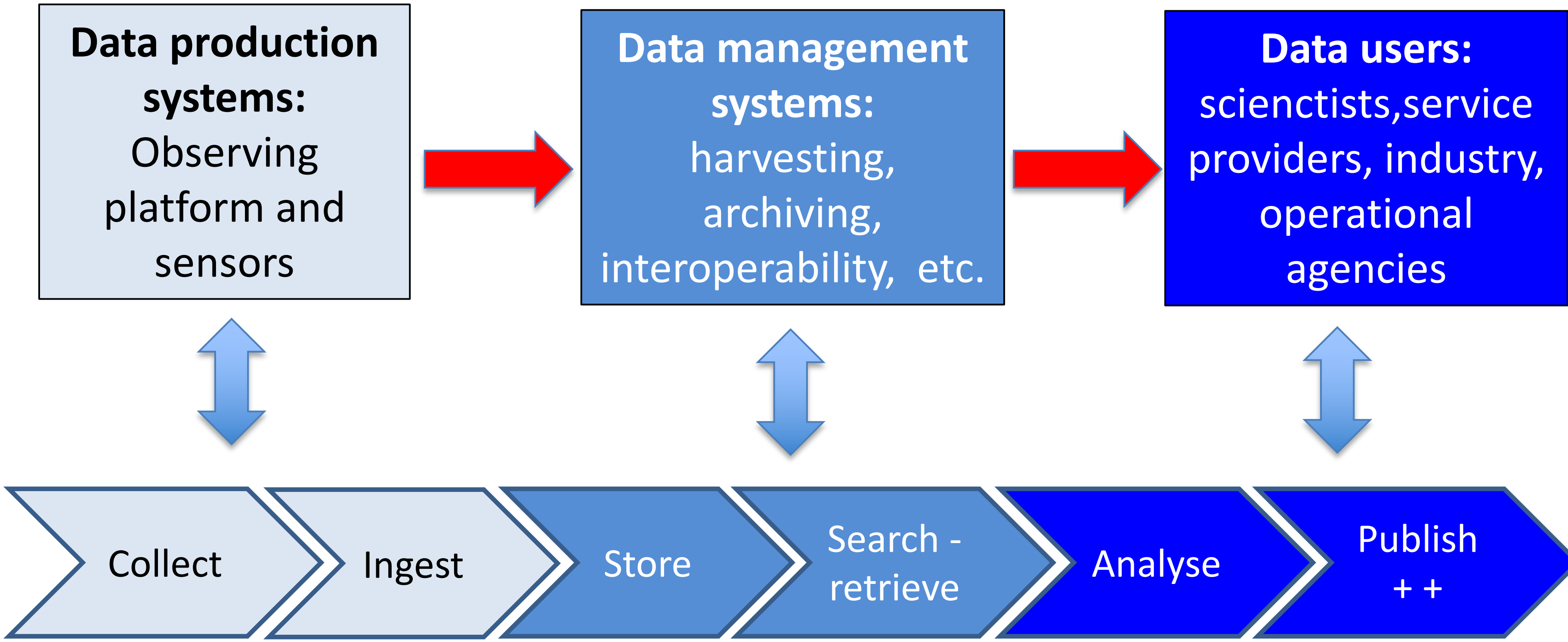
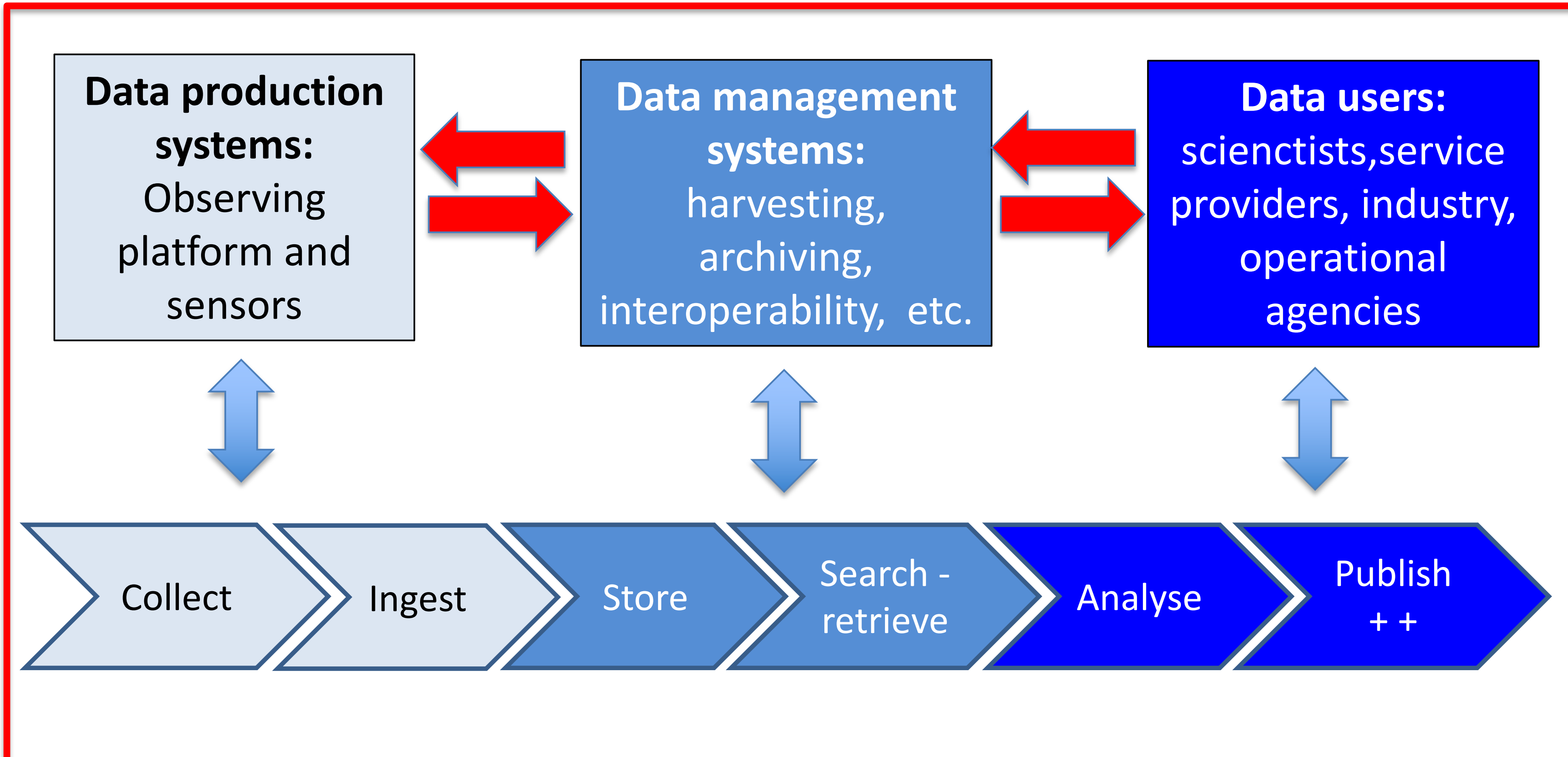
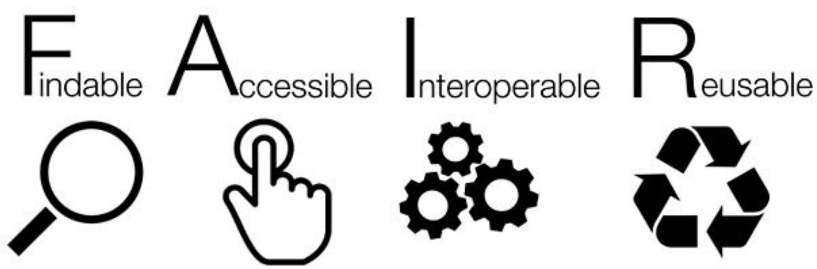
Data value chain: how does it work ?



The FAIR principles – enabling an integrated system





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Data integration challenges

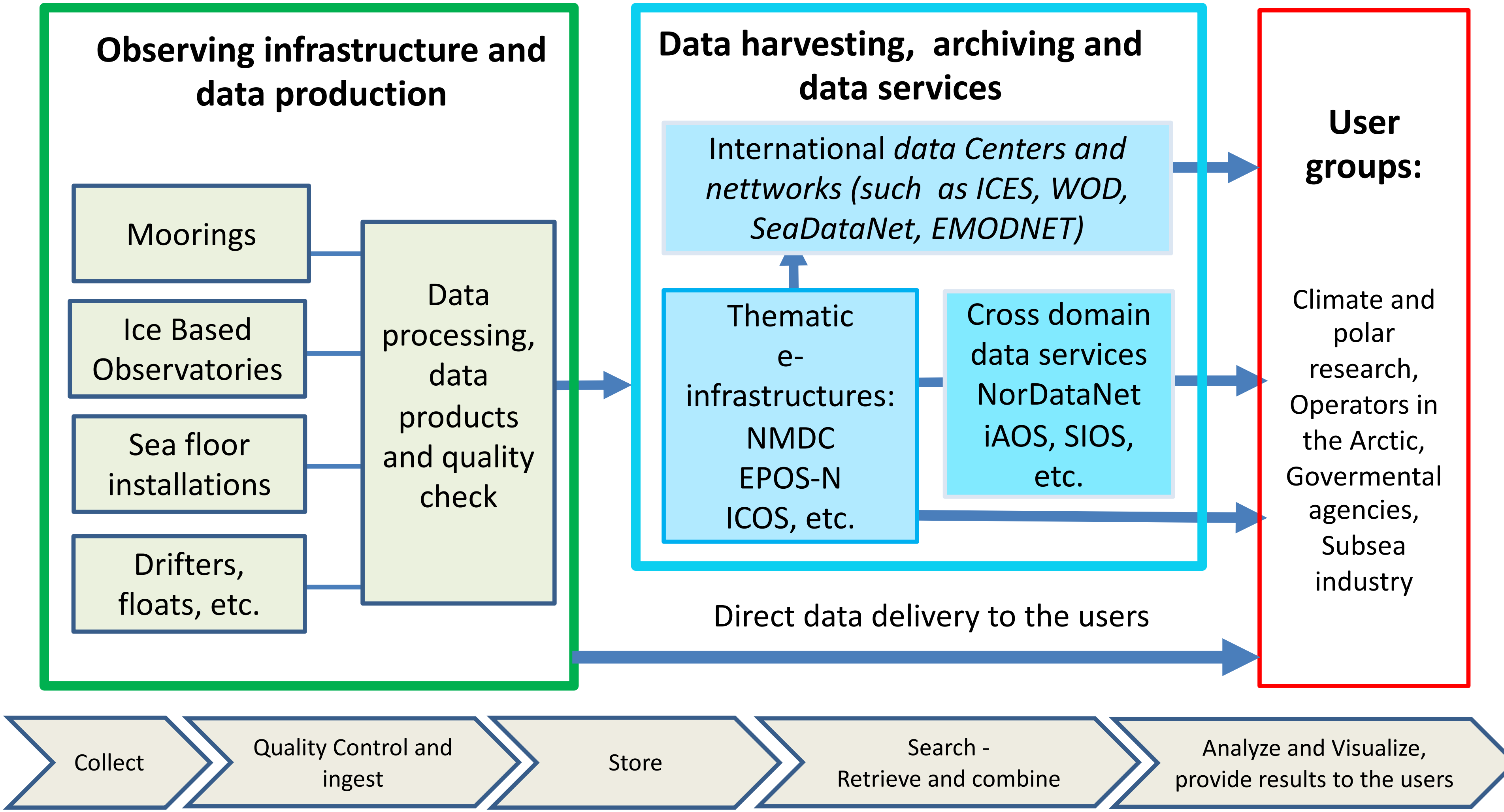
- Data from different spheres and scientific disciplines:
  - Land & cryosphere
  - Ocean and sea ice
  - Atmosphere

Physical oceanography, sea ice, biololgy, biogeo-chemistry, ocean acoustics, seismology, geology, etc.

- Lack of standards in many domains:
  - Complex data doesn't easily fit into a common structure
  - New parameters being measured / New sensors

- Broad range of data infrastructures holding Arctic data:
  - Use different standards for metadata and data
  - Offer various data search and access protocols
  - Variable level of openness and FAIR compliance

Data value chain: ocean observing systems



Case studies of INTAROS along the value chain from data collection to results

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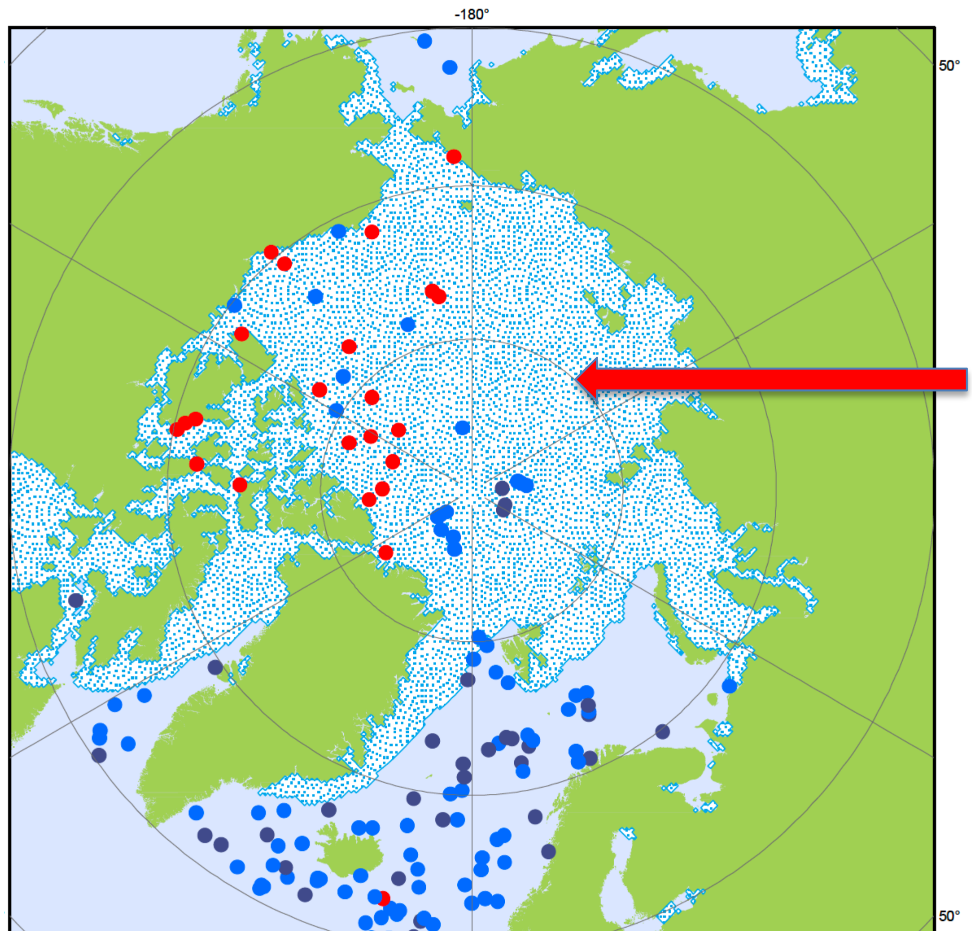
Operational surface buoys in the Arctic

Drifting buoys providing data to the GTS during the month. GTS data as received by Meteo France

Map generated by www.jcommops.org February 2020



Large data gaps in the eastern Arctic Ocean

Drifting Buoys

EUROPE (32)

USA (85)

CANADA (23)

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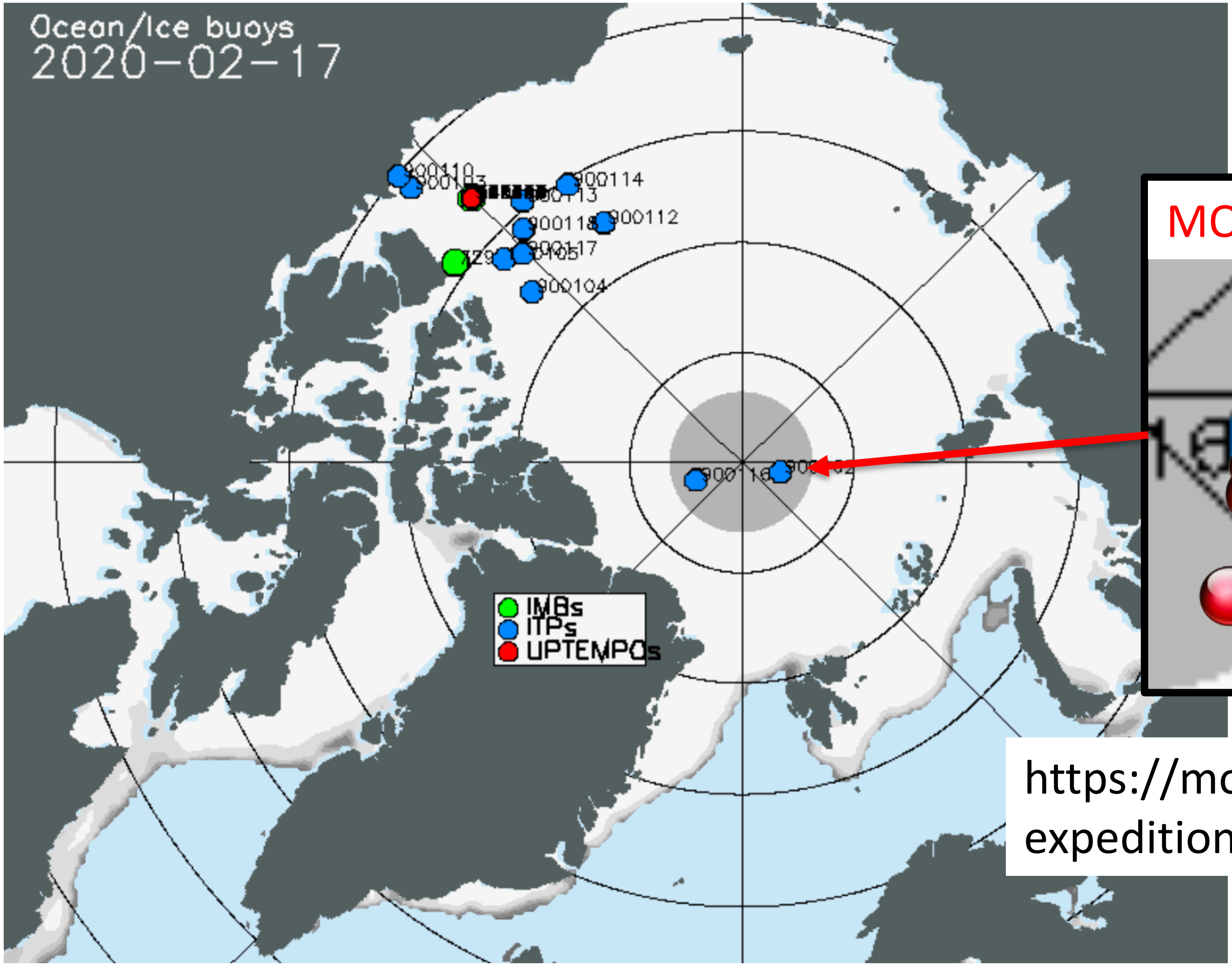
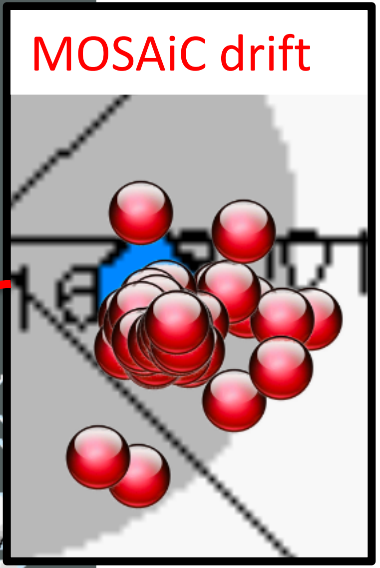
Drifting ice-ocean buoys in the International Arctic Buoy Progam

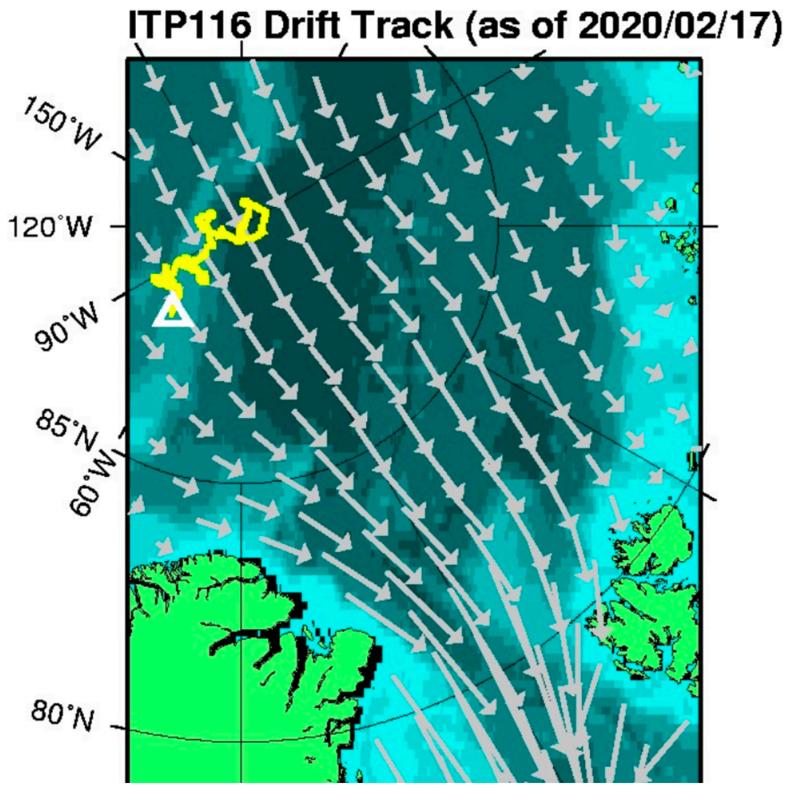




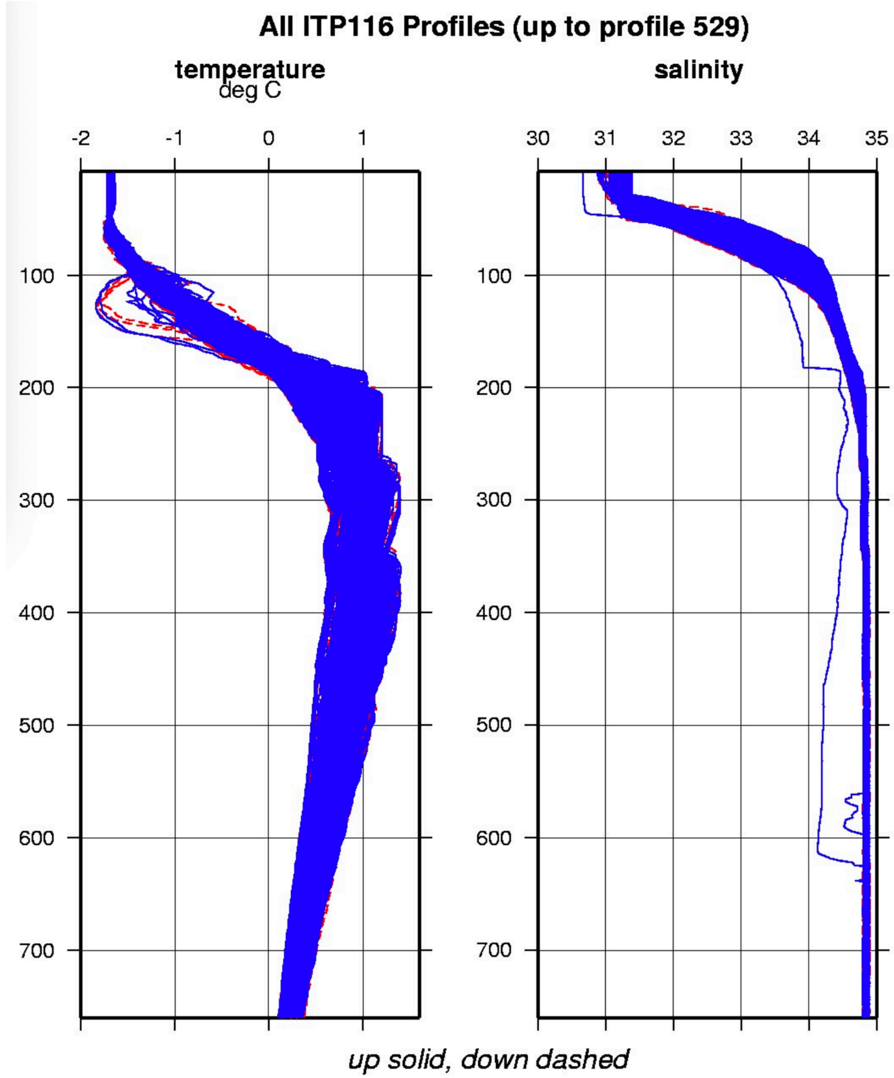
https://mosaic-expedition.org/science/

Map from http://iabp.apl.washington.edu/

Profiles from ITP no 116 (16. Feb 2020)



https://www.whoi.edu/page.do?pid=164836



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CAATEX
Coordinated Arctic Acoustic Thermometry Experiment

Woods Hole Oceanographic Institution

Arctic data collection campaigns

The Coordinated Arctic Acoustic Thermometry Experiment

©CHINARE2018

MOSAiC experiment 2019-2020

Esther Horvath, Alfred-Wegener-Institut

High-resolution Snow and Ice Mass Balance Array (SIMBA)

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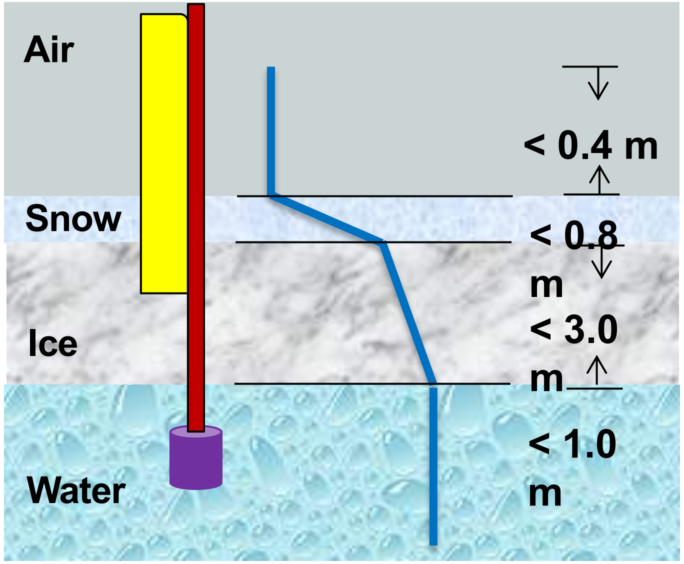
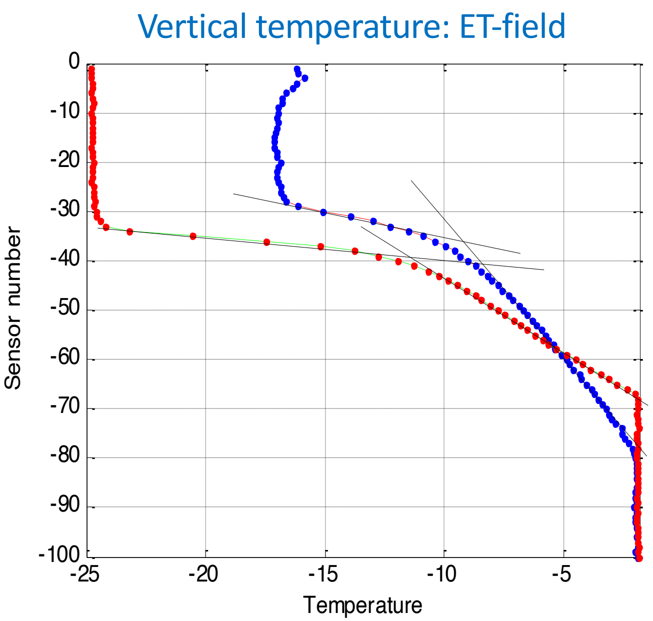
Example: snow and ice thickness observations

Automated measurements of temperature profiles from ice mass balance buoys (SIMBA) providing snow and ice thickness dtata through the seasonal cycle





Air-Snow-Ice-Water (ASIW) system and temperature distribution vertically through ASIW in cold condition.

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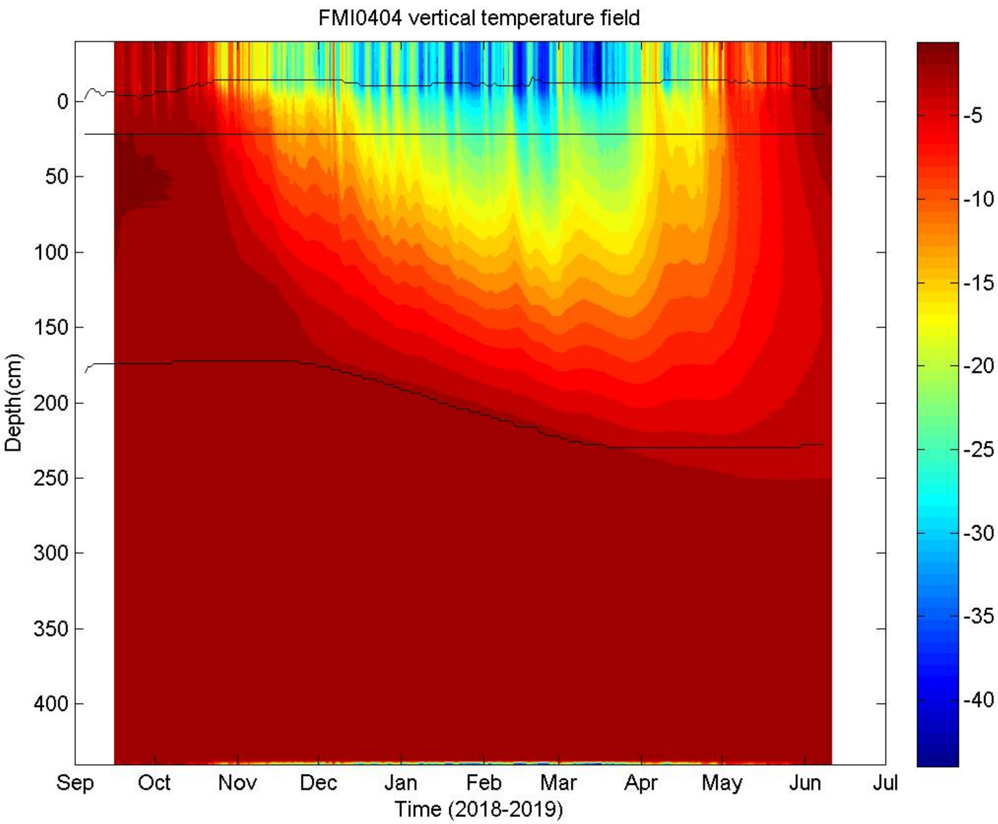
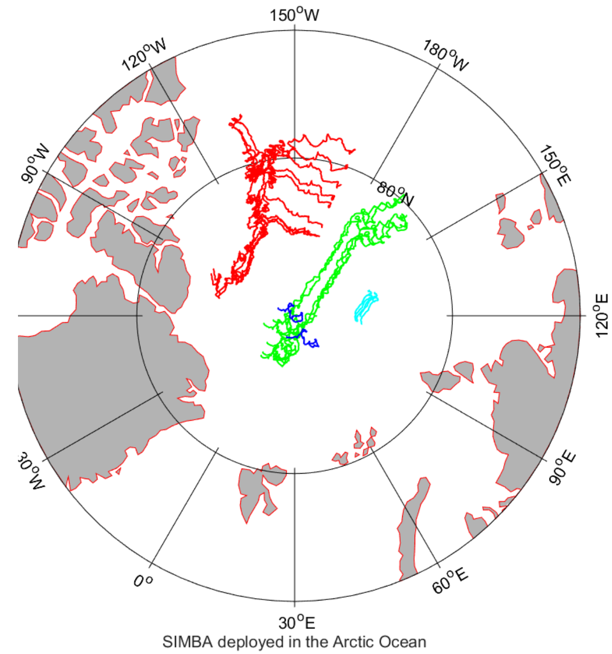
Snow and ice thickness data from 2018-2019





MOSAiC2019 (October)
North of Laptev Sea:
Hice = 1 m
Hsnow = 0.11m

CHINARE2018 (mid-August)
North of Chukchi Sea and Beaufort Sea:
Hice = 2.4m
Hsnow = 0.06m

NOBAS2018 (mid-September)
East Siberian Sea:
Hice = 2.3m
Hsnow = ~0m

CAATEX2019 (late-August)
North Pole:
Hice = 1.7m
Hsnow = 0.06m

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Challenges in building Arctic observing systems

(1) Develop coordination and collaboration between data providers and stakeholders in the pan-Arctic region in order to better use existing systems and resources (Organisation)

(2) Improvement of the observing platforms and sensors, filling of gaps in the observing network and facilitate for year-round operation, how to go from research to operational systems (Technology, filling gap, operational)

(3) Data sampling, transmission, calibration, processing, archiving and retrieval of required variables and build distributed and connected databases (Data generation, dissemination, and management)

(4) How to develop sustainability of the observing systems, and what are the funding mechanisms ? (Engagement→ Funding)

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