INTAROS – Integrated Arctic Observation System

Assessment of existing Arctic observing systems and data

Stein Sandven, Pirazzini Roberta, Hanne Sagen, Michael Tjernström, Andreas Ahlstrøm, Ingo Schewe, Georg Heygster, Carsten Ludwigsen, Mathias Goeckede, David Gustafsson and Torill Hamre

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An integrated Arctic Observing System needs to include data from

- Atmosphere
- Ocean
- Terrestrial themes

on variables according to user requirements.

The largest gaps are in the in-situ observation network, which should provide:

- data that cannot be obtained from remote sensing
- data needed for validation of remote sensing
- data needed in modelling (forecasting, reanalysis, etc.)

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INTAROS field activities in 2017-2019

Temperature profiles of the soil to observe thaw depth in Alaska sites (USFD and Univ. Exeter)

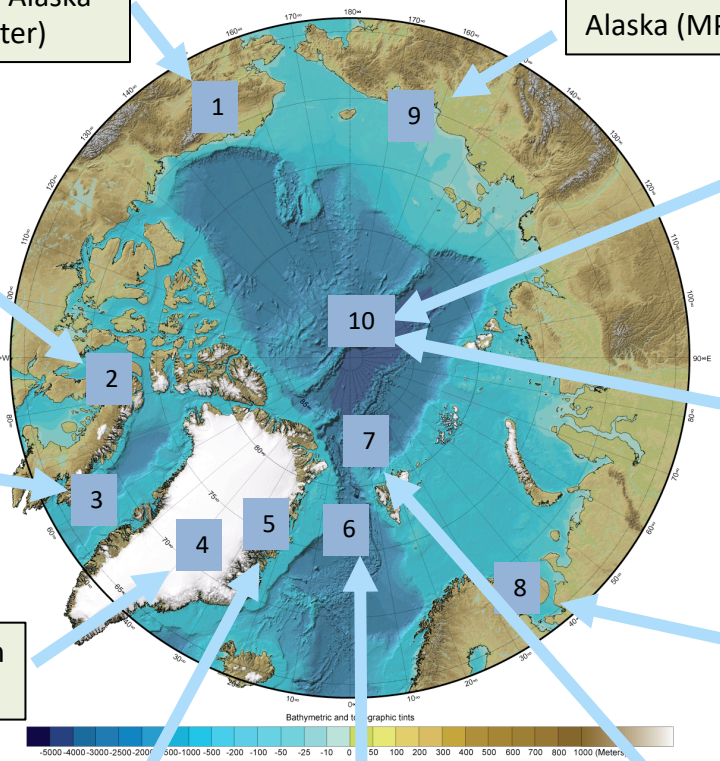
Observations of atmospheric C02 and CH4 in Siberia and Alaska (MPG)

Observing meteorological, snow and soil data from 4 location in Eastern Canadian Arctic by CNRS Takuvik

Oceanographic, sea ice and snow measurements in central Arctic from automated ice buoys (ITPs and IMBs) by FMI and IOPAN

Oceanographic and marine ecosystem data from bio-Argo floats in Baffin Bay by CNRS Takuvik

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



PROMICE weather station data from Greenland Ice Sheet by GEUS

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

Oceanographical CTD sections In Young Sound fjord, as paft of the Greenland Ecosystem Monitoring program (Aarhus University)

Biogeochemical observations in the Fram Strait (Hausgarten) and Kongsfjorden (AWI and CNRS IUEM), and seismometer deployment (UIB)

Oceanographic, biogeochemical, ocean optics data collection north of Svalbard (NERSC, UIB, IOPAS, and CNRS LOCEAN)

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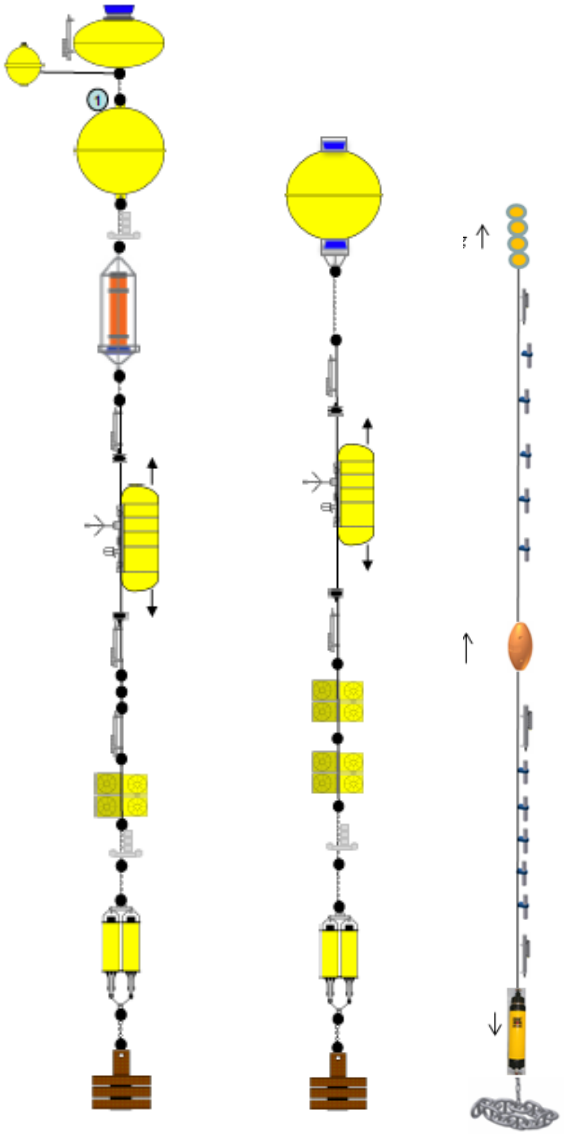
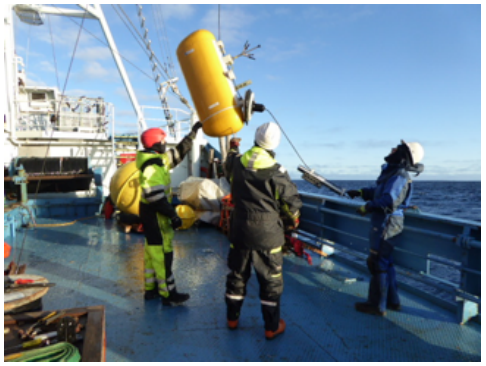
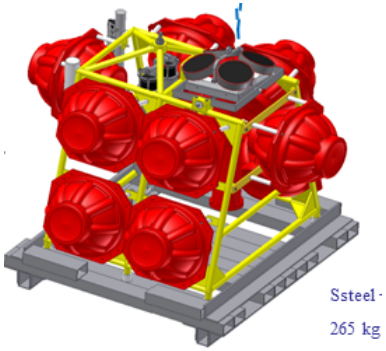
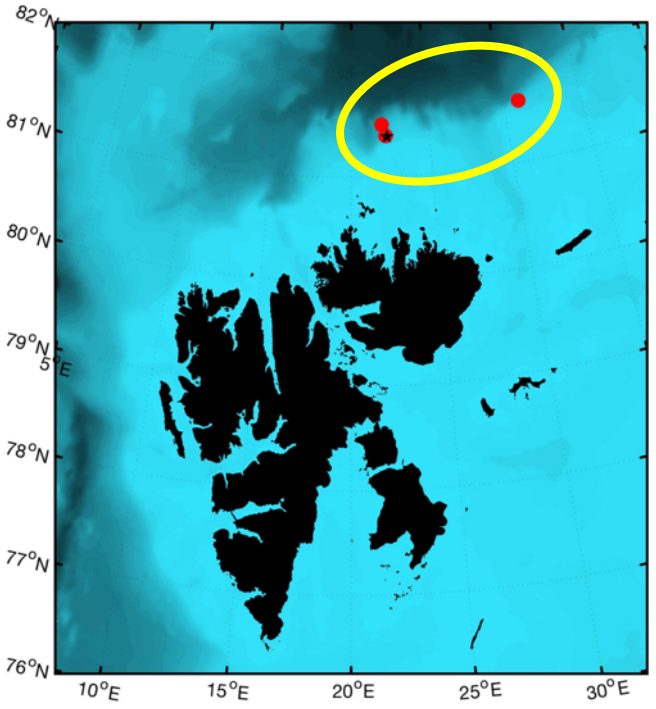
INTAROS moorings north of Svalbard

Moored array for ocean and sea ice (IOPAN, CNRS-LOCEAN)









Four moorings deployed in September 2017 and recovered in August 2018 from KV Svalbard

New deployments in 2018 with recovery in 2019

Temperature and salinity profiles and point measurements, ocean current profiles, oxygen point measurements, sea ice drift and draft measurements.

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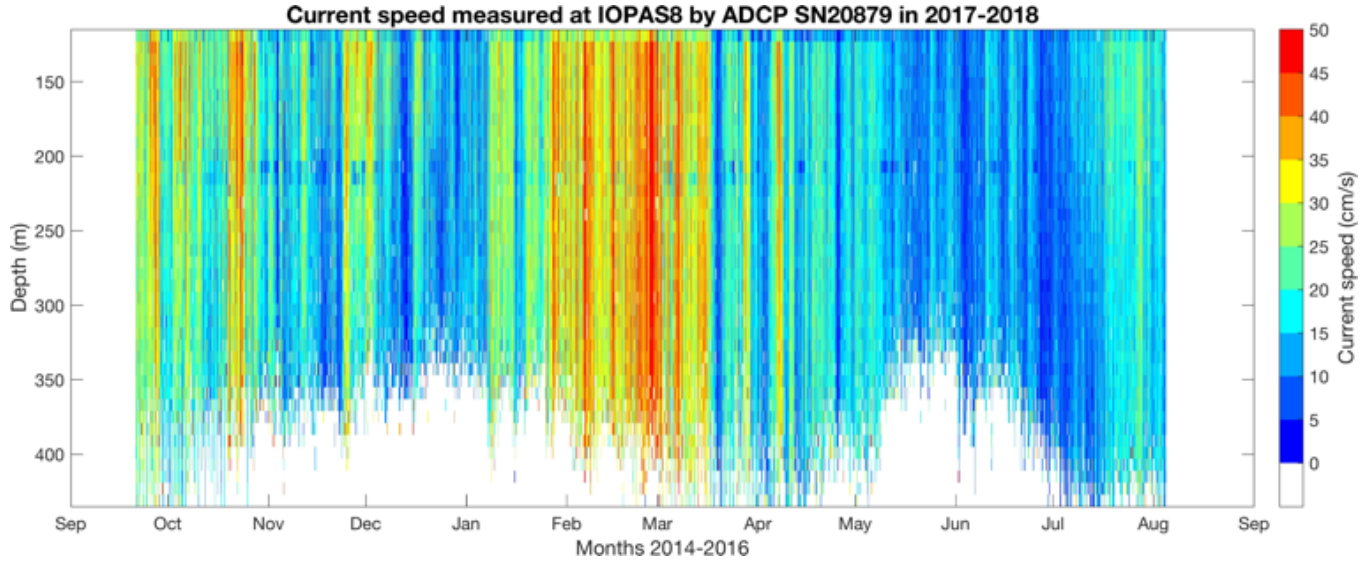
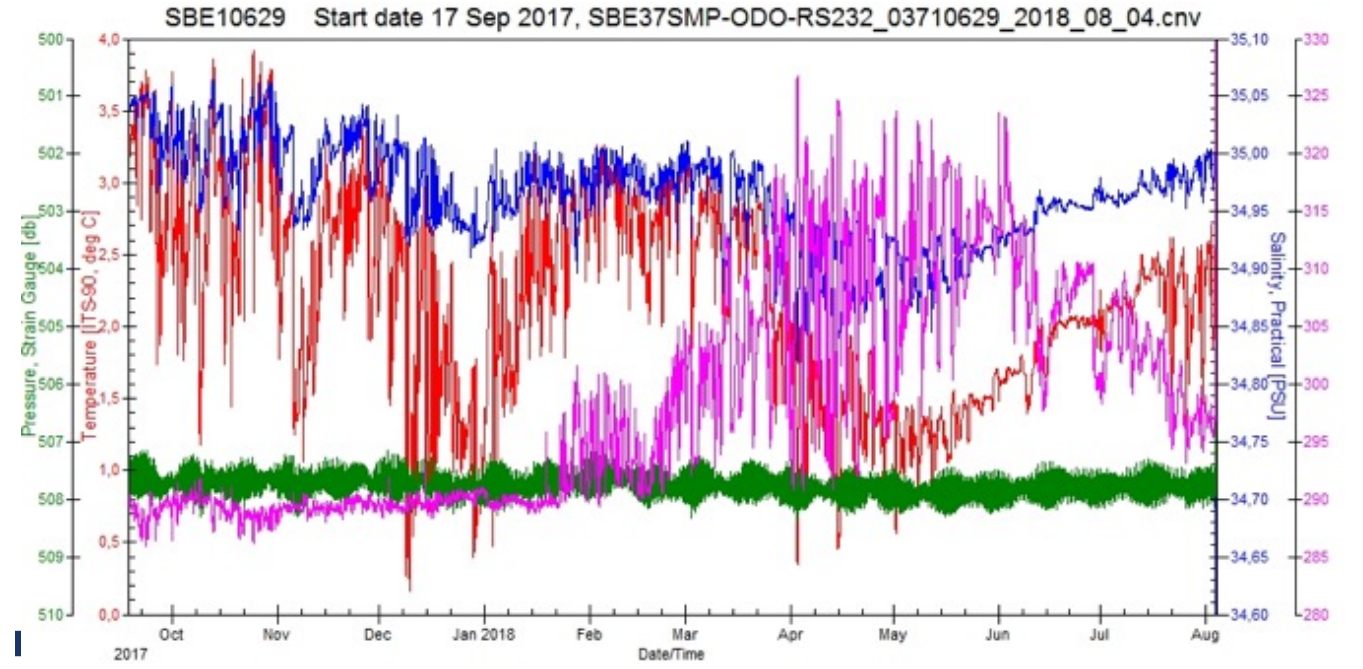
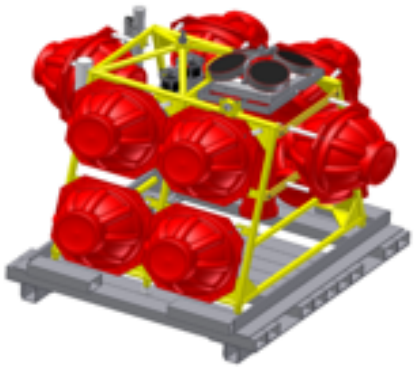
Data from INTAROS moorings

Moored array for ocean and sea ice (IOPAN, CNRS-LOCEAN)



IOPAS21: profiles of current speed from QMADCP

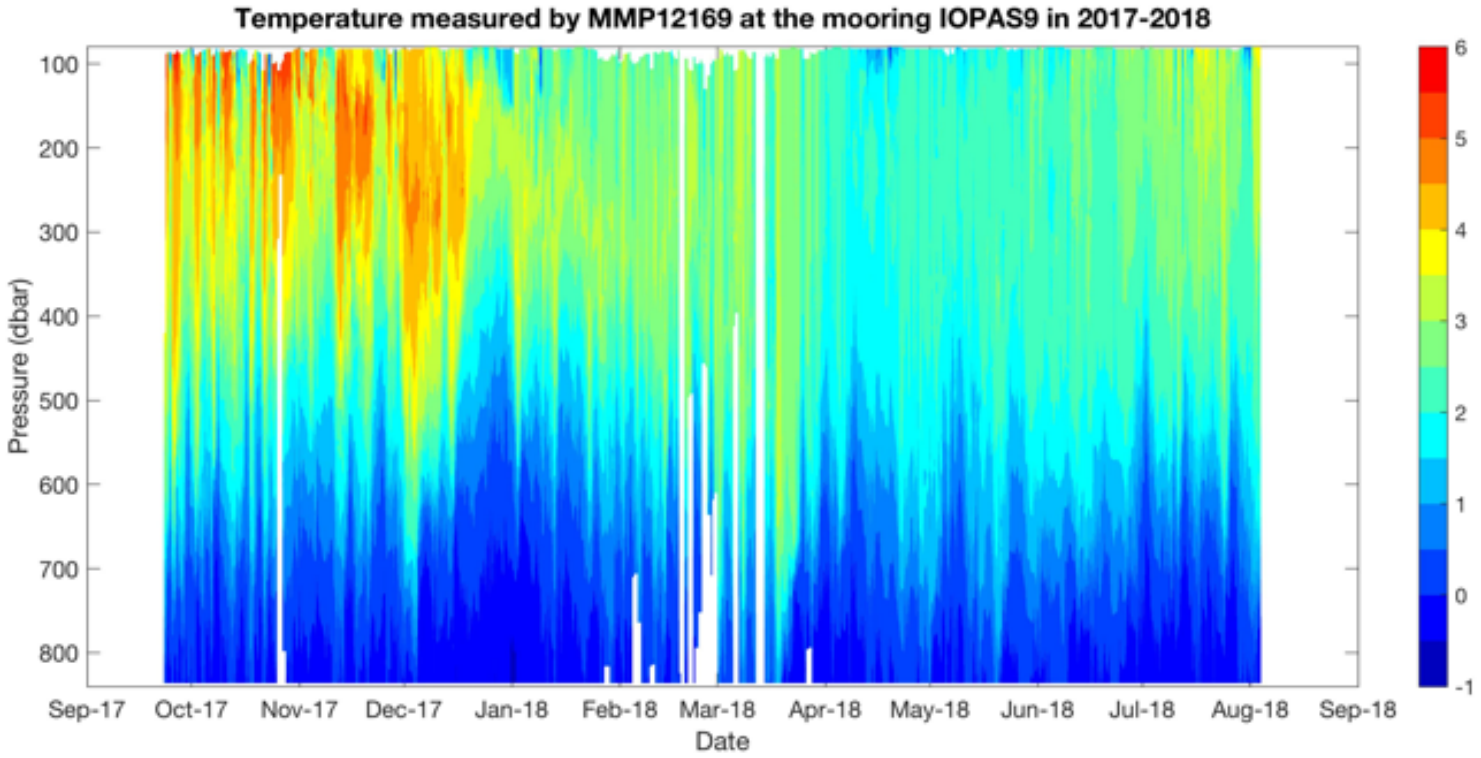




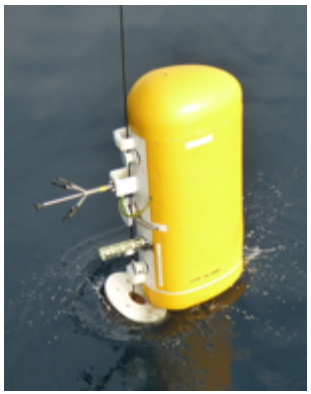
CNRS11: temperature, salinity and oxygen from SBE37

Data from INTAROS moorings

Moored array for ocean and sea ice (IOPAN, CNRS-LOCEAN)



IOPAS11: profiles of temperature from MMP



CNRS data will be available from SEANOE (www.seanoe.org) and via INTAROS data catalogue

IOPAN data will be available from IOPAN data base or ftp server and via INTAROS catalogue

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Oceanographic data collected in coastal Greenland 2016-2018:

Three different cruises in 2016, 2017, 2018
provided 50+ CTD profiles, pCO_2, nutrients etc.
Data will be submitted to public depository:
GEM data base http://data.g-e-m.dk/ after embargo

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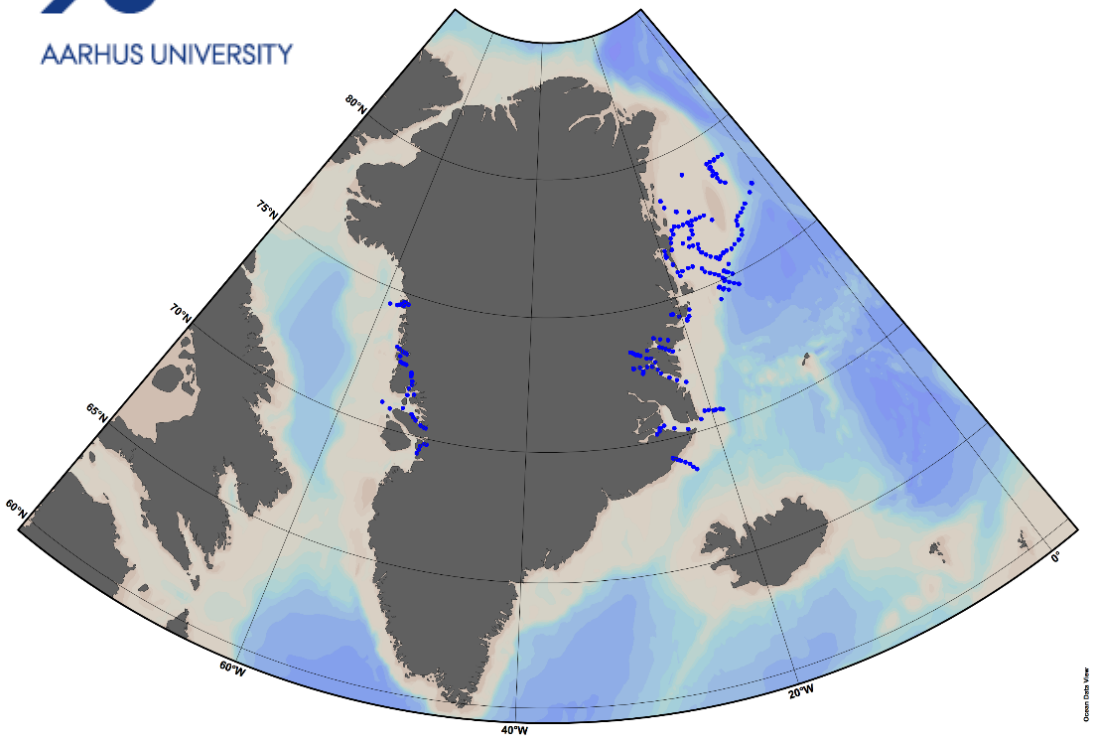

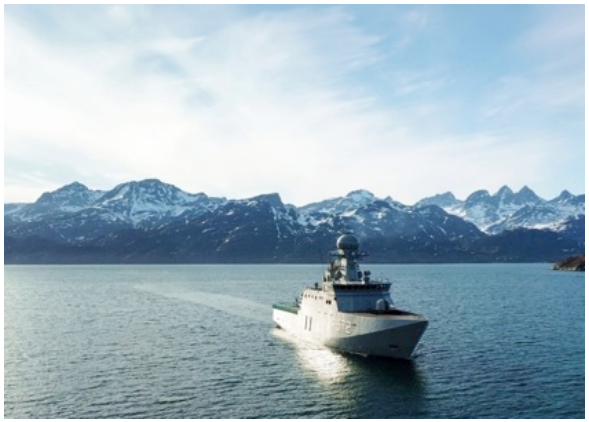

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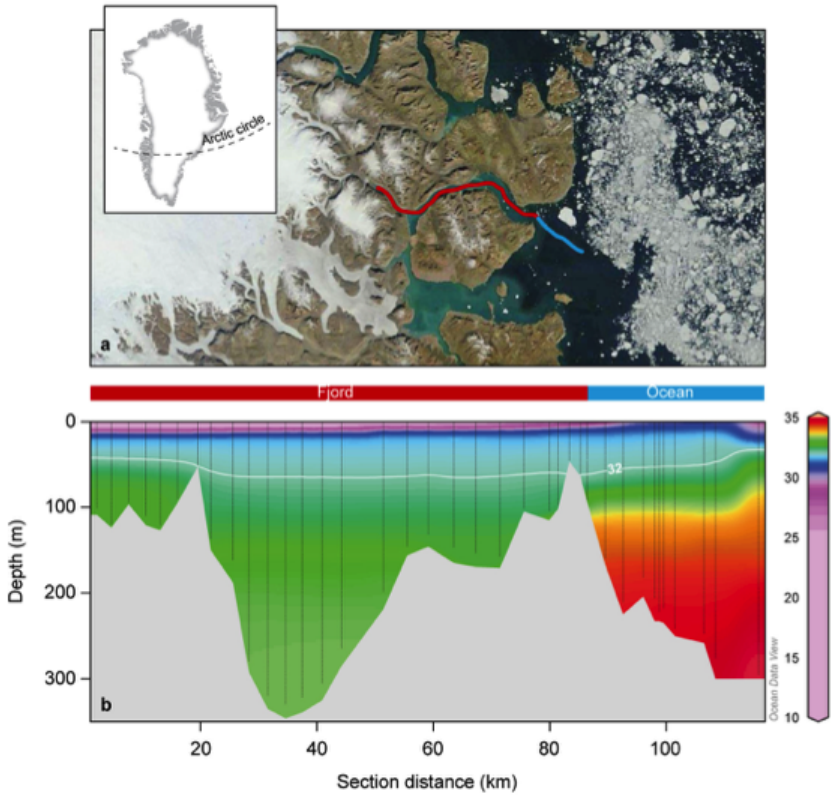
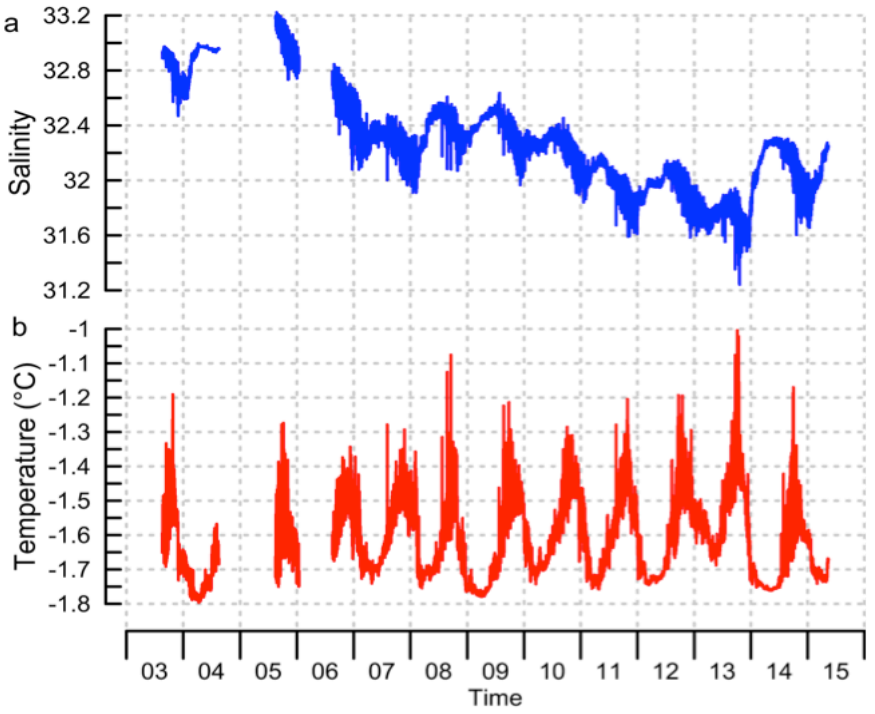
Annual CTD sections in Young Sound, East Greenland



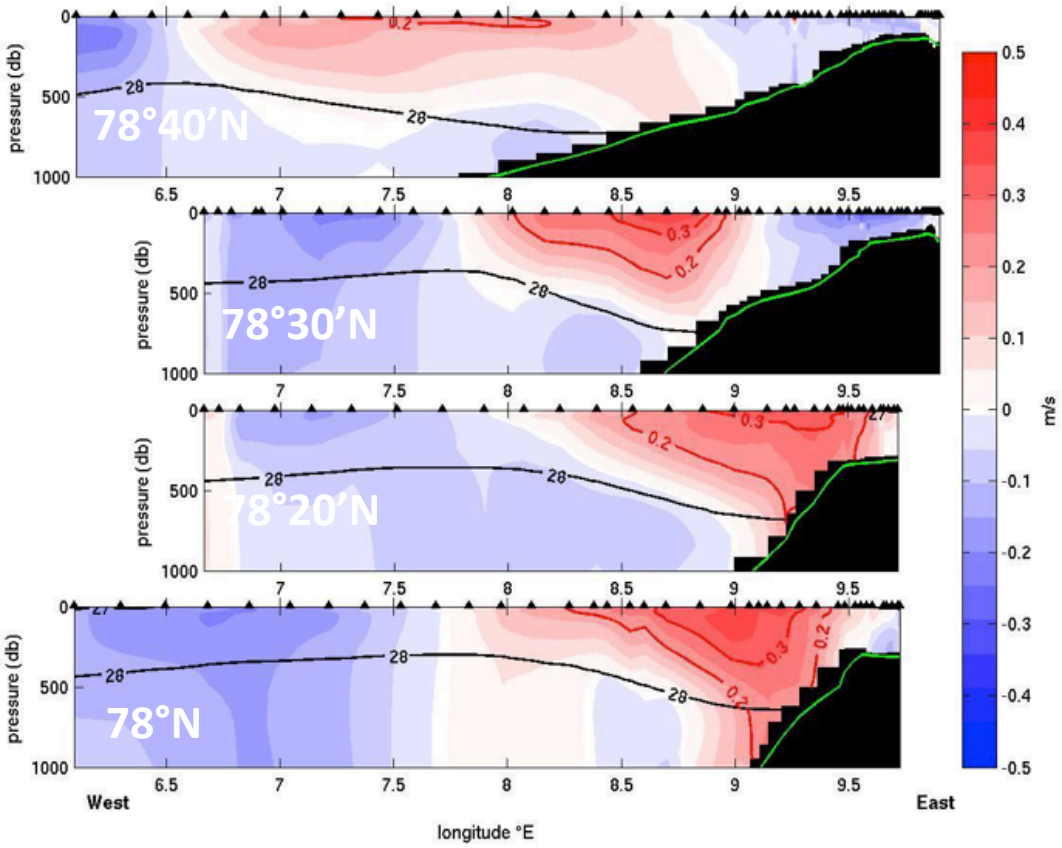
Repeated CTD transect measured every August since 2013 in Young Sound, East Greenland



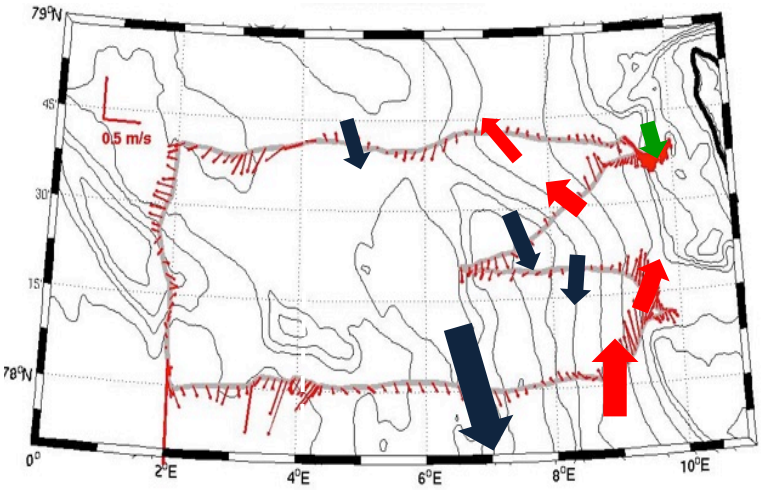
Temperature and salinity from 60 m depth from the Greenland Ecosystem Monitoring program in Young Sound. 2003 to 2015. Redrawn from Boone et al. 2018.

Endurance glider lines along the Atlantic Water pathways in Fram Strait (CNRS-LOCEAN)

2017 glider mission: Two repeat quadrangles in Fram Strait:
July 25 - Aug 30 and Aug 30 – Sep 22



«Cross-track» velocity (eastern domain)
→ meridional evolution of the flow between 78°N and 78°40' N



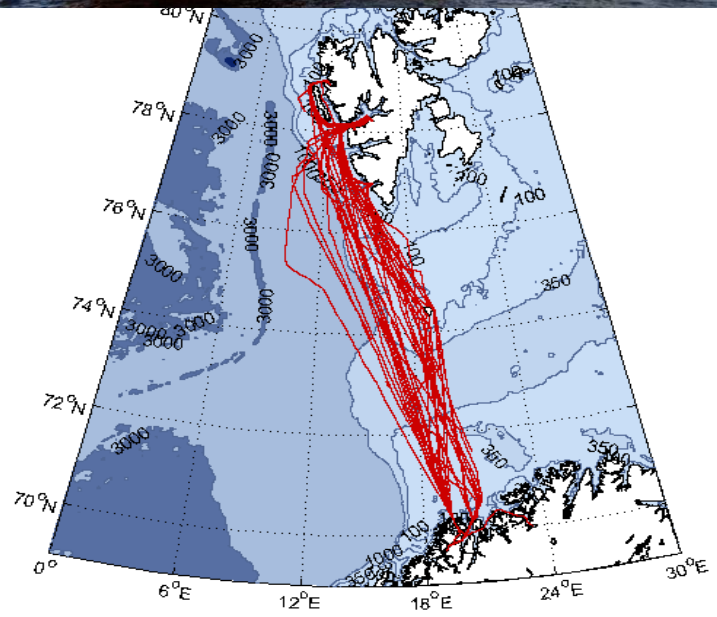
Circulation scheme based on the 0-1000 m transport associated with the main northward - southward flow branches

Sections	Northward (recirculated)
78°40'N	2.3
78°30'N	2.8 (0.5)
78°20'N	3.2 (0.4)
78°N	5.7 (2.5)

Roland, Master thesis, 2018

Extending the Ferrybox monitoring between Tromsø and Svalbard

- **INTAROS contribution:** novel sensors for FerryBoxes (ocean acidification and carbonate chemistry, inherent optical properties, microplastic sampler)
  (NIVA)



Existing Ferrybox system:

Wind sensor at deck (True wind speed and direction, Gill instruments)

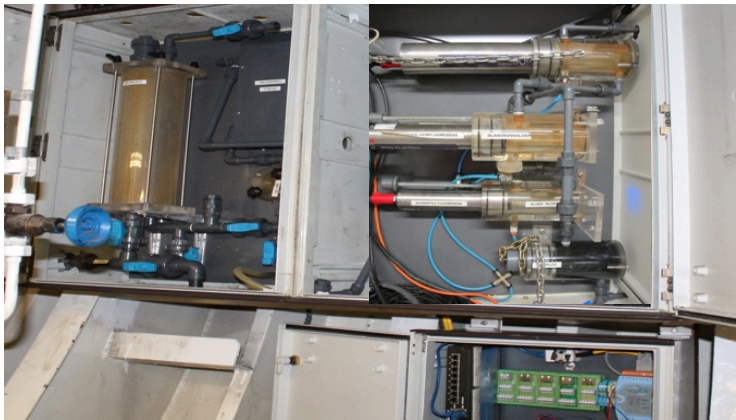
Air temperature (Optional). Weather stations?

Above water radiance/irradiance (TriOS Ramses Ed, Ld, Lu)

Temperature and salinity (Seabird SBE45)

Oxygen sensor (AADI Optode)

- + many biogeochemical sensors



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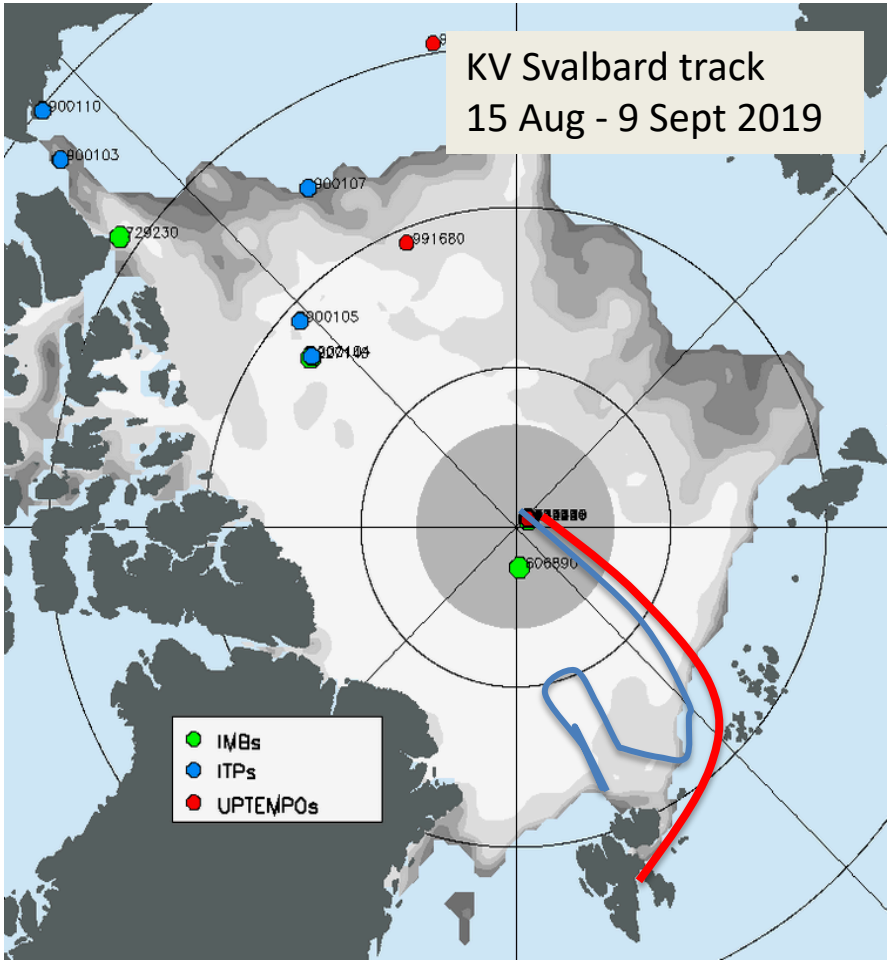
Ice-Tethered Profiler and SIMBA deployment at North Pole during CAATEX experiment 21 August 2019

SIMBA Ice Mass Balance Buoy



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

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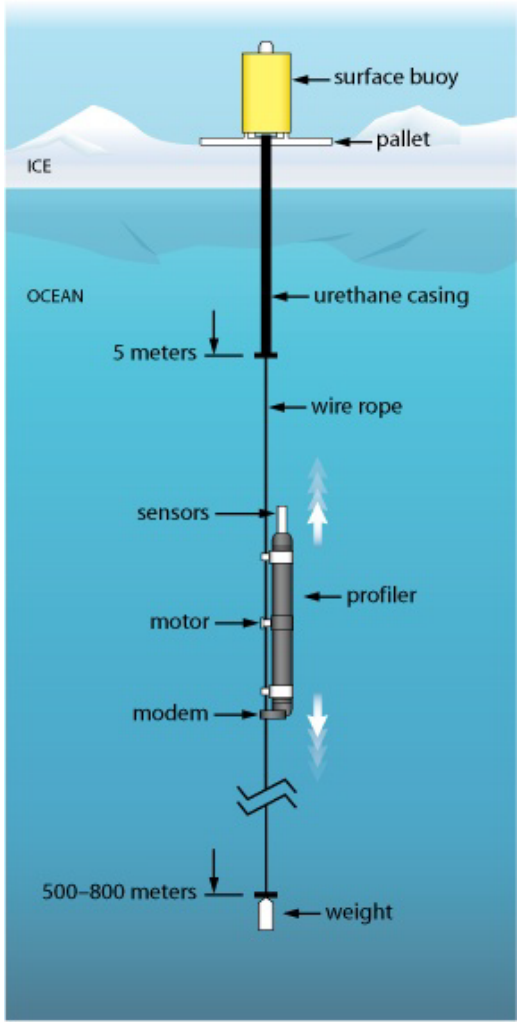
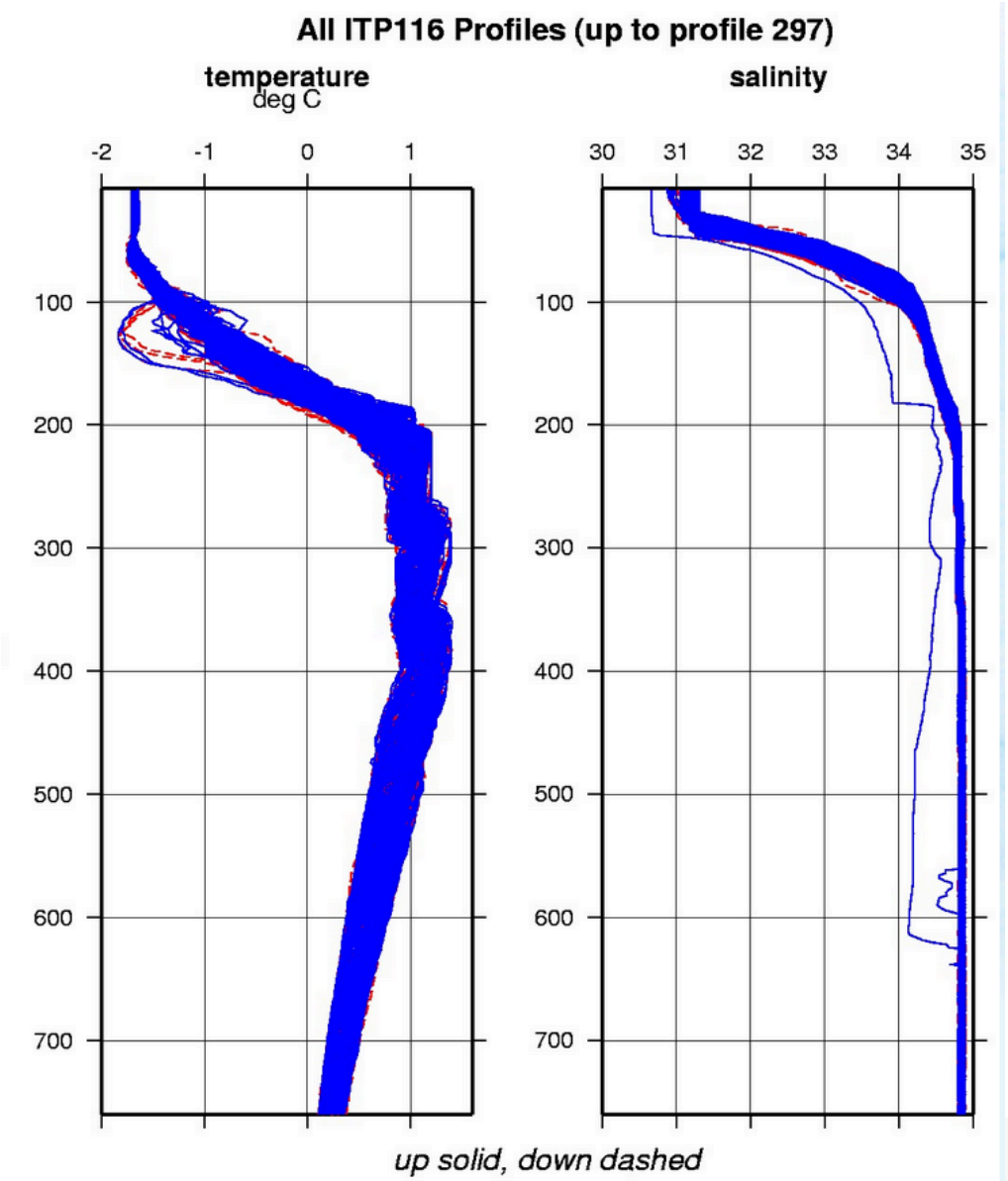
Profiles from ITP no 116 (4 Nov 2019)





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

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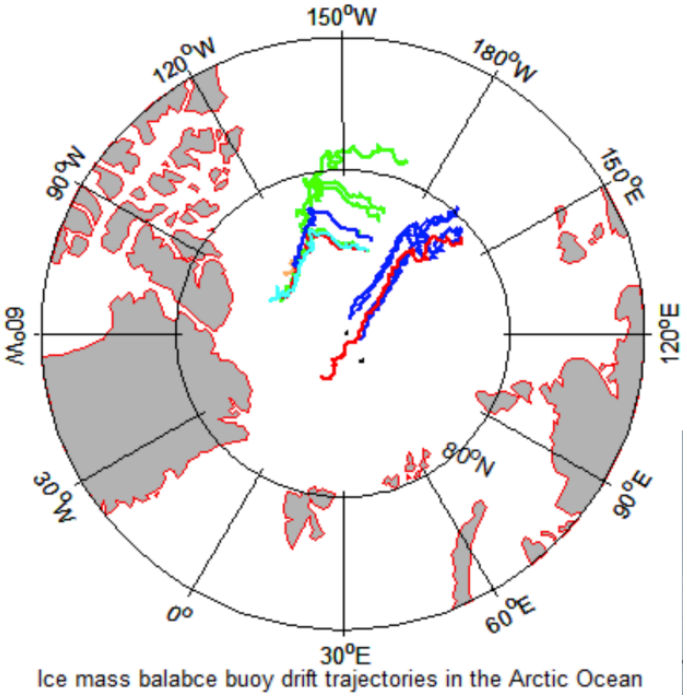
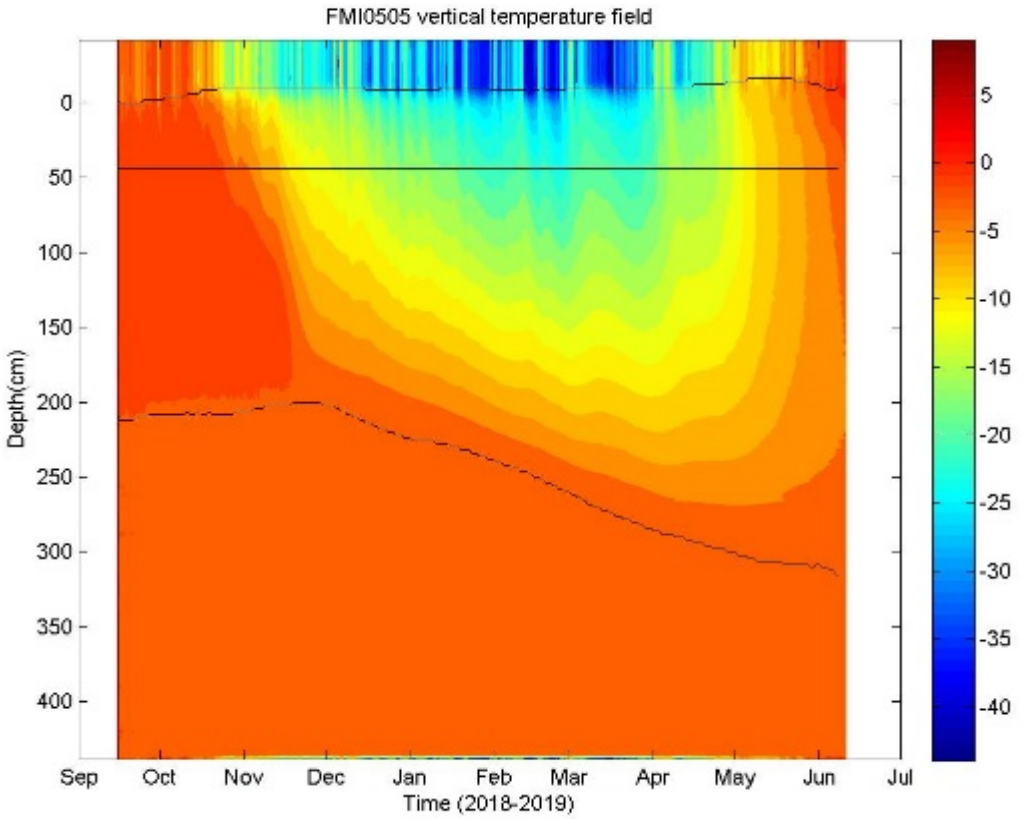
Woods Hole Oceanographic Institution

Snow and ice thickness from drifting SIMBA buoys

Contact person: bin.cheng@fmi.fi



Ice mass balabce buoy drift trajectories in the Arctic Ocean



- SIMBA measures high resolution temperature profiles in air-snow-ice-water.
- 15 buoys have been deployed in 2018 as part of the CHINARE program and INTAROS, in collaboration between FMI, NMEFC and PRIC

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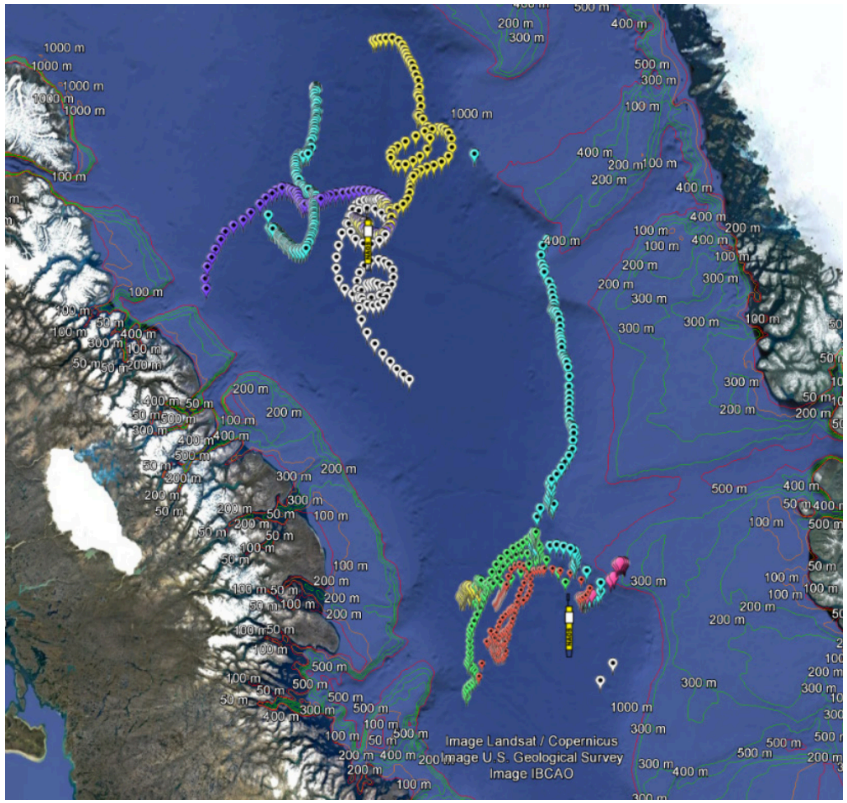
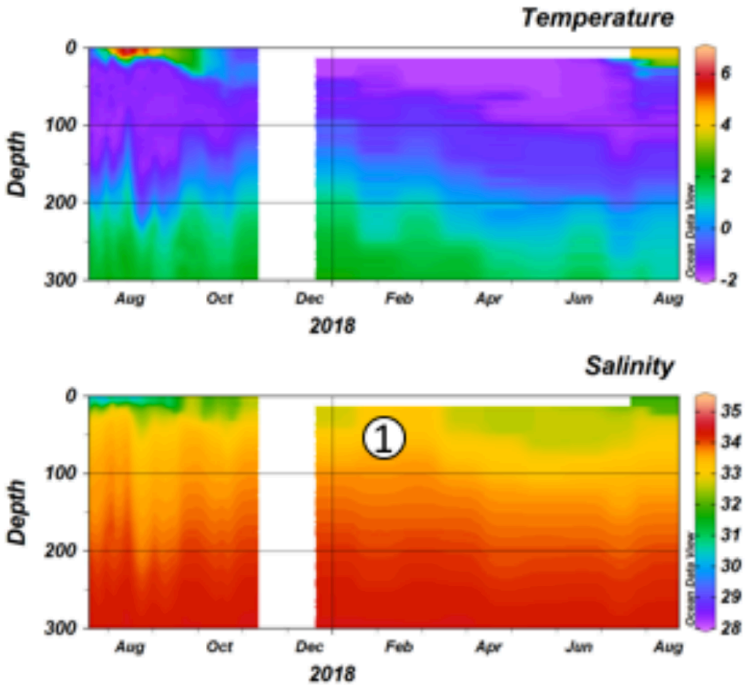
Biogeochemical Argo floats in Baffin Bay



Trajectories of the 7 bio-Argo floats (PRO-ICE) deployed in summer 2017 by CNRS Takuvik. 2 buoys were deployed 2018, 2 in 2019 and 5 are planned in 2020



One-year time series (July 2017 to August 2018; preliminary data) for temperature and salinity. Other parameters include chlorophyll a fluorescence, nitrate concentration, O2 concentration and CDOM fluorescence. (1) marks the winter vertical mixing of the upper water column, best seen in the salinity data. Courtesy: M. Babin

PI: Marcel Babin, marcel.babin@takuvik-ulaval.ca

Data collected are available in real time in Argo database

ftp://ftp.ifremer.fr/ifremer/argo/dac/coriolis/

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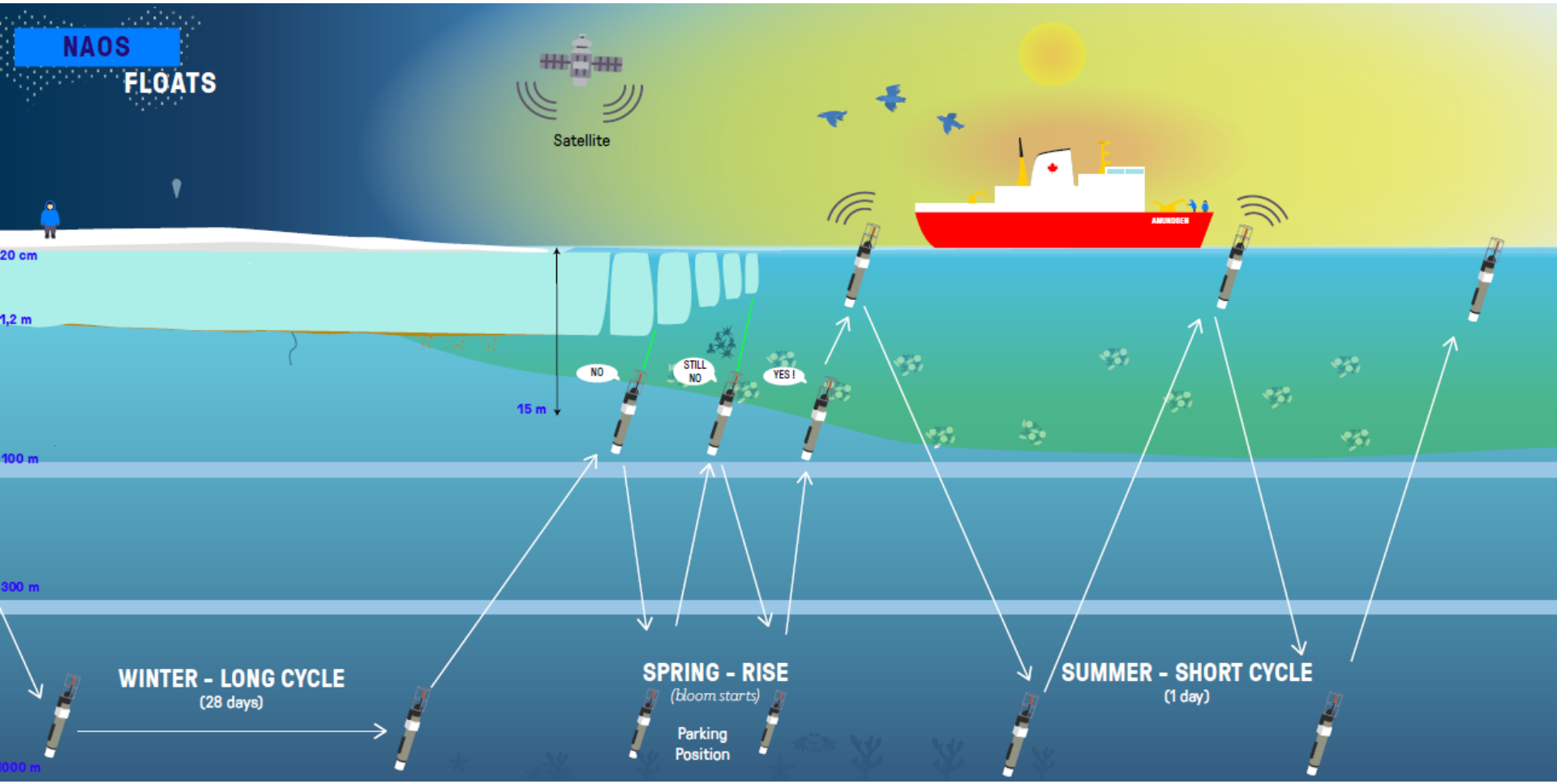
Sampling strategy for the Argofloats in Baffin Bay which is partly sea ice covered



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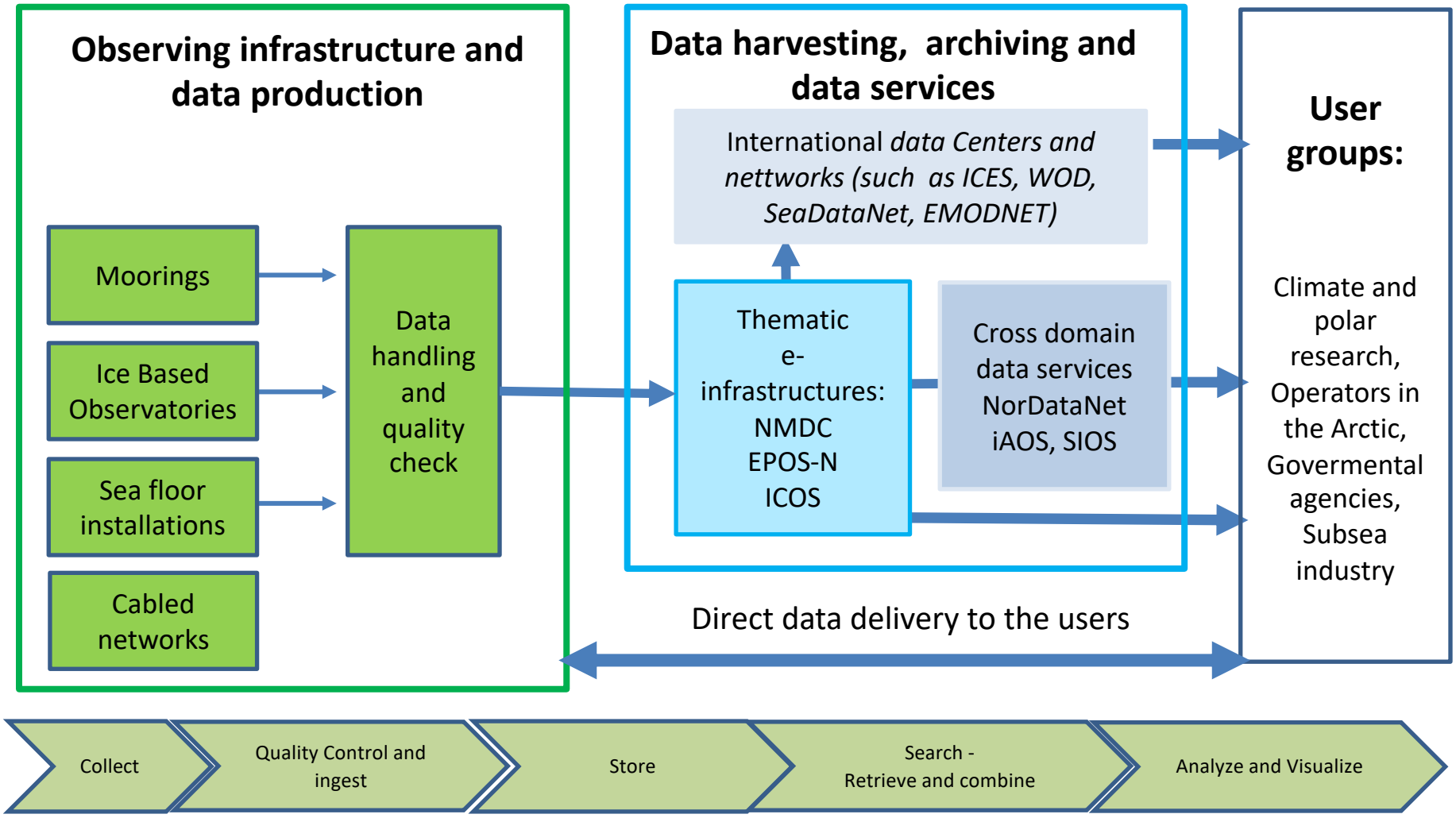
Data delivery chain: ocean observing systems



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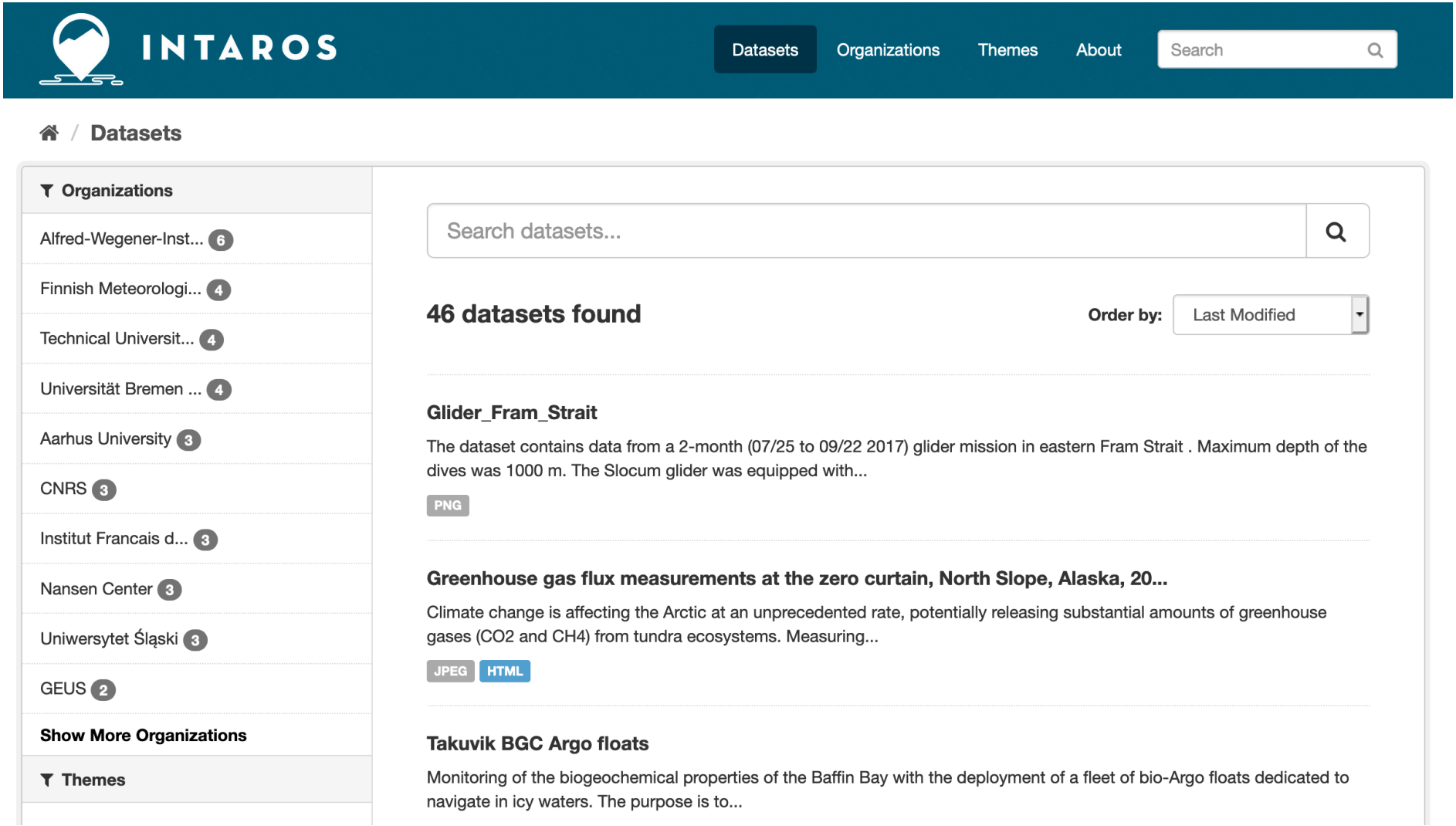
INTAROS Data Catalogue



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

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The main data integration challenges

- Difficult to fully understand the services (for both data providers and users) offered by existing repositories
- Different institutions have very different levels of data management expertise and data infrastructure maturity
- Data owners need training in data management including tools that can be tailored to different types of data
- Hetereogenerous structures and lack of standards in some domains; generic tools can be hard to learn and customize

- Competence building is needed between scientific themes and data expertise through educational and training acivities

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