

UNIS marine infrastructure – existing, planned and wanted

Arctic shelf interaction process studies

Prof. Frank Nilsen

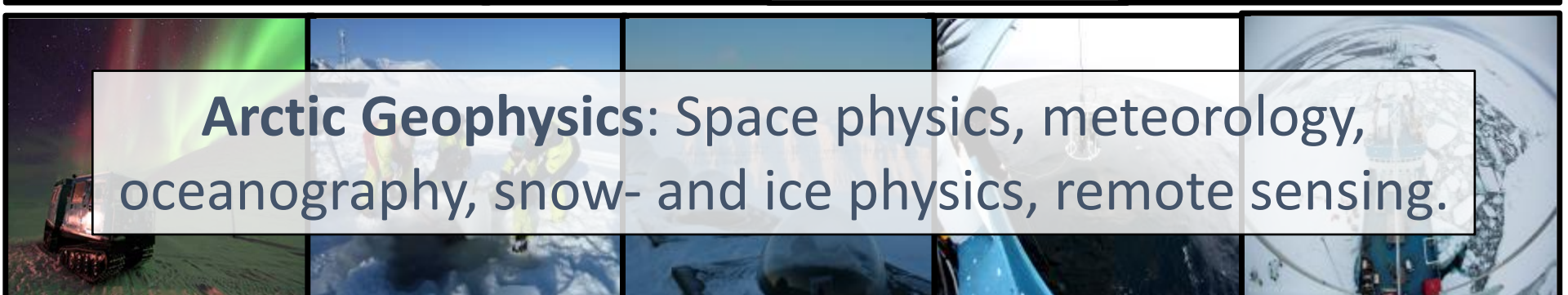
with contribution from R. Skogseth, E. A. Ersdal, E. Flack



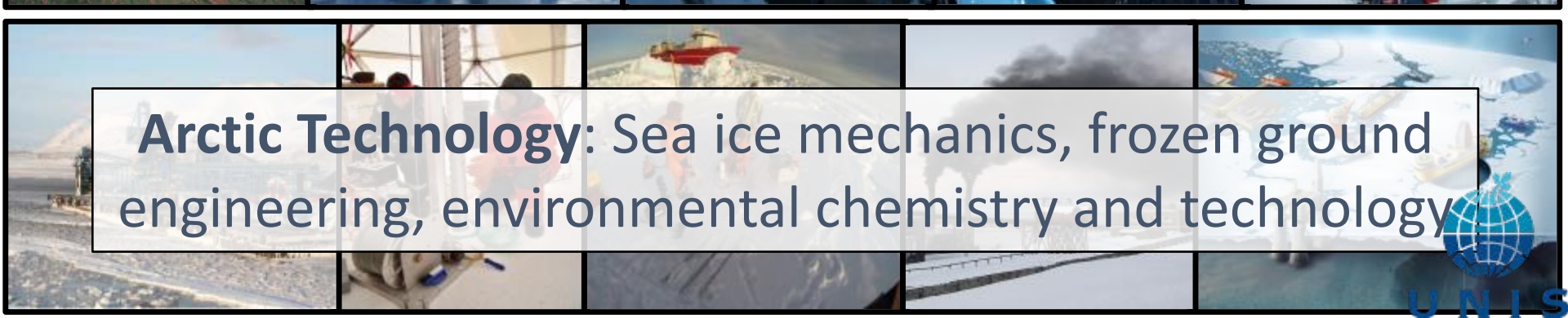
Arctic Biology: Marine and terrestrial ecology, genetics, behavior and physiology.



Arctic Geology: Sedimentary bedrock, terrestrial and marine quaternary, cryosphere.



Arctic Geophysics: Space physics, meteorology, oceanography, snow- and ice physics, remote sensing.

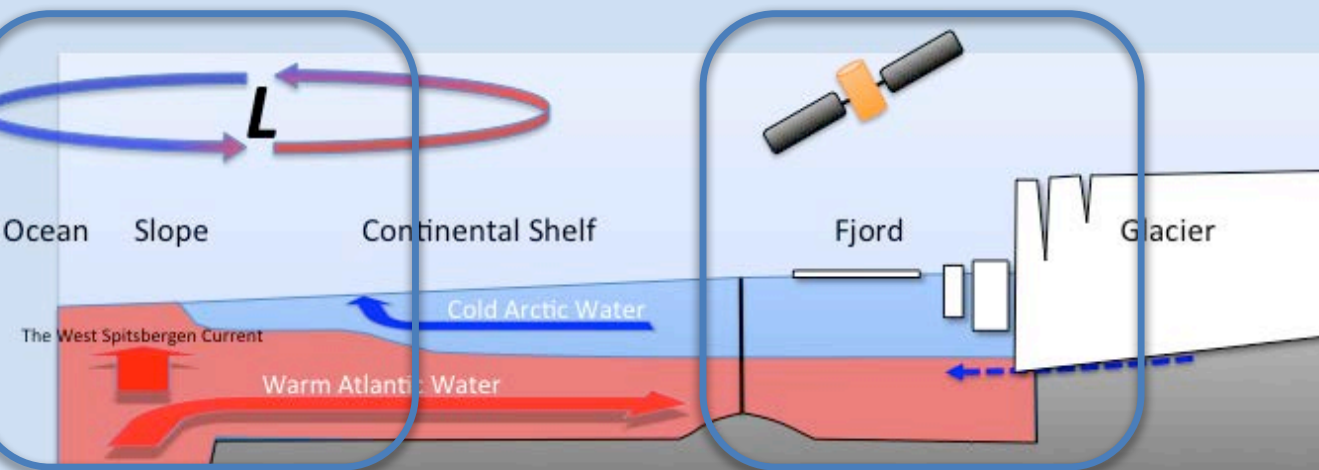


Arctic Technology: Sea ice mechanics, frozen ground engineering, environmental chemistry and technology



UNIS

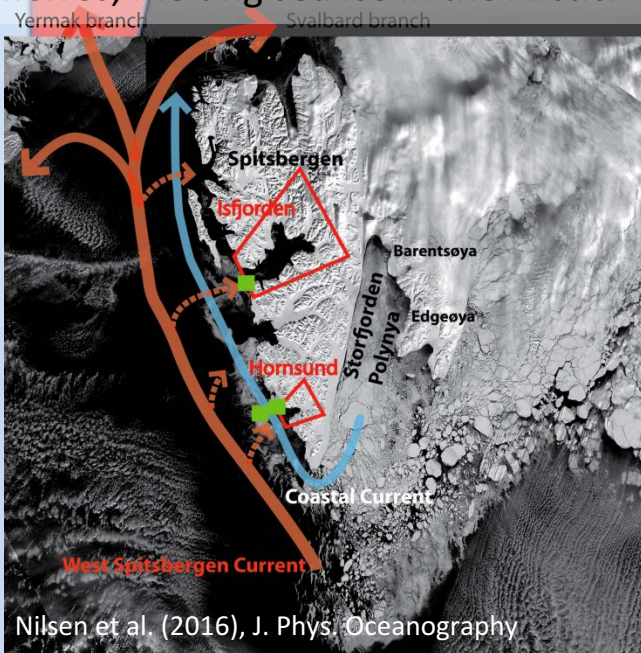
Air-Cryosphere-Sea Interaction



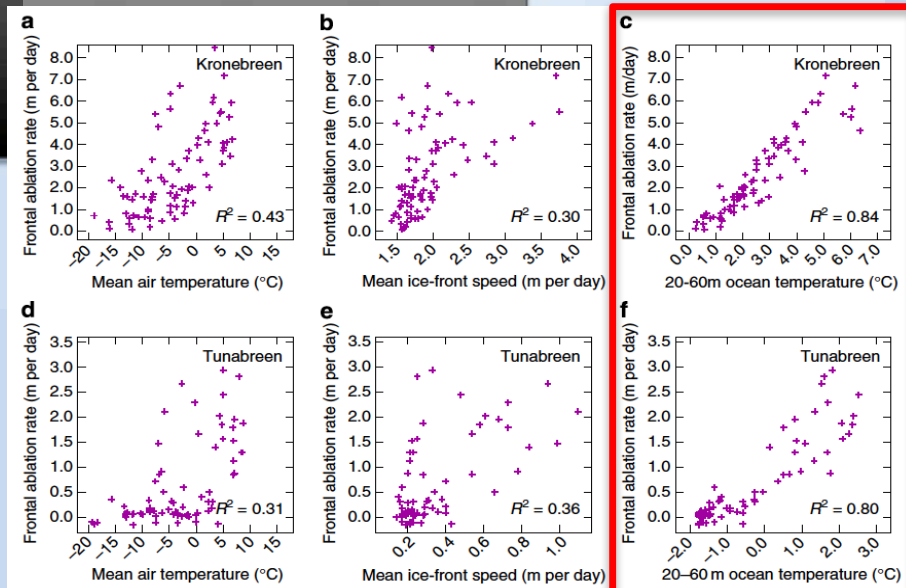
Interaction and interdisciplinary studies along an Arctic Shelf.

Warm Atlantic Water transport towards the Arctic and flooding of the Arctic shelves, melting sea ice in the Arctic.

Deep fjord temperatures control calving rates at tidewater glaciers. Combining glacier- and ocean dynamics with remote sensed data.



Nilsen et al. (2016), J. Phys. Oceanography

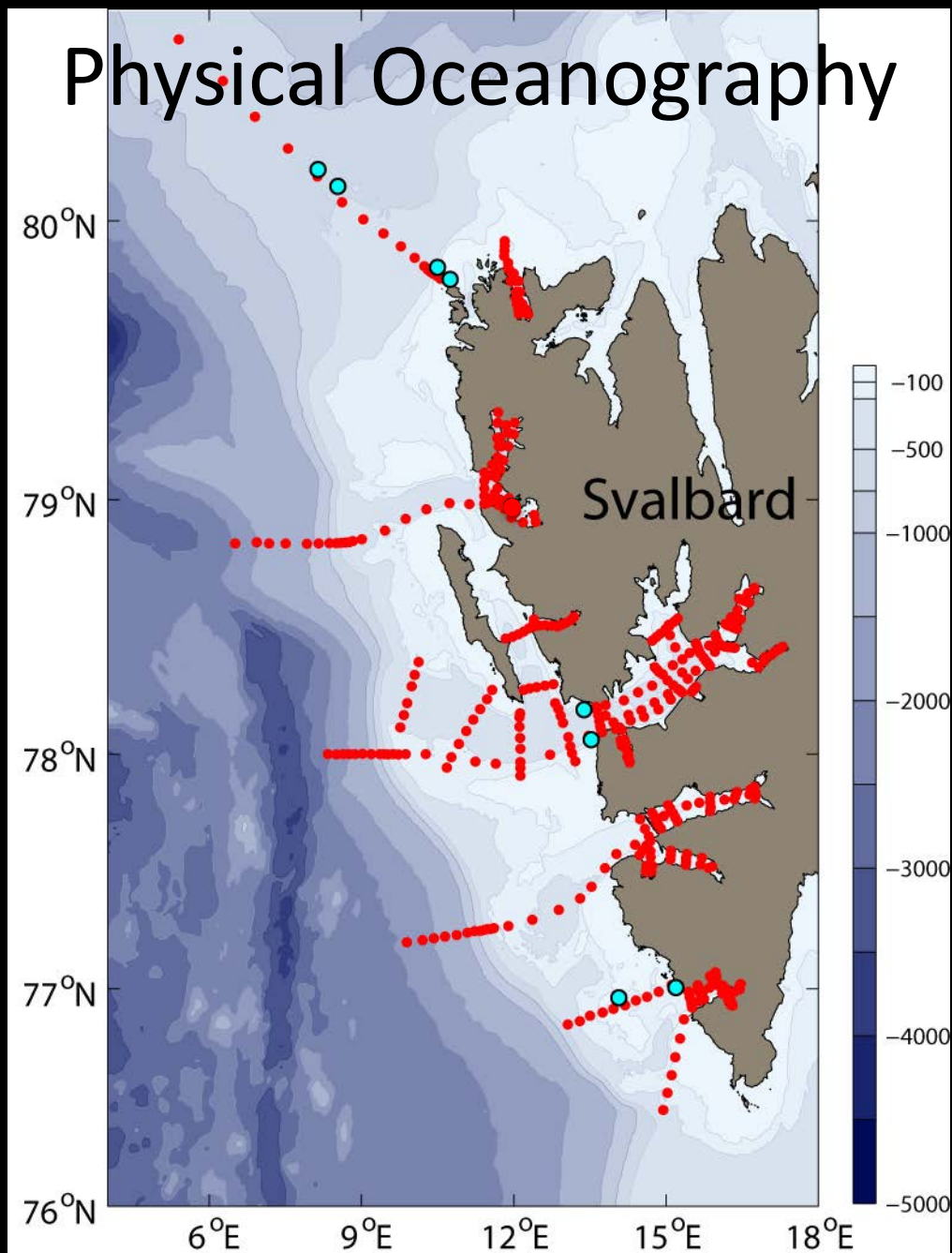


Luckman et al. (2015), Nature Communication



UNIS

Physical Oceanography



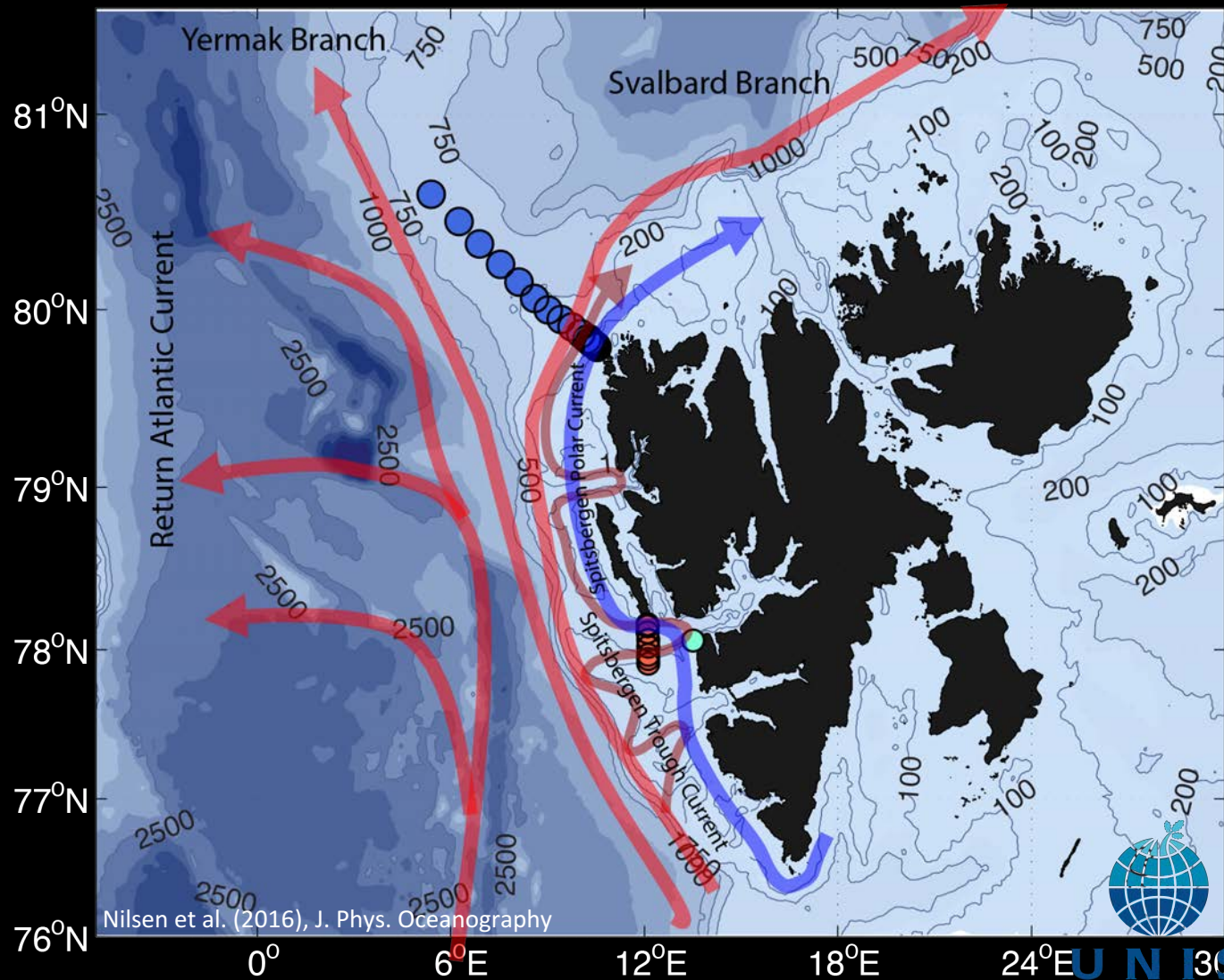
Ocean Circulation and Environmental Mass Changes

The West Spitsbergen Current (Atlantic Water)

The Spitsbergen Polar Current (mixture of meltwater, Arctic Water and Atlantic Water)

The Spitsbergen Trough Current (topographically steered Transformed Atlantic Water)

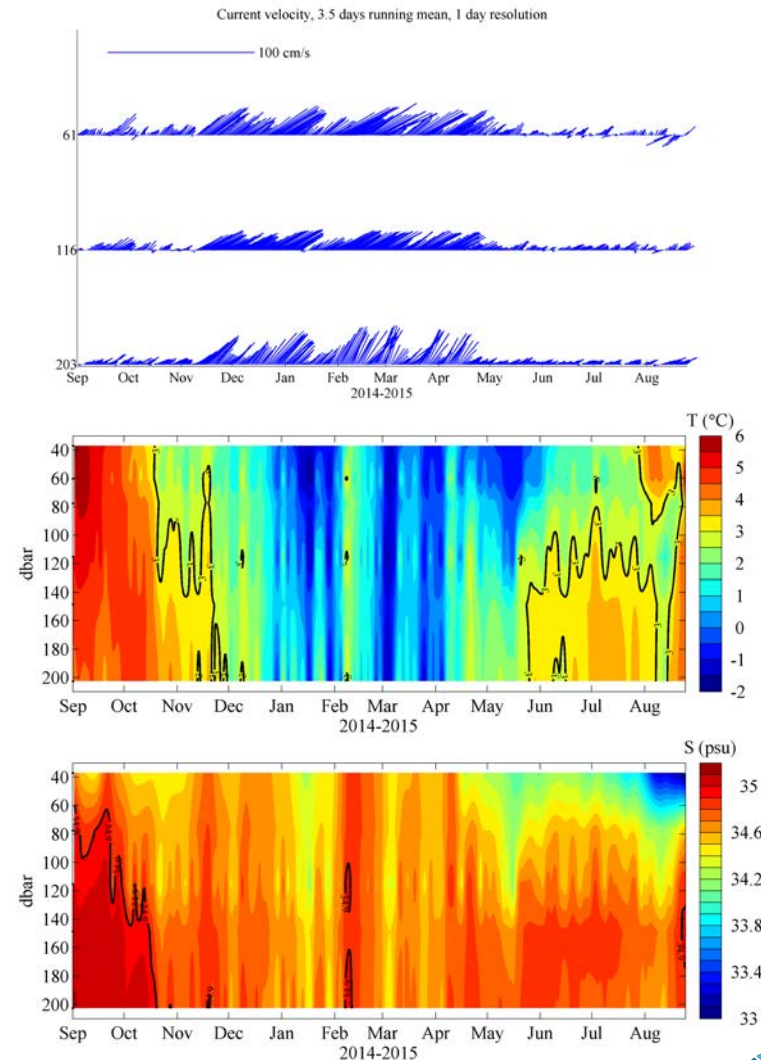
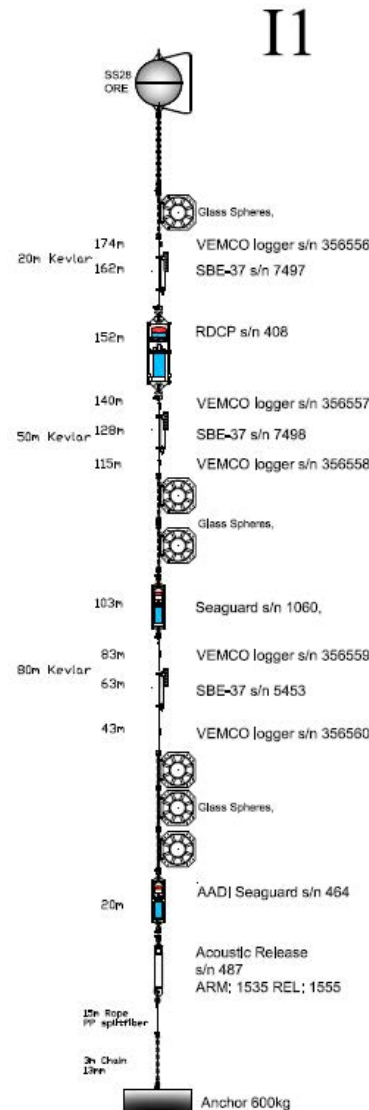
Nilsen et al. (2016), JPO



I1: southern side of Isfjorden mouth area (since Aug. 2005)

Pos: N 78 03.764, E 013 31.701; Depth: 211 m

- To capture the inflow of AW to Isfjorden
- 1 Aanderaa RDCP and 2 Seaguards with CTD sensors at ~50m, ~100m and ~200m depths
- Oxygen optode on upper Seaguard
- 3 SeaBird SBE37 CTDs at different depths
- 5 VEMCO temp. loggers at different depths



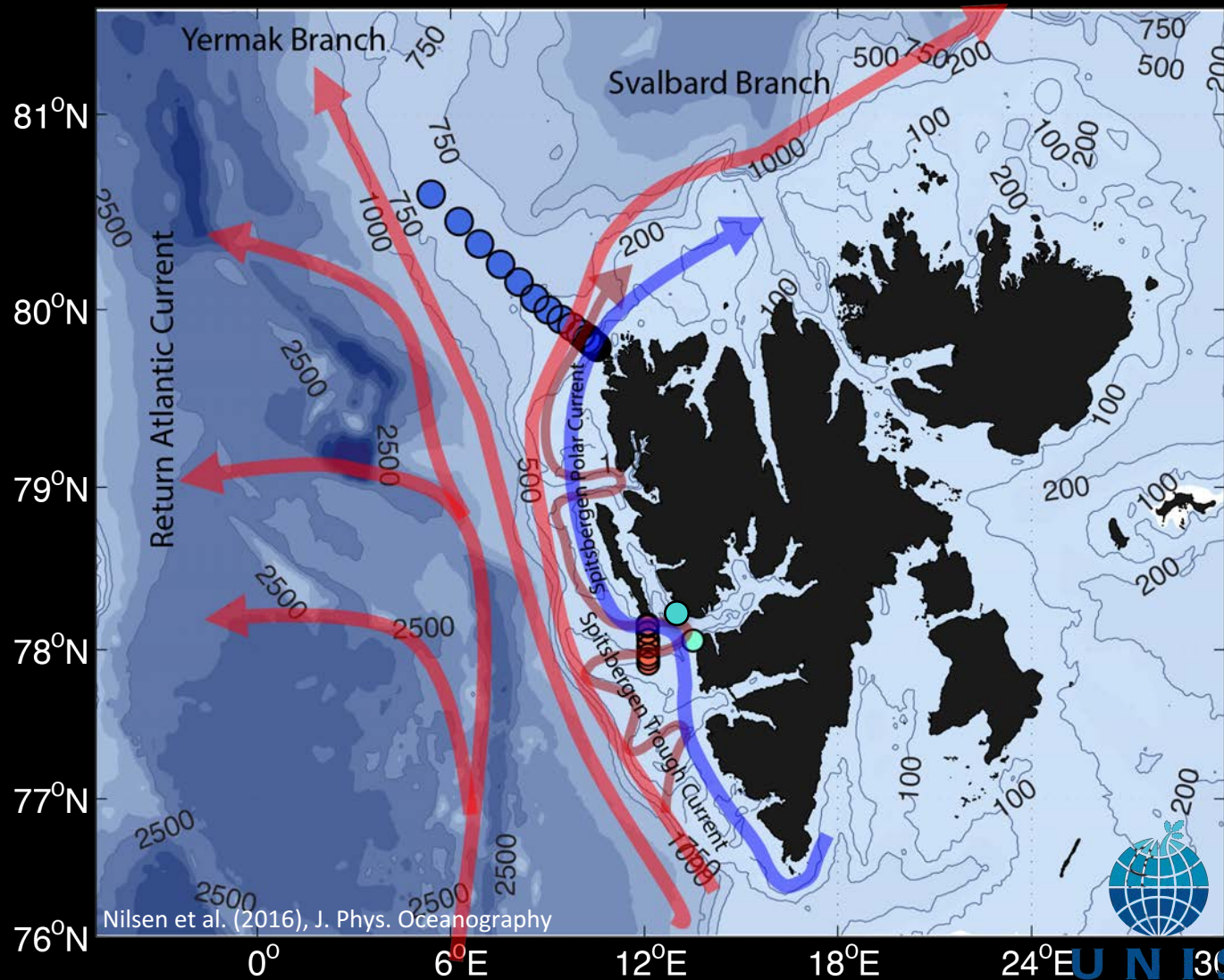
Ocean Circulation and Environmental Mass Changes

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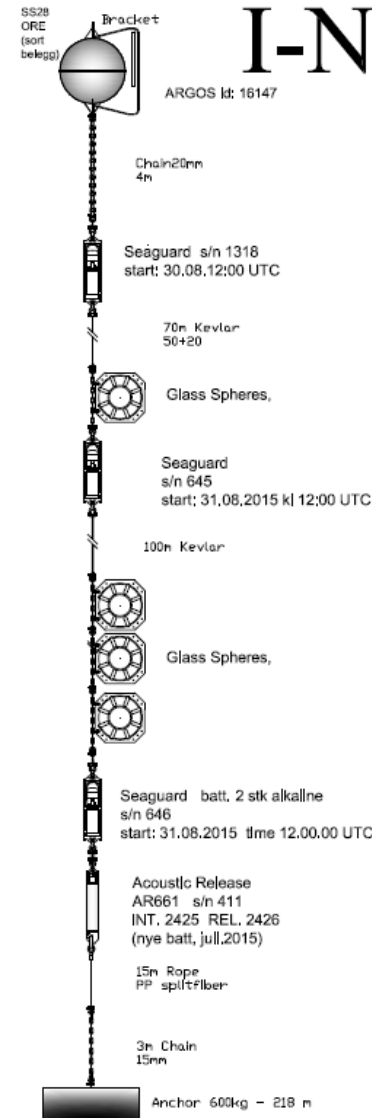
The Spitsbergen Trough Current (topographically steered Transformed Atlantic Water)

Nilsen et al. (2016), JPO



I-N: northern side of Isfjorden mouth area (since Aug. 2015)
Pos: N 78 10.829, E 013 22.737; Depth: 228 m

- To capture the transformed water masses leaving Isfjorden
- 3 Aanderaa Seaguards with CTD sensors at three depths
- Oxygen optode on upper Seaguard
- To be recovered and re-deployed in August 2016



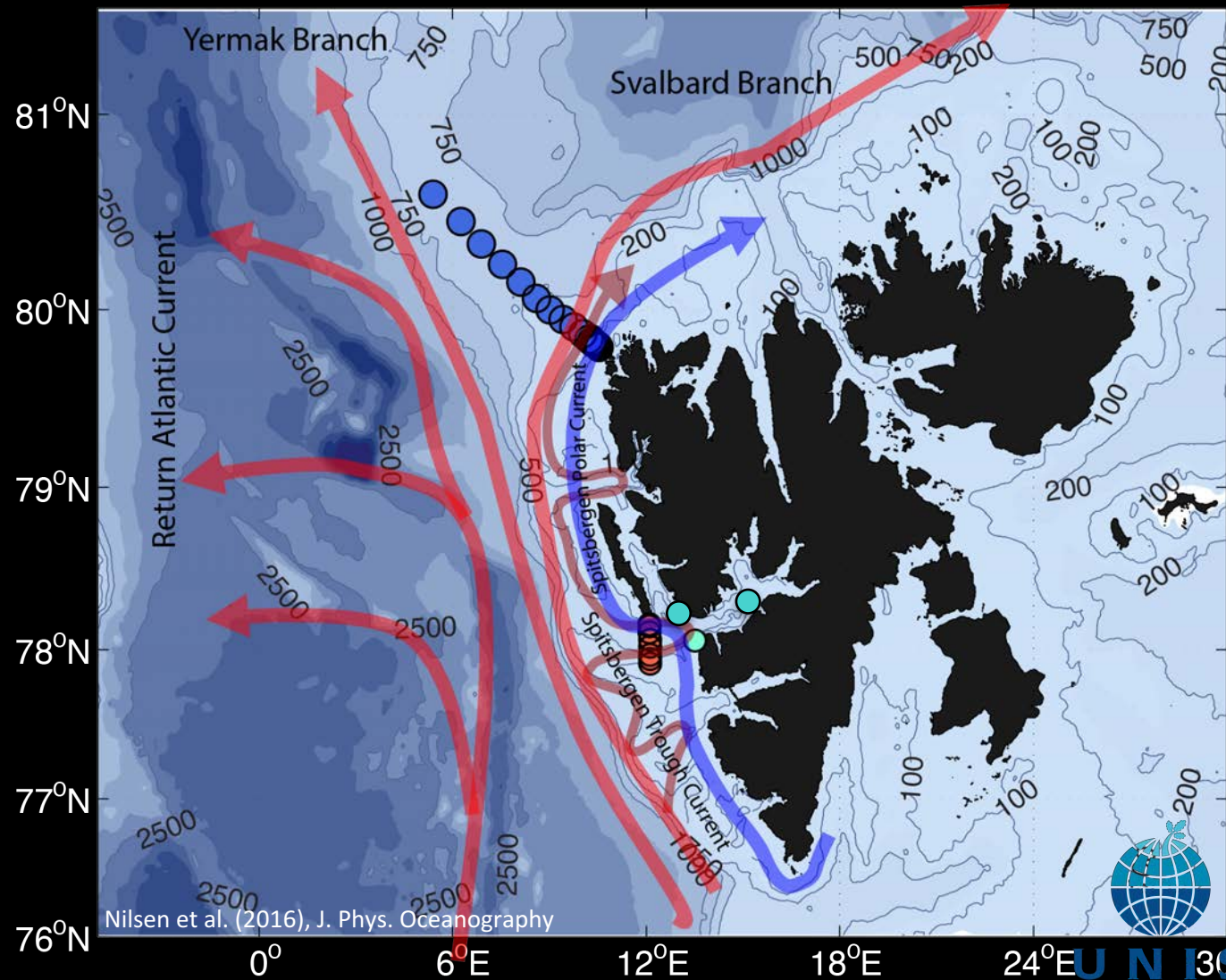
Ocean Circulation and Environmental Mass Changes

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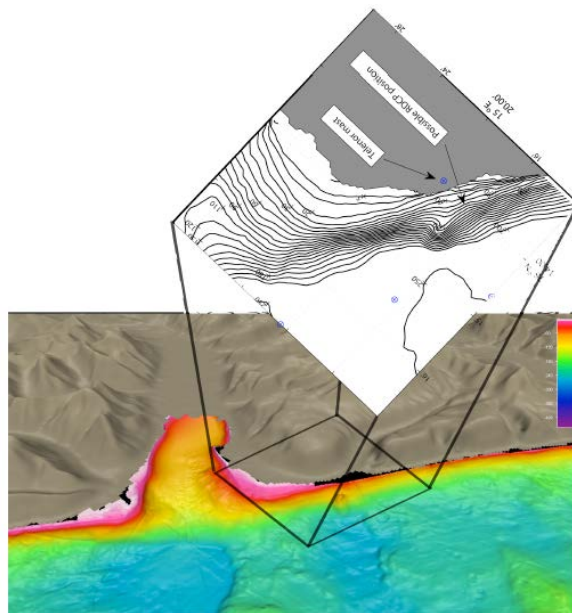
The Spitsbergen Trough Current (topographically steered Transformed Atlantic Water)

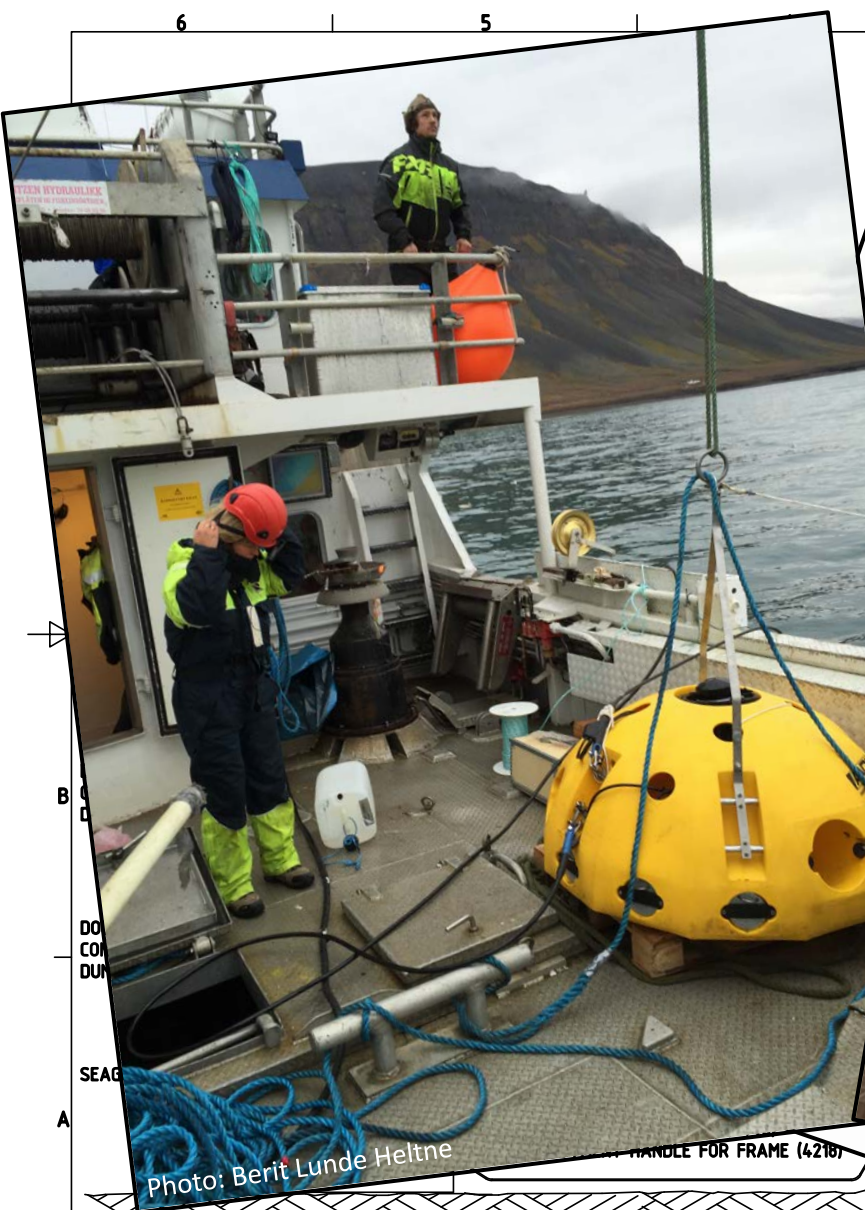
Nilsen et al. (2016), JPO



Ocean observatory in Isfjorden (from Sep. 2016)

- Svalbard Environmental Protection Fund project «Blir det is på Isfjorden i år?»
- To be deployed outside Bjørndalen/Vestpynten at 60 m depth
- Online via Telenors mast in Bjørndalen/Vestpynten
- Data publicly available through UNIS web page and Aanderaa Instruments data server
- Temperature, salinity and oxygen at several depths (between 60 and 20 m depth)
- Full-depth current profile including surface layer (indicate ice/no ice)
- Tidal bottom pressure sensor
- Fluorescence and PAR in ~20 m depth





AA
A team
installin

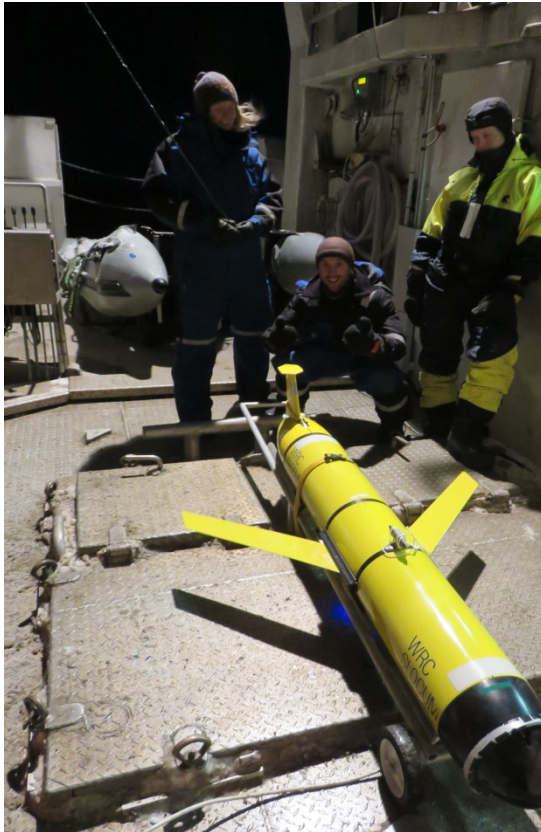
A team from Aanderaa, Berit Lunde Heltne, is installing a new mooring system for the observatory in the fjord.

It was to be installed via a unit on the ship.

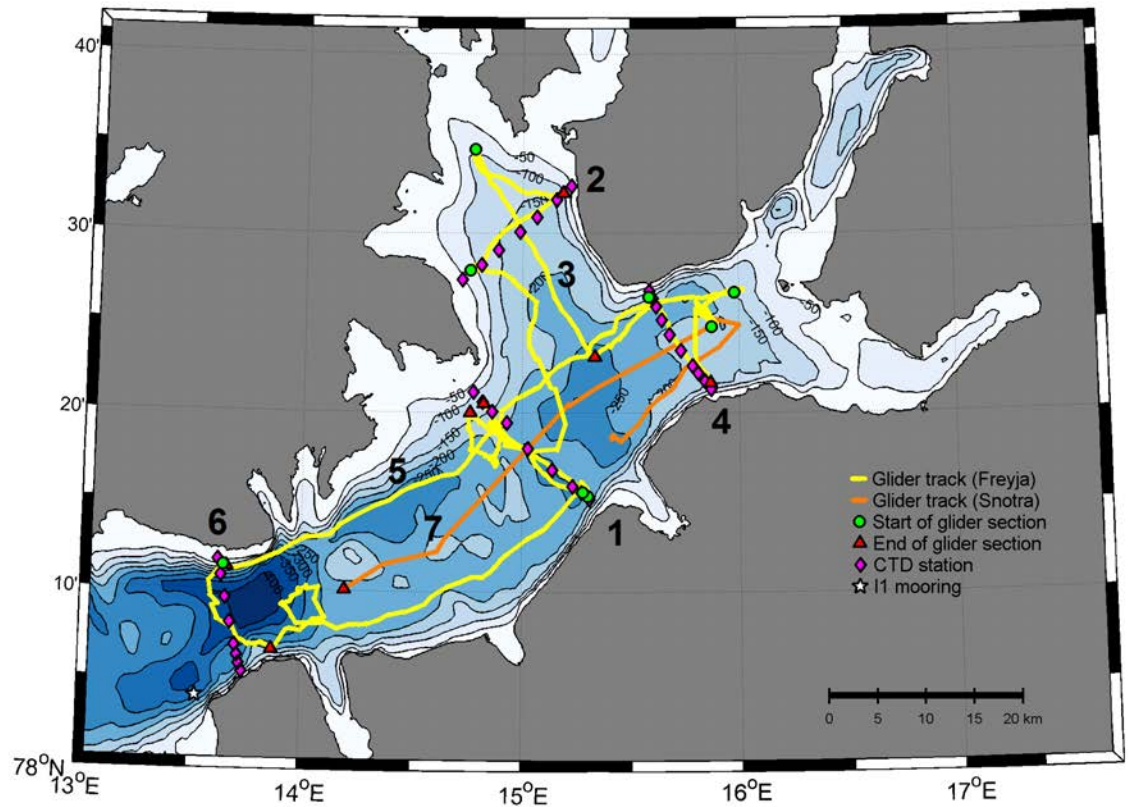


New technology

mapping and monitoring
and utilization of the Ar
to reduce operation time
seasons.



Slocum glider (NACO) used in Isfjorden and on the West Spitsbergen Shelf November 2014.

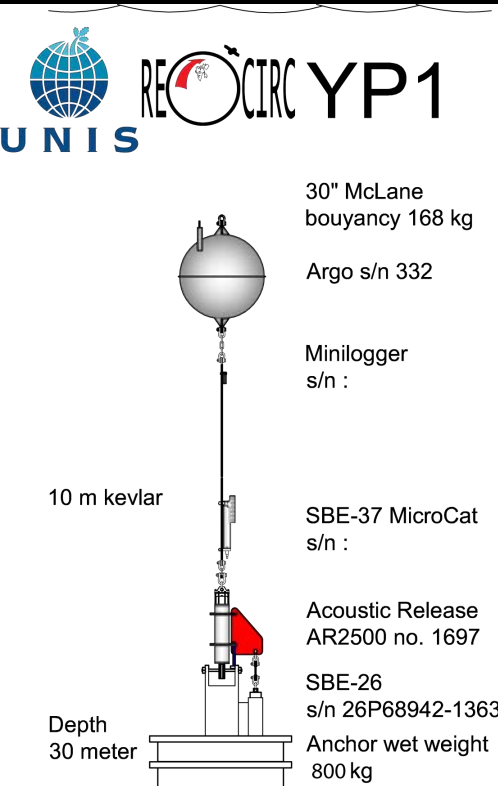


Small Unmanned Meteorological Observer (SUMO) used over land and sea.

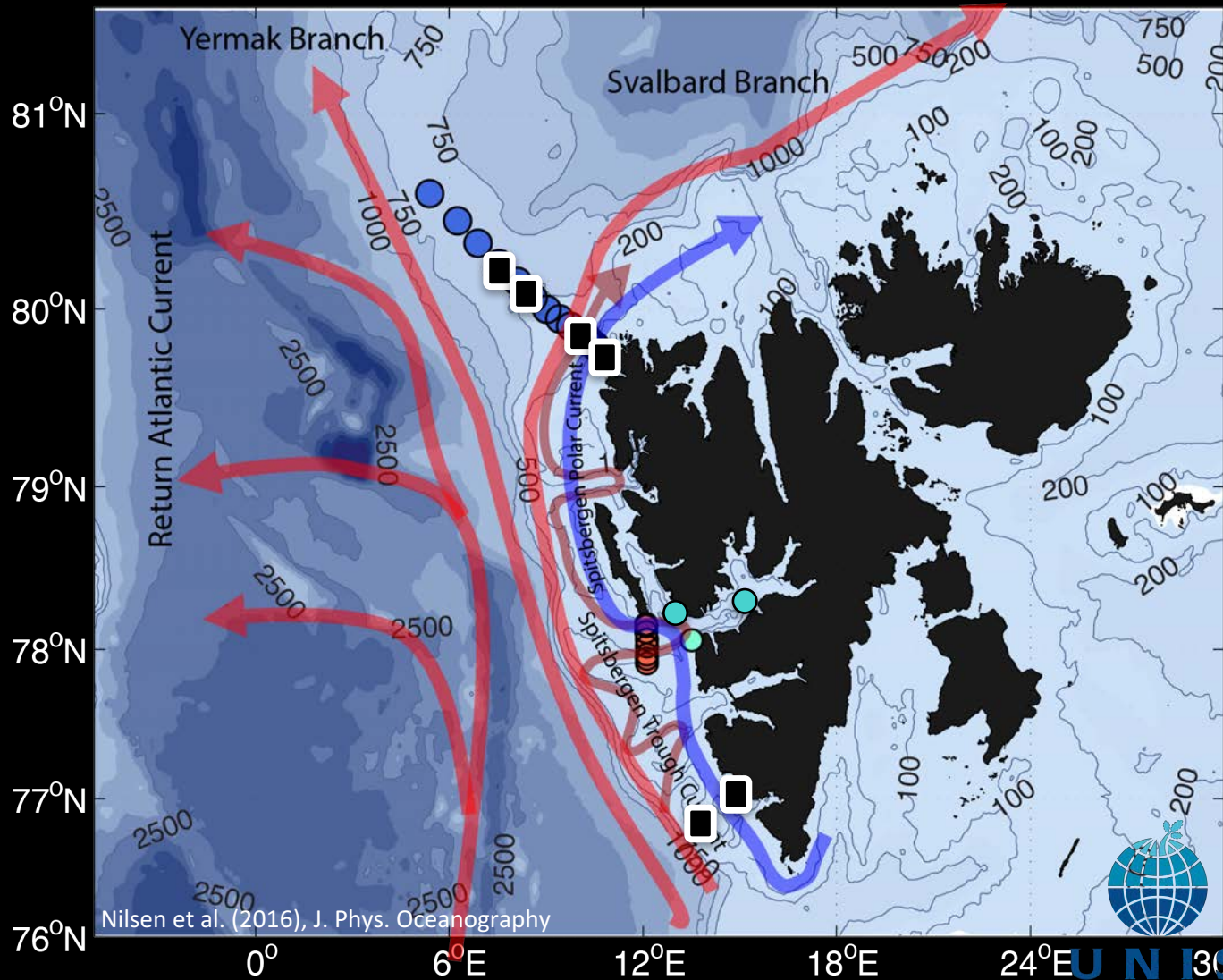


New and existing technology to be implemented in research and education.

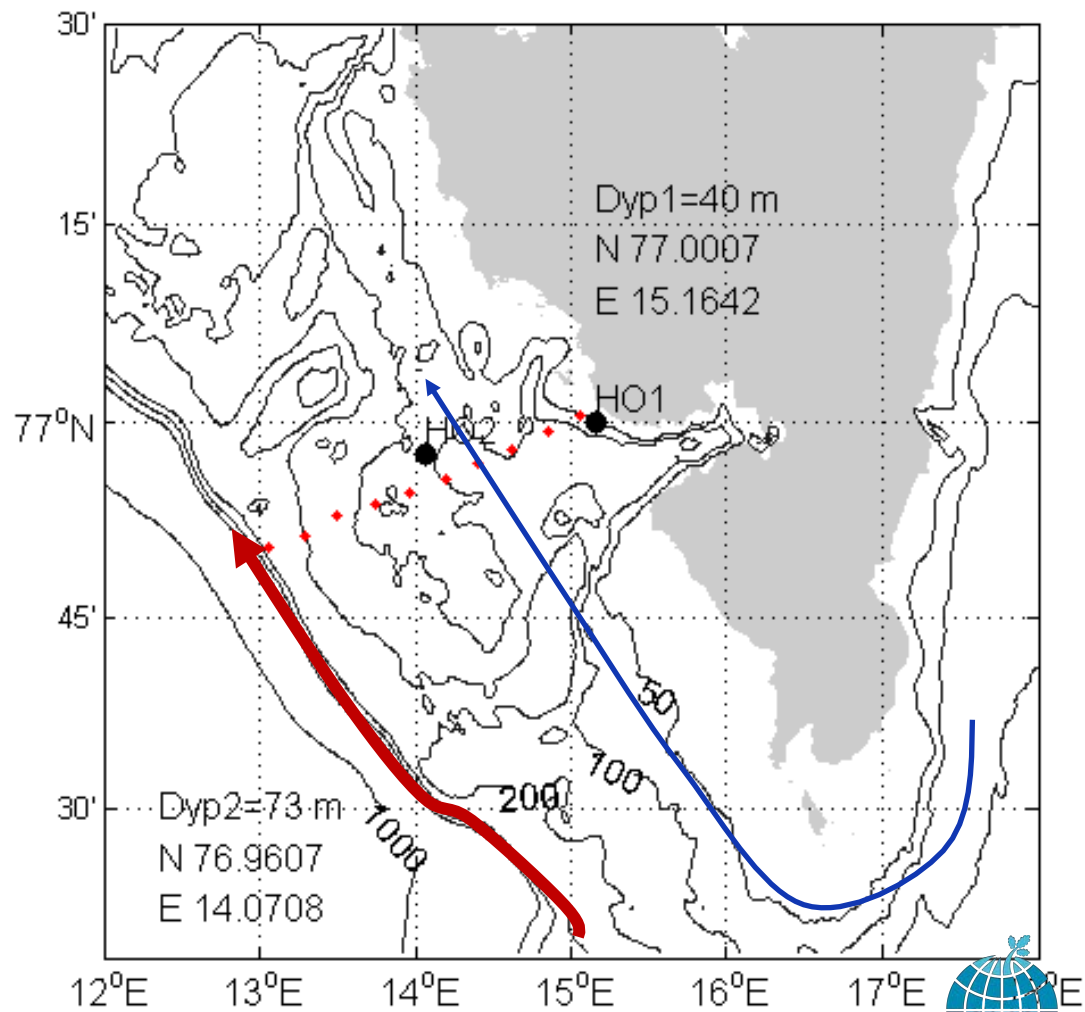
Ocean Circulation and Environmental Mass Changes



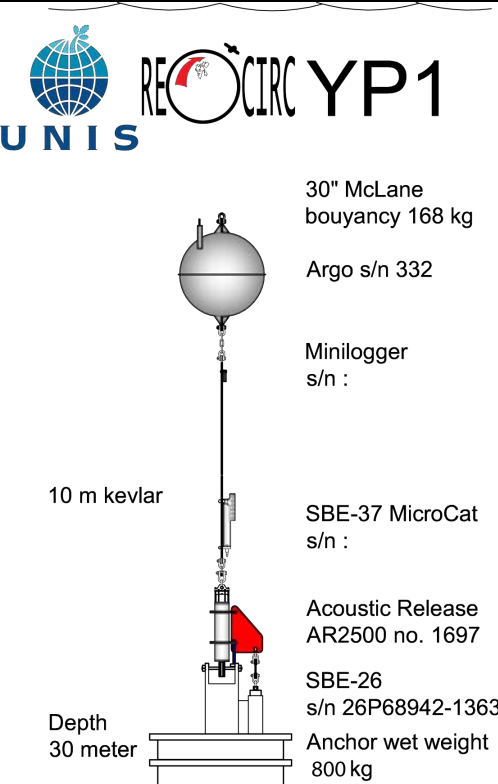
AWAKE-2



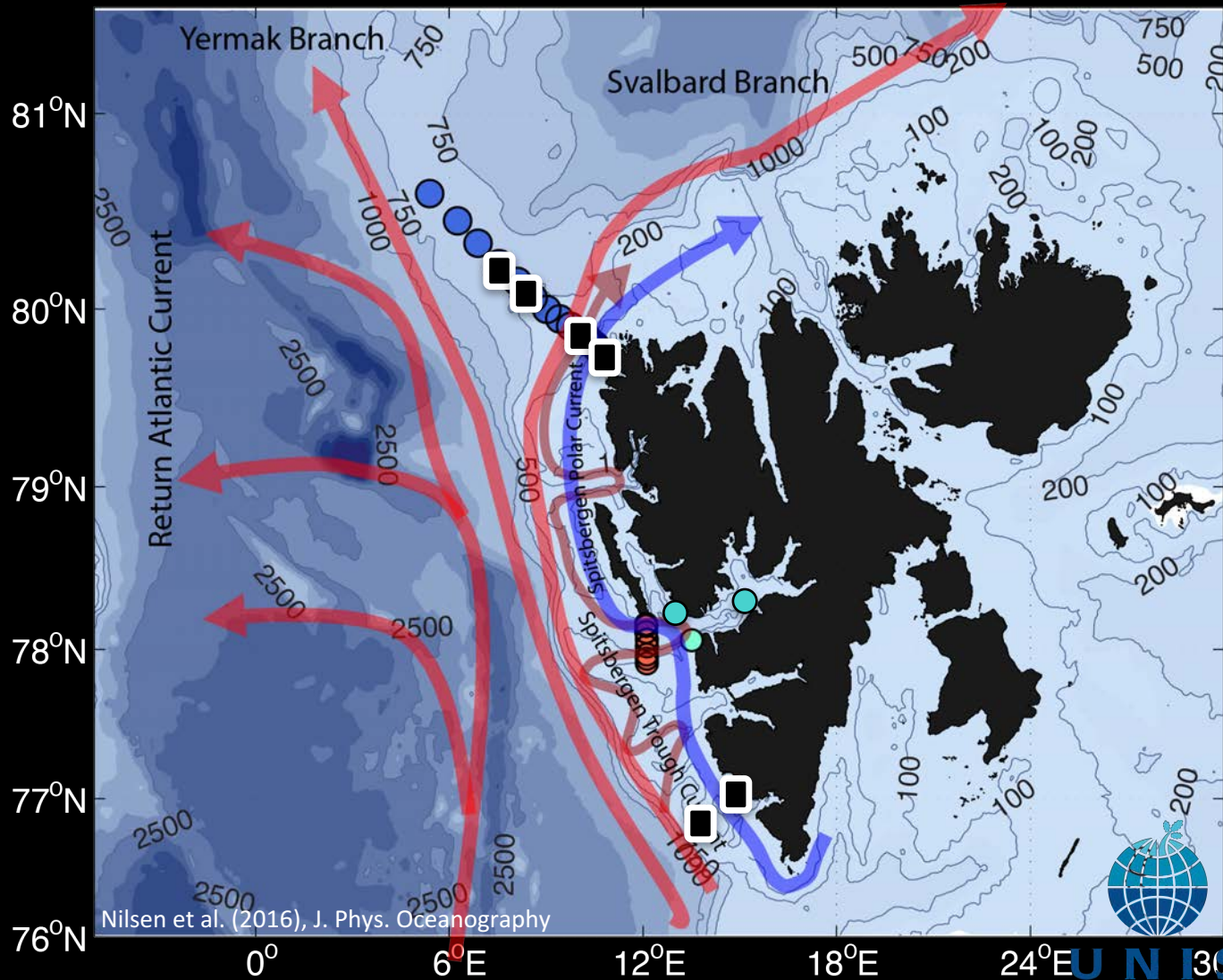
OBP moorings at Hornsund

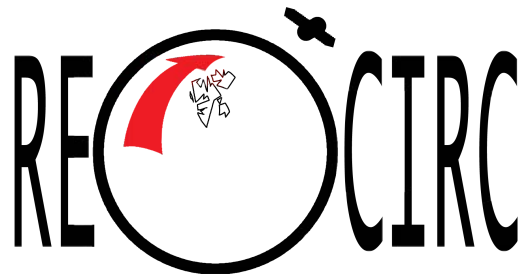


Ocean Circulation and Environmental Mass Changes



AWAKE-2





Remote Sensing of Ocean Circulation and Environmental Mass Changes

REOCIRC

RCN project nr. 222696/F50



Norwegian Partners

The University Centre in Svalbard (Leader)
Nansen Environmental and Remote Sensing
Center

International partner

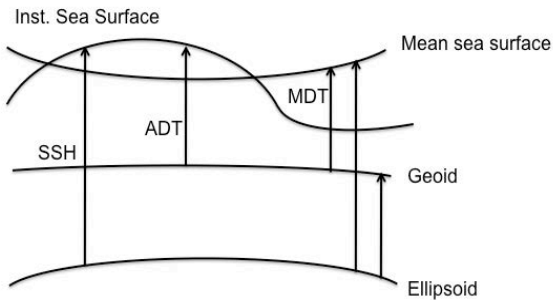
Polar Science Center, University of Washington

© Frank Nilsen



REOCIRC main objective

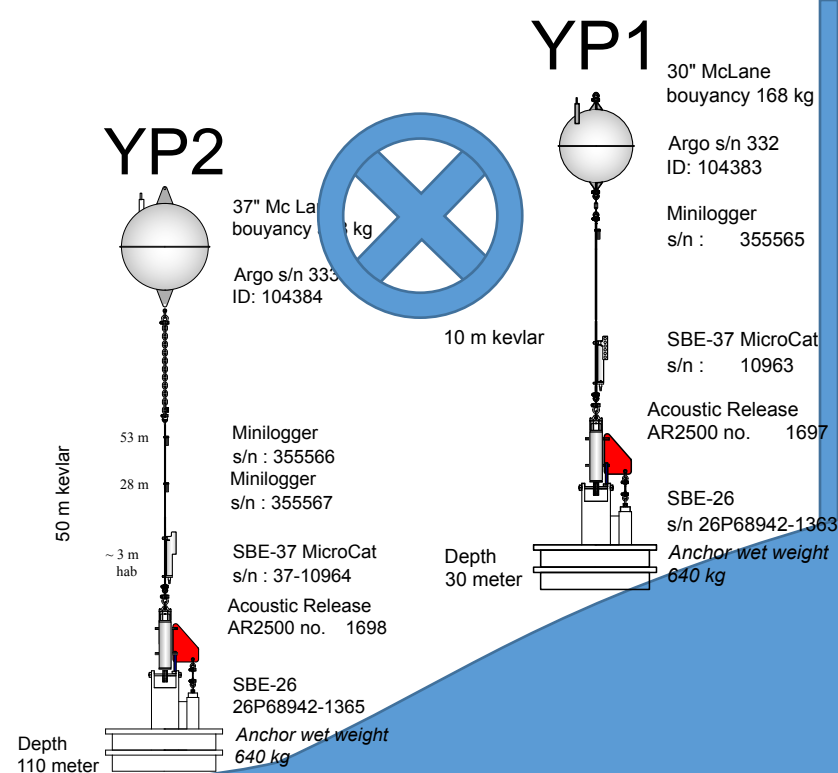
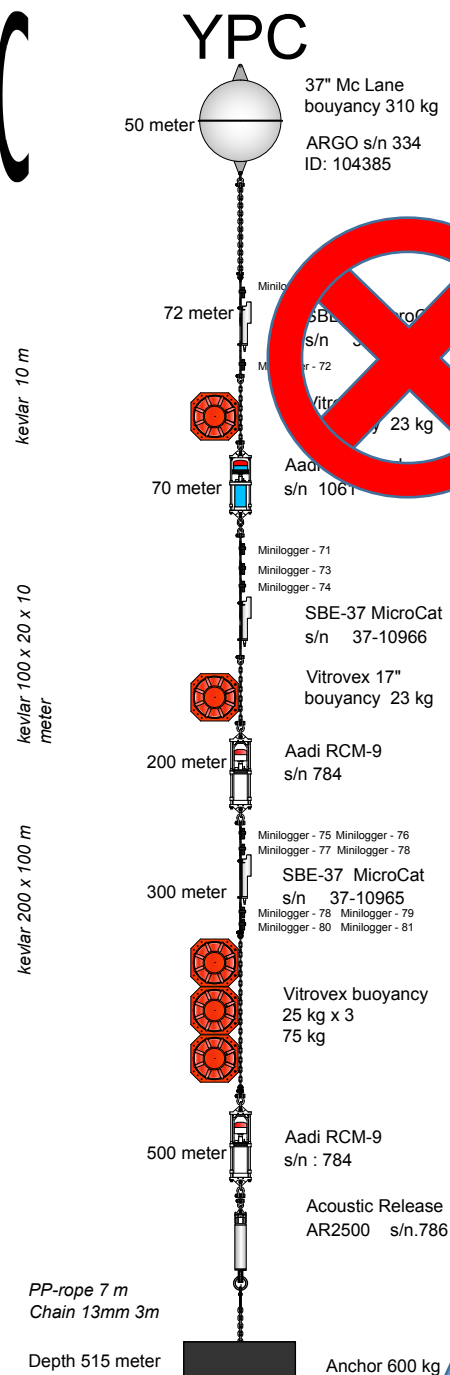
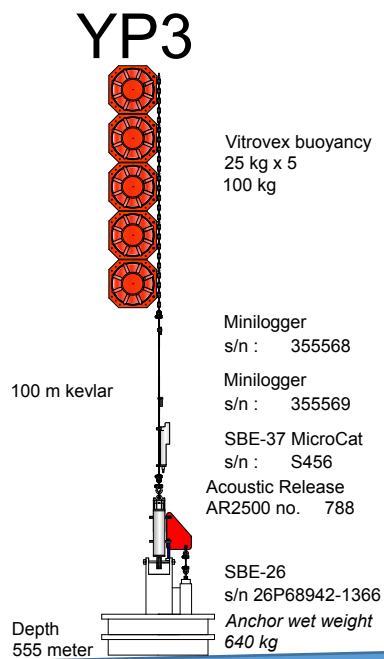
To study the Absolute Dynamic Topography (ADT) of the West Spitsbergen Current (WSC) by taking advantage of advances in satellite gravimetry (GOCE) and altimetry, and providing ground truth for satellite gravity solutions (GRACE) from in situ ocean bottom pressure measurements.



MDT = Mean sea surface – Geoid (referenced to the same ellipsoid)

We seek a better understanding of the variability (seasonal, interannual and decadal) in oceanic volume and heat fluxes towards the Arctic Ocean and a unified understanding of mass changes in the eastern Fram Strait and in Svalbard

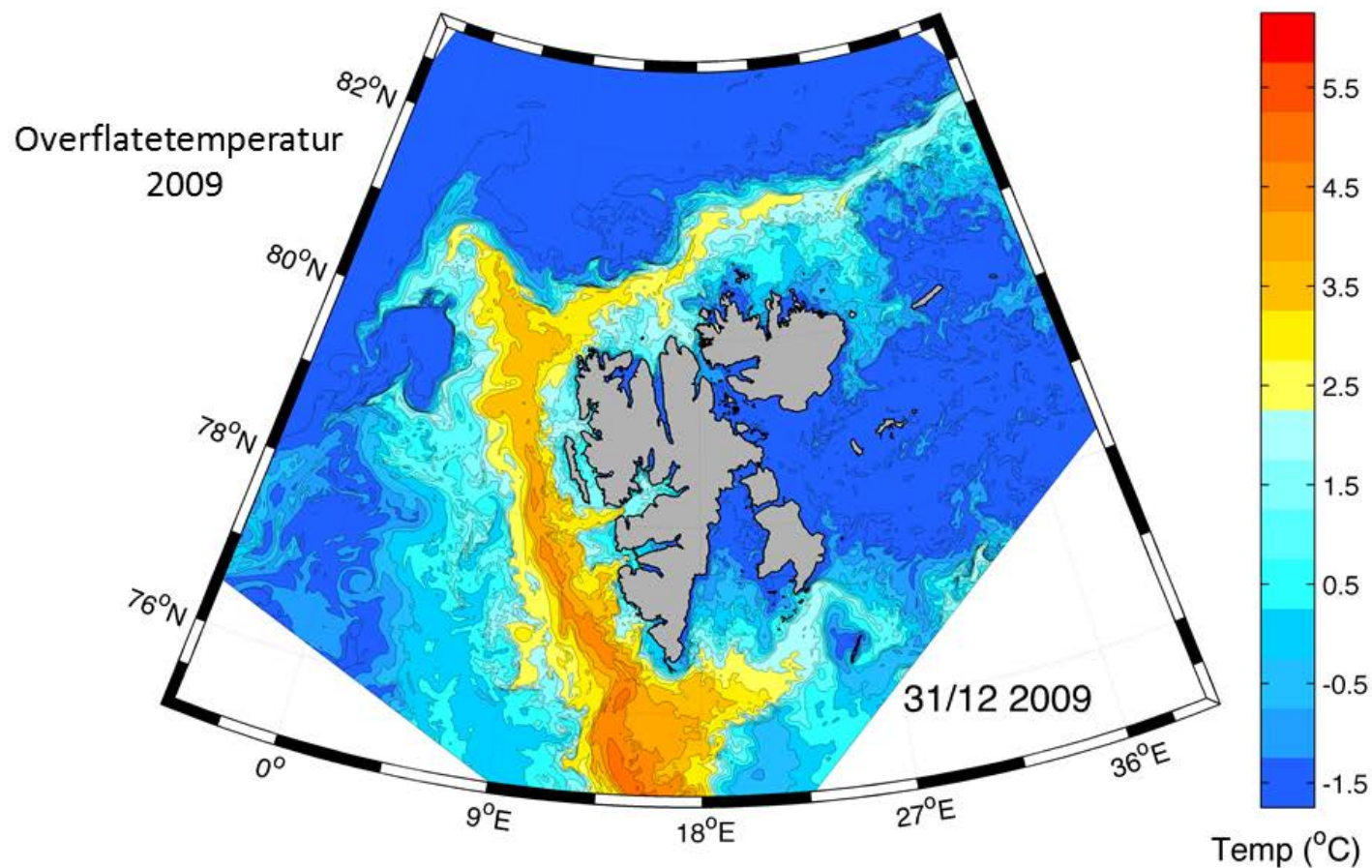




Mass [kg]:

$$M = \rho V = \rho H A, \quad H = SSH$$

Slide from Arild Sundfjord (NPI)



ROMS-simulering fra Fram Polhavet ModOIE-prosjektet.

Partnere: Akvaplan-niva, Havforskningsinstituttet, Met.no, Norsk Polarinstitutt, SINTEF.

INTAROS WP3

In situ observing systems



Agnieszka Beszczynska-Möller, IOPAN (lead)

Peter Voss, GEUS (co-lead)



WP3 main goal and ambition:

to improve critical gaps in the existing observing systems
by integration of new and mature technologies
for multidisciplinary Arctic observations

INTAROS WP3 *In situ* observing systems

Task 3.0

Scientific and operational coordination

Task 3.1

Coastal Greenland

Task 3.2

North of Svalbard towards the deep Nansen Basin

Task 3.3

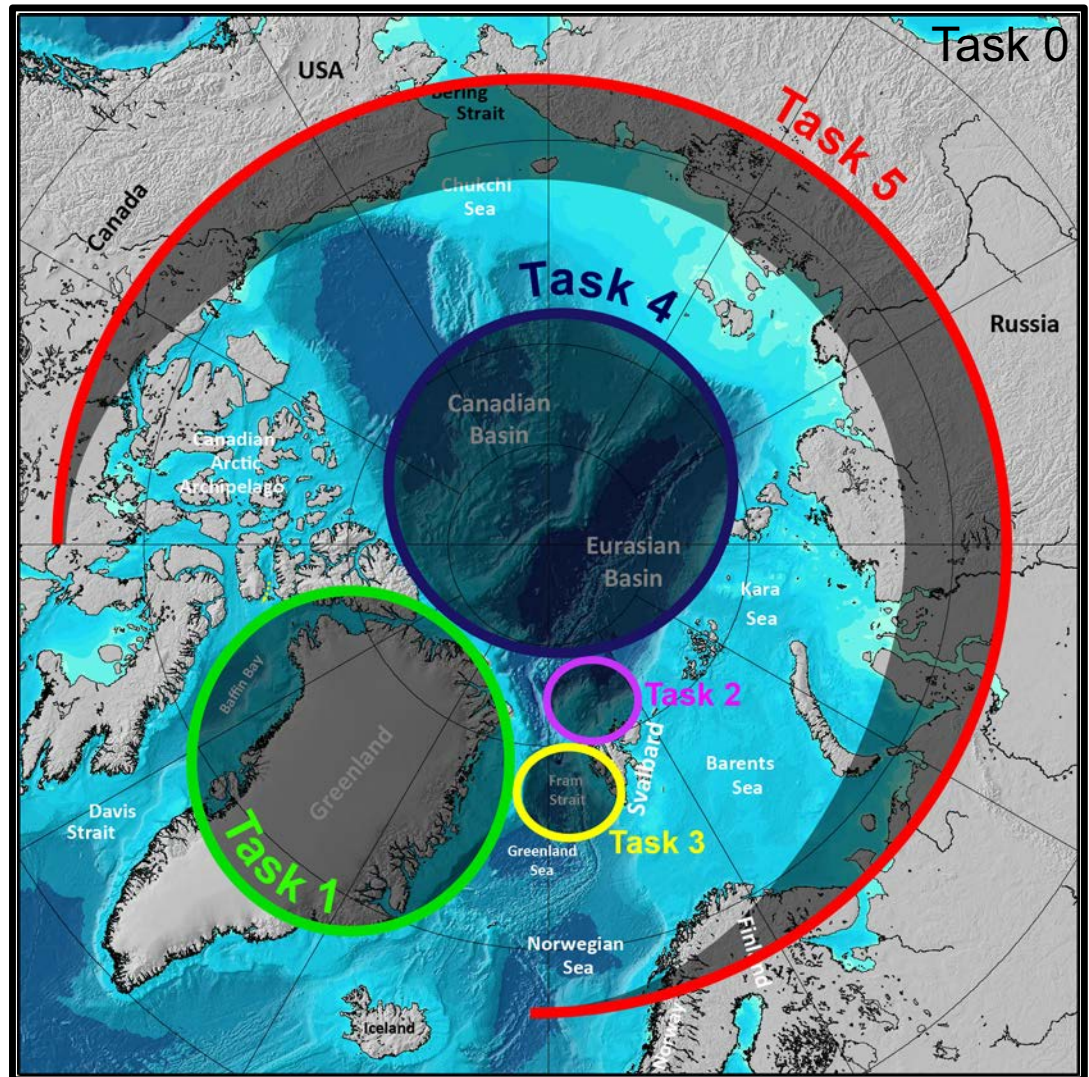
Fram Strait

Task 3.4

Distributed systems for ocean and sea ice

Task 3.5

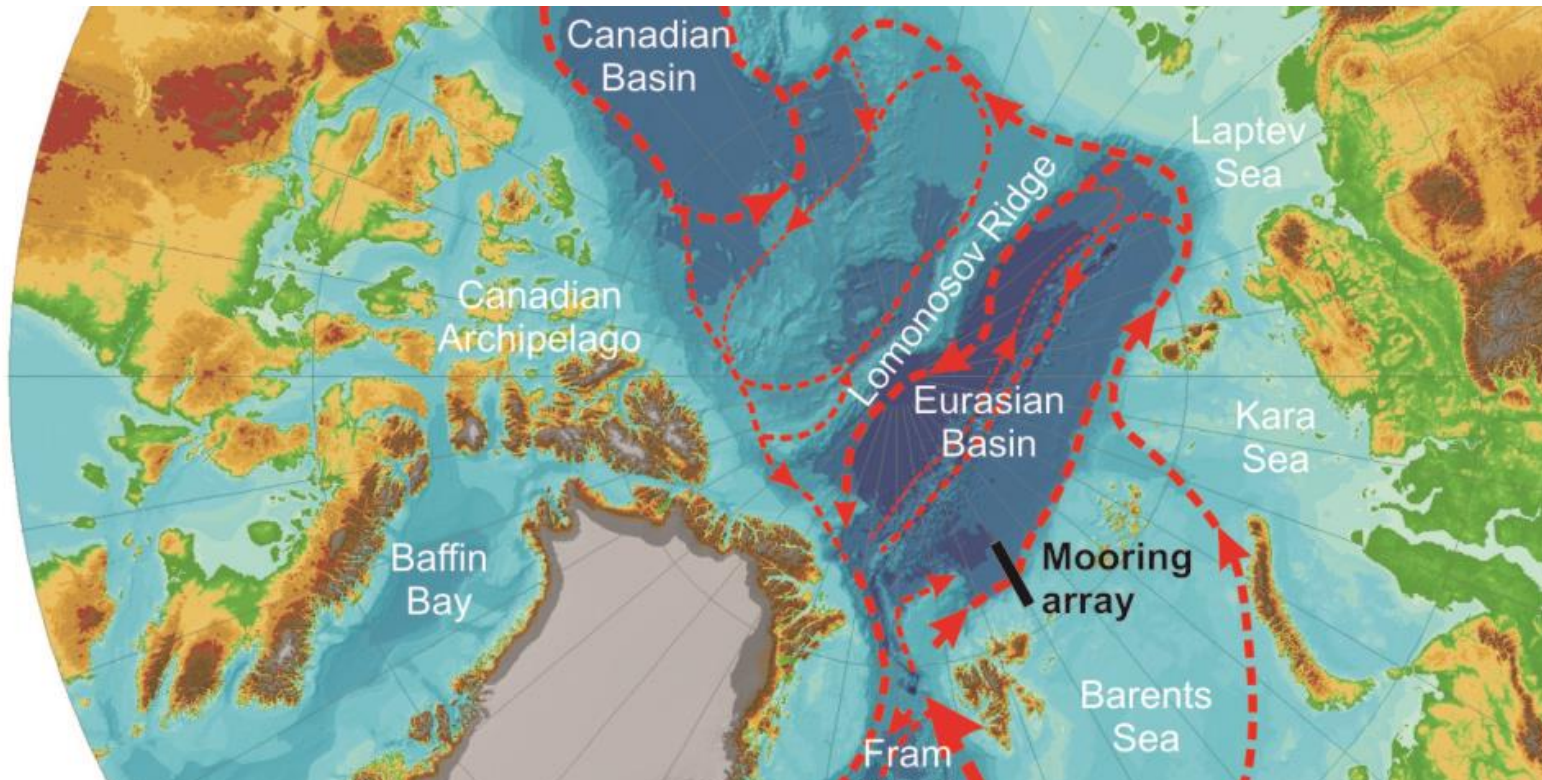
Distributed systems for atmosphere and land



A-TWAIN

From A. Sundfjord (NPI) &
R. Ingvaldsen (IMR)

Long-term variability and trends in the Atlantic Water inflow region



Partners: Norwegian Polar Institute (NPI), Institute of Marine Research (IMR),
University of Tromsø, University Centre in Svalbard (UNIS)
International collaborators: WHOI (USA) and IOPAS (Poland)

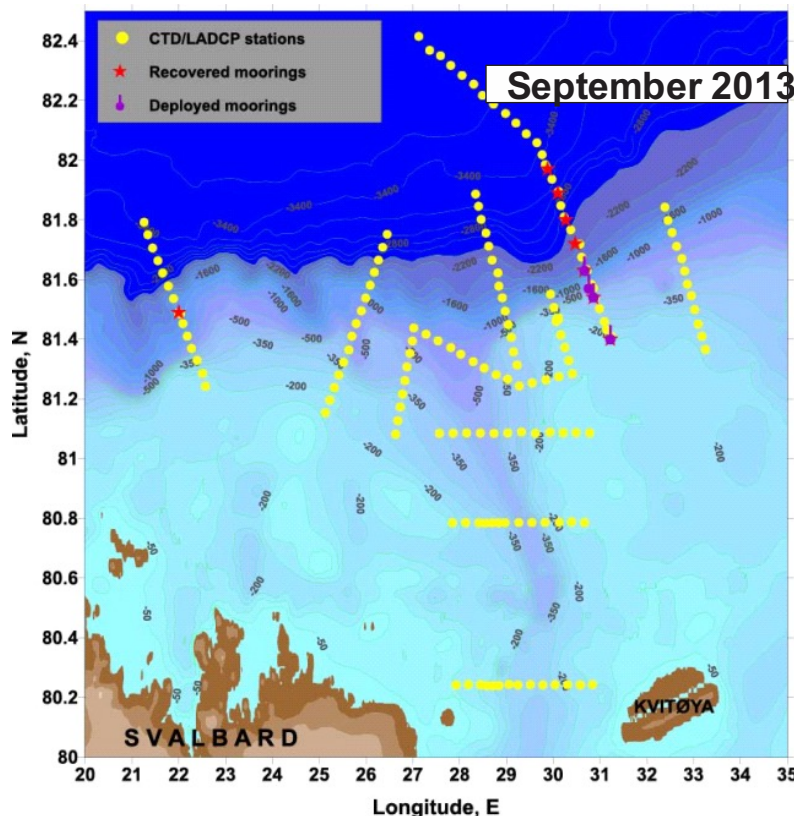
Project status

2012: first survey and deployment cruise (3 + 4 + 2 moorings)

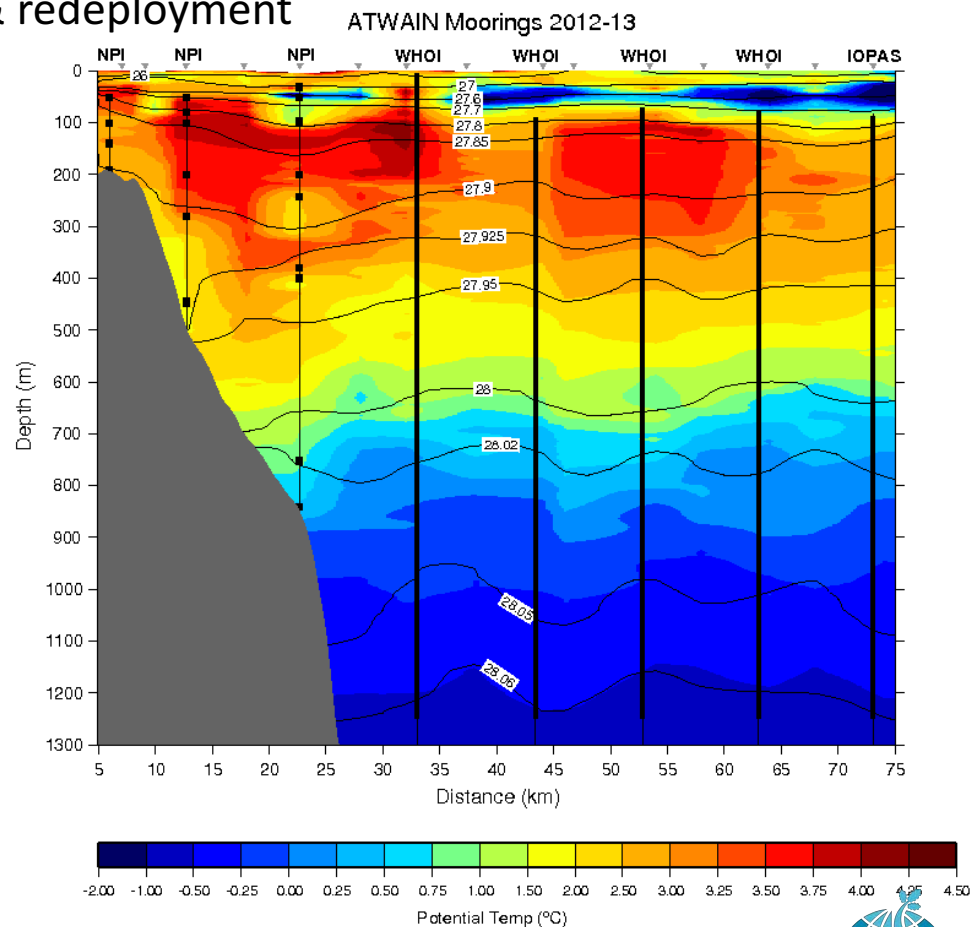
2013: survey + recovery & redeployment (in 8, out 4)

2014: survey and failed mooring service

2015: survey and mooring recovery & redeployment



Map of cruise area and mooring line location north of Svalbard in September 2012 -2013.



Section of potential temperature (color) during the A-TWAIN cruise in 2012.



Further plans

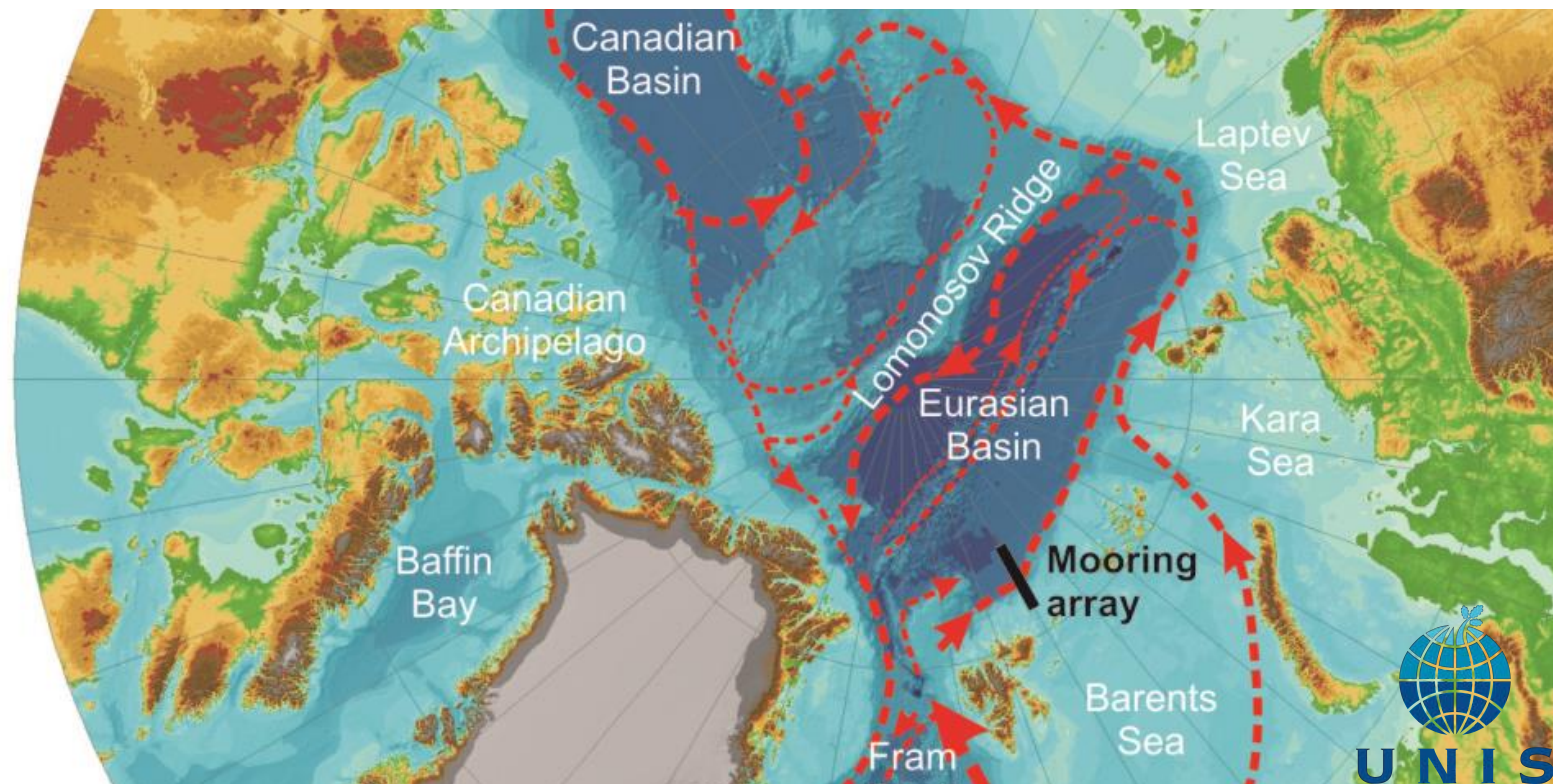
SIOS infrastructure proposal with A-TWAIN component to be submitted Oct 2016

2017: survey and mooring recovery & redeployment cruise (Fram Polhavet funding)

2017: start collaboration with recently UK NERC funded project Arctic Prize

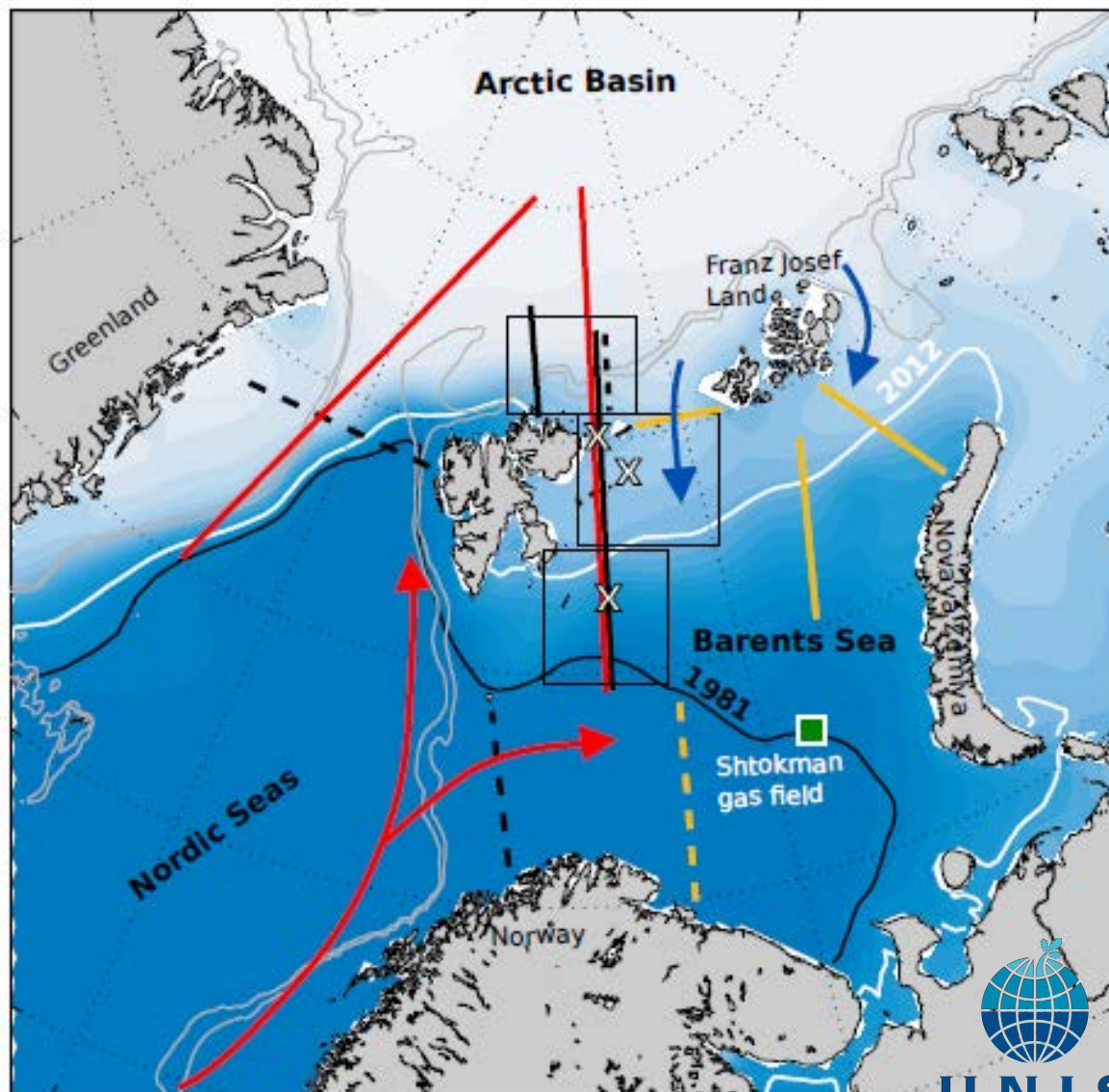
2017: further development of collaboration with NABOS project

2018: Nansen LEGACY project starts; joint analysis of data, possibly joint cruises

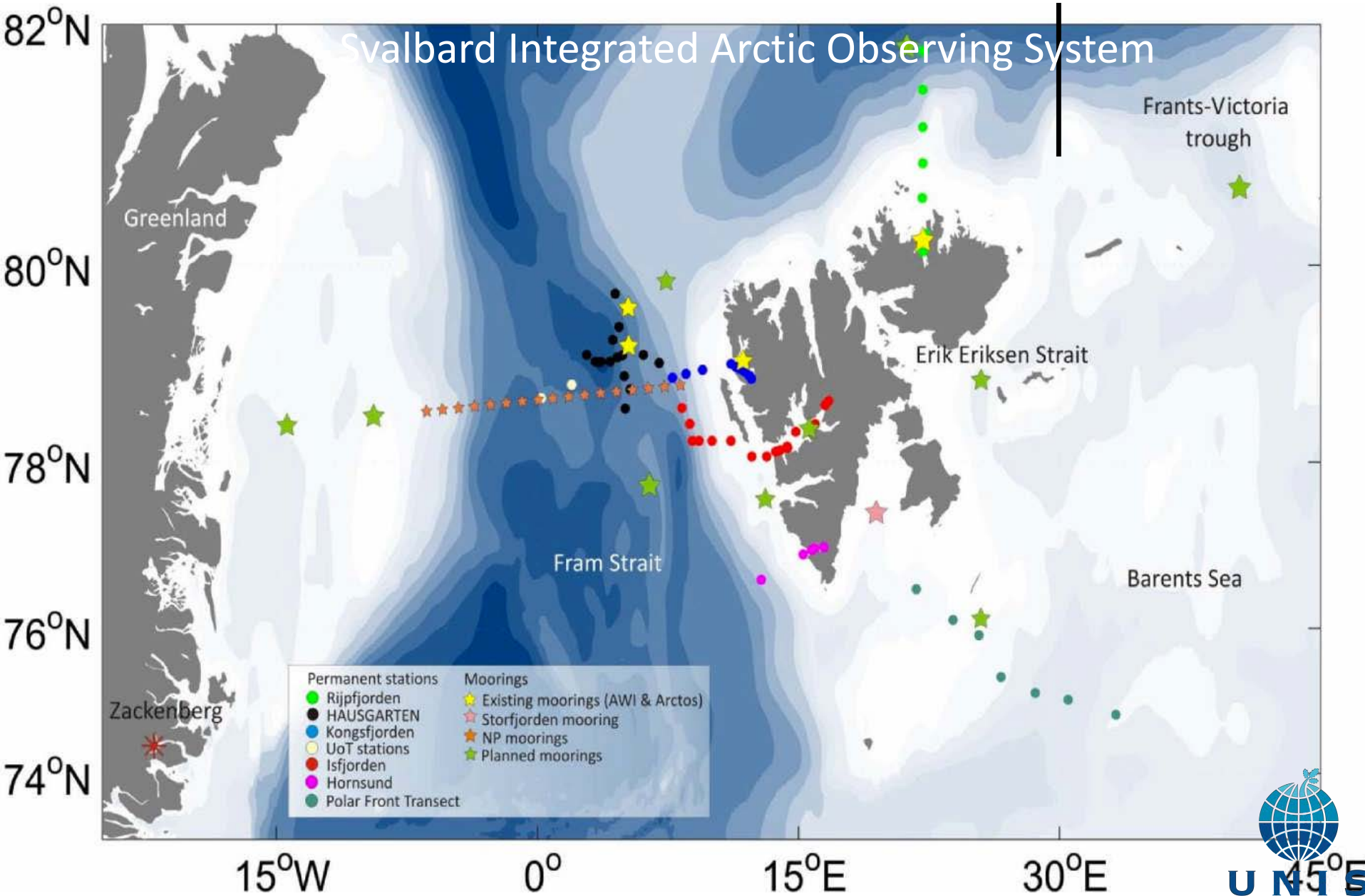


The Nansen LE

*Scientific exploration
and sustainable management
beyond the ice edge*



Existing and Proposed Moorings and stations for the SIOS SIOS-ID



NAMO

Norwegian Arctic Multi-disciplinary Observatory

