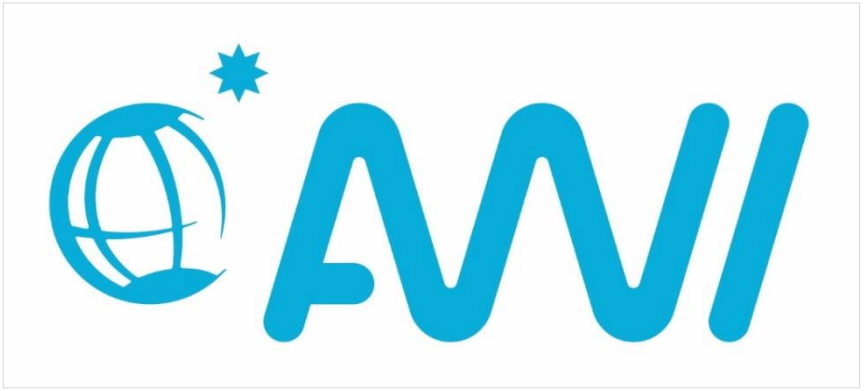
FRAM | FRontiers in Arctic marine Monitoring



Thomas Soltwedel

Alfred-Wegener-Institute Helmholtz-Center for Polar and Marine Research

2nd SSF Ocean Flagship Workshop, Bjørnefjorden Gjestetun, Norway, 04./05. October 2016

FRAM | FRontiers in Arctic marine Monitoring:
Aims and key tasks

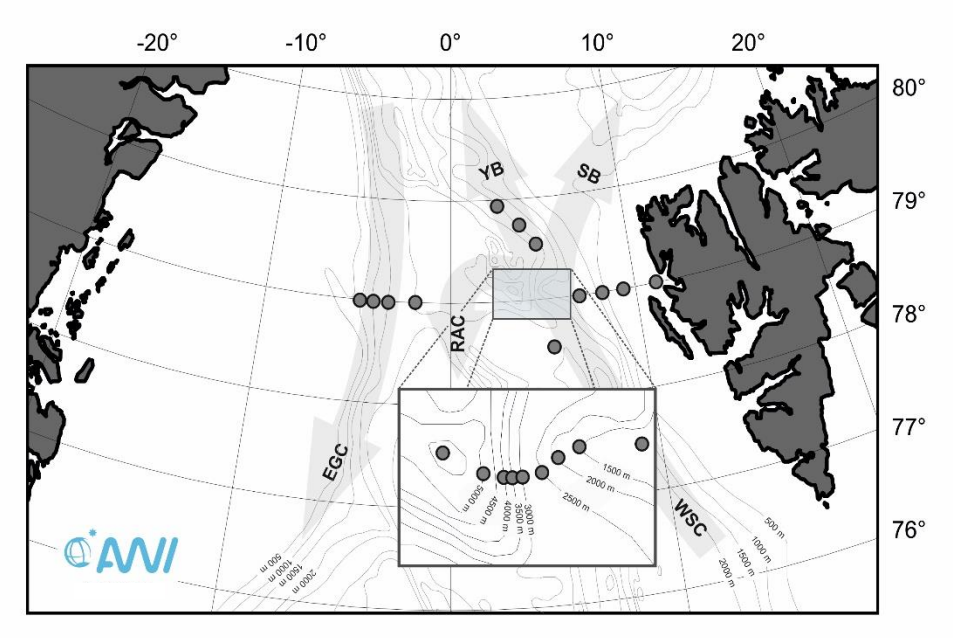
Sustained multidisciplinary, year-round surface to seafloor observations in the changing Arctic to address variability and trends in physical and chemical conditions, and ecosystem response

- 5 (7) year HGF Strategic Investment (25 Mio. Euro) to implement a distributed observatory infrastructure in Fram Strait and in the central Arctic (start: August 2014)
- Long-term operation by AWI for minimum 20 years
- Develop and implement cutting edge technologies
  (moored, mobile, and drifting platforms; autonomous sensors, samplers)
- Establish procedures for data dissemination
  (web portal, data archive, visualization of results, also for educative uses)

HELMHOLTZ | ASSOCIATION

FRAM | FRontiers in Arctic marine Monitoring:
Building on existing infrastructure

Integrating existing AWI time-series programmes (HAUSGARTEN, HAFOS) and extending the scientific scope as well as spatial and temporal coverage



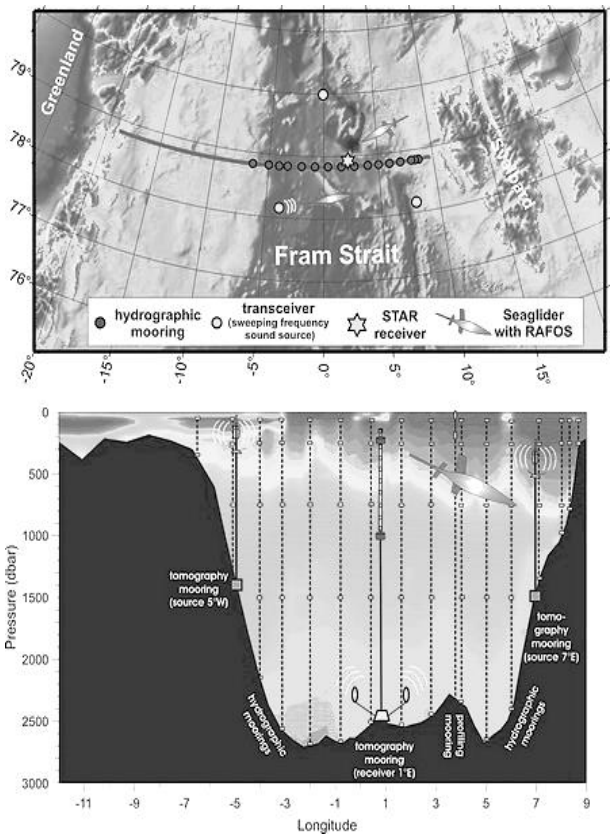
LTER HAUSGARTEN

- since 1999
- 21 stations
- 250 - 5500 m
- bathymetric and latitudinal transect
- repeated sampling
- continuous sampling and measurements
- visual observations
- experimental work

… to generate a mechanistic understanding of polar marine ecosystem response to environmental change

FRAM | FRontiers in Arctic marine Monitoring:
Building on existing infrastructure

Integrating existing AWI time-series programmes (HAUSGARTEN, HAFOS) and extending the scientific scope as well as spatial and temporal coverage



Hybrid Arctic Float Observation System

A hybrid system of ice-resistant profiling subsurface floats, surface drifters on the ice and moored stations communicating acoustically

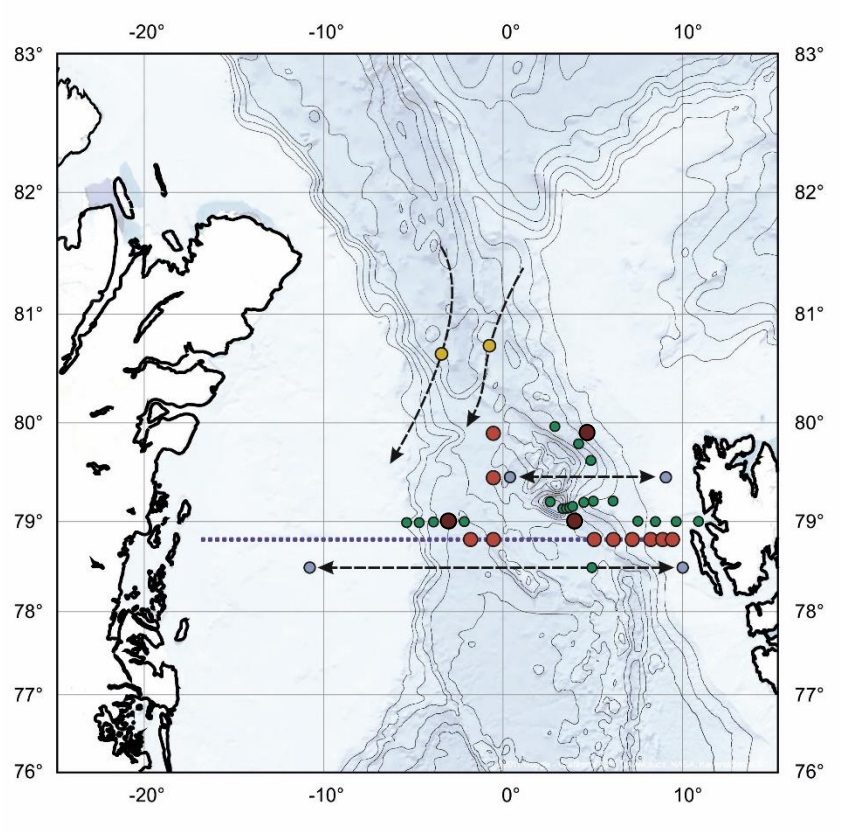
… to improve the endurance, depth range and reliability of the various systems

… to integrate new sensors, e.g. to measure biogeochemical parameters and ice thickness

… to develop high frequency acoustic data transfer by use of messenger platforms

FRAM | FRontiers in Arctic marine Monitoring:
Building on existing infrastructure

Integrating existing AWI time-series programmes (HAUSGARTEN, HAFOS) and extending the scientific scope as well as spatial and temporal coverage



fixed components:

- *oceanographic moorings*
- *moorings with sediment traps and water samplers*

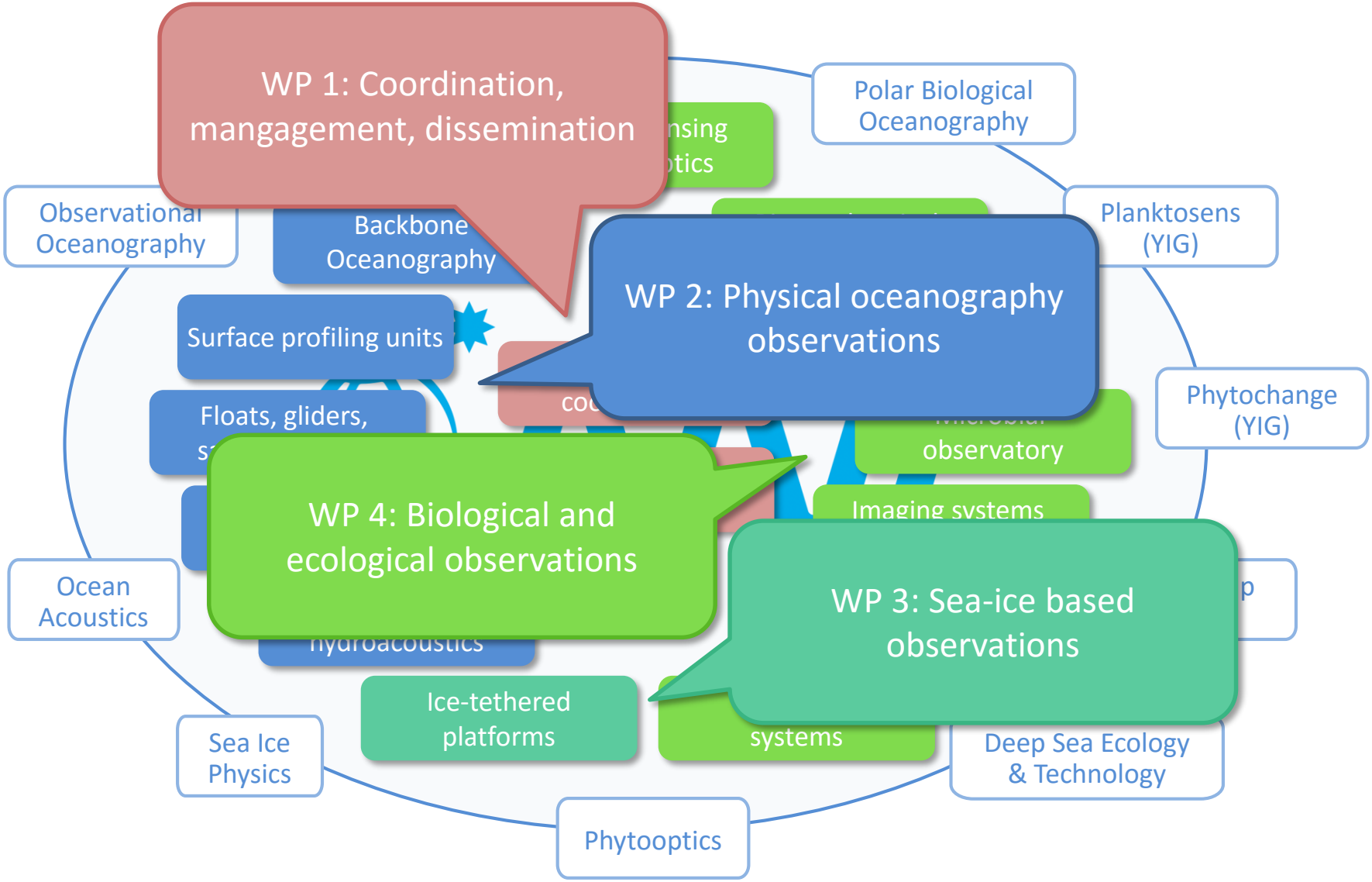
mobile components:

- *ice-tethered platforms*
- *seagliders / floats*

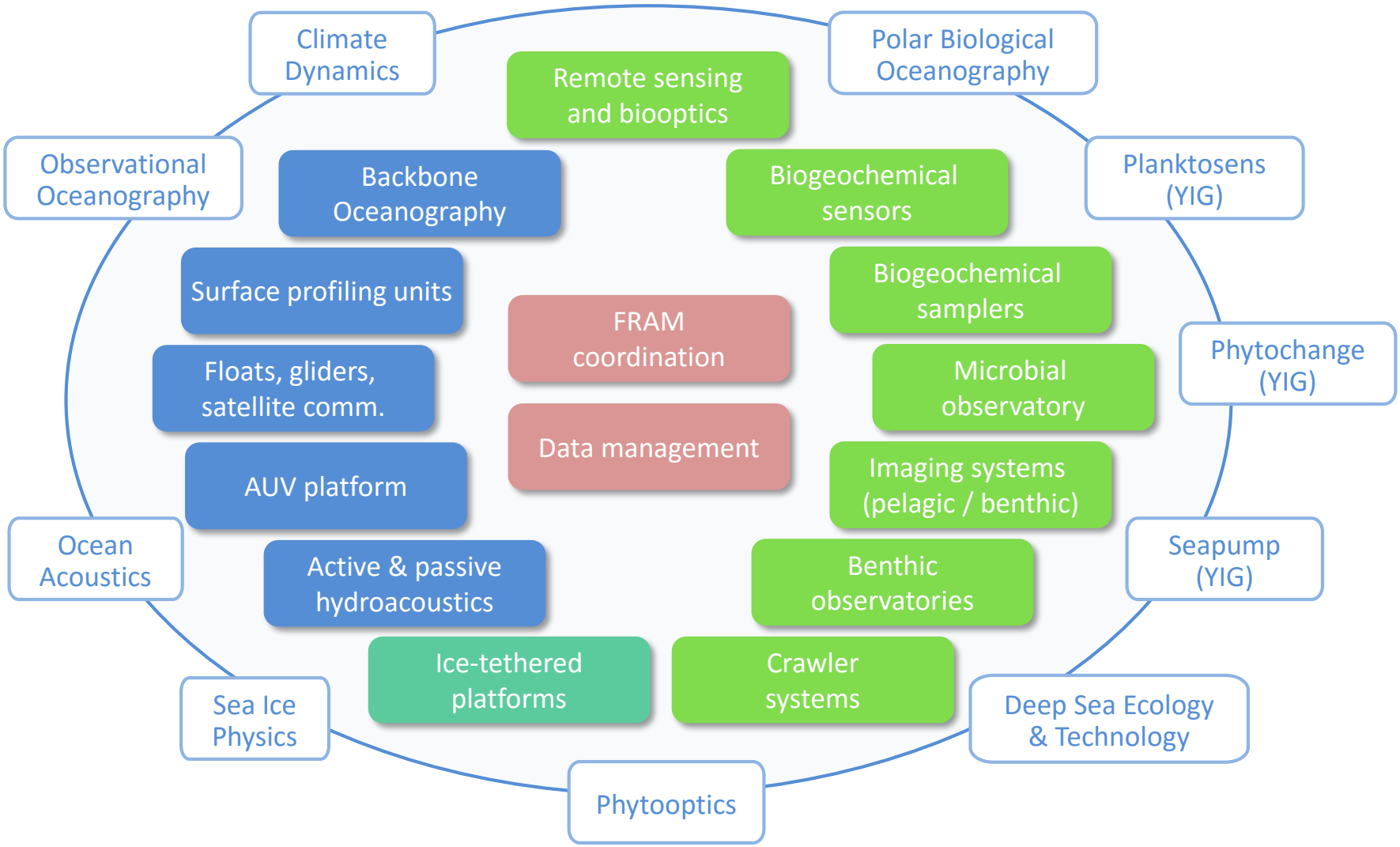
annual campaigns:

- *plankton / benthos sampling*
- *CTD casts, incl. water sampling plus en-route measurements*

FRAM | FRontiers in Arctic marine Monitoring:
Contributing sections, work packages and task teams



FRAM | FRontiers in Arctic marine Monitoring:
Contributing sections, work packages and task teams



FRAM | FRontiers in Arctic Marine Monitoring:
Tasks addressed in the first two years

- Hiring personnel

  (1 coordinator, 11 scientists, 3 engineers, 10 technicians)

- Select and purchase state of the art instruments and sensors

  (autonomous samplers and filtration devices, sensors, zooplankton and seafloor imaging systems, sea ice buoys, …)

- Develop and improve systems and components for autonomous observations

  (AUV payload, profiling sensor packages, ship-based filtration system, particle cameras, instruments measuring benthic flux, …)

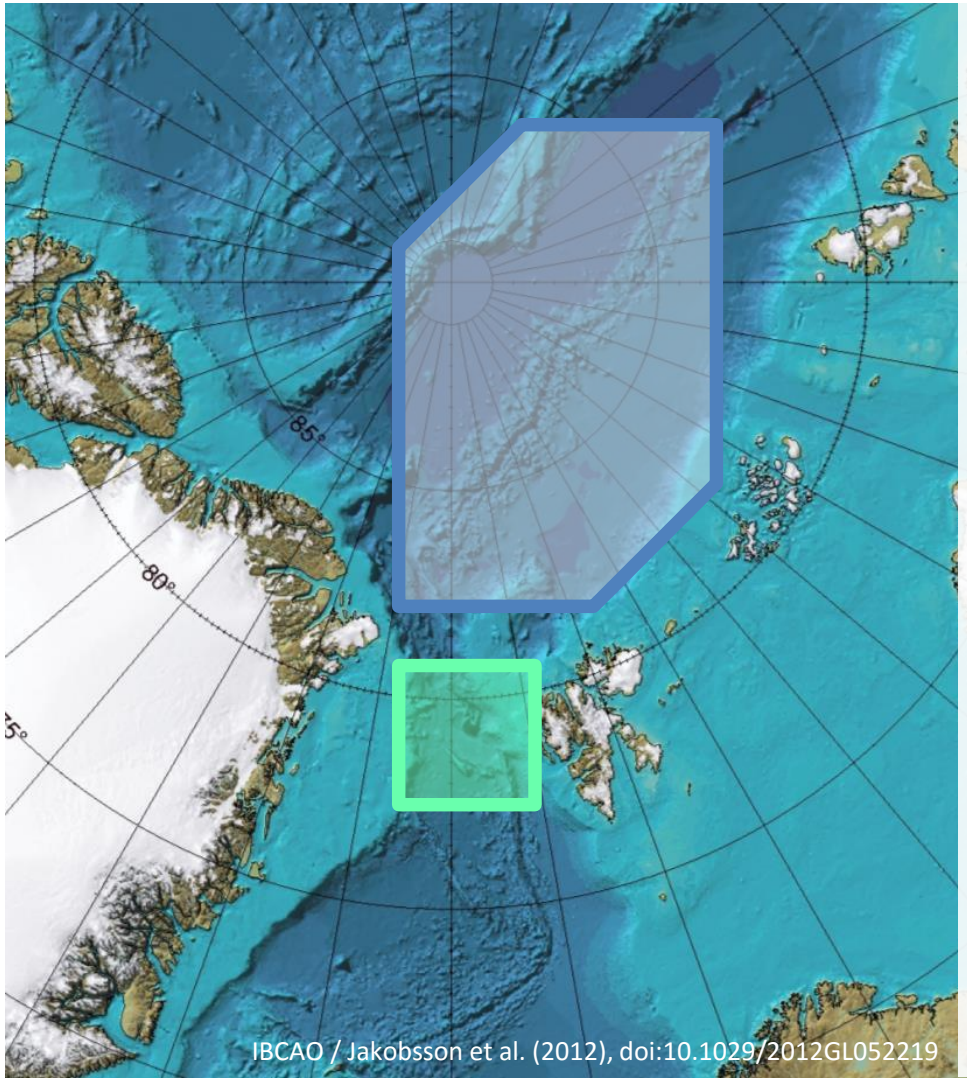
- Design novel observatory platforms

  (multidisciplinary ice-tethered platforms, benthic crawler, …)

FRAM | FRontiers in Arctic Marine Monitoring:
Tasks addressed in the first two years

- Test systems under laboratory conditions and at test sites
  (test basins, pressure tanks, North Sea, Kattegat, …)
- Instrument deployments and tests in the Fram Strait and Central Arctic, continuation of running time-series observations
  (profiling moorings, zooplankton and seafloor imaging systems, …)
- Installation of flow-trough systems on RV Polarstern
  (en-route measurements as part of the observing system, e.g. FerryBox, …)
- Develop procedures and tools for data dissemination and product generation
  (data portal with webGIS content, remote sensing products, …)

FRAM | FRontiers in Arctic Marine Monitoring:
Working areas



Central Arctic
(focus on the Eurasian Basin)

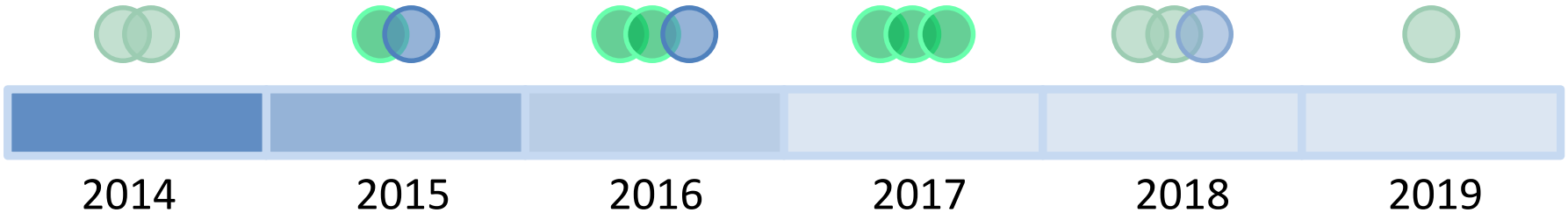
Ice tethered platforms, moorings, …

Fram Strait
(extending to Nordic Seas)

Floats, gliders, moorings, benthic observatories, benthic crawlers, …

+ ship-based observations

FRAM | FRontiers in Arctic Marine Monitoring:
Expeditions (Polarstern, Svalbard, Merian, …)



pre-FRAM cruises, but contributing to FRAM tasks (mooring installations):

2014: PS85, KV Svalbard (Fram Strait)

2015: PS93.2 (Fram Strait), PS94 (Central Arctic)

2016: PS99.2, PS100 (Fram Strait), PS101 (Central Arctic)

confirmed:

2017: PS107, PS108, PS109 (Fram Strait)

proposed:

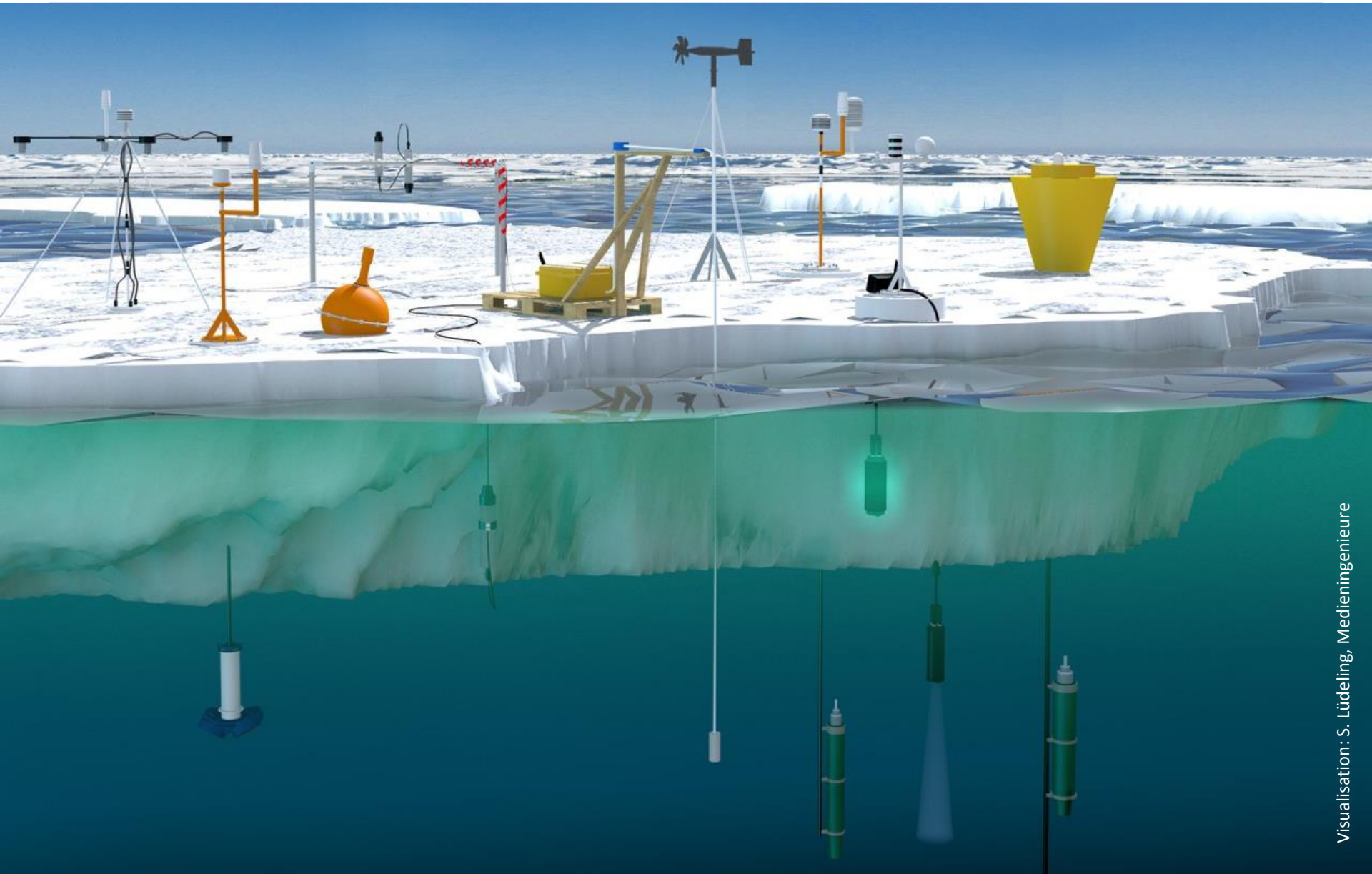
2018: MSM?, ODEN?? (Fram Strait), ??? (Central Arctic)

2019: PS113 (Fram Strait)

FRAM | FRontiers in Arctic Marine Monitoring:

From artist expression to reality

ICE STATIONS



Visualisation: S. Lüdeling, Medieningenieure

FRAM | FRontiers in Arctic Marine Monitoring:
Instruments deployed

Polar area weather station (PAWS)

surface unit mast with GPS, Iridium satellite antenna, anemometer, barometer, temperature and humidity sensor;

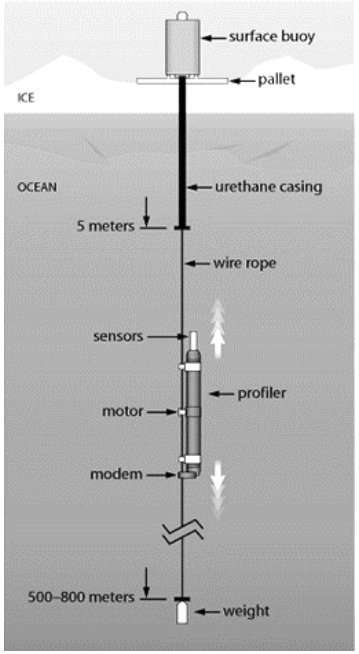
sea surface temperature sensor internal to the hull assembly;

transmission of weather related data on a 3-hour interval

surface buoy supporting a wire that extends through the ice flow and down into surface waters;

underwater profiler carrying oceanographic and various bio-optical sensors;

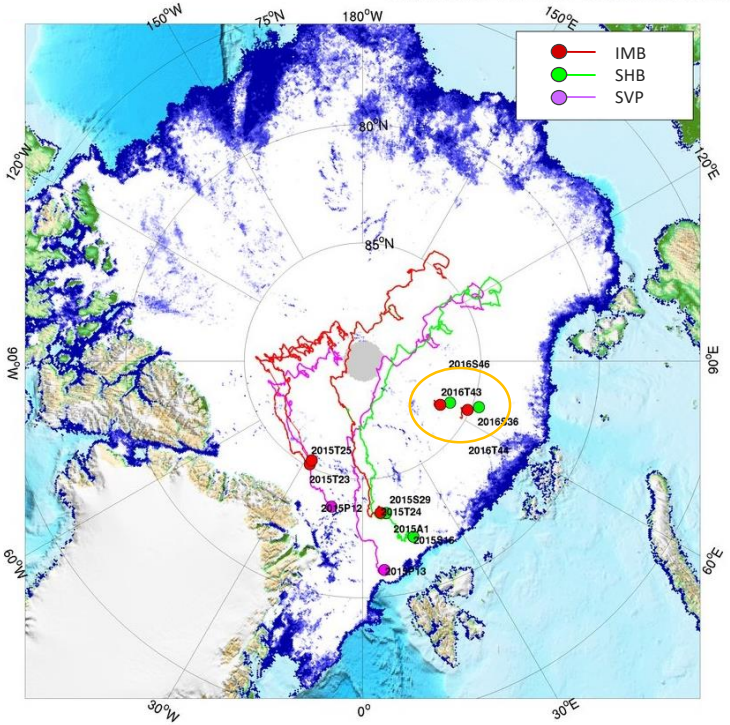
water property data are sent to shore in near-real time



Ice-tethered bio-optical buoys (ITBOB)

FRAM | FRontiers in Arctic Marine Monitoring:
Instruments deployed

Buoy positions on 26.09.2016



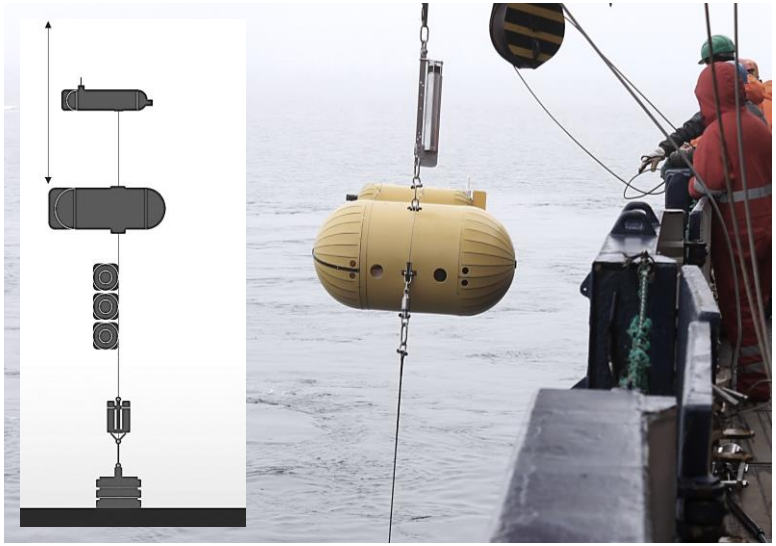
seaiceportal.de

FRAM | FRontiers in Arctic Marine Monitoring:
From artist expression to reality

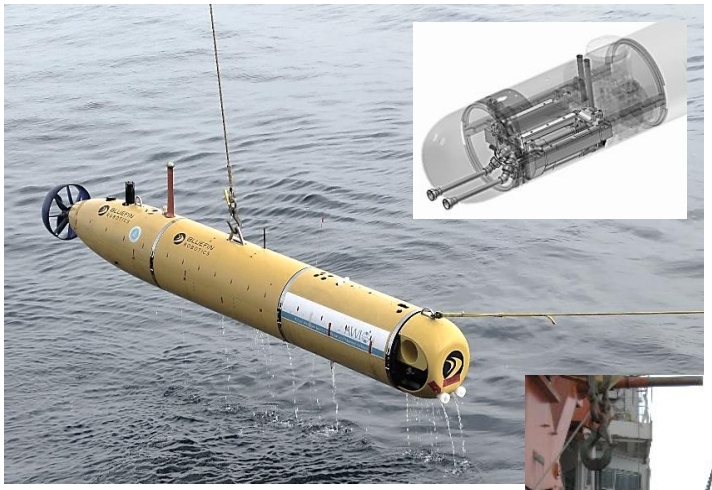
SURFACE WATERS

Visualisation: S. Lüdeling, Medieningenieure

FRAM | FRontiers in Arctic Marine Monitoring:
Instruments deployed

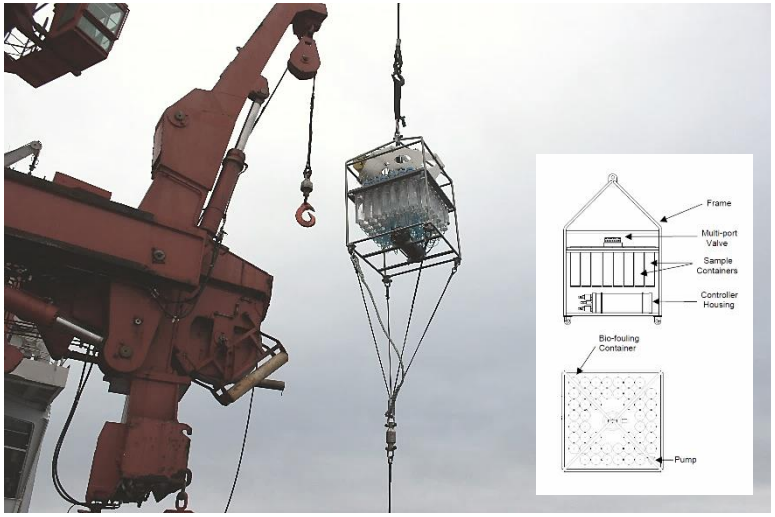


Mooring with profiling sensor unit …



AUV

LOKI

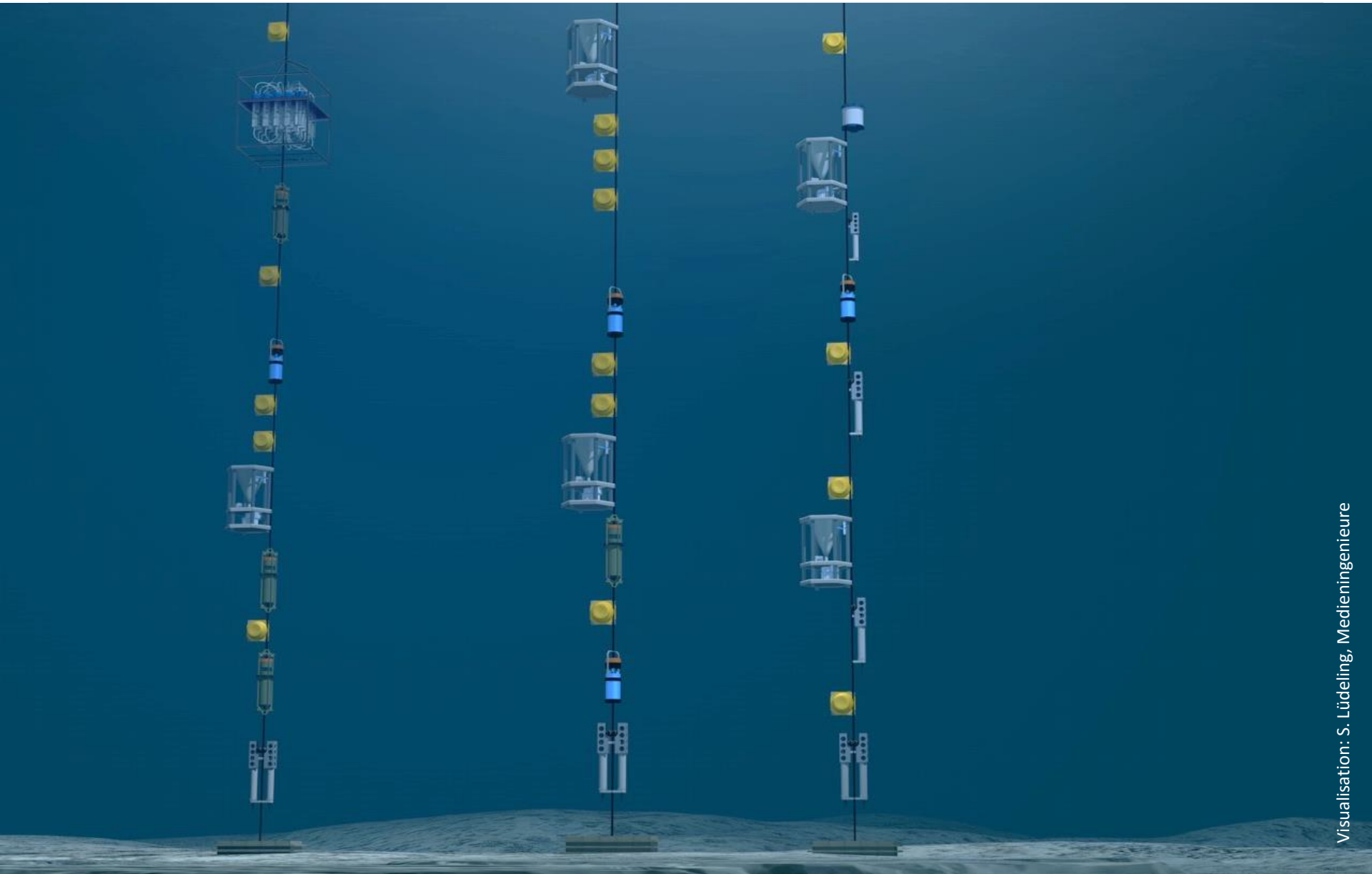


… and autonomous water sampler

FRAM | FRontiers in Arctic Marine Monitoring:

From artist expression to reality

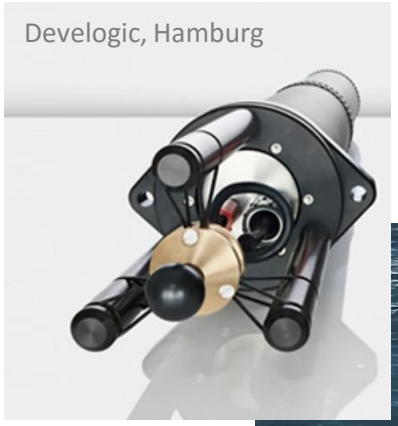
WATER COLUMN



Visualisation: S. Lüdeling, Medieningenieure

FRAM | FRontiers in Arctic Marine Monitoring:
Instruments deployed

Sediment Traps



Acoustic Recorder

FRAM | FRontiers in Arctic Marine Monitoring:
From artist expression to reality

SEAFLOOR

Visualisation: S. Lüdeling, Medieningenieure

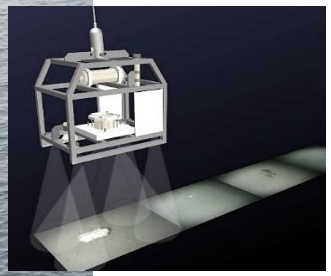
FRAM | FRontiers in Arctic Marine Monitoring:
Instruments deployed

Free-falling Systems

short-term:
SCOC incubations, micro-profiling

long-term:
time-lapse cameras, sediment trap, optodes, experiments

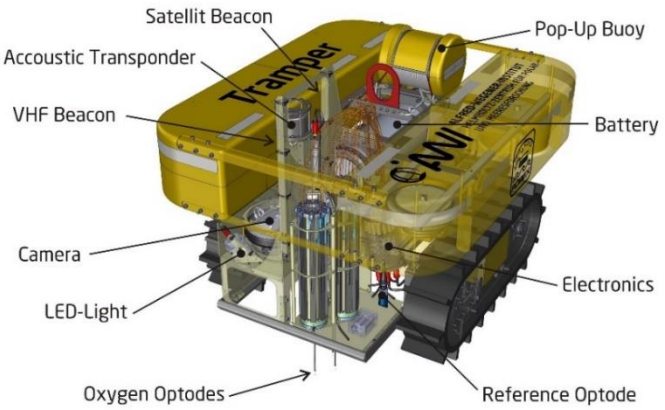
Towed Camera Systems

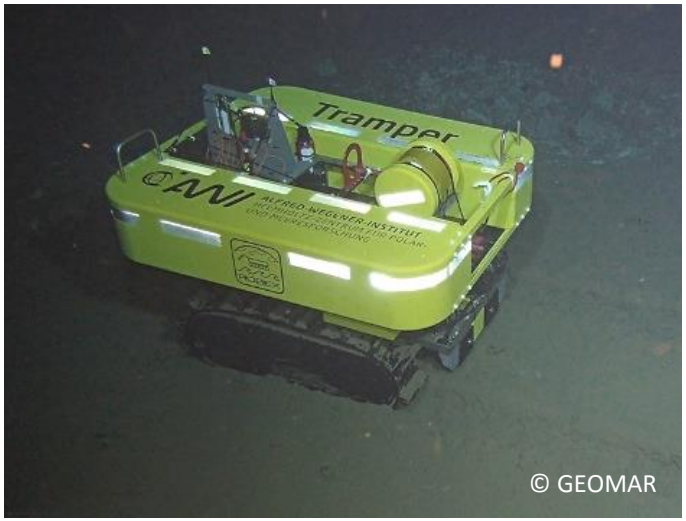


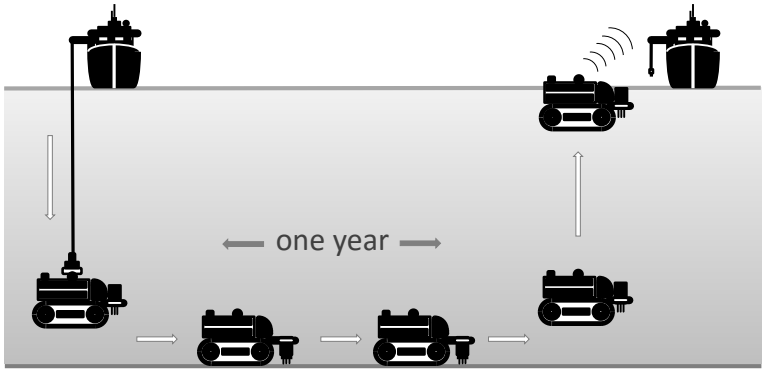
seafloor imaging:
Ocean Floor Observation System

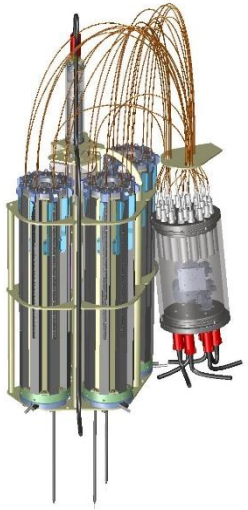
FRAM | FRontiers in Arctic Marine Monitoring:
Instruments deployed

Benthic Crawler









Microprofiler Unit

video-guided lowering

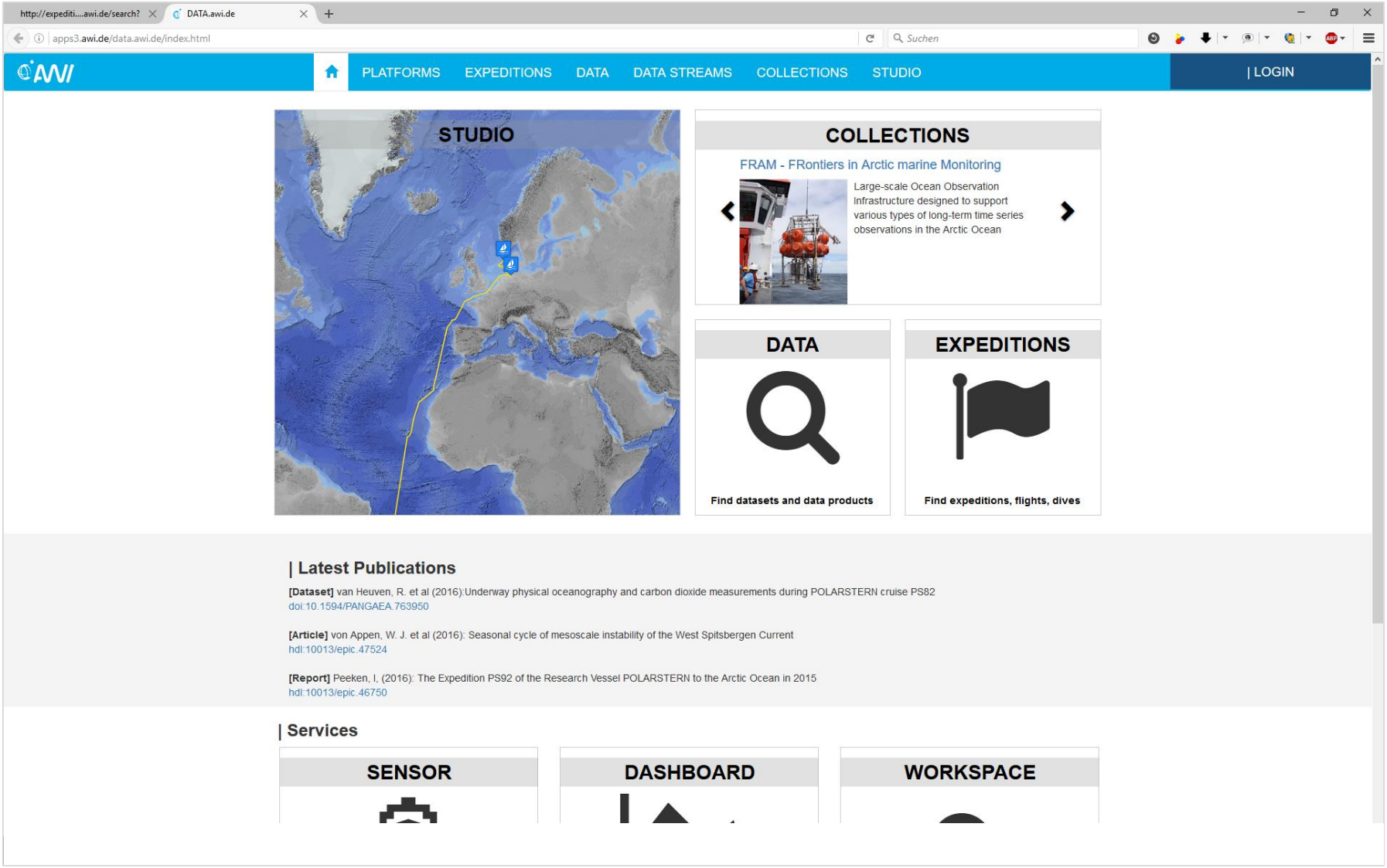
⇩

measurement and sampling in determined intervals

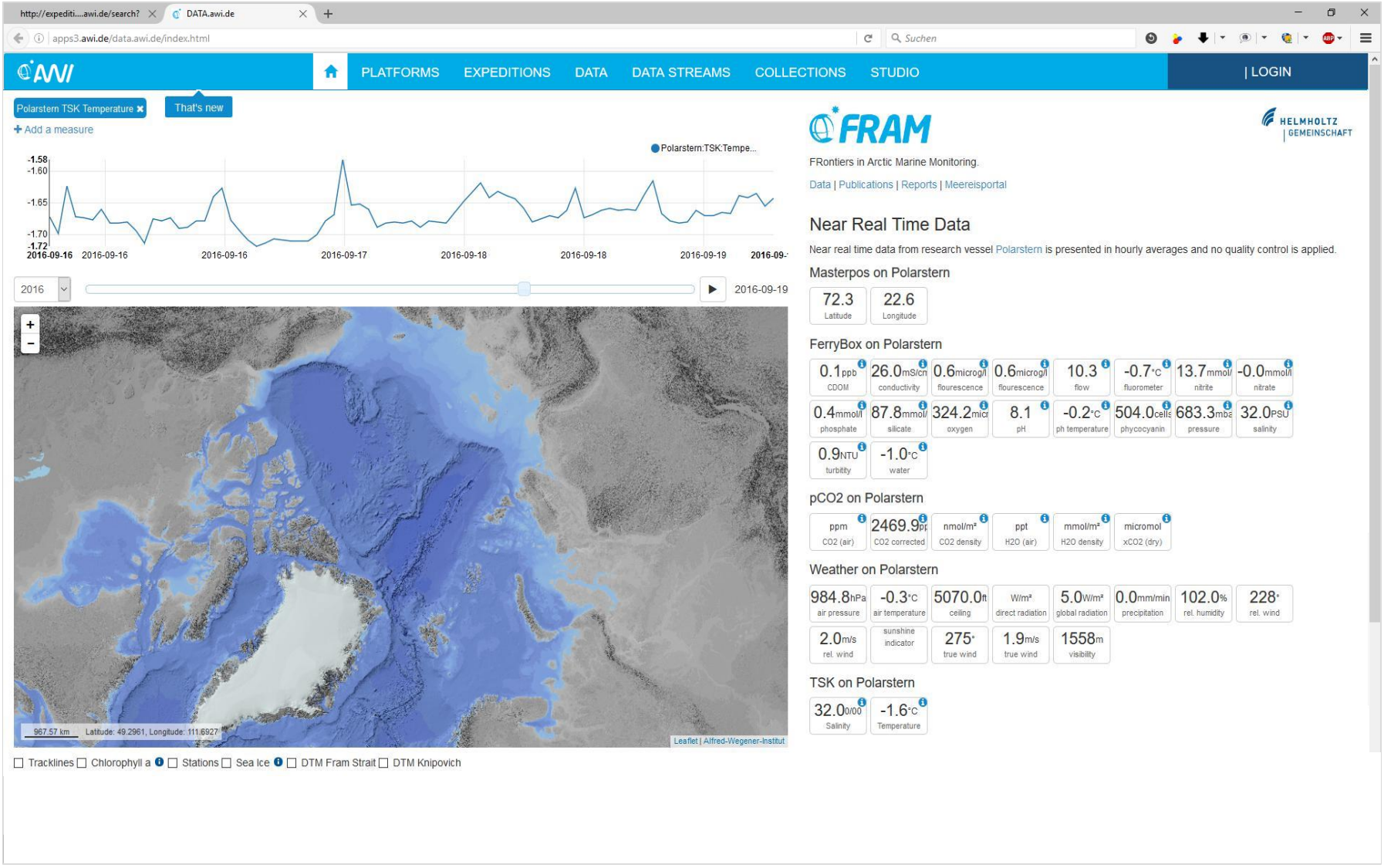
⇩

ascent after acoustic release signal

FRAM | FRontiers in Arctic Marine Monitoring:
Data supply and visualisation



FRAM | FRontiers in Arctic Marine Monitoring:
Data supply and visualisation



THANK YOU !