Woods Hole Oceanographic Institution 1930
FAMOS School and Meeting #4
3-6 November 2015

B23

Contact:
Mario.Hoppmann@awi.de

ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

M. Hoppmann, M. Nicolaus, B. Rabe, F. Wenzhöfer

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meersforschung, Bremerhaven, Germany

Ice-Based Observatories in the central Arctic: a contribution by the FRAM project (2015-2019)

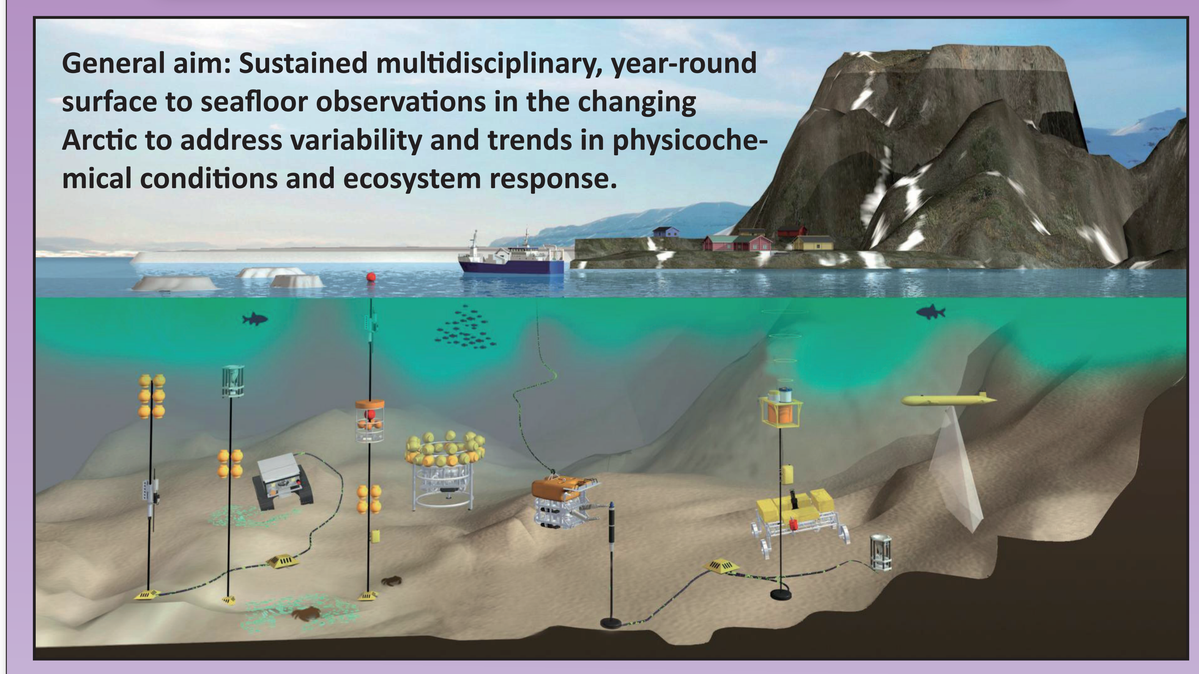
Summary

Although the **Arctic Ocean** has been studied extensively during recent decades, observational data are still relatively sparse due to its remoteness and harsh environmental conditions. One important tool to fill this gap has become more and more feasible during the last years: **autonomous, ice-based observation platforms**, which are able to record data throughout the winter, and to extend the investigation area of manned expeditions.

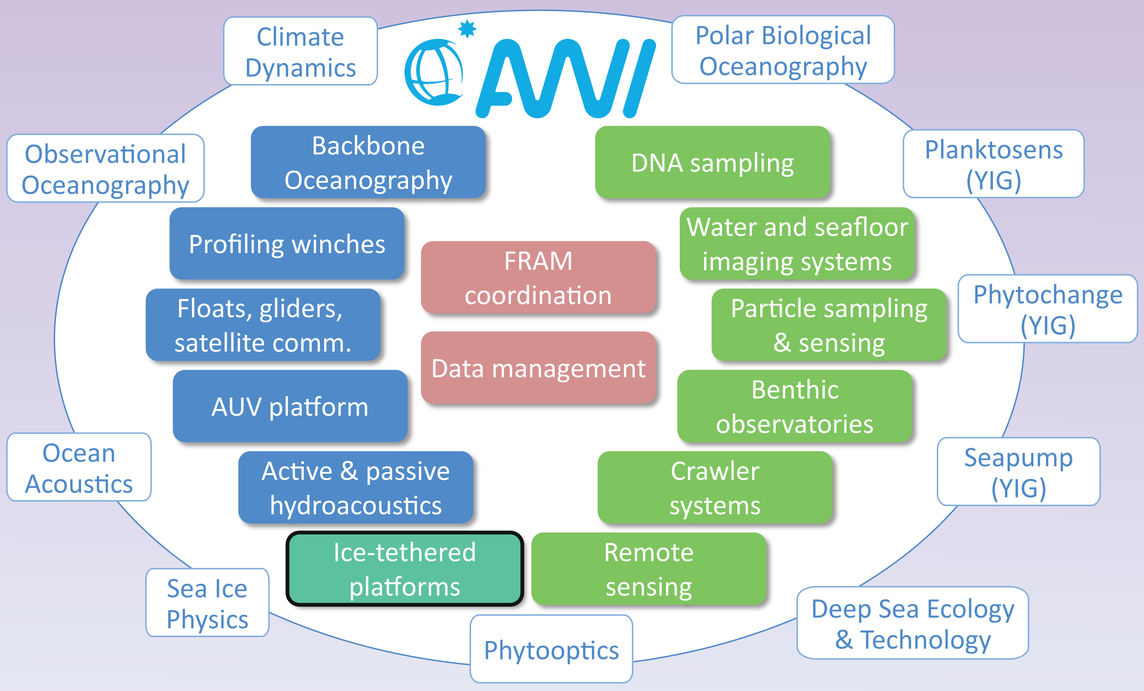
Over the following five years, the **FRAM (FRontiers in Arctic marine Monitoring)** infrastructure project aims to establish a network of autonomous, ice-based observatories (buoys) in the central Arctic Ocean. Types of buoys range from snow-depth and ice mass-balance buoys for monitoring ice growth and snow accumulation, over radiation and weather stations for energy budget estimations, to ice-tethered profilers to monitor upper ocean properties. The first wave of 32 buoys was deployed in September 2015 from onboard RV Polarstern.

Data from these buoys are expected to play a crucial role in understanding the **linkages between the atmosphere, sea ice and upper ocean** in the Arctic. Integration of bio-optical and biogeochemical sensors on established platforms will enhance our understanding of **physico-biological processes**, and enable us to derive reliable models of the physical, biological and biogeochemical states of the future Arctic Ocean.

FRAM (FRontiers in Arctic marine Monitoring)



- 5-year ‚**Strategic Investment**' to implement a distributed observatory infrastructure in Fram Strait and the central Arctic. Project duration: August 2014 - 2019.
- Integrate existing time series components (e.g. AWI Hausgarten project) and extend scientific scope as well as spatial and temporal coverage.
- Develop and implement **cutting edge technologies**, such as Autonomous Underwater Vehicles, Deep Sea Landers & Crawlers, Autonomous ice-tethered platforms, Moorings etc. (see Figure below)



Scope of FRAM (colored boxes) and involved AWI working groups (white boxes).

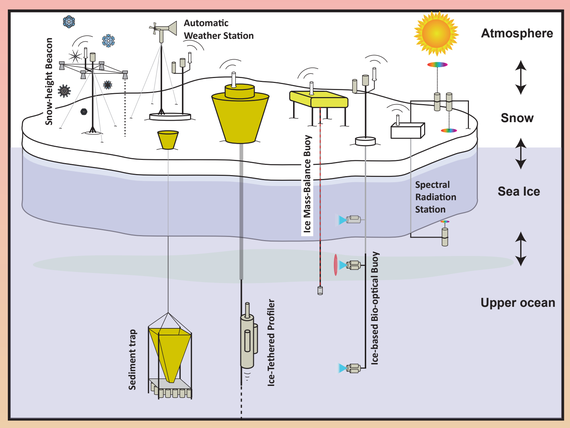
Ice-based Observatories within FRAM

Aim of this work package:

Fill gap of in-situ observations in the central Arctic Ocean, to gain a better understanding of the physical, biological and chemical processes governing its current evolution.

Tasks:

- Integrate innovative bio-optical and biogeochemical sensors into (profiling) platforms.
- Develop entirely new platforms for specific research questions.
- Deploy single observatories and multi-disciplinary arrays across the Arctic Ocean.
- Optimize dataflow and present quality-controlled data on web portal.

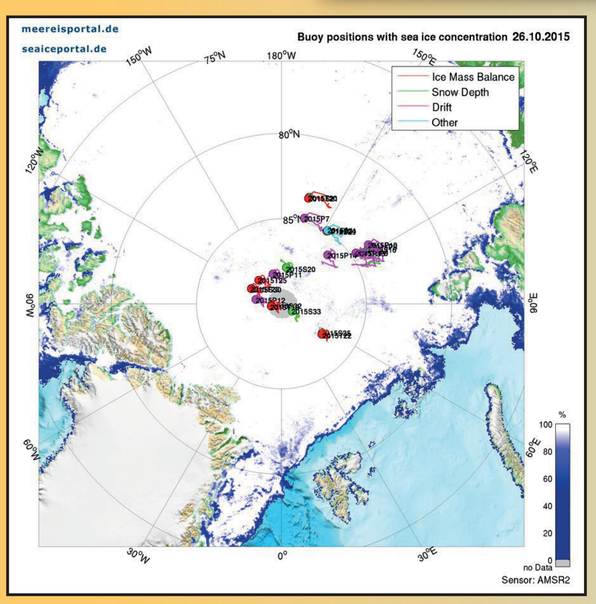


Example sketch of multi-disciplinary buoy array

Ongoing developments:

- **Autonomous Acoustic Doppler Current Profiler buoy** in cooperation with *OSIL Environmental Instruments and Systems.*
- **Above- and under-ice camera** system in cooperation with *Pacific Gyre.*
- **Spectral Radiation Station** for incoming, reflected and transmitted irradiance through sea ice and snow (*in-house development*).
- **Enhanced upper ocean profiler** with fluorescence and PAR sensors, as well as nitrate/pH sensors and more, in cooperation with *WHOI* and *Metocean.*
- **Bio-optical and biogeochemical platform** for in- and under-ice fluorescence, nutrients, PAR (*in-house development, in cooperation with FIELAX*).

Recent deployments



Buoy deployments during the Polarstern expedition PS94 (Transarc II). Map courtesy of www.meereisportal.de.

Platforms deployed by FRAM in 2015:

8 Surface Velocity Profiler (*Metocean SVP*)
6 Ice Mass Balance Buoys (*SAMS IMB*)
2 Ice Mass Balance Buoys (*BAS IMB*)
8 Snow height Beacons (*Metocean SB*)
1 Automatic Weather Station (*Metocean AWS*)
1 Spectral Radiation Station (*AWI SRS*)
1 Ice-Tethered Profiler with bio-suite (*WHOI ITP*)
1 SATICE (in cooperation with *ICM*, Spain)
4 IAOOS (Ice - Atmosphere - Arctic Ocean Observing System, in cooperation with *L'Ocean* France)

RV Polarstern TRANSARC Tromsø 17 August – Bremerhaven 15 October 2015

Data availability

SVP, SAMS IMB, AWS and SB data are available in near real time on www.meereisportal.de. These buoys also contribute to the Global Telemetry System (GTS). Data recorded by buoys associated to FRAM will be collectively presented in near-real time on a dedicated data portal, which is currently under construction. The ITP data are publicly available at www.whoi.edu/itp. The data of all buoys will be archived in the online databases PANGAEA and Coriolis shortly after a buoy ceases transmitting.

Acknowledgements:
The authors are grateful to Felix Janssen and Maria Nielsdottir for providing general information about the FRAM project. We highly appreciate the help of the crew and scientists onboard Polarstern expedition PS94 with the buoy deployments, and the support by WHOI and Metocean.