Multipurpose Acoustic Networks in the Integrated Arctic Ocean Observing System.

Hanne Sagen, NERSC

- INTAROS and the EU cluster of Arctic projects
- The potential of multipurpose acoustic systems in the Arctic
EU’s Arctic project cluster 2016-2017

EU PolarNET
Coordination action (AWI)

INTAROS
observing systems (NERSC)

APPLICATE
Modelling – forecasting (AWI)

Arctic permafrost
(start in 2017)

BLUE ACTION
Modelling – forecasting (DMI)

Infrastructure projects: ENVRI, INTERACT, ACTRIS, ICOS, EPOS, ++
INTAROS – Integrated Arctic Observation System
A project funded by EC - H2020-BG-09-2016

Coordinator: Stein Sandven
Nansen Environmental and Remote Sensing Center, Norway

The objective is to develop an efficient integrated Arctic Observation System by extending, improving, and unifying existing and evolving systems in the different regions of the Arctic
Workpackage structure

WP1: Requirements and strategy for a Pan-Arctic system

WP2: Exploitation of existing observing systems

WP3: Enhancement of in situ systems

WP5: Data integration & management - IAOS

WP4: Community-based observing systems

WP6: Applications towards stakeholders

WP7: Dissemination and outreach

Feedback to requirements, strategy and roadmap

Scientific data

Integrated data, prepared for applications

Community data

Climate modelling
Ice – ocean statistics
Focus areas in INTAROS

Experiment areas:

- Coastal Greenland/Baffin Bay
- North of Svalbard towards the deep Nansen Basin
- Fram Strait and Kongsfjorden
- Central Arctic: Distributed systems for ocean and sea ice
- Pan-Arctic region: Distributed systems for atmosphere and land

Main gap:
The ocean under the Arctic Sea Ice
Ocean/Ice buoys transmit data in real time

International Arctic Buoy Program

Toole et al., 2011
Multipurpose acoustic network in the Arctic - Drifting systems nested into a large scale system of fixed moorings

See Mikhalevsky, Sagen, Worcester et al. 2015
Multipurpose acoustic network in the Fram Strait

Sagen et al. 2017
Same systems have been used in Philippine Sea, Beaufort Sea, and is also considered to be used in Baffin Bay.

**USAGE 1: Underwater geo-positioning system**
**USAGE 2: Acoustic thermometry (“production line”)**

Objective: Measure the depth range average temperature (130 km x 1000 m) of the West Spitzbergen Current 8 times a day.

Time series of **mean temperature** over 130 km at accuracy 50 m degree C

Year long time series of **travel times** over 130 km

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Dushaw et al. 2016 a,b,c; Sagen et al. 2016
USAGE 3: Passive acoustic recordings: **Noise** in the ocean is an indicator in the Marine Strategy Framework Directive

- Seismic airgun signals

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\text{d} \approx 373 \text{ m} \\
\text{d} \approx 260 \text{ m}
\]

A. Yamakawa, 2016

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A. Yamakawa, 2016
Summary

Use of gliders and floats (e.g. modified ARGO, RAFOS) in ice covered regions relies on implementation of acoustic infrastructure.

Fixed underwater acoustic network provide:
- Under water geo-positioning system (UW – GPS) for all users
- Listening system to monitor the acoustic environment
- Mean ocean temperature along fixed sections (thermometry)

Drifting acoustic networks are cheaper more accurate as long as the float or the glider is within range, but limited to specific experiments and users.
RI-Proposal: Norwegian Arctic Multidisciplinary Observatory (Linked to INTAROS)

Coordinator: NERSC
Partners:
- University in Bergen
- (GFI, GEO, NOL)
- Institute of Marine Research
- Norwegian Polar Institute
- University Center in Svalbard
- Norwegian Defense Research Establishment

Yellow stars are the acoustic network complementing the standard oceanographic moorings (yellow dots) on the shelves. Green dots are ocean bottom seismometers.
Thank you!

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Google Earth