ACOBAR

Acoustic Technology for Observing the interior of the Arctic Ocean

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A Collaborative Project – Small and medium-scale focused research project
Contract negotiation: 2007 - 2008
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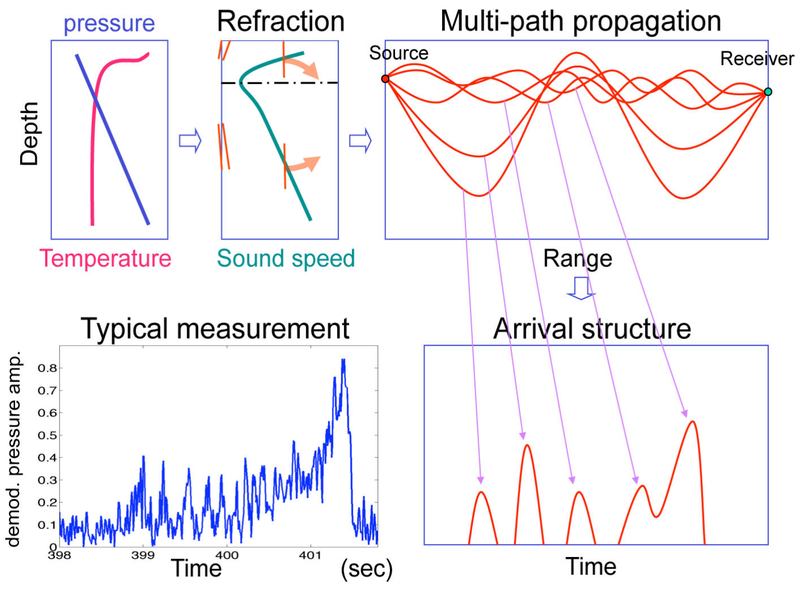
Objectives of ACOBAR

(1) Develop improved 3-D observations of the properties and transport of water masses in Fram Strait using an acoustic tomography array, oceanographic moorings and profiling gliders through data assimilation.
(2) Test and assess transmission of long-range acoustic navigation signals and commands to operate autonomous underwater vehicles such as gliders, floats and AUVs in Fram Strait.
(3) Implement data transmission by acoustic modems from underwater platforms to the surface for downloading to ships or satellite transfer.
(4) Exploit the existing array of acoustic sources from ice-tethered platforms for tomographic measurements of water mass properties in the ice-covered Arctic Ocean with real-time data provision via satellite.
(5) Dissemination of underwater oceanographic data to users with near real-time capability.
(6) Provide the technology to combine the oceanography array to transmit data through the ESONET Arctic cable when available.
(7) Transfer of technology and know-how between USA and Europe.

Principles of acoustic propagation

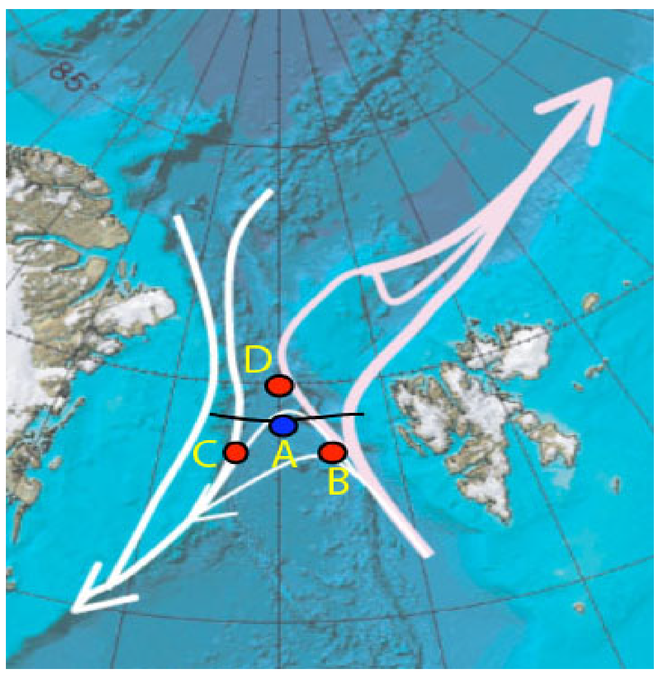


(A) Speed of sound is a function of water temperature and pressure, allowing temperature to be derived from travel time measurements between a source and a receiver.

(B) Acoustic signals propagate in multi-paths covering different water depths and arrive at different times at the receiver. The arrival structure is used to retrieve a mean temperature abetween source and receiver at several depths.

(C) Ocean velocity along the propagation path can be retrieved by reciprocal transmission, since the speed of sound increases in the current direction and decreases in opposite direction.

The experiment area



The acoustic tomography experiment in the Fram Strait as part of the DAMOCLES EU project has been launched by the Nansen Center and the collaborating partners. The first acoustic source and receivers were succesfully deployed in August 2008 from RV Håkon Mosby with Dr. Hanne Sagen as cruise leader. The tomography system will measure average sound speed in different depths of the water column. The data from the first array will be recovered next summer and be converted to a year-long record of temperature measurements across the West-spitzbergen Current. A profiling CTD mooring was also deployed close to the source and will be used to measure profiles of hydrography including sound speed every day. From 2009 the array will be expanded with additional sources and receivers as part of the new ACOBAR project. A triangle of transceivers, which are a combination of a source and a receiver mooring, is marked by red circles (see figureabove). The long vertical array in the middle, marked by a blue dot (A), and the southeastern source mooring (B) have now been deployed. Moorings C and D will be deployed in 2009.

First deployment in August 2008

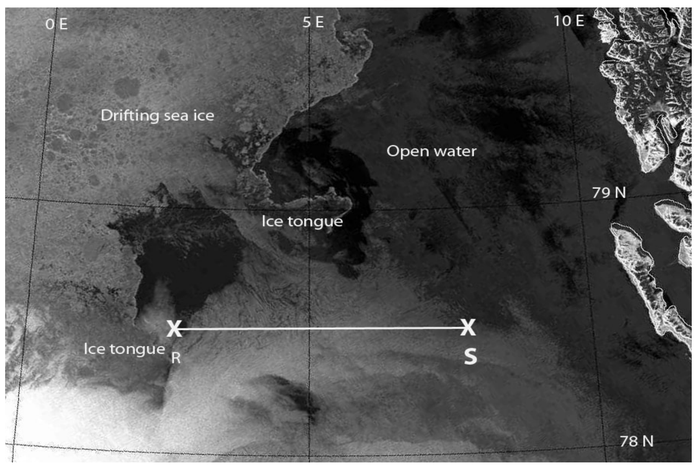
The array of two Simple Tomographic Acoustic Receiver (STAR) was deployed on 15 - 16 August from RV Håkon Mosby. The STAR was provided by Scripps Institution of Oceanography. The source, provided by Webb Research Corporation, was deployed in the same cruise. Both the STAR and the source were equipped with acoustic modems from Aquatec, allowing data transmission to a surface vessel.

Summary of ACOBAR

ACOBAR will develop an observing system for the Fram Strait and the interior of the Arctic Ocean based on underwater acoustic methods including tomography, data transmission, communication with underwater platforms, and navigation of gliders.

ACOBAR offers alternative methods to the ARGO system, which cannot be used in ice-covered seas, using platforms under the sea ice for data collection and transmission from the water column and the seafloor. ACOBAR will contribute to filling gaps in the global ocean observing system and thereby support the development of GEO/GEOSS.

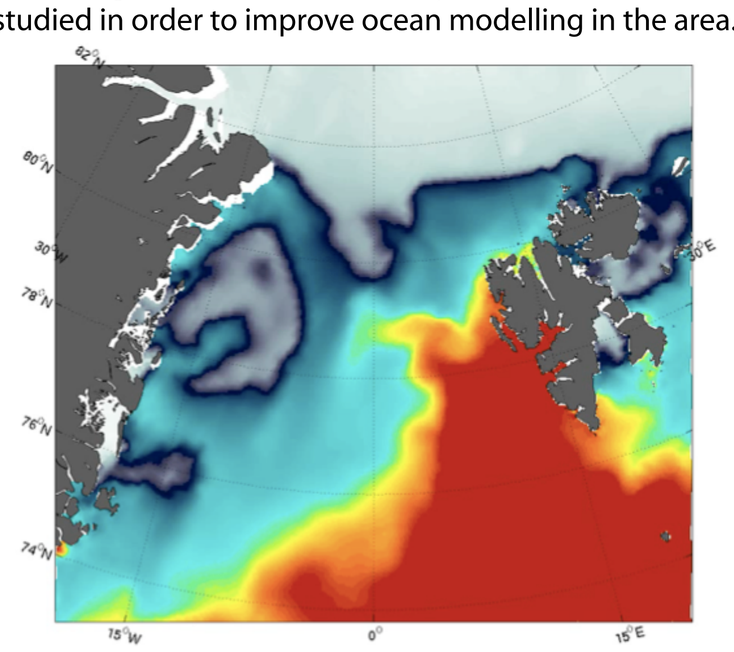
Sea ice monitoring by satellites



Satellite data are used to monitor the location of the sea ice in the area of the tomography array. The SAR image above shows the ice edge on 12 August 2008, just before the source (S) and receiver (R) moorings were deloyed.

Modelling and data assimilation

Methods for assimilation of acoustic data in the TOPAZ modelling and data assimilation system at NERSC will be studied in order to improve ocean modelling in the area.



Example of ice-ocean model results for the Fram Strait using a high-resolution, eddy -resolving model nested to the TOPAZ system. The examples shows surface temperature as colours and sea ice as the bright area. The modelling work is performed by Knut A. Lisæter at NERSC.

Partners

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