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Let's Solve Water

Application note
AN128

Hanging around at the North Pole

Aanderaa sensor string performance during Arctic ice drift

Fig. 1 | Photo credit: NERSC

In autumn 2024, scientists and students from the UAK2 project joined an international expedition aboard the Norwegian icebreaker KV Svalbard (Fig. 1). The primary objective of the mission was to deploy a large-scale ocean observation system in the central Arctic.

As part of the Norwegian Research Council (NFR)-funded UAK project, students and early-career researchers were invited to gain hands-on experience in fieldwork, instrumentation, and the deployment of deep-sea rigs.

This expedition also supported the HiAOOS (High Arctic Ocean Observation System) project, funded by the European Union Horizon Europe Programme (Grant Agreement No. 101094621) and coordinated by Hanne Sagen at NERSC. A key focus was the deployment of four deep-sea rigs in the Arctic Ocean for both HiAOOS and HiAATS (High Arctic Acoustic Thermometry Soundscape). The HiAATS project, led by Matthew Dzieciuch at the Scripps Institution of Oceanography, is funded by the US Office of Naval Research.

Four deep-ocean moorings, equipped with a suite of instruments, were installed to measure temperature, salinity, ocean currents, and the travel time of sound pulses. These moorings, spaced hundreds of kilometers apart, transmitted sound pulses between each other. By analyzing the travel time of these pulses, researchers can detect temperature changes in Arctic water masses over time—an important contribution to improving climate models.

Students on board also engaged in the "Float Your Boat" initiative, launching small, decorated wooden boats onto ice floes to study ice drift. This outreach project involves Arctic community members and school children, helping to raise awareness and understanding of the Arctic Ocean—its circulation, sea-ice cover, and ongoing changes.

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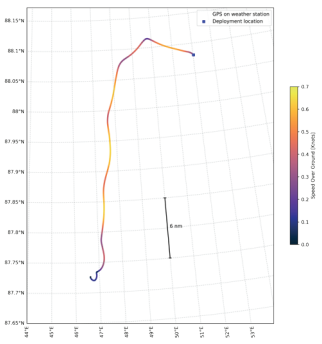
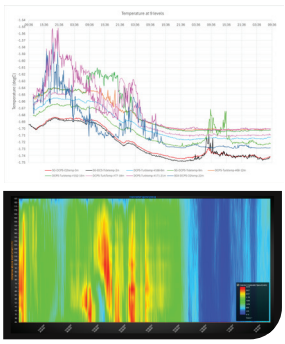
A key objective of the UAK2 project is to strengthen collaboration and foster joint technical development between ocean research and industry. In line with this goal, scientists from the Nansen Center deployed an Aanderaa sensor string system that drifted near the North Pole at 88°N (Fig. 2), suspended from a surface buoy through a hole drilled in the sea ice (Fig. 3). One aim of this deployment was to explore correlations and potential synergies between particle measurements obtained using multipoint-calibrated turbidity sensors and acoustic Doppler current sensors operating at 600 kHz and 2 MHz. By combining these methods, researchers hope to differentiate between echoes from suspended particles—such as clay, silt, ice crystals, algae—and swimming organisms like zooplankton and fish.





Pictured above: Fig. 2 (left) – GPS track of drifting sensor string system, Fig. 3 (middle) Photo credit: NERSC, Fig. 4 (top right), Fig. 5 (bottom right)

Another goal was to collect data for developing methods to quantify turbulence at various scales beneath the ice. This involved integrating acoustic Doppler current measurements at multiple frequencies with high-frequency pressure data from wave/tide sensors.

The 20-meter-long sensor string (Fig. 3) was outfitted with approximately 30 sensors, measuring:

- Temperature at 9 depths (Fig. 4)
- Salinity/Density at 3 depths
- Pressure at 3 depths
- Oxygen at 4 depths
- Turbidity at 5 depths

Data was logged by a SeaGuard*II* instrument located at the bottom of the string, 20 meters below the ice. This instrument was equipped with a Doppler Current Profiling Sensor to record currents, turbulence, and particle movement beneath the ice (Fig. 5).

The UAK2 expedition highlights the power of collaboration between science, education, and industry in advancing Arctic research. The successful deployment of the Aanderaa-Xylem sensor system near the North Pole provides valuable data to improve climate models and understand under-ice dynamics. These efforts not only push technological boundaries but also inspire future generations through hands-on learning and outreach.

The Useful Arctic Knowledge (UAK) project brings together scientists and students from Norway, the USA, and Canada to better understand changes in the Arctic Ocean. It trains young researchers in advanced technologies to study sea ice, ocean currents, underwater sound, and light—key indicators of climate change. The project also fosters collaboration between universities and industry to develop smarter, more effective Arctic observation methods.

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