Implementation of a multipurpose Arctic Ocean Observing System

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The central Arctic Ocean is one of the least observed oceans in the world. This ice-covered region is challenging for ocean observing with respect to technology, logistics and costs. Many physical, biogeochemical, biological, and geophysical processes in the water column and sea floor under the sea ice are difficult to observe and therefore poorly understood. Today, there are technological advances in platforms and sensors for under-ice observation, which offer possibilities to install and operate sustained observing infrastructures in the Arctic Ocean. The goal of the INTAROS project is to develop integrated observing systems in the Arctic, including improvement of data sharing and dissemination to various user groups. INTAROS supports a number of systems providing data from the ocean in delayed mode as well as in near-real time mode, but only a few operate in the ice-covered areas.

Autonomous observing platforms used in the ice-free oceans such as Argo floats, gliders, and autonomous surface vehicles cannot yet be used operationally in ice-covered Arctic regions. The limitation is because the sea ice prevents these underwater platforms from reaching the surface for satellite communication and geopositioning. To improve the Arctic Ocean Observing capability OceanObs19 recommended ‘to pilot a sustained multipurpose acoustic network for positioning, tomography, passive acoustics, and communication in an integrated Arctic Observing System, with eventual transition to global coverage’. Acoustic networks have been used locally and regionally in the Arctic for underwater acoustic thermometry, geo-positioning for floats and gliders, and passive acoustic. The Coordinated Arctic Acoustic Thermometry Experiment (CAATEX) is a first step toward developing a basin-scale multipurpose acoustic network using modern instrumentation.

To provide secure data delivery, submarine cables are needed either as dedicated cabled observatories or as hybrid cable systems (sharing the cable infrastructure between science and
commercial telecommunications), or both combined. Several large-scale cabled observatories existing coastal areas in world oceans, but none on the Arctic Ocean. At OceanObs19 it was recommended to transition (telecom+sensing) SMART subsea cable systems from present pilots to trans-ocean implementation, to address climate, ocean circulation, sea level, tsunami and earthquake early warning, ultimately with global coverage. Cabled observatories, either stand alone or branching from a hybrid system, could provide power and real time communication to support connected water column moorings and sea floor instrumentation as well as docking mobile platforms. Subsea cable developers are looking into the possibility to deploy a communication cable across the Arctic Ocean from Europe to Asia, because this offers a much shorter route compared to the terrestrial cables.

An international consortium of leading scientists in ocean observing with experience in state-of-the-art technologies on platforms, sensors, subsea cable technology, acoustic communication and data transmission plan to establish a project to implement and test the system based on experience from the CAATEx experiment and other Arctic observing system experiments. The INTAROS project is presently developing a Roadmap for an integrated Arctic Observing System, where multipurpose ocean observing systems will be one component.