

PROJECT SUMMARY

Collaborative Research: The Arctic Observing Network - Capturing and Understanding Arctic Change with Renewed Observations at the Davis Strait Gateway

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Overview

The proposed five-year effort will renew the integrated observational program at Davis Strait, matching ongoing collections at Bering Strait, Utqiagvik, Alaska, and Fram Strait to extend the time series of concurrent measurements across the major Arctic Gateways. The extended timeseries will be combined with numerical modeling to analyze several important science questions. The backbone system relies on the tested combination of moorings and biennial biogeochemical sampling that have successfully delivered core measurements for the past decade. Bottom pressure sensors augment the system to quantify sea surface height gradients, which will support investigations of the primary forcing mechanisms. Integrated marine ecosystem observing includes ongoing biogeochemical and marine mammal passive acoustic measurements augmented with tracking of key fish species, and zooplankton and phytoplankton observations. These observations will launch the Atlantic Distributed Biological Observatory (DBO) in Davis Strait as a complement to the DBO newly planned for Fram Strait and the existing Pacific DBO. The full suite of observations, from physics to top predators, supplemented by numerical modeling, represents an integrated approach that will provide context for the measurements and enable us to understand the dynamics driving observed variability.

Intellectual Merit Davis Strait is one of only three gateways between the Arctic and the global oceans. As such, physical and biological observations across the Strait are crucial to address internationally highlighted high-priority science objectives, including: (1) Quantifying, with robust error estimates, change in Arctic freshwater and heat balances including changes in water mass characteristics; (2) Understanding the interactions between Arctic change and global climate; (3) Understanding the ocean-cryosphere links related to rapid melt loss from the Greenland Ice Sheet; (4) Documenting changes in Arctic Ocean acidification and its potential impacts on subpolar oceans; and (5) Establishing a sustained, internationally integrated Arctic Observing Network that includes biological measurements. The Davis Strait measurements will be used together with numerical models to investigate the mechanisms that control transport variability through the Canadian Arctic Archipelago, and the impacts of these exchanges at interannual (weekly for physical properties) and longer time scales on deepwater formation rates, Atlantic Meridional Overturning Circulation strength, and the heat and freshwater balances of the Arctic Ocean. Atmospheric, anthropogenic and biogenic (marine mammal) seasonal and interannual variability in ambient noise in Davis Strait will provide an understanding of the variability in the underwater soundscape. Marine ecosystem components, from physics to upper trophic level consumers, will be explored to determine how environmental changes influence the presence and phenology of multiple trophic levels.

Broader Impacts

The accumulation of long, concurrent timeseries from the three major Arctic Ocean gateways enables quantitative assessments of pan-Arctic freshwater, heat, nutrient and carbon budgets and their impacts on both Arctic and global responses to climate change. Coordinated, concurrent sampling across a network of sites, provides the data required to address these questions of large-scale change. Similarly, the network of passive acoustic observations reveals changes in marine mammal species distributions but also atmospheric and anthropogenic signals from changing ambient noise levels that can be related to changing climate. The Davis Strait Gateway system is a component of several broad networks, including the Arctic Observing Network, Atlantic Meridional Overturning Circulation Program, Global Ocean Ship-Based Hydrographic Investigations Program (GO-SHIP), Global Ocean Acidification Observing Network (GOA-ON) and a case study site for the Arctic Monitoring Assessment Programme (AMAP) 2nd report on Arctic Ocean Acidification. The Davis Strait program also develops technologies that have broad applicability to observing in challenging ice-covered environments, and works to transition these for wider use within the community.