

B. Project Summary

Recent major changes in the extent, thickness and properties of Arctic sea ice have captured attention and posed significant challenges to a diverse group of stakeholders, ranging from maritime safety and security, resource management and development, politicians, coastal communities, weather and climate forecasters, climate change researchers, and a growing segment of the general public. Sea ice forecasting on seasonal-to-interannual timescales, especially over the summer and into fall, is of particular interest. Though each stakeholder is driven by different priorities, all require improved monitoring, prediction, and communication of sea ice conditions. To date, sea ice modeling efforts have largely focused on climate scales (i.e., response to greenhouse gas forcing) or targeted synoptic forecasting in support of navigation. Sea ice forecasting on seasonal scales is a challenge because of: (1) high variability in atmospheric and oceanic influence, (2) observations for initialization and validation have limited coverage and/or high uncertainties, (3) limitations of current model capabilities, (4) inherent limitations in sea ice predictability, and (5) an Arctic system changing in ways without recent historical precedent.

The SEARCH Sea Ice Outlook was implemented four years ago in an ad hoc fashion, requesting voluntary contributions to estimate September sea ice extent based on late spring (June 1) conditions. Contributions have been made using different methods that vary from complex (partially- and fully-coupled general circulation models and statistical relationships) to basic (trend extrapolation, heuristic, public poll). We propose to organize and expand the Outlook into a more structured, coordinated and formal effort that focuses on tackling key barriers to sea ice forecasting, including rigorous evaluation of predictions, coordination and organization of relevant observations for initialization, evaluation of methods, and finally, an organizational network structure to manage the efforts and communicate results in new ways. This proposal builds on the experience of the past four years and expands on structures already in place, leveraging resources and expertise at an international scale to help address a set of challenges recognized as priorities by a range of U.S. and international programs and organizations.

Intellectual Merit - This project advances NSF's goal of providing improved predictive tools for the Arctic by creating an innovative network of scientists and stakeholders to generate, assess and communicate Arctic seasonal sea ice forecasts. The network's focus is to develop new methods to evaluate forecasts, new metrics for synthesis and comparison across forecast methods and new approaches to initialize forecast methods with targeted observations. Finally, the network will investigate how different forecasting methods can be combined to exceed predictive skills of narrower approaches. Our research team will explore how to best plan observations for improved seasonal predictions and how these predictions in turn can advance understanding of the evolving state of the Arctic sea ice cover.

Broader Impacts – We aim to develop and disseminate improved seasonal forecasts of Arctic sea ice for societal benefit. By fostering and coordinating an international network of researchers and leveraging a broad range of activities, the project provides information tailored to stakeholders' needs. In addition to rigorous evaluations of stakeholder information needs, the network will develop a common reference framework for key sea ice variables and predictors, generating integrated datasets and predicted fields for the scientific community and stakeholders. Our team will also initiate activities to inform and engage the growing Internet communities of citizen scientists, many of whom already show a strong interest in Arctic science, have capabilities for their own original and potentially worthwhile analysis, and connect with wider networks of media and public discussion. Our team includes graduate students and post-docs who are mentored to conduct high-quality research at the intersection of fundamental and applied research. By entraining more young researchers into the network, the project also addresses an important need for qualified experts that can help address urgent questions concerning resource uses and ecosystem services impacted by rapid Arctic sea ice change.