FRAMS

Forecasting Regional Arctic Sea Ice from a Month to Seasons

Principal investigator

William Merryfield
bill.merryfield@canada.ca

Canadian Centre for Climate Modelling and Analysis

Other contact

Bertrand Denis, Meteorological Service of Canada, bertrand.denis@canada.ca; Bruno Tremblay, Department of Atmospheric and Oceanic Sciences, McGill University, bruno.tremblay@mcgill.ca

Areas of contribution

User-aspects and verification
Modelling and forecasting
Sea ice processes
Economic aspects

Summary

This project will advance the science of multi-model sea ice forecasting on time scales of a month to seasons, while developing products and services in association with the establishment of WMO’s Polar Regional Climate Center.

Description
The objective of this project is to develop improved products and services relating to forecasting of Arctic sea ice on time scales from a month to seasons. This will be achieved by building on existing capabilities of Environment and Climate Change Canada’s Meteorological Service of Canada (MSC), the Canadian Ice Service (CIS) and other centers, within the framework of Canada’s role in the WMO’s new Polar Regional Climate Centre (PRCC).

These sea ice forecasts will be provided by models from WMO’s Global Producing Centres (GPCs) for Long-Range Forecasts along with additional models such as MSC’s subseasonal Global Ice Ocean Prediction System (GIOPS) contributing to prediction activities under YOPP. The capabilities for such models to forecast sea ice has recently begun to be evaluated in research settings, but has yet to be fully exploited for societal benefit.

The project will have three main components. The first consists of building capacity for multi-model seasonal forecasting of sea ice in support of the PRCC node that is being established at MSC’s Canadian Centre for Meteorological and Environmental Prediction (CCMEP) near Montreal. Forecasts from both single models and combinations of models, which often perform better due to error cancellation across models, will be assessed. Forecast products drawn from existing research that will be considered include pan-Arctic sea ice area and extent, local sea ice concentration, and local sea ice advance and retreat dates. In addition, new end user-relevant products will be developed and tested. An essential element will be to represent and communicate uncertainties that are inherent in monthly to multi-seasonal forecasts.

The second component of the project will identify physical processes and aspects of initial states that enable sea ice to be skillfully predicted, and examine their representation in the forecast models. Because accurate representation of such will impart forecast skill whereas inaccurate representations will introduce errors, anticipated outcomes include guidance for efforts to improve seasonal sea ice forecasts and climate models generally. This activity also will benchmark model-based forecast skill against that of simpler statistical models, and will be centered at McGill University.

The project’s third component will interface with end users in the Arctic shipping sector to ascertain sector needs for seasonal sea ice forecast information. This will occur through two-way dialogues facilitated by stakeholder workshops, and by MSC, CIS and stakeholders working together to develop tailored forecast products, along with effective means for presenting them that express forecast uncertainties. This activity will build on existing relationships and modes of communication between CIS and the Arctic shipping sector, and will enhance CIS’s existing seasonal sea ice forecast products contributing to North American Ice Service’s seasonal outlooks.

The overall outcome will be to realize the nascent potential of ensemble seasonal forecasting systems to produce societally relevant operational forecasts of sea ice, within the framework of the WMO’s developing PRCC. This will benefit the Arctic shipping sector and other stakeholders for which seasonal forecasts of sea ice have value.

These activities support the YOPP objectives to
• explore the predictability of sea ice on time scales from days to a season.
• improve verification of polar weather and environmental predictions to obtain quantitative knowledge on model performance, and on the skill of operational forecasting systems for user-relevant parameters; and efficiently monitor progress.
• improve understanding of the benefits of using existing prediction information and services in the polar regions, differentiated across the spectrum of user types and benefit areas.
• provide training opportunities to generate a sound knowledge base on polar prediction related issues.
Timeline

2017-11-01 - 2020-10-31

User relevant aspects

Two workshops coordinated through the Canadian Ice Service (CIS) will engage forecasters with a panel of end users in the Arctic shipping sector, drawing on existing CIS contacts. The first, to be held in the initial year of the project, will inform end users about emerging sea ice forecasting capabilities, and gather information about end user needs and preferences for how forecasts and accompanying uncertainties should be communicated. The second workshop, in the final year of the project, will train end users on the interpretation and use of sector-oriented products that have been developed, and gather feedback on how these products could be further improved. A webinar in the second year of the project will report progress and gather “course correction” feedback from the end users. Prior to the start of the project a core Leadership Team has been assembled that will anchor the end user panel and consists of three highly experienced members of the North American Arctic marine transport community representing (i) the International Arctic Research Center (Fairbanks, USA), (ii) Fednav, a leading Canadian shipping company having the world’s largest fleet of ice-class bulk carriers and based in Montreal, Canada, and (iii) Martech Polar Consulting, Ltd., which provides global ice pilotage and navigation services and is based in Victoria, Canada. End user panel members representing additional North American companies and organizations will be assembled prior to the first workshop based on recommendations from the end user Leadership Team and CIS, which has well established contacts with the Canadian Arctic marine transportation sector through its annual pre-season briefings on predicted Arctic summer ice conditions. The international scientific and Arctic shipping communities will be informed of progress and outputs through engagement with YOPP and a collaboration agreement between the H2020 APPLICATE project and Environment and Climate Change Canada which is the government department involved in this project, and through submissions to industry publications.

Provider relevant aspects

Forecast and product development activities at the Meteorological Service of Canada (MSC) will include coordination of data acquisition and exchanges with contributing WMO Global Producing Centers and other centers providing sea ice forecast data.

Regional emphasis

Northern hemisphere: Yes
Southern hemisphere: No
Key project deliverables

Develop real time multi-model sub-seasonal to multi-seasonal forecasts of Arctic sea ice area and extent, sea ice concentration and thickness (deterministic and probabilistic), advance and retreat dates, and shipping navigability and risk.

Assess the performance of these forecasts through hindcast and real time verification against observations.

Assess sources of sea ice forecast skill and errors in terms of physical processes and model attributes, informing efforts to improve sea ice forecasting systems.

Engage with a panel of end users in the Arctic shipping sector to ascertain sector needs and optimal means for communicating seasonal sea ice forecast information.

Data management

Sea ice hindcast and forecast fields will be archived and served openly by Environment and Climate Change Canada, which includes MSC.

Is data provided to WMO Global Telecommunication System

No

Real-time provision

Basic and tailored forecast products will be served in near-real time by MSC and transferred to WMO Lead Center for Long-Range Forecast Multi-Model Ensemble operations where applicable.

Other information

Currently a proposal to Canada's Marine Environmental Observation Prediction and Response (MEOPAR) Network under its YOPP-related call for proposals