ALERTNESS

Advanced Models and Weather Prediction in the Arctic: Enhanced Capacity from Observations and Polar Process Representations

Principal investigator

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Areas of contribution

User-aspects and verification

Polar atmospheric processes

Modelling and forecasting

Data assimilation

Outreach

Summary

ALERTNESS will significantly improve AROME Arctic, the recent entry-into-service weather forecast model system at MET Norway. It is an operational convection-permitting model system dedicated to the European Arctic and one of the core models of the Year of Polar Prediction (YOPP). The project will advance challenges unique for the Arctic: The sparse conventional observation network, exploitation of satellite observations over snow and ice, atmospheric data assimilation at high latitudes, parameterization and representation of key polar processes, and the associated representation of uncertainties. The project is led by MET Norway, with co-leads from University of Bergen, the University Centre in Svalbard (UNIS), and Uni Research.

Description

MET Norway runs operationally a version of the AROME NWP model: AROME Arctic. This model is convection permitting with 2.5 km horizontal resolution and covers a region comprising parts of the Arctic Ocean and the Greenland and Barents Seas. It produces four times daily with a lead time of 66 hours. AROME Arctic output is expected to be valuable to the YOPP community for comparisons with observations and for studies utilizing super-site data, for model intercomparison studies, and as guidance for weather forecasts during observation campaigns.

The ambition of ALERTNESS is to develop world-leading predictive capacity for weather in the Arctic that is able to deliver reliable and accurate forecasts and warnings for the benefit of maritime operations, business and society. In a strong collaboration between academia, research institutions and operational forecasting centres, Arctic is moved into the focus of research efforts on weather prediction.

In accordance with challenges outlined in the YOPP Science Plan and in the YOPP Objectives, the project focuses research on some key topics:
a) Develop and apply metrics to evaluate AROME Arctic in high-impact weather
The project will tackle the Arctic verification problem by using as many observation and model data sets as possible for in-depth evaluation of AROME Arctic. It will develop, test, use and distribute metrics and diagnostics that take into account the different weaknesses of the polar observational data sets.
b) Improve the use of Arctic observations for accurate mesoscale forecasts
ALERTNESS will investigate and develop methods to address important shortcomings in data assimilation in the Arctic, by e.g. developing aggregation techniques on model first-guess, and introducing flow-dependency by employing 4D-Var and 3D-Var in Ensemble of Data Assimilation in AROME Arctic. The project will carry out Observing System Experiments to evaluate the benefit of enhancements to the operational observing network.
c) Identify and exploit uncertainty from interacting sub-gridscale processes
Identify how interaction between parameterised processes leads to error compensation, implement a new parameterisation for the sensible heat flux, identify uncertainty from parameterised processes with a novel combination of methods, exploit uncertainty by implementing situation-dependend stochastically perturbed parameterisations, optimise uncertainty for use in ensemble forecasting, and propose pathways to improvement for next generation of models.
d) Develop an optimum Ensemble Prediction System (EPS) setup for improved polar weather prediction and downstream applications.
ALERTNESS will determine appropriate perturbations to uncertain components of AROME Arctic and incorporate them into an EPS that is ready for operational implementation. This will include perturbations to initial conditions; lateral and surface boundary conditions; observations; and model physics.

ALERTNESS will, to the extent feasible, focus its experiments around the YOPP Special Observing Periods

(SOPs), in order to make optimal use of the additional observations available. The project will have an open data policy, and data from the experiments and extra model output will be readily available to the YOPP community. As a dedicated YOPP contribution, AROME Arctic model tendency output will be produced for the SOPs in this project.

Timeline

2018-02-01 - 2022-01-31

User relevant aspects

A project web site will be developed, web adress to be determined, from which access to model data and written material, verification results etc. can be accessed.
Model data will also be made available via the YOPP data portal yopp.met.no where relevant.

Regional emphasis

Northern hemisphere: Yes

Southern hemisphere: No

Key project deliverables

- Additional model output (tendencies) during the YOPP SOPs
- Model output from relevant experiments of particular scientific interest
- Recommendations for WMO and national meteorological services on the design of the future Arctic observing system
- Written documentation of scientific results

Data management

Data will be archived at the facilities provided by MET Norway, and/or Norstore, the Norwegian infrastructure for storage of scientific data.
According to our open data policy, all model data will be made freely available to the public.
Access to the data will be provided via the YOPP data portal yopp.met.no, the thredds service thredds.met.no, and/or a dedicated project web page.

Is data provided to WMO Global Telecommunication System

No

Other information

The project is lead by Dr. Jørn Kristiansen at MET Norway, and co-lead by Marius Jonassen (UNIS).
Work package leaders are Erik Kolstad (UNI), Roger Randriamampianina (MET), Harald Sodemann (UiB) and Inger-Lise Frogner (MET).
We will involve several national and international institutes as partners in this project.