ALERTNESS project: advanced models and weather prediction in the Arctic

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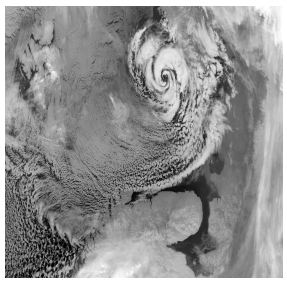
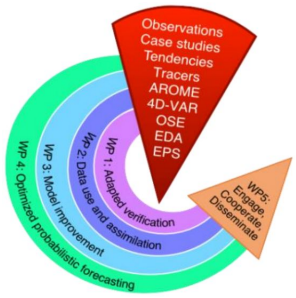
MET, UiB, NERSC, UNIS, UiT, KNMI, FMI, SHMI

1.Objectives

The ambition and primary objective of ALERTNESS is to develop world leading capacity for the delivery of reliable and accurate Arctic weather forecasts and warnings for the benefit of maritime operations, business and society. The secondary objectives are:

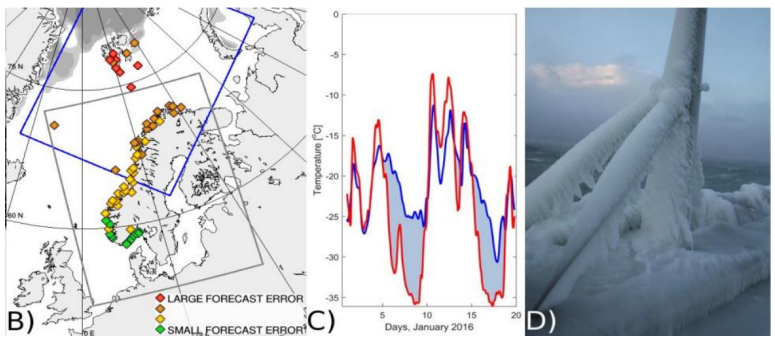
1. Develop and apply verification metrics and diagnostics for Numerical Weather Prediction (NWP) in the Arctic,
2. Improve use and assimilation of Arctic observations for NWP,
3. Enhance and improve NWP model capabilities and diagnostics for high latitudes,
4. Develop an Ensemble Prediction System optimized for Arctic conditions,
5. Improve polar prediction through the ALERTNESS value chain.





2.Background

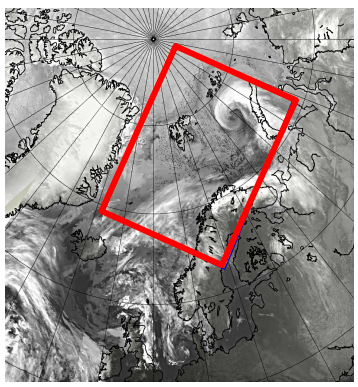
There is a growing interest in Arctic operations due to socio-economic opportunities. Fuelled by increased accessibility due to recent sea ice retreat, activities related to exploration, tourism, transportation and scientific research are expected to attract economic investments exceeding $100bn over the coming decade. However, Arctic weather can be a hazard to high-latitude activities and infrastructure, such as shipping, fishery, gas and oil exploration and exploitation, land transport and aviation. There is an urgent need for research towards reliable and accurate polar weather prediction capabilities.



B) Forecast errors for sea level pressure increase towards higher latitudes and the sea-ice edge (grey shading) in comparison to coastal SYNOP stations. The boxes indicate the domains of AROME Arctic (blue) and MetCoOp (Müller et al. 2017b; grey). C) A 1km model overpredicts 2m temperature during cold events in the Arctic (blue shading). Blue: Model time series (data by M. Varentsov) for the Kola Peninsula; Red: station data. D) Icing on an installation in northern Norway during the extreme weather event Ask in 2010 (photo: Karl-Idar Berg).

3.AROME Arctic

In response to the urgent need for Arctic weather prediction, a convection-permitting mesoscale model for the Arctic has recently been introduced into service by MET Norway. AROME Arctic, an operational short range, convection permitting prediction system dedicated to the European Arctic, issues forecasts four times per day with a lead time of 66 hours, at a horizontal grid spacing of 2.5 km.



4.Work packages

The objectives are translated into five work packages.

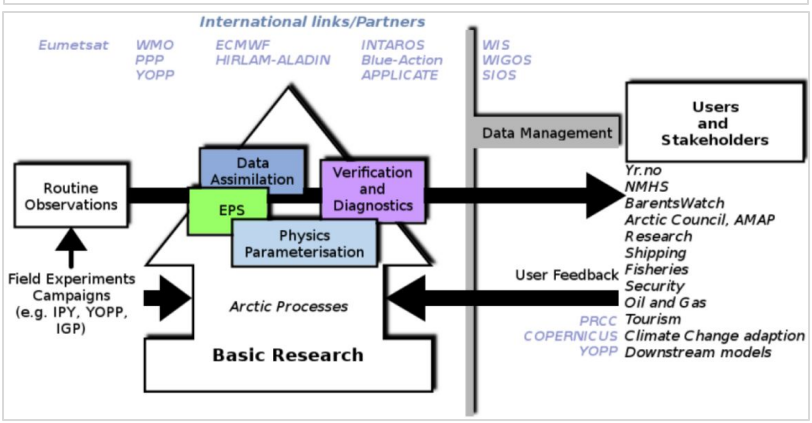
WP1 will **develop and apply verification metrics and diagnostics for NWP in the Arctic**. We will follow key research foci in polar verification to account for observational uncertainty, enhance synergies between verification and data assimilation by exploring the use of model analyses for verification, and include spatial and probabilistic verification methods available in the HIRLAM-Aladin R Package (HARP).

WP2 will **improve use and assimilation of Arctic observations for NWP**. We will advance atmospheric mesoscale and sea ice DA in the Arctic using more and new types of observation types, optimize observation usage and implement state-of-the-art analysis techniques for the benefit of weather prediction.

WP3 will **enhance and improve NWP model capabilities and diagnostics for high latitudes**. It includes a revised approach to heat flux parameterisation, developing novel ways to trace the impact of model uncertainty from individual components, and to identify how interactions between parameterised polar processes lead to error compensation.

WP4 will **develop an Ensemble Prediction System optimized for Arctic conditions**. It will address uncertainties due to both the sparsity of, and errors in, the observations, and the errors in the model parameterisations.

WP5 will **improve polar prediction through the ALERTNESS value chain**. The experience and expertise of the project lead will ensure project progress, collaboration, cooperation and quality according to the project plan and within the assigned budget.



5. Dissemination of project results

Mature research results in ALERTNESS will be disseminated through the main communication channel of MET Norway: In the operational weather forecasts published on Yr.no. Improvements and forecast issues of significance will be picked up by the science journalists in Yr.no (NRK) and social media via MET's newsdesk Redaksjonen. Given the large number of different end-users and stakeholders, we will use existing mechanisms (see figure above) to target the different preferences and needs for weather information. We will inform forecast users on results of significance for their work and how ALERTNESS tackles the unique Arctic forecasting challenges to improve the weather forecasting capacity, e.g. **BarentsWatch**, **SIOS**, the **YOPP** Community, **WMO-PRCC** and other regular "downstream" providers of polar environmental information. An important aim is to transfer the accurate and reliable weather predictions into better informed decision making and special focus will be given to enable stakeholders to use the advances of probabilistic forecasting.

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