

# Advanced models & weather prediction in the Arctic

## Arctic weather forecasts benefit from better use of observations

Computer simulations have provided clear guidance on the added value of different land-based and remote observing systems for the initialization of global and regional weather forecast models. The information content of observations can be better exploited when the weather forecast takes into account the horizontal and vertical extension of the atmospheric volume observed by the instrument.

## Ensemble Prediction Systems add value to Arctic weather forecasts

Perturbations to observations and the model physics to better represent uncertainties in Arctic weather forecasts will be implemented in the operational system. A new method for modelling uncertainties in the surface gives greater flexibility for future research studies and operational implementations.

## More detailed weather forecasts

Experiments with more vertical model levels and 0.5 km horizontal grid spacing over Svalbard and 1,25 km for the AROME-Arctic domain reveals potential for improved weather forecast capabilities. This is shown for wind speed while for other parameters the release of the full forecast improvement potential can first be utilized when combined with additional model developments.

Weather forecast model development

## Verifying Arctic weather forecasts

Through model comparisons, we revealed that AROME-Arctic is the world-leading NWP model for the Arctic. It is shown that this model has state-of-the-art predictive skills. We developed methods for user-oriented verification of Arctic phenomena, and for taking the scarce observational network and observation errors into account.

Weather forecast evaluation

## Sea surface meteorology

In situ observations from a meteorological buoy deployed in the Iceland and Greenland Seas were made publicly available and used together with other field campaign observations to evaluate surface meteorology and fluxes in the ERA5 data set.

Weather forecast evaluation

## Communication

YOPP endorsed, popular scientific articles on forskning.no, seminar on UNIS Svalbard and live Youtube presentations and Bjerknes podcast. In social media #AlertnessArctic. 22 scientific publications, conference presentations.

## Sharing data sets:

Output from model experiments and enhanced output for Supersites. Buoy observation data from Iceland Greenland Sea, LIDAR observations from Svalbard and mobile weather station from Svalbard

International collaboration

## Hazardous Arctic weather:

**Polar Lows, cold air outbreaks, icing, warm spells.**

Alertness has gained insight into the local water cycle in Cold Air Outbreaks, on the physics of polar lows, and the capabilities of NWP models capabilities to forecast them. In addition, a vessel icing model has been updated and is ready to be used as a part of an Ensemble Prediction System.

Hazardous Arctic weather

## Enhanced sea ice description

A new sea ice data assimilation framework is introduced to assimilate satellite sea ice products and improve the representation of the sea ice surface.

Weather forecast model development

## The model: AROME-Arctic

is a high-resolution state-of-the-art Numerical Weather Prediction Model used by MET Norway to produce short-range weather forecasts for the European East Arctic. The cornerstone of the project.

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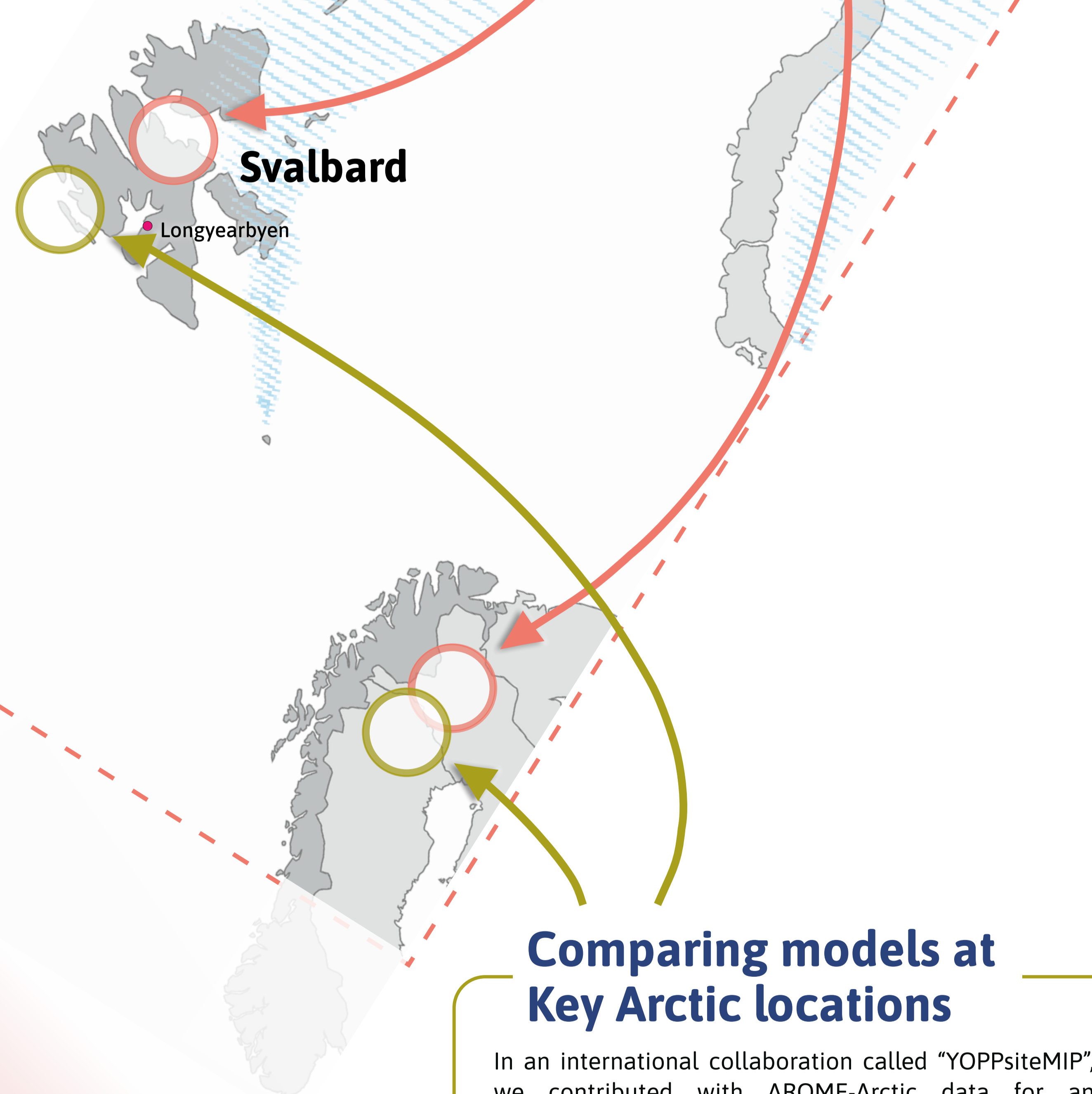
## Improving detailed processes in cold regions

In Alertness we focused on how the model works and performs, enabling long-term model improvement. Specifically, we improved low clouds in the boundary layer by a revised description of turbulence. We partly attribute warm bias in the stable boundary layer to boundary layer thickness.

We revealed previously "invisible" model fields and behaviour and interactions between processes from a new tendency output diagnostic. We disentangled the interactions between physical processes for Arctic high impact weather situations. We evaluated the sensitivity of cloud microphysics parameters in a single-column model setup.

Weather forecast model development

Sea Ice



## Comparing models at Key Arctic locations

In an international collaboration called "YOPPsiteMIP", we contributed with AROME-Arctic data for an in-depth model intercomparison. For selected periods, this includes physical and dynamical tendencies at the Sodankyla and Ny-Ålesund supersites. Compared to observations AROME-Arctic is among the best models in this comparison.

Weather forecast evaluation

## International cooperation

Alertness is led by the Meteorological Institute of Norway (MET Norway) and is a cooperation between MET Norway, University of Bergen (UIB), NORCE, University of Tromsø (UIT), The Royal Netherlands Meteorological Institute

(KNMI), Nansen Environmental and Remote Sensing Center (NERSC) and The University Centre in Svalbard (UNIS). Alertness is a YOPP-endorsed project, which contributes to YOPPsiteMIP and cooperate with other projects, e.g. the EU H2020 project APPLICATE and the Iceland Greenland Sea project.



## Publications

Reports and publications are available at the project webpage: [alertness.no/en/project#publications](http://alertness.no/en/project#publications)

Or by scanning this qr-code:

