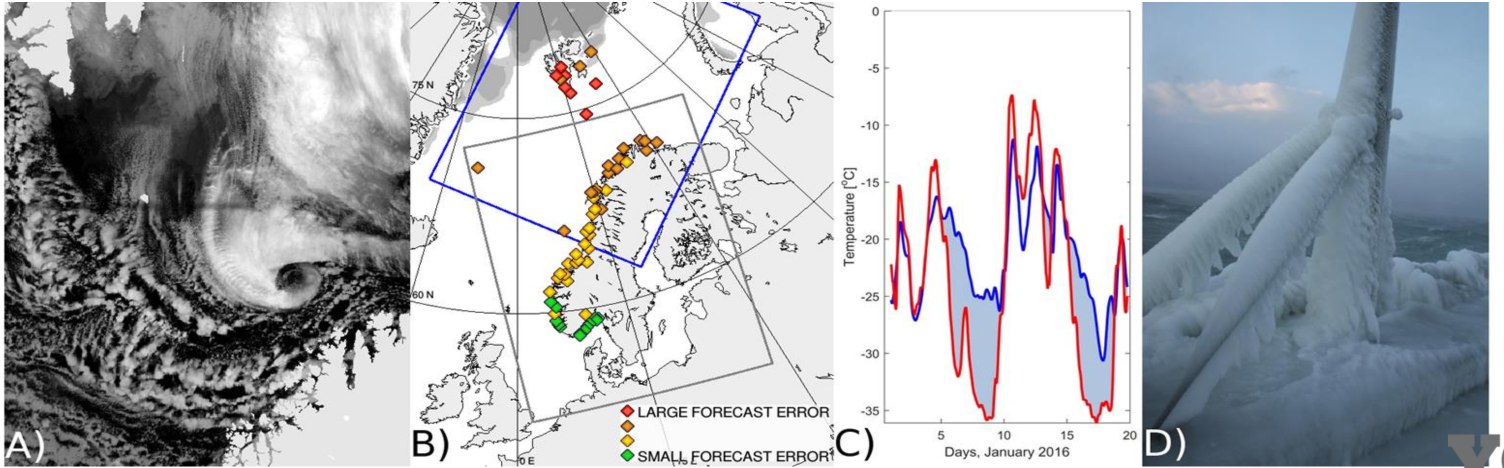
Alertness



YOPP
YEAR OF POLAR PREDICTION

The Research Council of Norway

UNIVERSITETET I TROMSØ

UNIS
The University Centre in Svalbard

NORCE

KNMI

Meteorologisk institutt

NERSC

UNIVERSITAS BERGENSIS

The ambition and primary objective of Alertness

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.

Sommarøya, Troms, 2015. Photo: Gunnar Noer.

Scientific hypotheses

(i) improved observations and improved use of observations enable advances in Arctic forecasting,

(ii) new ways to identify error compensation will create a pathway to sustained model improvement, and

(iii) embracing forecast uncertainty will result in more robust forecasts of Arctic weather.

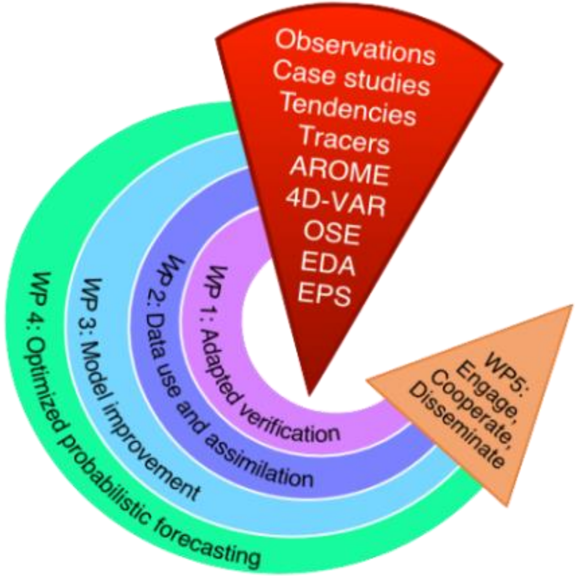
Four scientific objectives

1. Develop and apply verification metrics and diagnostics for NWP in the Arctic

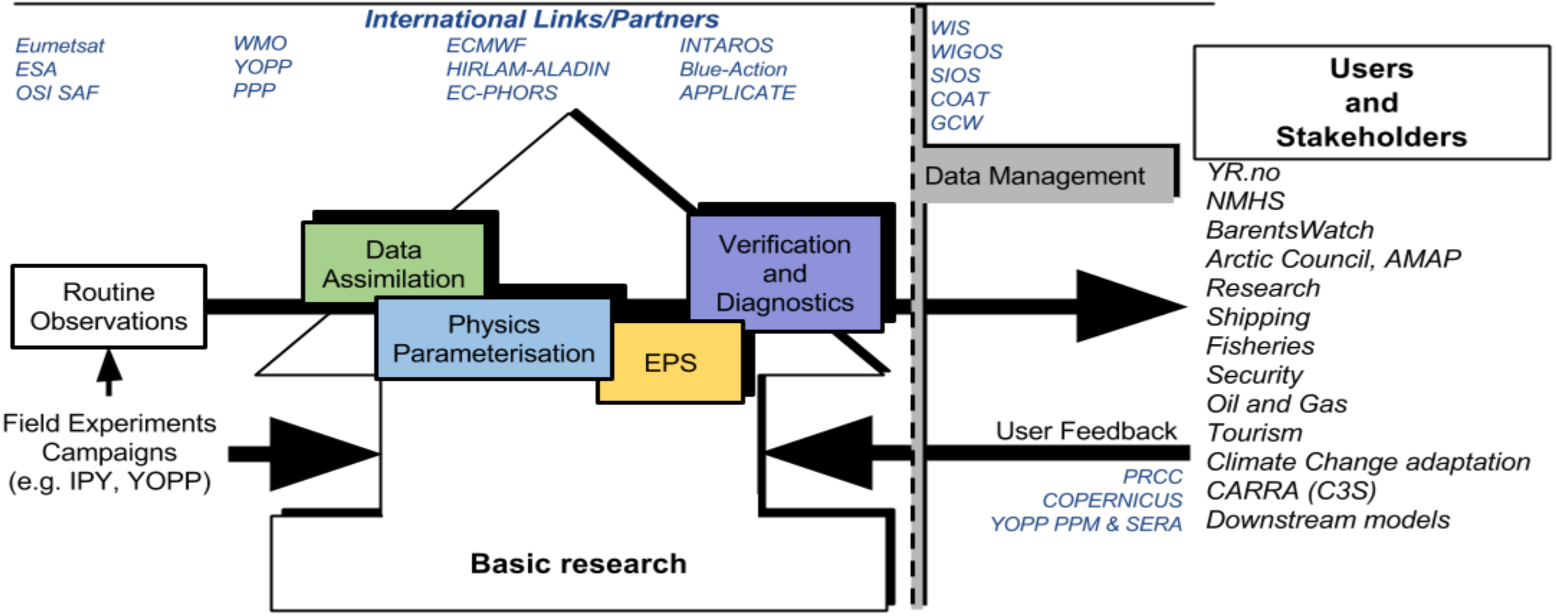
2. Improve use and assimilation of Arctic observations for NWP

3. Enhance and improve NWP model capabilities and diagnostics for high latitudes

4. Develop an Ensemble Prediction System optimized for Arctic conditions

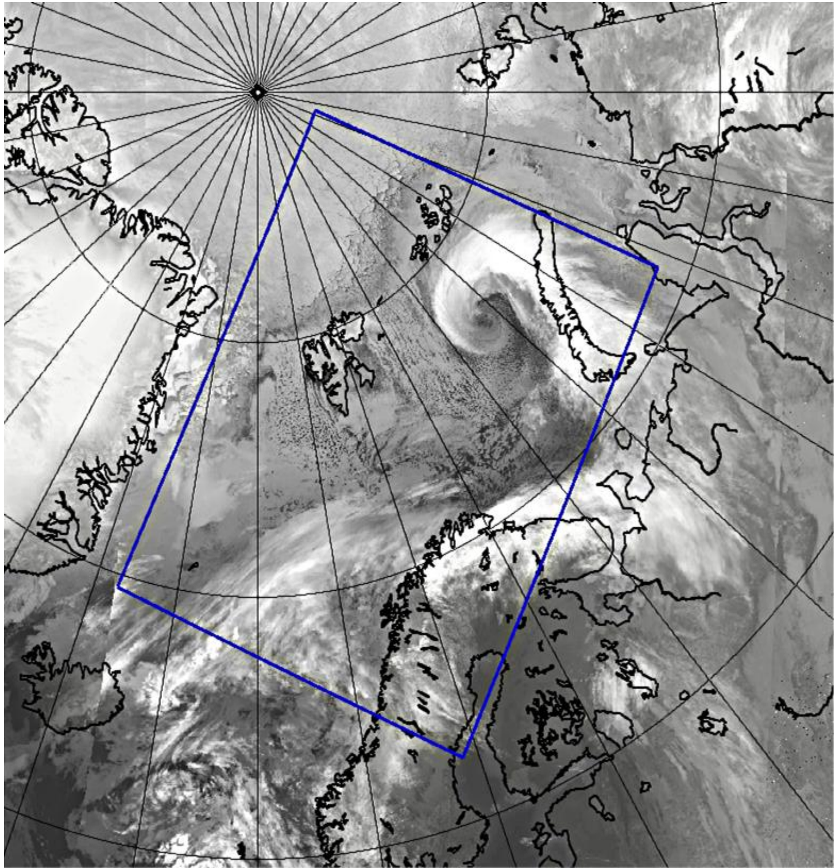


ALERTNESS NWP value chain



AROME Arctic

https://www.met.no/en/projects/The-weather-model-AROME-Arctic



Müller, M., Y. Batrak, J. Kristiansen, M.A. Køltzow, G. Noer, and A. Korosov (2017): Characteristics of a Convective-Scale Weather Forecasting System for the European Arctic. *Mon. Wea. Rev.*, **145**, 4771–4787, https://doi.org/10.1175/MWR-D-17-0194.1

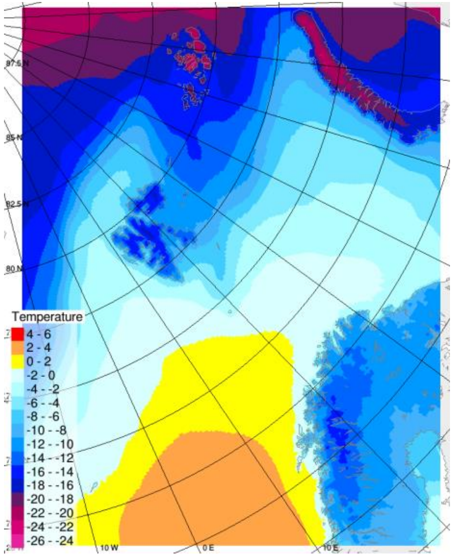
Batrak, Y., & Müller, M. (2018): Atmospheric response to kilometer-scale changes in sea ice concentration within the marginal ice zone. *Geophysical Research Letters*, 45, 6702–6709. https://doi.org/10.1029/2018GL078295

Batrak, Y., Kourzeneva, E., and Homleid, M. (2018): Implementation of a simple thermodynamic sea ice scheme, SICE version 1.0-38h1, within the ALADIN–HIRLAM numerical weather prediction system version 38h1, Geosci. Model Dev., 11, 3347-3368, https://doi.org/10.5194/gmd-11-3347-2018

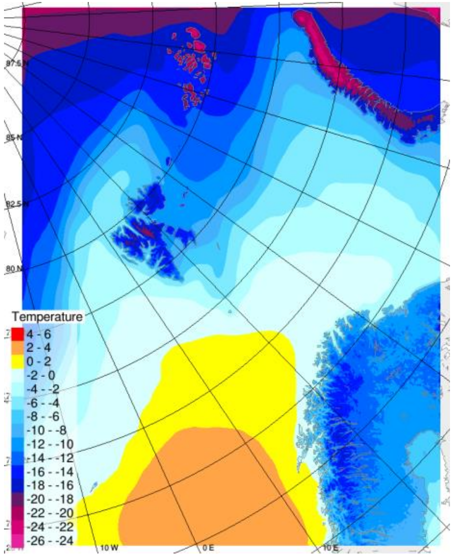
Alertness and APPLICATE

NWP model-intercomparison during YOPP SOPs

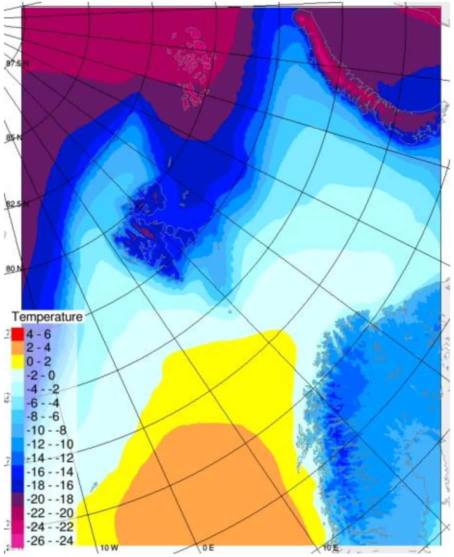
Mean SOP1 near-surface temperatures in short range forecasts



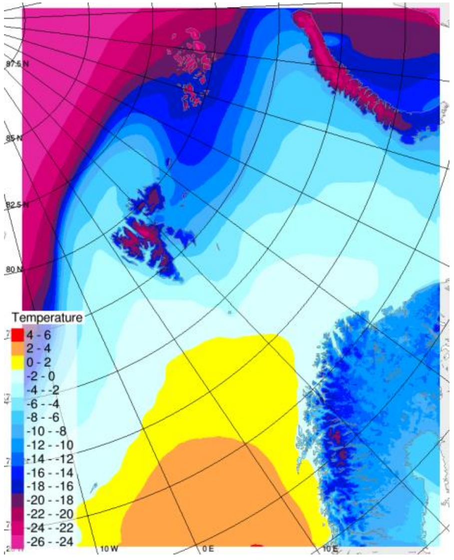
IFS HRES
(ECMWF)



AROME Arctic
(MET Norway)



CAPS
(ECCC)



MF AROME
(Meteo France)

Many similarities between “model climatologies” and forecast error characteristics, but they also have distinct regional differences in climatology and skill.

More tomorrow in Morten’s presentation: A NWP model inter-comparison of surface weather parameters during the Year of Polar Prediction Special Observing Period Northern Hemisphere

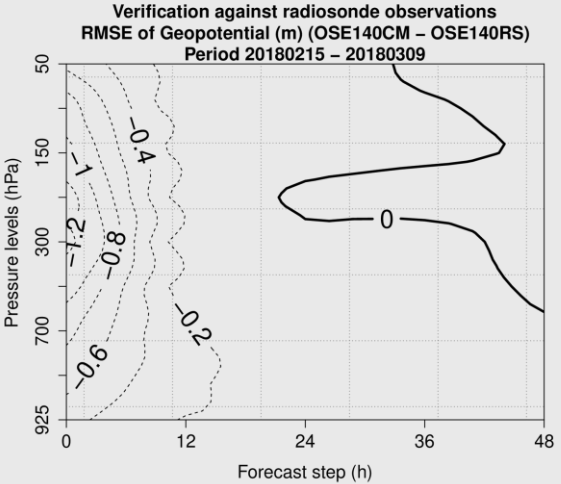
APPLICATE.eu
Advanced prediction in polar regions and beyond

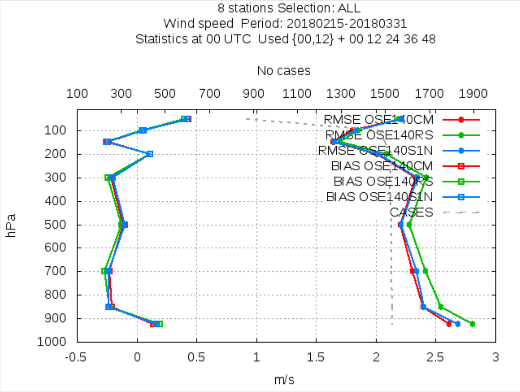
Alertness

OSE experiments in Alertness

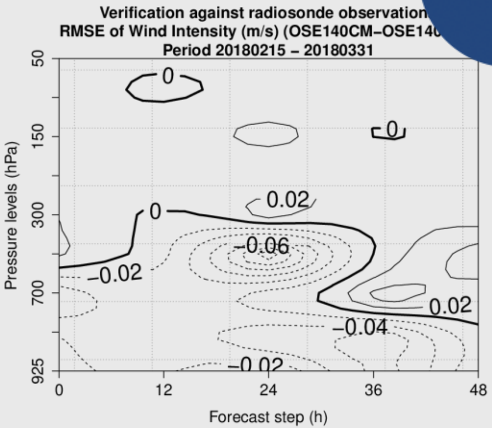
Red-control; blue-without SOP1, green- without all RS

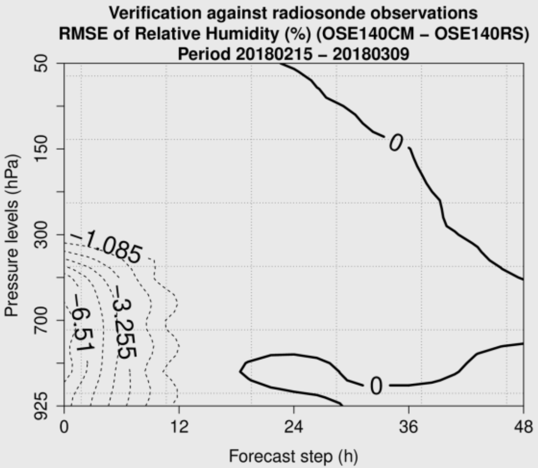
Without all RS

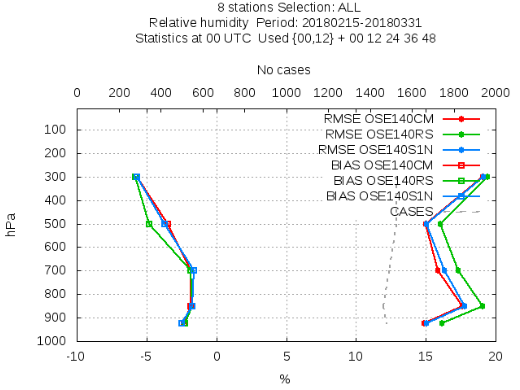


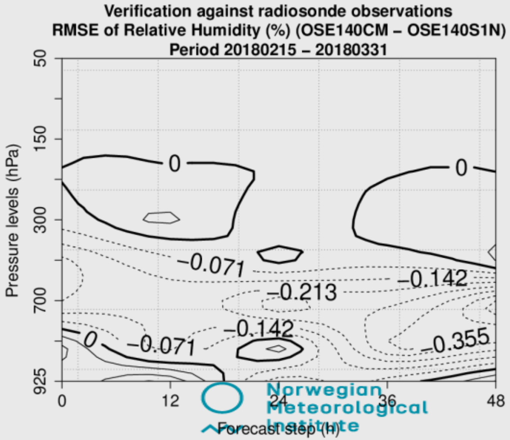


Without SOP1



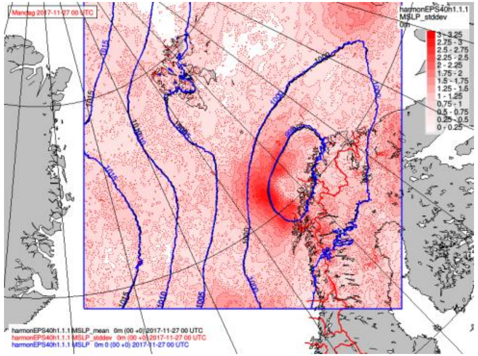




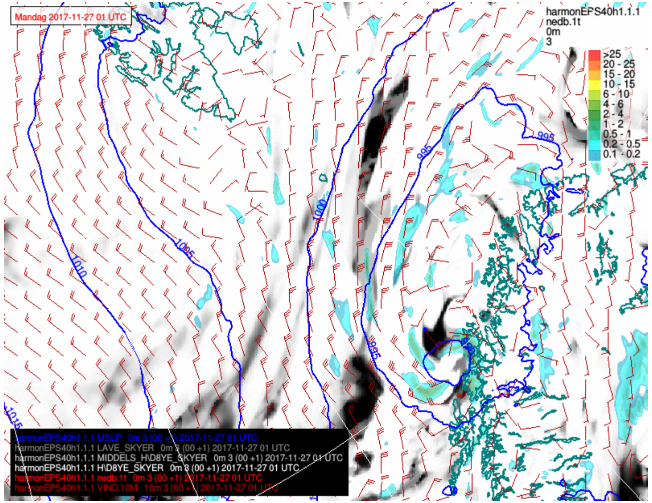


Norwegian Meteorological Institute

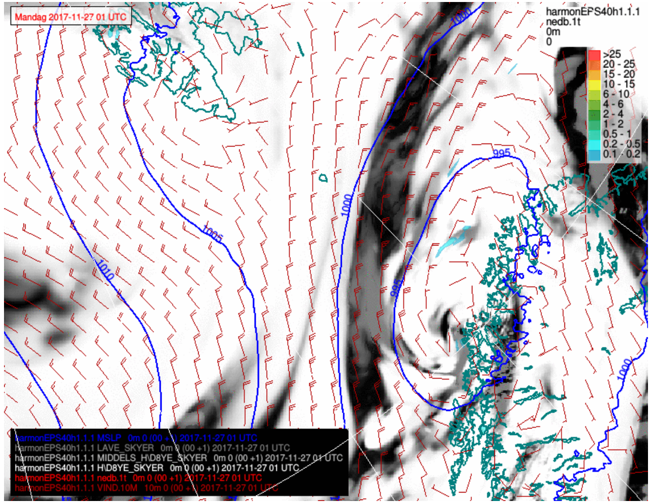
A future AROME Arctic EPS: Polar Low 2017-11-27



MSLP mean
& standard deviation



Control-member:
MSLP, cloud-cover, wind,
precipitation



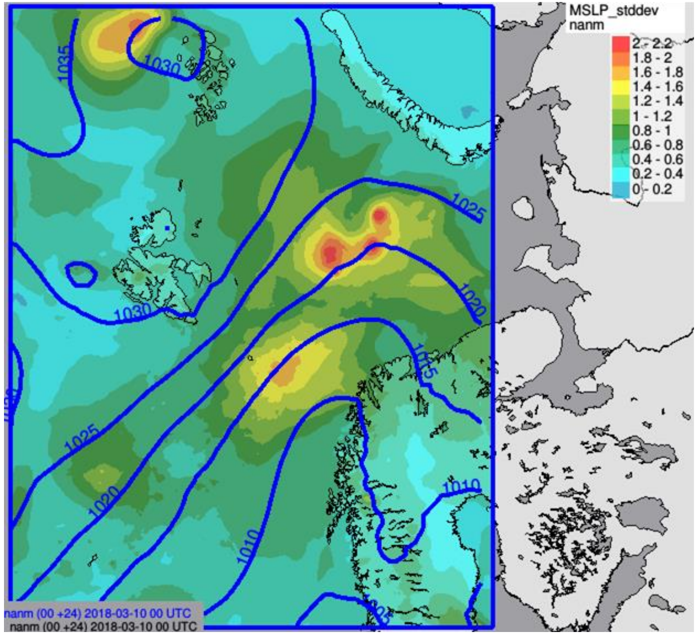
Perturbed-member:
MSLP, cloud-cover, wind,
precipitation

APPLICATE Task 5.3.4

Uncertainties in the sea ice and sea surface temperature boundary conditions for LAMs will be accounted for through a novel ensemble generation approach in a NWP framework using a high-resolution limited area model for an Arctic domain.

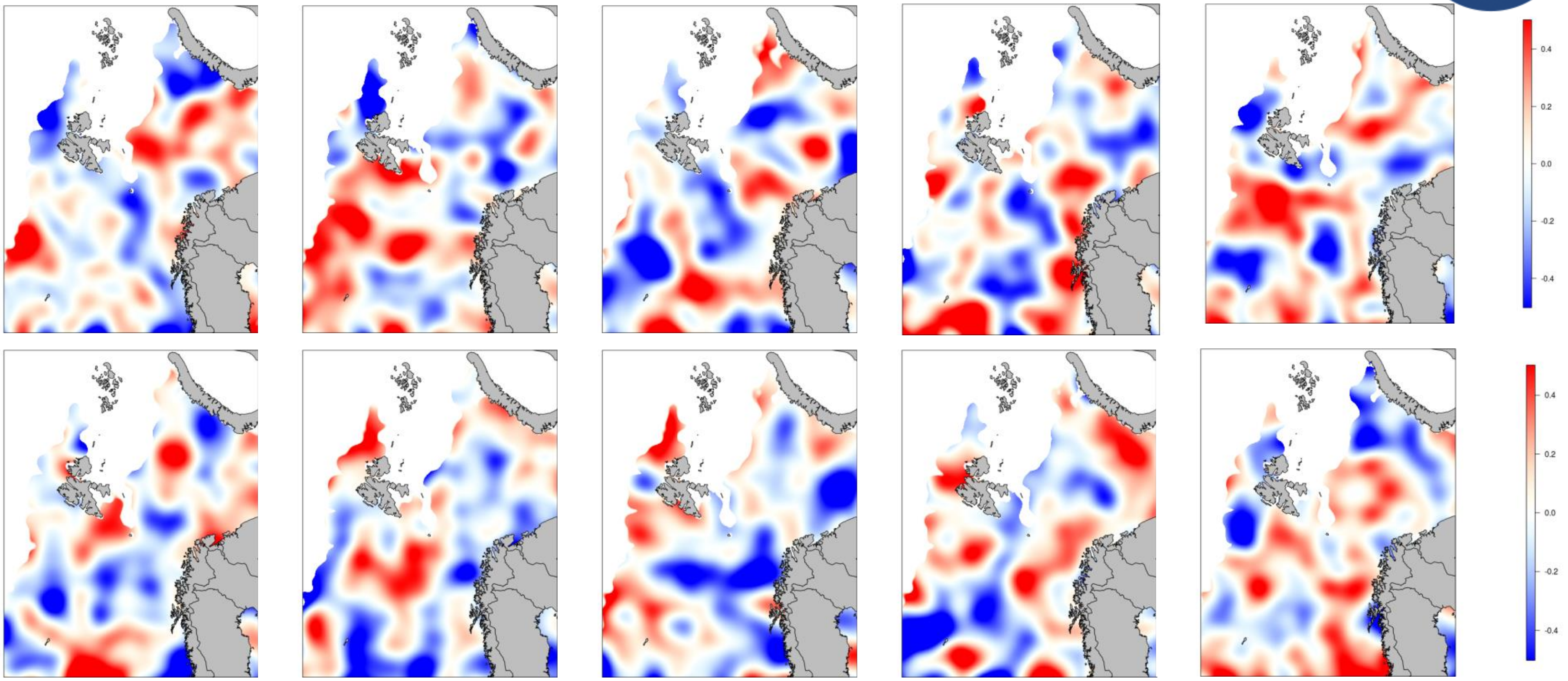
EPS runs for YOPP SOP1 period (08.03.2018 - 31.03.2018)

- Model: harmonEPS40h1.1.1 (“AROME Arctic EPS”)
- Domain: AROME Arctic
- Members: Control + 10 perturbed
- IC perturbations: PertAna / SLAF
- Boundary perturbations: SLAF
- Surface perturbations:
    - White noise spatially smoothed to a predefined correlation length scale.
    - Applied additively or multiplicatively.
    - Rescaling and clipping of perturbation fields.



Evaluation of effect of SST perturbations and the associated added value of EPS vs deterministic runs

SST perturbations for YOPP SOP1 runs



Towards an AROME Arctic EPS

In collaboration with APPLICATE (Task 5.3.4), assess the sensitivity to changes in sea ice and SST and develop novel methods to perturb these fields.

>> Alertness will build on the work done in APPLICATE by assessing the impact of targeting perturbations where the uncertainty is greatest.

>> Further, the combined effects of sea ice perturbations and SST perturbations will be investigated.

Thank you for your attention!

jornk@met.no #alertnessarctic alertness.no

OSE experiments in Alertness

In frame of the **APPLICATE** project ECMWF is running OSE experiments (cf. Heather's presentation) and sharing the results to be used as lateral boundary conditions (LBCs).

Two series of OSEs: with global and Arctic (lat >= 60) observations denial.

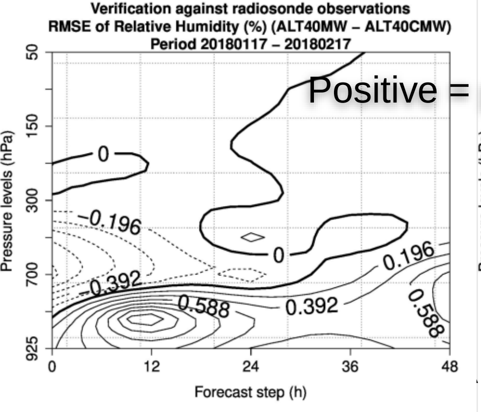
Scenarios: **(1)Control global LBC1** **(2)Denial global LBC2** **(3)Control LAM** **(4)Denial LAM**

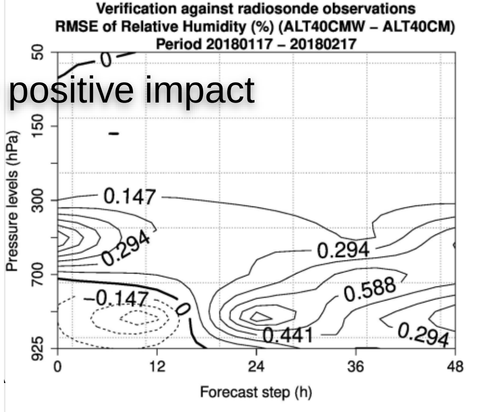
Case 1: LBC1 + (3) vs LBC1 + (4) => impact of obs in LAM
Case 2: LBC1 + (4) vs LBC2 + (4) => impact of obs through LBC in LAM
Case 3: **Global** vs **Arctic** denial => impact of non-Arctic observations in Arctic (LAM)NWP

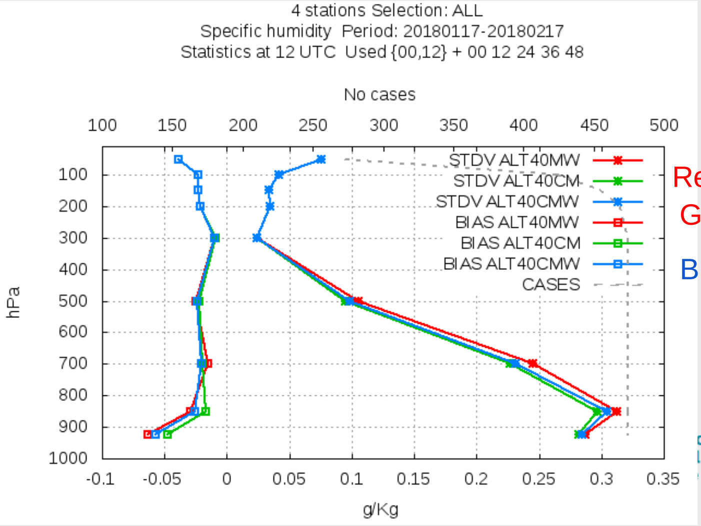
Case 2 (microwave)
Impact of obs through LBC

Case 1 (microwave)
Impact of obs in LAM

Positive = positive impact







Red- no microwave Global & Regional

Blue- no microwave Regional

Green- with microwave

Table 1: Time schedule for milestone activities. Deliverables: R-Report/peer-review publication; P-Prototype; D-Data	2018				2019				2020				2021			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
WP1: Develop and apply verification metrics and diagnostics for NWP in the Arctic																
Establish a reference database of well-observed high-impact weather events (T1.1)				D								D				
Develop metrics and diagnostics appropriate for the (maritime) Arctic (T1.2)							R									
Evaluate the model performance during high-impact weather events (T1.3)									R							
Analyse the forecast skill of existing and enhanced AROME Arctic (T1.4)																R
Participate in IGP flight campaign (T1.1 and T1.5)																
WP2: Improve the use of Arctic observations for accurate mesoscale forecasts																
Optimized assimilation of satellite observations (T2.1)								R								
Implement assimilation of satellite observations over sea ice (T2.2)											R					
Implement flow-dependent DA (T2.3)															P	
Change clear-sky to all-sky radiance assimilation (T2.4)															R	
OSEs to evaluate the benefit of enhancements to the Arctic observing network (T2.5)								R								
Benefits of a coupled ROMS-CICE-AROME Arctic configuration (T2.6)														R		
WP3: Enhance and improve NWP model capabilities and diagnostics for high latitudes																
Test a new approach to parameterise heat fluxes in stable boundary layers (T3.1)					P											
Identify how interaction between parameterisations causes error compensation (T3.2)			P													
Implement and test stochastic parameterisations of key processes (T3.3)										P						
Analyse the sensitivity of fog/icing weather forecasts to cloud microphysics (T3.4)																
Analyse the importance of key aspects for the future model development (T3.5)																R
WP4: Develop an Ensemble Prediction System optimized for Arctic conditions																
Run reference experiments and tune for the Arctic (T4.1)					D	R										
Develop methods for perturbing sea ice and sea surface temperature (T4.2)												R				
Implement and tune EDA in EPS (T4.3)																
Implement stochastic physics in EPS and tune spatial and temporal correlations (T4.4)															R	
Select optimum EPS setup for the Arctic (T4.5)																P
WP5: Improve polar prediction through the ALERTNESS value chain																
Project initiation (T5.1)	R															
Management and coordination (T5.2)								R								R
Communication and dissemination (T5.3)		R														
Connect weather information and sectoral interests (T5.4)												R				

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