The MetCoOp EPS

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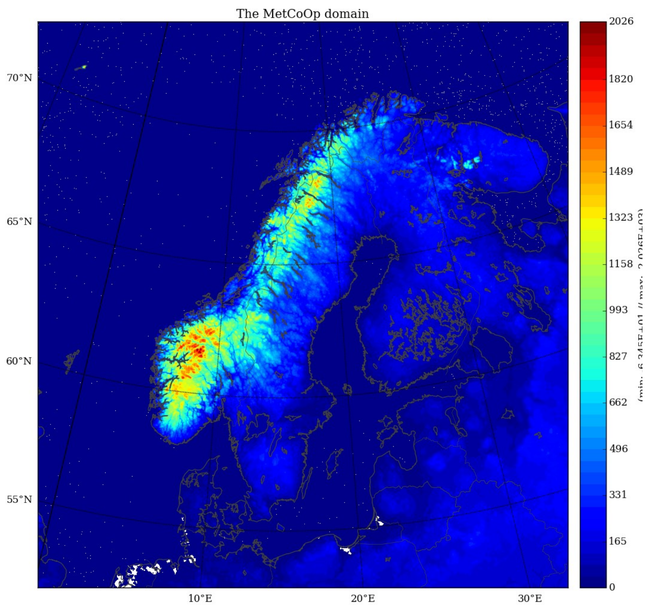
Current MEPS setup, operational since 21st of March 2018



Current MetCoOp domain
Operational since September 2017

Forecast model aspects

- Based on harmonie-40h1.1.1.rc1 using HARMONIE-AROME
- Domain is 900x960 points, 2.5km grid spacing, linear grid, 65 levels. 75s timestep.
- MetCoOp specific settings
  - Two patches for the nature tile ***(fig 1)***
  - FLAKE freshwater model
  - Ocean ice model SICE
  - Updated tree height and corresponding roughness formulation ***(fig 2)***
  - Increased roughness for heat and momentum over snow, XZ0SN=0.003, XZ0HSN=0.0003
  - Allow larger undersaturation in cloud formation, VSIGQSAT=0.03
  - Modified snow melting

Assimilation aspects

- Control member(s) run 3DVAR with large scale mixing every 3h.
- Observations used are: conventional observations, AMSU A/B, MHS, IASI, ASCAT, RADAR and GNSS
- EDA derived structure functions
- All members runs surface assimilation every 6h with using T2M, RH2M, SNOW, ECMWF+NEMO SST/ice
- MetCoOp specific settings
  - Using BATOR only for observation preprocessing ***(fig 3)***
  - Stronger response to T2M/RH2M increments on soil temperature and moisture.
  - Increased T2M tolerance, RCT2SY=10, to include more stations in very cold conditions.
  - Blacklisting of snow observations causing errors due to LSM inconsistencies between CANARI and SURFEX(SODA) ***(fig 4)***

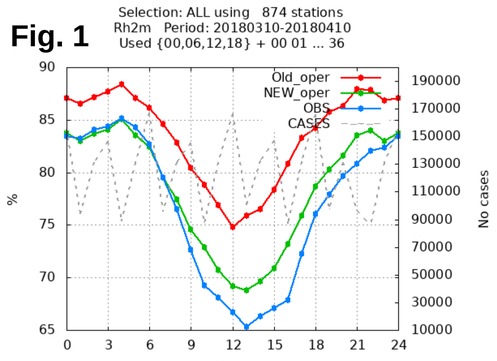
Ensemble system aspects

- MEPS currently consists of 1+9 members.
- The members are distributed over three HPCs where one member on each site servers as a (perturbed) backup for the control in case of failures.
- Control and perturbed members runs up to 66h and 54h respectively every 6h.
- SLAF is used to produce initial and boundary perturbations from ECMWF deterministic forecasts using a lagging technique.
- Random perturbations of surface variables is applied to all members.

MEPS member distribution over the MetCoOp HPC sites

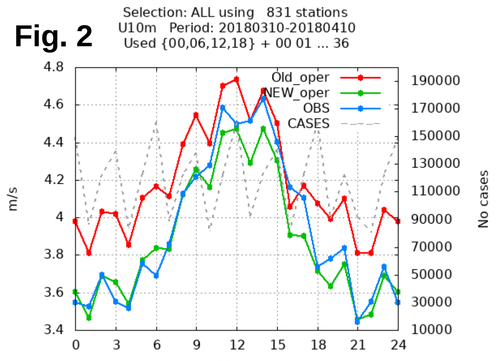
	Control mrb Runs to +66h	Q-control Runs to +66h	Perturbed mbrs Runs to +54h
Alvin (MET)	0		5,6,9
Frost (SMHI)		1	3,4,7,8
Teho (FMI)		2	

Fig. 1



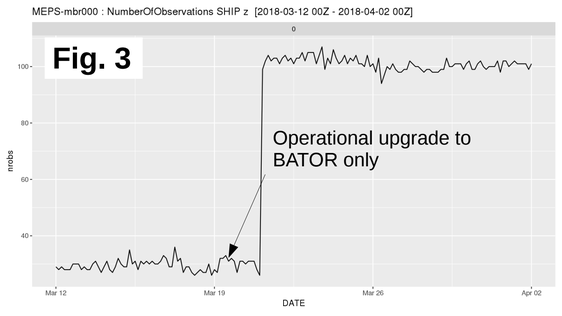
Introducing a separate tile for open land and forest has helped to reduce the wet bias in near surface relative humidity. As can be seen above the model is still a bit to moist during daytime. This causes problems in predicting risk of grass fire important at this time of the year.

Fig. 2



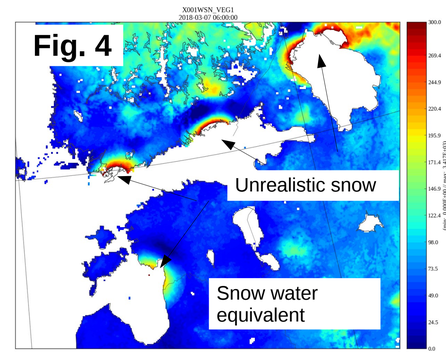
Response in wind speed to an updated tree height. The overall bias is reduced over the MetCoOp domain. The downside is a somewhat larger underestimation of the highest wind speeds (not shown)

Fig. 3



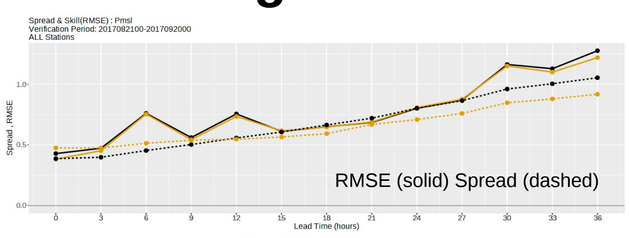
Excluding Oulan from the observation preprocessing chain allows us to assimilate more ship obserations due to previous problems in station identification. It also makes the system more well prepared for high resolution TEMP data.

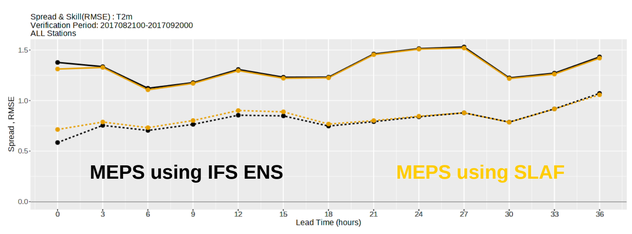
Fig. 4



Assimilation of snow observations in points where we have no nature tile has given repeated increments causing unrealistic snow cover. Example from the Finnish bay shows above 1.5m of snow in some spots. As a short term solution a number of coastal stations has been blacklisted.

Extending the number of members in MEPS





In October 2018 MetCoOp will install nearly double the HPC capacity at the National super computer centre in Linköping, hosting the MET and SMHI resources. One way to utilize this increase is to enlarge the ensemble size.

From the very start MetCoOp has used SLAF generated from IFS HRES to produce intial and boundary perturbations. This has been an efficient way to get started and has produced good scores. The SLAF method however has a limitation in number of members that prevents us from going beyond ten members.

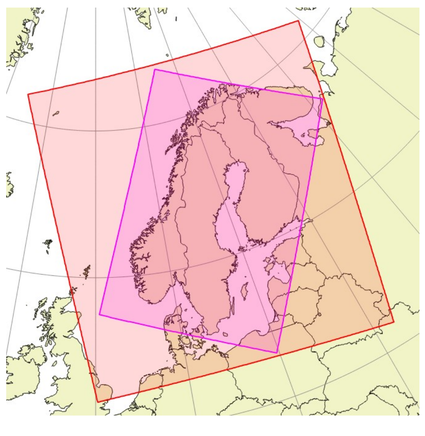
Recent experiments shows that we can reproduce the performance of SLAF with IFS ENS data. Earlier problems with increased T2M bias has been identified as originating from SST interpolation problems and solved by using SST from the HRES analysis.

Using IFS ENS better preserves the spread/skill ratio throughout the forecast but gives somewhat smaller initial perturbations. The latter has to be addressed by other means.

Nowcasting in MetCoOp

We have recently started real time 9h forecasts with a 15 minute cutoff hourly assimilation suite using a rapid refresh approach with first guess from the MEPS control member. Starting with same domain and resolution as MEPS this serves as a baseline for further investigations. Continued work includes:

- Ingest of MSG-NWCSAF information for cloud initialisation
- Evaluation of a 1.5-2km resolution domain
- Replace CANARI by gridpp (MET post processor) and include public Netatmo observations in the surface assimilation
- Assimilation of MODE-S data and radar winds



Potential 2km nowcasting domain inside the operational MetCoOp domain

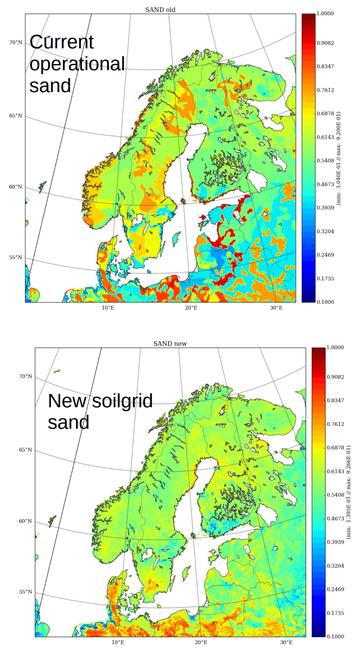
Updated SAND/CLAY information

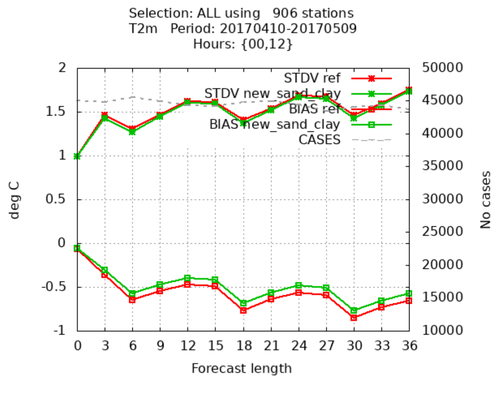
Within the context of the NORDNWP project the availability of high resolution physiography data has been investigated. The aim is to find national data and similar that could be made available for ECOCLIMAP 2nd generation.

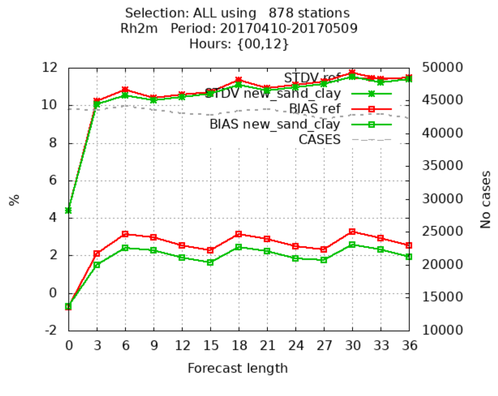
One more short term activity has been to update the sand and clay data available for the MetCoOp domain. The data is based on data from http://soilgrid.org available on 250 meters resolution.

The resulting sand distribution is exemplified in the figure to the right. The updated sand has a much more realistic spatial distribution.

The new database has been tested over the MetCoOp domain with the current operational system for April-May 2017. We see a small but significant improvement in scores for both near surface temperature and humidity.







The results shows the importance of a correct description of the underlying physiographic information. The tests will continue further into the summer period and will be accompanied by case studies on convective events where surface fluxes are assumed to play an important role for the initiation of convection.