

MetCoOp status and plans

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Current MEPS setup, operational since 10th of December 2018

Forecast model aspects

- Based on harmonie-40h1.1.1 using HARMONIE-AROME
- Domain is 900x960 points, 2.5km grid spacing, linear grid, 65 levels. 75s timestep.
- Explicit treatment of open land and forest
- FLAKE freshwater model
- Ocean ice model SICE

Assimilation aspects

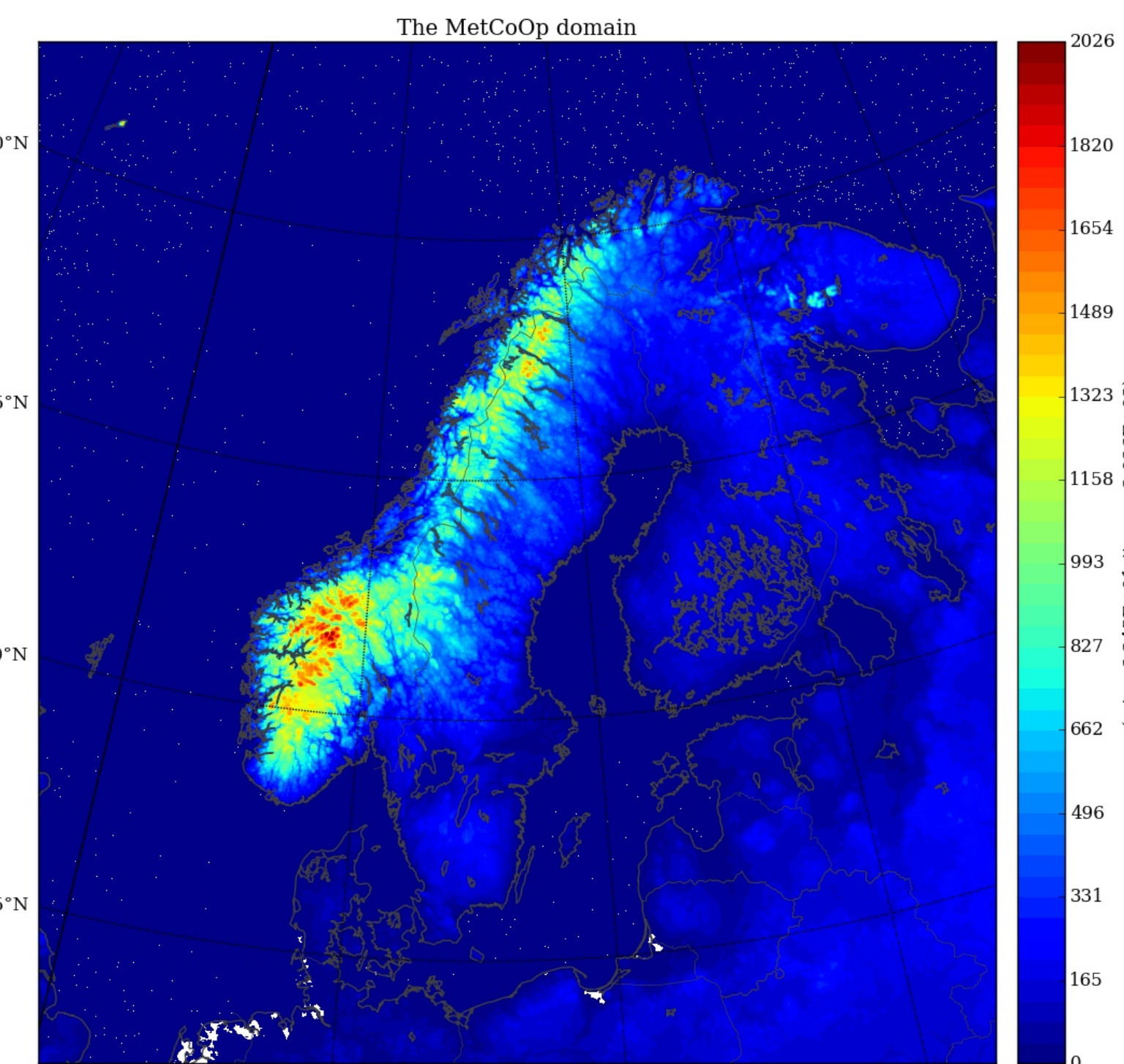
- Control member(s) run 3DVAR with large scale mixing every 3h.
- Observations used are: conventional observations, AMSU A/B, MHS, IASI, ASCAT, RADAR and GNSS
- EDA derived structure functions
- All members runs surface assimilation every 6h with using T2M, RH2M, SNOW, ECMWF+NEMO SST/ice

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 the 9 members.

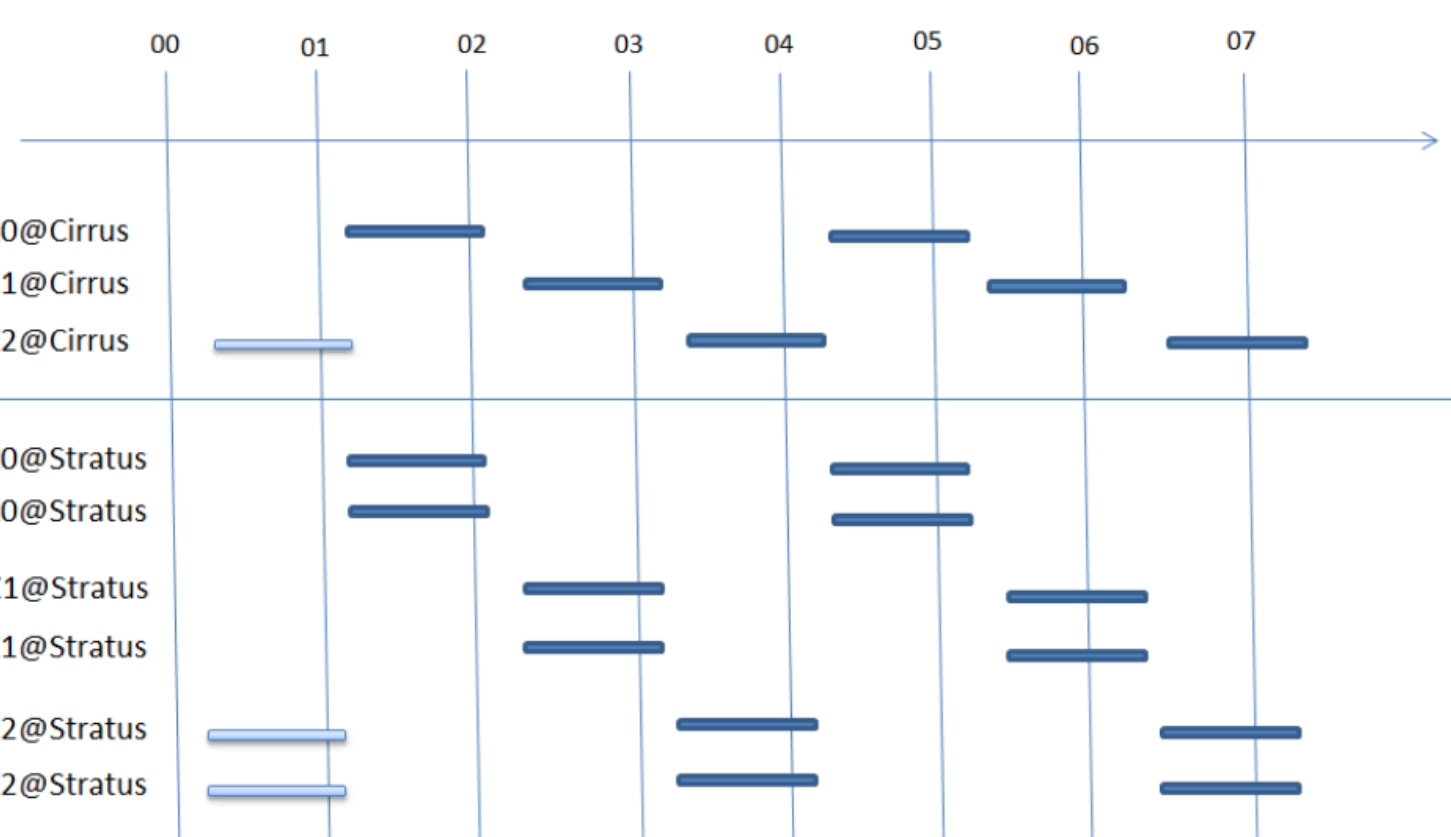
	Control mbr Runs to +66h	Q-control Runs to +66h	Perturbed mbrs Runs to +54h
Cirrus (SMHI*)	0		3,4
Stratus (MET*)		1	5,6,7,8,9
Teho (FMI)		2	

MEPS member distribution over the MetCoOp HPC sites
* Cirrus and Stratus are joint SMHI/MET computers



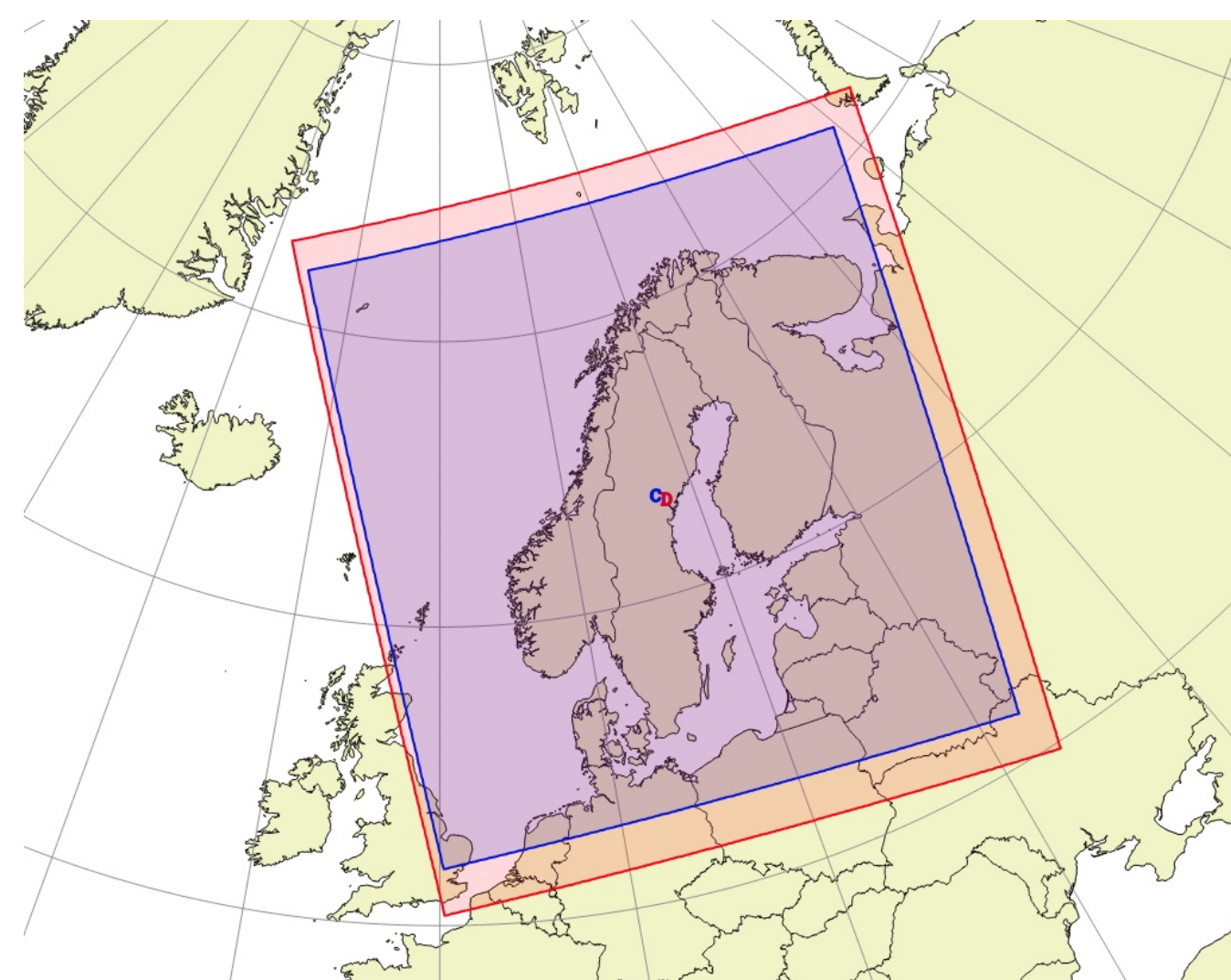
Current MetCoOp domain
Operational since September 2017

Pre-operational and planned updates



Continuous production of ensemble members

With the joint acquisition of new HPC between SMHI and MET Norway, more computing power enabled us to test a more continuous (hourly) production of ensemble members in a pre-operational suite (codename C-MEPS, see also separate presentation by Ulf Andrae). In this setup SLAF boundaries have been replaced by boundaries from IFS ENS. Also, each member is doing its own 3D-Var (as well as surface) assimilation (using EDA, with perturbation of observations). In addition, random perturbations are applied to surface variables just like in MEPS. This setup, which produces 18 members every 6 hours, has run regularly since February 11, 2019.



New enlarged domain

Feedback from forecasters and the future inclusion of the Baltic states has lead us to plan for a 20% domain increase, from domain "C" to domain "D". This will be put first into one of the pre-operational suites, running some configuration of cycle 43. Because of the extra cost it might also be introduced together with single precision reals when this is considered ready. Increased resolution in the vertical is also under consideration, but will first be evaluated in the nowcasting suite.



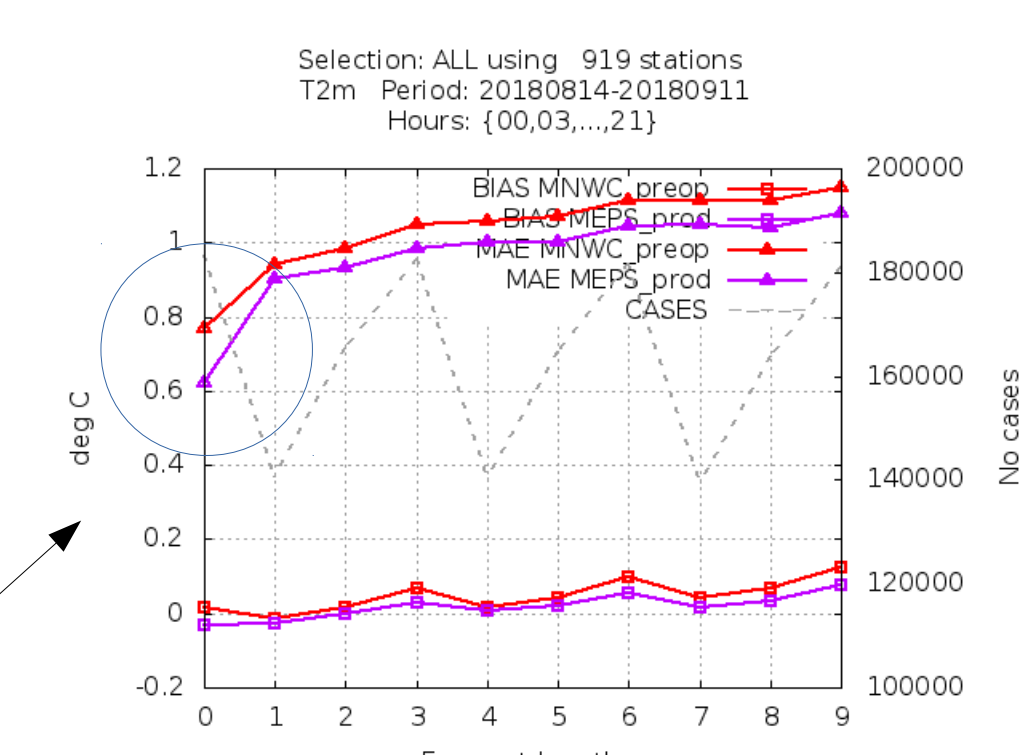
Moving to GRIB2 and different packing

The increasing amount of data created not only by the ensemble but also by sub hourly output creates higher demand for e.g. efficient packing. A large part of the output from MEPS is now encoded in GRIB2, where ccstds packing is used and seems to provide the best balance between file size and encoding/decoding cost without changing the results. Validation of the effect on downstream applications is currently ongoing.

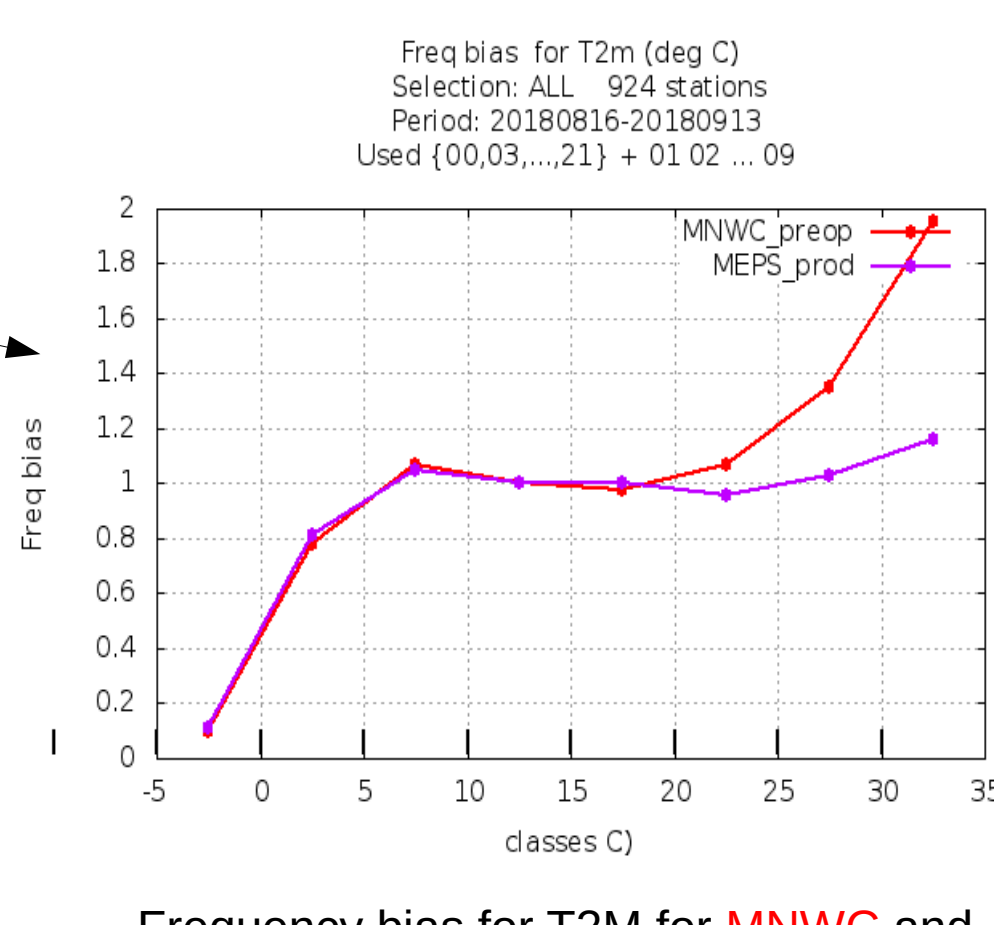
Nowcasting in MetCoOp

Since April 2018 we have been running real time 9h forecasts with a 15 minute cutoff hourly assimilation suite using a rapid refresh approach with the upper air first guess from the MEPS control member. Forecasts are available ~20 minutes after cutoff. Starting with same domain and resolution as MEPS this serves as a baseline for further development of HARMONIE as a nowcasting tool.

- The short cutoff penalizes conventional observations but the frequent analysis gives more satellite data. Short cutoff GNSS is currently being introduced. Assimilation of AMV, MODE-S data and radar winds is in the plan.
- We saw a over-prediction of the high temperatures, see right, which was related to the shorter assimilation frequency. This was circumvented by taking the first guess from MEPS instead of the nowcasting itself.
- The forecasts lacked an improvement of convection initialisation compared to MEPS. Ingest of MSG-NWCSAF cloud information at the start of the forecast improved the convection initialization. This has recently been introduced in the real-time runs.

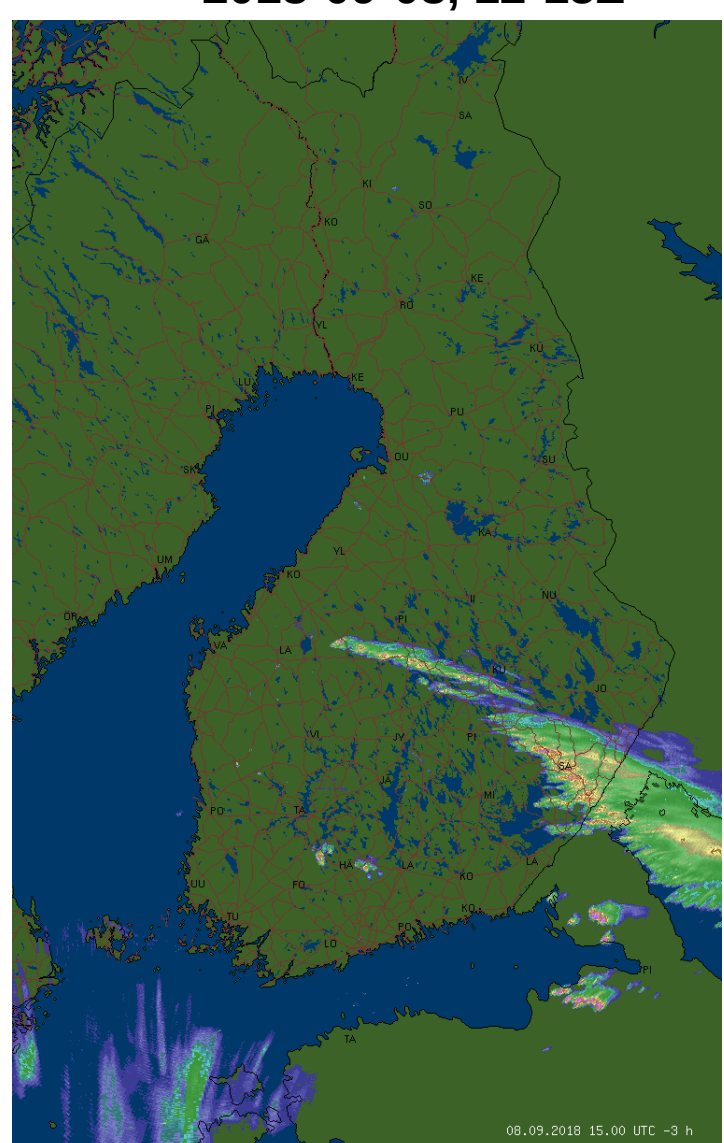


MNWC has a worse fit than MEPS in the surface analysis

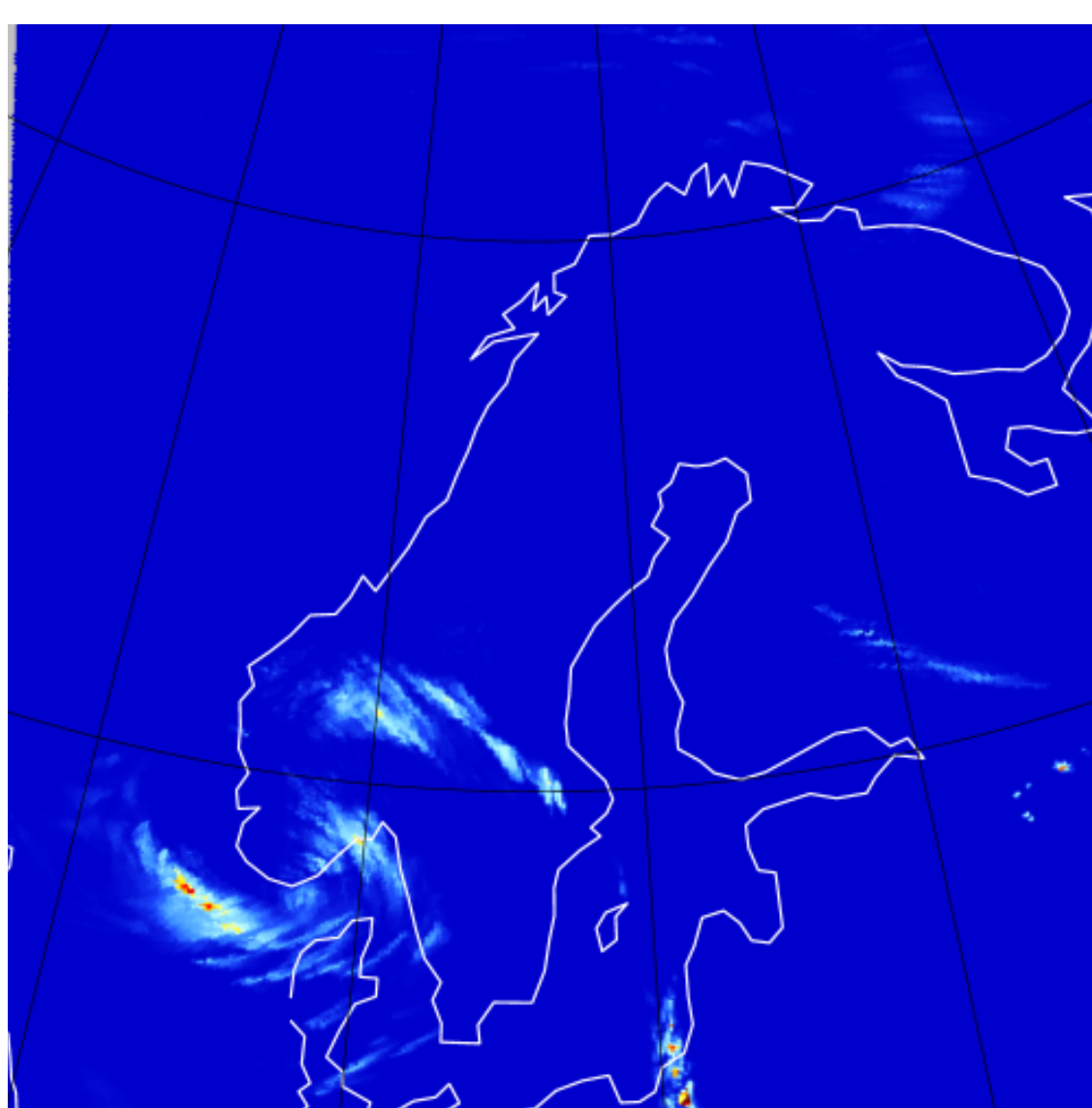


Frequency bias for T2M for MNWC and MEPS

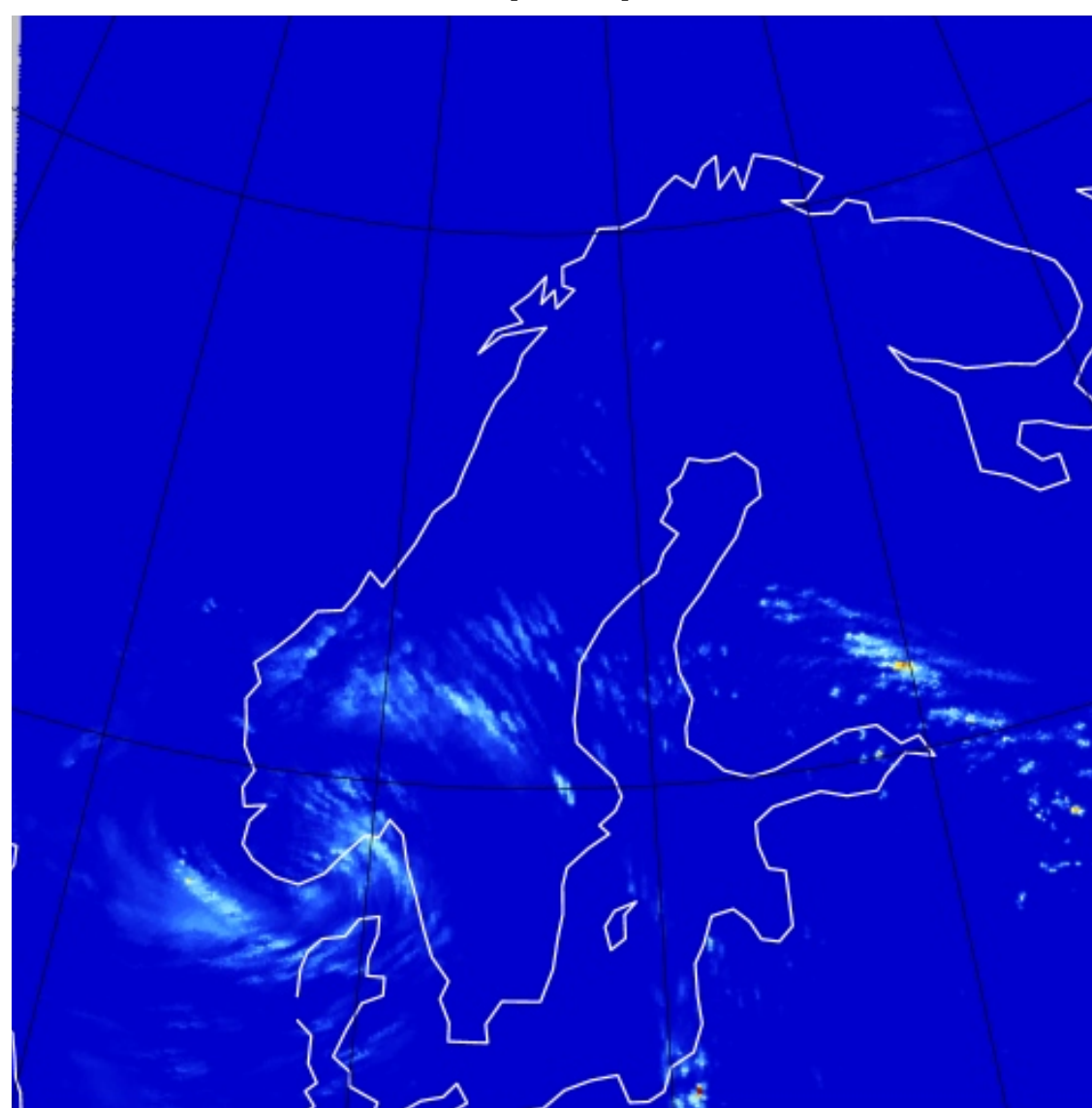
Radar precipitation
2018-09-08, 12-15Z



MNWC fc012+03h
Total precipitation



MNWC with MSG fc012+03h
Total precipitation



Moving to harmonie-cy43h2

The next version of HARMONIE is currently under construction and will be based on CY43T2 of the IFS-ARPEGE code where SURFEX V8.0 has been replaced with V8.1. This new version brings several new developments that will be tested during this year:

- Ability to run forecast and assimilation in single precision mode with a cost reduction of about 40% (see also presentation by Ole Vignes).
- Multi Energy Balance surface scheme. Multi layer snow and soil schemes
- ECOCLIMAP 2nd generation land use database
- An updated version of HARATU, the turbulence scheme in HARMONIE, with enhanced mixing dealing with fog and cloud problems.
- Incremental analysis update for better initialization
- Replace CANARI by gridpp in the nowcasting setup and include public Netatmo observations in the surface assimilation
- Further tests with higher resolution, 1-2km, in the nowcasting suite
- Assimilation of AMV, MODE-S data and radar winds both for nowcasting and the ensemble
- Explore the performance of 4DVAR with respect to the current 3DVAR scheme and it's operational feasibility

MetCoOp introduced a baseline cy43 running as an E-suite in the beginning of March 2019

Extension of MetCoOp

An MoU has been signed aiming at including Estonia, Latvia and Lithuania in the cooperation by 2022. Estonia has already entered as observers in the weekly video meetings, and will also host the next working meeting in Tallinn, May 27-29.