MetCoOp

One year with operational experiences

Morten Køltzow

With colleagues from SMHI & MET-Norway

Norwegian Meteorological Institute

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Outline

- What is MetCoOp?
- AROME-MetCoOp Configuration
- Examples of added value compared to ECMWF
- Examples of model deficiencies & ongoing development
- 2015/2016 -plans

What is MetCoOp?

- SMHI and MET-Norway
- Joint NWP production
- ***AROME-MetCoOp*** & C11
- Operational since March 2014
- RCR (Cycle38)

Organization

- Operations
  - 1.line, 2.line & 3.line
- Development
- Frequent meetings (rotate on leaders)

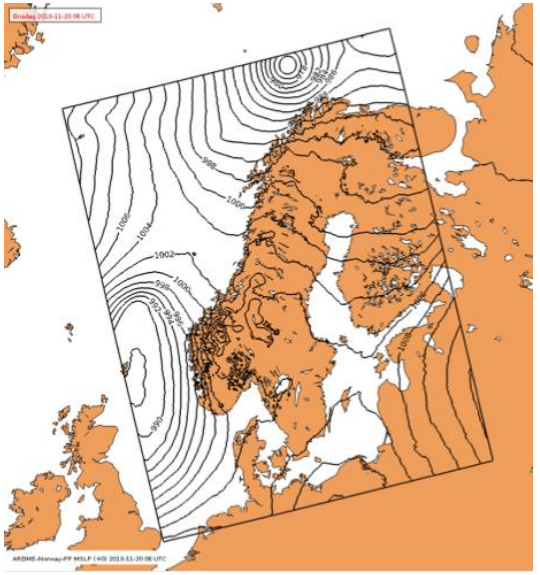
Use at MET-Norway

- AROME-MetCoOp basis for official forecasts
- Post-processing of T2m, precipitation, wind, clouds, lightning

Use at SMHI

- AROME-MetCoOp part of forecast database and frequently used as «model of the day» by duty-forecasters
- Post-processing of T2m, clouds and precipitation

AROME-MetCoOp Configuration



- ✓ ***Cycle 38h1.2*** (8.December 2014)
- ✓ ***3D-Var + surface analysis***
- ✓ ***2.5 km hor. res. / 65 vertical layers***
- ✓ ***Cycles, lead times and cut-off***
  - ✓ +66 hours at 00,06,12,18 UTC, cut-off 1hr 15min, delivery ~2hr
  - ✓ +3 hours at 03, 09, 15 and 21UTC (cut off ~3hr 40min)
- ✓ ***Pre-operational AROME-MetCoOp suite***
  - ✓ +48hr at 00 & 12UTC
  - ✓ +3hr at 03, 06, 09, 15, 18 and 21UTC

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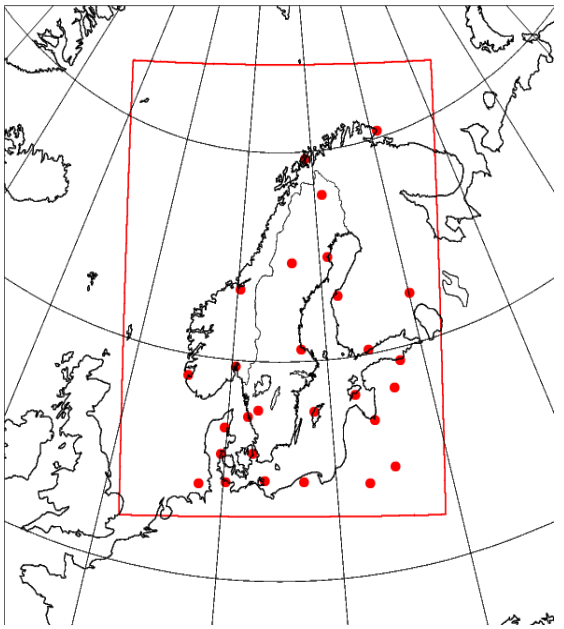
Data assimilation and observation usage in MetCoOP

Upper-Air 3D-Var DA
(LSM of ECMWF at large scales)

- Conventional types of observations
- Satellite radiances from AMSU-A, AMSU-B/MHS (VarBC)
- GNSS ZTD from METO and ROBH processing sites (VarBC)

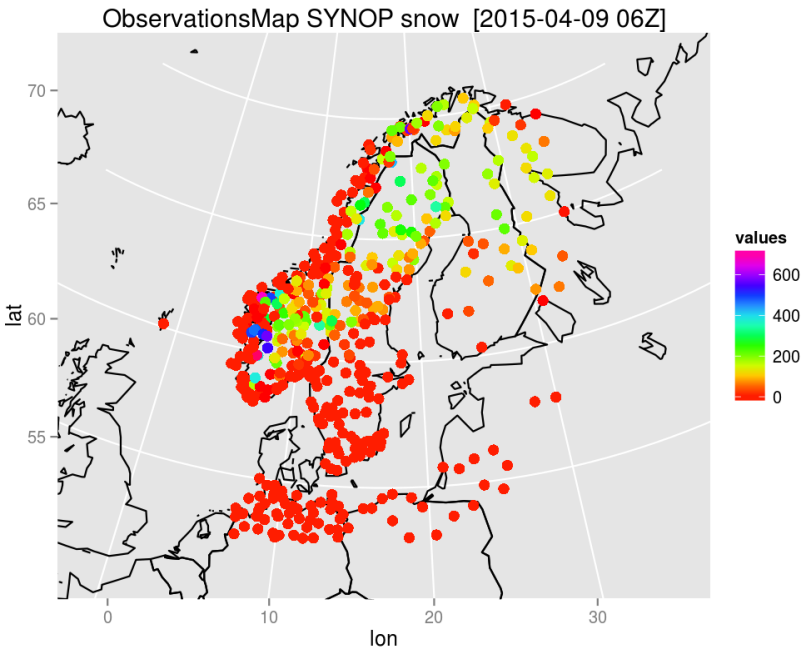
- *Pre-operational run*
  - Satellite radiances from IASI (passive)
  - Radar reflectivity soon to be included



GNSS ZTD observations used

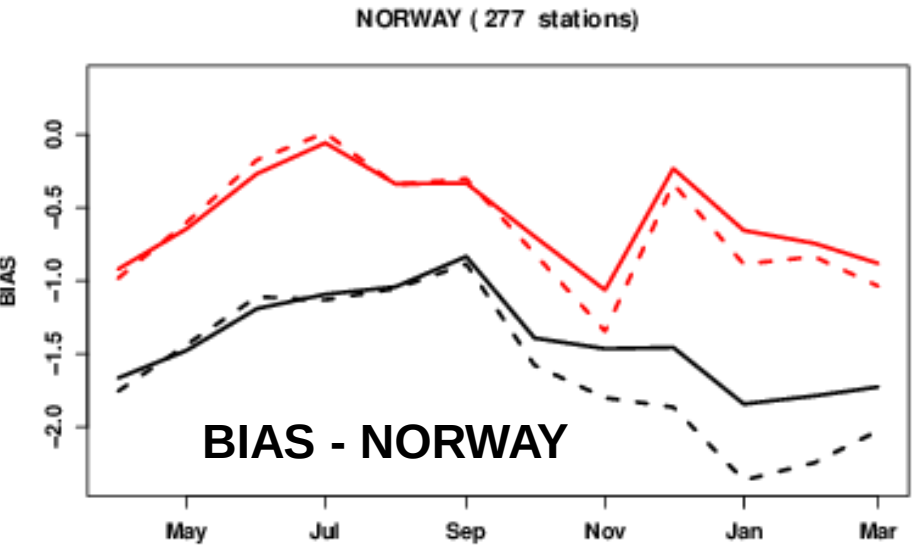
Surface DA based on CANARI

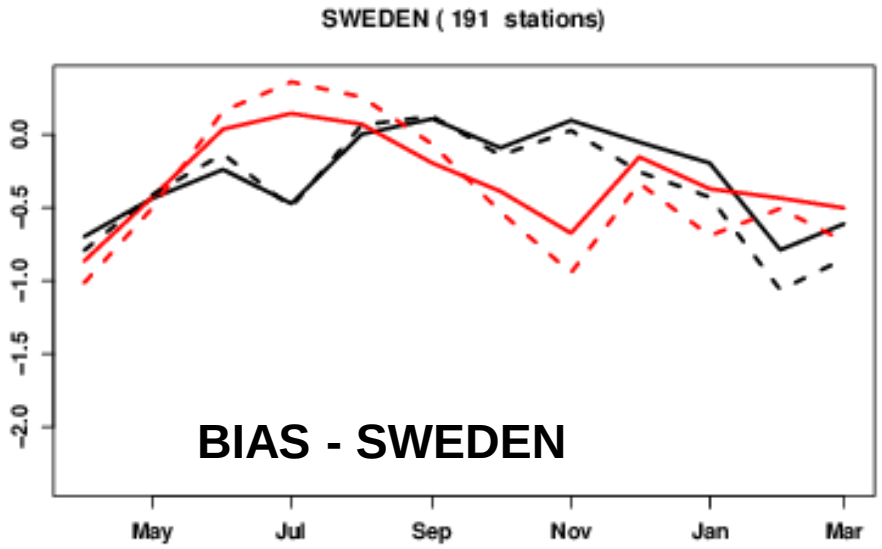
- RH2m and T2m from SYNOP stations
- Snow depth from SYNOP and climate stations
- SST and SIT from ECMWF

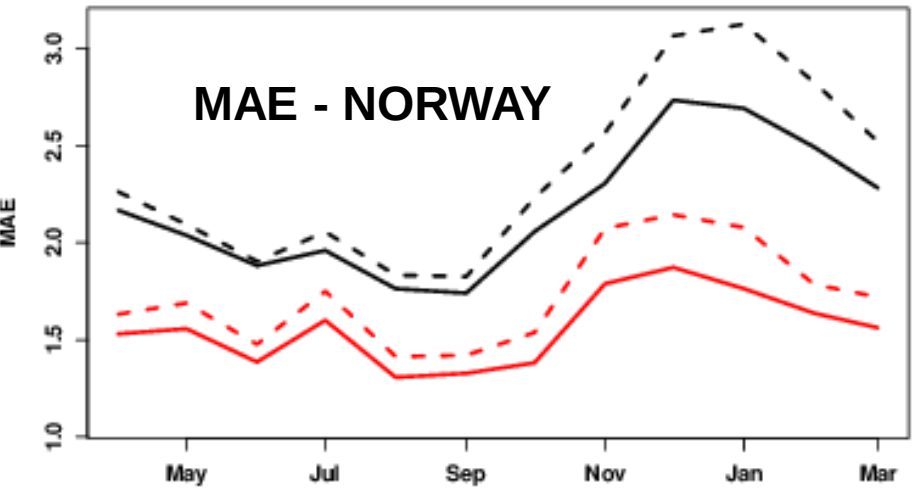


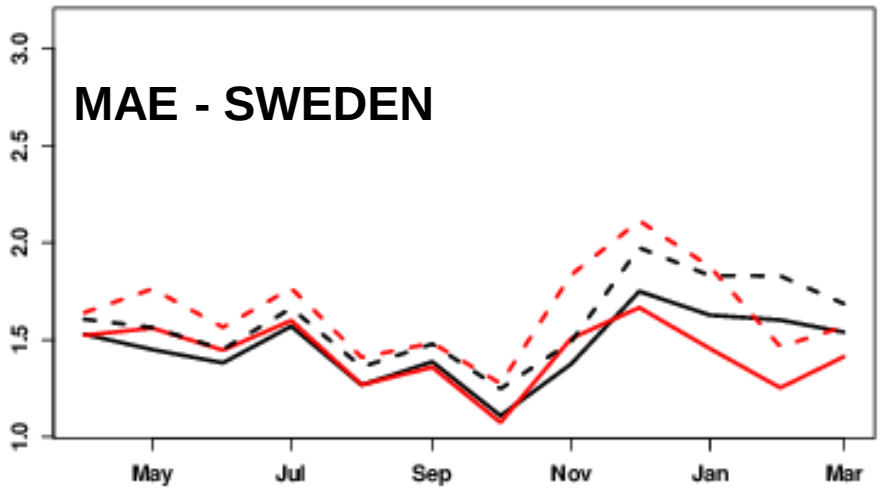
Some examples of added value compared to ECMWF

2m air temperature





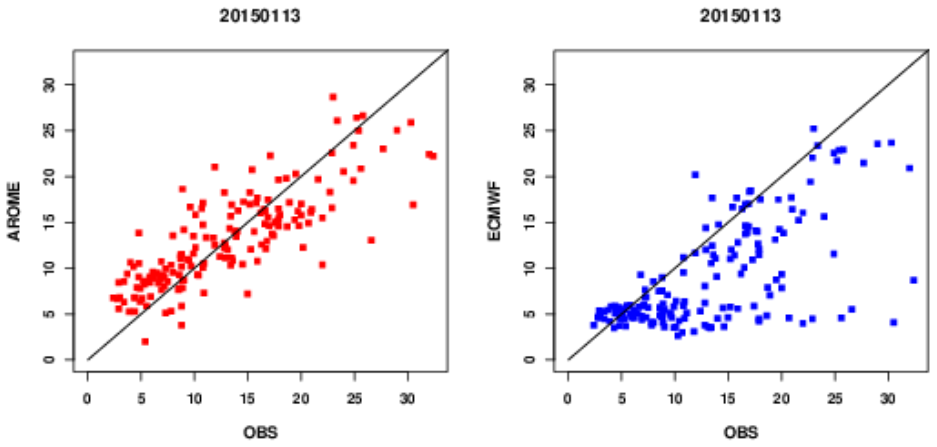


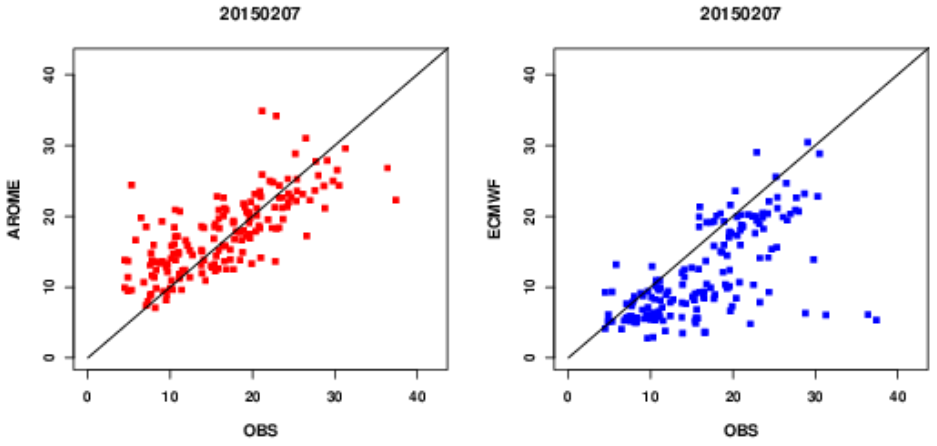


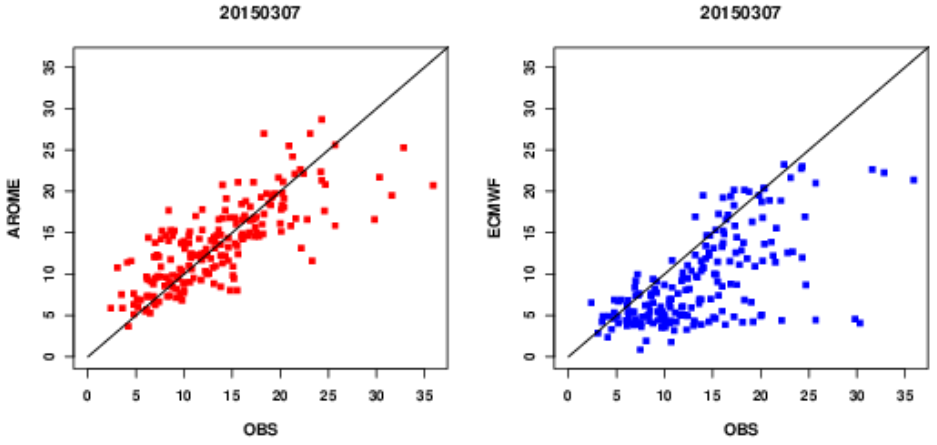
AROME (red), ECMWF (black), Day1 (solid), Day2 (dashed)

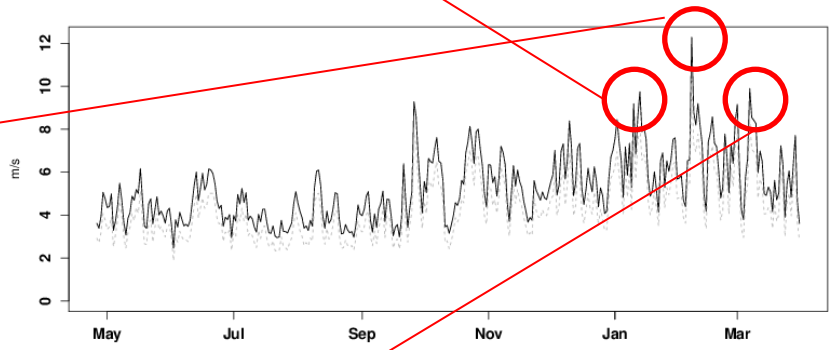
Severe wind

3 most windy days in Norway
April 2014 – March 2015
"max wind per station"

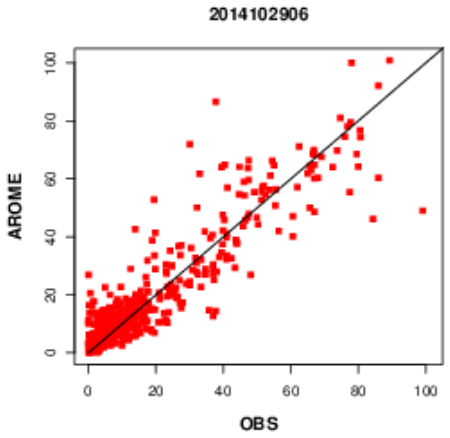


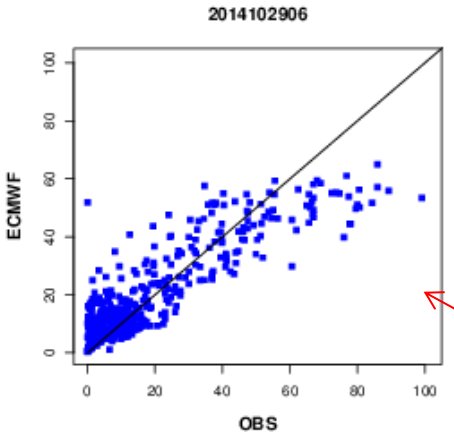


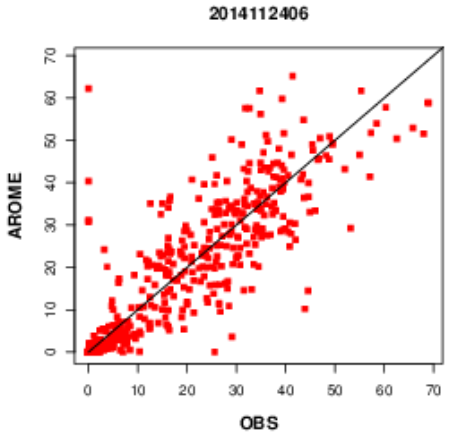


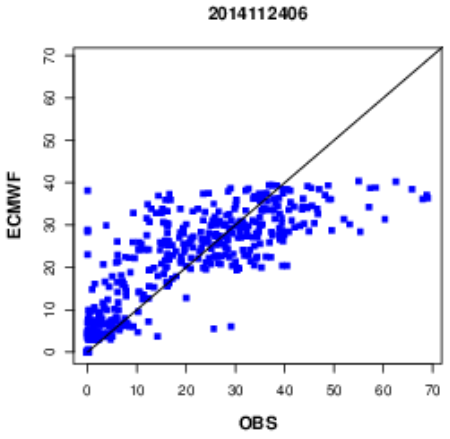


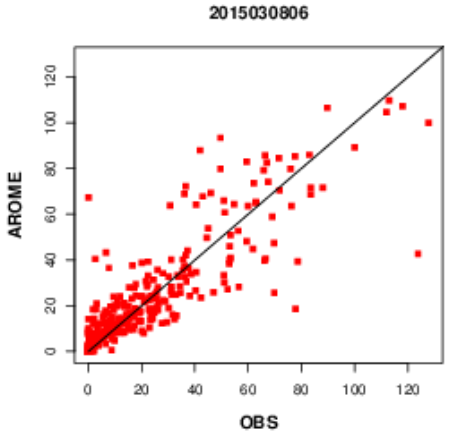
Severe precipitation

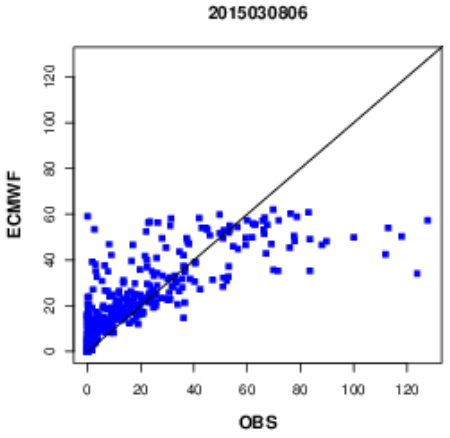




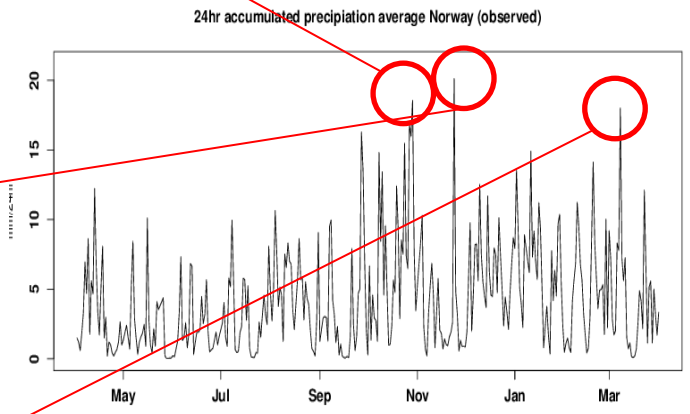








3 wettest days in Norway
April 2014 – March 2015
"24hr acc precipitation"

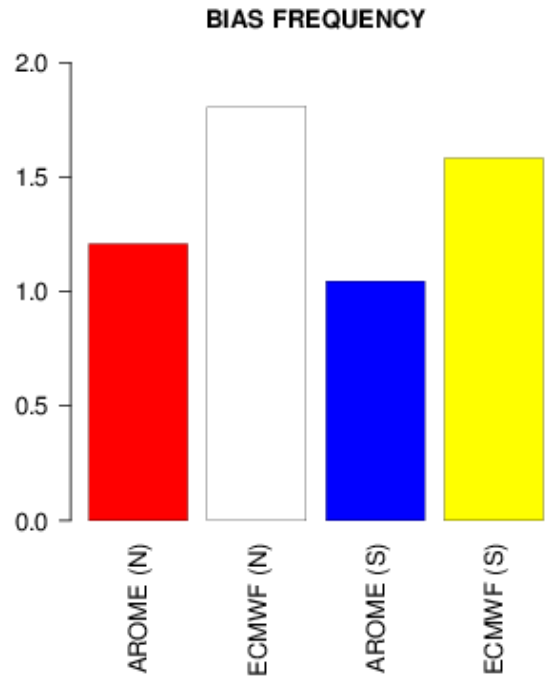


Some examples of model deficiencies & ongoing development

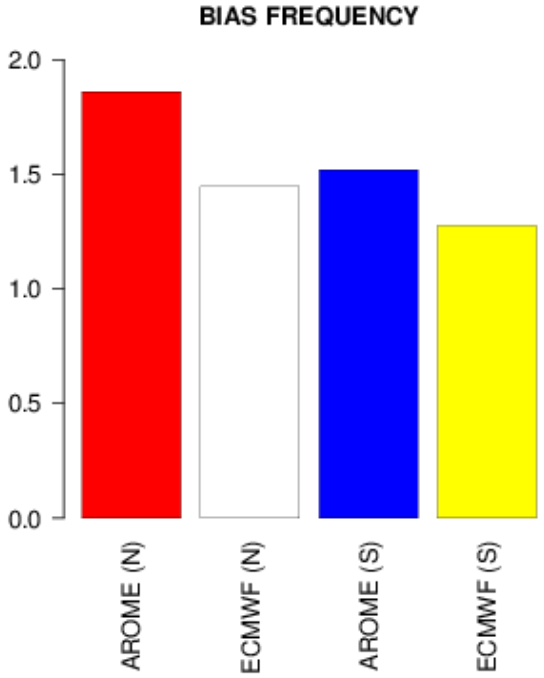
Intense summer convection

12hr acc precipitation – daytime summer

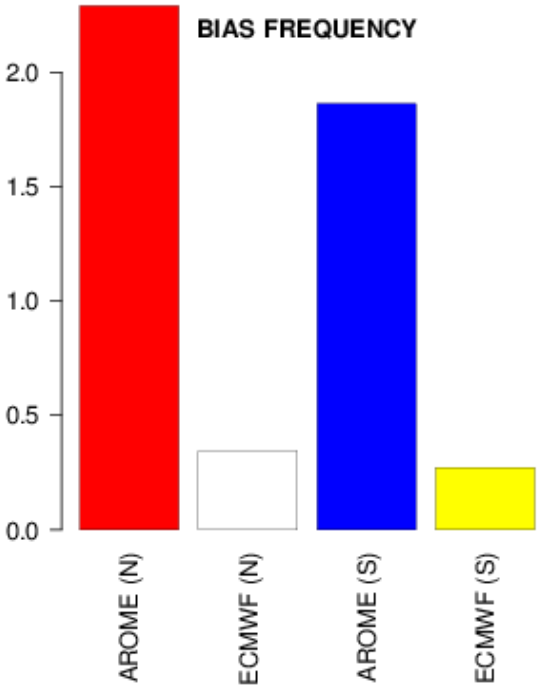
No problem in Cy37h1.2
Problem in Cy38h1.1
What about Cy38h1.2?



0,2mm/12hr



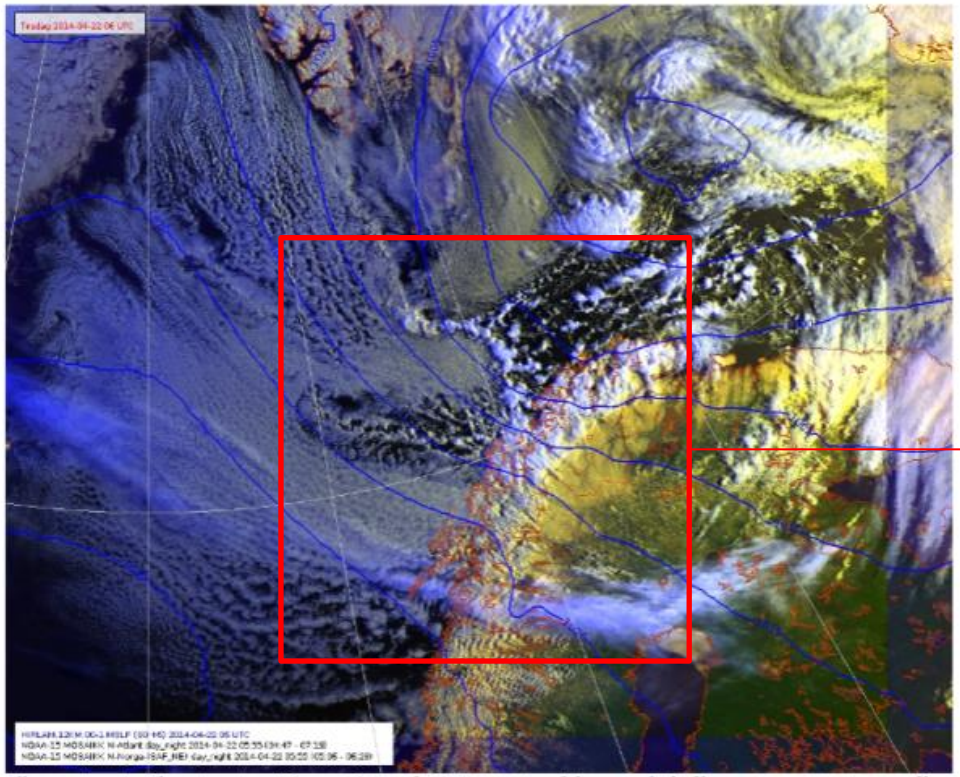
7,0mm/12hr



20mm/12hr

See also HIRLAM-discussion forum:
http://hirlam.org/index.php/forum/6-operational-monitoring/1146-summer-precipitation-arome-cy38h1-1

Development:
Precipitation from (very) shallow convection under Arctic conditions.



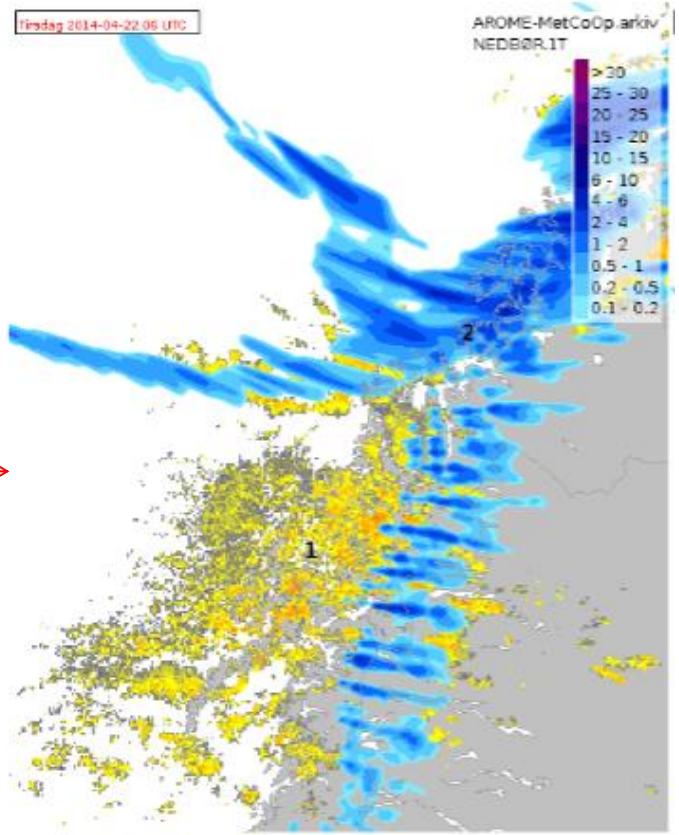


Illustration 1: The situation 06z on 22 April 2014. A mix of deep and shallow convection in a well developed cold air outbreak.

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Precipitation from (very) shallow convection under Arctic conditions.

In vdfhghtnhl.F90, replace ZCLDDEPTHDP=4000 m with:

Depth = 4000	$T_{LCL} > 20$ C
Depth = 1200	$T_{LCL} < 0$ C
Depth = $1200 + 140T_{LCL}$	$0C <= T_{LCL} <= 20C$

Where T_{LCL} is the temperature at Lifting Condensation Level

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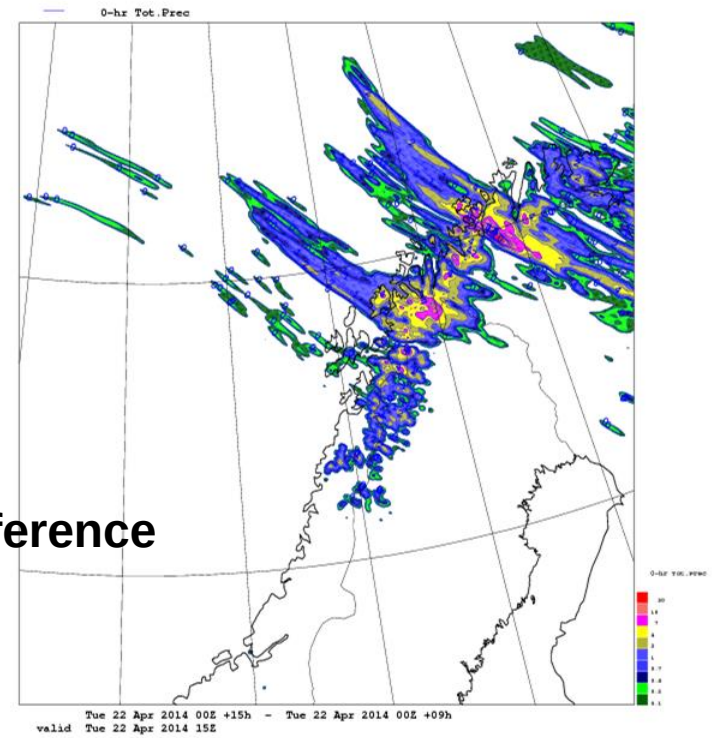
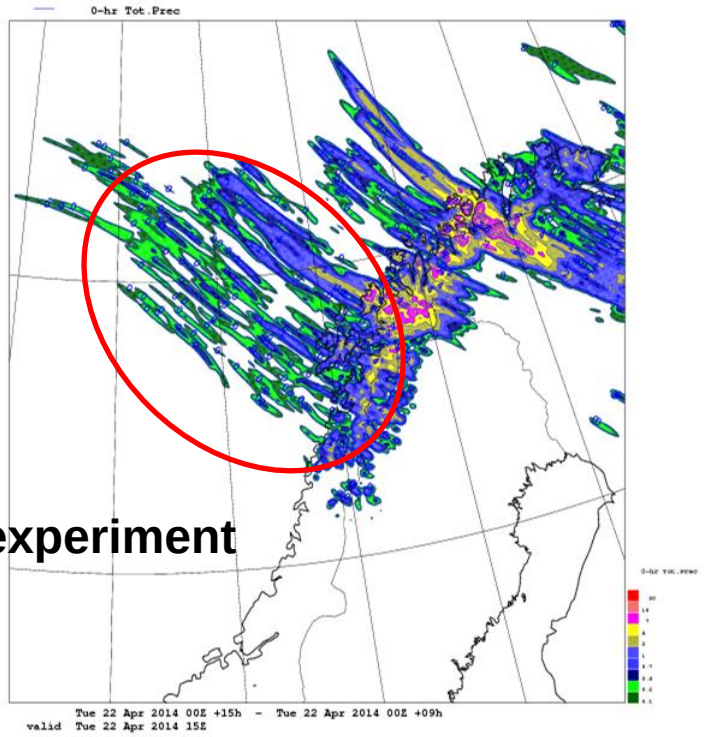
Case of April 22nd, 6h acc precip



reference



experiment

Positive impact on case of April 22nd, more precipitation along the coast, and out over sea. Note if ZCLDDEPTHDP=1500 was not enough to generate precipitation, so the clouds in this case were very shallow and still generated precipitation. (see also Poster by Lisa B.)

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SST

Baltic Sea
coastal stations

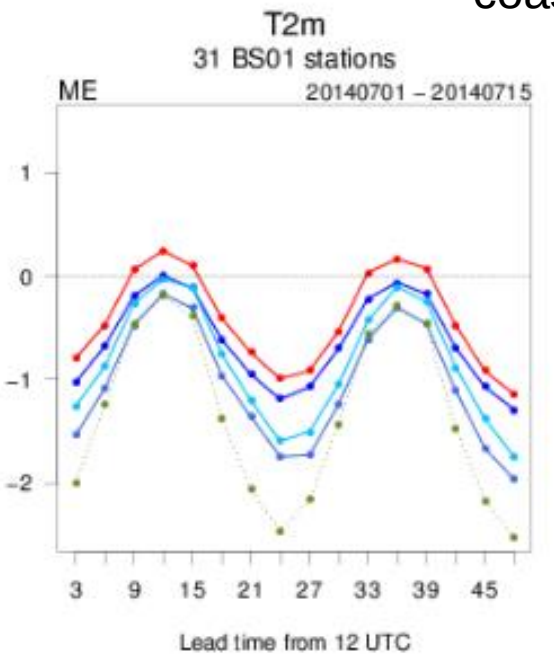
Cy38h1.2
HIROMB SST (from 06UTC)

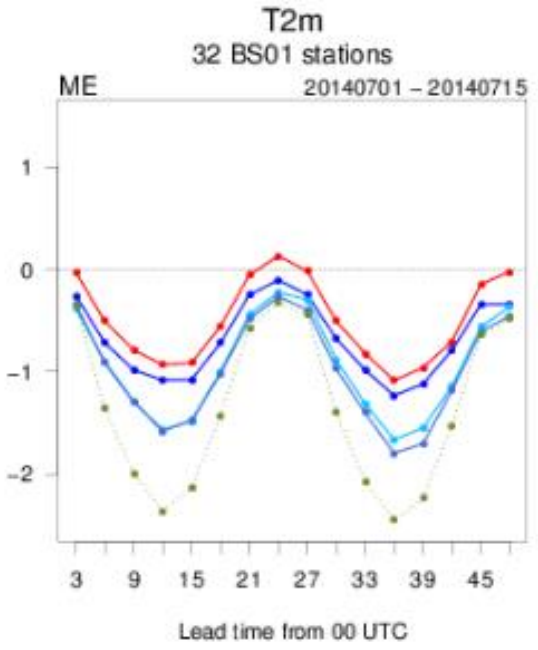
Cy38h1.2
EC - SST

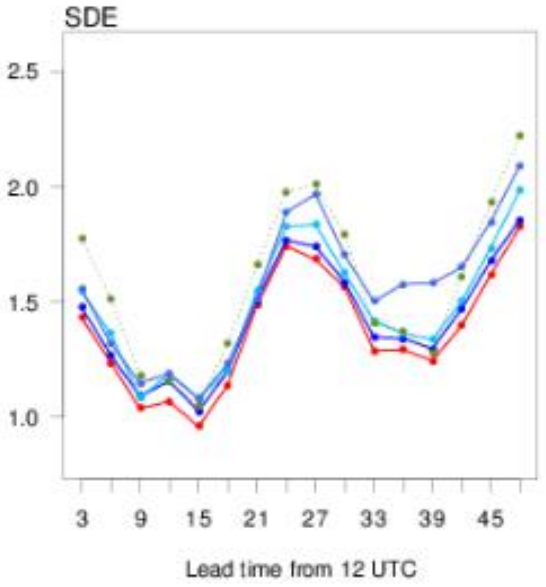
sst_f
sst_c
AROME_Norway
AM25
EC

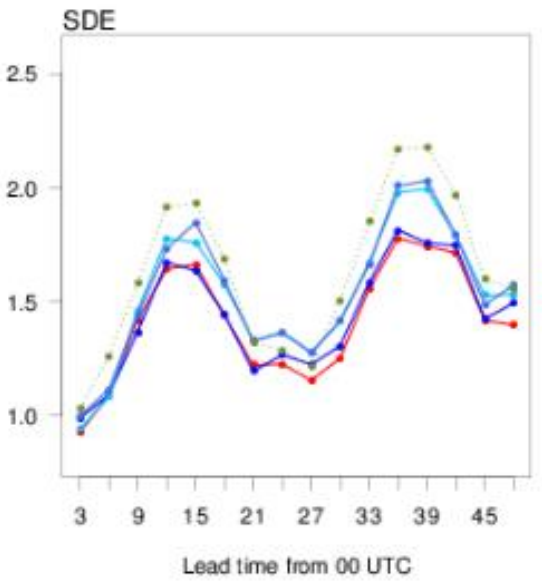
Cy38h1.1
EC-SST

Cy37h1.2
EC - SST









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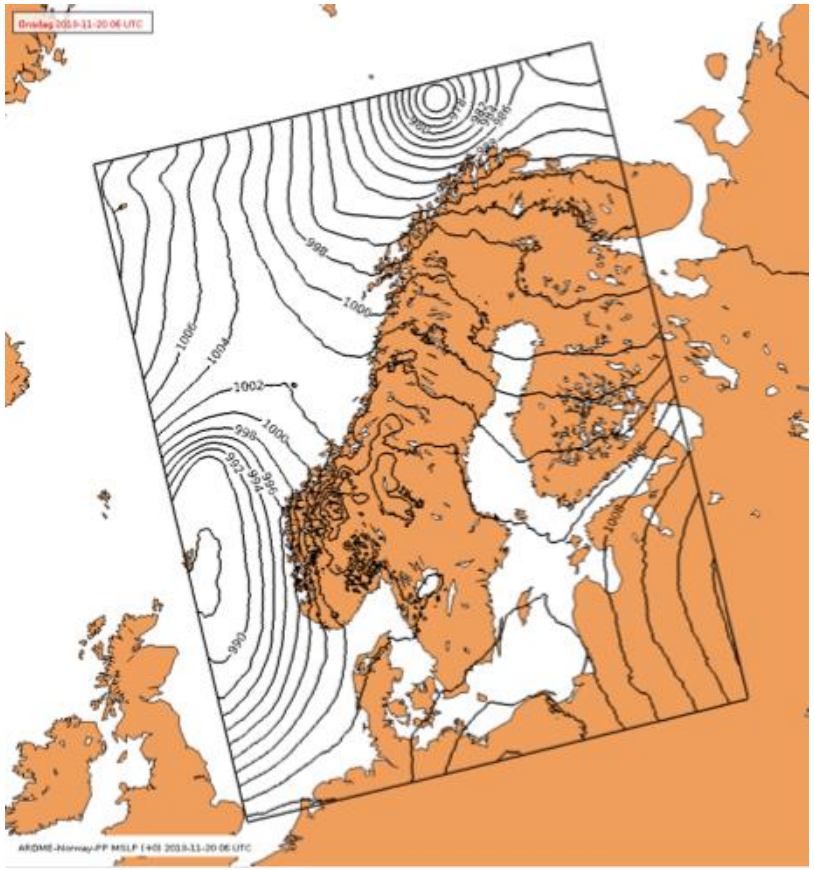
2015/16 – plans

New Swedish HPC («Frost»)

MetCoOp-EPS

- ✓ Cycle 40
- ✓ AROME-MetCoOp domain
- ✓ Control run ~ AROME-MetCoOp

- ✓ Lead times?
- ✓ 2,5km or 3,1km?
- ✓ Perturbations?
- ✓ Multi-physics?
- ✓ Cut-off?
- ✓ …..
- ✓ ….



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Summary

- ***The co-operation increase our HPC-capacity, and give us a broader knowledge of the model system.***
- ***In general we are satisfied with model quality and the model output is widely in use at SMHI and MET-Norway***
- ***The update from Cy38h1.1 to Cy38h1.2 was very beneficial for temperature (still a small cold bias) and cloud cover (not shown)***
- ***Compared to ECMWF, AROME-MetCoOp add value in forecasting temperature, wind, and precipitation***
- ***AROME-MetCoOp has deficiencies w.r.p.t shallow convection in polar regions, too intense summer convection (Cy38h1.1) and the use of ECMWF SST is not optimal in certain regions/seasons. There are also issues connected to fog/low stratus and lower tropospheric temperature gradients(not shown)***
- ***The pre-operational suite use IASI (passive mode) and soon radar reflectivity***
- ***Next step is new Swedish HPC and MetCoOp-EPS***

Thank you for your attention!

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