



Daily runs with ALADIN/AROME
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HIRLAM All Staff Meeting / 17th ALADIN Workshop,
Oslo 23-26 April, 2007

ALADIN/AROME experimentation in HIRLAM (without assimilation)

- Last year we reported about the first tests with ALADIN/AROME since then we are running AROME on regular basis at FMI, DMI and SMHI.
- Experimental daily runs with AROME have been performed since May 2006.
- FMI is running CY30t1 and SMHI is running CY31t0, DMI is running with CY31t1
 - The main difference (in ALADIN) is the prognostics cloud scheme (Lopez)
- Data have been used to learn about the model behaviour, for education and to increase the local interest in meso scale modelling.
- General model behaviour and case studies have been performed
 - Sami Niemela, Convective precipitation in AROME, Tuesday morning
 - Bjarne Stig Andersen: Semi-operational ALADIN forecasts at DMI using AROME and HIRLAM physics, Tuesday morning

FMI setup at 00,12 UTC

ALD@30t1 11km, 245x277x40 forced by RCR

ARO@30t1 2.5km, 300x300x40 forced by ALD every hour

DMI setup at 00 UTC

ALD@31t1 11km, 245x277x40 forced by ?

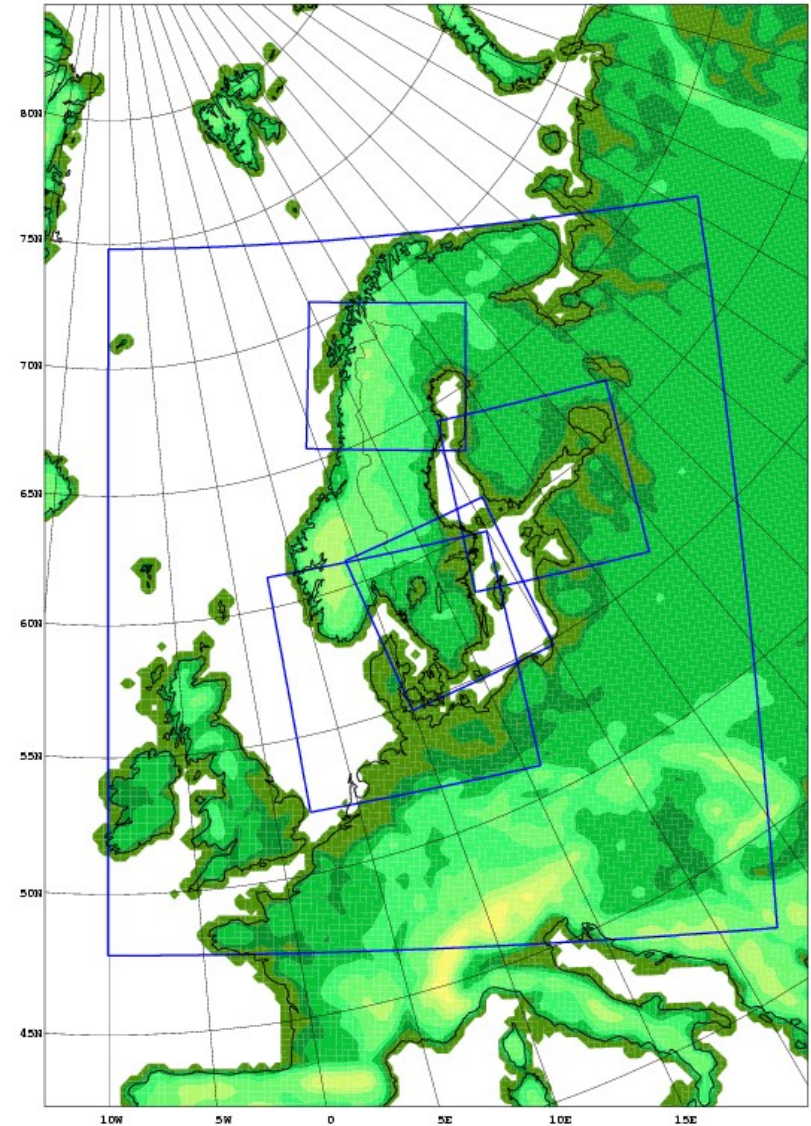
ARO@30t1 2.5km, 373x389x40 forced by ALD every hour

Also running with HIRLAM physics

SMHI setup at 00UTC

al00_31t0 11km, 245x277x60 forced by 22km HIRLAM.

ar025_31t0, ar026_31t0 2.5km
277x259x60 levels, forced by al00_31t0
every hour



Cost for a 24h forecast

FMI SGI ALTIX

MODEL	PEs	TIME
ALADIN 10km	64	~10min
AROME 2.5km	64	~3h

DMI NEC SX6

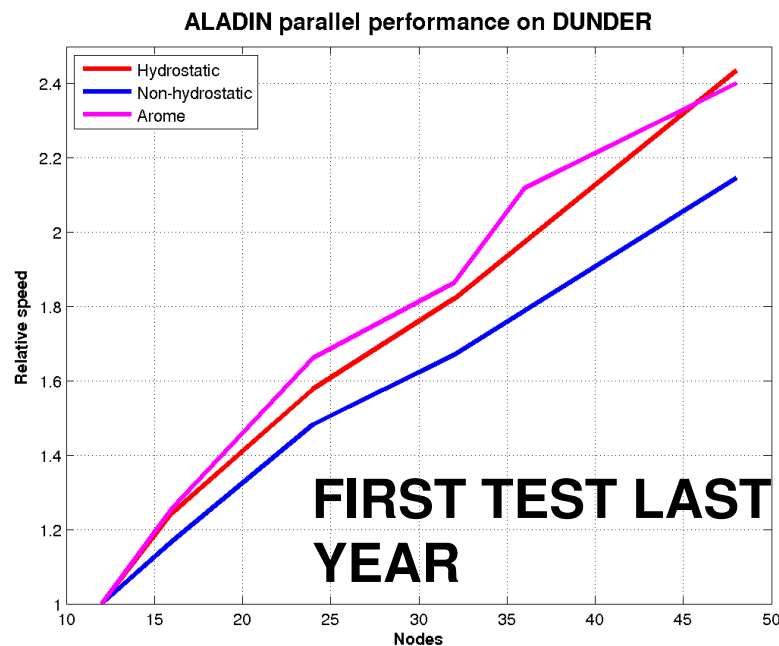
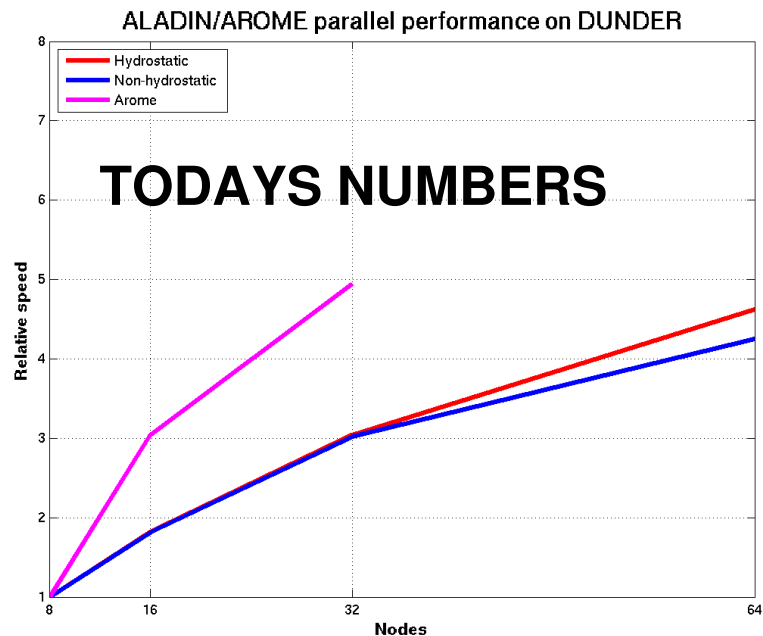
ALADIN 10km	16	~10min
AROME 2.5km	16	~2h

SMHI LINUX CLUSTER

ALADIN 10km	32	~20min
AROME 2.5km	32	~5h

NH – ALADIN scales as H-ALADIN,
AROME scales even better

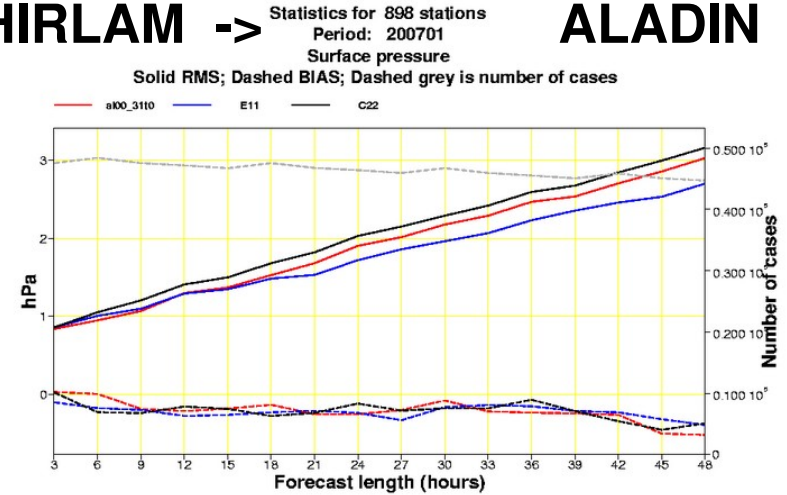
Local problems for the northern
Swedish AROME domain. First IO step
takes ~1800s !!!!!



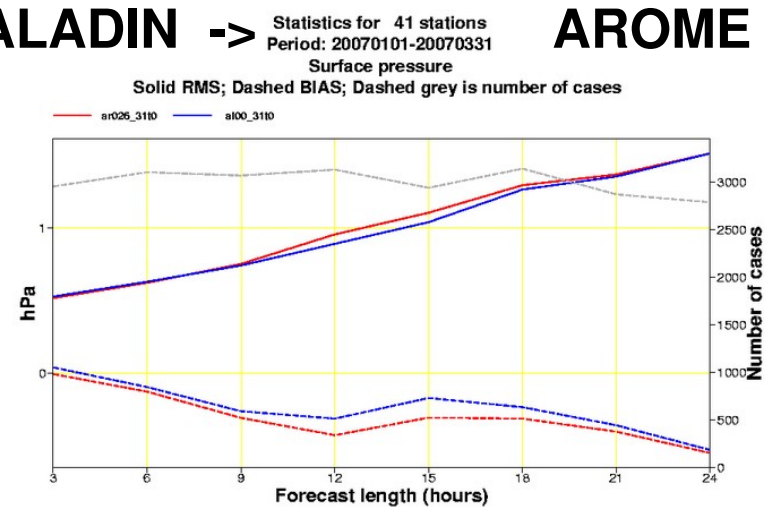
Coupling of ALADIN/AROME

- Separate program (gl) to interpolate from HIRLAM/IFS data.
- Since CY31t0 ALADIN has cloud ice -> estimate from HIRLAM cloud water if not present.
- HIRLAM can be directly coupled to AROME by going via FULLPOS (cheating). It's been tested but not evaluated.
- When running AROME at the moment we always go HIRLAM -> ALADIN -> AROME.
- Dynamically the coupling seems to work.

HIRLAM -> ALADIN



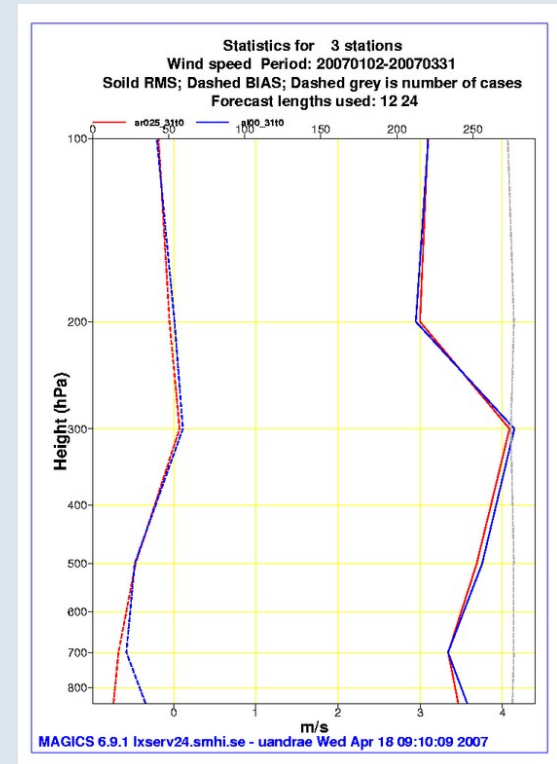
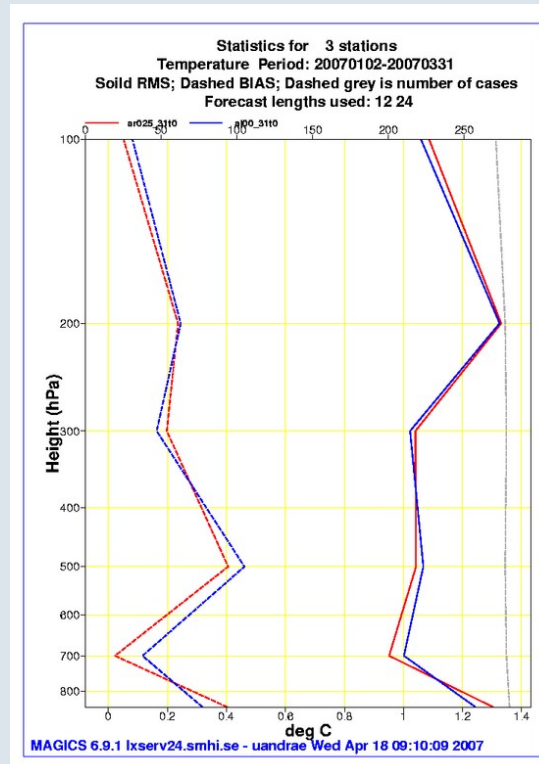
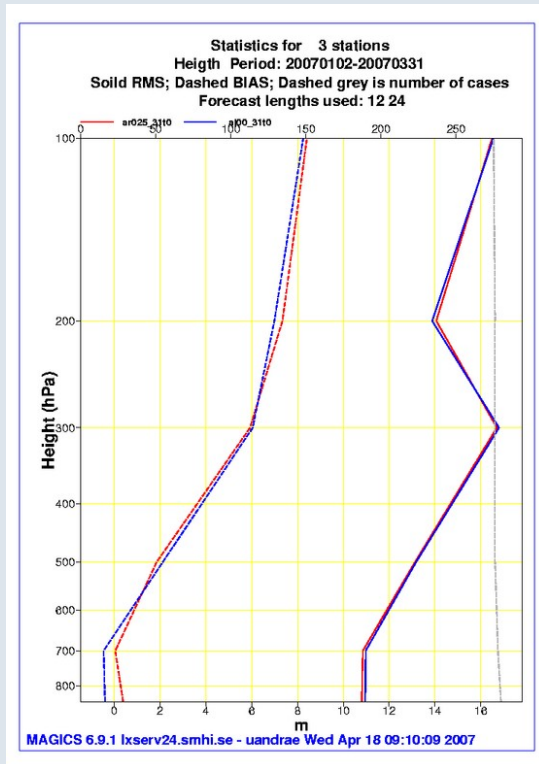
ALADIN -> AROME



Large scale performance ALADIN vs AROME (Northern Swedish domain)

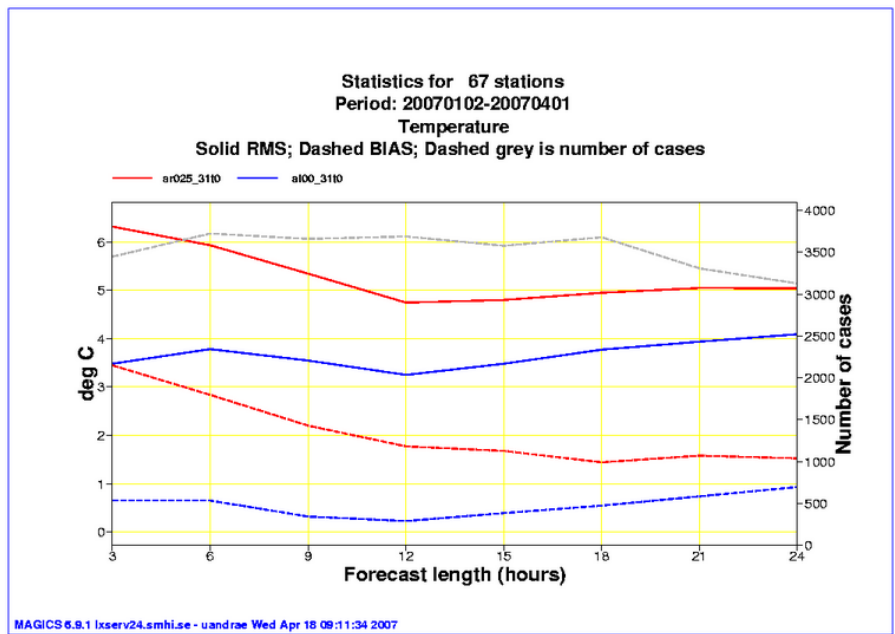
The synoptic scale features are kept, not improved nor destroyed.

This is what we should expect with a domain on the order of ~700 km, at least when the initial state is not improved by observations.

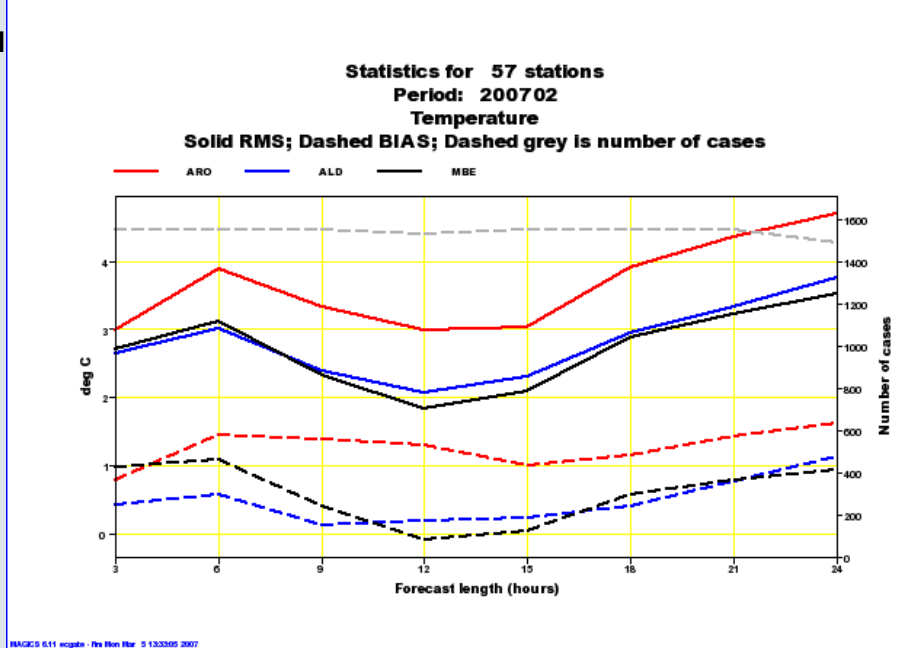


Coupling is not all about what's in the atmosphere

- One difference between AROME and ALADIN (CY31t0) is running with or without SURFEX. HIRLAM have had problems with summer soil ice and the ice was set = 0 when running ALADIN.
- Left is an example from the northern Swedish domain (CY31t0) with temperatures far to warm at the start



U

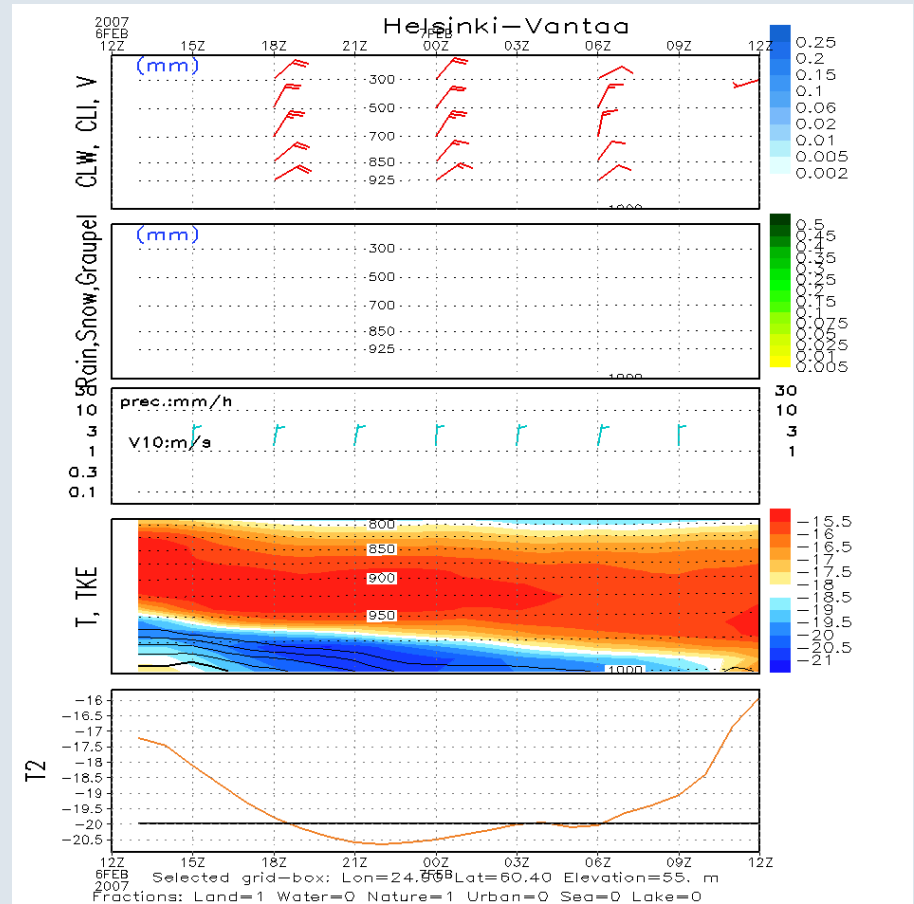
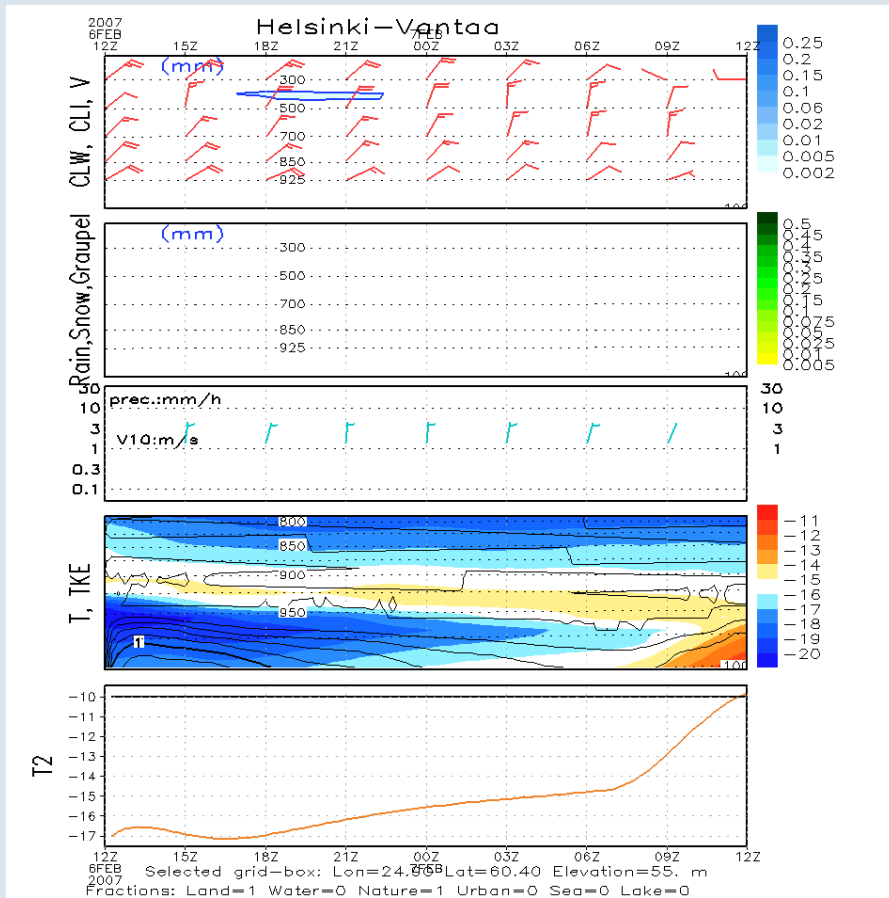


When Sami started using the soil ice and added some safety measures:

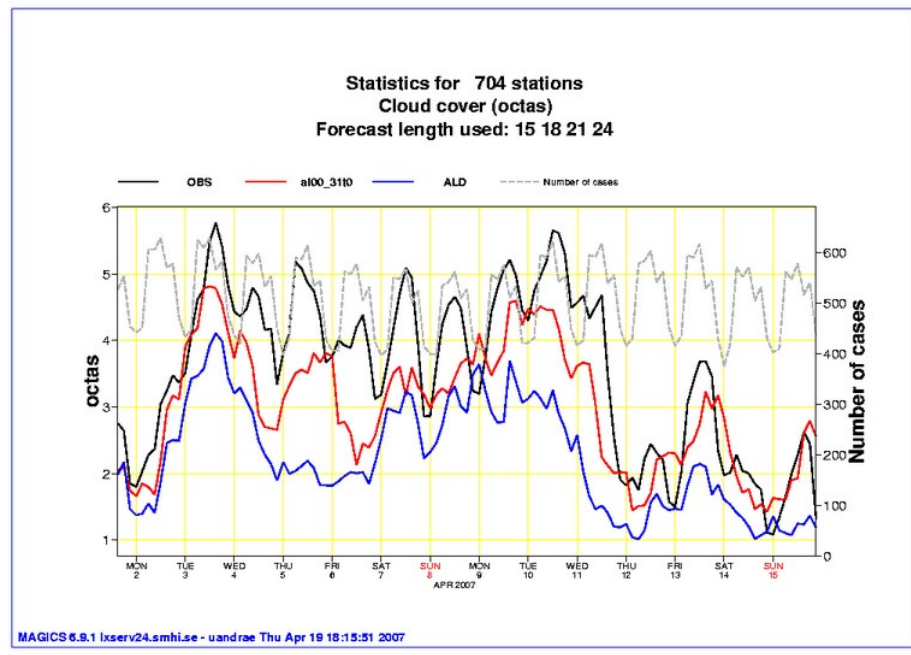
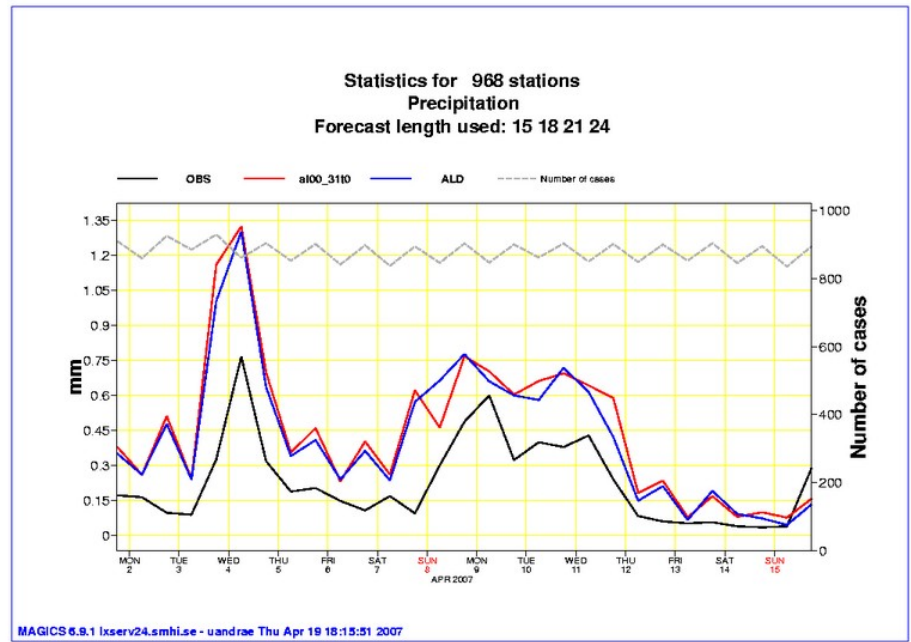
NO ICE

<- Running AROME with ->

ICE

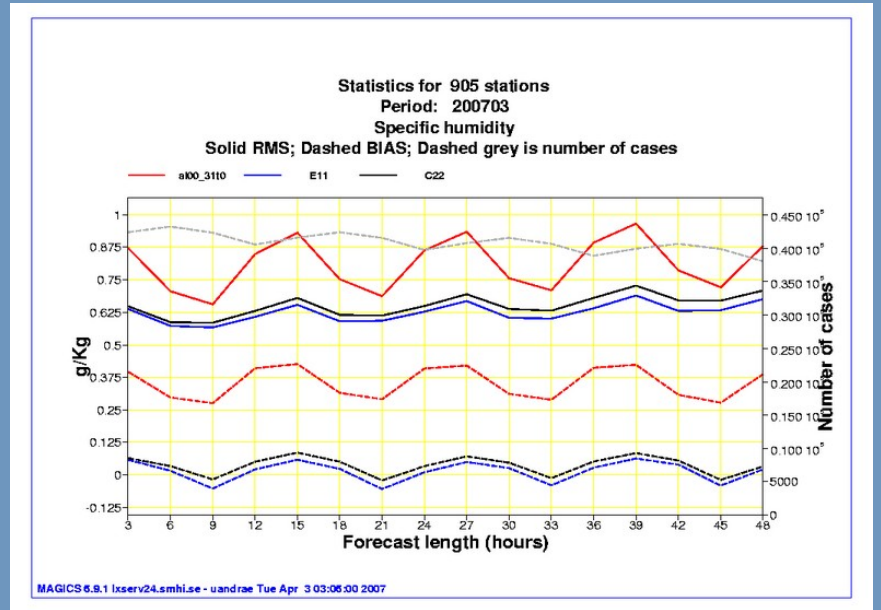
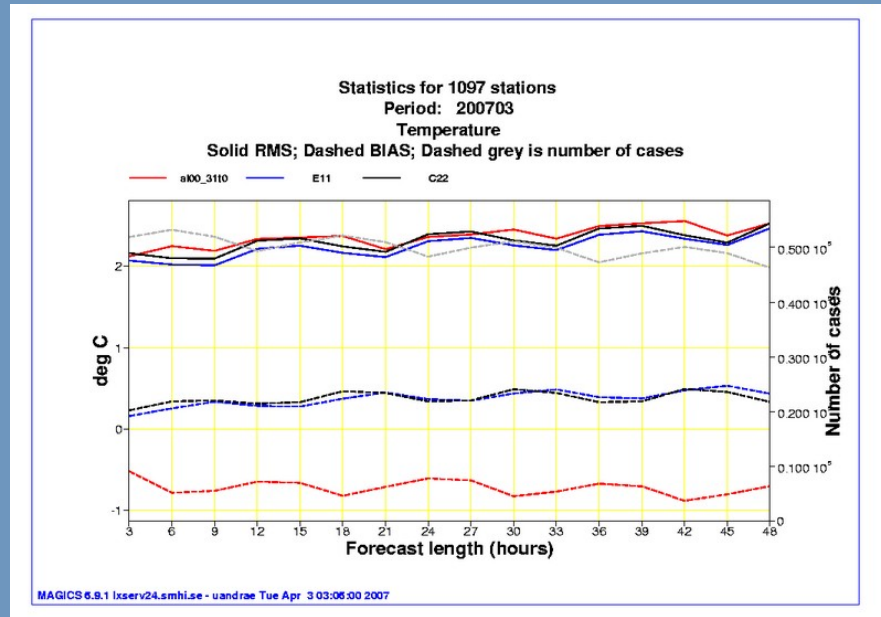


- Both FMI and SMHI are running the same Scandinavian domain, but with different cycles.
- Daily monitoring is set up to discover differences.
- The results are very similar, but we have seen some (unexplained) differences in cloud cover.



ALADIN and HIRLAM behaves very similar as forecast models for the free atmosphere.

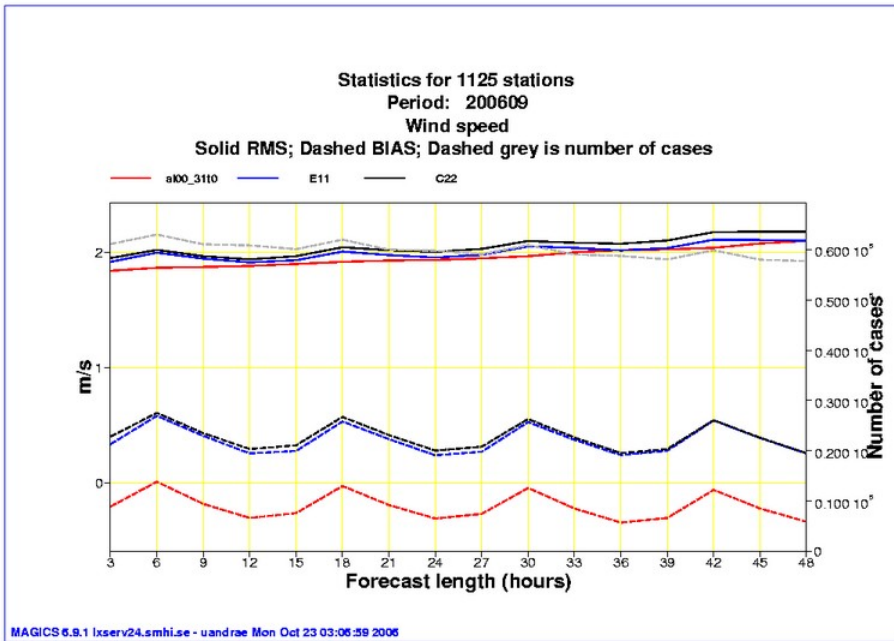
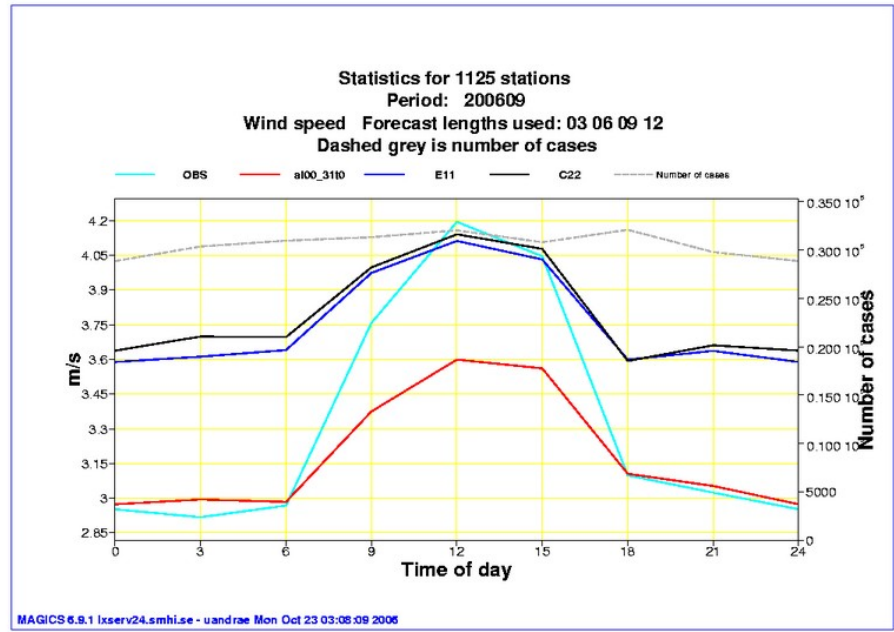
There are differences in near surface parameters but it is hard to tell if it is a model problem or a coupling problem?



HIRLAM is always to windy at night.

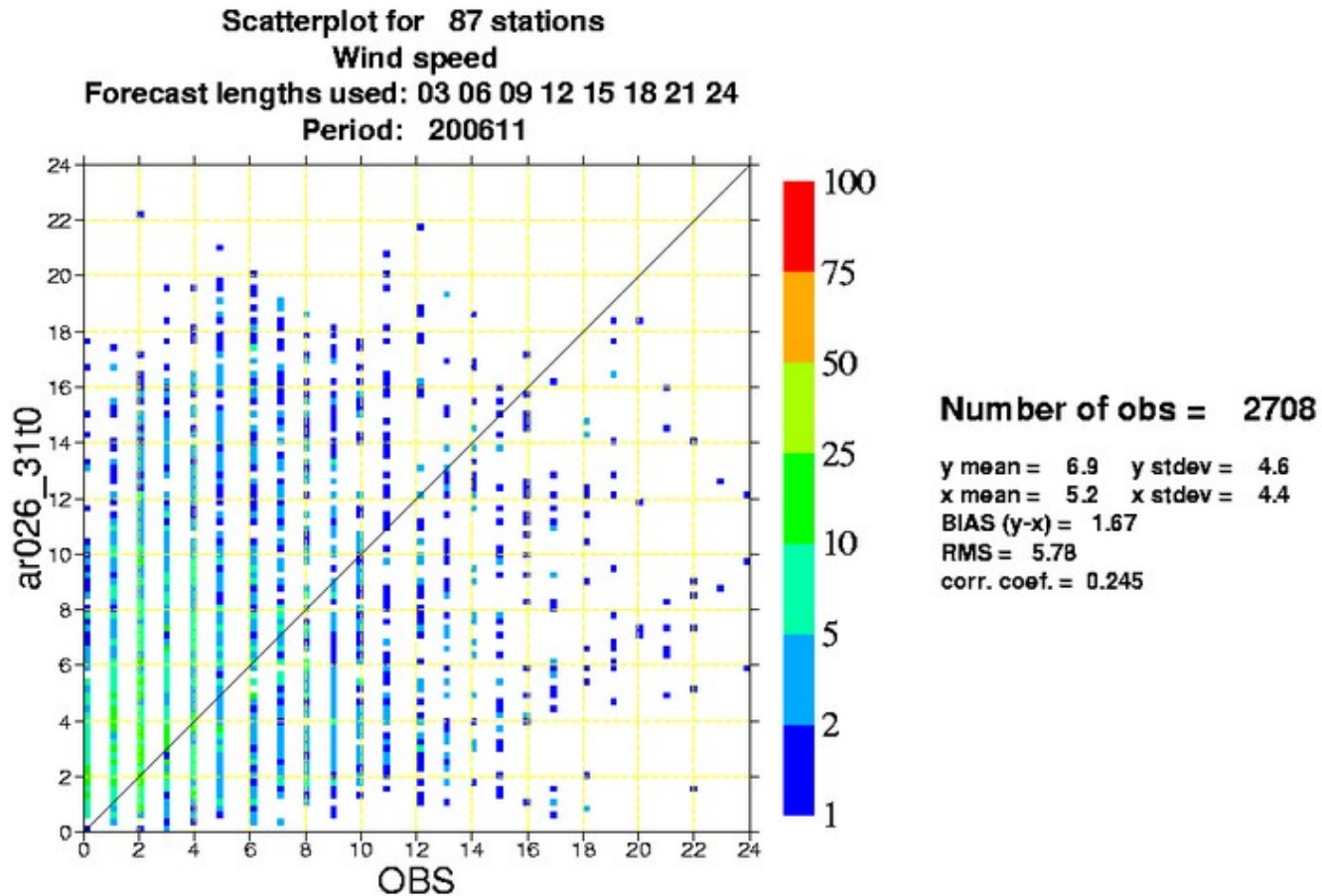
ALADIN always underestimates the midday wind.

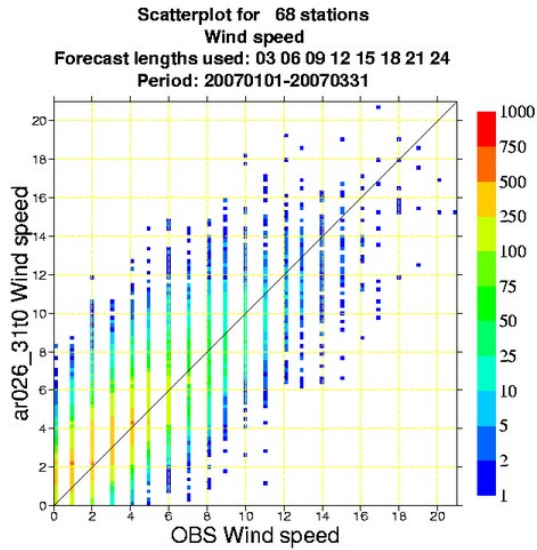
Feedback mechanism from difference in temperature or due to difference in formulation?



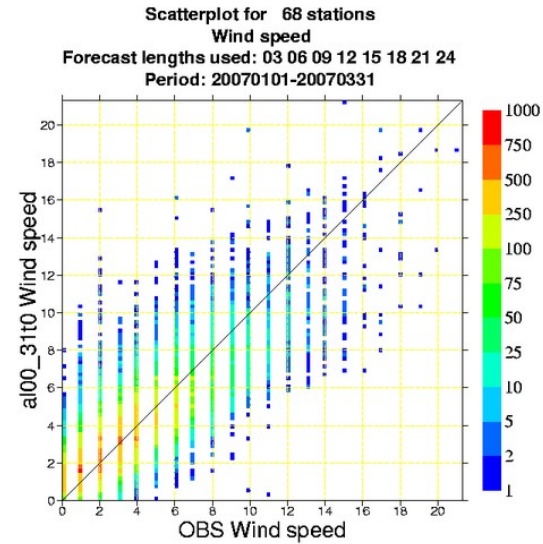
Results from AROME

First results from last year was very strange ...

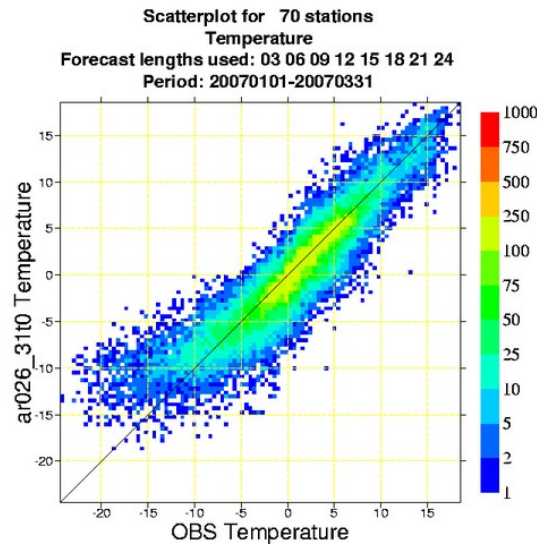




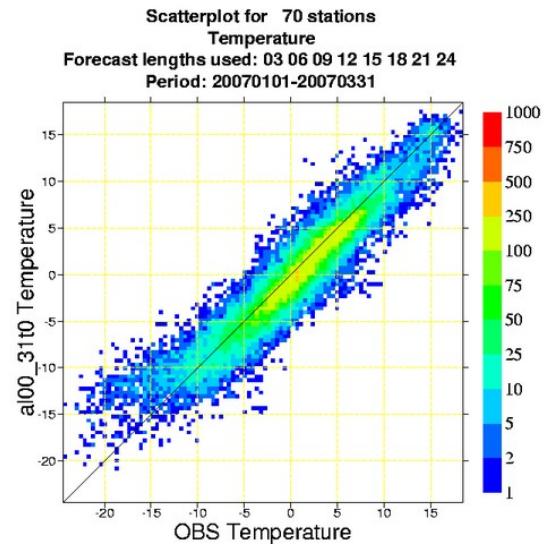
Number of obs = 40530
y mean = 4.0 y stdev = 2.5
x mean = 3.4 x stdev = 2.5
BIAS (y-x) = 0.61
RMS = 1.72
corr. coef. = 0.793



Number of obs = 40530
y mean = 3.6 y stdev = 2.2
x mean = 3.4 x stdev = 2.5
BIAS (y-x) = 0.18
RMS = 1.52
corr. coef. = 0.805



Number of obs = 42144
y mean = 0.5 y stdev = 5.2
x mean = 0.8 x stdev = 5.5
BIAS (y-x) = -0.35
RMS = 2.20
corr. coef. = 0.919



Number of obs = 42144
y mean = 0.2 y stdev = 5.2
x mean = 0.8 x stdev = 5.5
BIAS (y-x) = -0.59
RMS = 1.87
corr. coef. = 0.946



From Sami Niemela, about verifying against Helsinki testbed data

- Monthly verification does not reveal any added value from high-resolution model.

- The performance of high-resolution model is comparable with synoptic scale models.

High resolution observations are not required.

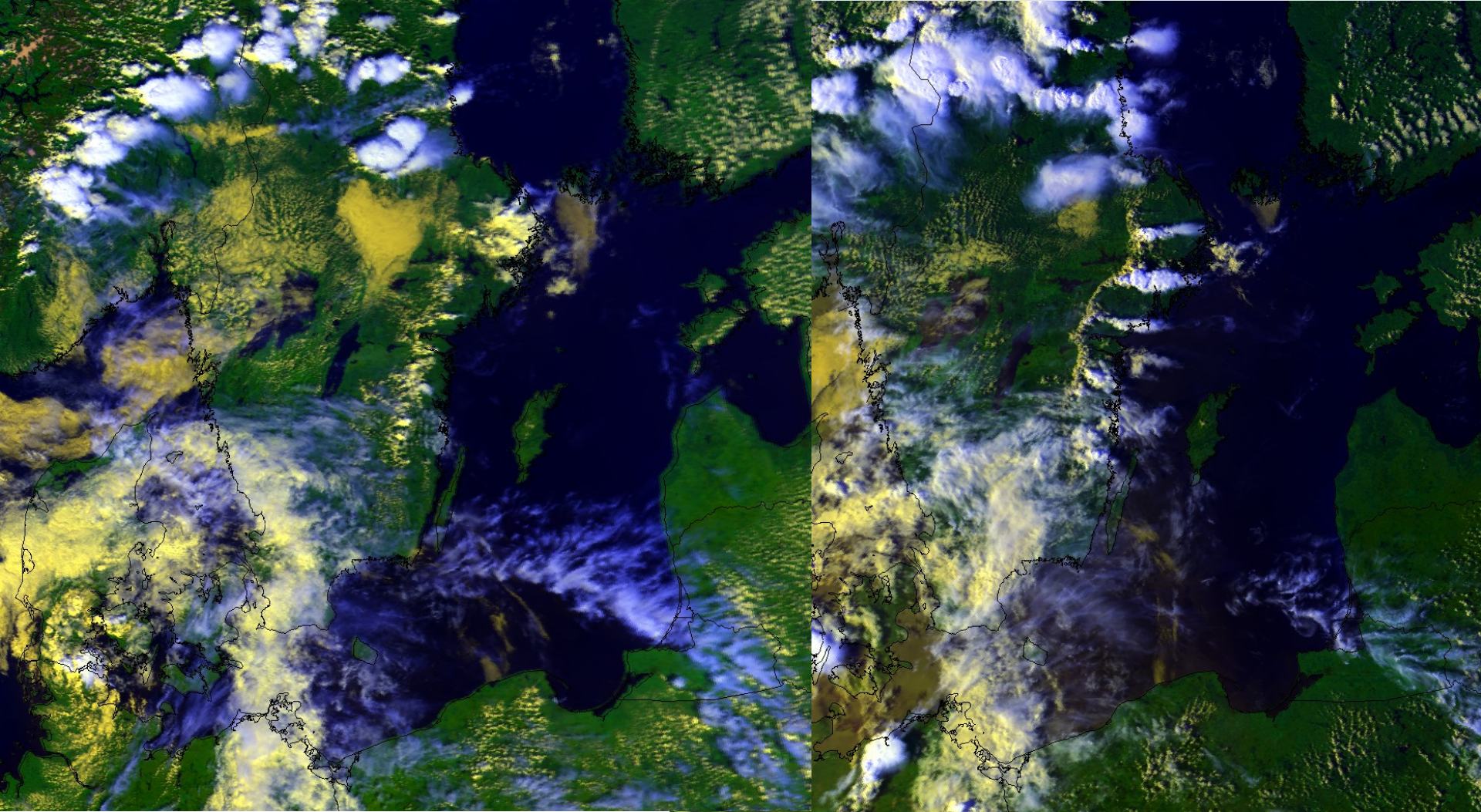
- Added value can be found by studying shorter periods (case studies).

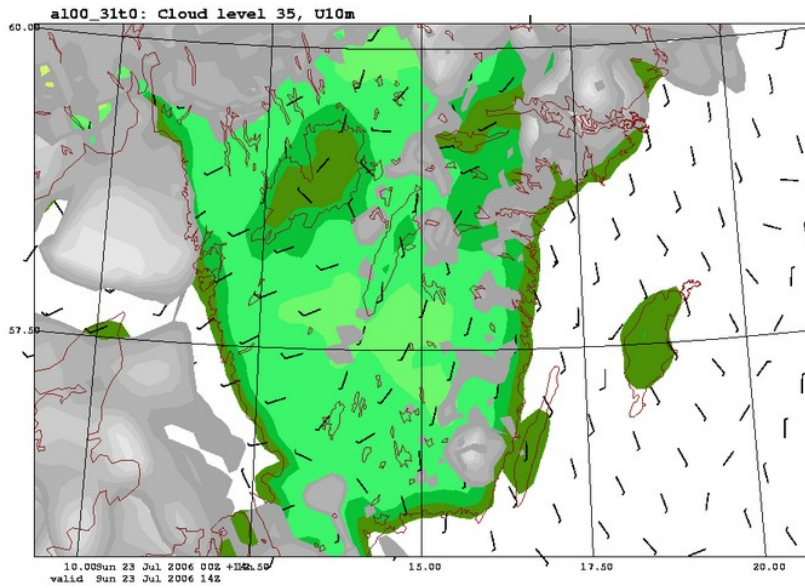
- High resolution (both spatial and temporal) observations are required.

- In general, HTB WXT-measurements are as good as Synop observations for NWP verification.

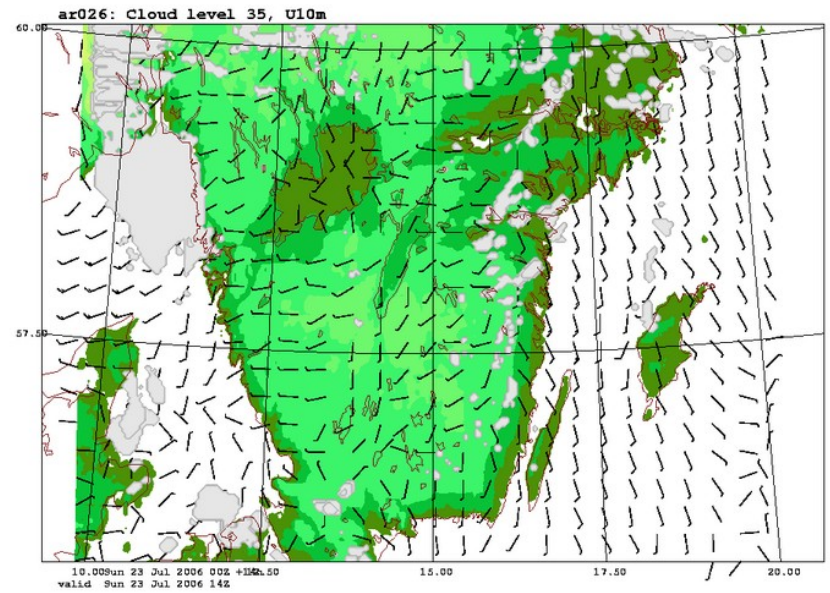
http://fminwp.fmi.fi/WebgraF/AROME_00/

If monthly statistics doesn't reveal anything, make a case study!
Visual satellite images from 20060723 at 1231 and 1458 UTC

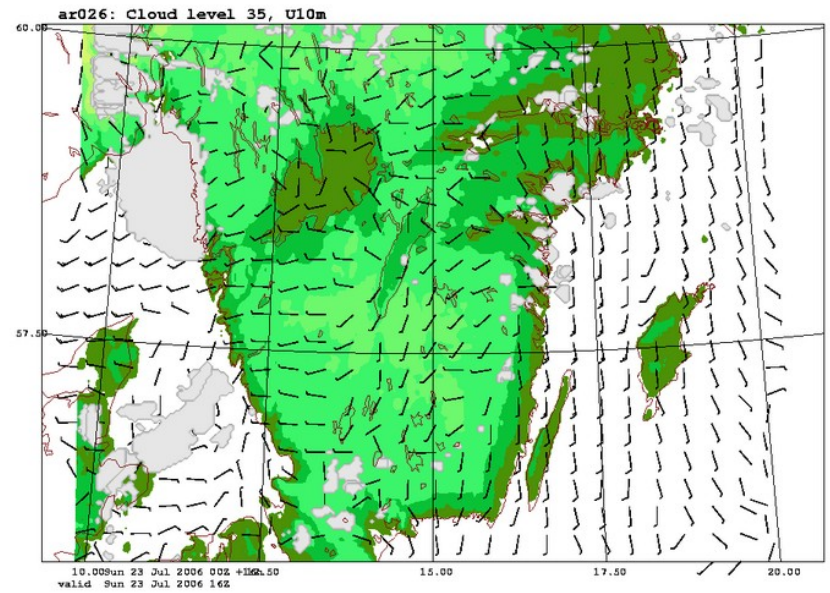
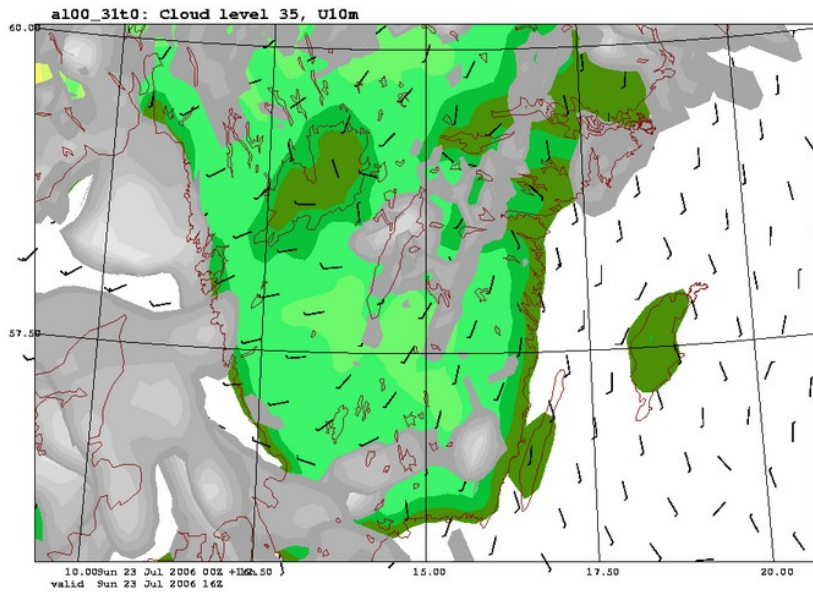




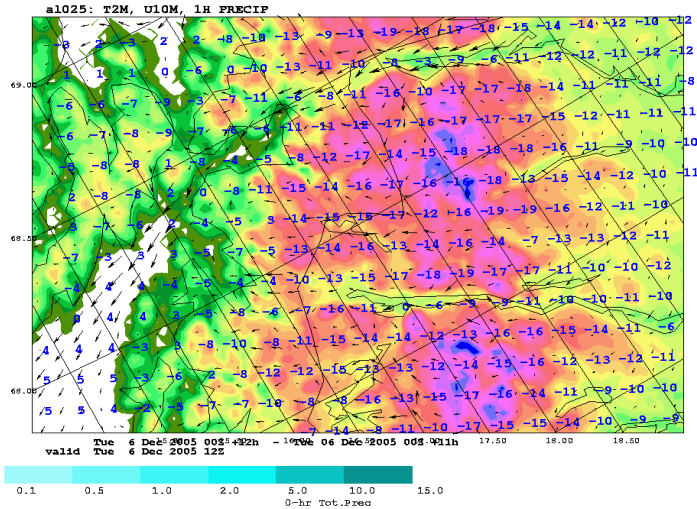
ALADIN



AROME



Mountain winds

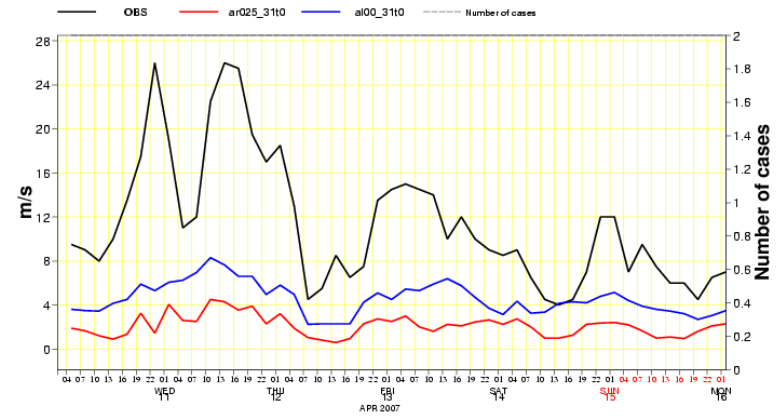


- When increasing the horizontal resolution we expect a good response in the wind field
- Example from two reliable mountain stations in northern Sweden shows that there are more work to be done

ALADIN

Statistics for 2 stations **AROME**

Wind speed
Forecast lengths used: 03 06 09 12 15 18 21 24 Window: 3h

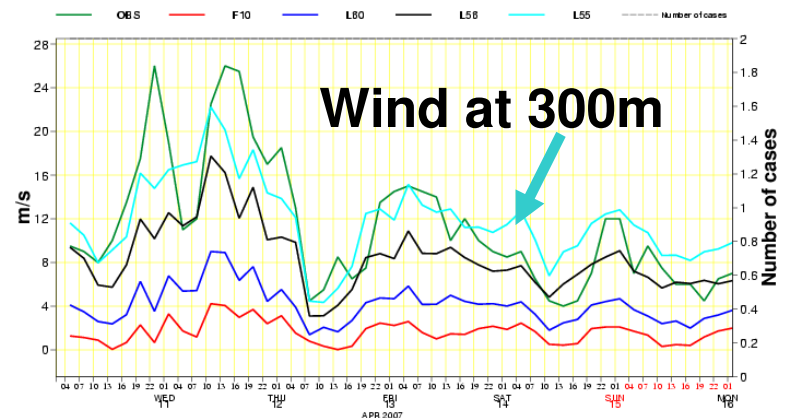


MAGICS 6.9.1 pclx054 - uandae Fri Apr 20 10:40:25 2007

AROME 2.5km

Statistics for 2 stations
Wind speed

Forecast lengths used: 03 06 09 12 15 18 21 24 Window: 3h



MAGICS 6.9.1 pclx054 - uandae Fri Apr 20 10:44:23 2007

Surface fluxes

Comparison of fluxes at the surface is important for evaluation of the surface model (SURFEX/ISBA)

We are lucky enough to have Sodankylä inside the northern Swedish domain. FMI performs real time monitoring and compares with HIRLAM and ARPEGE data.

Data from our regular AROME/ALADIN experiments will be added later.

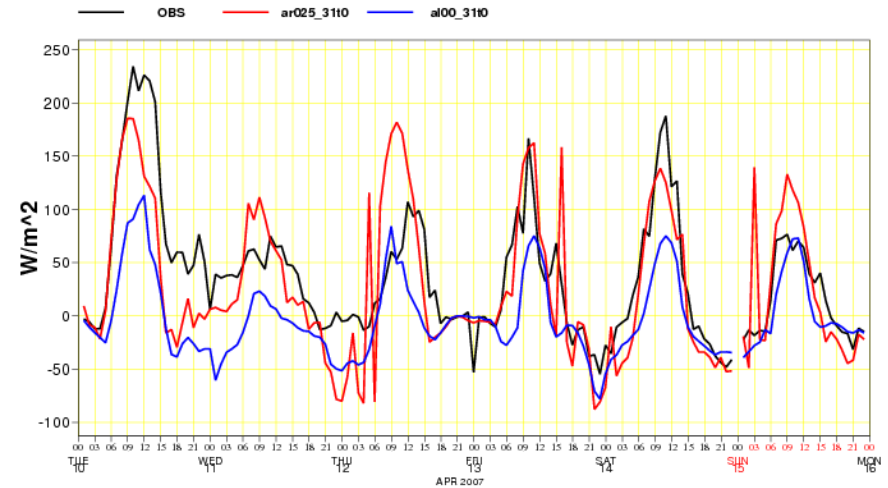
ALADIN

Statistics for SODANKYLA

AROME

Sensible heat flux

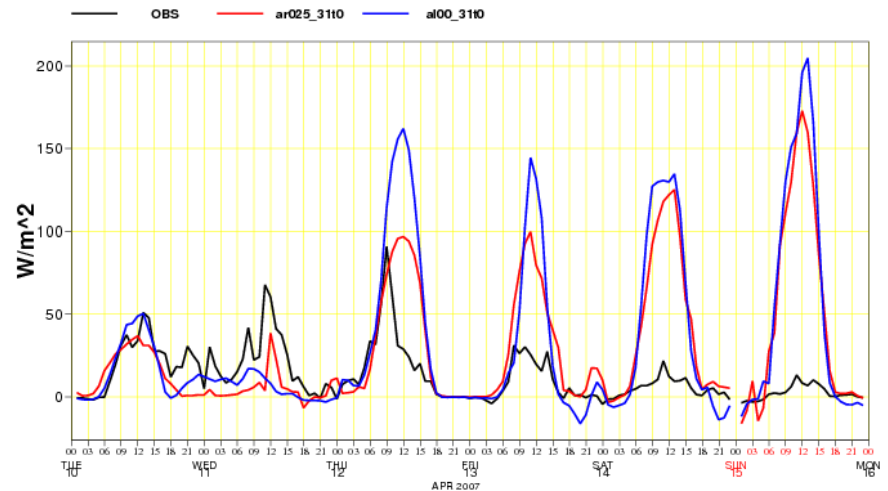
Forecast lengths used: 1 2 ... 24 Window: 1h



Statistics for SODANKYLA

Latent heat flux

Forecast lengths used: 1 2 ... 24 Window: 1h



Surface fluxes cont.

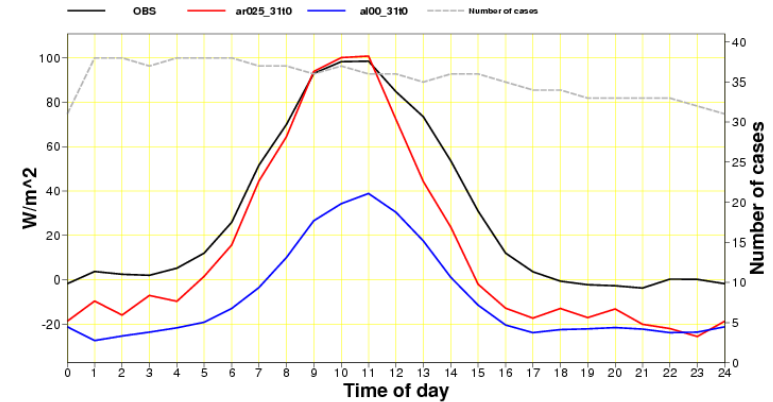
In the cycle running at SMHI (cy31t0). Long and short wave radiative surface fluxes is not easily available but essential for surface budget studies.

Sensible heat flux looks reasonable but the latent heat flux is far to high, fort this period.

ALADIN

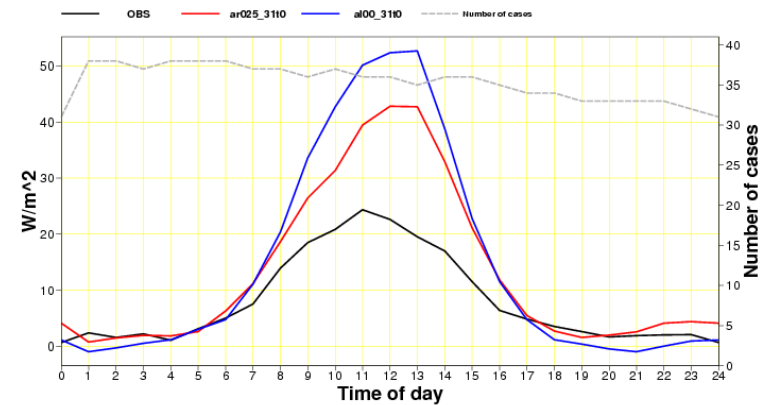
Statistics for SODANKYLA
 Period: 20070301-20070415
 Sensible heat flux Forecast lengths used: 01 02 ... 24
 Dashed grey is number of cases

AROME



MAGICS 6.9.1 lxserv24.smhi.se - uandrae Sat Apr 21 22:28:12 2007

Statistics for SODANKYLA
 Period: 20070301-20070415
 Latent heat flux Forecast lengths used: 01 02 ... 24
 Dashed grey is number of cases



MAGICS 6.9.1 lxserv24.smhi.se - uandrae Sat Apr 21 22:28:12 2007

Daily runs with ALADIN/AROME have proven to be useful and will continue. Start with CY32TX during the spring.

- **Problems have been seen with coupling (initial conditions) of the surface.**
- **Several technical problems to solve and questions answer.**
- **More specialized evaluations:**
 - **Daily monitoring of fluxes from Sodankylä will continue with more variables.**
 - **Try to take a closer look at Helsinki testbed.**
 - **Evaluation of precipitation pattern against radar.**
- **More verification on <https://hirlam.org/trac/wiki>**
- **Talk about the HARMONIE system aspects and environment tomorrow morning**