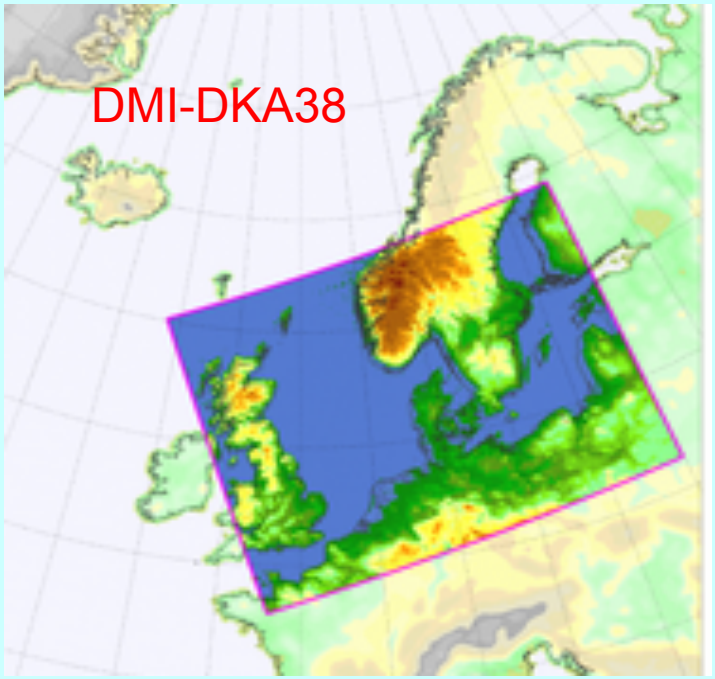
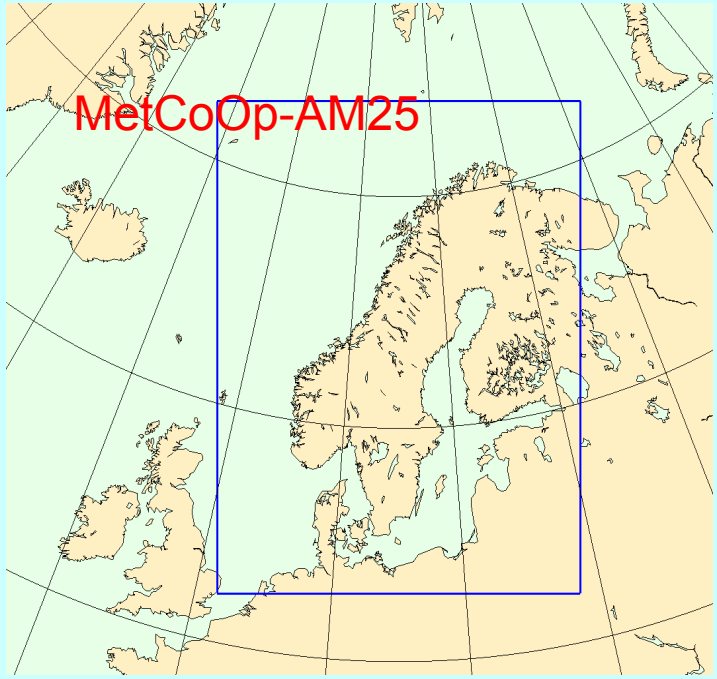



# HARMONIE Regular Cycle of Reference (RCR) in 2014

Xiaohua Yang
(PL on Operational Collaboration)

Ulf Andrae
(PL on System)

# Outlines

Introducing RCR: Regular Cycle of Reference HARMONIE

- Background
  - First (quality assured) HARMONIE-38h1.1 released on Feb 7 2014.
  - First HARMONIE-RCR became operational in March 2014
    - MetCoOp (SMHI/MET): March 18 2014
    - DMI: March 31 2014
- RCR
  - Perspectives about needs for RCR
  - Setup and procedure
  - Pre-operational Validation
  - Operational monitoring
  - Archived data
  - Outlook for RCR-40h1,  (2015)

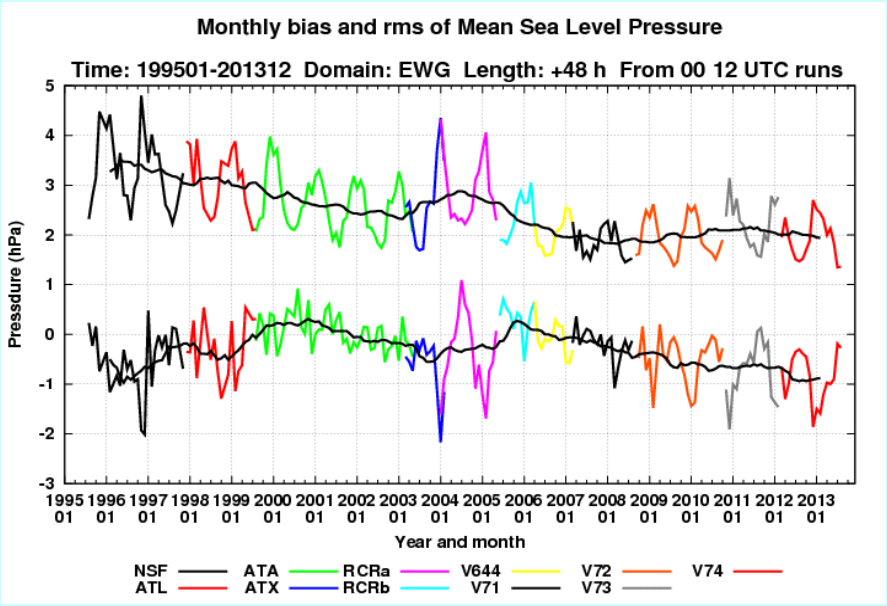
# Improving Harmonie Cycle Evolution

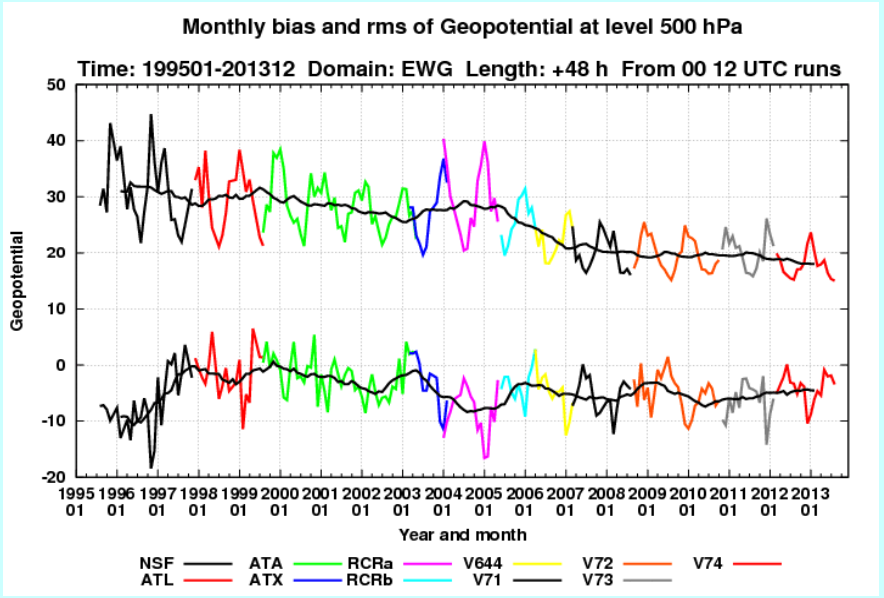
From ‘Reading’, ‘Toulouse’ to ‘HARMONIE’ releases, the cycle evolution usually takes 1-1.5 year

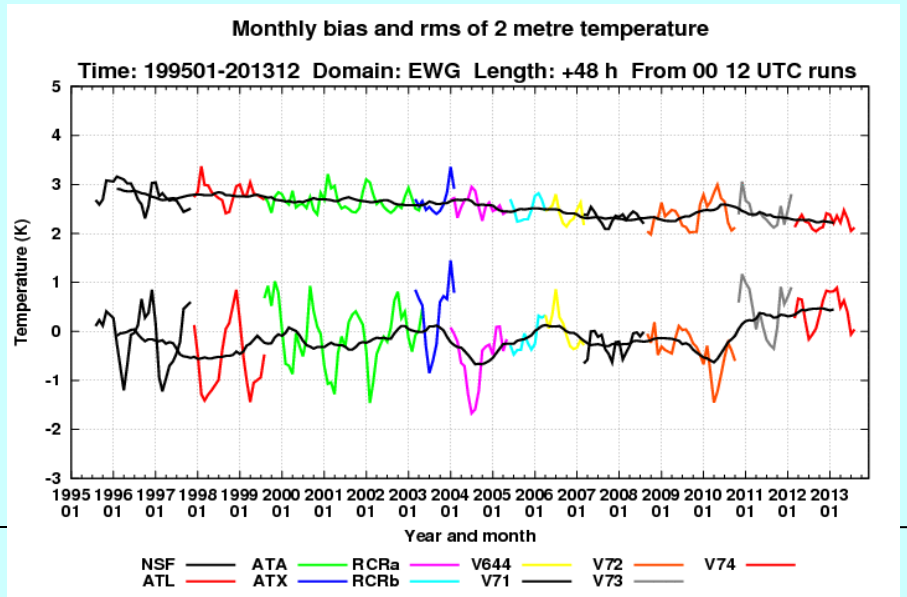
HIRLAM Perspectives: the community needs to

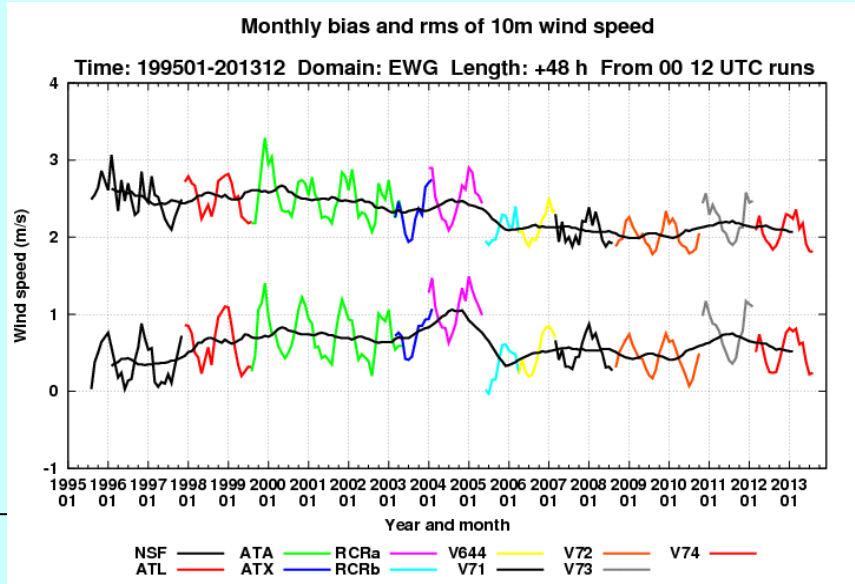
- **reduce latency between ‘r’,’t’ and ‘h’ releases.**
  - This is critical for HIRLAM research community to contribute
  - How? Enlarged adaptation community; common validation
    - 38h1 has involved more services and research staffs
- **reduce latency between H release and operational implementation at member services**
  - It is important for HIRLAM services to profit from the research collaboration in a timely manner.
  - How? RCR and the mechnism for rotation of RCR centers
    - HIRLAM experiences: RCR pushed ahead significantly the focus at operational services on the development version, so that more can contribute technically and meteorologically to the new cycle

# HIRLAM Quality Trend as Shown by RCR



# Establishing Quality Trend in HIRLAM

- HIRLAM Programme has a task to quantity its quality evolution
- In the era of HIRLAM-models, monitoring of the evolution and inter-comparison between HIRLAM versions is conveniently organised around reference HIRLAM system and RCR
  - significant overlap with operational model domains
  - conventional verification is natural approach
- Quality benchmark for HARMONIE needs new approach
  - mesoscale and probablistic aspects
  - limited or none overlap between operational domains
  - main added values now smaller scale, short range and ‘significant weather’, not well represented by conventional scores

**https://hirlam.org/trac/wiki/dataportal**

# Setup of HARMONIE-RCR

Target

- shorten the gap between the reference and operational implementation
- harmonize operational systems where appropriate
- contribute to quality benchmark

Approach

- One or several operational centers run shortly after official release of each HAMONIE cycle and use it for operational purposes
- RCR centres play leading role throughout release process
- RCR commitment is acknowledged by HIRLAM Programme through resource allocation
- RCR commitment is per cycle, and can be rotated

Process

- HIRLAM MG issues invitation during preparation of new HARMONE cycle
- HIRLAM council selects one or several services for next RCR centre(s)
- RCR centers actively engaged in pre-release test and validation
- RCR centers and HIRLAM MG agree on eventual configuration deviation
- RCR centers contribute actively to monitoring, validation and archiving

# RCR Commitment

**Responsibilities of an RCR centre:**

- To run a configuration of HARMONIE in line with the reference HARMONIE. The final setup shall be agreed between HIRLAM MG and the RCR centers.
- Participate in the technical evaluation coordinated by the HIRLAM system manager. Performance tests on the local platform start from the alpha versions.
- Participate in the meteorological evaluation of the reference configuration following release of the beta versions, under coordination of the project leader for quality assessment and operational applications.
- Deliver monitoring data and participate in real-time monitoring on the common platform hirlam.org.
- Implement in timely manner officially released versions and follow up update

**The RCR arrangement is per cycle, and shall preferably be in rotation**

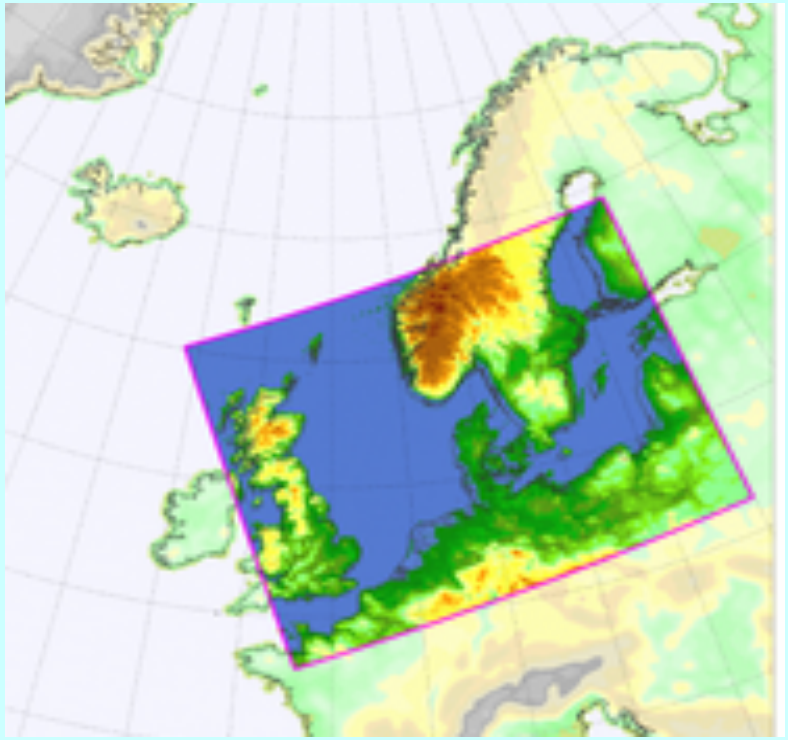
# Targeted RCR Configurations

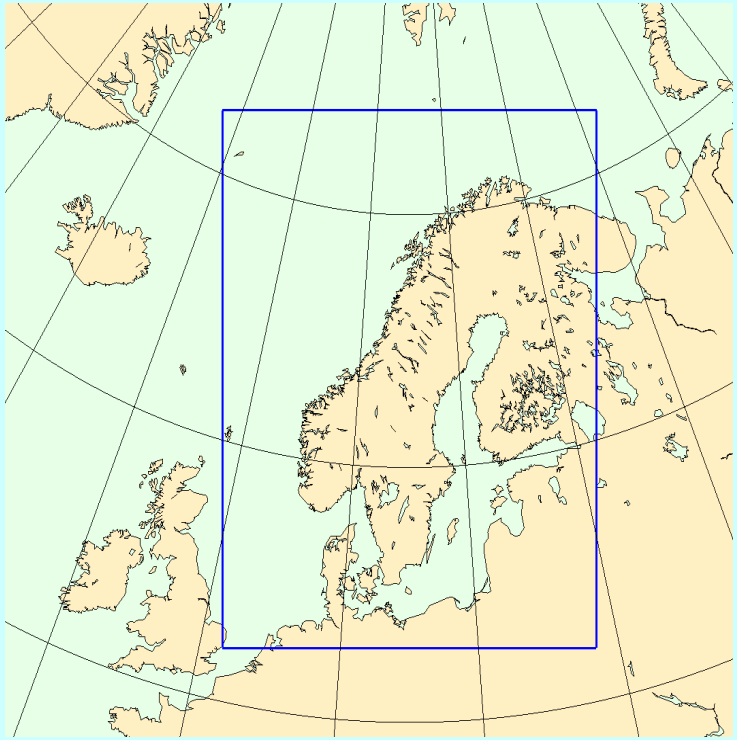
- A model domain covering an area over a minimum of 1500-2000 kilometers at the same or higher horizontal resolution as the references and with the same set of vertical levels. ***L65***
- The physics configuration as the Reference System (***AROME*** *for the upper air and* ***SURFEX*** *for the surface*). Major deviations need to be agreed between the RCR center and the HIRLAM management.
- Similar assimilation setup and frequency as the Reference System. ***3h cycling 3DVAR***
- Use at least the same set of conventional observations and unconventional observations as the reference. ***Conv + ATOVS***
- Produce the same minimum set of diagnostics and postprocessing as the Reference System. ***RCR_POSTP option***
- Differences from the Reference version documented in a branch

**First HARMONIE RCR based on 38h1.1 shared by DMI and MetCoOp**

High Resolution Hirlam Limited Area Model

# HARMONIE RCR 2014





- ✓ DMI Cray XT5 since March 2014
- ✓ 2.5km, 800x600x65
- ✓ 3DVAR, surface da, **asynoptic** 3h cycling, 58h
- ✓ +AMSU-A, **AMV, MODES**

- ✓ SMHI/MET-Norway, Operational 18 March
- ✓ Runs on Vilje (Norwegian HPC)
- ✓ Back up runs at Byvind (Swedish HPC).
- ✓ 2.5km, 750x960x65
- ✓ 3DVAR, surface da, 3-h cycling, 66h
- ✓ +AMSU-A, **AMSU-B/MHS**

# Pre-release Validation and Quality Aspects

- Most HIRLAM services have been involved in adaptation and validation efforts leading to release of 38h1, but especially with DMI and MetCoOp
  - AEMET, FMI, MetEireann, LHMS, KNMI, DMI, SMHI,MET
- Main issues addressed at RCR centres for 38h1
  - Parallel monitoring suites with trunk-38h1 (DMI)
  - Episodes/case studies and tuning for selected period
    - ECOCLIMAP II, surface drag, sso, parameterisation tuning for cloud and precipitation

# Scorecard

## 38h1b3 vs 37h1.2, DMI-DKA

| | PS | T2M | W10m | Prec | Td | Cloud |
|---|---|---|---|---|---|---|
| winter | + | - | + | ~ | ++ | ~ |
| summer | ~ | + | + | ~ | ++ | ~ |
| autumn | ~ | ~ | ~ | ~ | ++ | ~ |

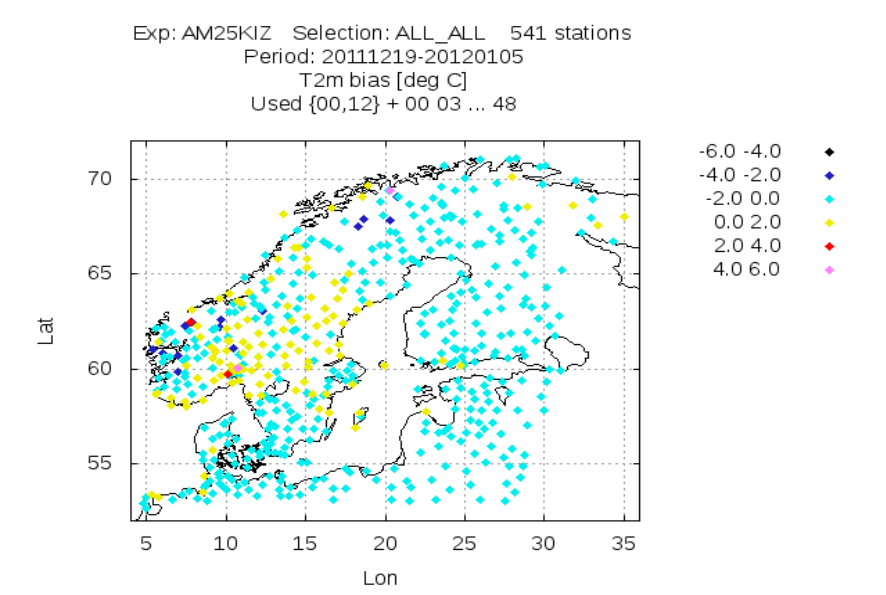
(+/++: Harmonie better/much better ~: similar skill, -/--: Harmonie worse/much worse)

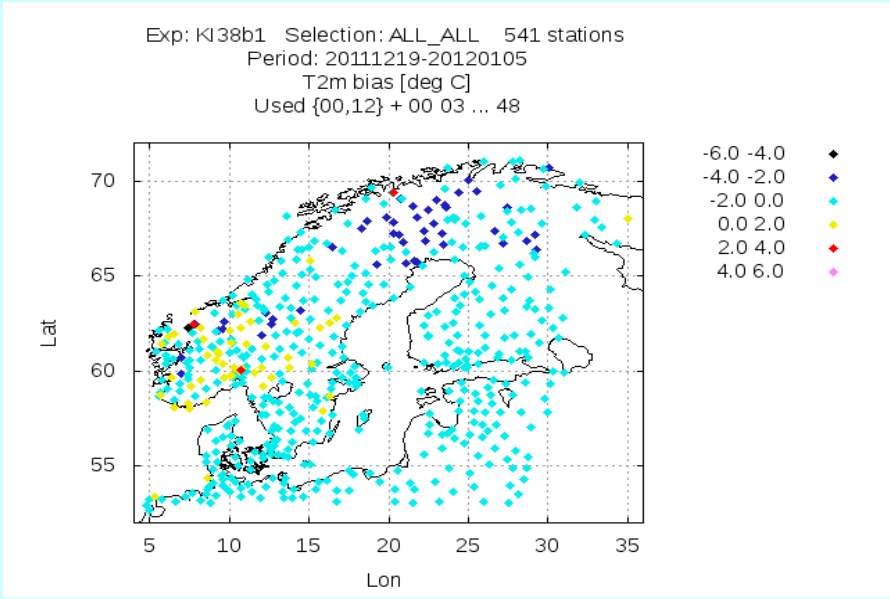
# Scorecard
## 38h1b3 vs 37h1.2, MetCoOp

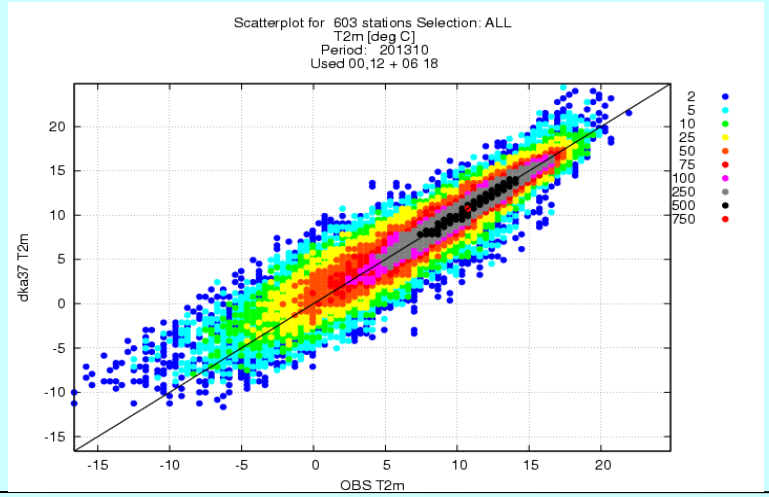
| | PS | T2M | W10m | Prec | Td | Cloud |
|---|---|---|---|---|---|---|
| winter (cold/windy) | ~ | - | ~ | ~ | + | ~ |
| summer (rainy) | ~ | + | ~ | + | ++ | ~ |

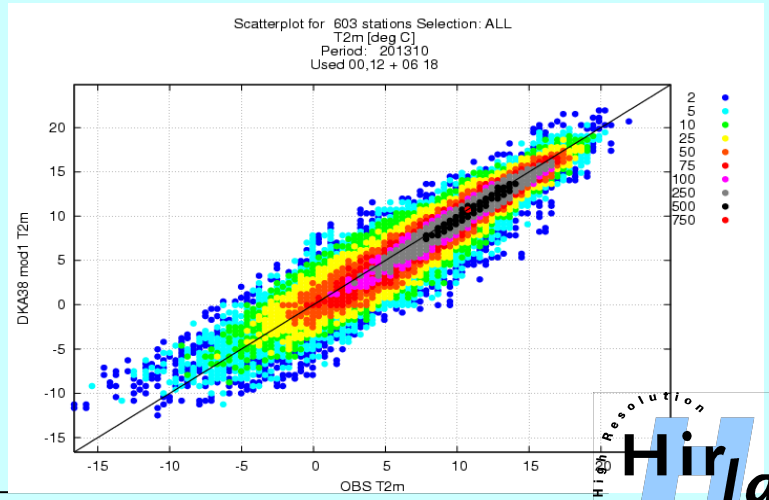
(+/++: Harmonie better/much better ~: similar skill, -/--: Harmonie worse/much worse)

# T2m bias problems



# Evaluation: From 37h1 to 38h1

Features: Surfex 7.2, 3h data assimilation, ECOCLIMAP II

Observed Changes: mainly in surface wind and temperature.

Low T2m in “Nordic conditions” (cold, clean and calm days...) about same

Negative autumn/winter time t2m bias (Netherlands, Nordic area )

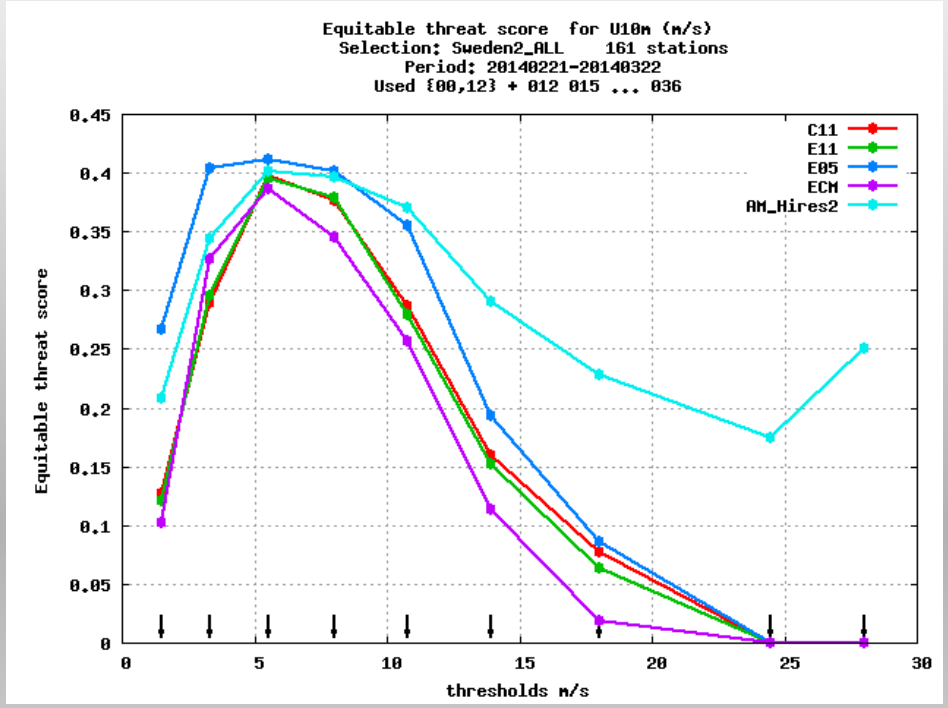
Too weak wind over mountains improved

Excessive low clouds and fog issues (Netherlands, Denmark) about same

Negative humidity & surface parameter diagnose problem for water fraction (Nordic domains) corrected

All in all no substantial variation in meteorological quality

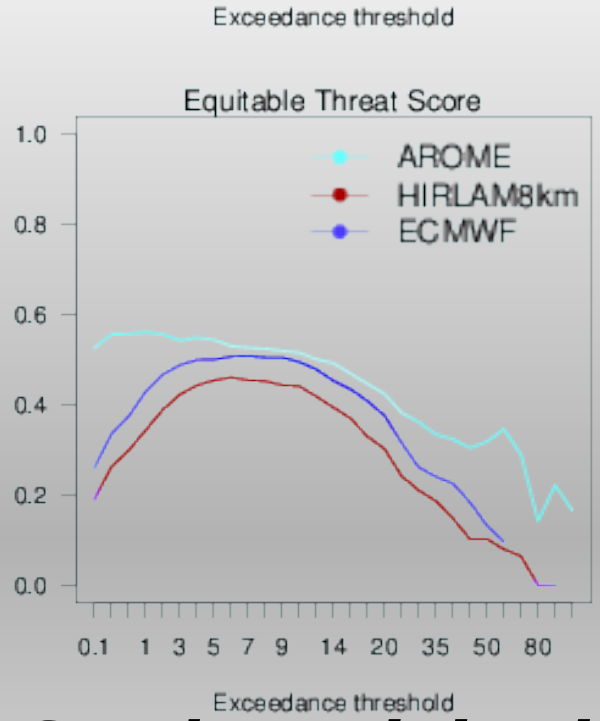
# AROME-MetCoOp




***Good wind forecasts***

ETS wind speed
161 Swedish stations

AROME-MetCoOp (ligth blue),ECMWF (violet), 3 different SMHI HIRLAM model set-ups ,(red, green and blue).




***Good precipitation forecasts***

ETS 24hour precipitation
~500 Norwegian stations

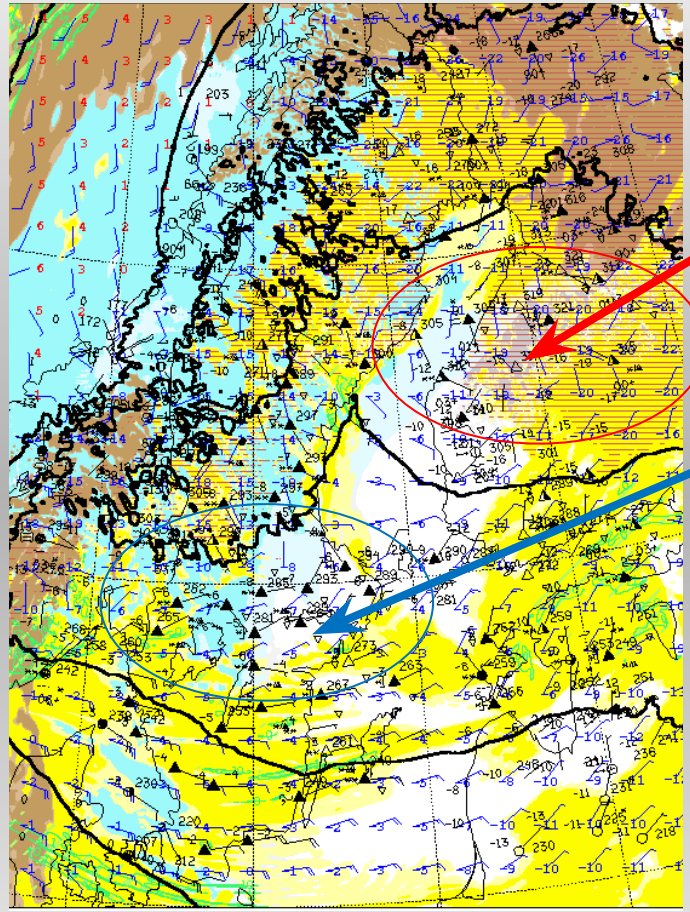
AROME-MetCoOp (light blue), ECMWF (violet), and MET-Norway Hirlam8km (red)

Norwegian Meteorological Institute

MetCoOp

SMHI

# AROME-MetCoOp



Forecast 22.January

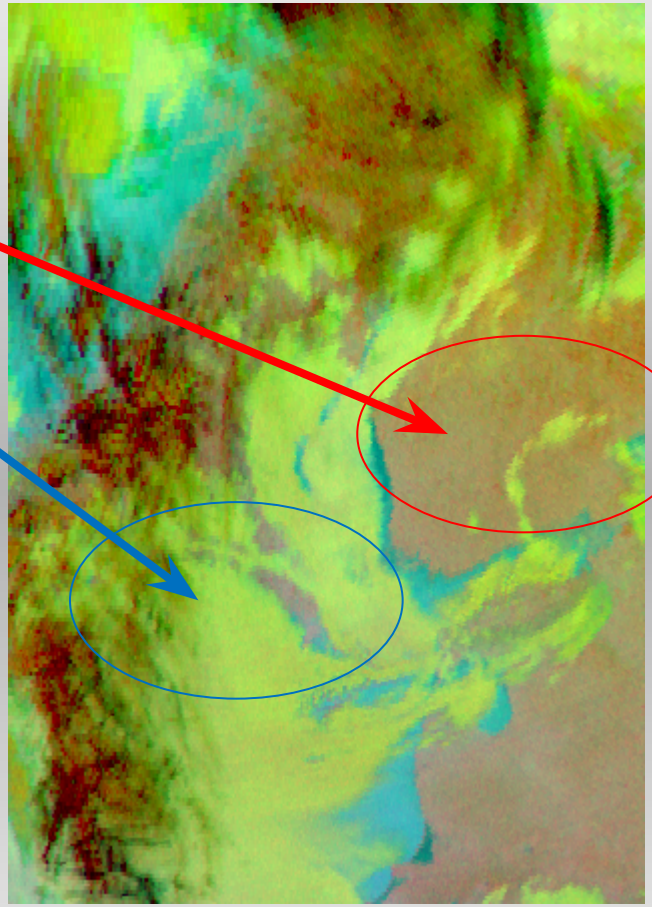
## *Clouds*

Overestimates fog under cold conditions.

Too little clouds when 0C > T2m > -10C

In general a slightly Overestimation of cirrus and fog.

On/off behaviour.



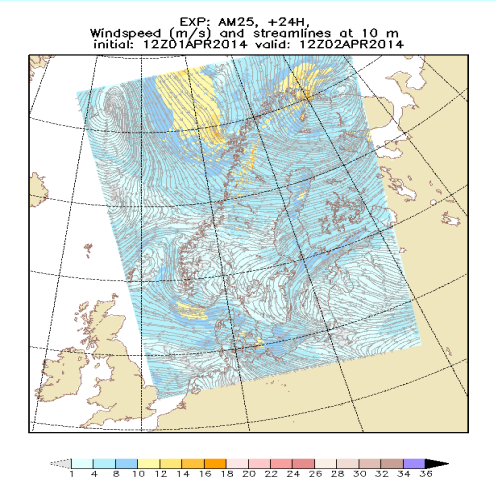
Satelite picture 22.January

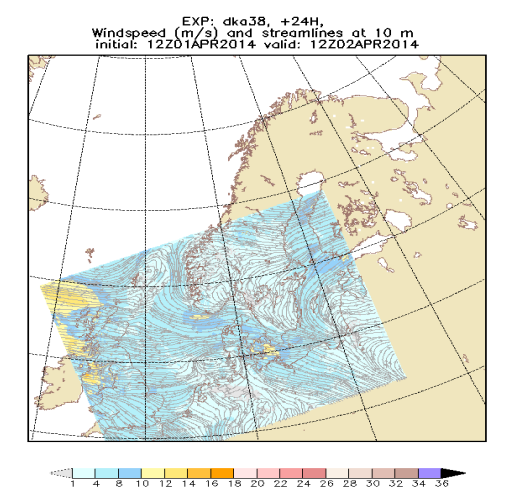
Norwegian Meteorological Institute

MetCoOp

SMHI

# RCR Archive and Monitoring




**A selected sets of near-real time operational data from RCR centers are archive at ECMWF ECFS and shared with HARMONIE community, for monitoring and research needs.**

- **Hourly forecast for selected parameters, every 6 h**
- **Minimum data needed for rerun/restart (obs, fgs, climate data...)**
- **logdata**

**Ec:/hirlam/harmonie/RCR/EXP/archive/YYYY/MM/DD/HH**

**Daily monitoring through the hirlam.org interface: Verification and assimilation https://hirlam.org/trac/wiki/dataportal**

# Timeline of one AROME-MetCoOp cycle on Norwegian HPC Vilje

Timelines for MetCoOp runs

Norwegian Meteorological Institute

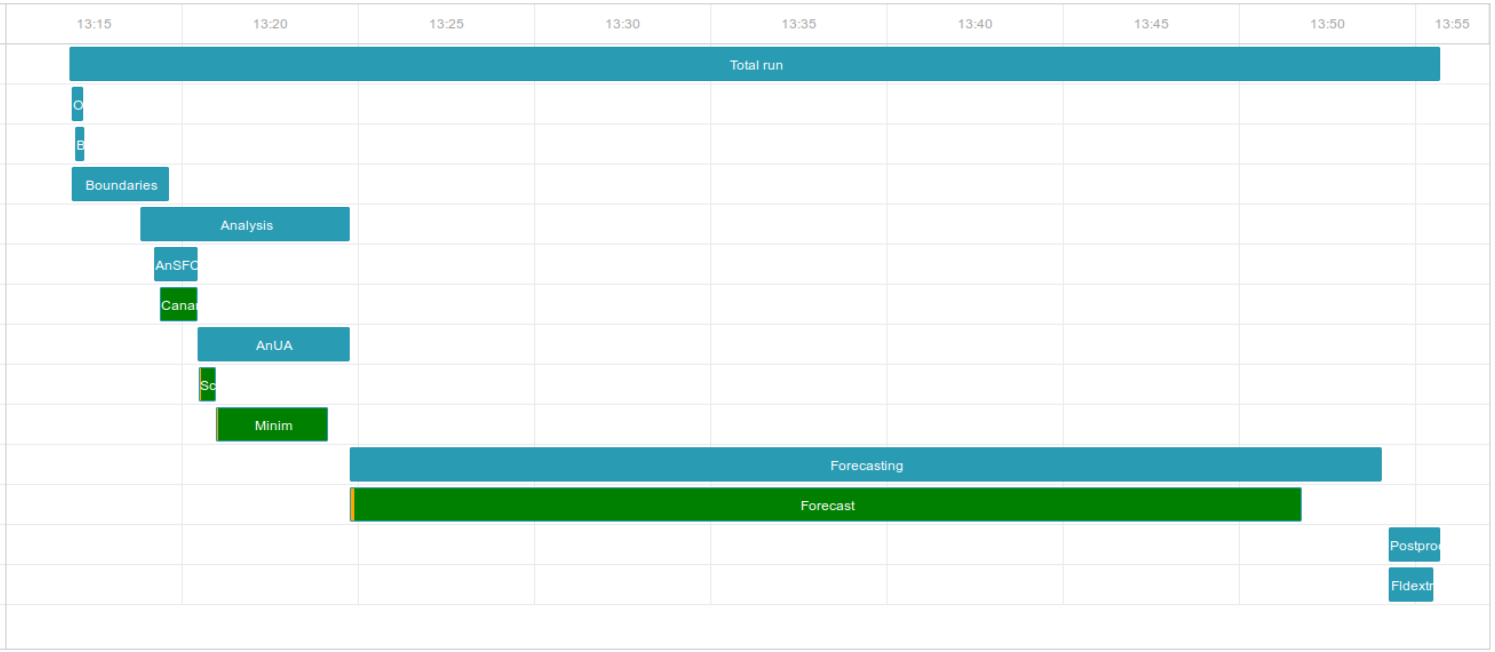
Model: AROME 2.5km main | Date: 2014-04-02 | Cycle: 12 | Show

SMHI

## Timeline for MetCoOp 12 UTC run

**Started 2014-04-02 13:16:48 UTC, ended 2014-04-02 13:56:40 UTC, status: COMPLETE**

| Task name | Start time | Duration |
|---|---|---|
| Total run | 13:16:48 | 39:52 |
| Observations | 13:16:51 | 0:20 |
| Bator | 13:16:56 | 0:15 |
| Boundaries | 13:16:51 | 2:45 |
| Analysis | 13:18:48 | 5:57 |
| AnSFC | 13:19:11 | 1:14 |
| Canari | 13:19:21 | 1:04 |
| AnUA | 13:20:25 | 4:20 |
| Screening | 13:20:27 | 0:30 |
| Minim | 13:20:57 | 3:10 |
| Forecasting | 13:24:45 | 29:18 |
| Forecast | 13:24:45 | 27:01 |
| Postprocessing | 13:54:14 | 2:25 |
| Fldextr | 13:54:14 | 1:58 |




Norwegian Meteorological Institute

MetCoOp

SMHI

# MetCoOp Monitoring Interface

## OBSERVATION USAGE MONITOR

Which ODB base to select from
- (•) ECMA
- ( ) ECMA_SFC
- ( ) CCMA

What to plot? (NB! maps are "demanding")

FG dep + Bias correction (map

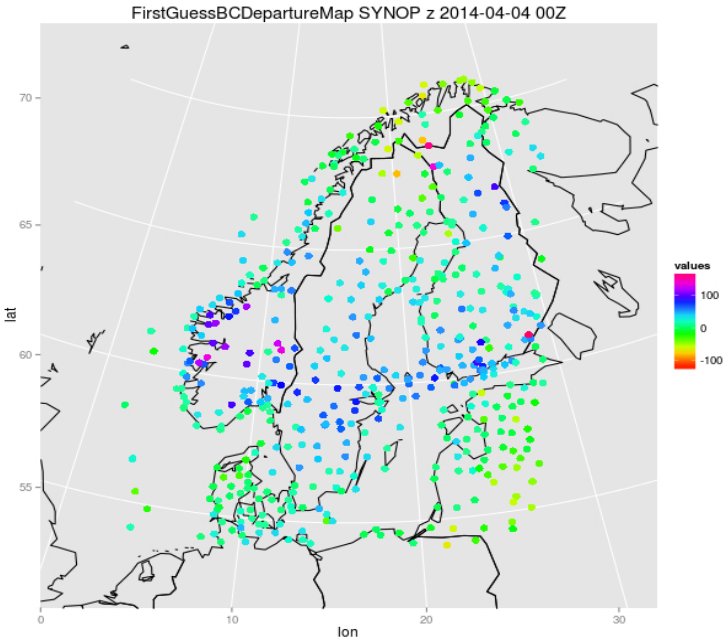
SYNOP
- [ ] u10m
- [ ] v10m
- [ ] t2m
- [ ] rh2m
- [x] z
- [ ] snow

SHIP
- [ ] u10m
- [ ] v10m
- [ ] t2m
- [ ] rh2m
- [ ] z

AIRCRAFT
- [ ] u
- [ ] v
- [ ] t

TEMP
- [ ] u
- [ ] v
- [ ] t
- [ ] q

AMSUA

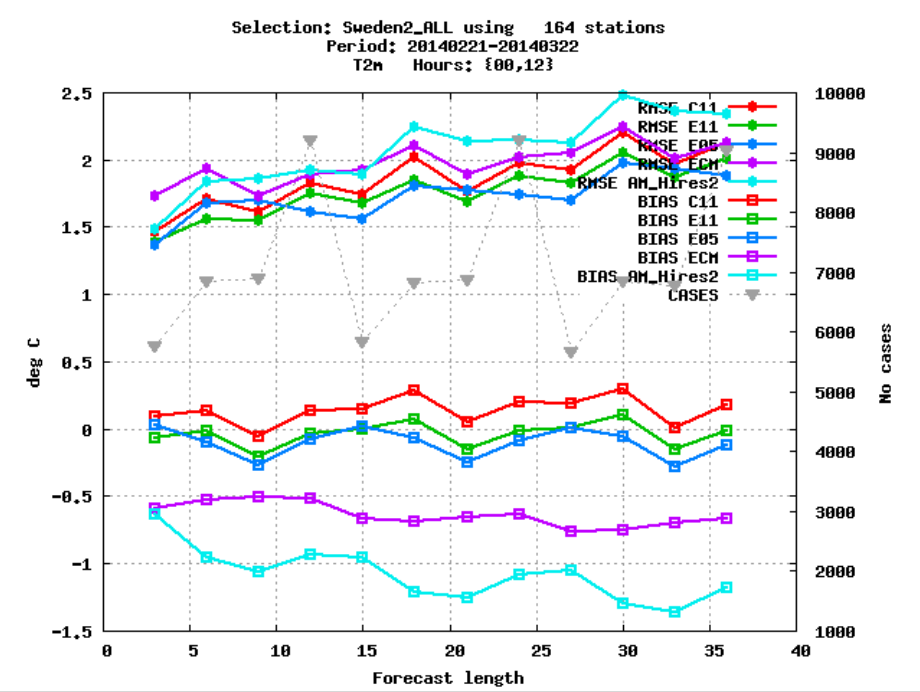



**hirlam.org:3838/obsmon**

# Summary and Outlook

- HARMONIE RCR is a vehicle to benefit HIRLAM programme in multiple ways
  - secure reference HARMONIE to suite operational needs
  - shorten the gap between reference HARMONIE and operational suites
  - promote pre-rlease adaptation, testing and evaluation
  - enhance system harmonisation where possible
  - obvious platform for quality benchmarking, data archive, joint monitoring, model intercomparson
- Characterics with HARMONIE RCR
  - arrangement per cycle, in rotation
  - multiple RCR centres
  - certain detachment between reference HARMONIE and RCR
- Invitation for RCR center for Harmonie-40h1 in second half of 2014
  - Radar, GPS, flake, Surfex 7.3?

# AROME-MetCoOp




## *Cold bias in winter*

AROME-MetCoOp (ligth blue), ECMWF (violet), 3 different SMHI HIRLAM model set-ups (red, green and blue).

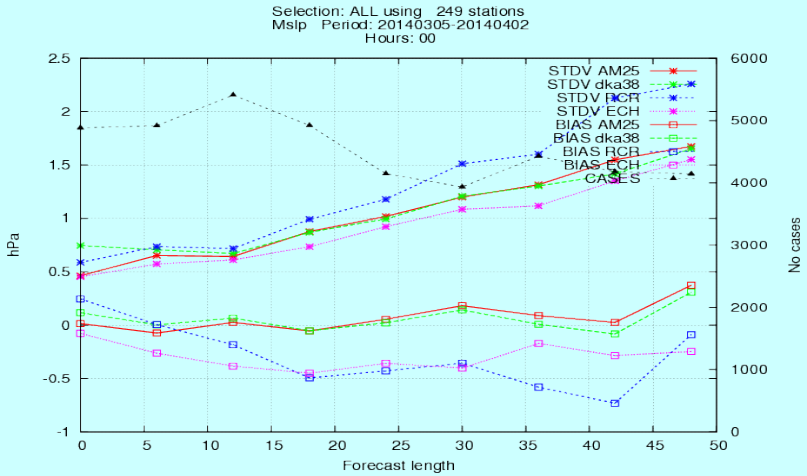
*The cold bias needs further investigation. See separate poster «Surface modelling - some Nordic challenges"*

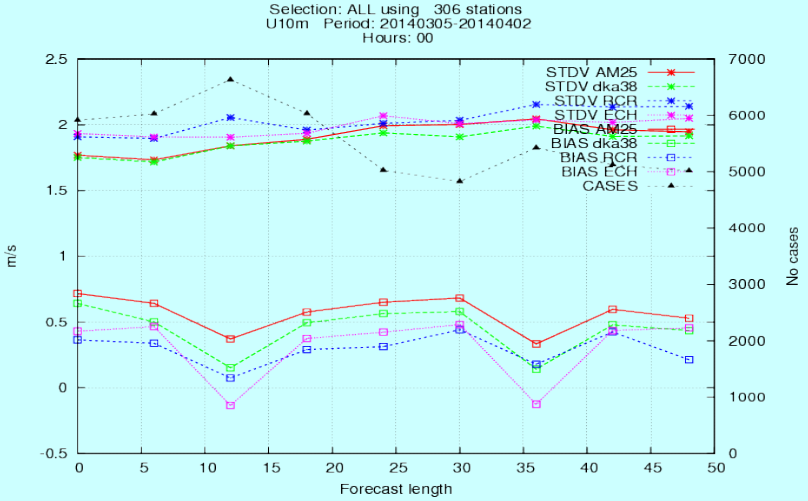
Norwegian Meteorological Institute

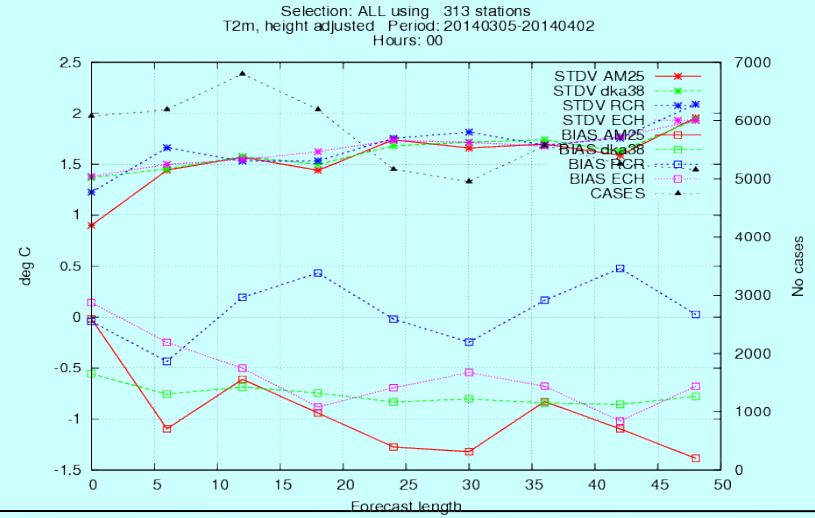
MetCoOp

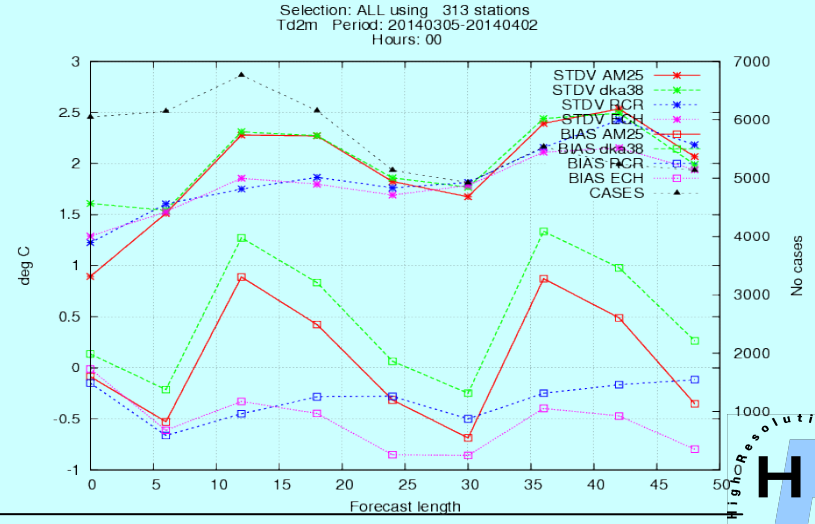
SMHI

# HARMONIE RCR Quality Trend (March 2014->)

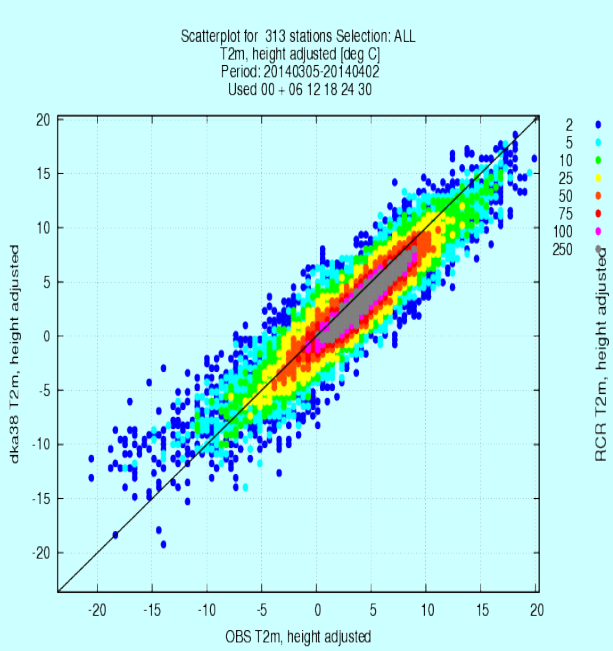


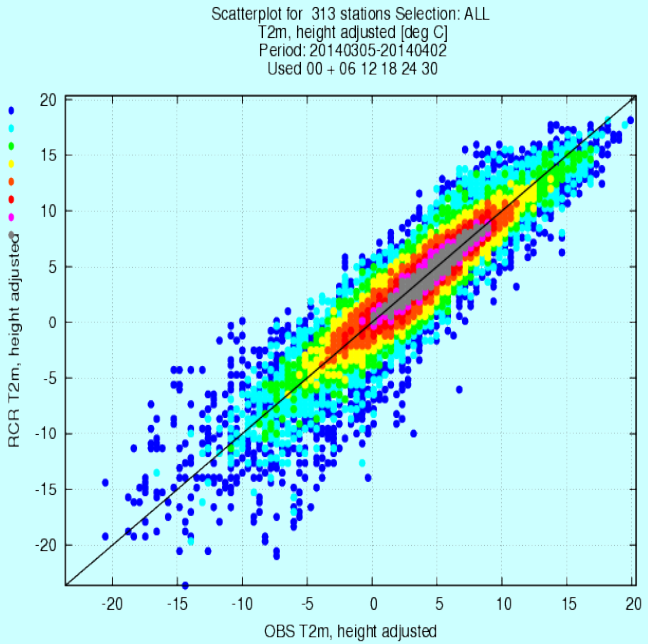



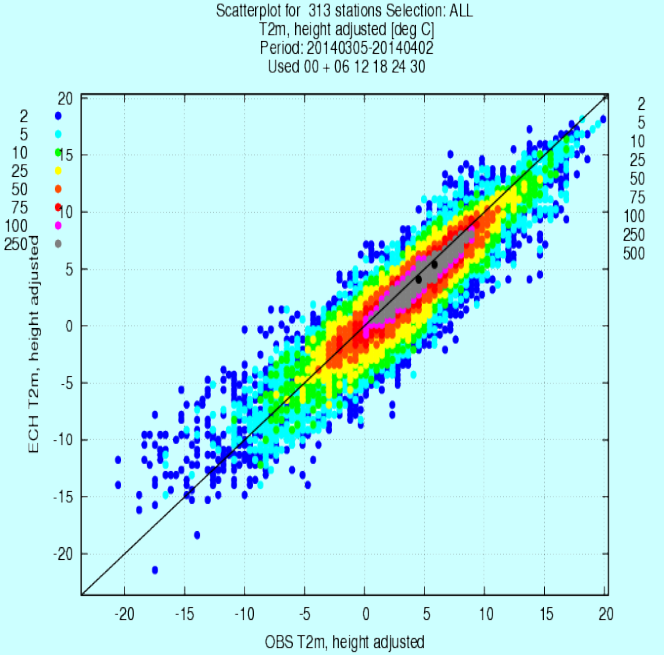




High Resolution Hirlam Limited Area Model


Scatterplot for 313 stations Selection: ALL
T2m, height adjusted [deg C]
Period: 20140305-20140402
Used 00 + 06 12 18 24 30
dka38 T2m, height adjusted
OBS T2m, height adjusted
2
5
10
25
50
75
100
250


Scatterplot for 313 stations Selection: ALL
T2m, height adjusted [deg C]
Period: 20140305-20140402
Used 00 + 06 12 18 24 30
RCR T2m, height adjusted
OBS T2m, height adjusted


Scatterplot for 313 stations Selection: ALL
T2m, height adjusted [deg C]
Period: 20140305-20140402
Used 00 + 06 12 18 24 30
ECH T2m, height adjusted
OBS T2m, height adjusted
2
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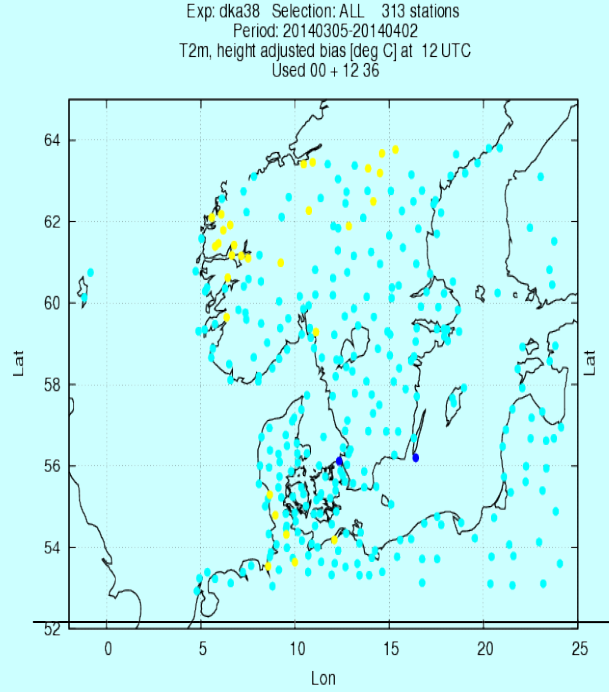
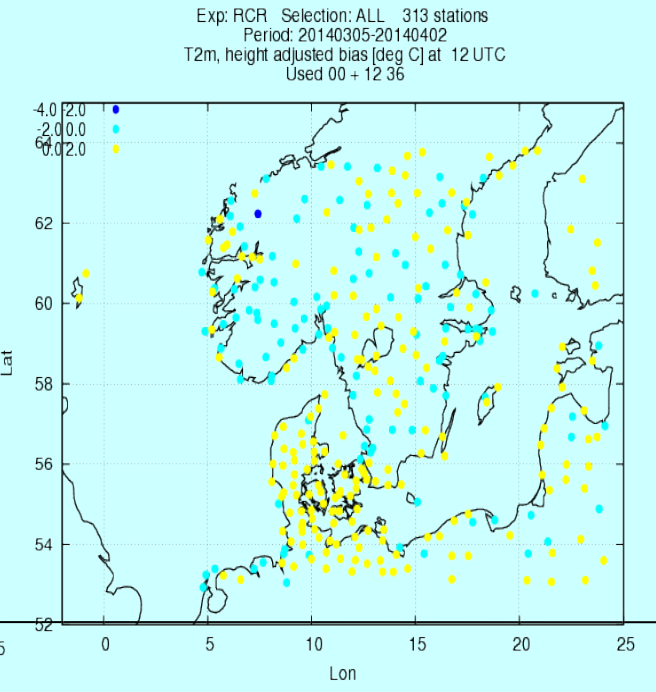

Exp: dka38 Selection: ALL 313 stations
Period: 20140305-20140402
T2m, height adjusted bias [deg C] at 12 UTC
Used 00 + 12 36
Lat
Lon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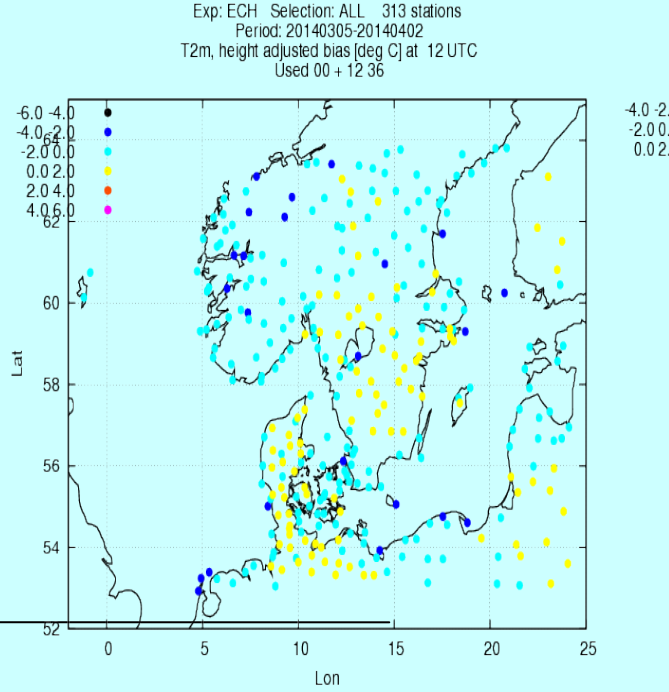
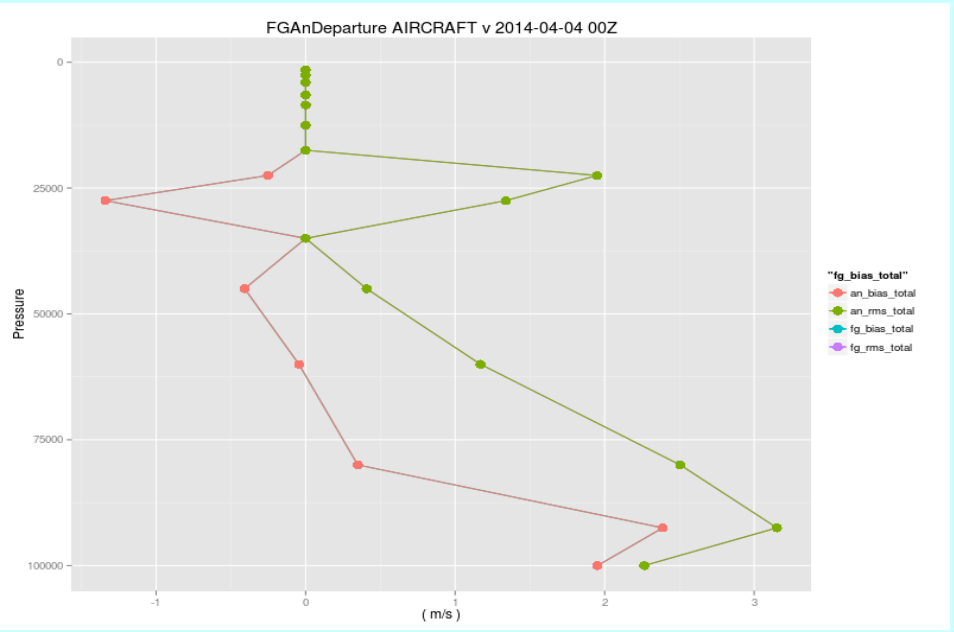
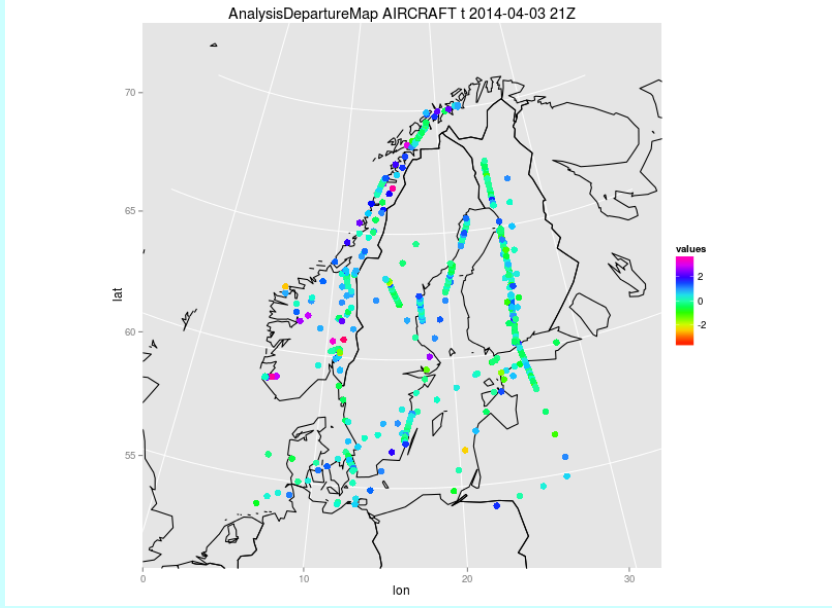
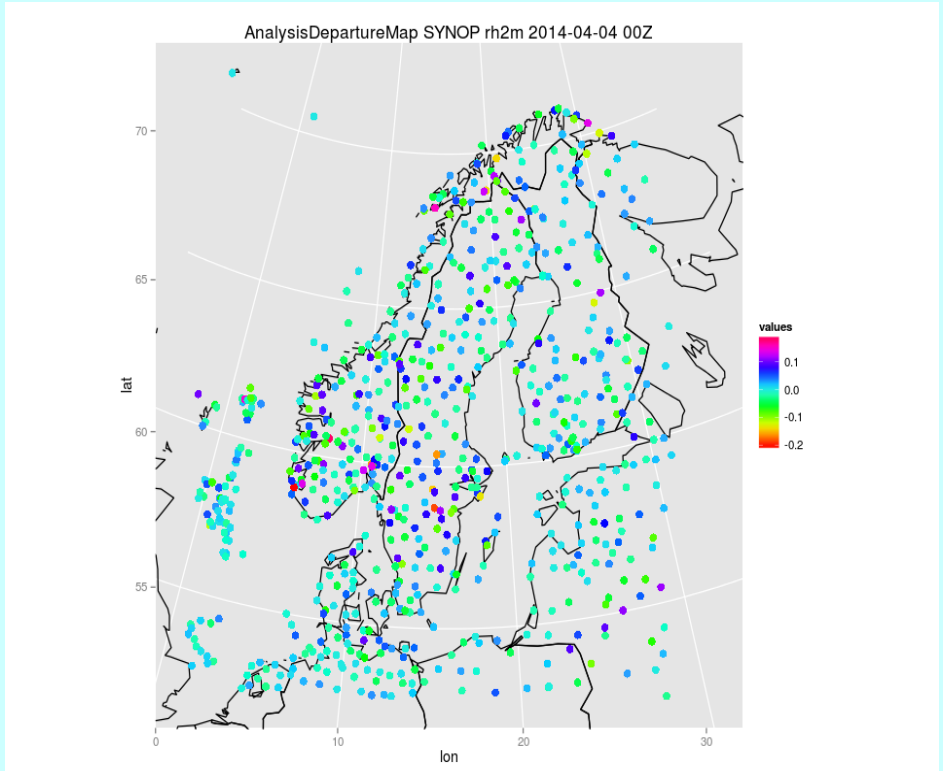
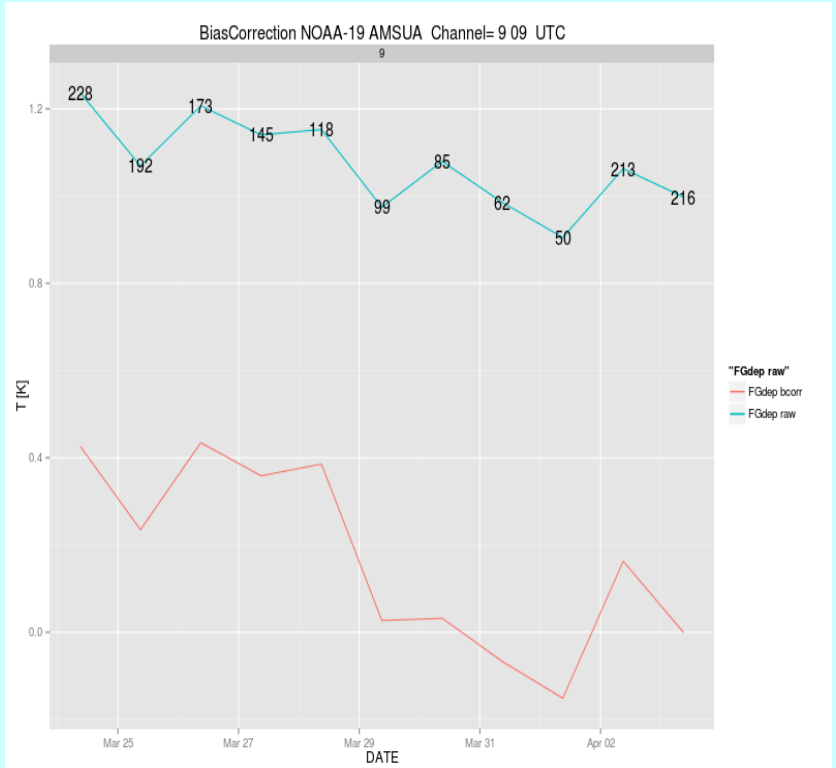
Used 00 + 12 36
Lat
Lon


Exp: ECH Selection: ALL 313 stations
Period: 20140305-20140402
T2m, height adjusted bias [deg C] at 12 UTC
Used 00 + 12 36
Lat
Lon


FGAnDeparture AIRCRAFT v 2014-04-04 00Z
Pressure
( m/s )
"fg_bias_total"
an_bias_total
an_rms_total
fg_bias_total
fg_rms_total


AnalysisDepartureMap AIRCRAFT t 2014-04-03 21Z
lat
lon
values


AnalysisDepartureMap SYNOP rh2m 2014-04-04 00Z
lat
lon
values


BiasCorrection NOAA-19 AMSUA Channel= 9 09 UTC
T [K]
DATE
"FGdep raw"
FGdep bcorr
FGdep raw