Recent news in HIRLAM verification and monitoring

Xiaohua Yang, also reporting works by
Ulf Andrae, Karl-Ivar Ivarsson, Bent H. Sass, Carl Fortelius, et al

Outlines

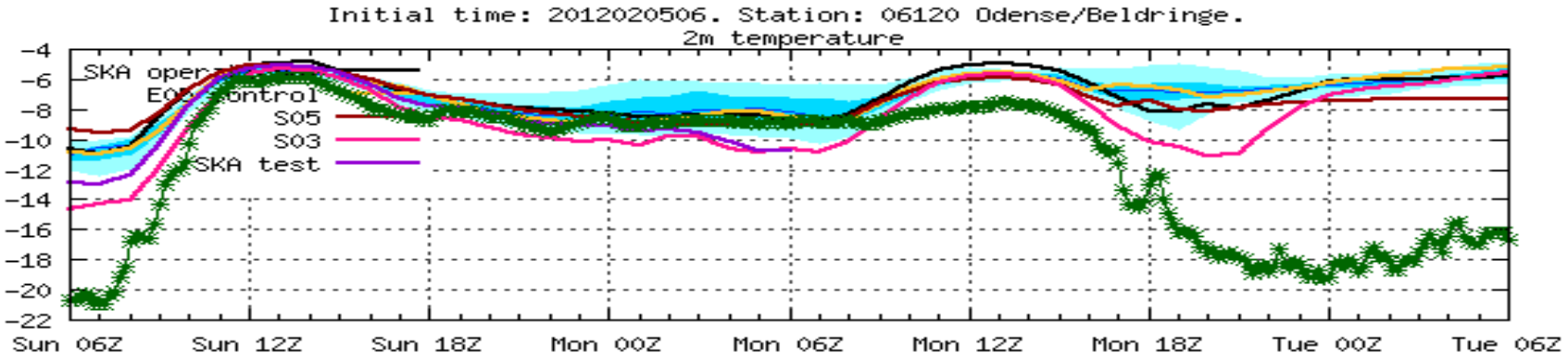
What's new in the HIRLAM observation verification

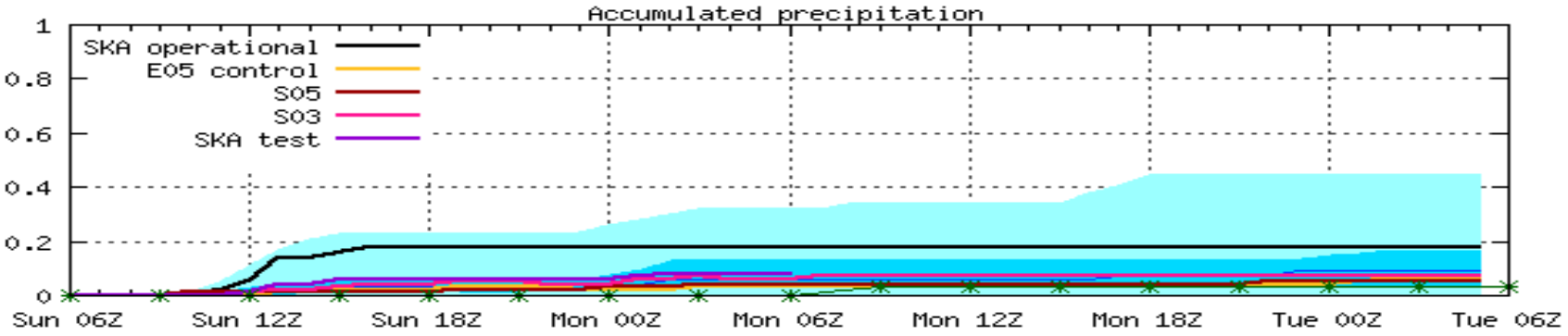
- Stratified verification
  - Conditional verification
- Compare comparables!
  - Height correction of surface temperature
  - Extraction of surface wind
  - Use of nearest grid point for prec, cloud, gust etc.
- New convention for local observation station-id
- New flexibility to add additional parameters
- Spatial verification and upscaling
  - FBSS, SWS

New features in operational HIRLAM/HARMONIE monitoring

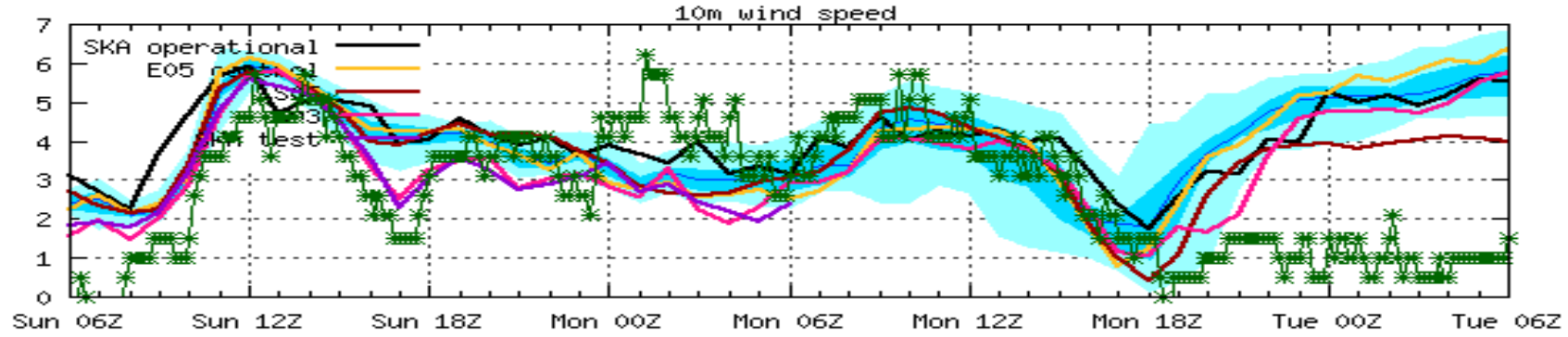
- Hirlam data portal
  - Additional skill scores, significance scores
  - Harmonie forecast chart, DA and forecast diagnosis, verification
  - Expansion of participating service, model and data category
- Monthly statistics of mast profile verification
- Hirlam on-duty team

Cold Feb 5, Feb 7 morning in Odense

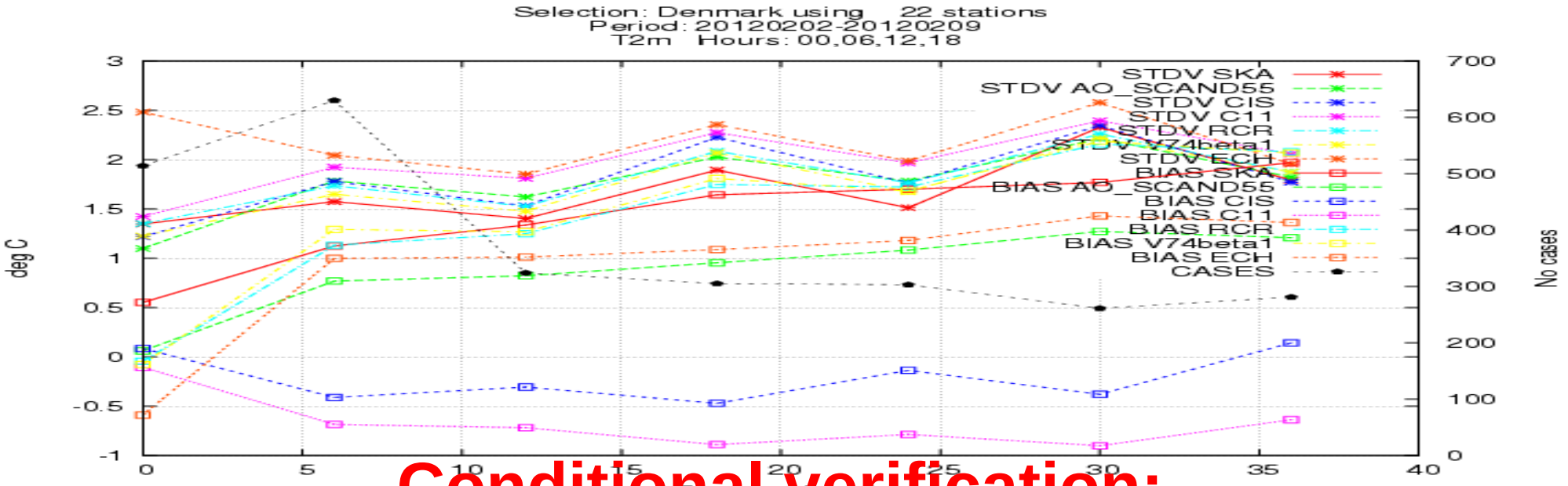




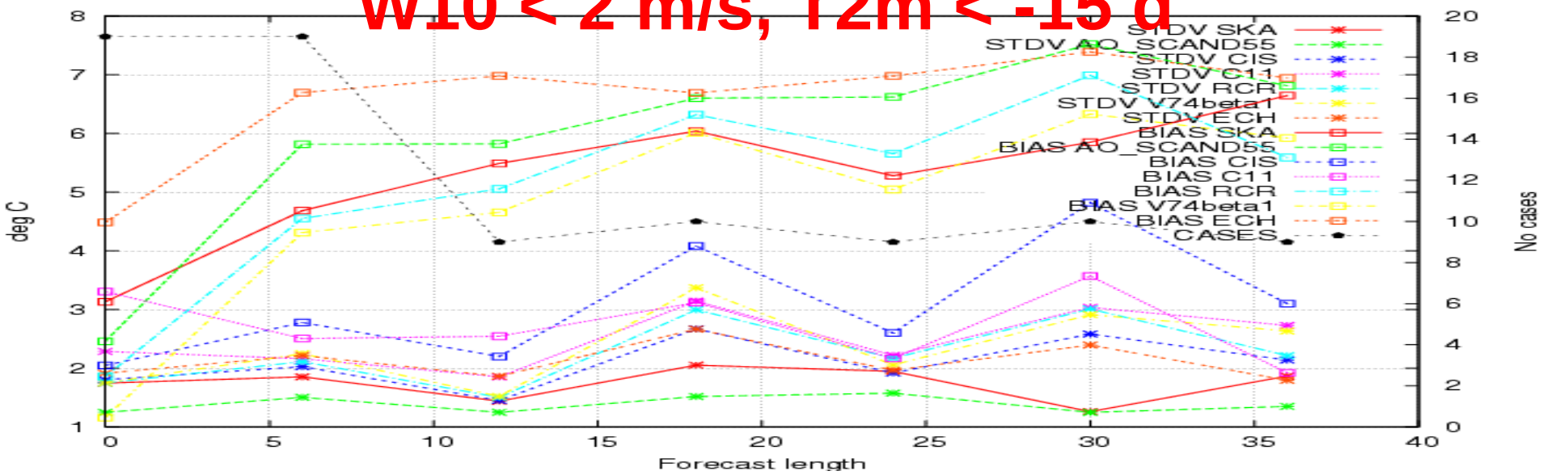
Updated: 07/02-2012 13:13 UTC

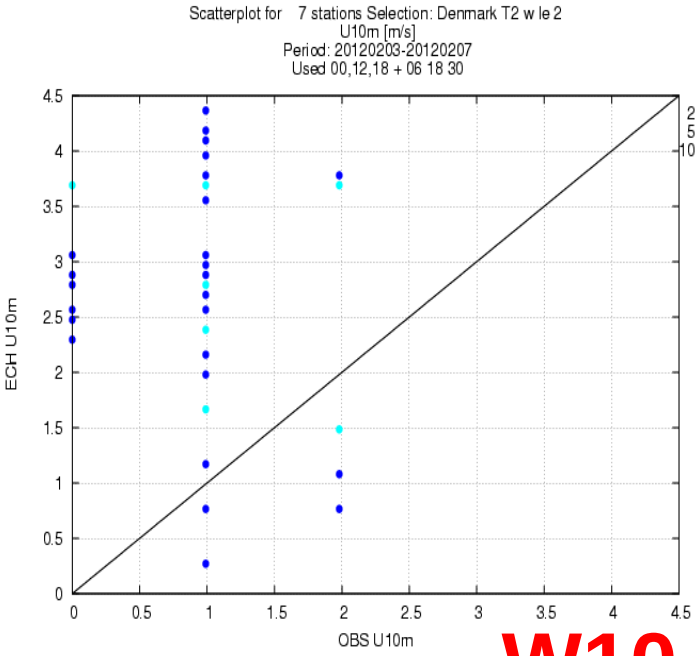


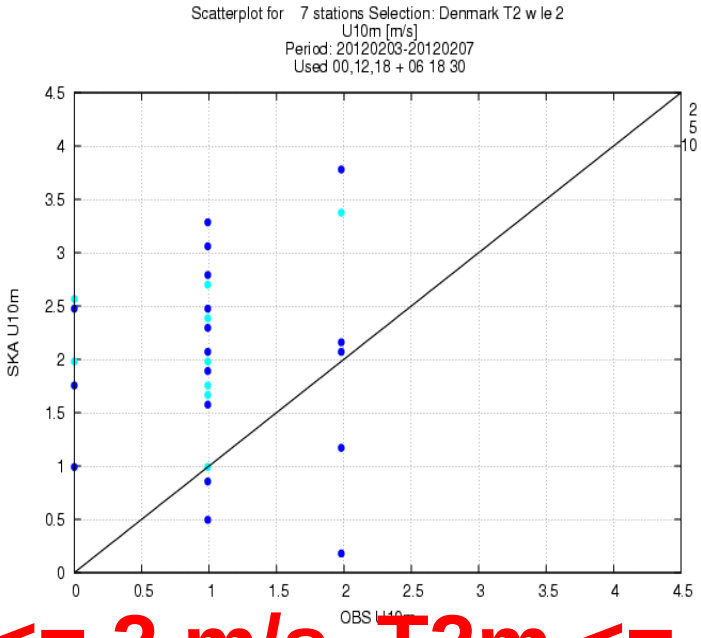
T2m verification

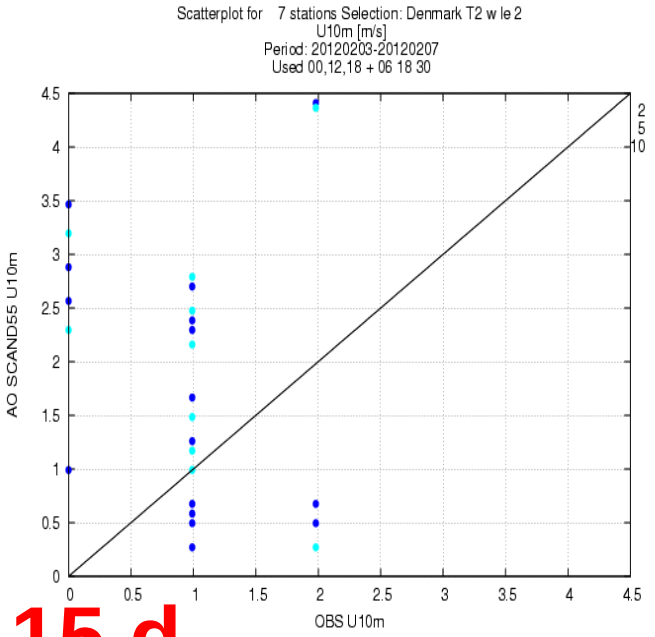


Conditional verification: W10 < 2 m/s, T2m < -15 d

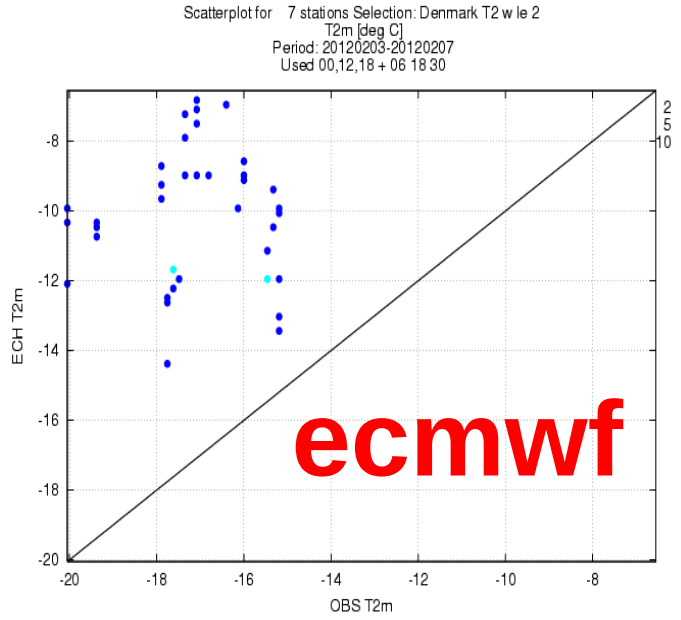




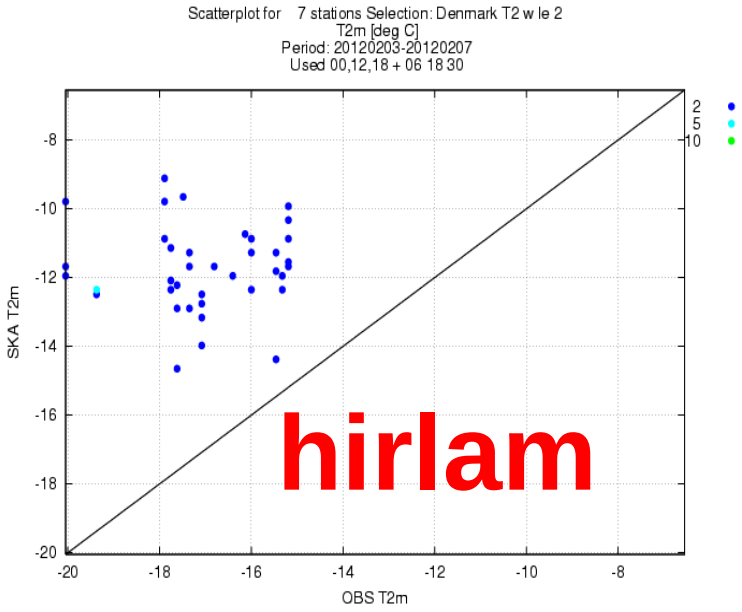




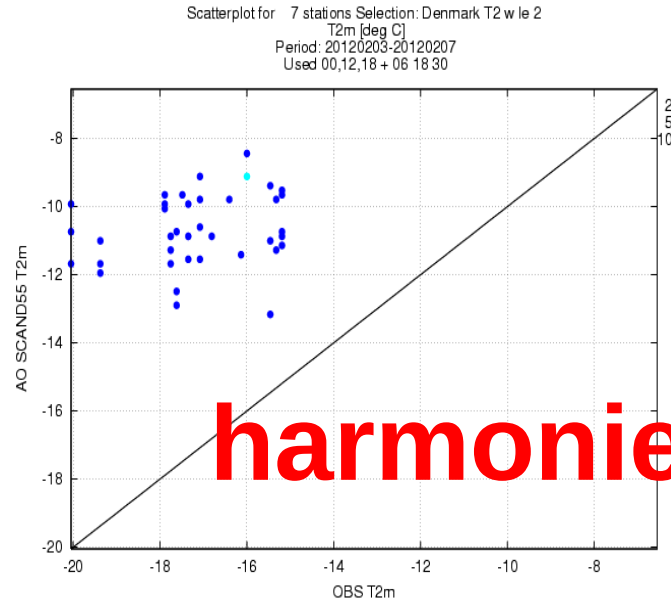
W10 <= 2 m/s, T2m <= -15 d



ecmwf



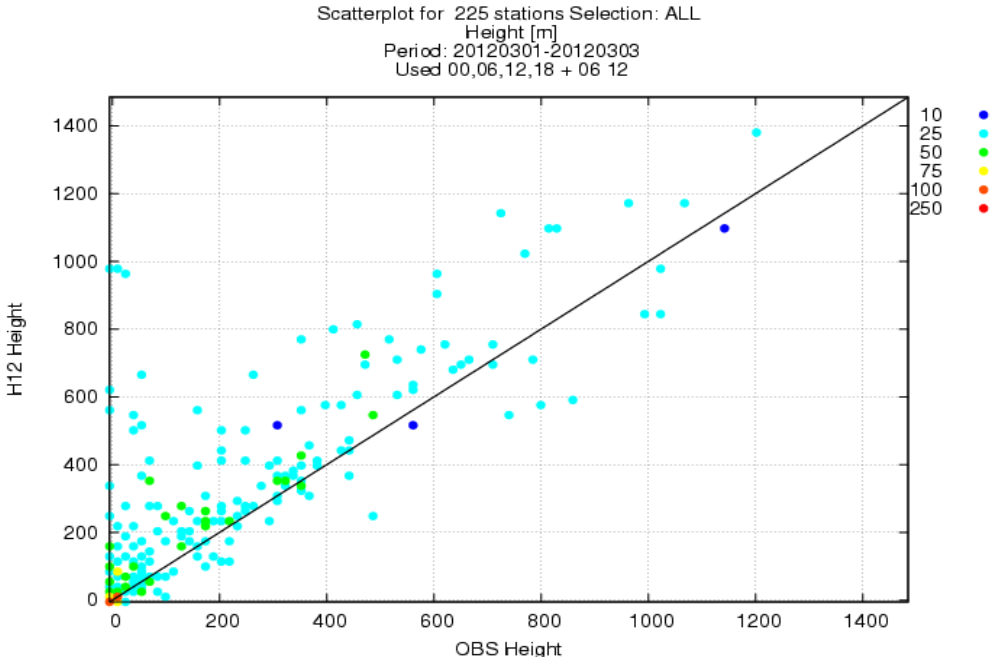
hirlam

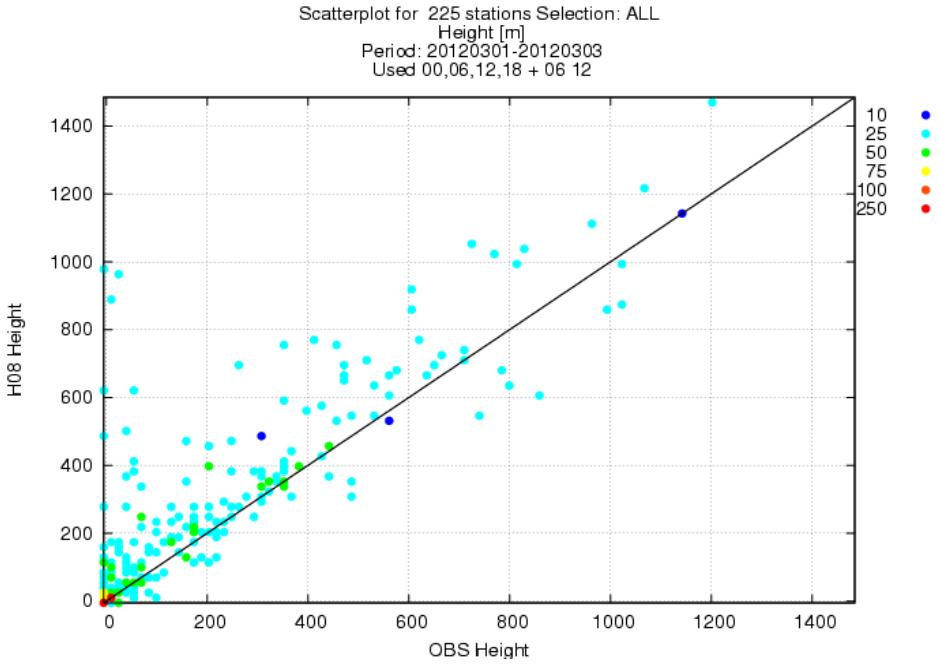


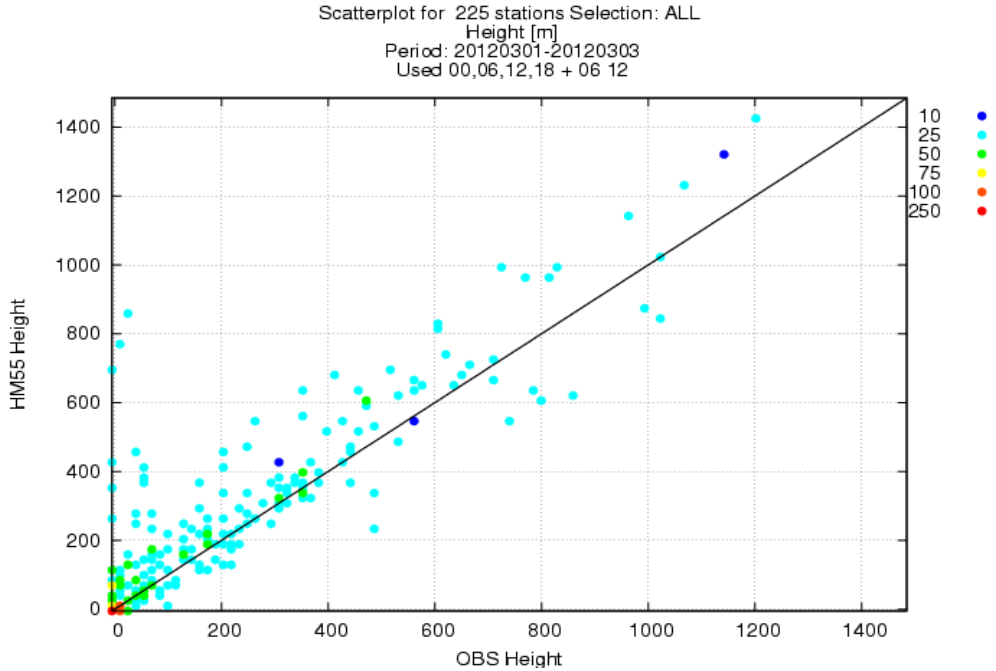
harmonie

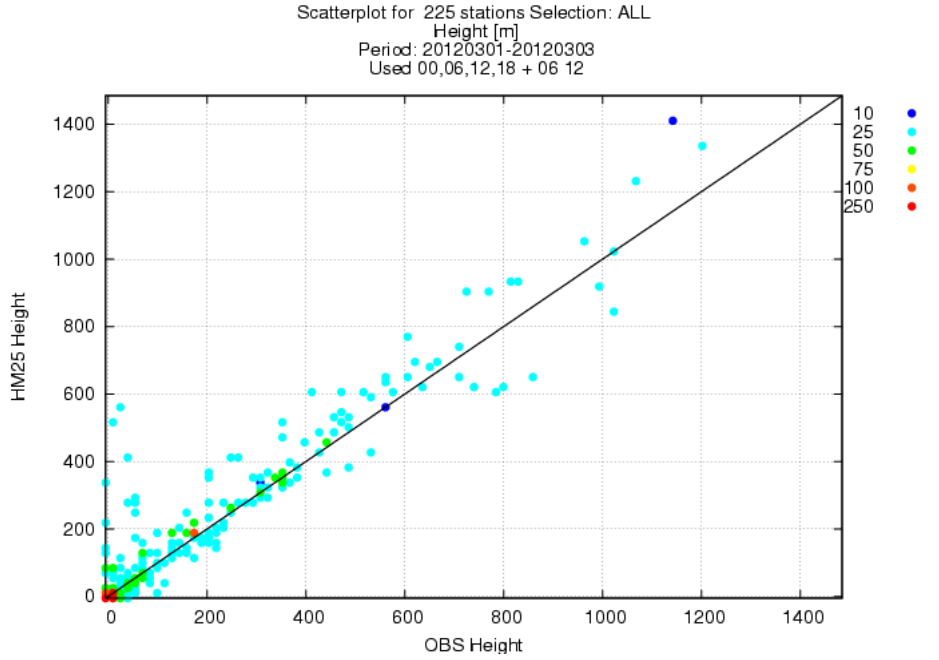
Conclusion: most extreme T2m conditions here were associated with clear and calm conditions. Models in general fail to predict calm conditions.

Model vs station heights: Norway







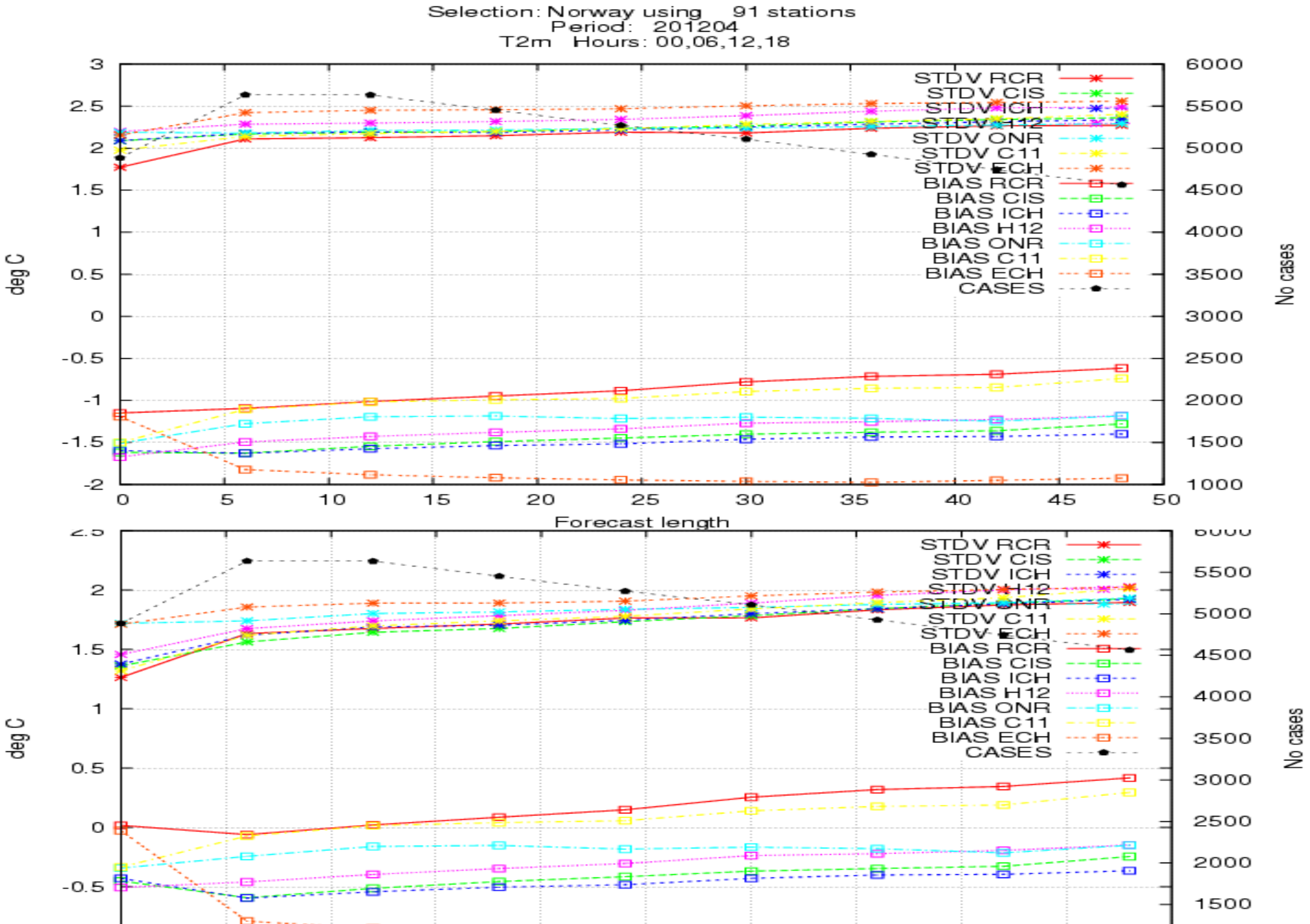


Height correction of T2m

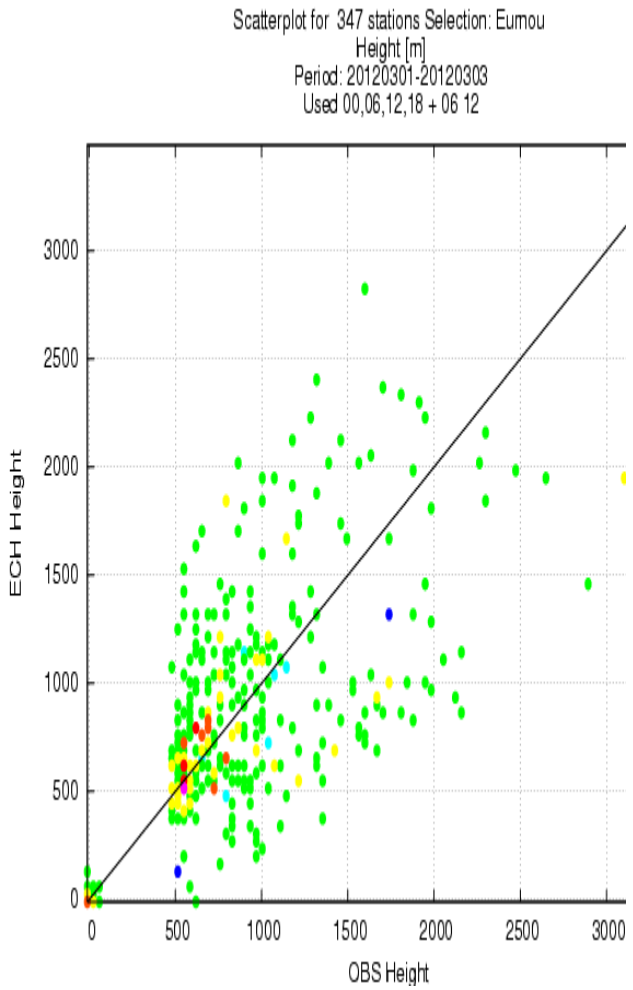
Observation sites in hilly area (Norway, …) often lie in a valley

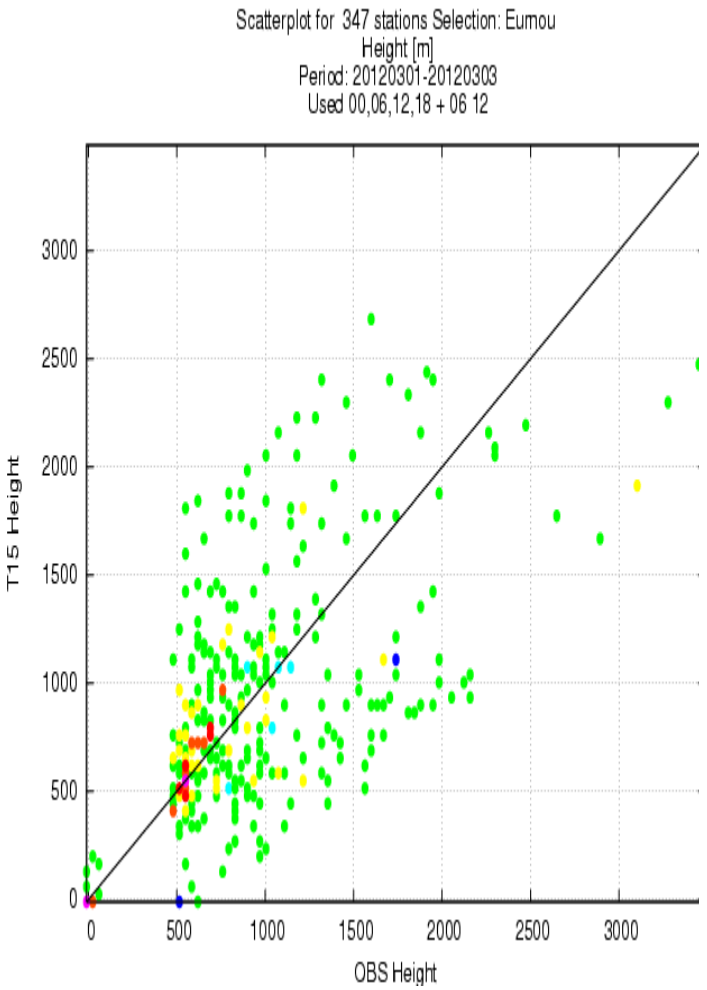
- Model heights > observation heights
  - ECMWF/T15: + 165m (norway)
  - H12: +120 m (norway), +180m (south norway)
  - H08: +150 m (south norway)
  - Alaro 5.5: +120 m (south norway)
  - Arome 2.5: + 80 m (south norway)
- Accordingly, post-processed model values of T2m interpolated to station position suffers systematic bias due to height difference
- HIRLAM observation verification now provides optional correction using constant lapse rate

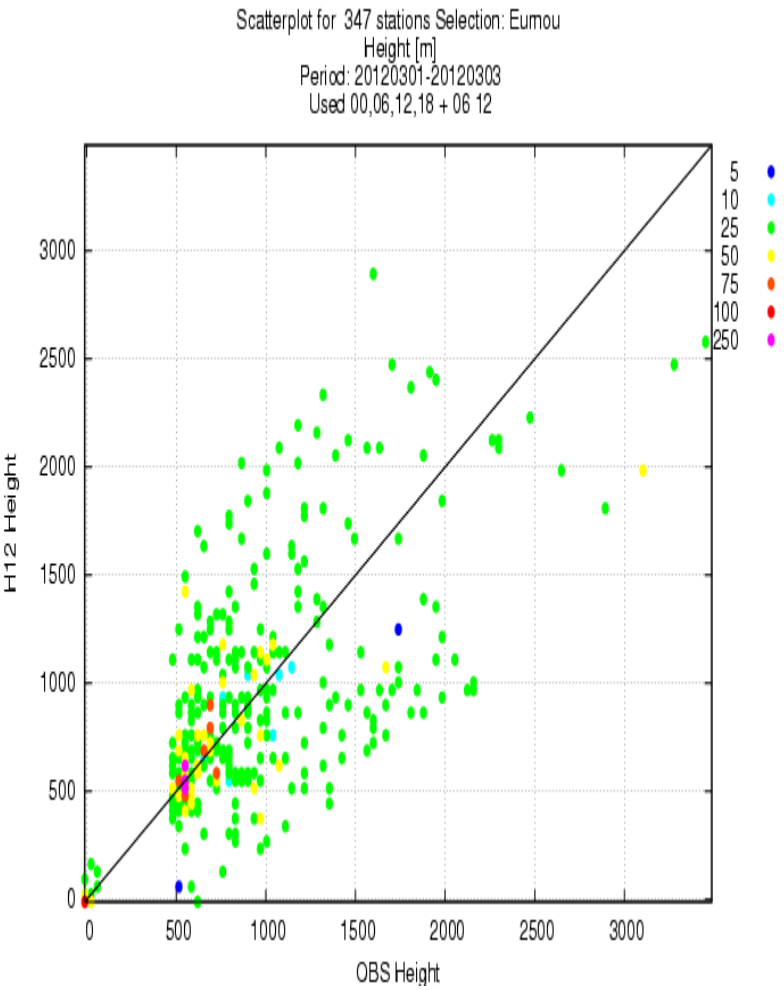
Observation verification



However, such is not generally true for European mountains...







ecmwf **dmi T15** **met.no H12**

Verification of surface wind: With and without forest fractions?

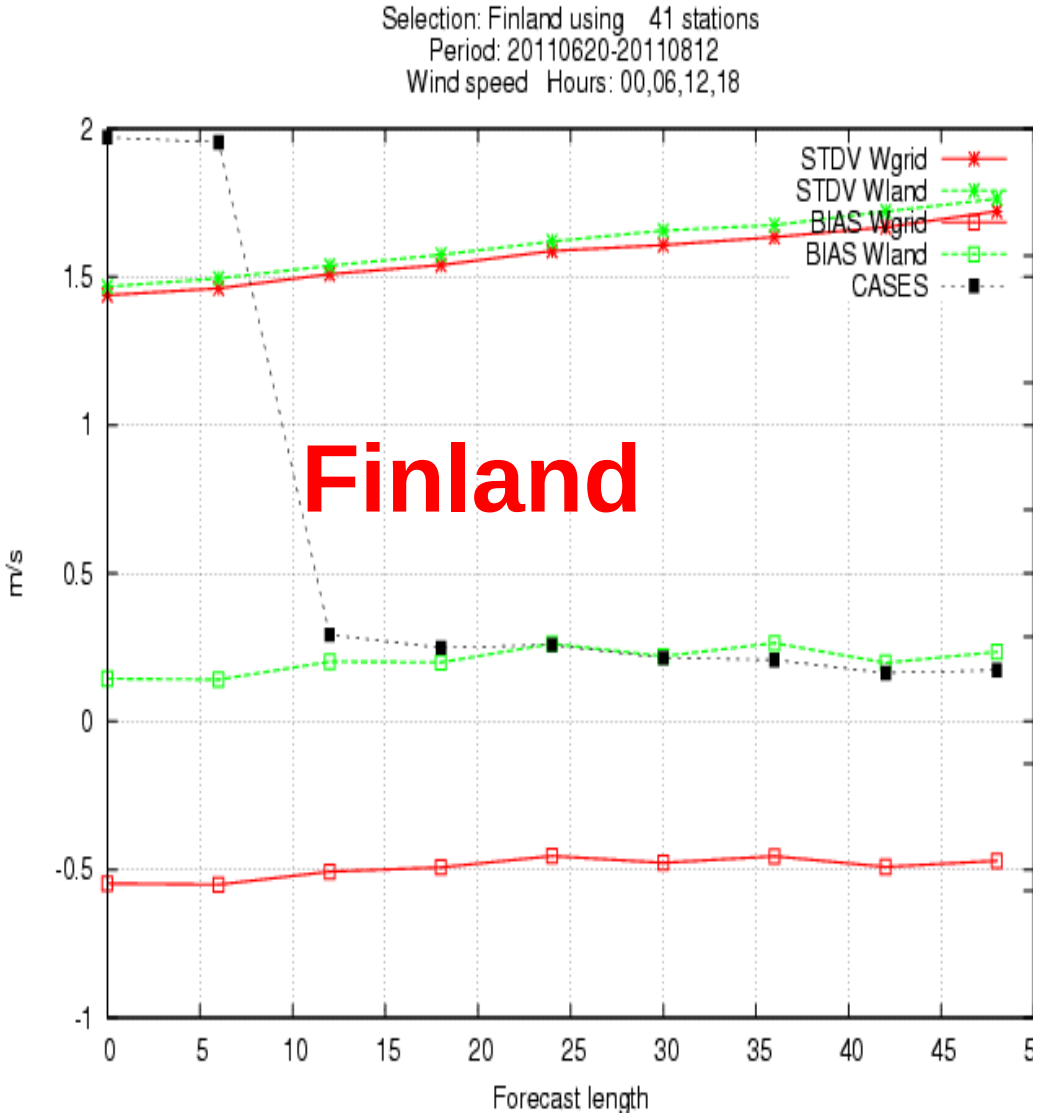
Up to now HIRLAM obs verification for surface T/RH uses weighted model average from open land tiles (non-water/ice/forest)

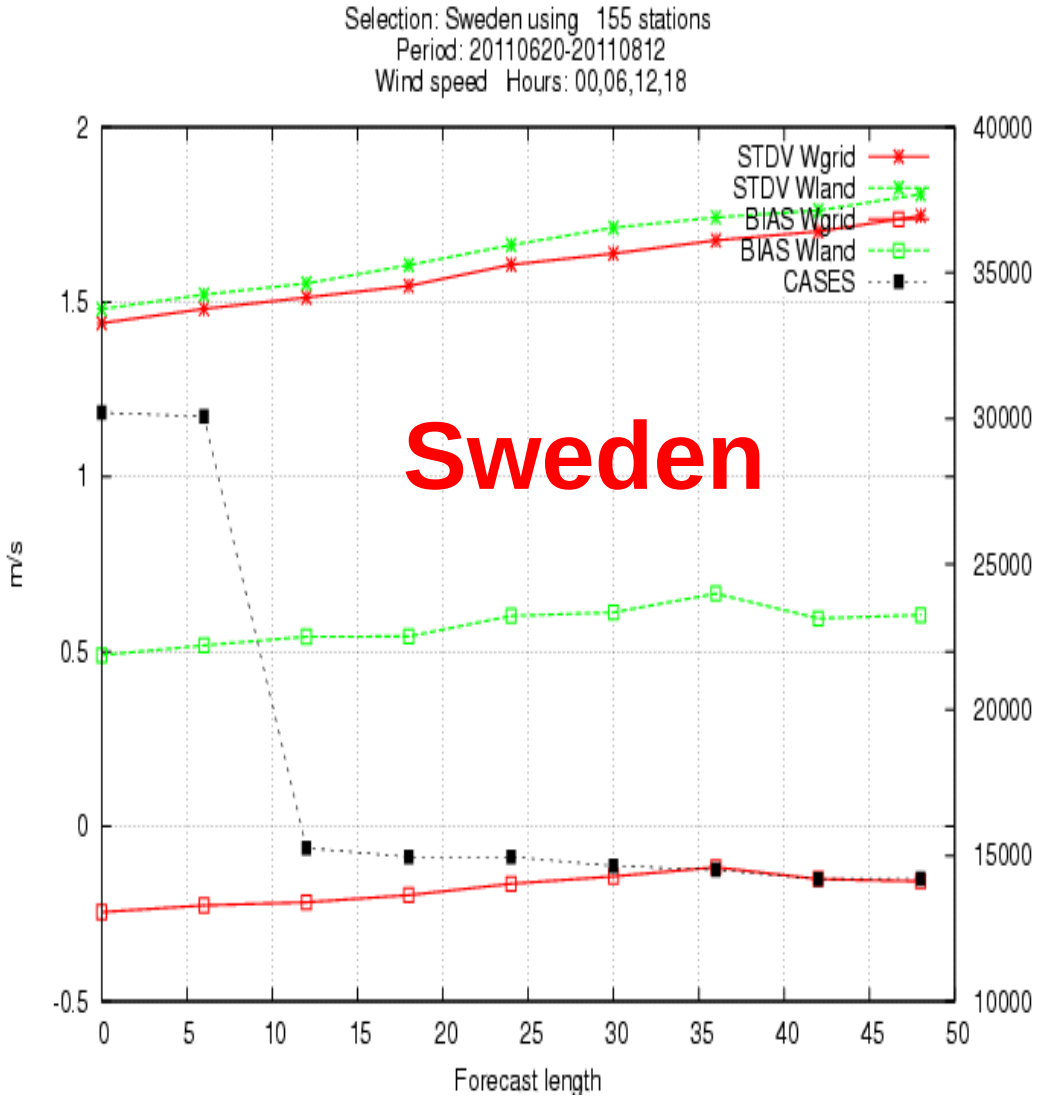
for other parameters (MSLP, W10m), all-tile weighted sum have been used

However, no surface measurement is done within forest...

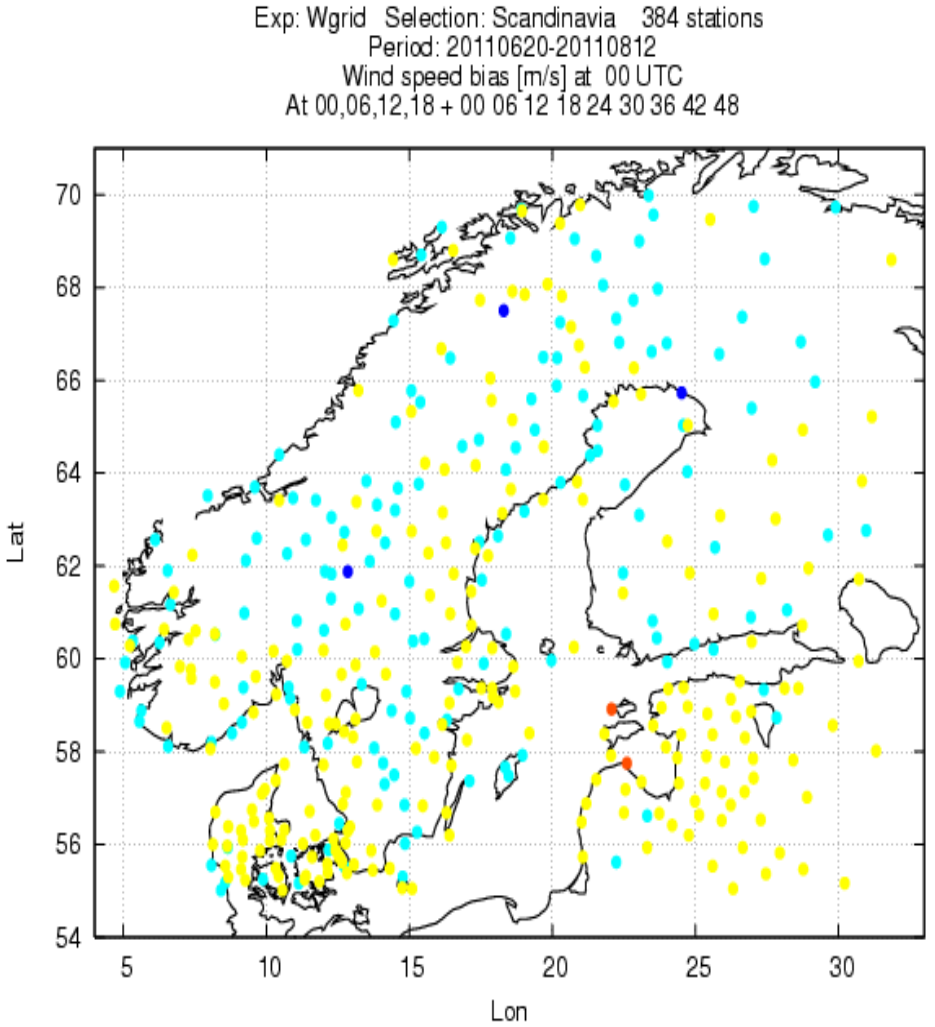
Hirlam RCR

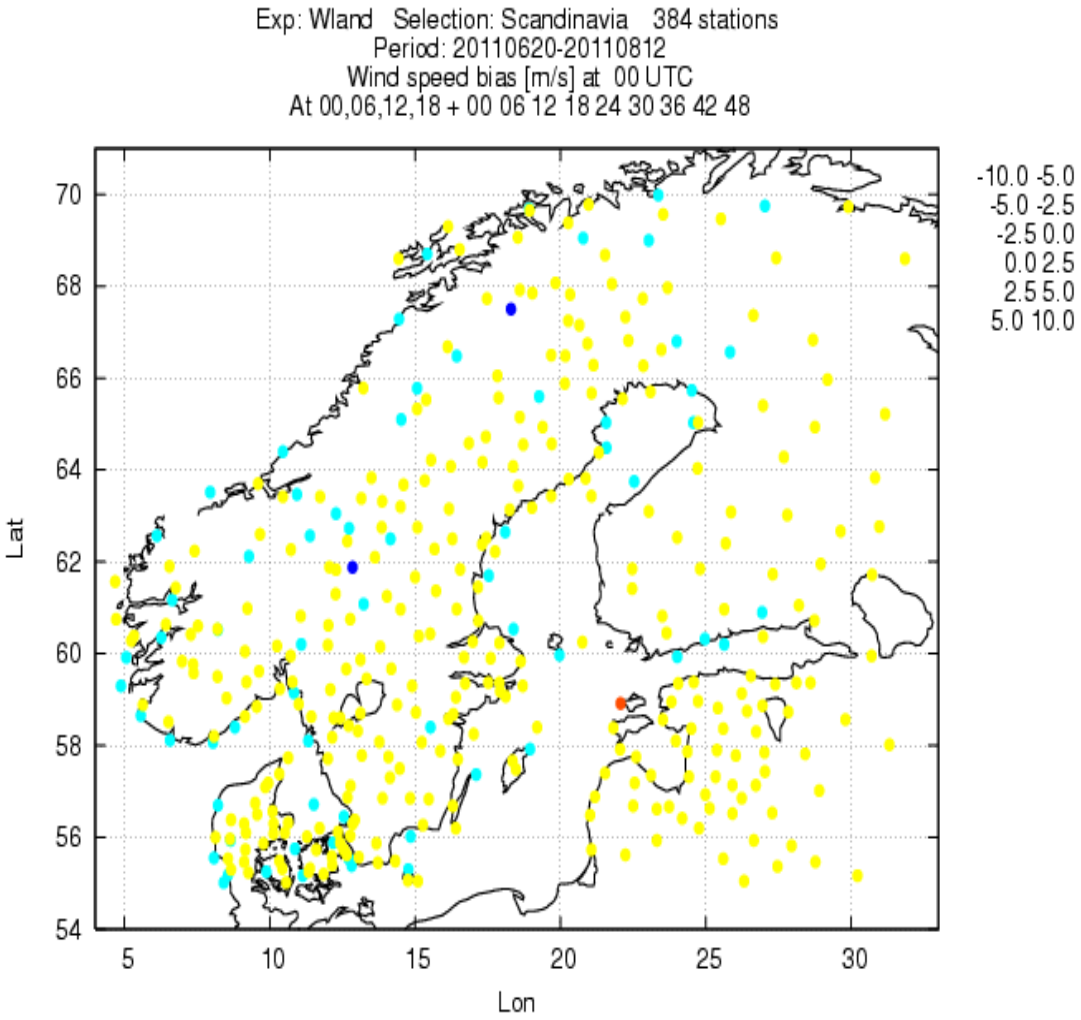
Wind verification, average





Wind verification over forest-dominant area



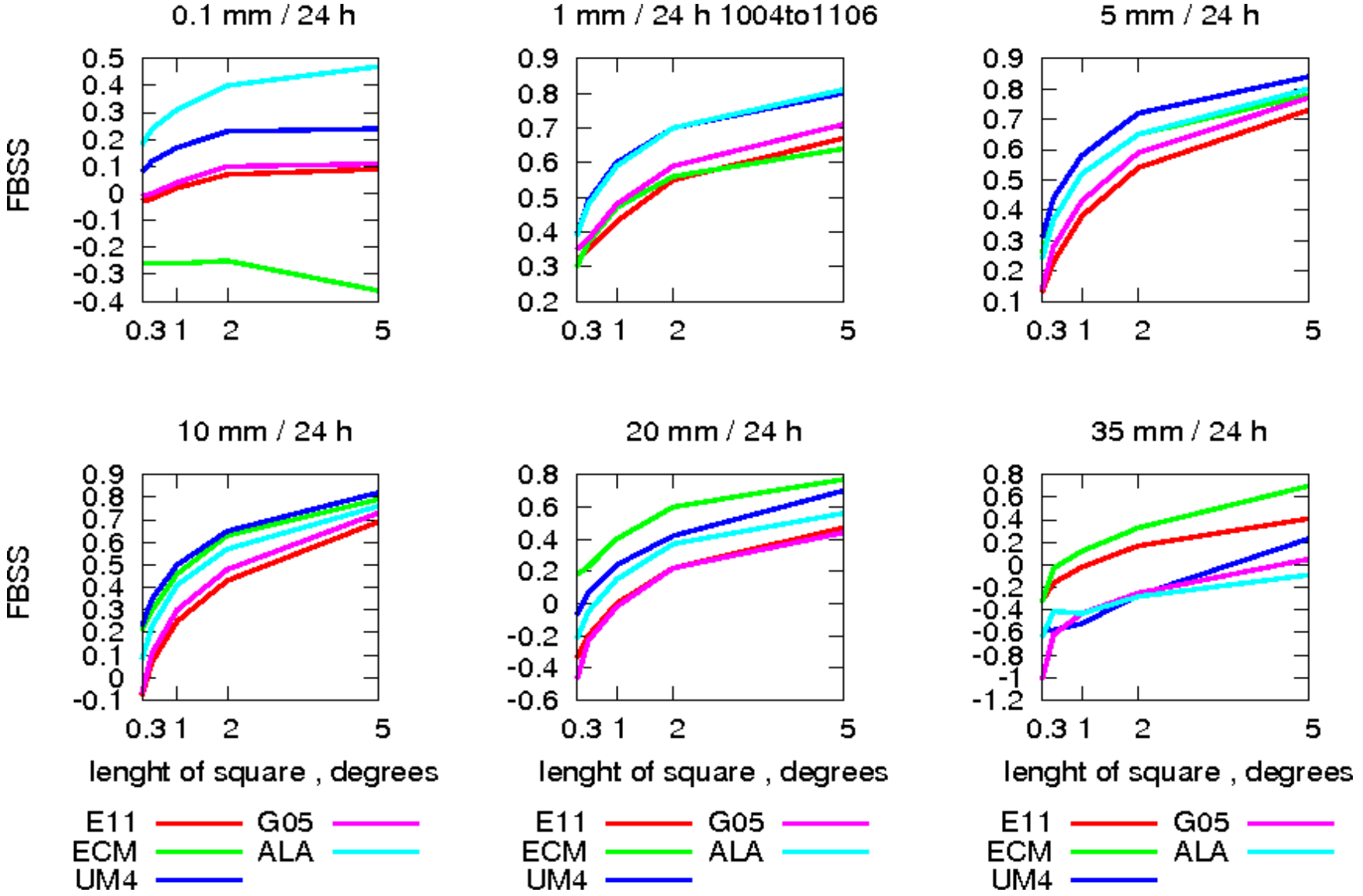


Conclusion: model extracted surface wind shall only be computed from non-forest land tiles.

Fractions Brier skill Score (FBSS)
(K-I Ivarsson)

- Swedish gauge data, climatological, 24h, ~30 km.
  - fewer obs than radar, larger reliability error
  - Still more reliable!
- FBSS: detect information on sub-grid scale variation of a forecast by comparing the mean values of forecasts and observations for different sizes of areas.
- ECMWF, HIRLAM, UM, HARMONIE-ALARO, multi-year (earliest data from 2006)

Results (April 2010 to June 2011. Minimum 4 values per square, reference forecast = sample clim.) E11: Hirlam 11km,G05: Hirlam 5.5km,ECM=ECMWF,ALA= Alaro 5.5 km, UM4= Unified model 4km



Karl-Ivar's early Christmas 2011 wish : Reliable radar data to use

SWS (B. Sass, 2011): “severe weather score” --
A performance measure on relative skills between two models on correct forecasts for defined events, with upscaling principles:

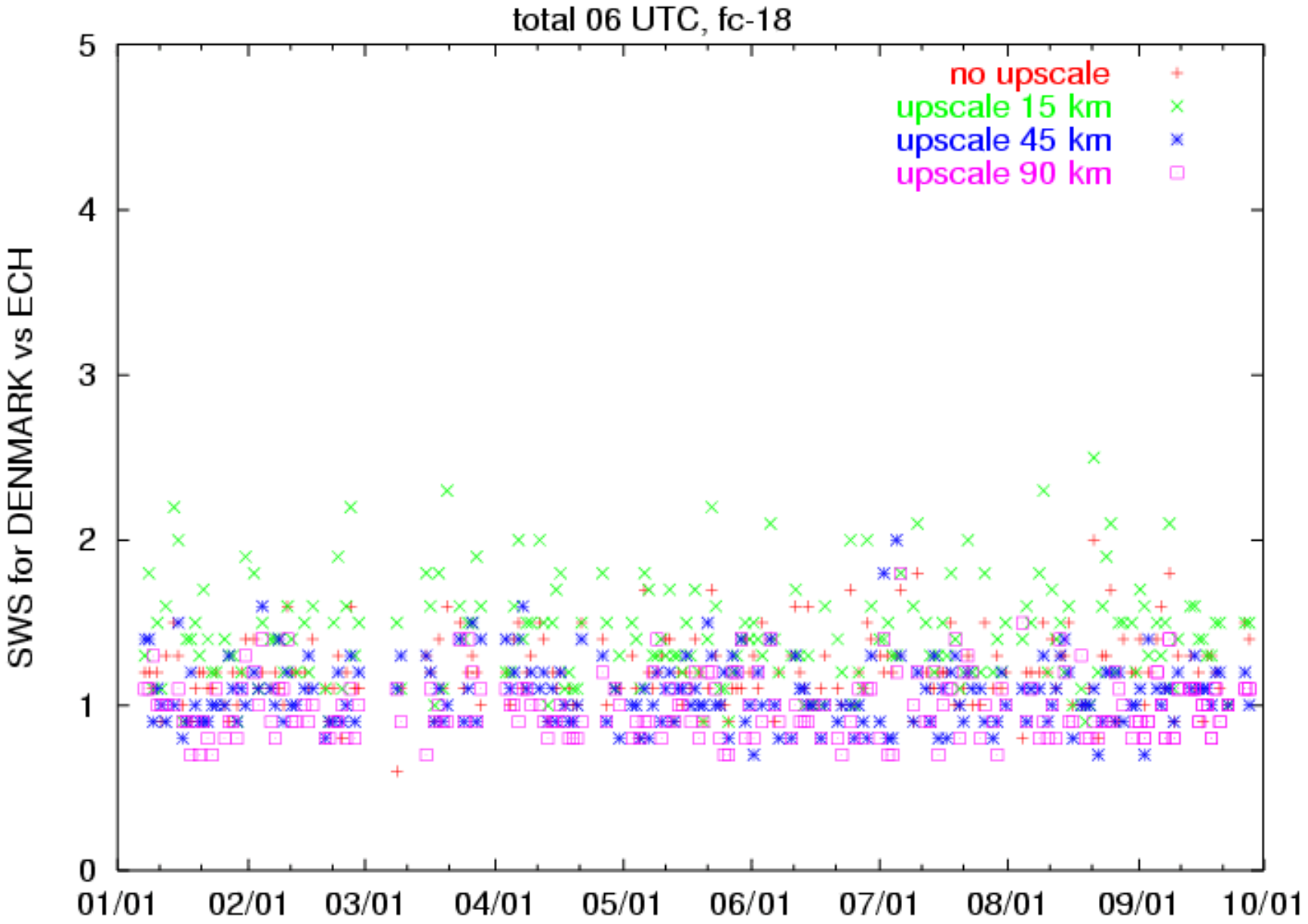
$$SWS = \left(1 + \sum_{j=1}^{K} J_{meso}\right) / \left(1 + \sum_{j=1}^{K} J_{ref}\right)$$

J is the hit rate for a defined event, 0 < SWS < infinite

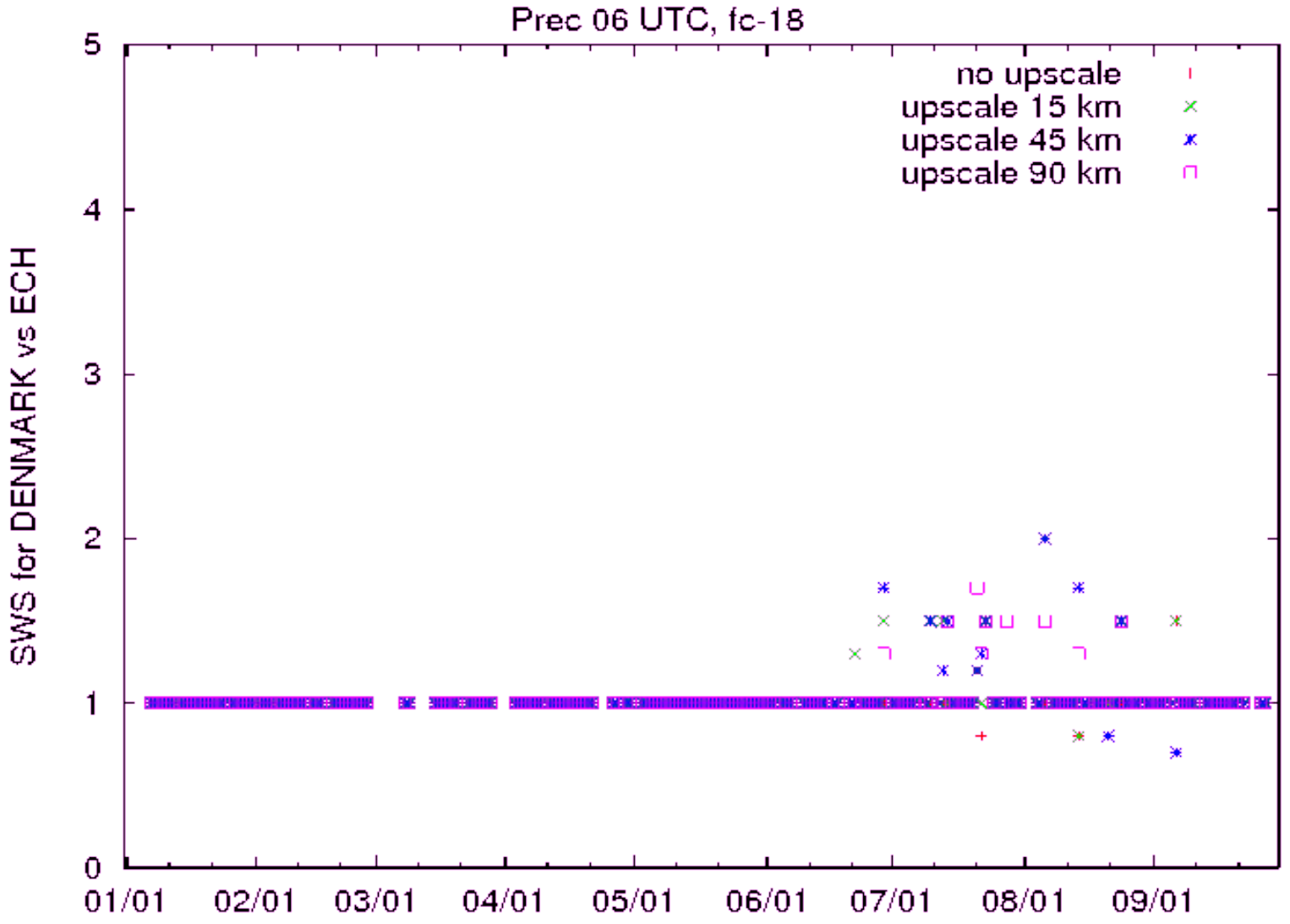
a SWS > 1 indicates better mesoscale model forecast

combined SWS score (T2m,W10m,Precip)

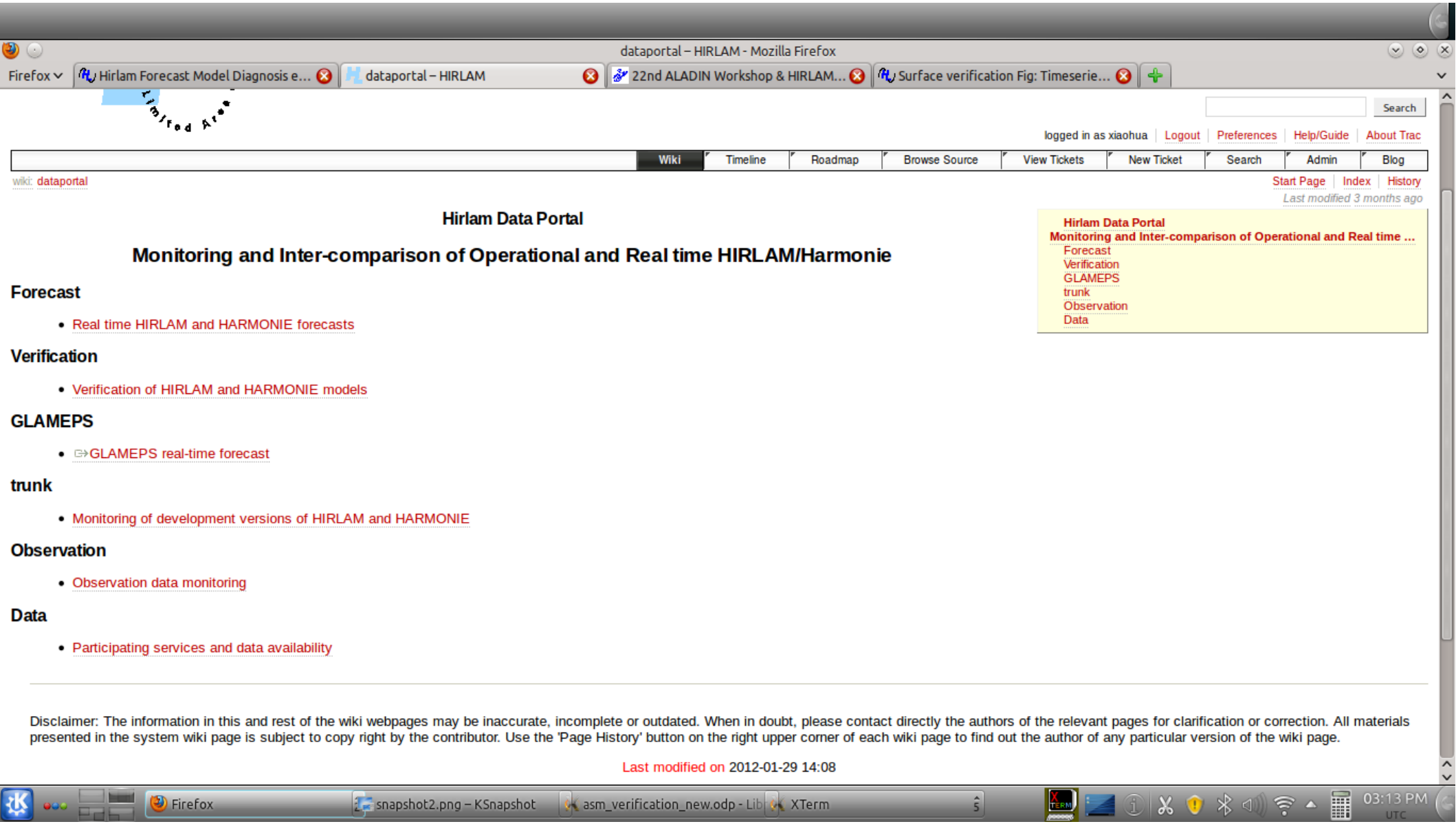
Harmonie 2.5 km / ECMWF, 1 Jan.- 1 Oct. 2011



SWS (Warning over Danish area)
Harmonie 2.5 km / ECMWF, rr/12h > 24 mm



Data portal at Hirlam.org



Mast verification summary statistics (Carl Fortelius)

Sodankylä
2010 DJF
2010 MAM
2010 JJA
2010 SON
2011 DJF
2011 MAM
2011 JJA
2011 SON
2012 DJF
2012 MAM

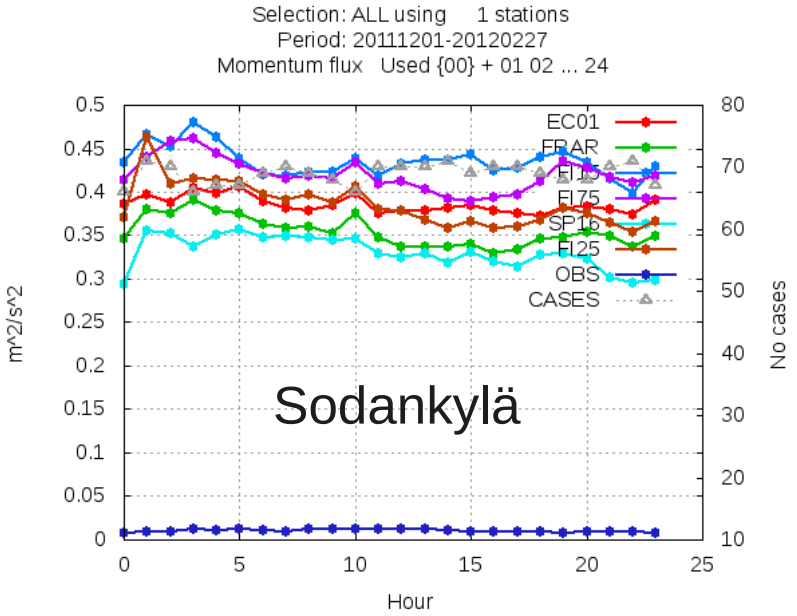
Cabauw
2010 DJF
2010 MAM
2010 JJA
2010 SON
2011 DJF
2011 MAM
2011 JJA
2011 SON
2012 DJF
2012 MAM

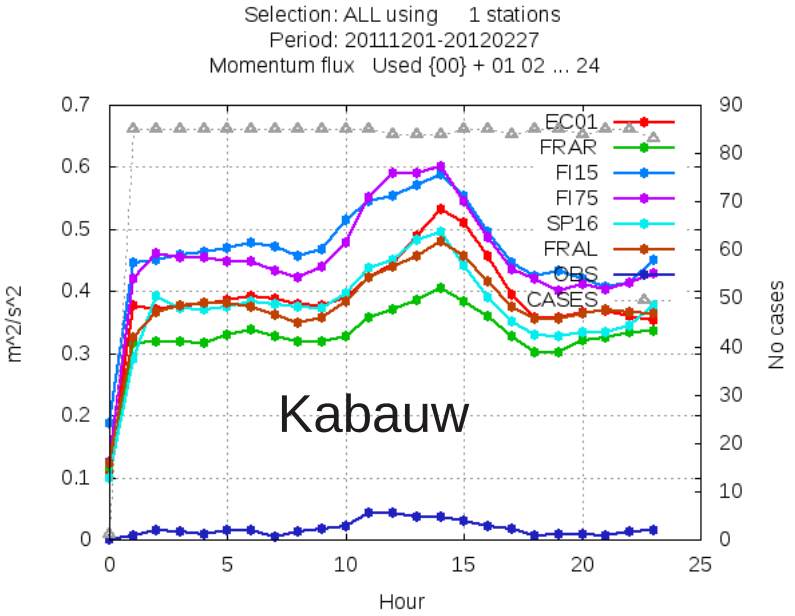
Lindenberg
2010 DJF
2010 MAM
2010 JJA
2010 SON
2011 DJF
2011 MAM
2011 JJA
2011 SON
2012 DJF
2012 MAM

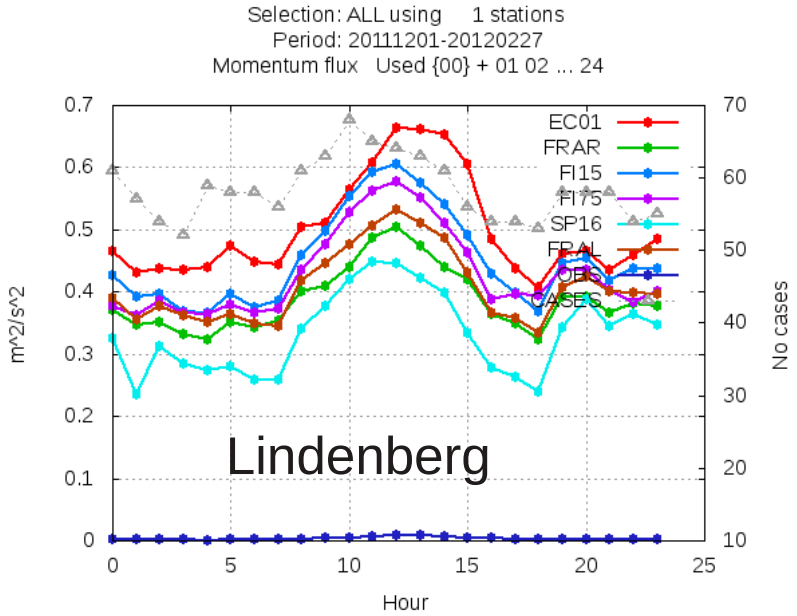
Valladolid
2011 DJF
2011 MAM
2011 JJA
2011 SON
2012 DJF
2012 MAM

- Graphics of seasonal statistics have been included in the HIRLAM on-line mast verification facility under http://hirlam.org/
- Data-model inter-comparisons are compiled using the HARMONIE verification system are shown for each site individually
- Data from Sodankylä, Cabauw, and Lindenberg start from the winter 2009/2010. Data From Valladolid a year later
- Forecasting systems included in the inter-comparison are currently: HIRLAM RCR “FI07”, ECMWF IFS “EC01”, MF ARPEGE “FRAR”, INM HIRLAM “SP16” FMI HARMONIE “FI25” , and MF ALADIN “FRAL”
- Graphics are updated in the middle and at the end of each 3-monthly season
- The graphics are generated from the data as it has been displayed in the daily graphs

Surface momentum flux







- Mean diurnal cycle of the surface momentum flux in DJF 2011/2012.
- **All models overestimate flux at all stations where it is measured.**
- Similar results are obtained in other periods as well, although relative differences tend to be smaller in summer. **Visit the site and see for yourself!**

hirlam.org on-duty team needs you!