

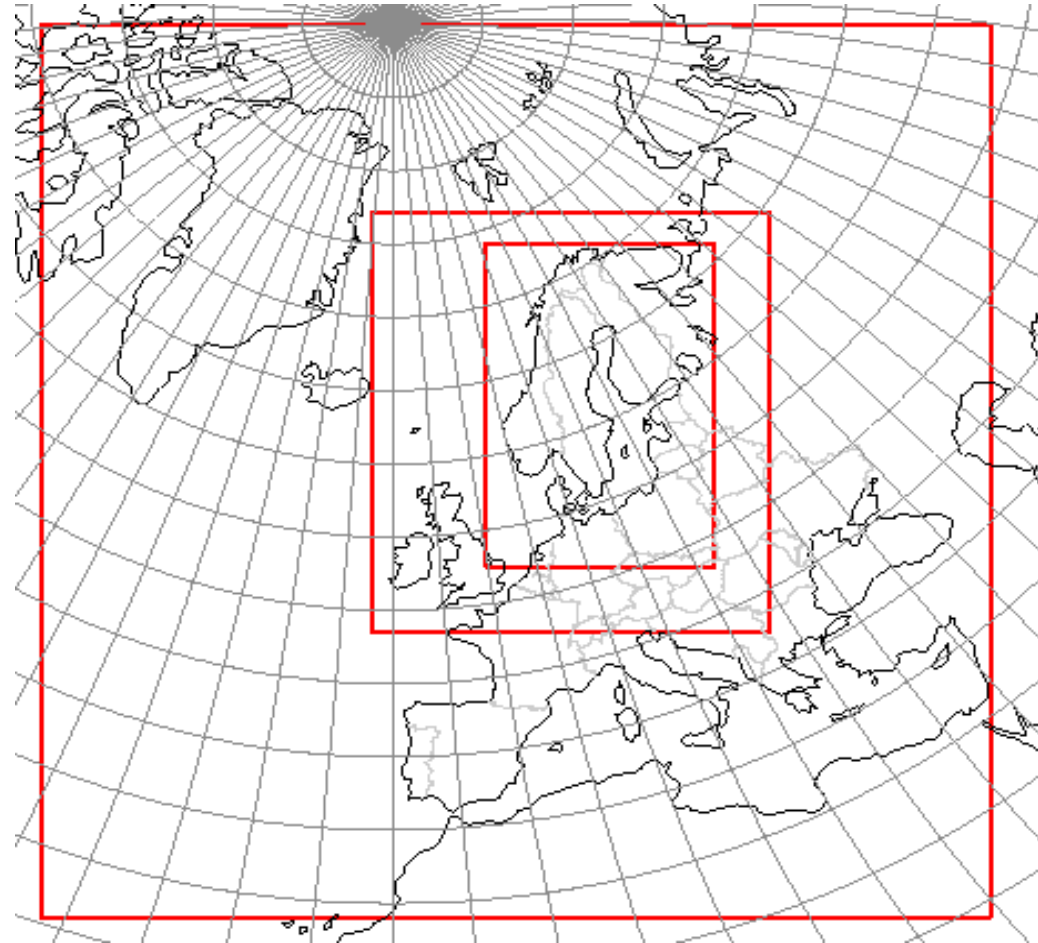
SMHI experience of Harmonie surface data assimilation

Karl-Ivar Ivarsson, surface data assimilation meeting on Nordic aspects March 9-11 2011, Helsinki

- Test with different weighting of the temperature analysis increment for deep surface temperature – description of the experiment
- Verification result
- Conclusions
- Surface data assimilation of sea and lake temperatures for SMHI operational Hirlam: What may be used in Harmonie ?

Description of the experiment

- 3DVAR, ECMWF boundaries every 3h.
- Surfex surface scheme
- Alaro physics
- Spinup January 1-5 2010
- Test period January 6-30 2010
- The “middle size” domain - E-area
- 5.5 km resolution ,60 levels



Surface data assimilation

Spatialisation of screen level data (OI)

$$x^a = x^b + BH^T (HBH^T + R)^{-1} (y - Hx^b)$$

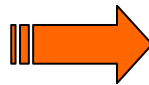
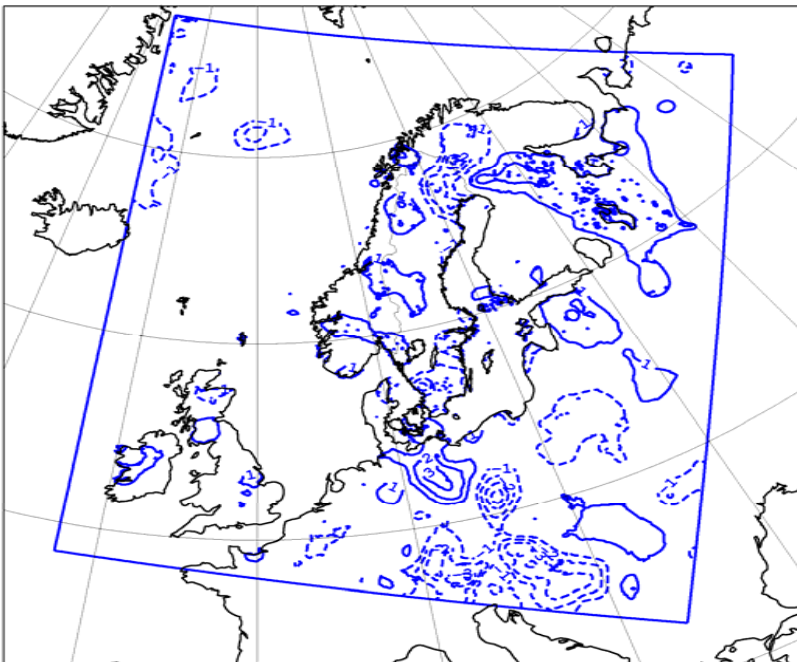
Surface data assimilation Olmain

$$\Delta T_1 = \Delta T_{2m}$$

$$\Delta T_2 = \frac{\Delta T_{2m}}{2\pi}$$

$$\Delta w_1 = \alpha_1^T \Delta T_{2m} + \alpha_1^H \Delta H_{2m}$$

$$\Delta w_2 = \alpha_2^T \Delta T_{2m} + \alpha_2^H \Delta H_{2m}$$

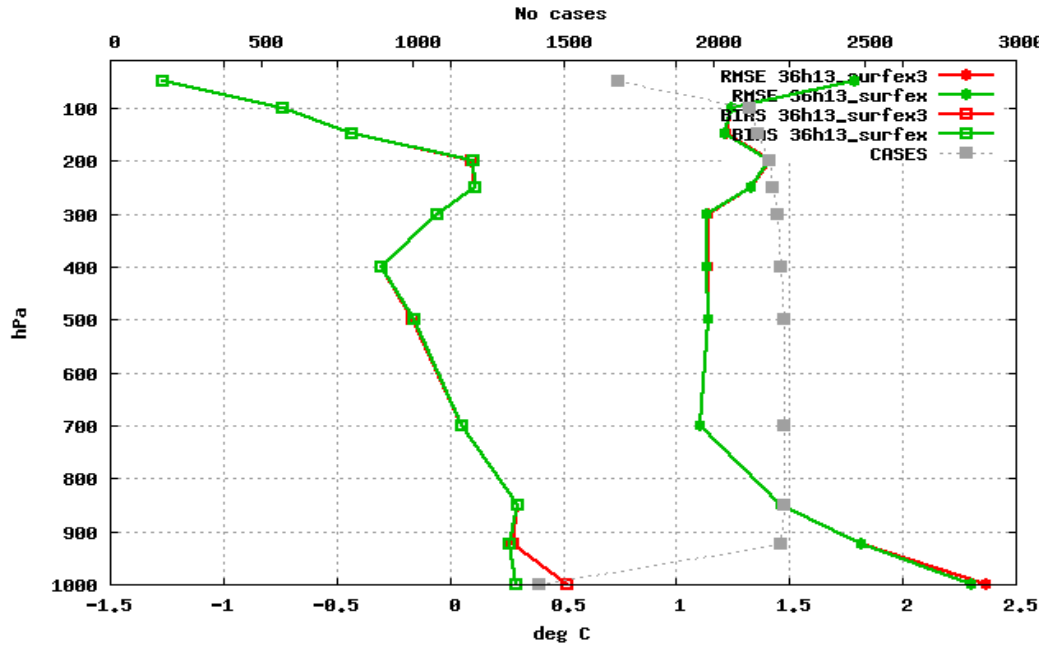


T_1, w_1

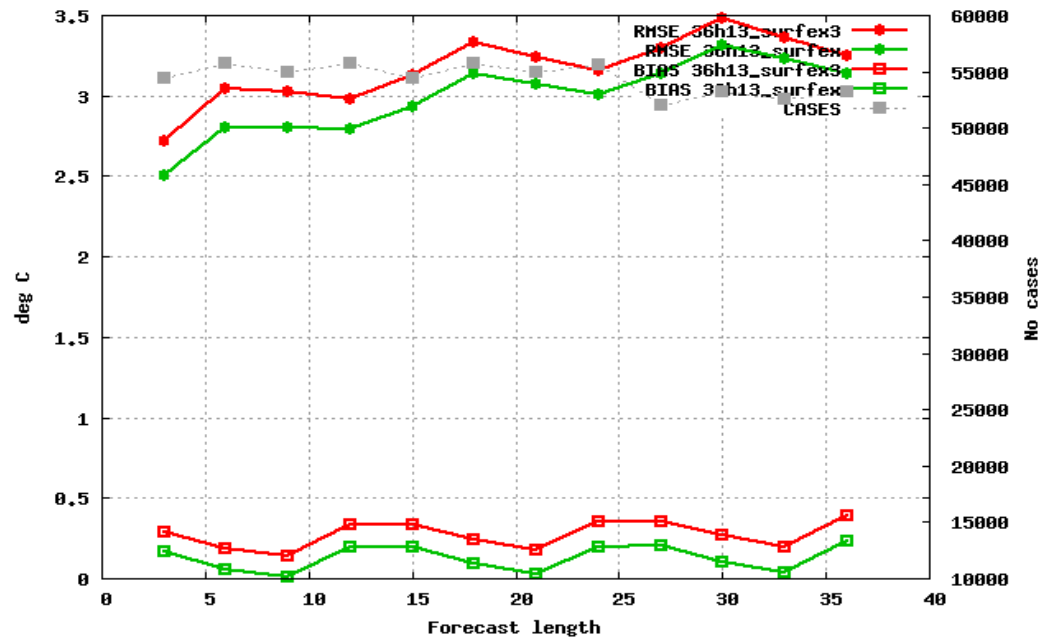
T_2, w_2

Results

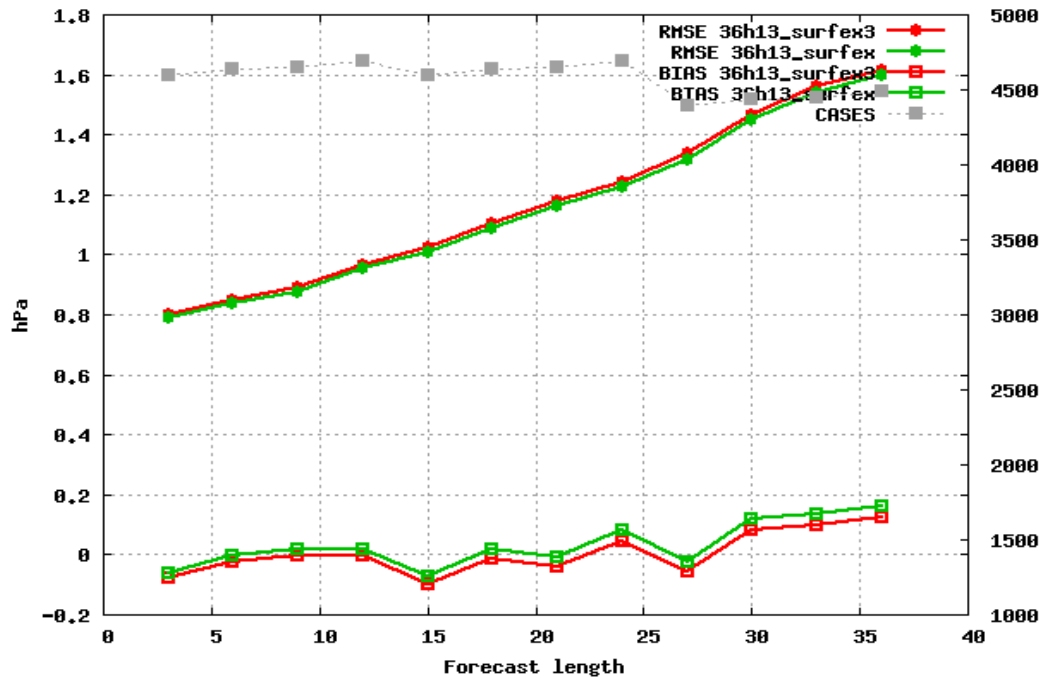
62 stations Selection: ALL
 Temperature Period: 20100106-20100129
 At {00,12} + 36



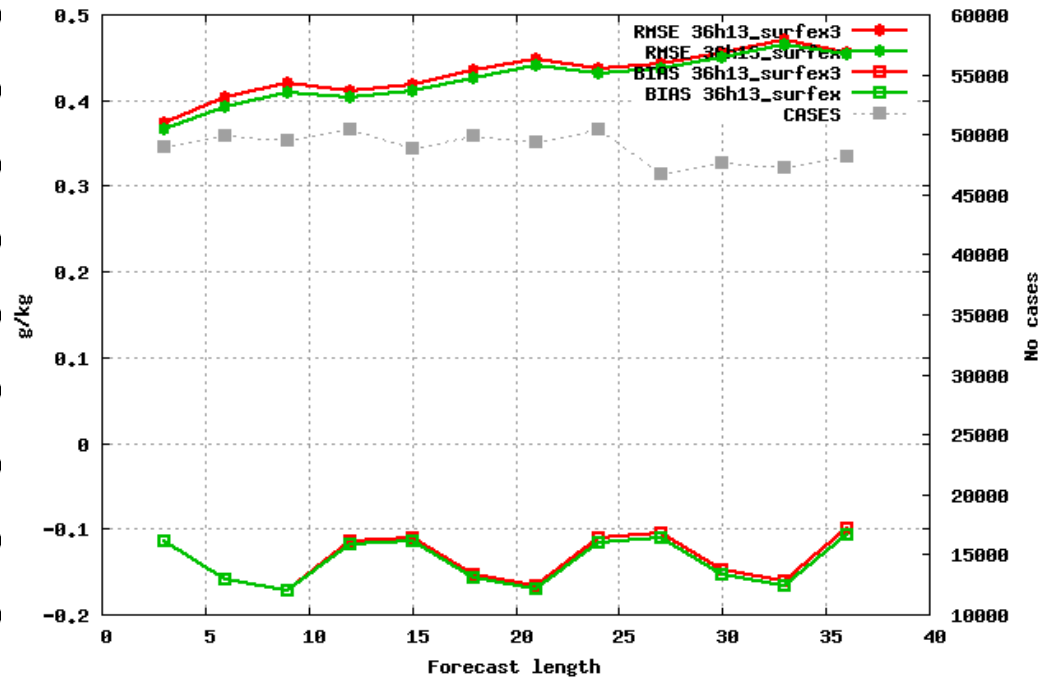
Selection: ALL using 1288 stations
 Period: 20100106-20100130
 Temperature Hours: {00,12}



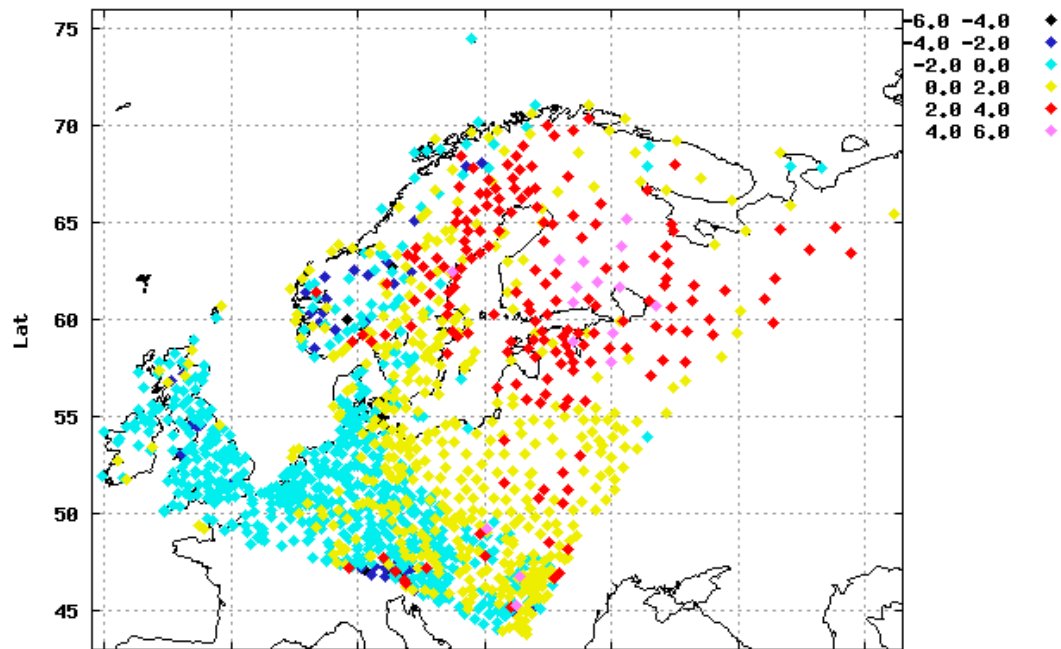
Selection: ALL using 1075 stations
 Period: 20100106-20100130
 Surface pressure Hours: {00,12}



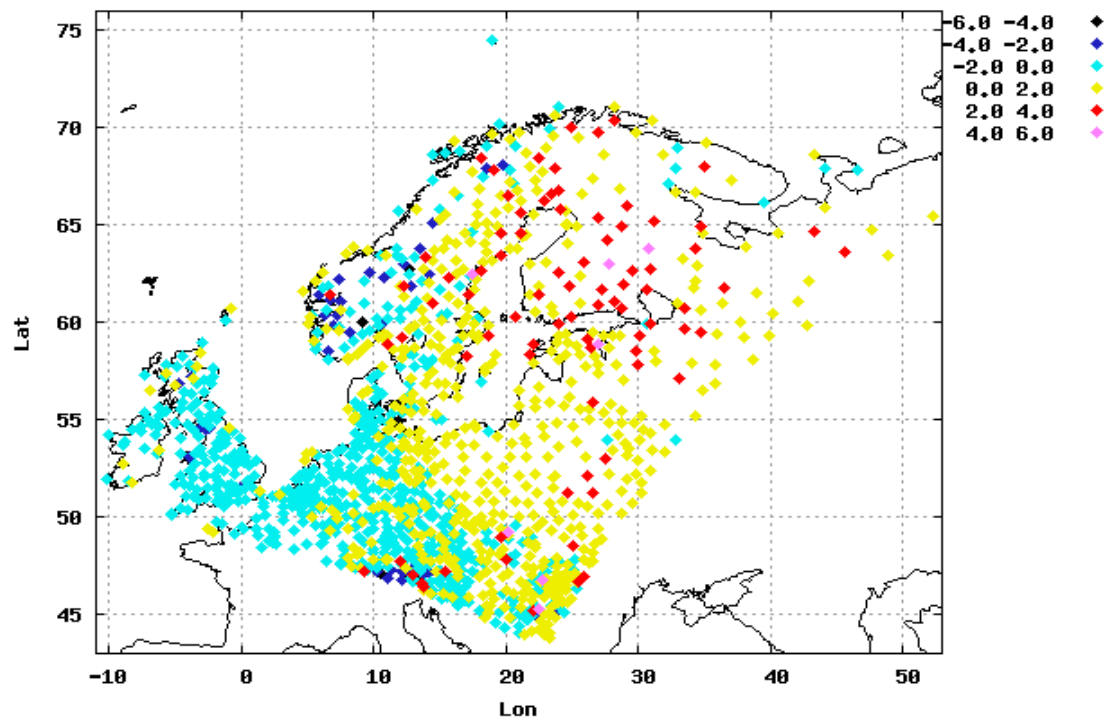
Selection: ALL using 1165 stations
 Period: 20100106-20100130
 Specific humidity Hours: {00,12}



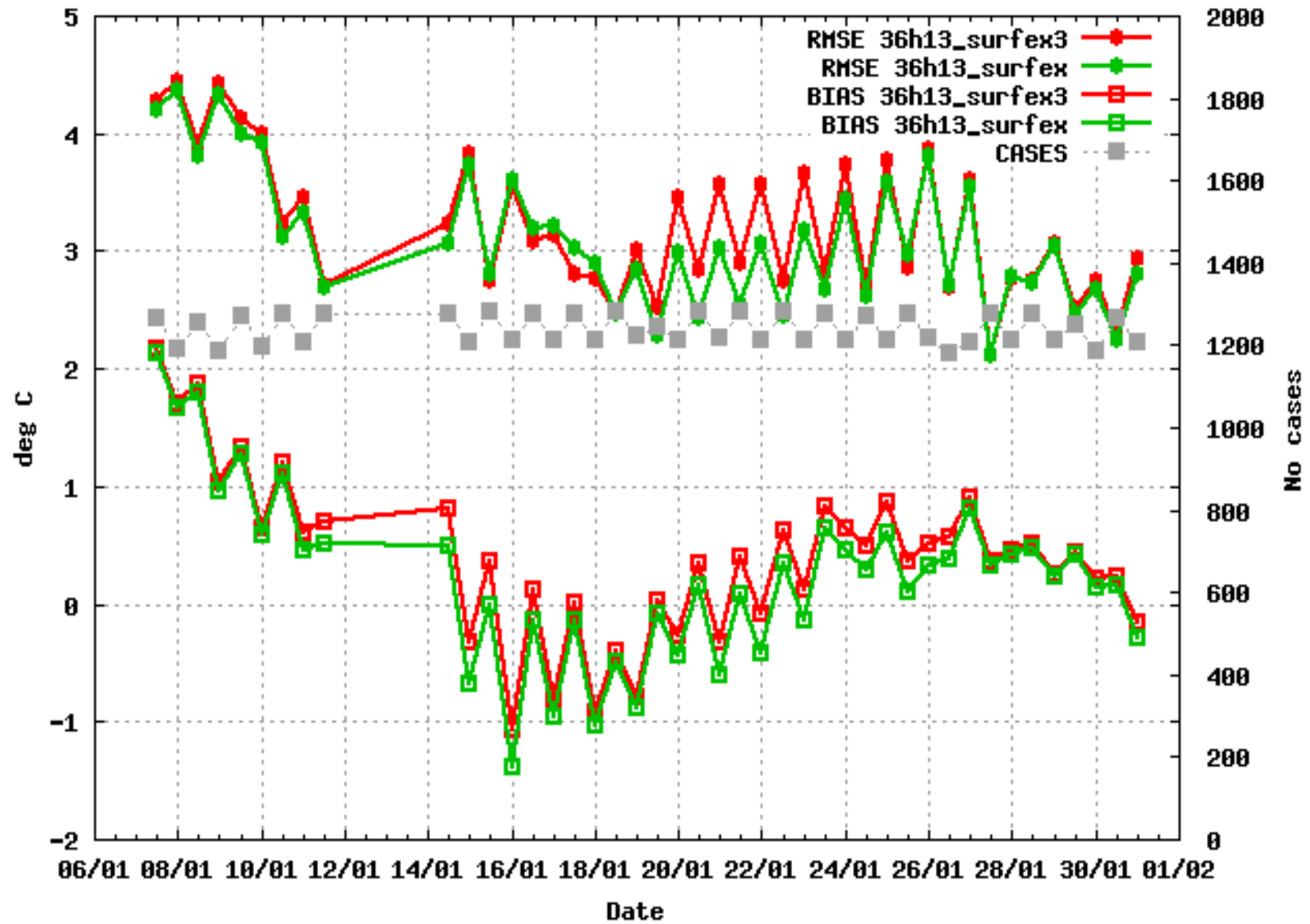
Exp: 36h13_surfx3 Selection: ALL 1288 stations Period: 20100106-20100130
Temperature bias [deg C]
At {00,12} + 03 06 ... 36



Exp: 36h13_surfx Selection: ALL 1288 stations Period: 20100106-20100130
Temperature bias [deg C]
At {00,12} + 03 06 ... 36



Selection: ALL 1288 stations
Temperature
At {00,12} + 36 Window: 12h



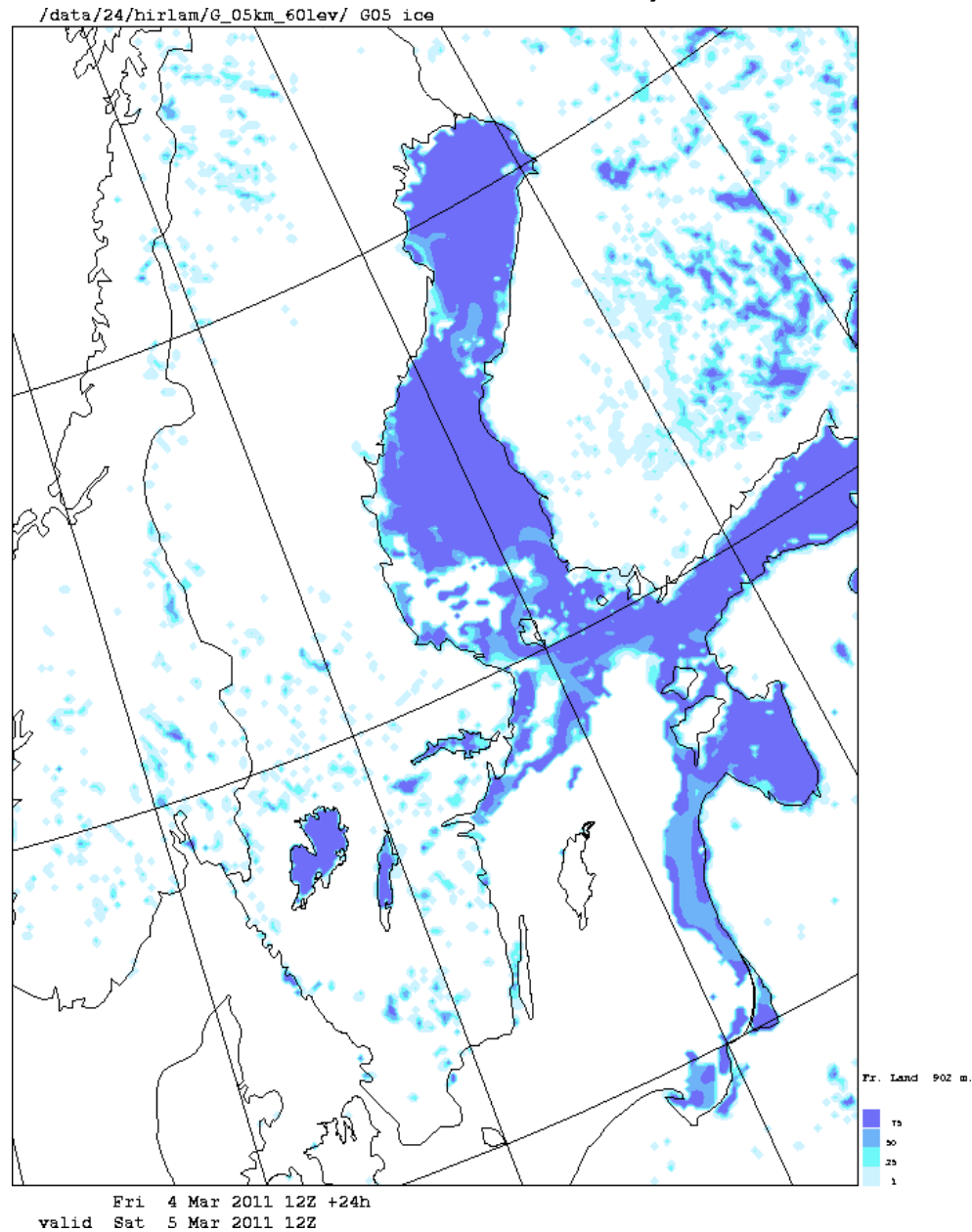
Conclusions

- Somewhat better t2m and q2m with larger increments for deep temperature.
- Small effect on higher parts of troposphere.

•Surface data assimilation of sea and lake temperatures for SMHI operational Hirlam: What may be used in Harmonie ?

- Most lakes : Deep surface temperature in forest.
- Largest Swedish lakes (Värnen and Vättern) From ocean model Hiromb.
- Whole Baltic area : Hiromb
- The rest : Atlantic etc . Pseudo obs ECMWF.
- Hiromb is a 3d dynamical ocean model (50 levels, 1.8 km horizontal resolution) with complex sea ice physics (ice deformation etc) and dynamics. Data assimilation : OI.

Example (Ice coverage in blue from Hiromb etc in Hirlam 5.5 km)



Thank you ! Coffee break ?

