

met.no – SMHI experiences with ALARO

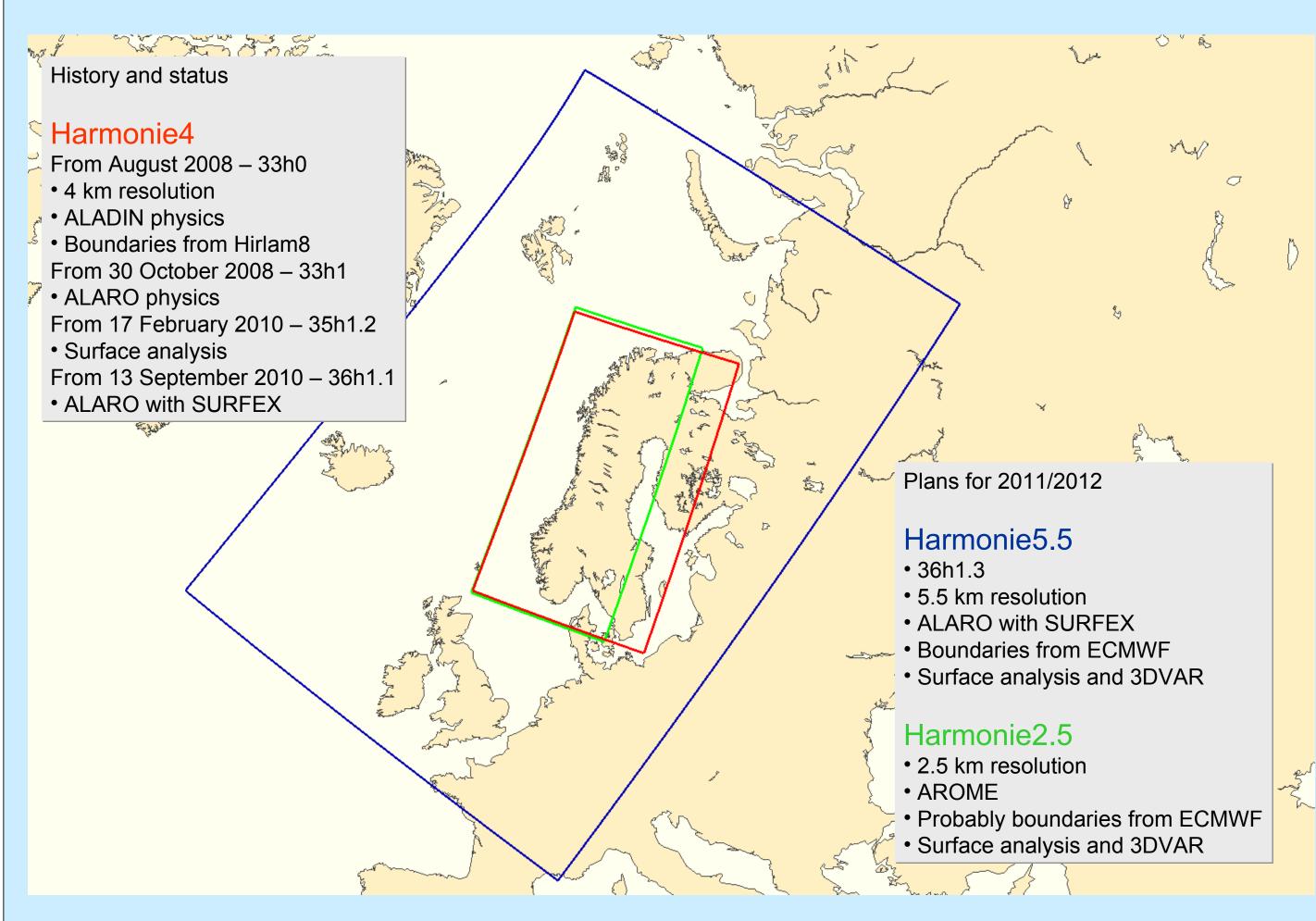
ALADIN Workshop & HIRLAM ASM, 5-8 April 2011, Norrköping, Sweden



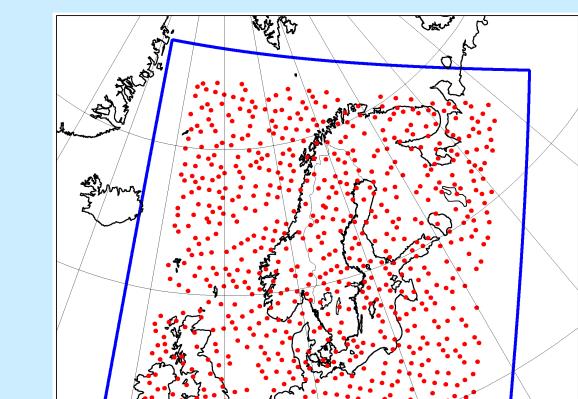
Ulf Andrae (SMHI), Trygve Aspelien (met.no), Lisa Bengtsson-Sedlar (SMHI),

Mariken Homleid (met.no), Magnus Lindskog (SMHI) and Ole Vignes (met.no)

Daily ALARO runs in Norway



Daily ALARO runs in Sweden

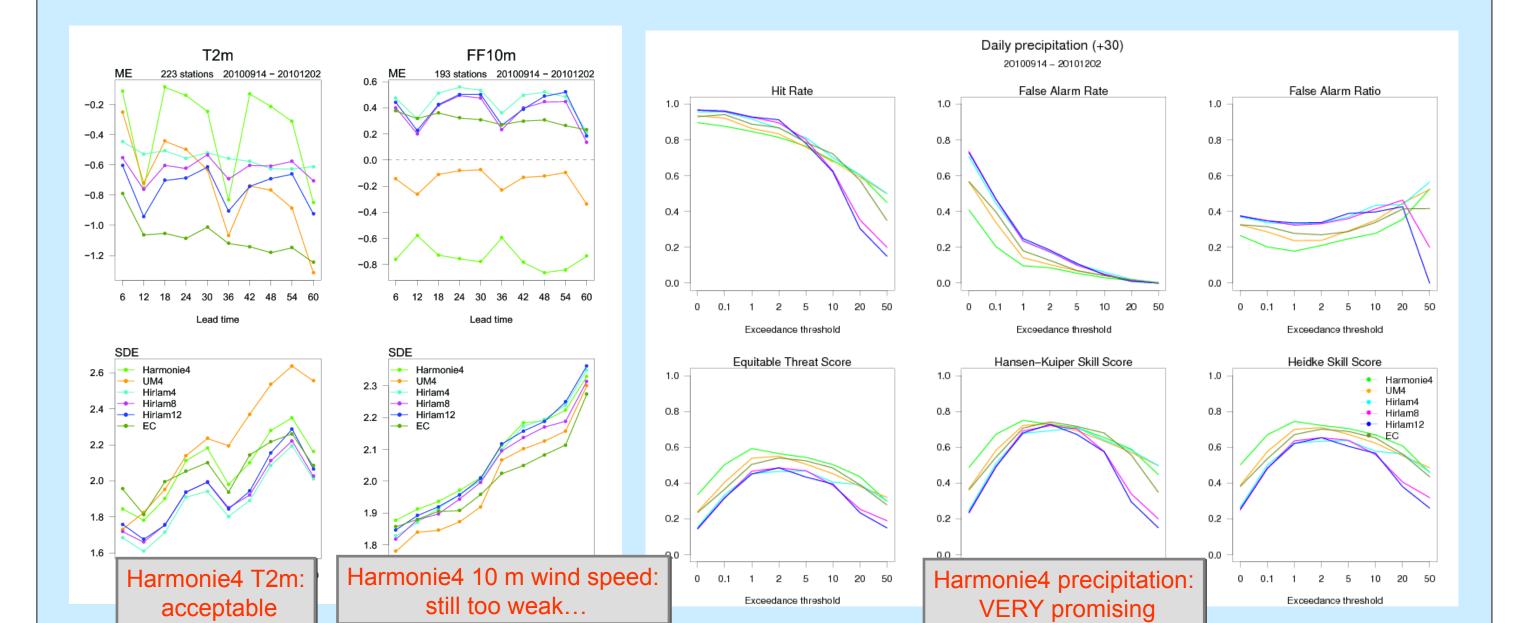


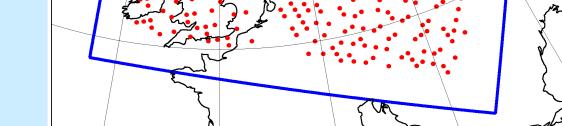
System Design

SMHI HARMONIE 2010: • 35h1.3 • 5.5 km horisontal resolution • 60 vertical levels (HIRLAM definitions)

- Lateral boundaries from ECMWF
- Forecast length: 0-36 h
- ALARO with 2-L ISBA (not SURFEX) Surface analysis and 3DVAR

Summary verification of Harmonie4, UM4, Hirlam4/8/12 and ECMWF at Norwegian synop stations Autumn 2010





Model domain (blue frame) and NOAA 18 AMSU-A channel 10 data coverage for one particular case (red dots).

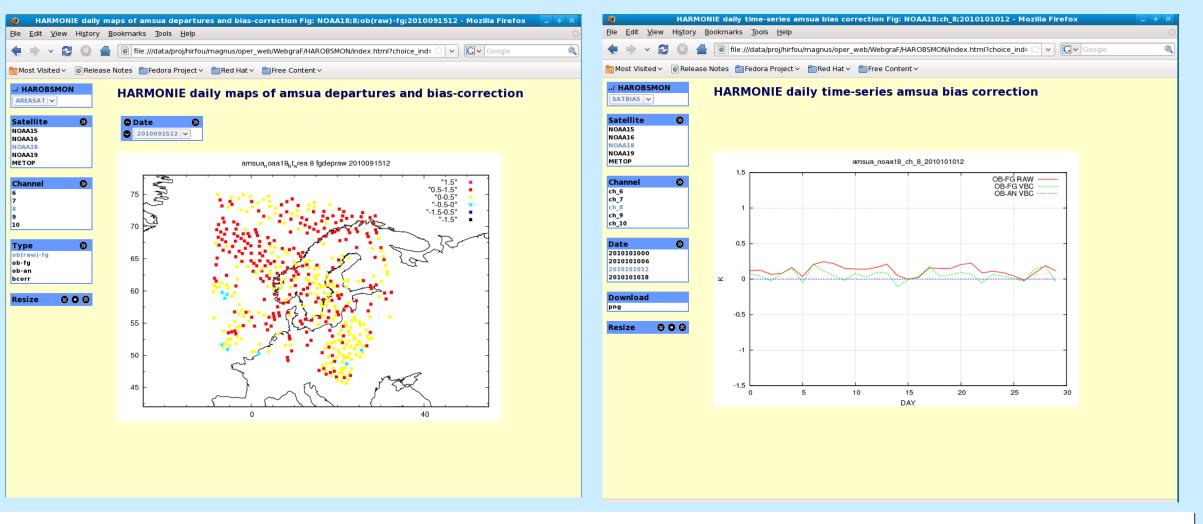
SMHI HARMONIE 3DVAR

• 6 h data assimilation cycle.

• Background error statistics from differences of downscaled forecasts. These are downscaled from an ECMWF data assimilation ensemble experiment.

- Conventional types of observations and ATOVS AMSU-A channels 6-10.
- Variational Bias Correction.

• Monitoring System for satellite data to be introduced to HARMONIE system. • No observations closer to lateral boundary than 250 kms are assimilated. •Future plans include assimilation of ATOVS AMSU-A/MHS, radar radial winds, and GPS ZTD.



Web-based satellite data assimilation monitoring system to be included in the HARMONIE system. Monitoring

SMHI HARMONIE 2011: • 36h1.3 • ALARO -0 physics with surfex scheme

of satellite observation minus background departures (left) and of variational bias correction (right).

Experiences over Norway with Harmonie4 - 36h1.1

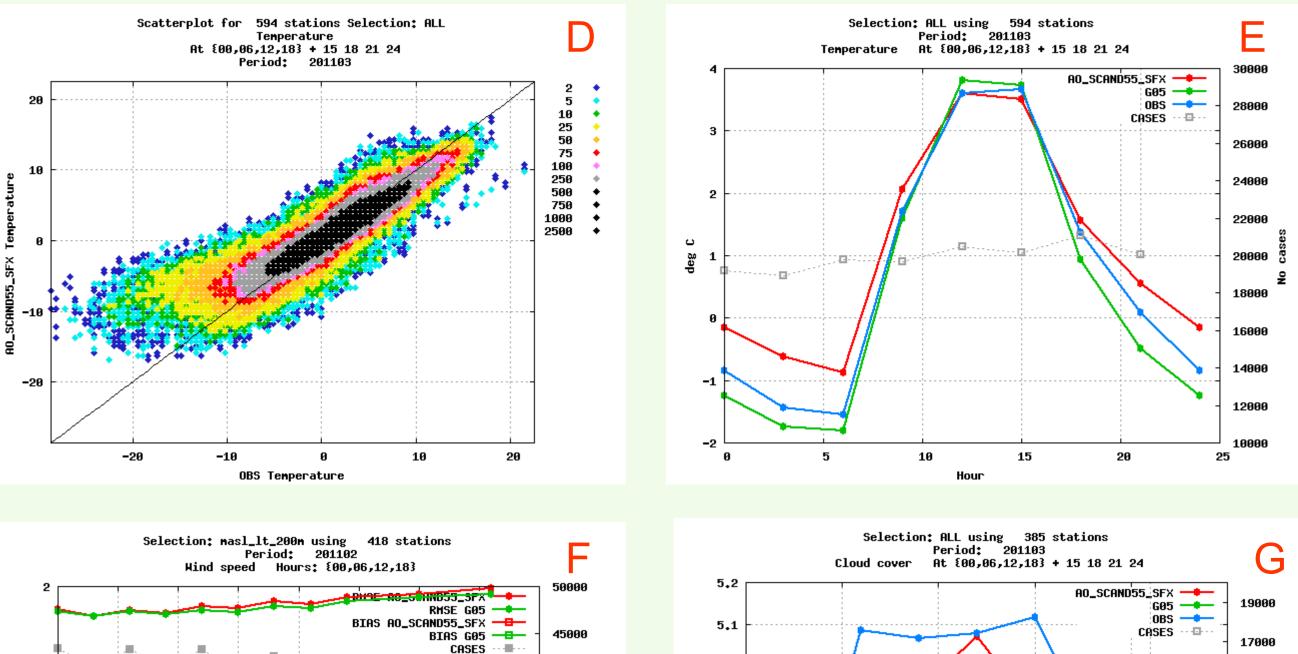


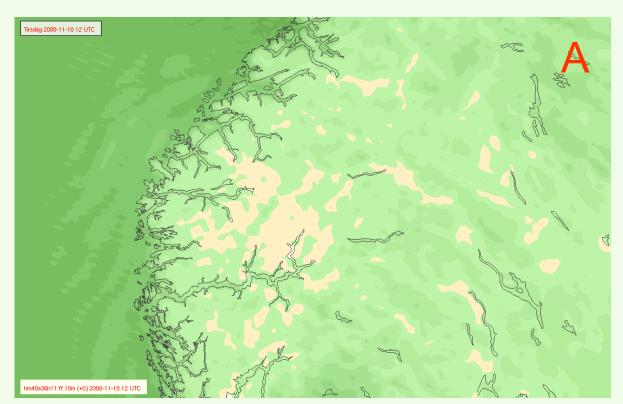
- Previous versions of Harmonie had large and systematic errors related to the physics, e.g.:
 - very low surface temperatures in winter
 - too low wind speed over land
- 36h1.1 with SURFEX from Seep 2010 shows significant improvements which can be related
 - tiling (nature/sea/lake/town)
 - canopy module (multilayer surface scheme)
 - increased wind speed (from A to B) with reduced drag as a function of st.dev. of Small Scale Orography (C), but still too low (D)
 - mean orography instead of envelope

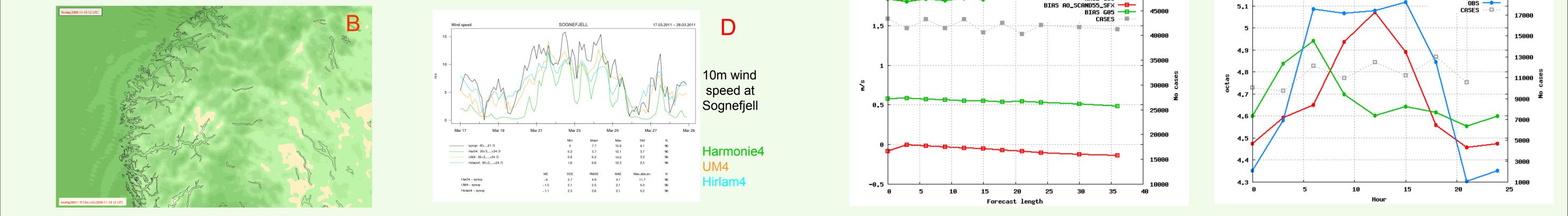
2011 experiences at SMHI with 36h1.3

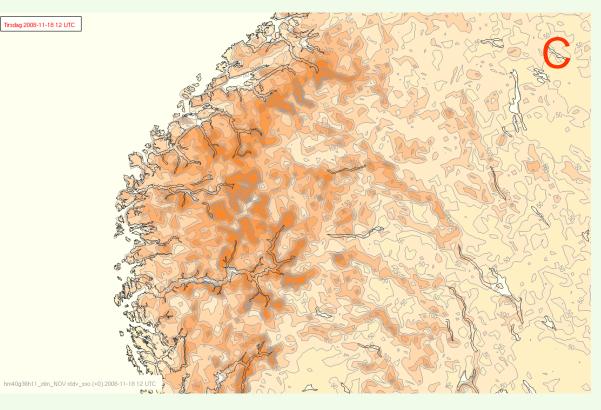
- ALARO still have problems predicting the low temperatures (D) The daily T2M cycle shows good
 perfomance during daytime (D). Recent sensitivity tests indicates that a better surface assimilation may help
- Very good wind speed over low land (F), still underestimation over high land (not shown)
- Better daily cycle for clouds(G) and better precipiation (not shown)
- Comparison against radio sondes shows similar perfomance for ALARO and HIRLAM

Red: ALARO 5.5km , Green: HIRLAM 5.5km, blue observations











Future work

- Improved treatment of snow and lakes
- Implement and evaluate EKF for surface assimilation
- Improved observation usage
- Look into reasons for poor 10 meter wind scores in high terrain
- SMHI and met.no plans for a joint operational NWP suite on the 2-5km scale in 2014. Integration and preparations starts during autumn 2011.

References

- Le Moigne, P., 2009: SURFEX OFF-LINE Scientific Documentation and User's Guide, available at http://www.cnrm.meteo.fr/surfex
- Taillefer, F., 2002: CANARI Technical Documentation Based on ARPEGE cycle CY25T1 (AL25T1 for ALADIN), available at http://www.cnrm.meteo.fr/aladin/