HIRLAM/HARMONIE Monitoring System

Xiaohua Yang

with contributions from
Ulf Andrae, Kalle Eerola, Ole Vignes,
Roger Randriamampianina, Markku Kangas

Outline of the talk

- Motivation
- Goal
- Status
  - model intercomparison package
- Final remarks

HIRLAM community needs…

- Utilities to monitor progress of the HIRLAM program ”in a measurable way”
  - Reference Hirlam
  - Within consortia
  - Across consortia (also a coming initiative for SRNWP)
- Evaluation tools to quantify forecast skills
  - Reference model upgrade
  - Impact study (forecast model; data assimilation system)
- Routine NWP monitoring utilities
  - Charts, meteograms, time series, statistics
  - Model diagnosis
- Adaptation of the above to the increased system complexity
  - HARMONIE: meso-scale verification; new variables and observations
  - Multi-model system in SREPS

There are many wheels out there …

- Verification
  - System (both obs and field): Hirlam reference, DMI, met.no, SMHI, HIRVDA, HARMONIE, MetEirean, INM-SREPS
  - Products: ”traditional”; fog, visibility, Forecast quality index
- Graphic display for forecast charts, meteograms
  - ECMWF; Metgraf; Grads; DIANA; Gnuplot
- Data assimilation monitoring
  - DMI, met.no, SMHI, FMI,…
- Model diagnosis tools

… really many choices.
But still not enough!

Approaches…

- Consolidation, harmonisation, joint development
- Emphasis on
  - Good functionality
  - Synergy in view of system diversity
    - Hirlam/Harmonie/EPS
    - Diverse platform
  - Non-commercial tools
  - Good documentation
  - Wide participation
- New tools made available in the HIRLAM repository
- Respect existing local packages
  - For historical consistency
  - For user friendliness
  - User preferences
- Incremental

Components Development
(Target delivery 2008)

- Observation verification package suitable for model intercomparison
- Web-presentation tool
- Extension to mast-profile intercomparison
- Launch of operational HIRLAM model inter-comparison
- Extension to assimilation monitoring

Observation verification

- Last autumn, HARMONIE monitoring package was selected as basis for further development
  - Widest user base (all services with HARMONIE suites)
  - Can handle internal as well as external data
  - Adequate algorithm for common verification and impact study
- Model data extraction algorithm in GL enhanced
  - Rh, td, q, Ts, t2m, w10m, orography, visibility
  - Extension to master profile data extraction
- Extraction of HIRLAM model data added as default for 7.2 system
  - Current 'reference verification package' kept in the system
- Near real time operational model verification inter-comparison up i hirlam.org since Nov 2007

Info

Download

Intercomp i

Map_Surface

Hirlam Operational Model Intercomparison

HIRLAM Operational Model Verification Intercomparison

Display:
-Map_surface: SYNOP data verification error map in bias and standard deviation error
-Prof_temp: Verification against TEMP data in the vertical
-Surface: SYNOP data verification of surface parameters: time series, average statistics, error distribution
-Surface_scat: Error scatter plot for SYNOP data
-Temp: TEMP data verification on pressure levels

Models currently featured in Intercomparison

-RCR: FMI-RCR model since February 2004
-T15: DMI-T15 model since Jan 2005
-C22: SMHI-C22 model since Nov 2007
-EC5: ECMWF forecast since 2001
-DMR: HIRLAM Delayed Mode Run between 2000 and March 2003

Check https://hirlam.org/trac/wiki/HirlamInventory/Operational for detailed listing of HIRLAM operational model

Contact system@dmi.dk for further details about the interface.

../ Intercomp

Prof_Temp

Parameter

Temperature
Wind speed
Wind direction
Geopotential
Relative humidity
Specific humidity

Comparison

FMI_ECMWF
DMR_ECMWF
DMI_FMI_ECMWF
DMI_FMI_SMHI_ECMWF

Resize

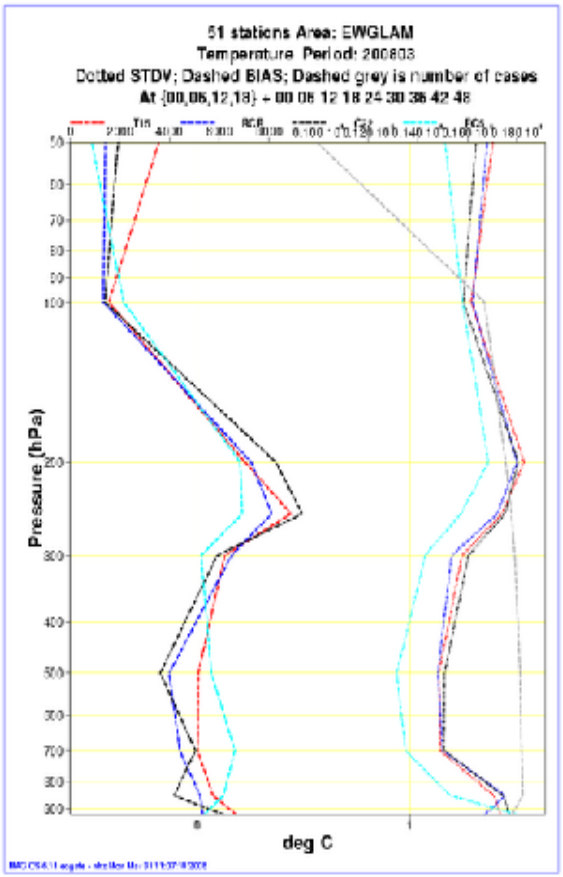
Send

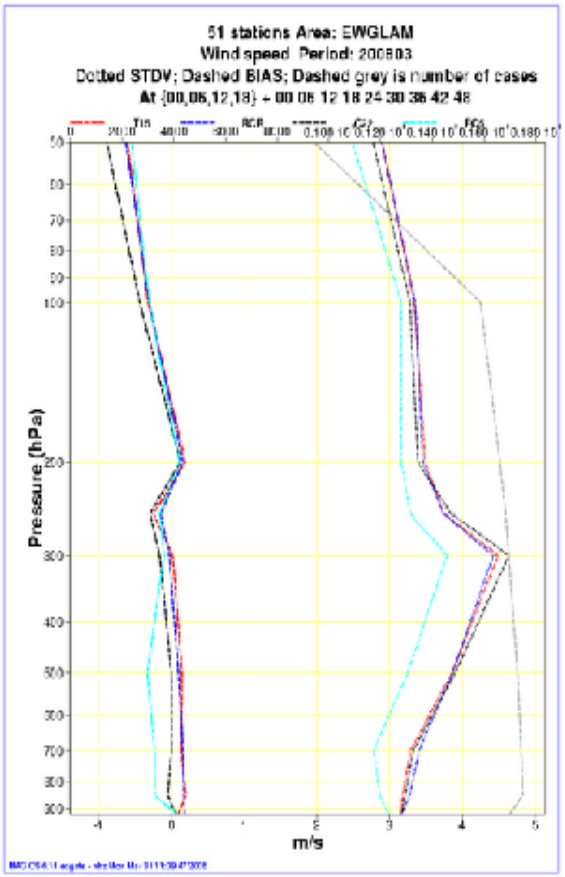
Statistics

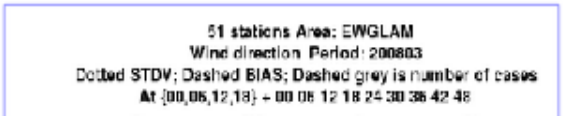
Quality control

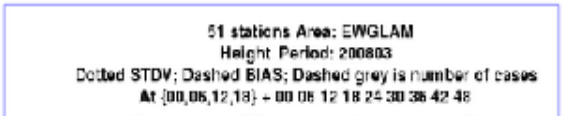
Vertical profiles

Year 2008 | Area EWGLAM | Month 03 | All Save Clear 2008;EWGLAM;Specific humidity;DMI_FMI_SMHI_E







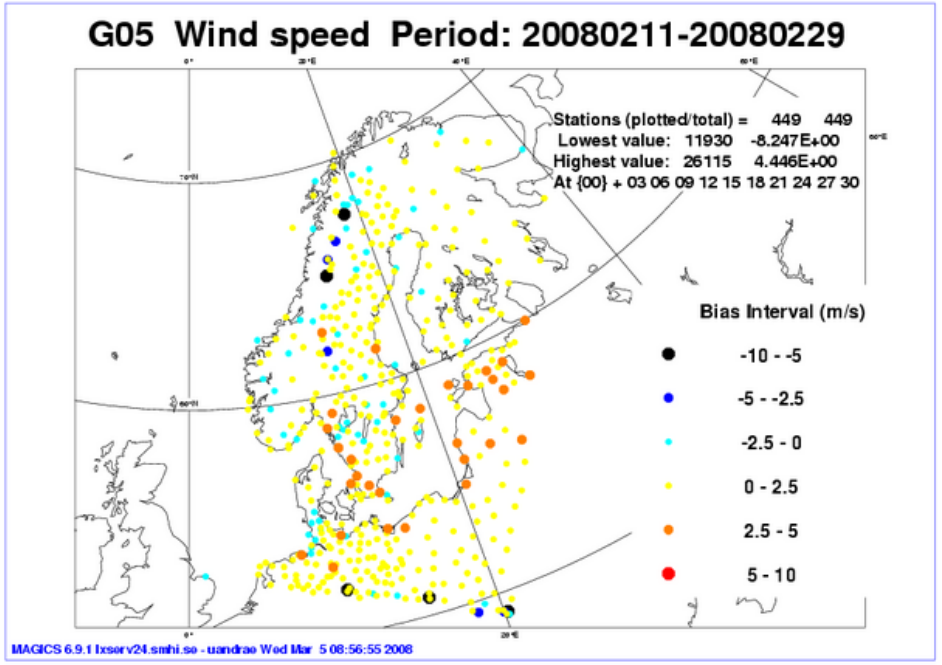


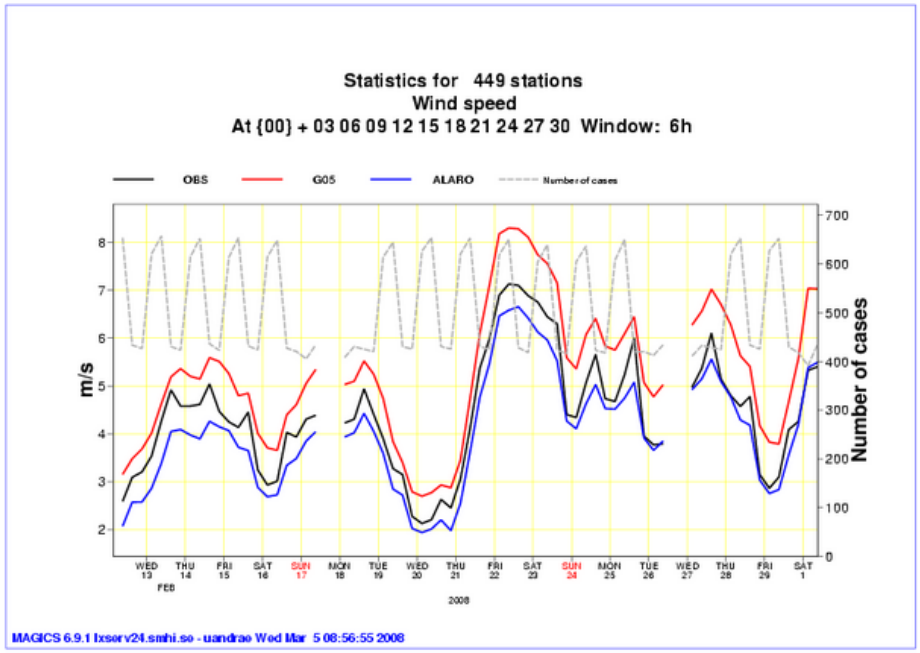
Near future outlook

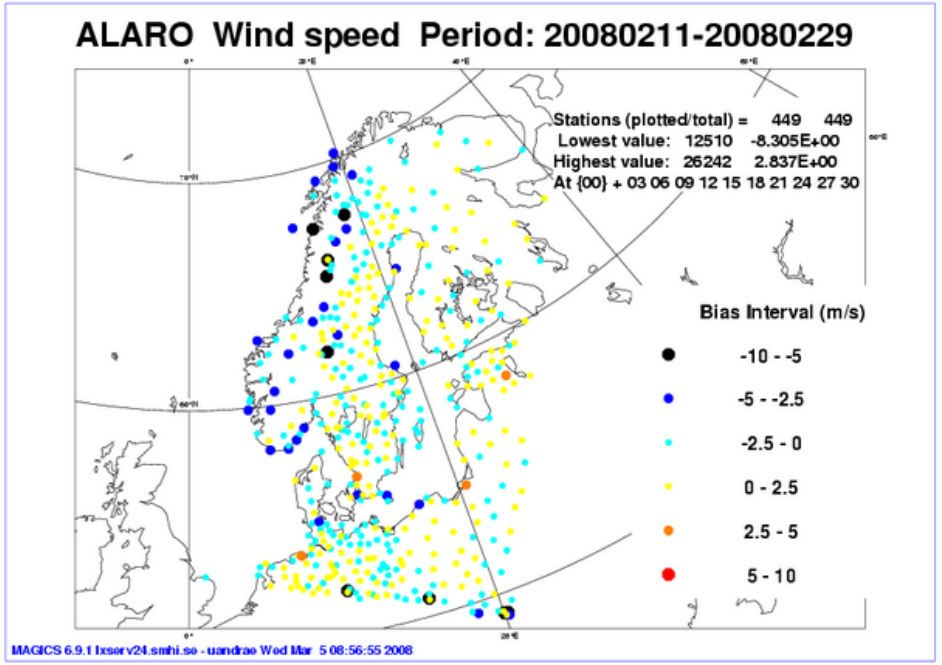
- Extend common verification to cover all services
  - Ask remaining operational services (met.no, KNMI, AEMET, metie, EMHI, LHMS) to add model data extraction step in operational suite and deliver in real time
  - Extend the work for archived model data in member services
  - Extend the work to cover more external data
  - Extend to high resolution

Harmonie Monitoring Tools:

time series
error maps



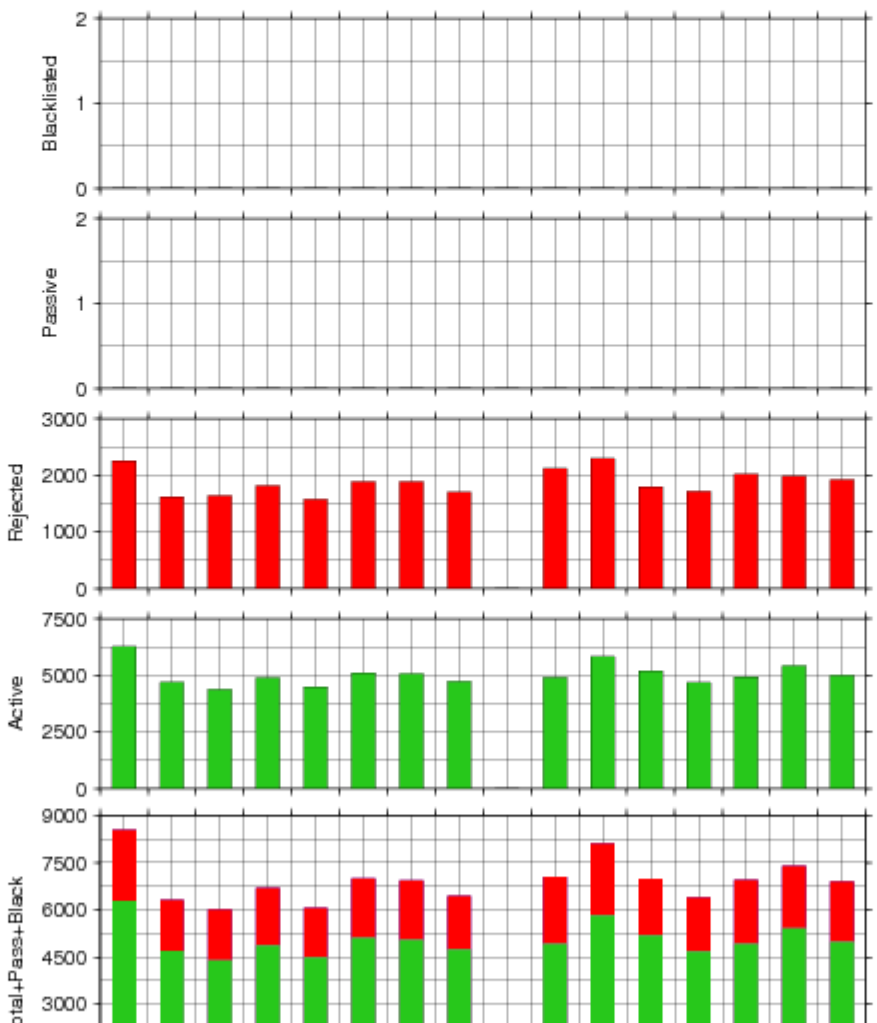




Near future outlook

- Extend common verification to cover all services
  - Ask remaining operational services (met.no, KNMI, AEMET, metie, EMHI, LHMS) to add model data extraction step in operational suite and deliver in real time
  - Extend the work for archived model data in member services
  - Extend the work to cover more external data
  - Extend to high resolution
- Add assimilation monitoring

DA: ALD/3DVAR Exp: HIR20
Period: 2008.02.12–2008.02.27 HH: 12 UTC
Obs: AIREP Reports
Active Passive Rejected Blacklisted



Near future outlook

- Extend common verification to cover all services
  - Ask remaining operational services (met.no, KNMI, AEMET, metie, EMHI, LHMS) to add model data extraction step in operational suite and deliver in real time
  - Extend the work for archived model data in member services
  - Extend the work to cover more external data
  - Extend to high resolution
- Add assimilation monitoring
- Add mast profile

Surface verification Fig: Fc length ver;Sodankyla;All Parameter - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Surface scatterplots Fig: All;All Parameter;FI15 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Surface scatterplots Fig: ...

../ mastverif

Surface_scat

Station

All
Sodankyla
Cabauw

Parameter

T2m
Rh2m
U10m
Long wave up
Global rad
Momentum flux
Sens heat flux
Lat heat flux
dT/dz

Resize

Send

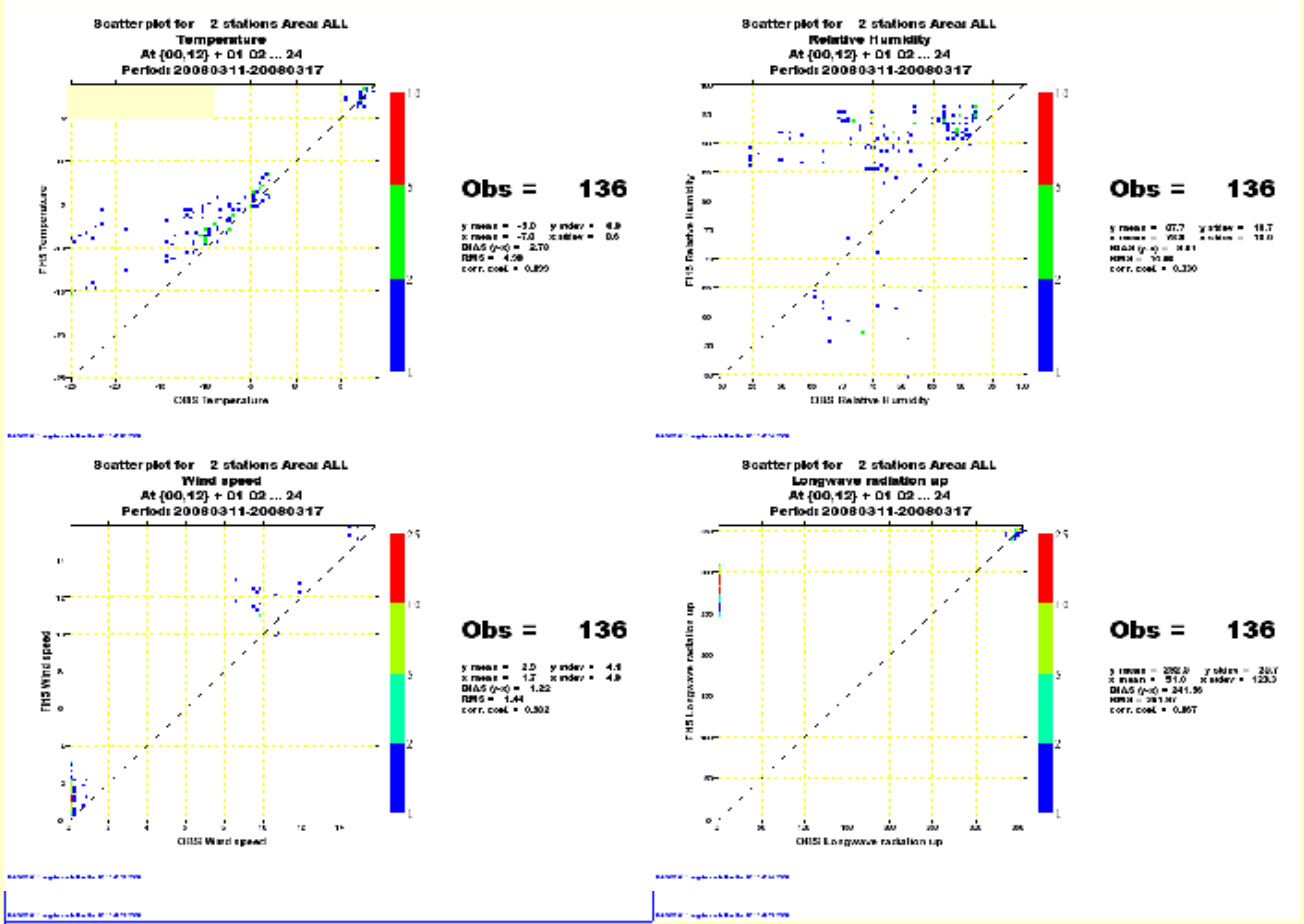
Statistics

Quality control

Surface scatterplots

Exp FI15

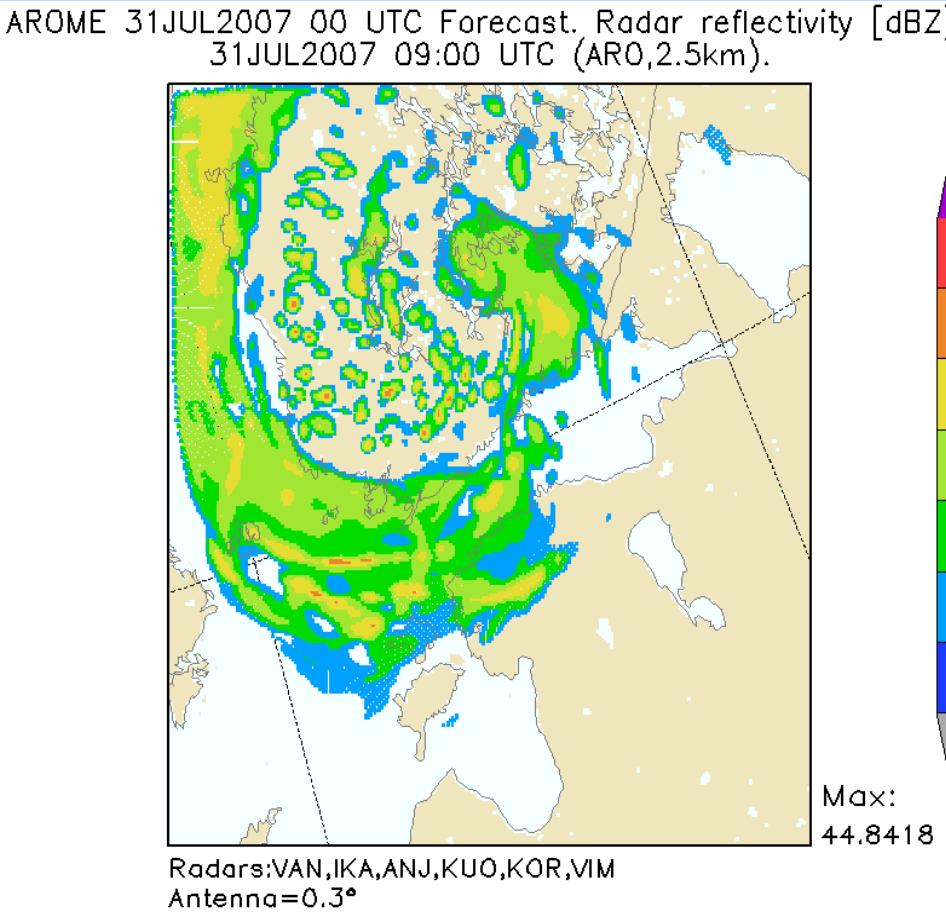
All Save Clear DEL All;dT/dz;FI15

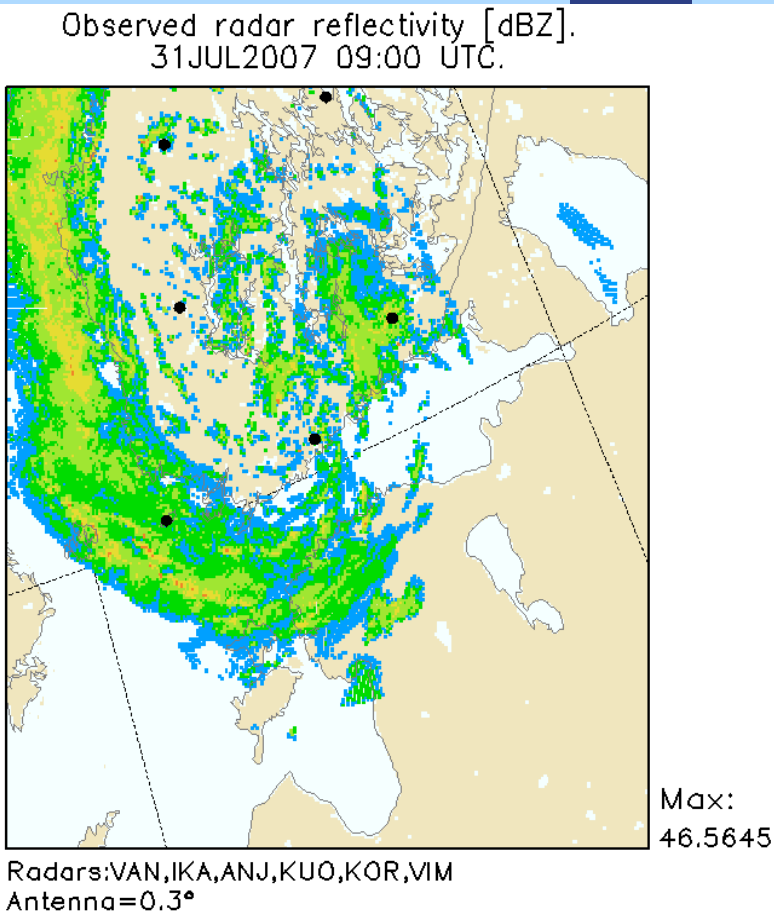


Near future outlook

- Extend common verification to cover all services
  - Ask remaining operational services (met.no, KNMI, AEMET, metie, EMHI, LHMS) to add model data extraction step in operational suite and deliver in real time
  - Extend the work for archived model data in member services
  - Extend the work to cover more external data
  - Extend to high resolution
- Add assimilation monitoring
- Add mast profile
- Add other diagnosis products
  - Radar simulator, Satellite imagies with RTTOV …
  - HARMONIE/DDH
  - …

“Radar simulator”





(Courtesy: Sami Niemela)

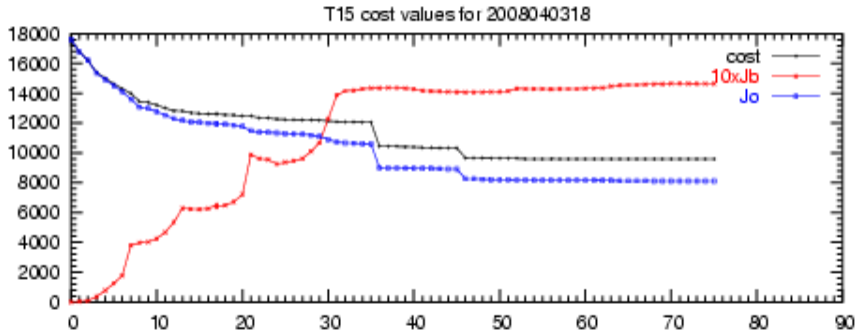
Near future outlook

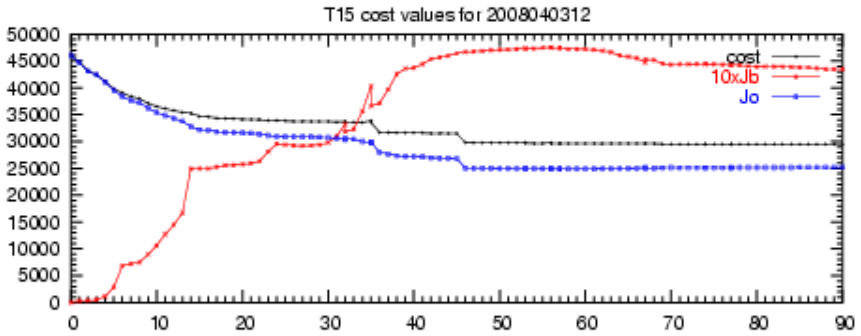
- Extend common verification to cover all services
  - Ask remaining operational services (met.no, KNMI, AEMET, metie, EMHI, LHMS) to add model data extraction step in operational suite and deliver in real time
  - Extend the work for archived model data in member services
  - Extend the work to cover more external data
  - Extend to high resolution
- Add assimilation monitoring
- Add mast profile
- Add other diagnosis products
  - Radar simulator, Satellite imagies with RTTOV …
  - HARMONIE/DDH
  - …
- Test collection of real-time field data for
  - Forecast charts; meteograms
  - Field verification

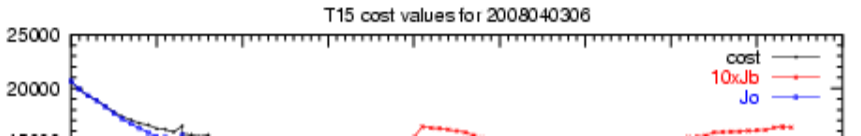
DMI-Hirlam model run

T15
S05
Q05
M1T
M1V

Surface Statistics
VAR Minimization







Near future outlook

- Extend common verification to cover all services
  - Ask remaining operational services (met.no, KNMI, AEMET, metie, EMHI, LHMS) to add model data extraction step in operational suite and deliver in real time
  - Extend the work for archived model data in member services
  - Extend the work to cover more external data
  - Extend to high resolution
- Add assimilation monitoring
- Add mast profile
- Test collection of real-time field data for
  - Forecast charts; meteograms; precipitation (POD,FAR,PC, HSS,B…)
  - Field verification
- Cooperation from ALADIN/LACE partners welcome!

Concluding remarks

We aim for a harmonized monitoring utility with wide applicability

- Suitable for model inter-comparison
- Suitable for routine model system monitoring
- Applicable to both HIRLAM and HARMONIE system
- Open-source software preferred; Good documentation required

Appeal:

- Share your tools
- Try looking around first before inventing new wheels
- Contribute to a common framework