

Coherent observation impact studies

**HIRLAM/ALADIN All-Staff Meeting/Workshop
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Structure

- Background
- Overview remote sensing research in HIRLAM
- Ongoing coordinated activities
- Assimilation and impact experiments

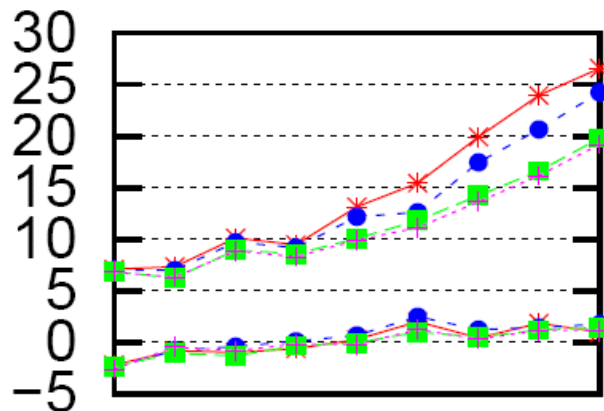
Background – 1

With HIRLAM 4D-Var, HIRLAM forecast quality comes closer to ECMWF, but not all the way!

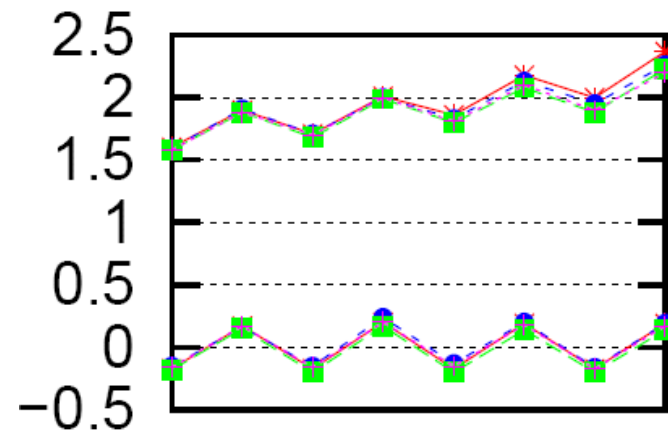
From a 4D-Var test by Xiaohua Yang:

- 3D-Var without large scale mix
- 4D-Var without large scale mix
- 3D-Var with large scale mix
- 4D-Var with large scale mix

500hPa H



2M T



Background – 2

Why is ECMWF D.A. better than HIRLAM D.A. ?

- **4D-Var – 3D-Var !**
- **Later cutoff !**
- **More satellite observations !**
- **LAM D.A. more difficult than global D.A. ?**
- **Better model ?**

Background – 3

Remote sensing observations presently in
reference HIRLAM:

AMSU-A channels 5 - 10 over sea areas only!

Status of remote sensing research activities in HIRLAM – 1

- Upper looking AMSU-A channels over land and ice: Ready for the reference system !
- Lower looking AMSU-A channels over sea, land and ice: More research needed; emissivity and skin temperature modelling and control!
- AMSU-B channels over sea: Ready for the reference system, bias correction missing!
- AMSU-B channels over land and ice: More research needed!
- Cloud free SEVIRI radiance (water vapour channels); First impact tests done; further improvements needed; e.g. Thinning, Bias correction

Status of remote sensing research activities in HIRLAM – 2

- **Cloudy SEVIRI radiance data: Research just started (EUMETSAT research fellow)**
- **Binary cloudiness information (AVHRR): Research just started (EUMETSAT research fellow)**
- **IAASI and AIRS radiance data: Research just started**
- **Seawinds scatterometer winds: Almost ready for the reference system (Sep. 2007)**
- **AMV/geostationary: Almost ready for the reference system; screening and thinning may be improved**
- **AMV/MODIS: Similar to AMV/geostationary**

Status of remote sensing research activities in HIRLAM – 3

- **Ground-based GPS data, zenith delays: some further improvements needed: e.g. bias correction**
- **Ground-based GPS data, slant delays: More research needed; Small impact expected at model resolution above 5 km**
- **OSI SAF SST and sea ice data: Close to be included in the reference system; The surface analysis scheme is being modified.**

Status of remote sensing research activities in HIRLAM – 4

- **Radar wind VAD profiles:** Further development work is needed, for example, understanding of bias problems
- **Radar radial wind vectors:** Bias problems as with VAD profiles; A pre-processing package is being developed (super-obbing and de-aliasing)
- **Radar reflectivities:** Joint project with ALADIN

Why is work with remote sensing data slow in HIRLAM?

- Difficult problems, at least one person per instrument needed!
- Externally funded projects, not dedicated to HIRLAM progress!
- Small efforts (so far) on coordination!

To improve:

**4D-Var training week for observation experts
SMHI, Norrköping 19-23 February 2007**

Coordinated activities in the following areas

- **Synoptic scale assimilation over mid-latitude sea areas**
- **Synoptic scale assimilation studies over the Arctic in the context of the IPY**
- **Assimilation studies aimed at improving the forecasts of convection with mesoscale/synoptic scale model**

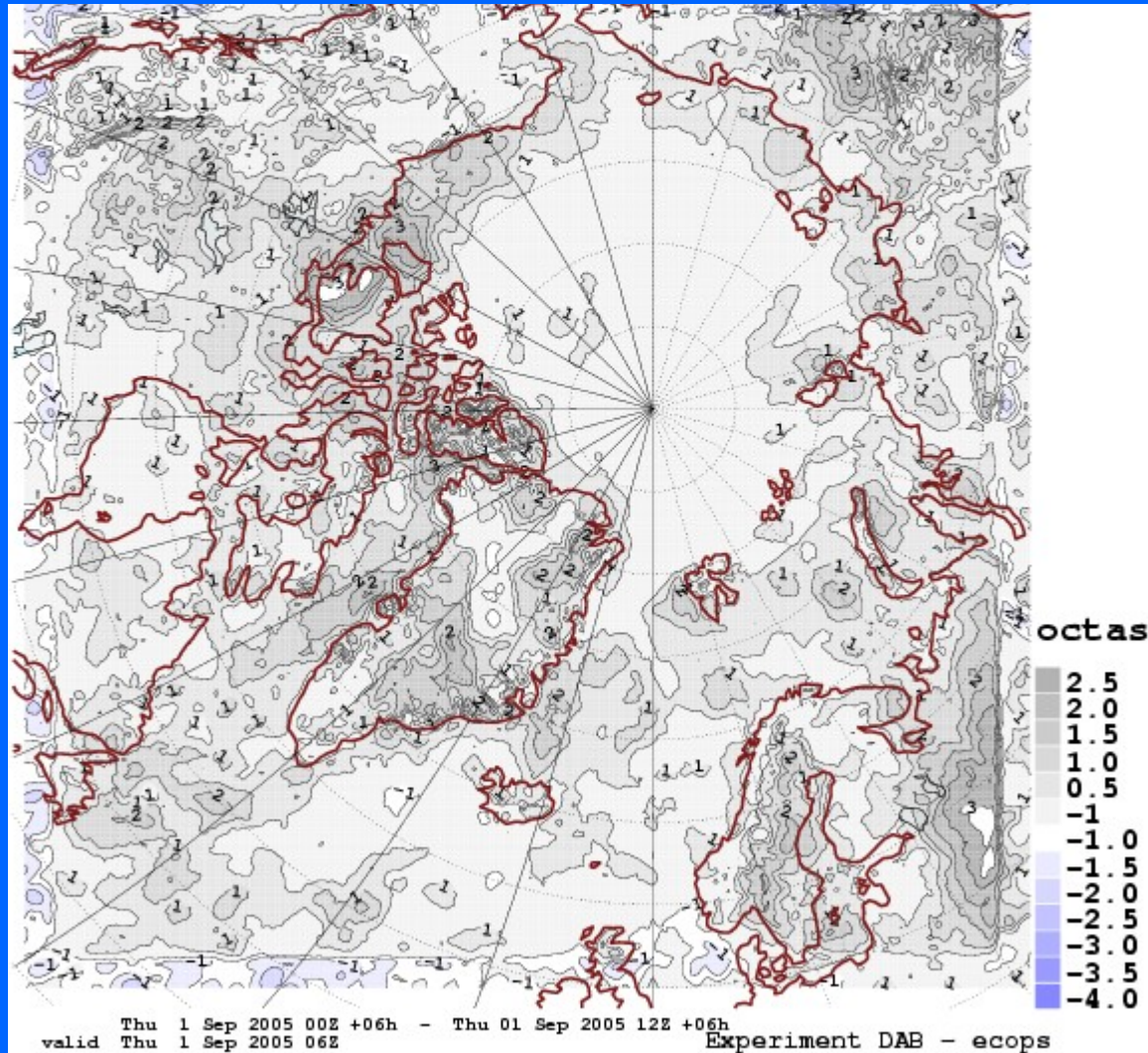
Synoptic scale assimilation over mid-latitude sea areas

- RCR domain (7.1 resolution), no LSM
- Conventional obs. types, AMSU-A over sea, AMSU-B, scatterometer, AMV, VAD, OSI/SAF SST/Ice and AMSU-A over ice and land
- 3D-Var and 4D-Var (RTTOV 8)
- Snow-forest scheme
- Four full scale parallel assimilation experiments for January 2007 and August 2006 (3D/4D-Var with: (1) ref. obs, (2) ref. obs. +all)
- One common verification package, great care over data sparse regions, observations cross verified against each other

Synoptic scale assimilation studies over the Arctic in the context of the IPY

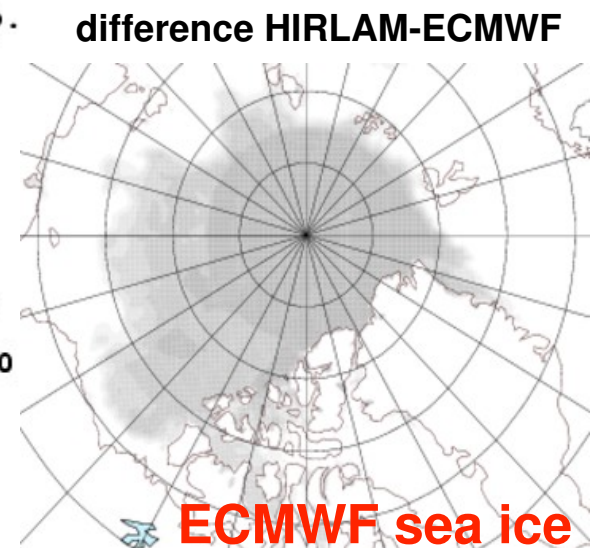
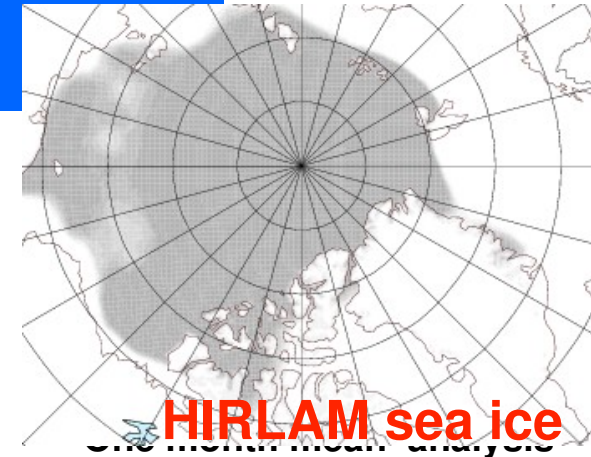
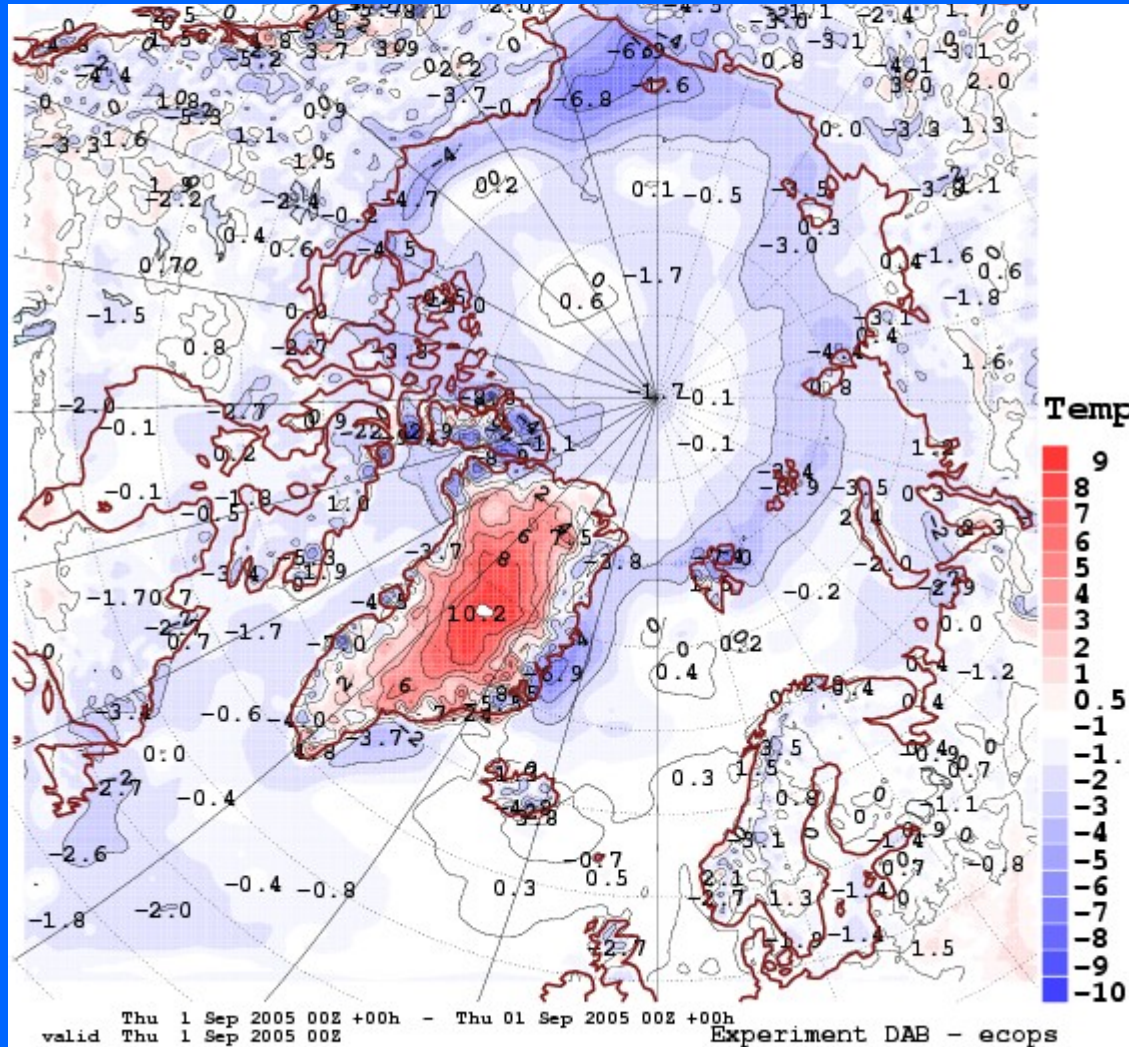
- Arctic domain
- Conventional obs., AMSU-A over sea, and ice, OSI SAF SST and sea ice, MODIS winds
- Initially 3D-Var
- Replace reference surface scheme
- Three parallel assimilation experiments:
(1) conv. obs., (2) conv obs. + AMSU-A,
(3) conv obs. + AMSU-A+MODIS
- Evaluate rejection rate of conventional obs., effects of Greenland topography, low level stratus
- Field verification using ECMWF analyses

Preliminary results for run using conventional obs.



Total Cloud cover
One month mean 6h
forecast difference
HIRLAM-ECMWF
(Sep. 2005)

Preliminary results for run using conventional obs.



Assimilation studies aimed at improving the forecasts for mesoscale/synoptic scale convection

- DMI 15 km domain, 5 km
- Conventional obs., RH2M, SEVIRI, GPS ZTD, radar radial winds
- 3D-Var and later with 4D-Var
- Possibly QC of humidity outside HIRVDA
- Validation against independent data sources. Comparison of satellite images and radar composites with model-simulated quasi-satellite and quasi-radar images