Joint HIRLAM/ALADIN plans on mesoscale data assimilation

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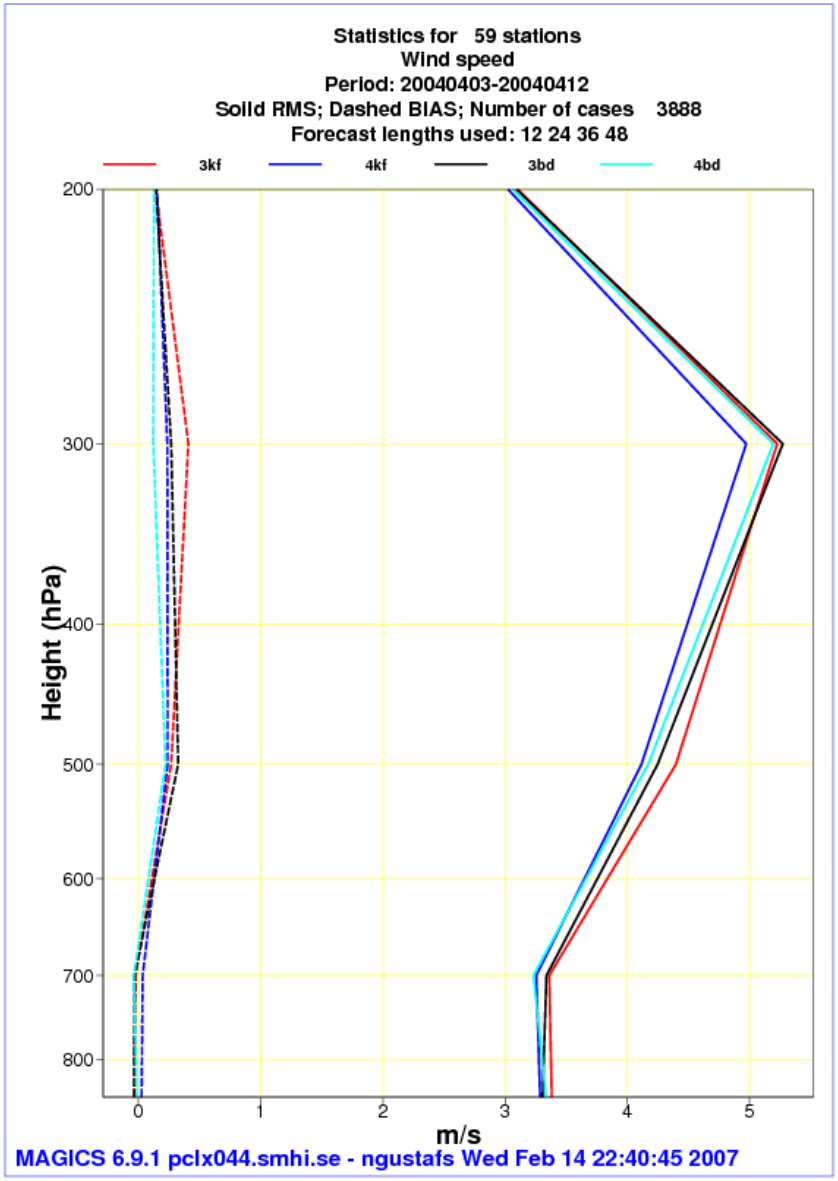
How was the plan created?

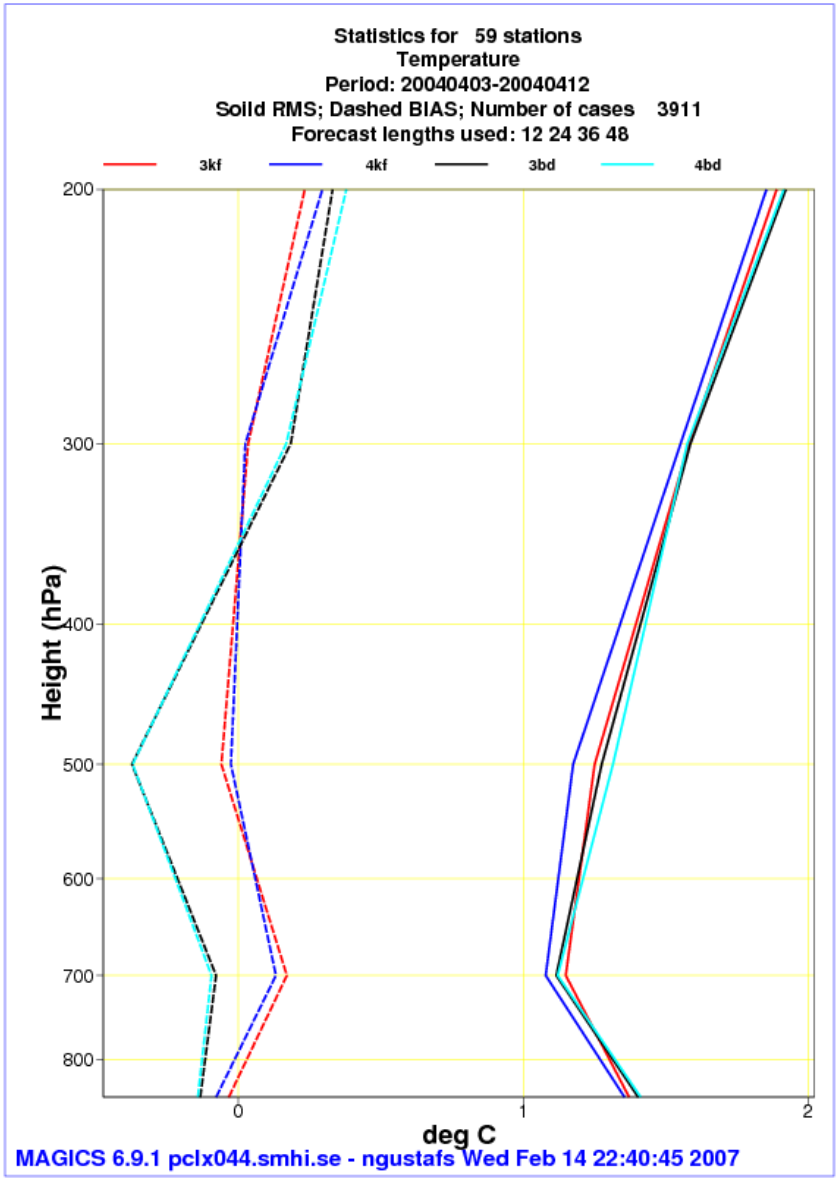
- **A planning meeting in October 2006 in Zürich (besides EWGLAM)**
- **The “Surface/Surfex” workshop held in Toulouse in December 2006**
- **A common meeting of D.A. staff in Norrköping (besides the SRNWP workshop) in March 2007**

Some initial considerations (1)

- During the Zürich planning meeting a strong consensus among the participants from the 2 communities for development of **A common HIRLAM/ALADIN mesoscale data assimilation system** was established.
- 4 year planning horizon (2007-2010)
- The question of **dynamical/physical "balances"** lies in the heart of the data assimilation problem. We must be able to project the observed information on structures that will survive initial oscillations (adjustment processes).
- **The present state of knowledge on adjustment processes and "balances"**

Example: HIRLAM 4D-Var dependence on condensation/convection in the non-linear model

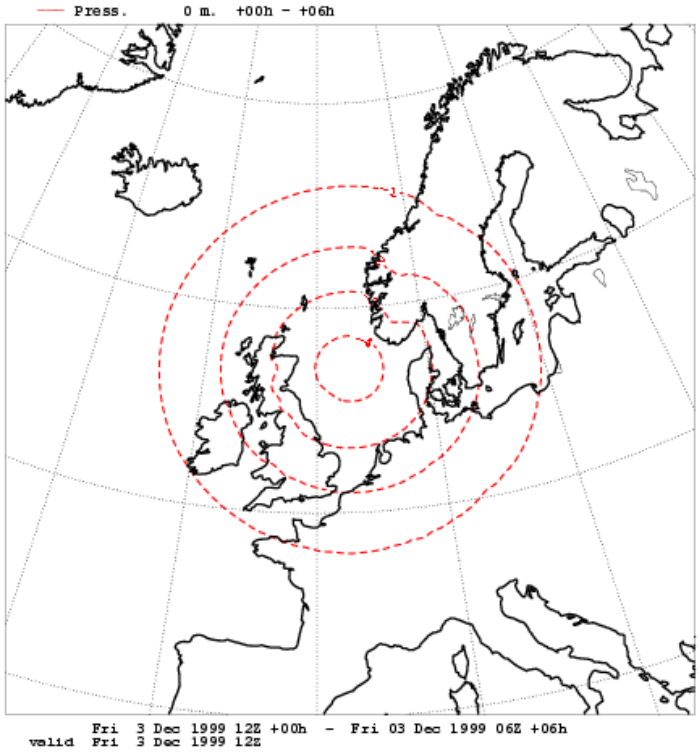


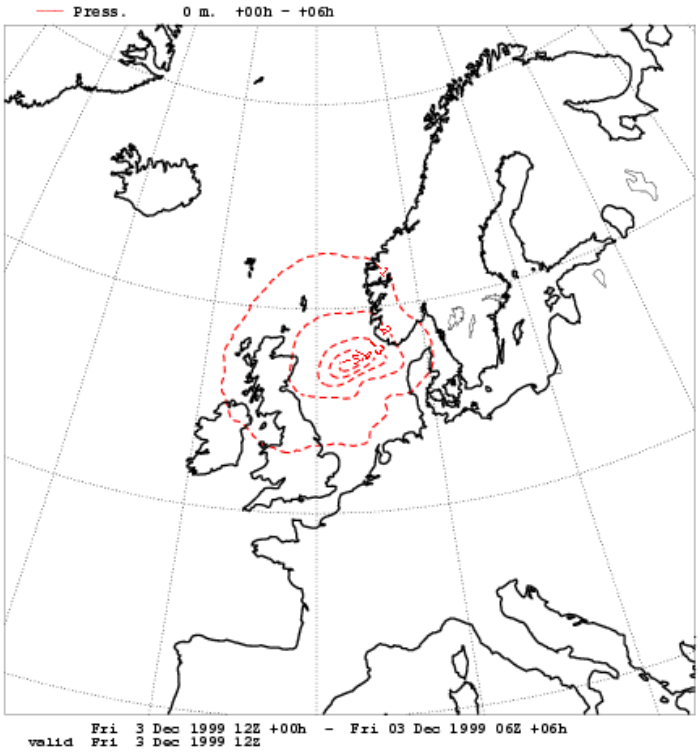


Some initial considerations (2)

- **Variational techniques** should continue to be the core of our strategy, in order to select challenges with the most likely substantial return of investments. However, we should be very open to improve the variational techniques by **utilizing ensemble prediction input information.**
- We need to pay **more attention to surface and soil data assimilation**, and for this purpose we need to utilize all available remote sensing data, in particular satellite data that will become available in the near future. Furthermore, as is the case with the surface parameterisation, it will (in the long run) be beneficial with an **externalisation** of the surface and soil assimilation

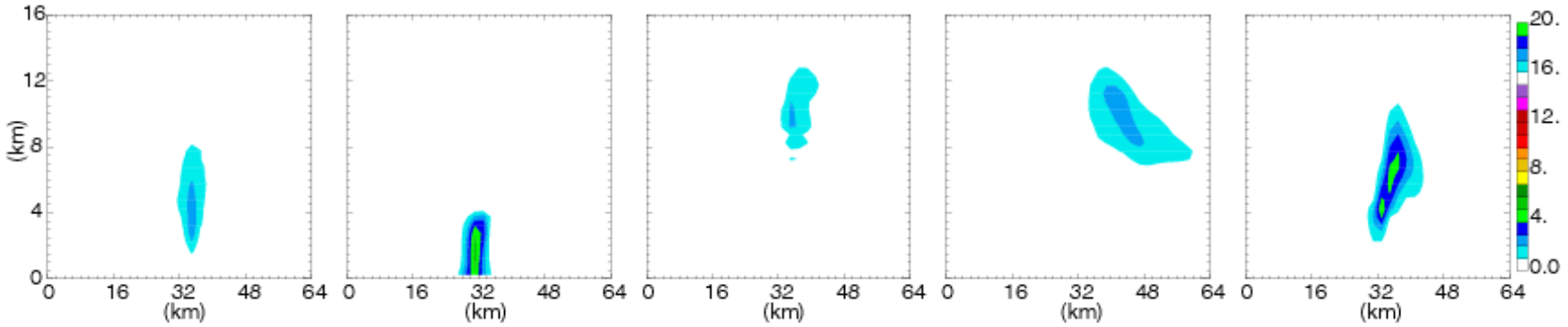
Example: Implicit flow-dependent structure functions through 4D-Var



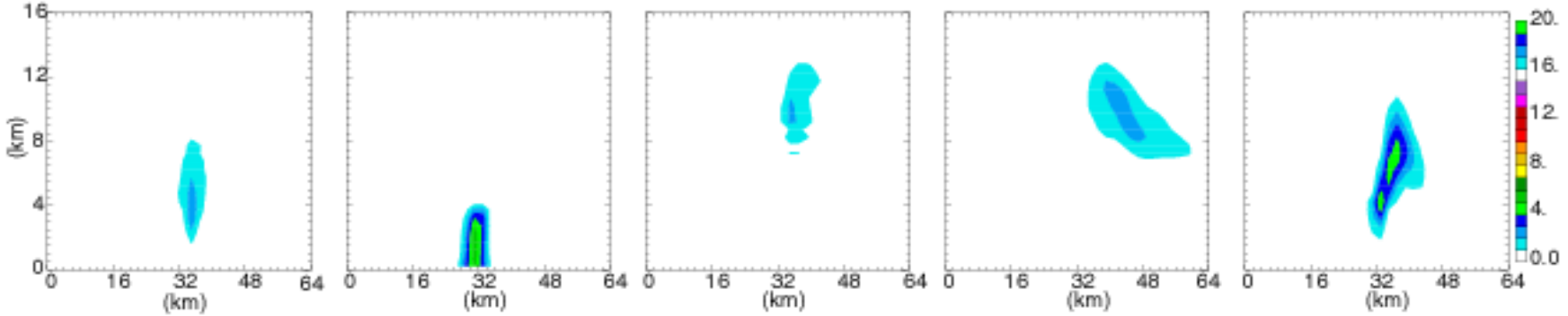


Retrieval of Microphysical Variables at T=65 min

Truth



Vr + Z



q_c, q_r, q_i, q_s, q_h

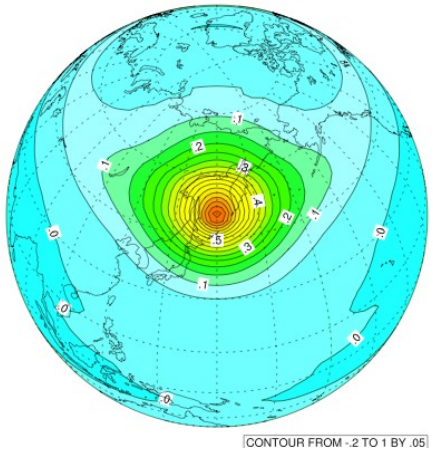
RESULTS TOO GOOD!

Frome Dale Barker 2007

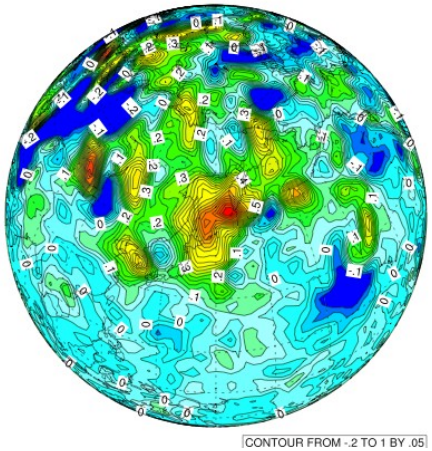
Hybrid DA (Global) Single Observation Test

- Temperature observation (O-B, σ_o=1K) at 50N, 150E, 500hPa.
- Worst case scenario: Ensemble size N=1 (taken from KMA's error breeding system)

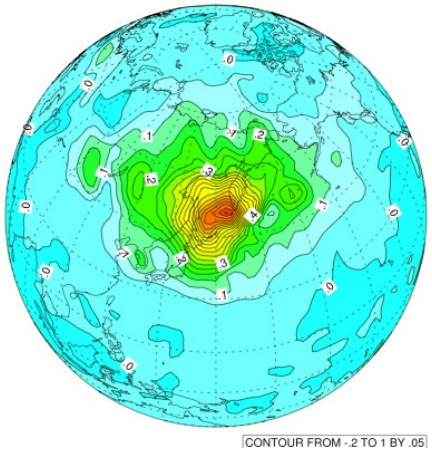
T increment



Pure 3D-Var

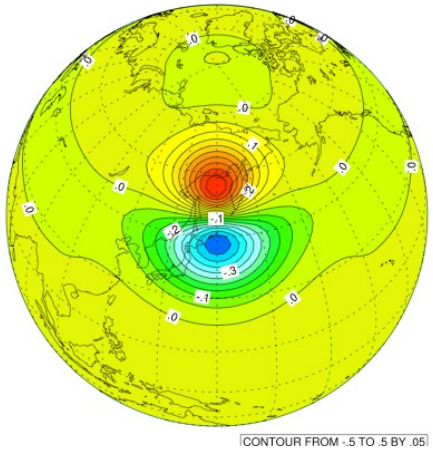


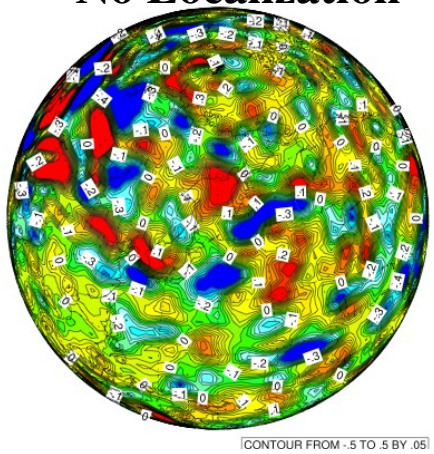
Pure Ensemble, No Localization

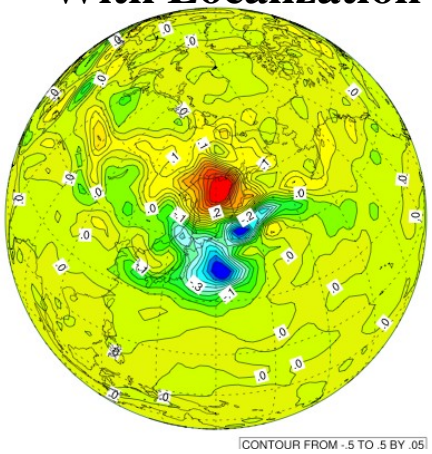


Pure Ensemble, With Localization

u increment







From Dale Barker 2007

WP1: Construction of a basic version of a common HIRLAM-ALADIN 3D-VAR data assimilation system

1) **Installation and testing of ALADIN 3D-VAR within the HIRLAM community**
2) **Possible adaptation of the extension zone treatment in ALADIN (especially needed for efficiency of 4D-VAR)**
3) **Observation operator recoding and convergence**
4) **Comparison and validation of ALADIN and HIRLAM 3D-VAR.**

January 2007 – June 2008

WP2: Further development of the common HIRLAM/ALADIN 3D-VAR data assimilation system (1)

WP2.1: Formulation of a background error constraint based on a wavelet representation. (2007-2009)

WP2.2: Introduction of a new (water vapour) assimilation control variable. (2007)

WP2.3: Derivation of background error constraint (J_b) and large scale error constraint (J_k) statistics based on ensemble assimilations. (2007-2008)

WP2.4: Formulation of background error balance constraints based on the non-linear balance equation and the omega equation. (2007-2008)

WP2: Further development of the common HIRLAM/ALADIN 3D-VAR data assimilation system (2)

- **WP2.5: Flow-dependency through background error standard deviations based on ensembles. (2007-2008)**
- **WP2.6: Flow-dependency through background error correlations based on ensembles. (2007-2010)**
- **WP2.7: Introduction of total water (or similar including ice) as moisture control variable in the common HIRLAM/ALADIN 3D-VAR. (2008)**

WP3: Development of common mesoscale HIRLAM/ALADIN 4D-VAR data assimilation system (1)

- **WP3.1: Development of 4D-VAR in a nutshell. (2007)**
- **WP3.2: Development of an initial HIRLAM/ALADIN 4D-VAR data assimilation system (2008-2009)**
- **WP3.3: Strategy for development and coding of physical parameterisation schemes to serve both 4D-VAR and the forecast model (2007-2008)**

WP3: Development of common mesoscale HIRLAM/ALADIN 4D-VAR data assimilation system (2)

- **WP3.4: Initiation of a research program for inclusion of moist processes in mesoscale data assimilation with emphasis on 4D-VAR (''How to project on a good estimate of the moist attractor before it anyhow moves away'')? (2007-2010)**
- **WP3.5: Inclusion of moist processes in the common HIRLAM/ALADIN mesoscale 4D-VAR. (2008-2010)**

WP4: Experimentation with rapid update cycling and blending in of large scale information

- **Hourly update cycles**
- **Focus on nowcasting and very short range forecasting**
- **ALADIN will start experimentation in 2007**
- **HIRLAM will join in 2008**

(2007-2010)