Data assimilation activities in LACE 2006-2007

28th EWGLAM meeting
2006.10.09-12

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LACE data assimilation

- Coordinated work since 2003

- Local assimilation in Czech Republic (surface assimilation) and in Hungary (3DVAR assimilation)

- Contribution to the coordinated work from most of the LACE countries (Croatia, Czech Republic, *Romania,* Slovakia)

- Collaboration with France

- Harmonization of LACE and ALADIN plans

LACE data assimilation

Work on...

Background errors

Cycling aspects

Towards 4D assimilation (FGAT)

Use of observations

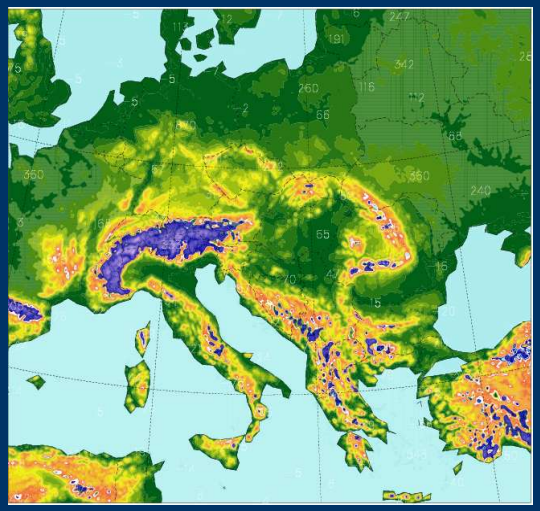
Observation handling (ODB)

System monitoring

Surface assimilation

3DVAR in Hungary

Main features:
- CY30T1
- 3DVAR assimilation
- max54 h production (4/day)
- ARPEGE LBC



Model geometry:
- dx=8km (349*309)
- 49 levels
- linear grid
- Lambert projection

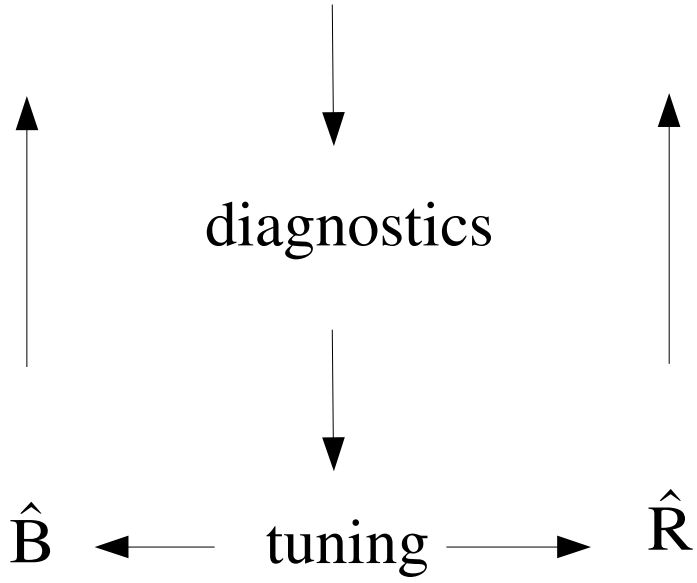
Assimilation settings:
- 6h cycle
- short cut-off prod. analyses
- NMC method
- DFI
- LBC every 3 hours

Observation use:
- SYNOP, SHIP (geop)
- TEMP (T,u,v,q)
- ATOVS/AMSU-A
- ATOVS/AMSU-B
- AMDAR (T,u,v)

Background errors

A posteriori diagnostics and tuning

$$J(x)=(x-x_b)^T B^{-1}(x-x_b)+(y-H(x))^T R^{-1}(y-H(x))$$



Background errors

A posteriori diagnostics and tuning

$$E[d_b^o (d_b^o)^T] = H B H^T + R$$
$$E[d_b^a (d_b^o)^T] = H B H^T$$
$$E[d_o^a (d_b^o)^T] = R$$

...if B and R are correctly specified!

$$d_b^o = y - H(x_b)$$
$$d_a^b = H(x_a) - H(x_b)$$
$$d_o^a = y - H(x_a)$$

Diagnostics and tuning:

$$\hat{\sigma}_b^{\,2} = \frac{1}{P} \sum_i^P d_{bi}^a d_{bi}^o \longrightarrow \hat{B}$$

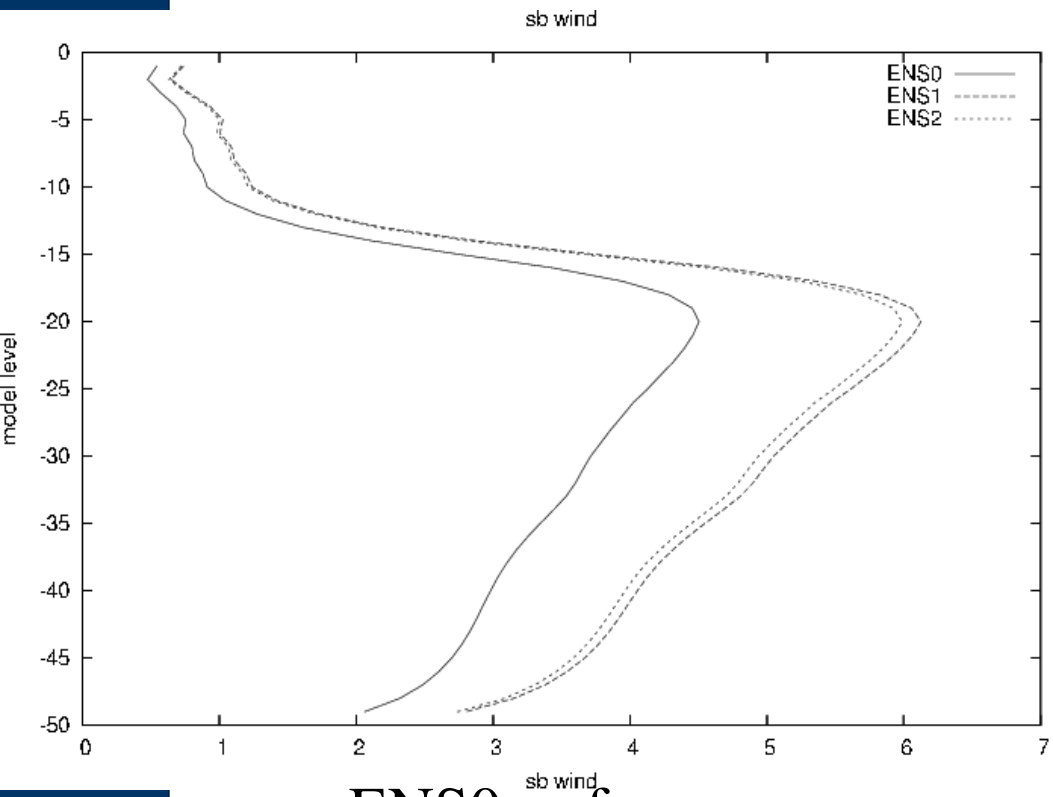
$$\hat{\sigma}_o^{\,2} = \frac{1}{P} \sum_i^P d_{ai}^o d_{bi}^o \longrightarrow \hat{R}$$

(Desroziers et al, 2005)

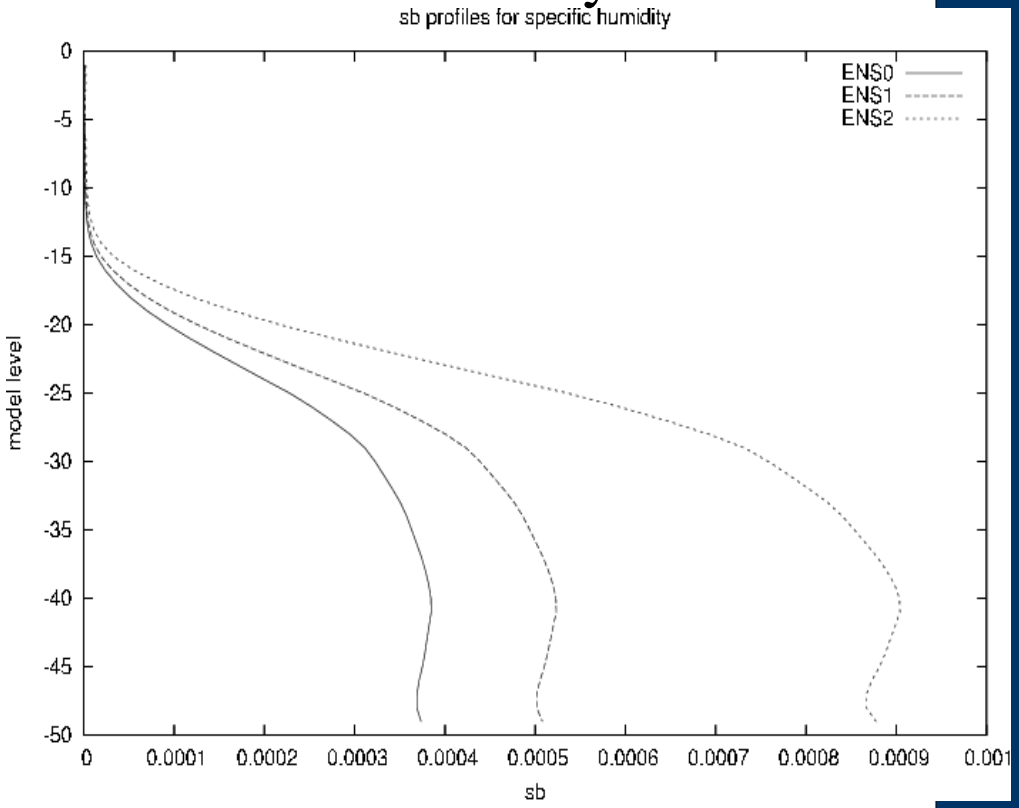
Background errors

A posteriori diagnostics and tuning

wind



humidity



ENS0: reference

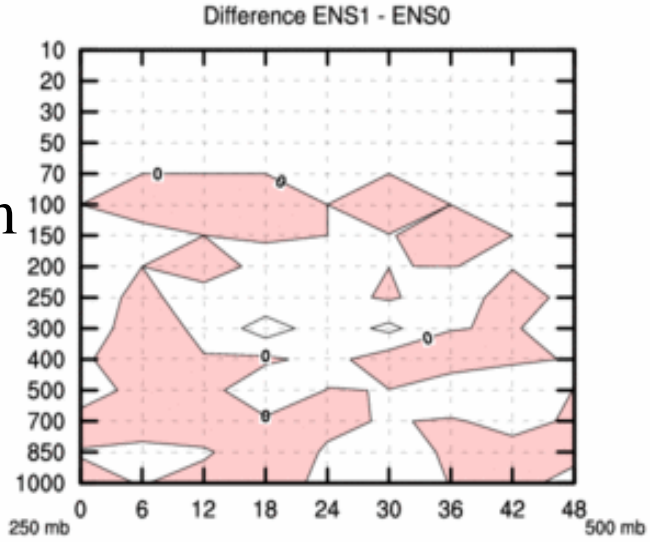
ENS1: uniform tuning

ENS2: variable dependent (vertically uniform) tuning

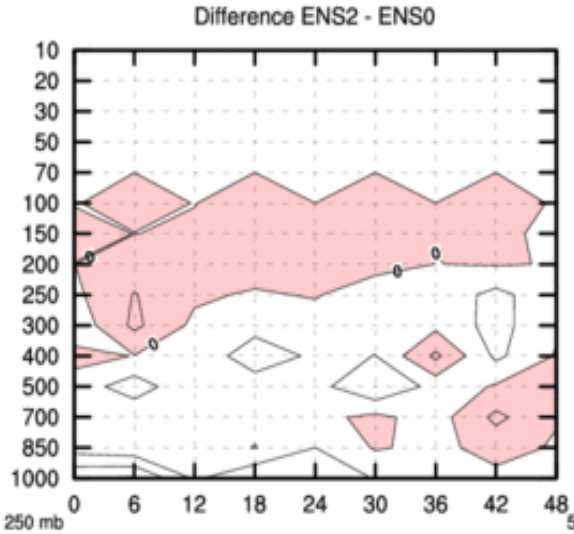
Background errors

A posteriori diagnostics and tuning

uniform tuning



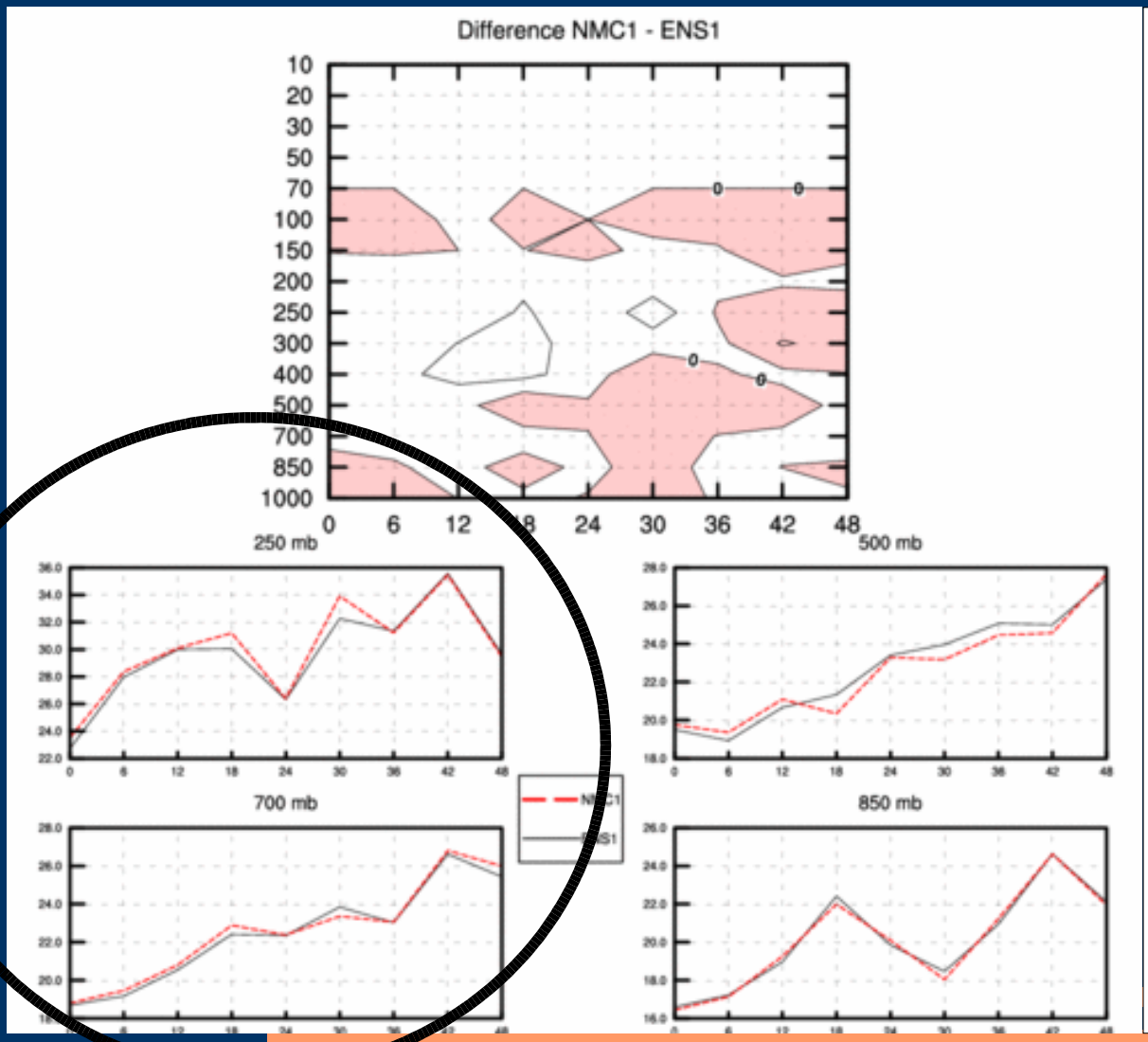
humidity RMSE diff



variable dependent tuning

Background errors

A posteriori diagnostics and tuning



Comparison with the presently operational B matrix (NMC1)

Background errors

A posteriori diagnostics and tuning

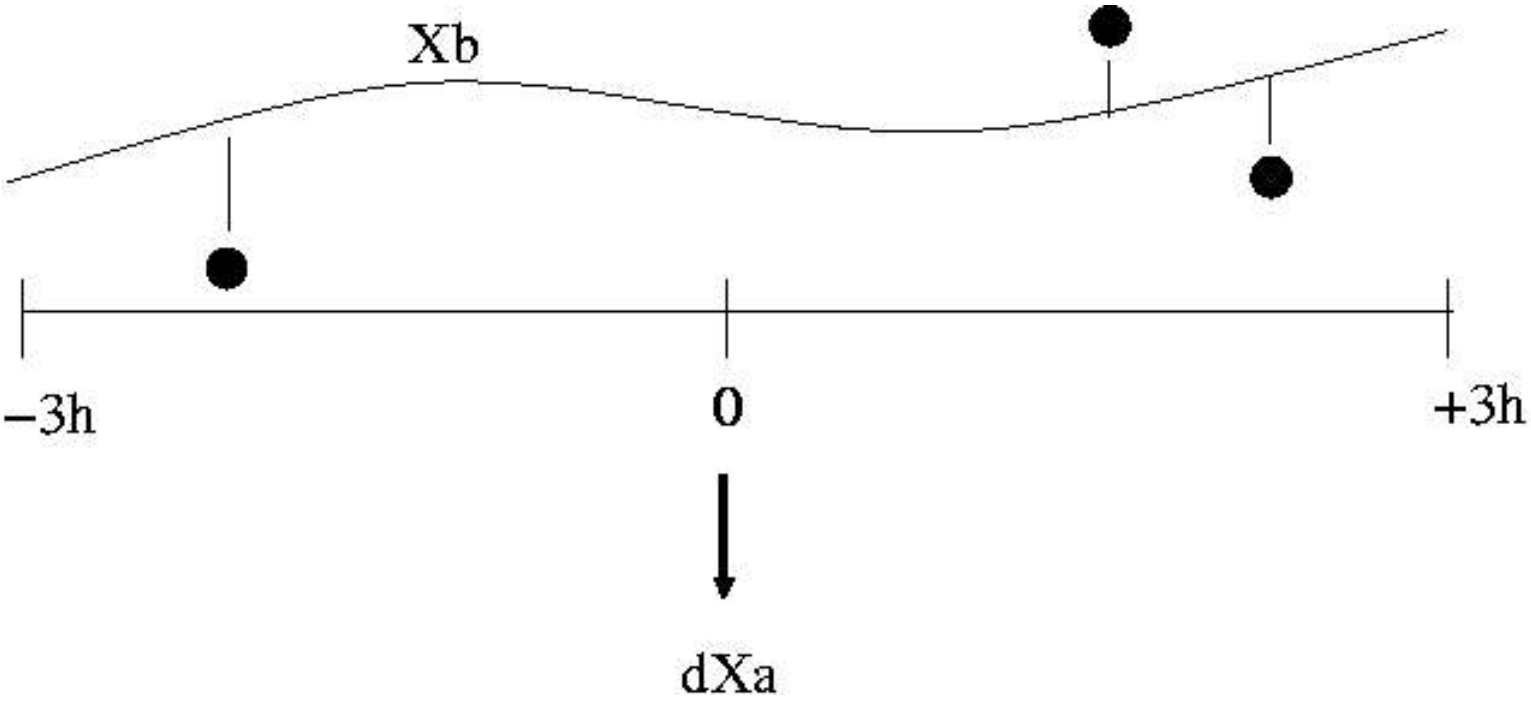
Continuation:

- parallel suite with the tuned ENSEMBLE B matrix

- height dependent diagnosis and tuning of Sigmab and Sigmao

3D-FGAT

"placement" of the analysis increment

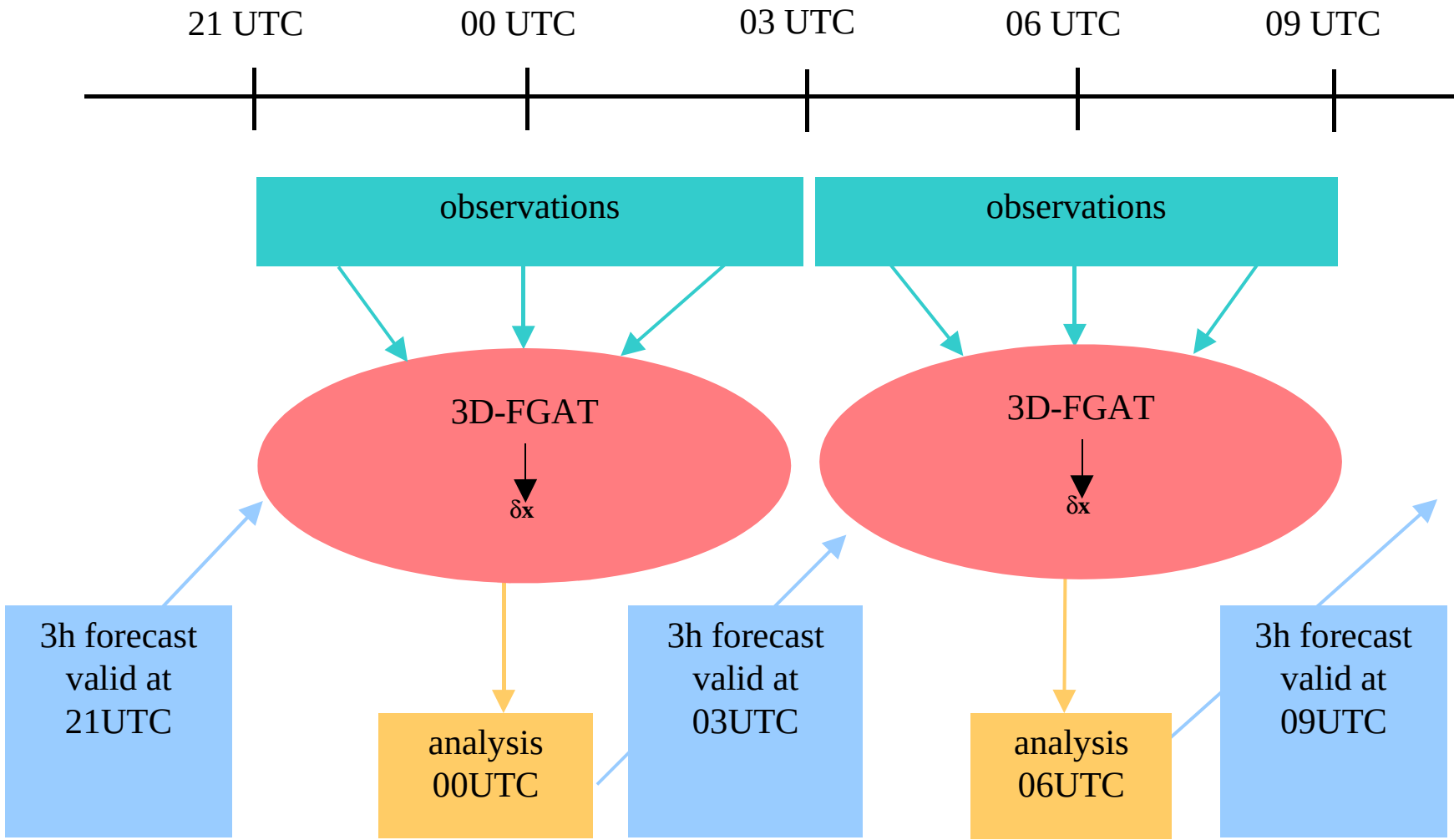


Original solution: $x_a = x_b(-3\,h) + \delta x_a$

New solution: $x_a = x_b(0) + \delta x_a$

3D-FGAT

Cycling method



3D-FGAT

Experiments

<u>10 day period in May 2005</u>:

1. 3DVAR operobs

2. 3DVAR operobs + SYNOP T2m, RH2m

3. 3DFGAT operobs

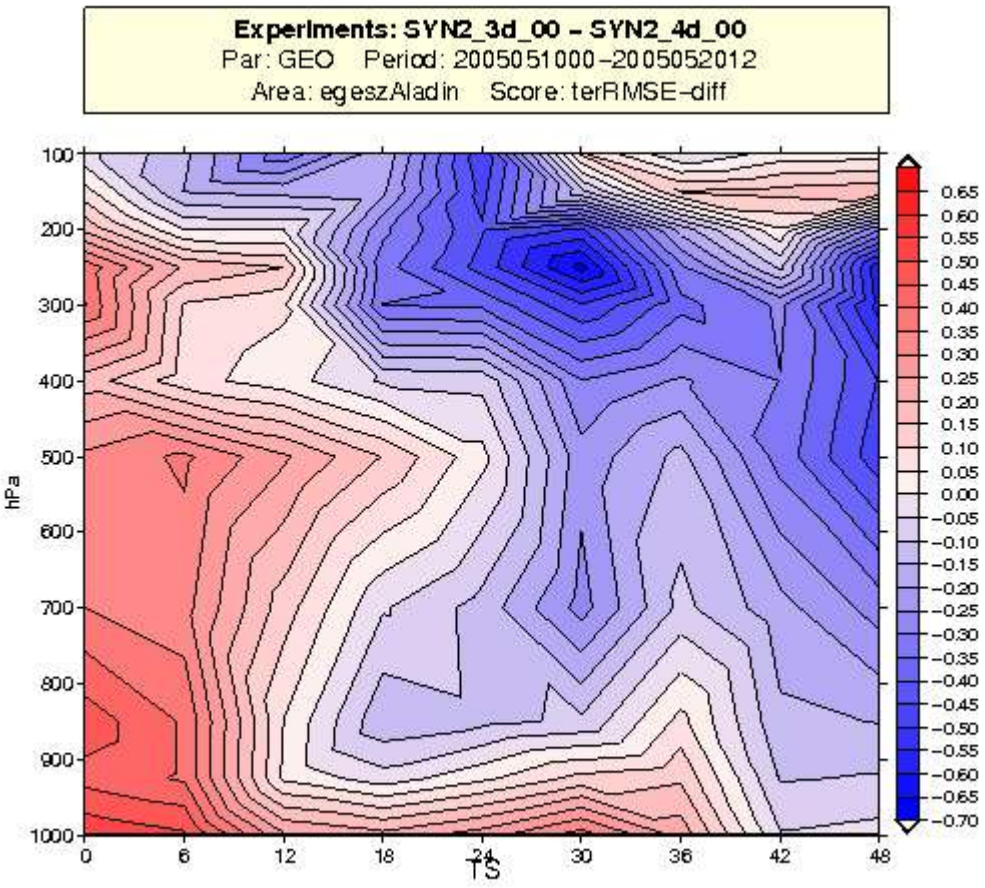
4. 3DFGAT operobs + SYNOP T2m, RH2m

5. 3DFGAT operobs + SYNOP T2m, RH2m + SYNOP(all timeslot)

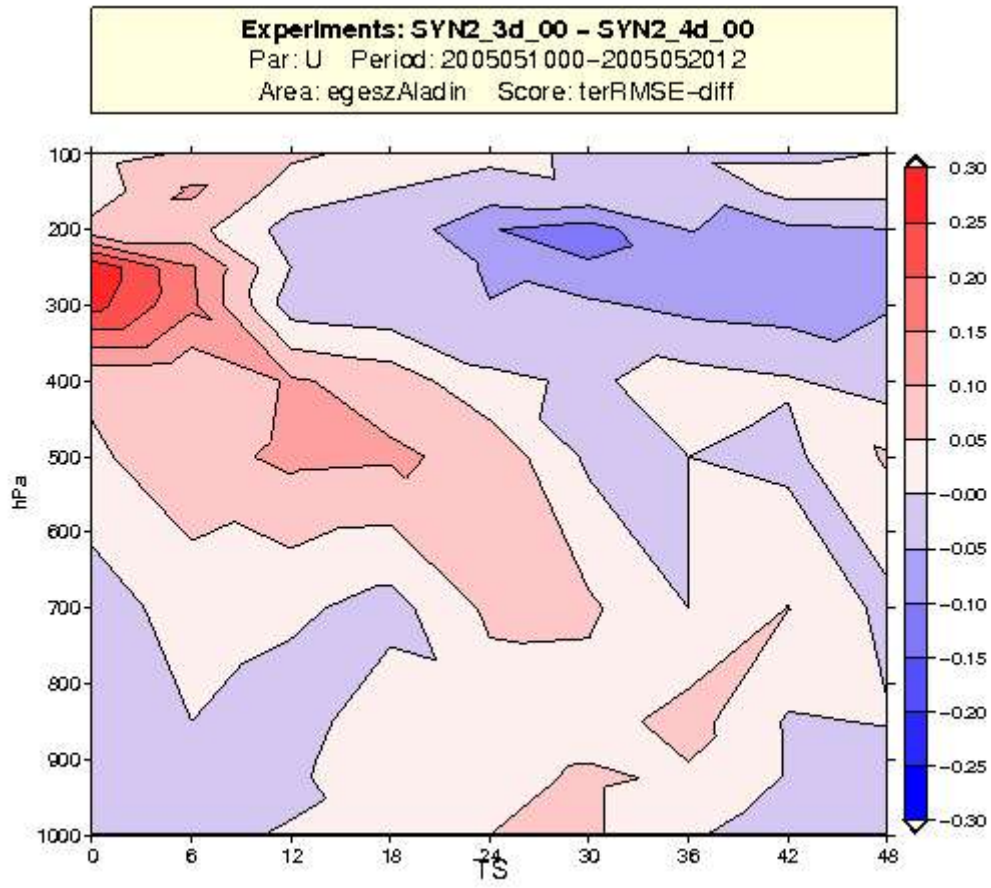
3D-FGAT

Impact of FGAT (operobs)

geopotential



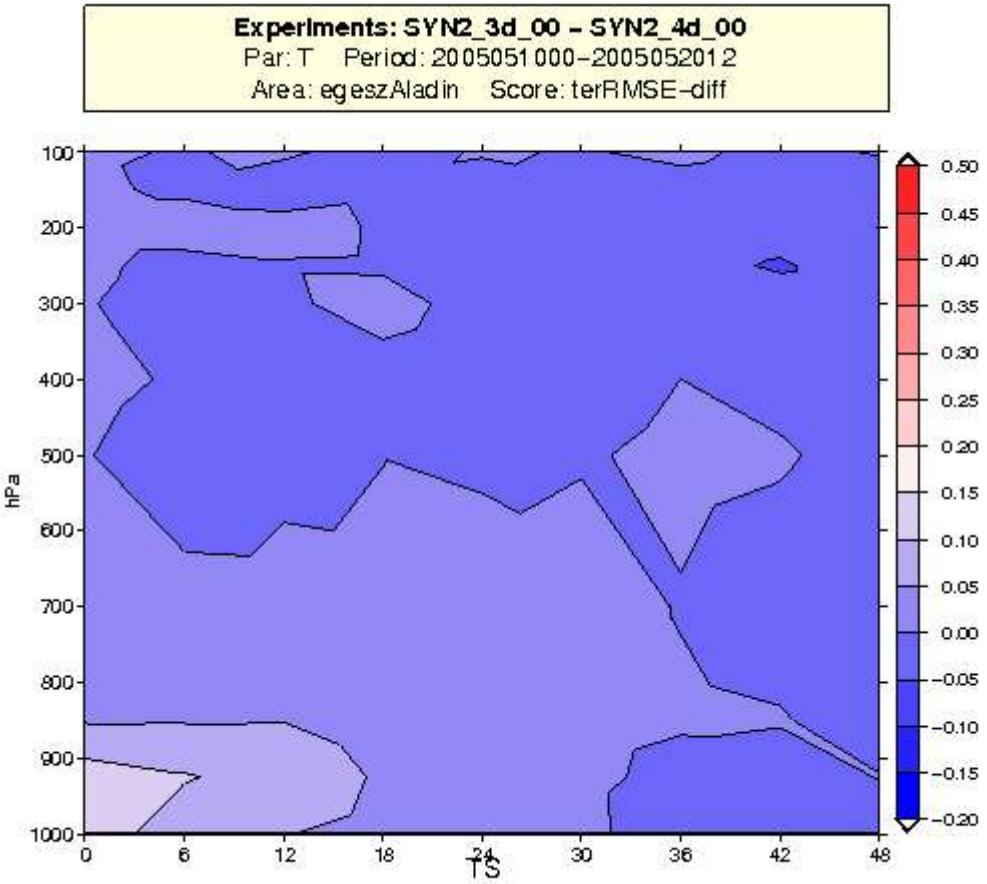
wind



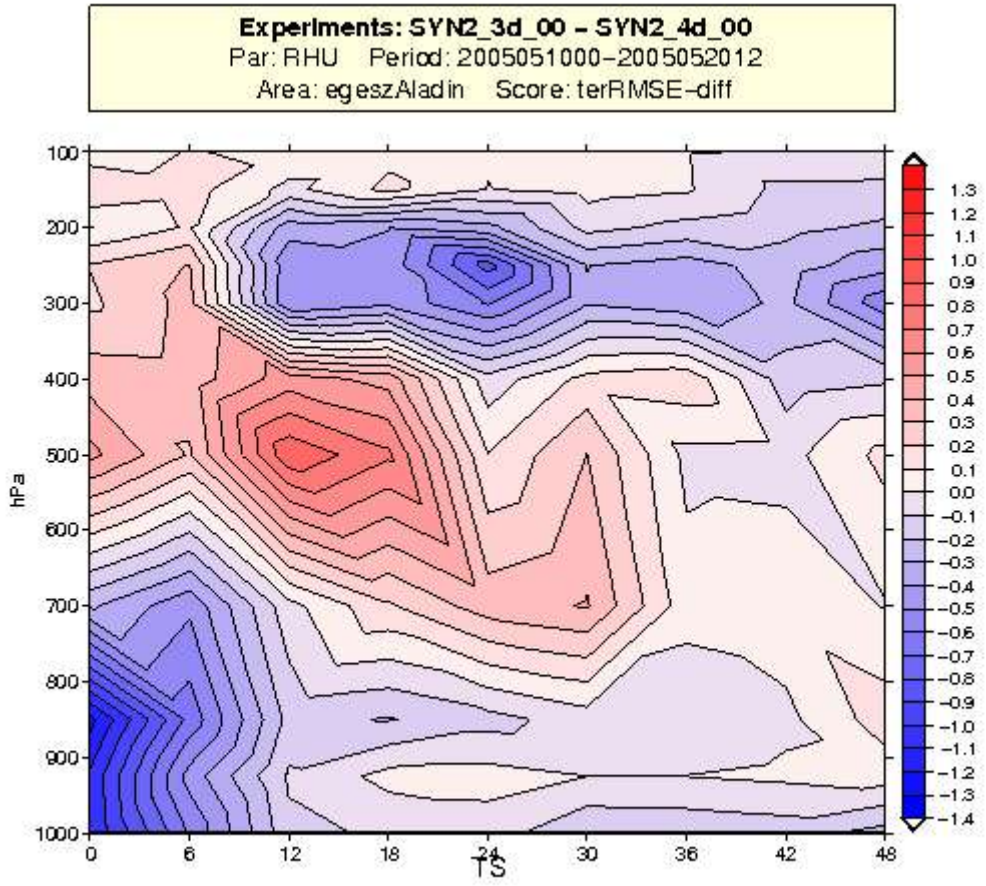
3D-FGAT

Impact of FGAT (operobs)

temperature



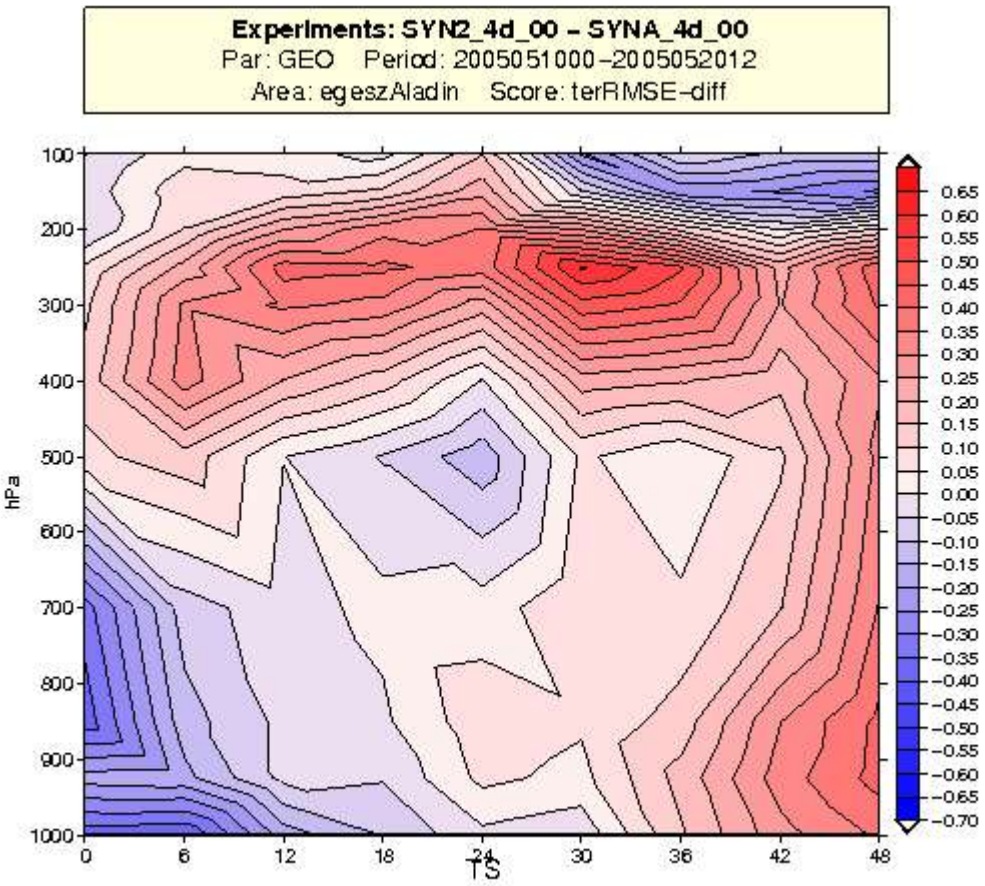
relative humidity



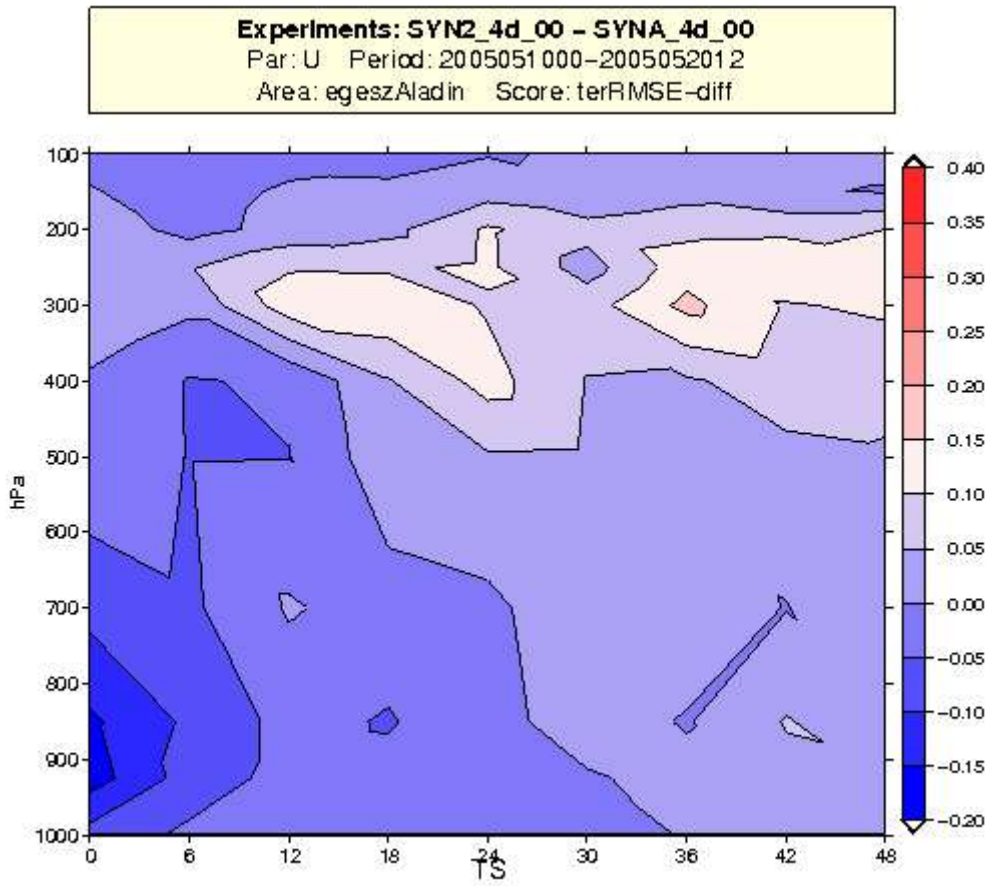
3D-FGAT

Impact of “all timeslots” SYNOP with FGAT

geopotential



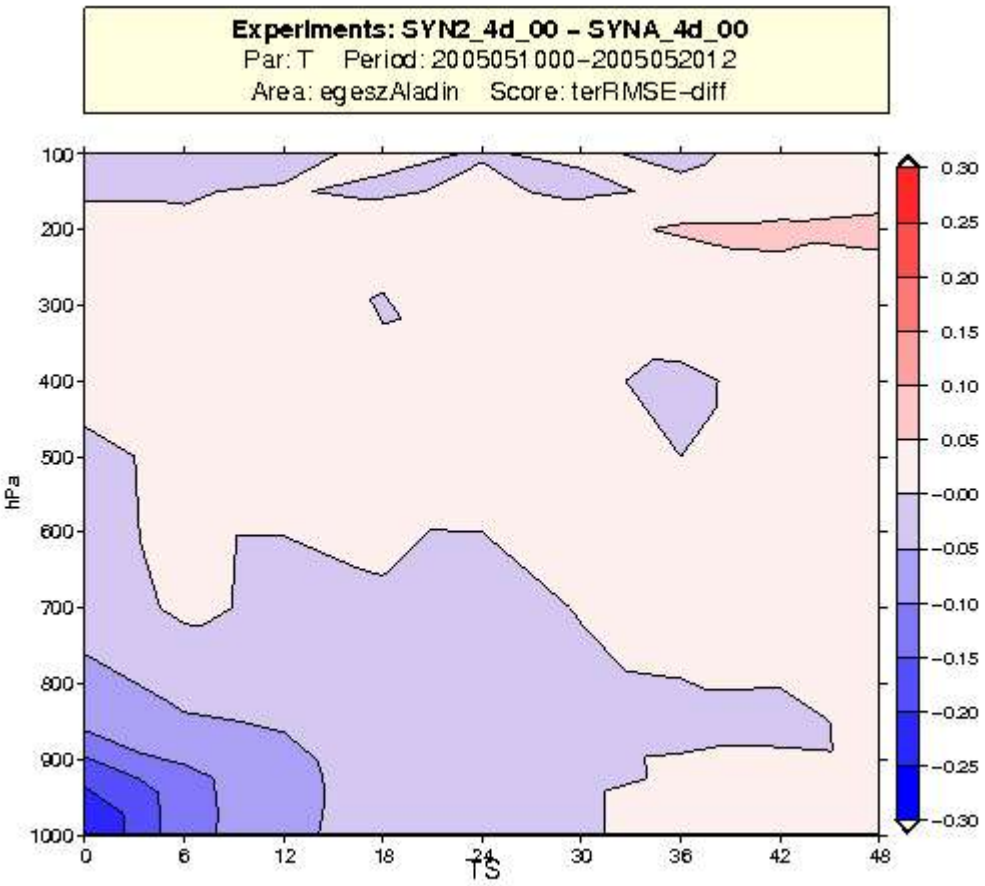
wind



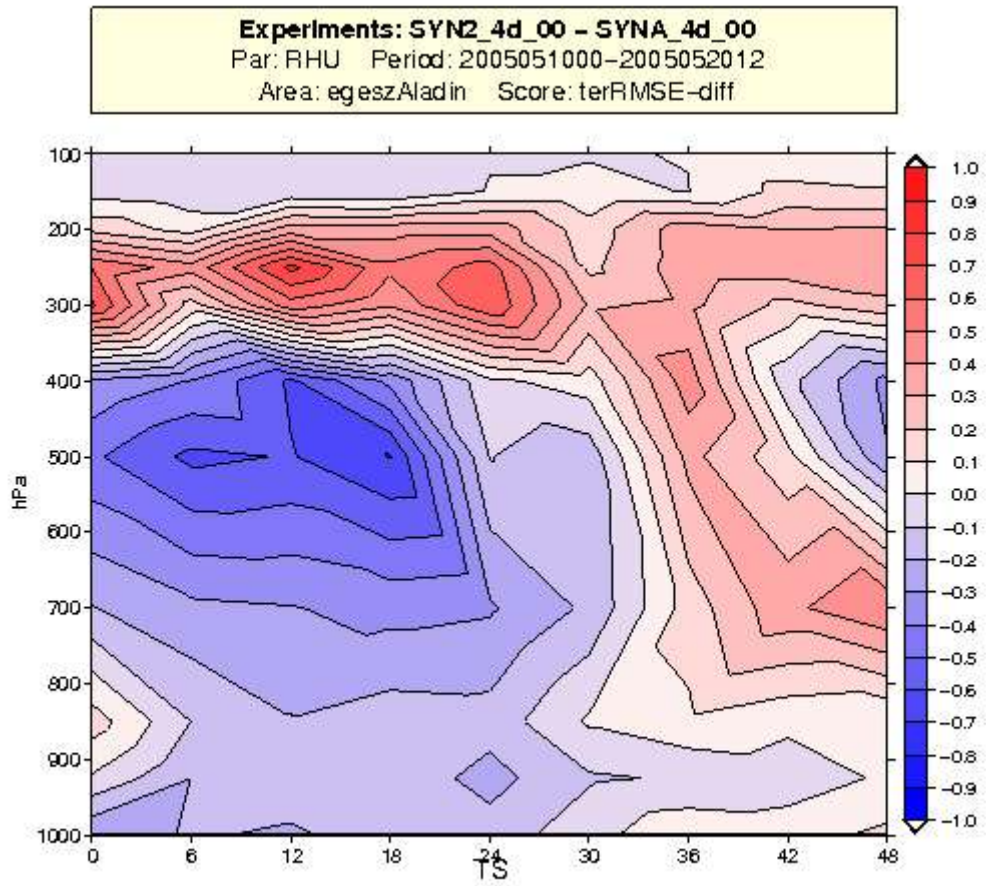
3D-FGAT

Impact of “all timeslots” SYNOP with FGAT

temperature



relative humidity



3D-FGAT

Continuation:

- use SEVIRI data

- “reduce” CPU cost

- comparison with 3DVAR RUC (3h frequency)

Observation use

AMV (GEOWIND)

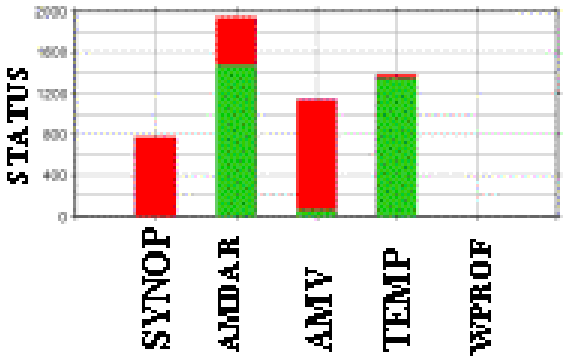
Experiments

	QI	use over land
WDEF	QI> 85%	no
W80P	QI > 80%	no
WLAN	QI > 85%	yes

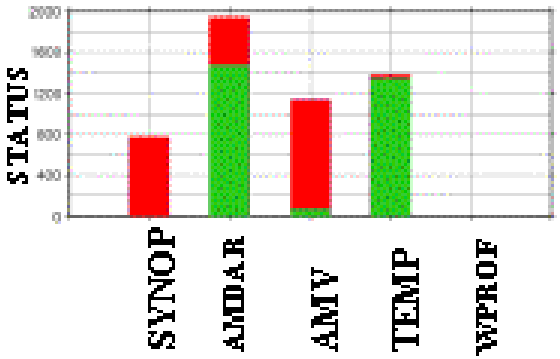
350 hPa < p < 800 hPa data are not used

Observation use

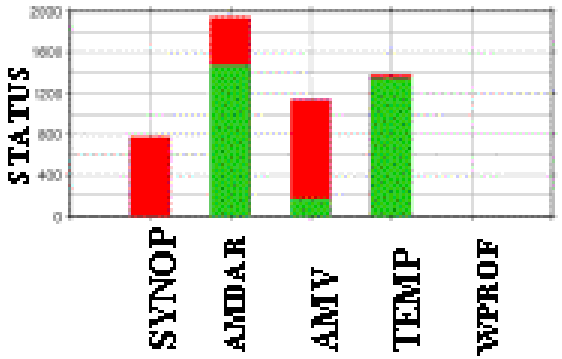
AMV (GEOWIND)



Active AMV : 57 (WDEF)



69 (W80P)



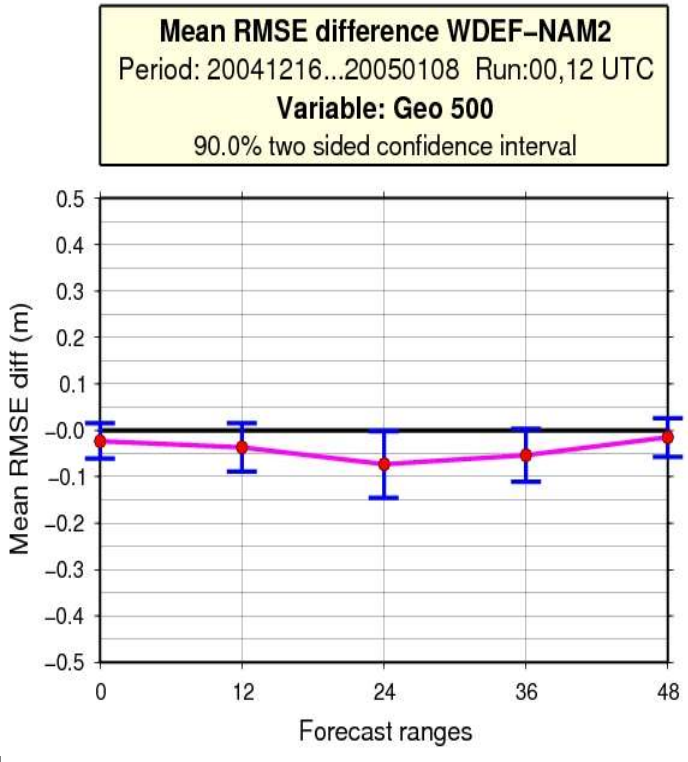
165 (WLAN)

Observation use

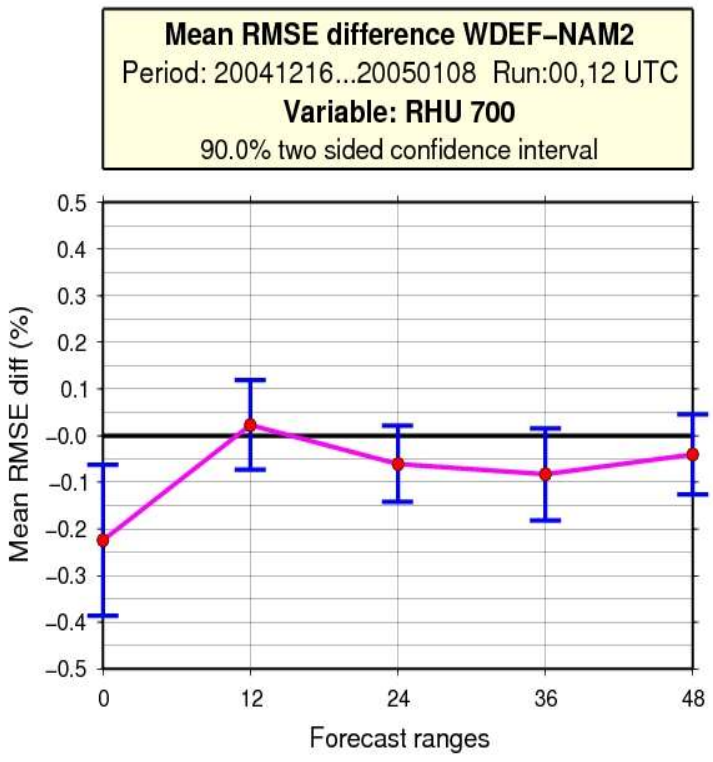
AMV (GEOWIND)

impact of AMV data

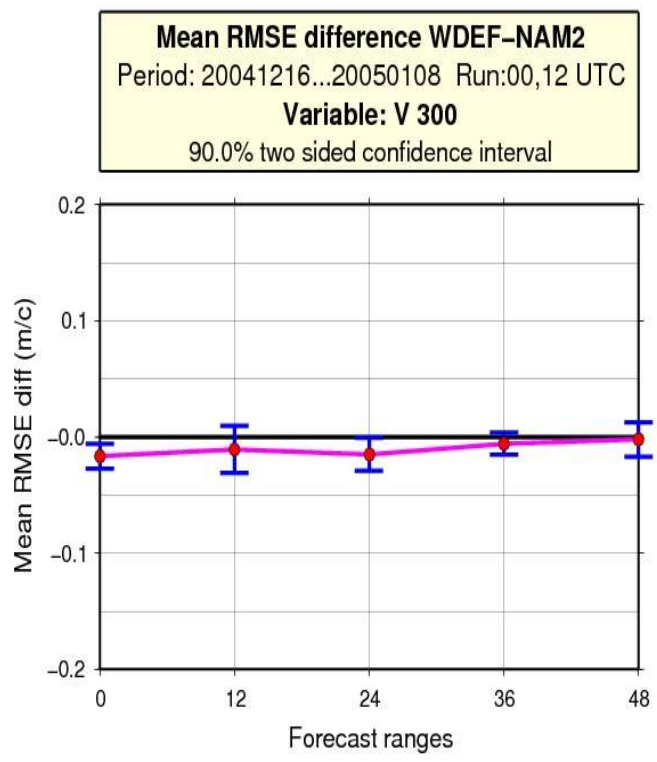
geo 500hPa



RH 700hPa



V 300hPa

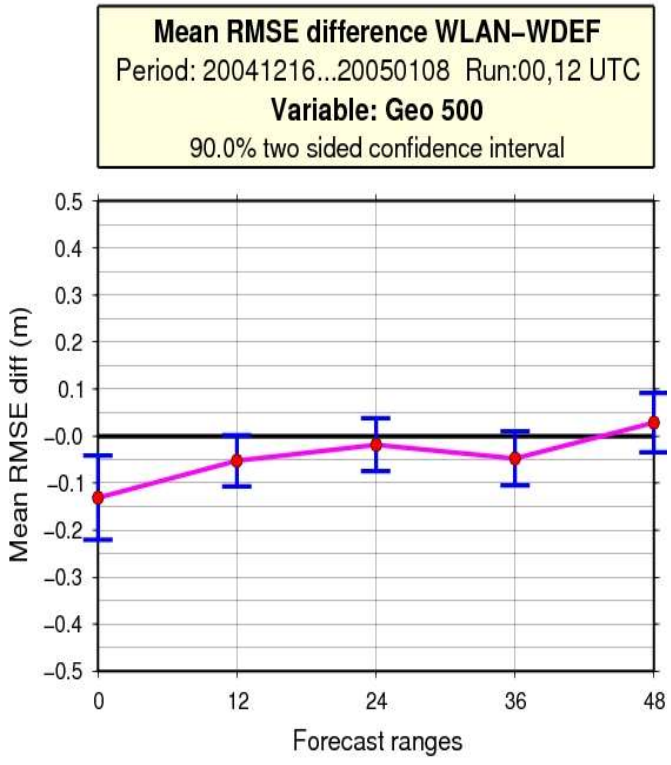


Observation use

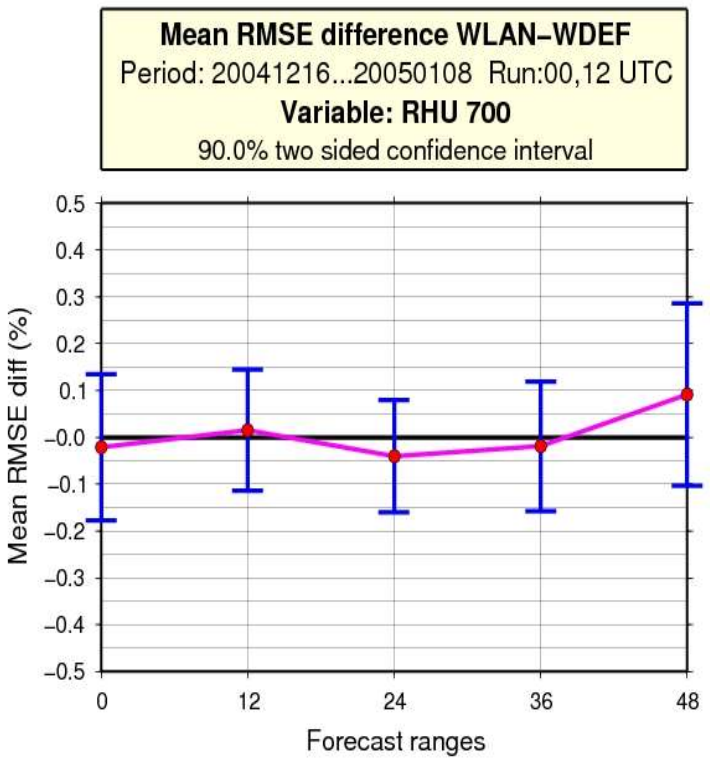
AMV (GEOWIND)

impact of data over land (in addition)

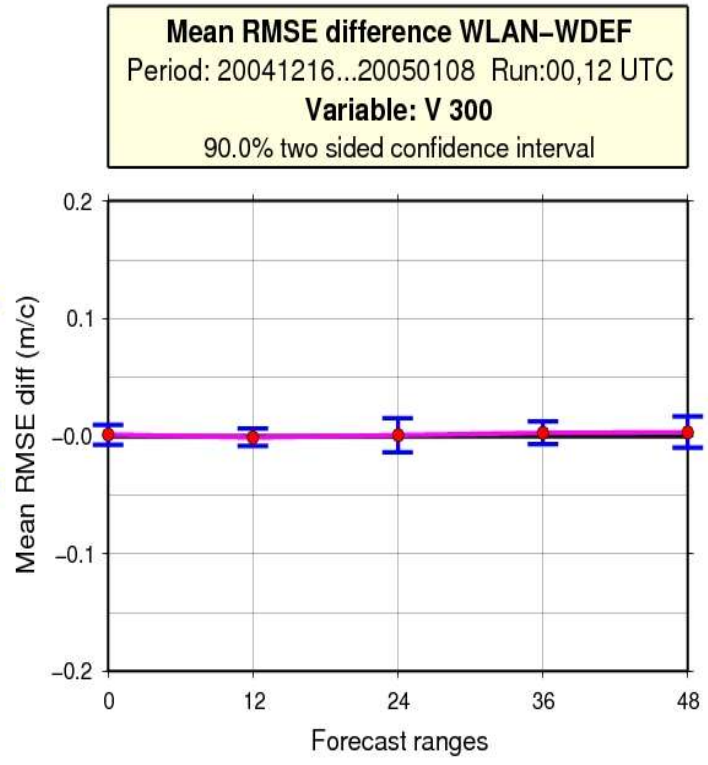
geo 500hPa



RH 700hPa



V 300hPa



Observation use

AMV (GEOWIND)

Continuation:

- parallel suite for subjective evaluation

Observation use

EUCOS: sat vs. ground based observing system

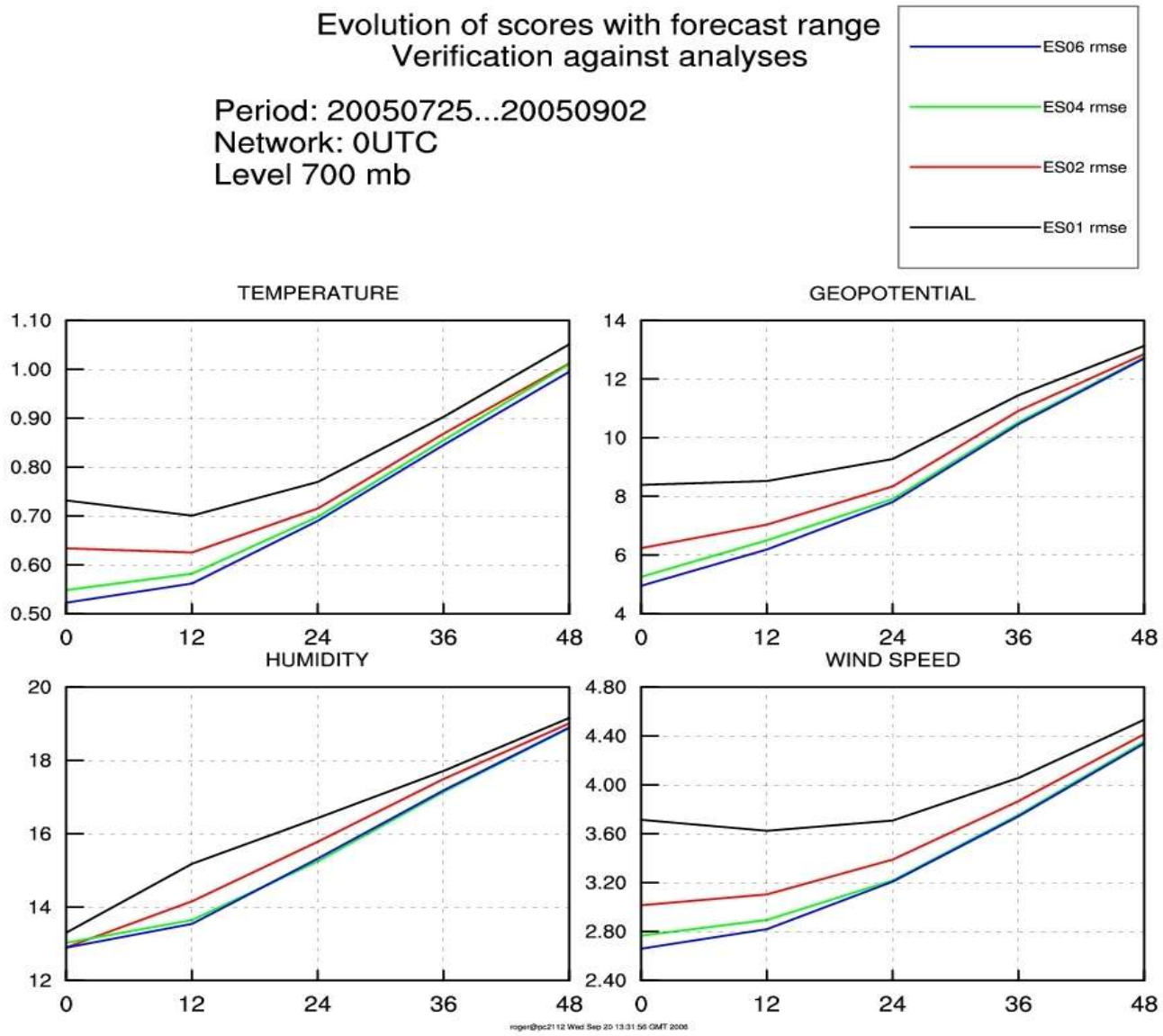
Description of the experiments:

ES01- baseline (GSN surface and GUAN radiosonde + AMV + ATOVS rad.)
ES02- baseline + aircraft
ES03- baseline + radiosonde wind
ES04- baseline + radiosonde wind and temperature
ES05- baseline + wind profilers
ES06- baseline + radiosonde wind and temperature + aircraft
ES07- baseline + radiosonde wind , temperature and humidity
ES08- full observation (radiosonde + aircraft + wind profiler + GSN surface)

(Experiments were financed by EUCOS)

Observation use

EUCOS: impact of AMDAR vs. TEMP data

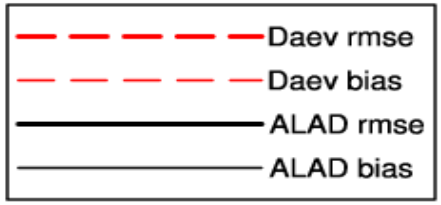


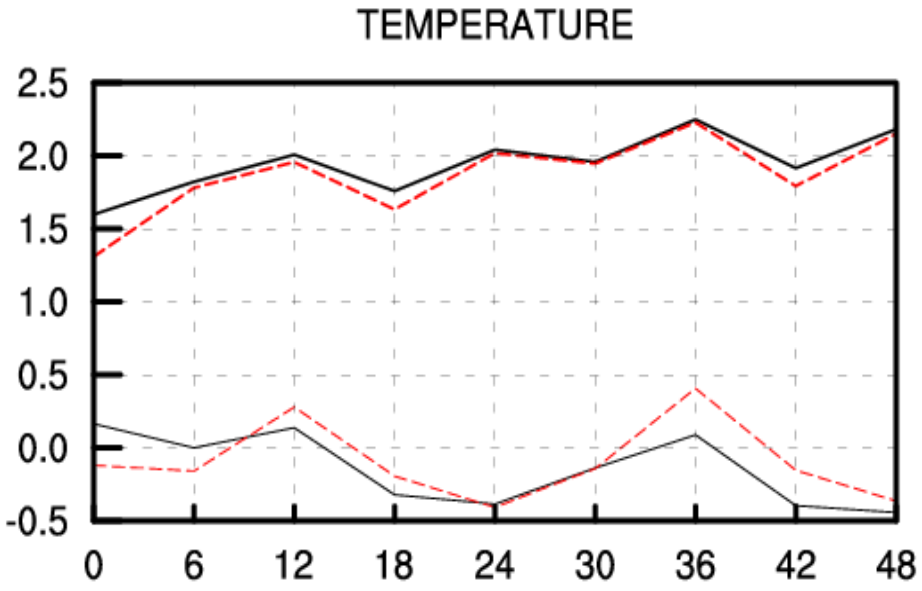
Surface

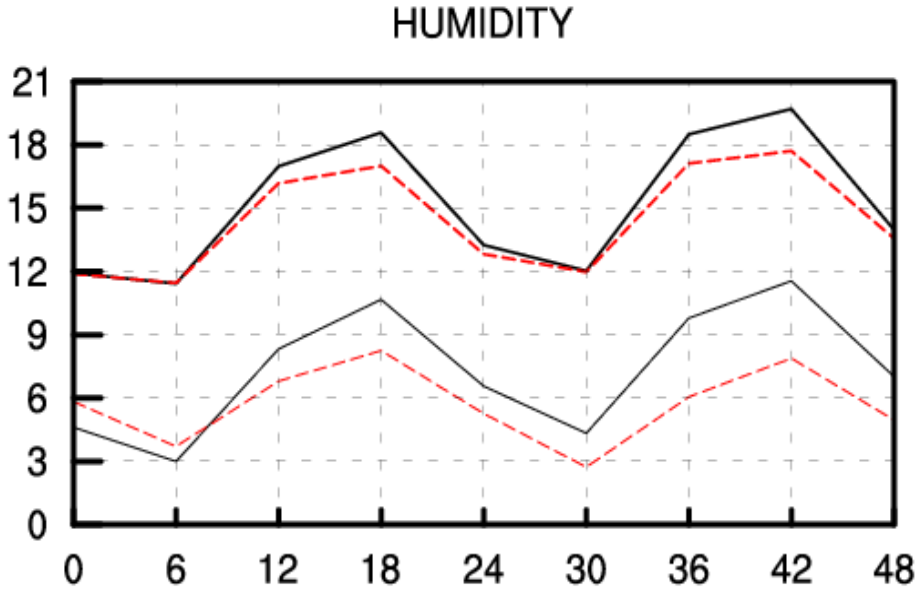
DFI Blending + CANARI OI (ALADIN/CE)

Period: 20060310...20060430
Network: 0UTC
SURFACE

Impact on the forecast



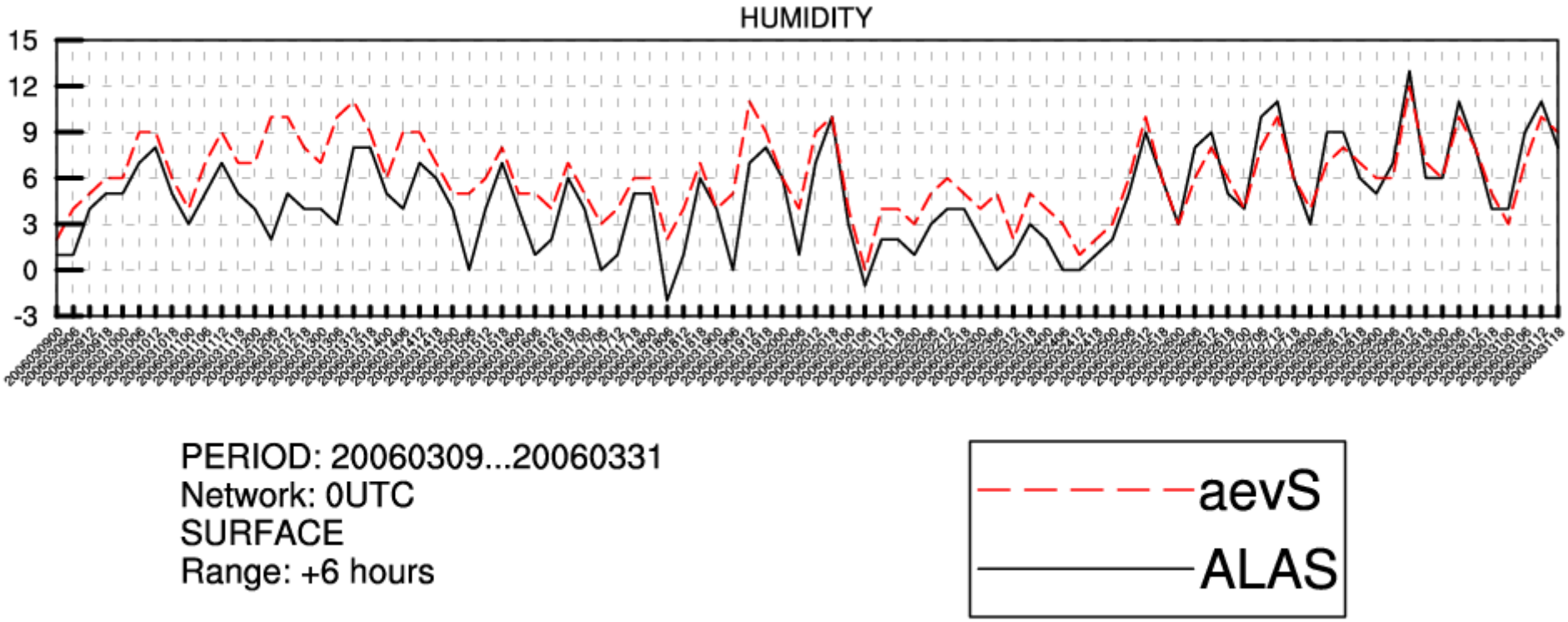




Surface

DFI Blending + CANARI OI (ALADIN/CE)

Impact on the first guess



Plans 2007(algorithmic aspects)

- Tests with a 1st version 4DVAR *(LACE stay in Toulouse)*

- Tests with the CONGRAD minimizer

- Tuning background and observation error variances *(continuation)*

Plans 2007 (cycling)

- Assimilation experiments using ECMWF LBC

- Experiments with FGAT *(continuation)*

- Experiments with 3DVAR RUC (3h frequency) *(proposed stay at HMS)*

Plans 2007 (observations)

- SEVIRI data *(proposed stay at HMS)*

- Radar data *(LACE stay in Toulouse)*

- Non-GTS SYNOP data

- SYNOP T2m and RH2m data

- “Degrees of Freedom for Signal” (sensitivity of the analysis system to the used observations)

- GPS data *(proposed stay at HMS)*

- ATOVS/HIRS data *(proposed stay at HMS)*

Plans 2007 (surface)

- Surface assimilation tests *(proposed stay at HMS)*

... Building strategy for working on surface assimilation ...

Thank you for your attention!