# Advances in the use of observations in the ALADIN/HU 3D-Var system

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- Studies related to Satellite AMSU-A data
  - choice of the bias correction file
- Studies related to Aircraft AMDAR data
  - problems in pre-processing of the local data
  - preliminary results of our impact studies
- New observations to be assimilated in the 3D-Var/HU
- Summary

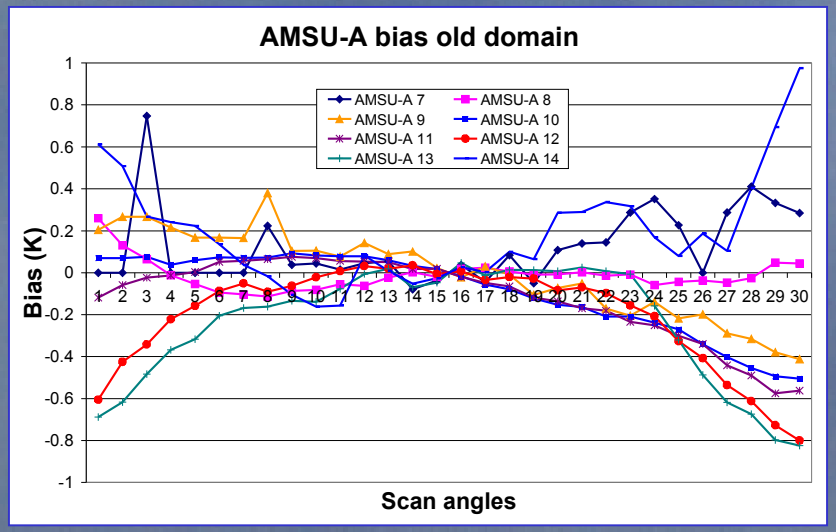
# Studies related to Satellite AMSU-A data

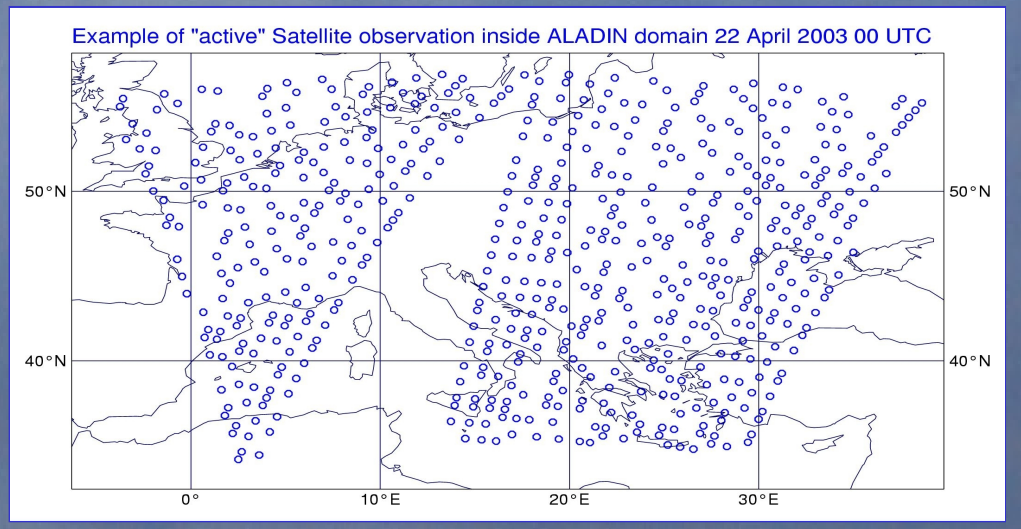
- Choice of bias correction file

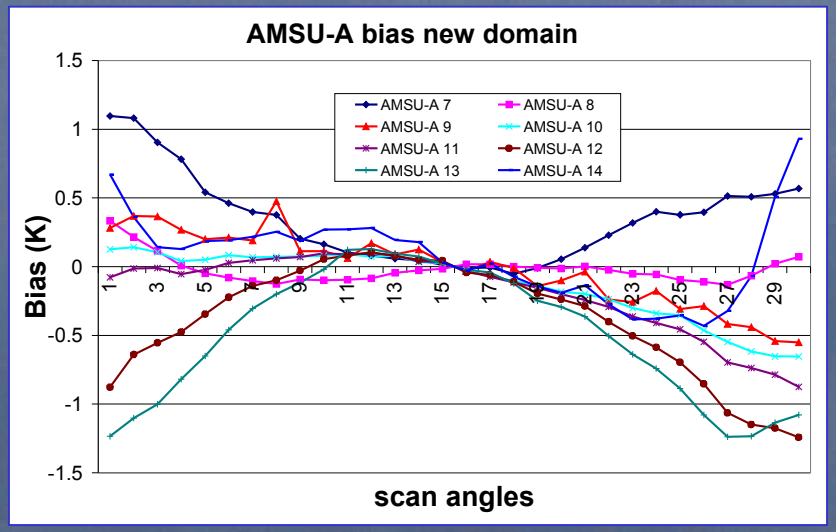
  - the “bcor_noaa.dat” file

# The bias correction file: “bcor_noaa.dat”

## the problem related to the limited area model




## Air-mass predictors for ARPEGE/ALADIN models:

Harris and Kelly (2001)

- model first guess thickness (1000-300 hPa)
- model first guess thickness (200-50 hPa)
- model first guess surface skin temperature
- model first guess total column water vapour

# Description of the experiments with AMSU-A data

***1 Period***: 20.02.2003 – 06.03.2003; ***thinning of AMSU-A***: 80 km

***2 Period***: 18.04.2003 – 07.05.2003;

## Experiments:

-***T80U***: TEMP, SYNOP and AMSU-A (80km); LAM bias (scan angle & air-mass)

-***T8B1:*** TEMP, SYNOP and AMSU-A (80km); ARPEGE bias (scan angle & air-mass)

-***T8B2***: TEMP, SYNOP and AMSU-A (80km); ARPEGE bias (scan angle) & no air-mass

-***T8B3***: TEMP, SYNOP and AMSU-A (80km); ARPEGE scan angle & LAM air-mass

# The ALDIN/HU model and its assimilation system

**Model:** - Hydrostatic (AL15)

- Resolution: 12 km
- 37 vertical levels

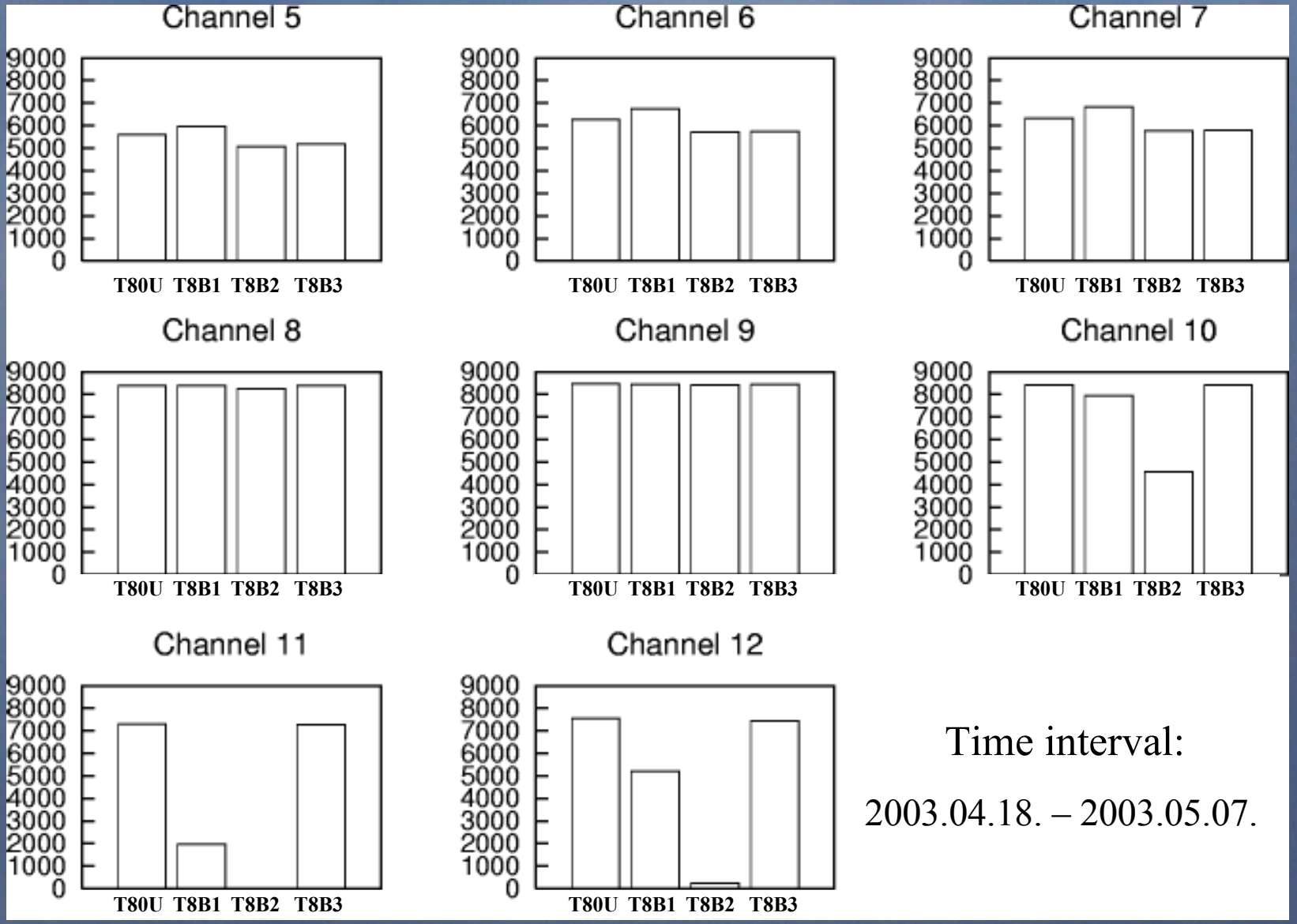
**3D-Var:**

- Background error covariance matrix "B": computed using "standard NMC" method
- Simulation of radiances ➔ RTTOV 6.0
- 6 hour assimilation cycling: 00, 06, 12 and 18 UTC
- Coupling: ARPEGE long cut-off analysis
- ATOVS from NOAA-15 and NOAA-16 (T ± 3hour)
- AMDAR

**Forecast:**

- 48h from 00 UTC (ATOVS) and 12 UTC (AMDAR)

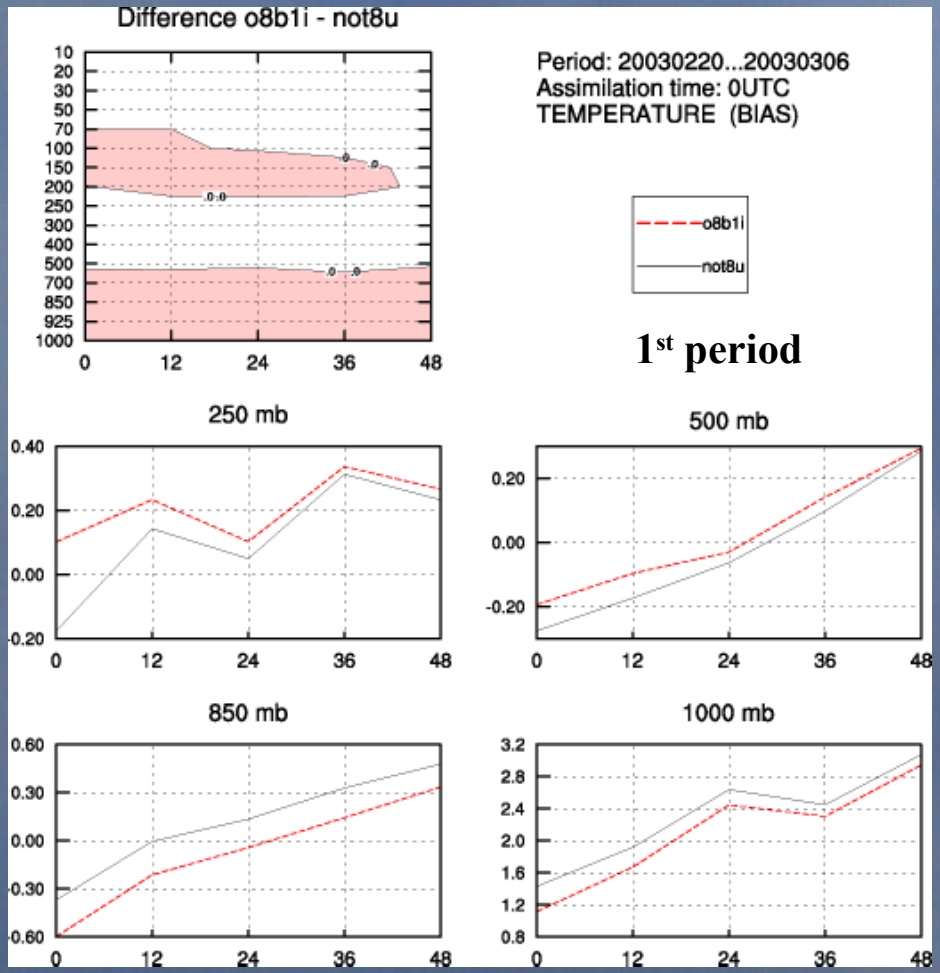
# Total amount of satellite data, used in the experiments

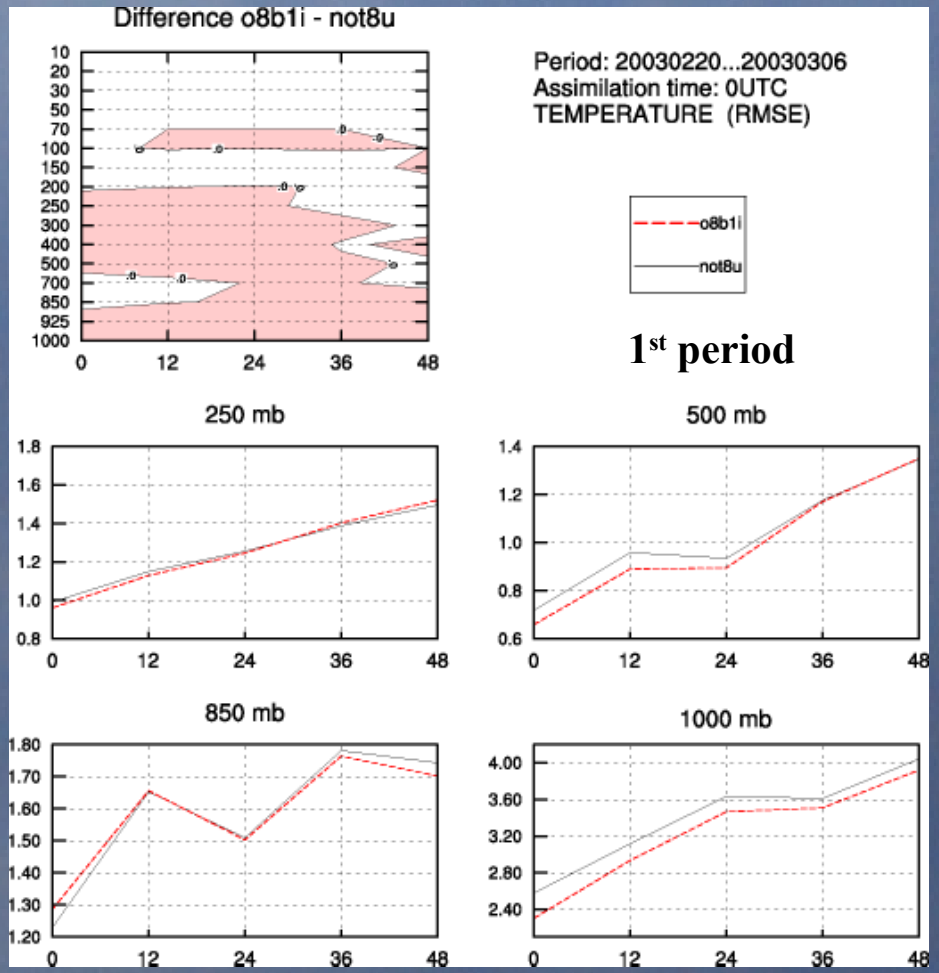



Time interval:

2003.04.18. – 2003.05.07.

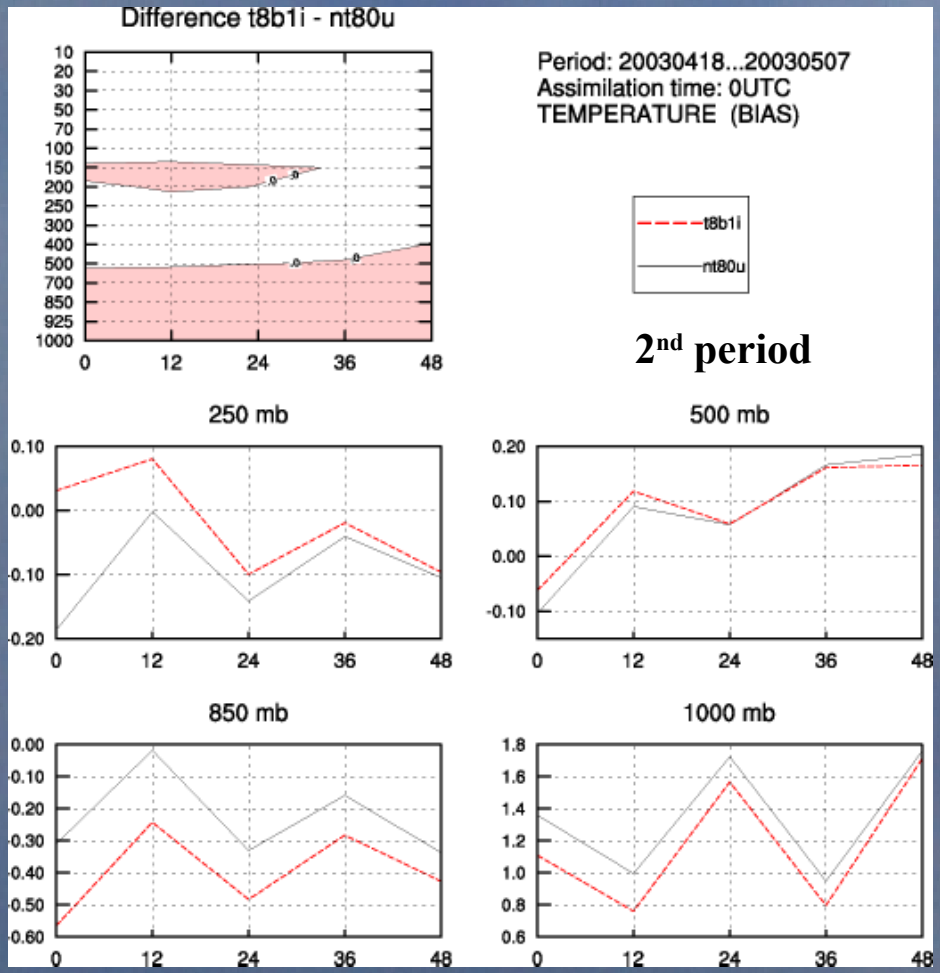
# Bias and RMSE of the temperature

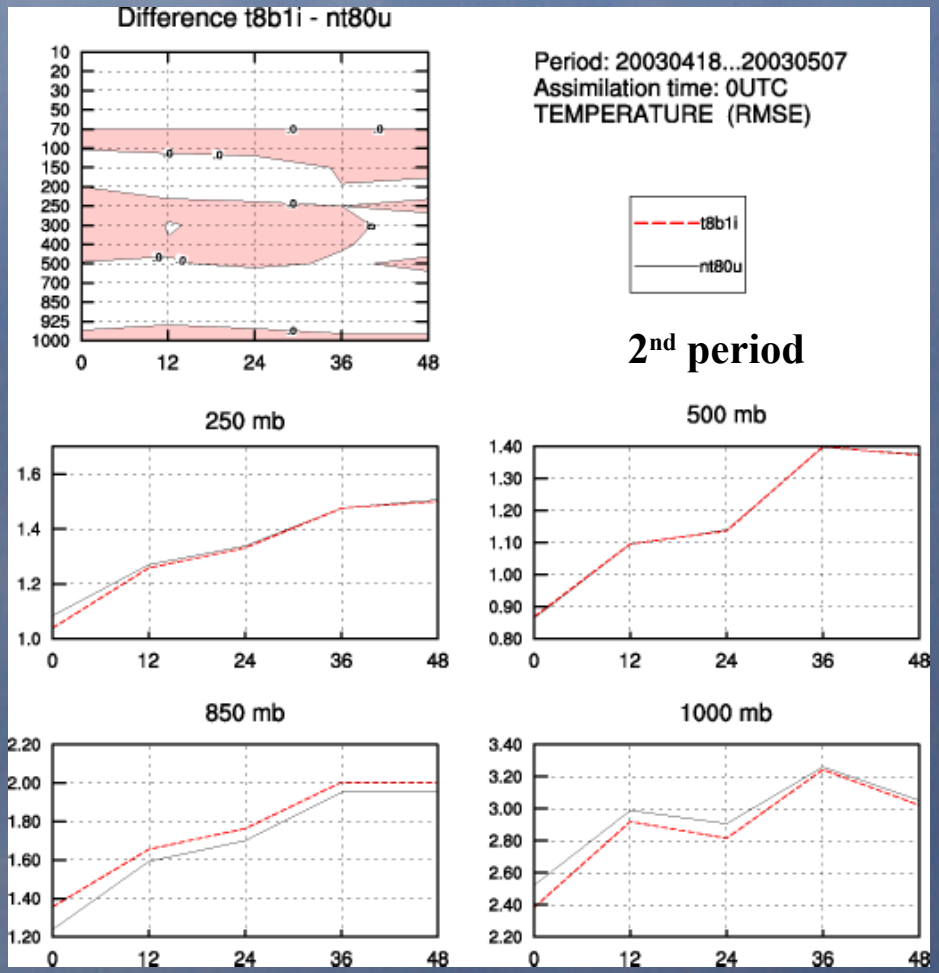



Run with LAM bias (scan angle & air-mass) compared to the run with ARPEGE bias (scan angle & air-mass)

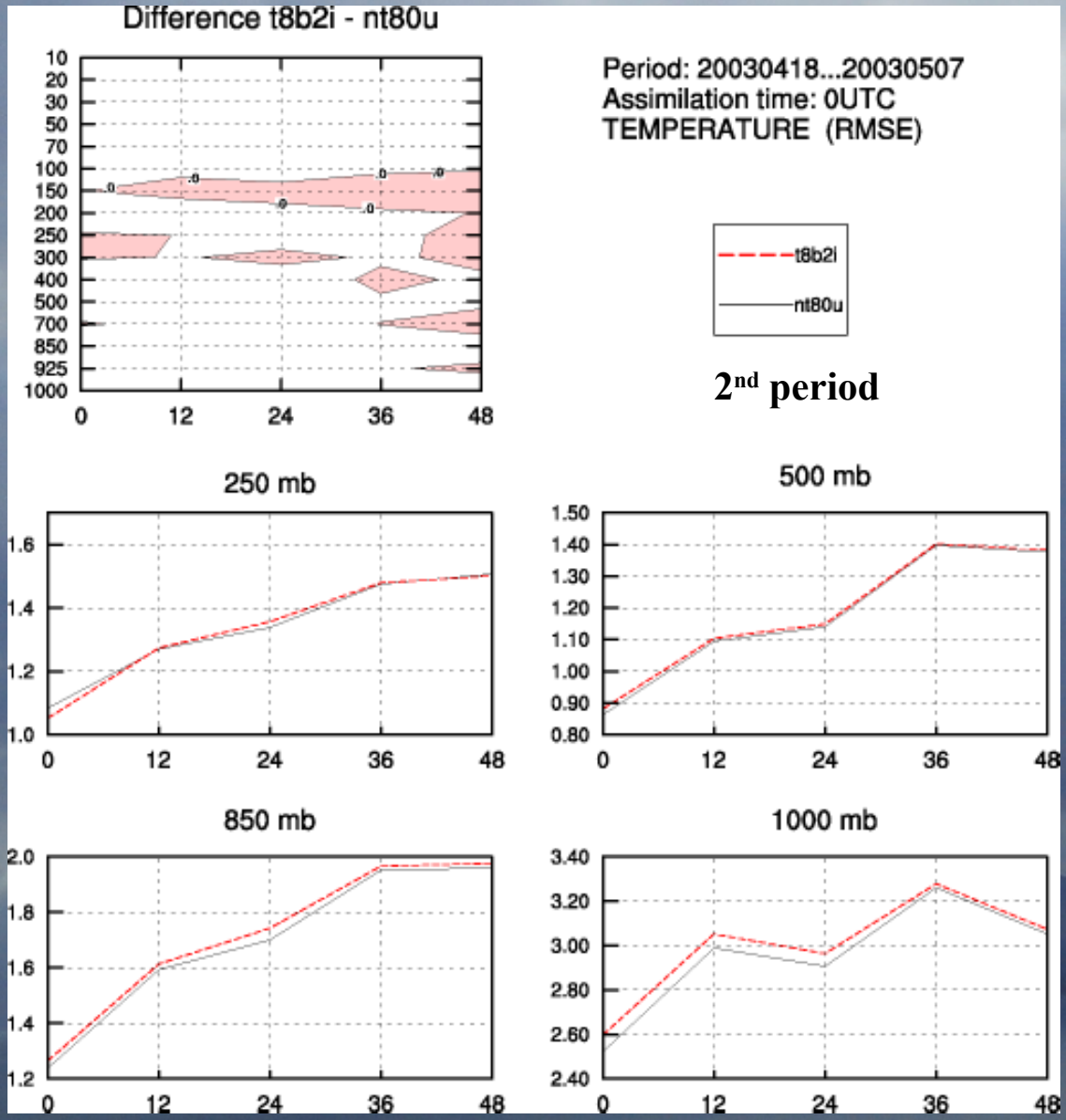
# Bias and RMSE of the temperature



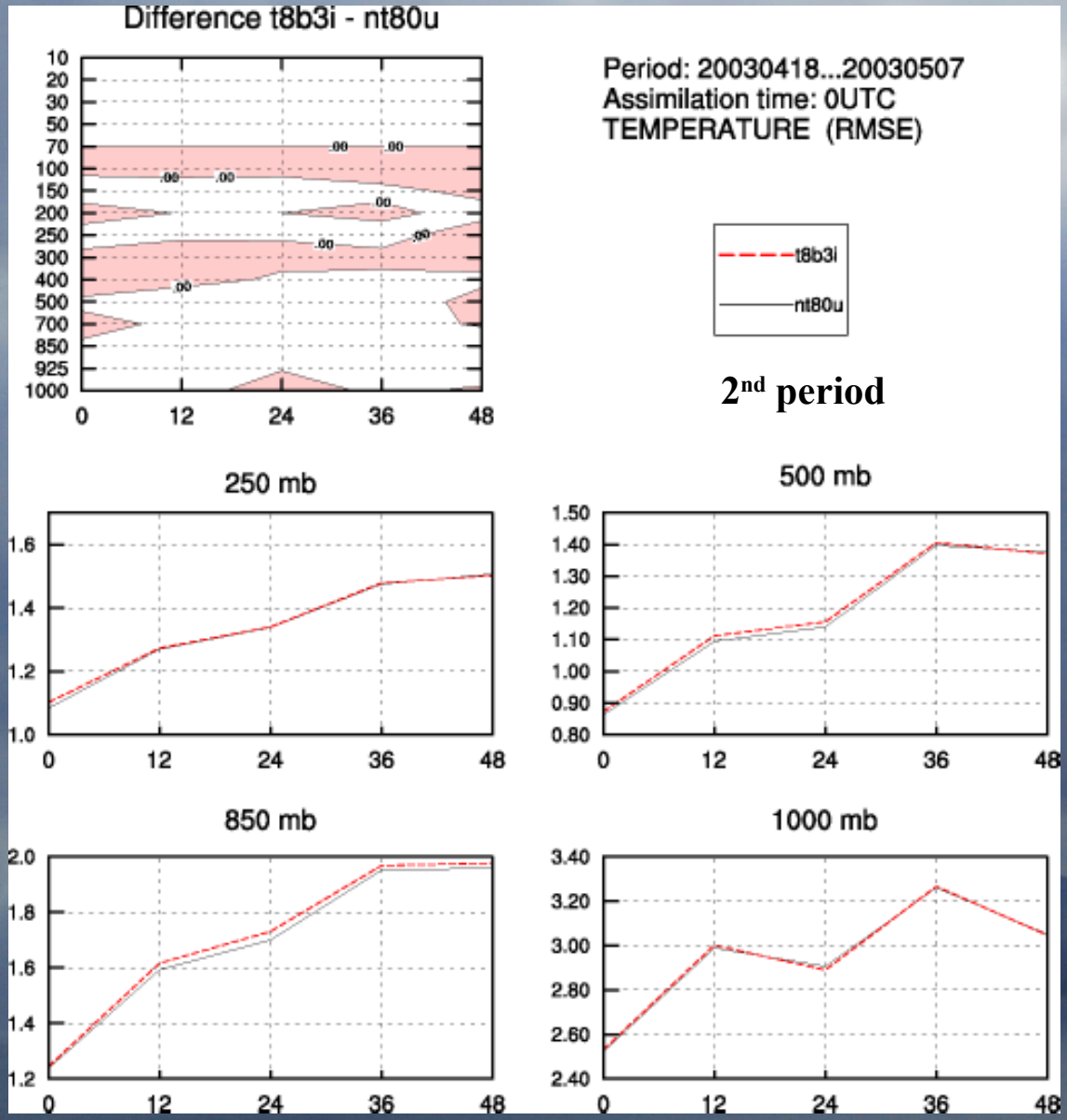

Run with LAM bias (scan angle & air-mass) compared to the run with ARPEGE bias (scan angle & air-mass)

# RMSE of the temperature




Run with LAM bias (scan angle & air-mass) compared to the run with ARPEGE bias (scan angle) & no air-mass

# RMSE of the temperature

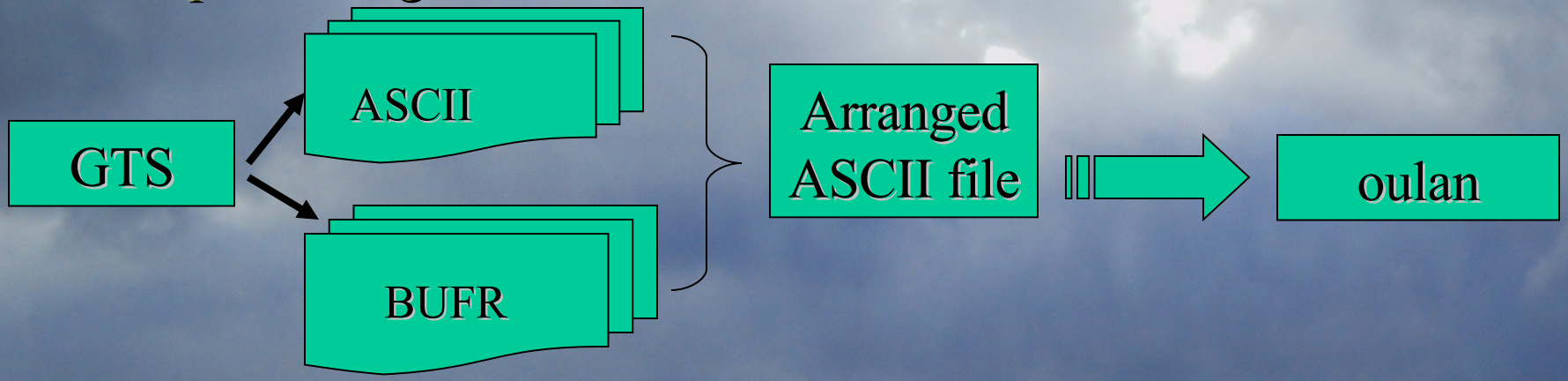



Run with LAM bias (scan angle & air-mass) compared to the run with ARPEGE scan angle & LAM air-mass

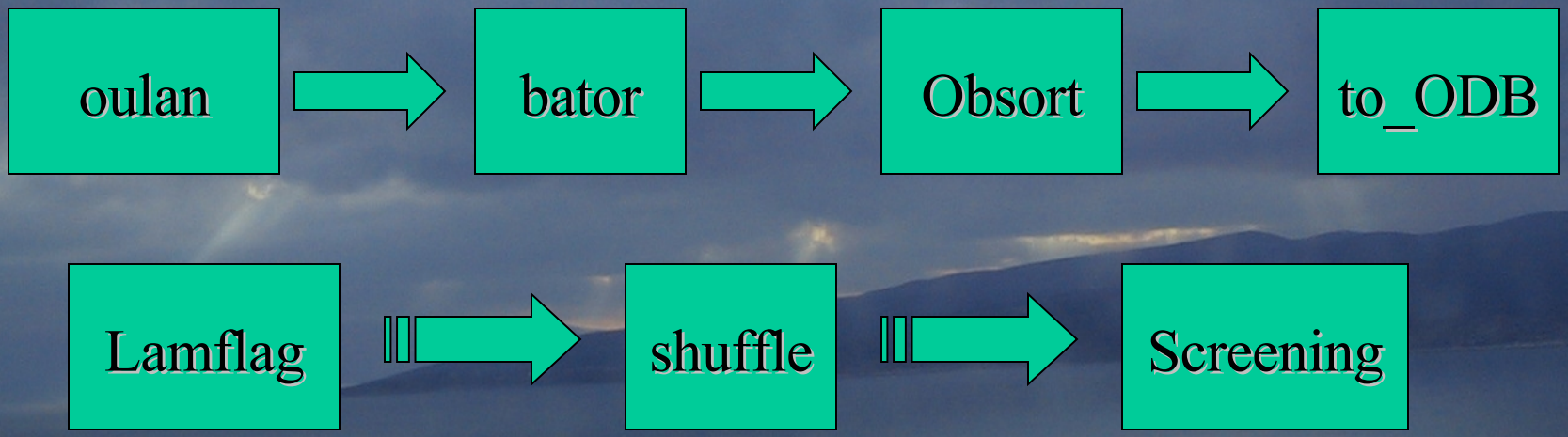
**Studies related to AMDAR data**

- problems in local data pre-processing
- preliminary results of our impact studies

## Pre-processing of the AMDAR data




## Creation of the ODB:



**Problem in the pre-processing**:

- during the pre-processing, the observations with "old datum" are not "filtered" ➔ obs. communicated with „late" datum

**Solutions**: 1- time checking in OULAN for each parameter

2- time/datum filtering in Lamflag √

**Specificities of AMDAR data:**

- depending on the extraction time interval,
  - → there is possibility to get all flights
  - → at one airport we can get more profiles (ascendant or descendent) for the same assimilation time
- the screening of AMDAR data is done separately for different aircraft ID

**Possible solution:**

→ to reduce the extraction time interval (two or one hours)

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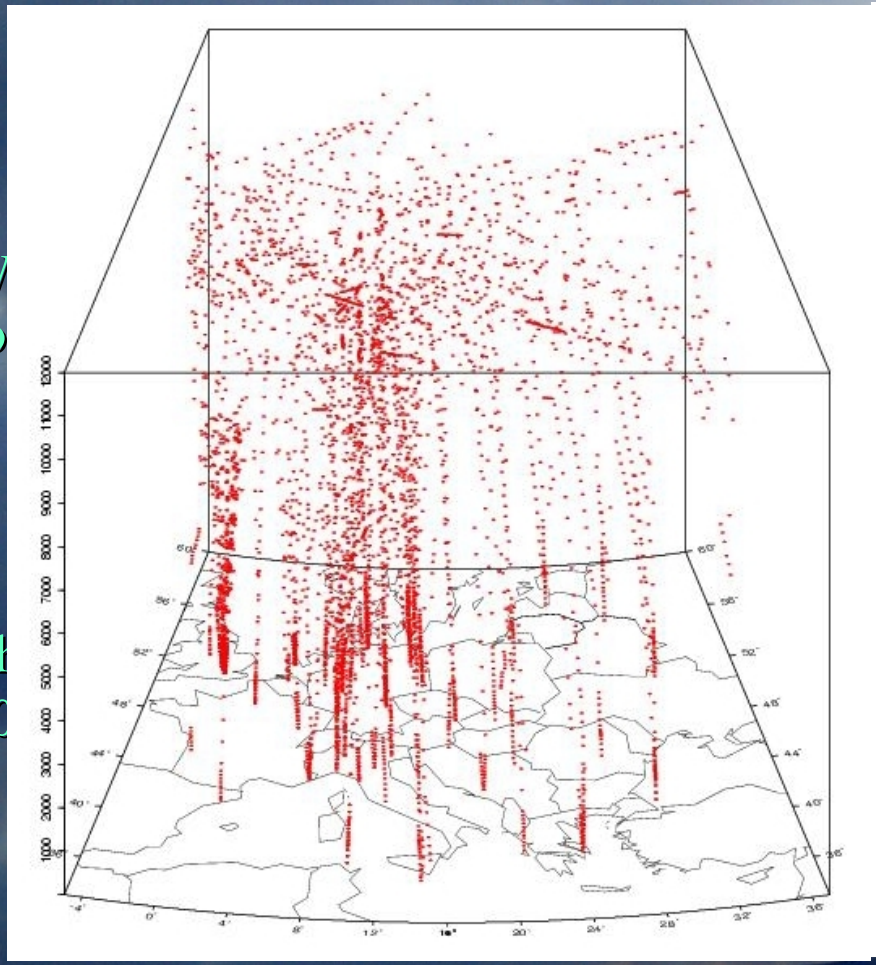
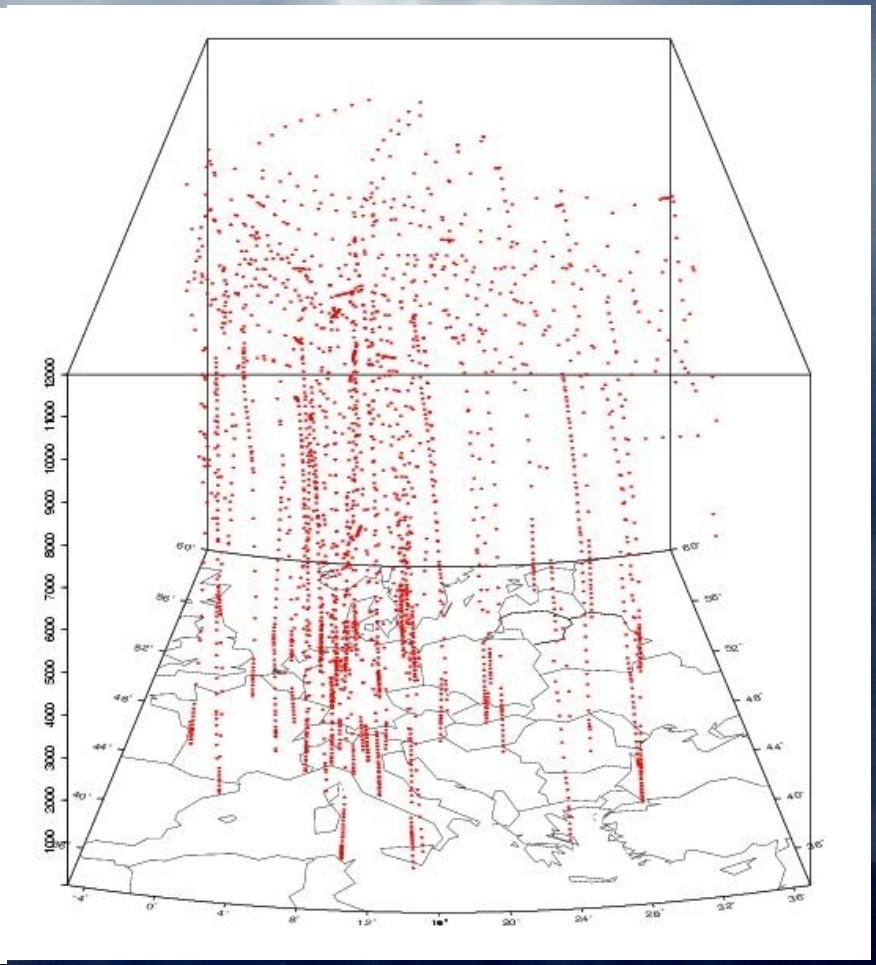




**Local data** **data from EUCOS**

**AMDAR data 24th August 2003 around 12 UTC**

Next combination of experiments are under investigation:

➔changing the observation extraction time interval ➔6-, 2-, 1-hour

➔changing the thinning distance ➔ 170, 25, 10 km

Preliminary results:

➔4 experiments

**UAMDH** - run with TEMP,SYNOP and ***local AMDAR*** **(170km, T ± 3 hour)**

**UAMDL** - run with TEMP,SYNOP and ***EUCOS AMDAR*** **(170km, T ± 3 hour)**

**A10HE** - run with TEMP,SYNOP and ***local AMDAR*** **(10km, T ± 1 hour)**

**AM10E** - run with TEMP,SYNOP and ***EUCOS AMDAR*** **(10km, T ± 1 hour)**

**Control run:**

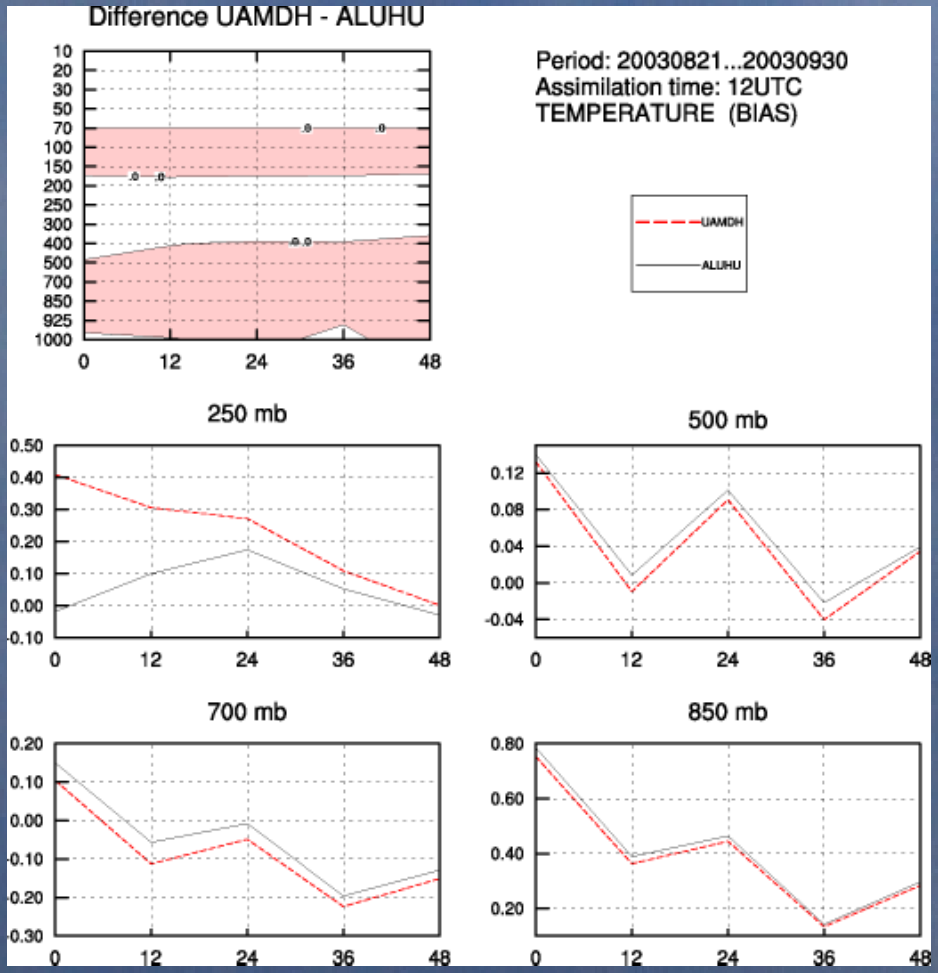
**AUHU** - run with TEMP and SYNOP only

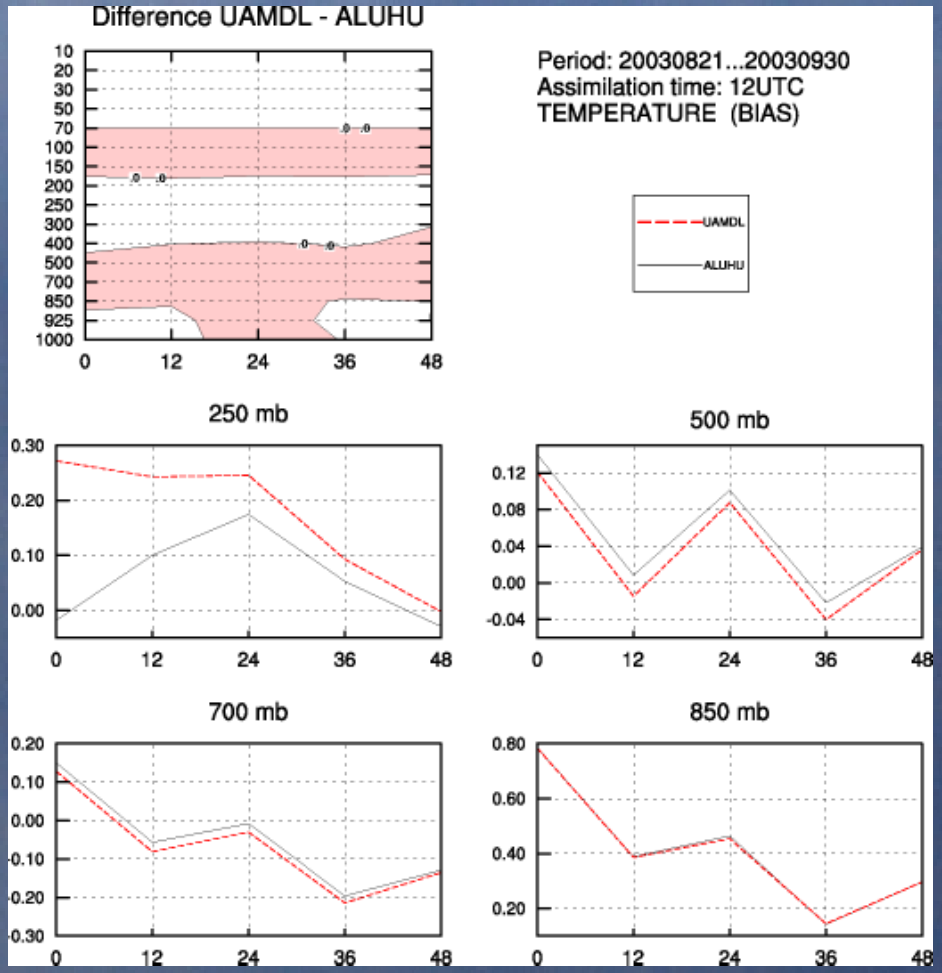
# Comparison of the forecast against radiosonde observations

**Period: 2003.08.21. – 2003.09.30.**

**(40 days)**

# Bias of the temperature (AMDAR data are assimilated at 170 km)

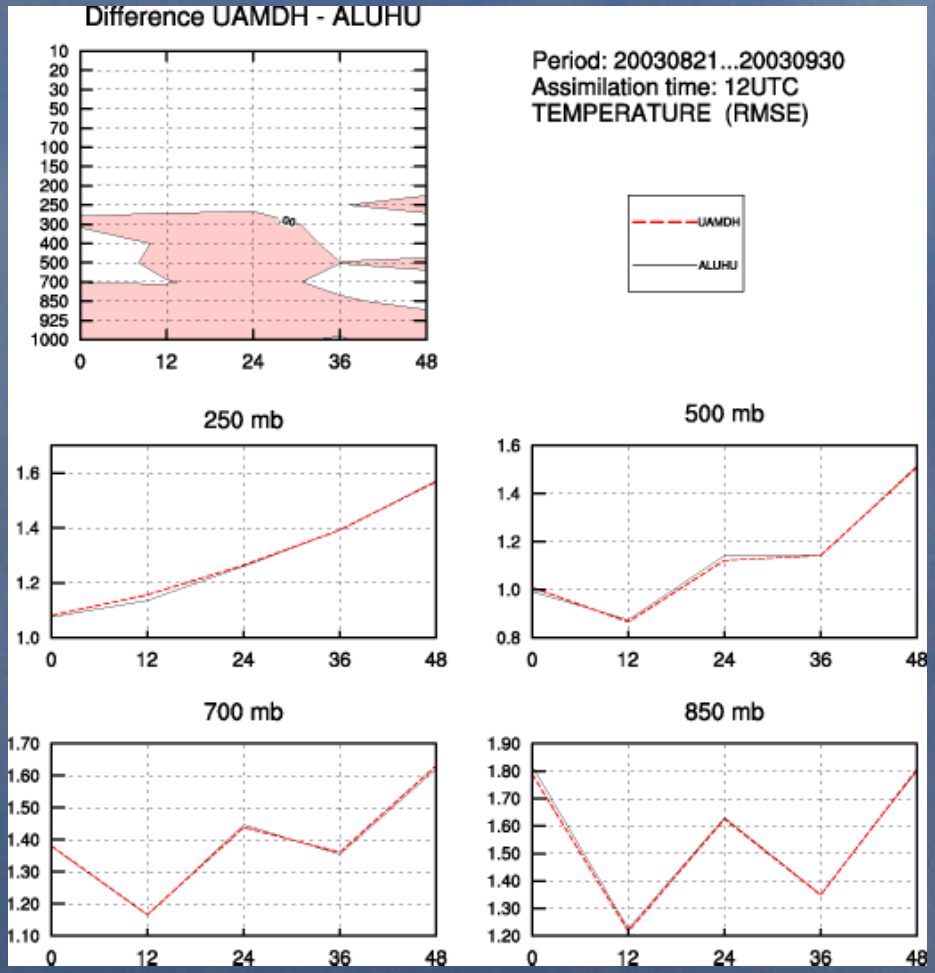


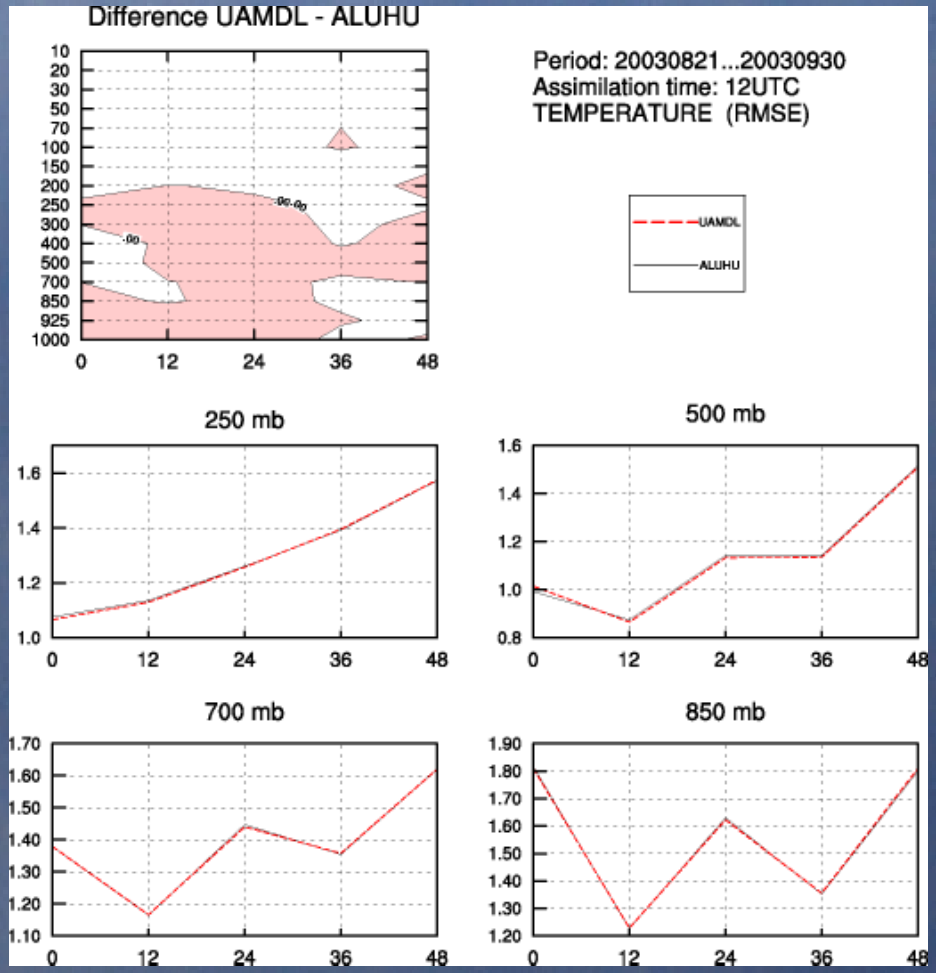




***local AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

***EUCOS AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

# Root Mean Square Error of the temperature (AMDAR data are assimilated at 170 km)

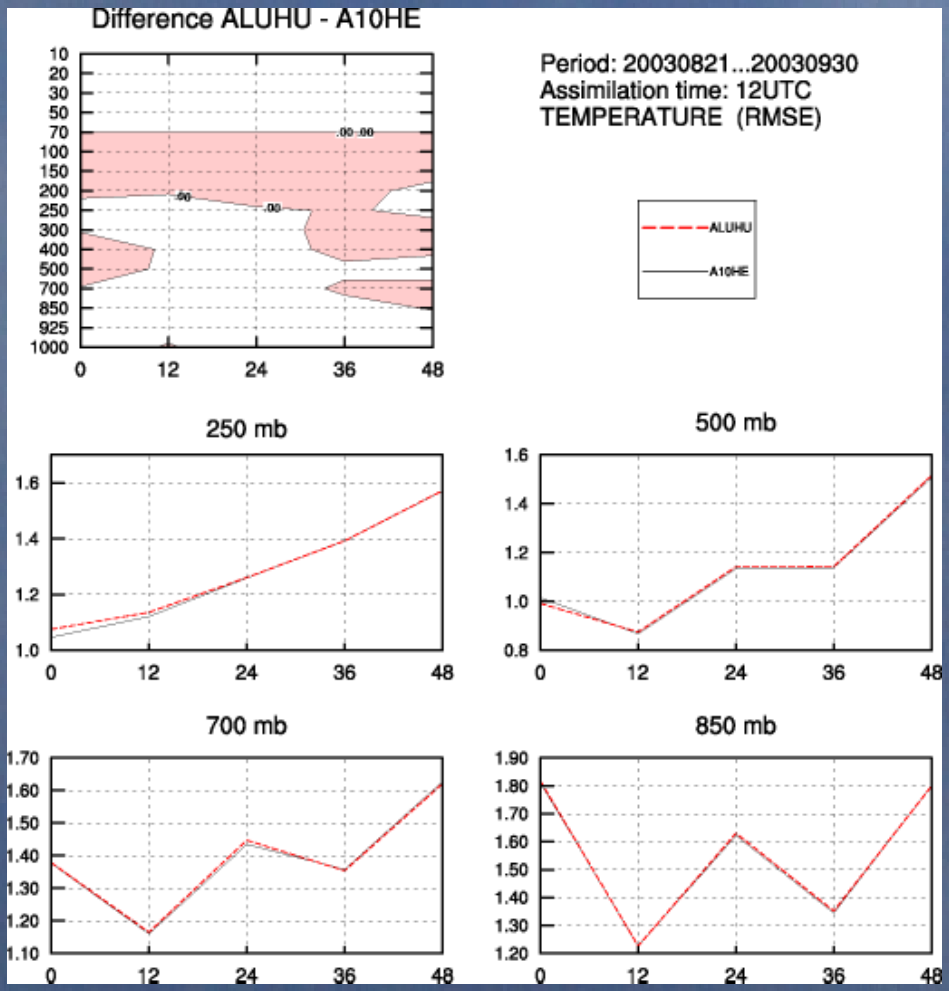


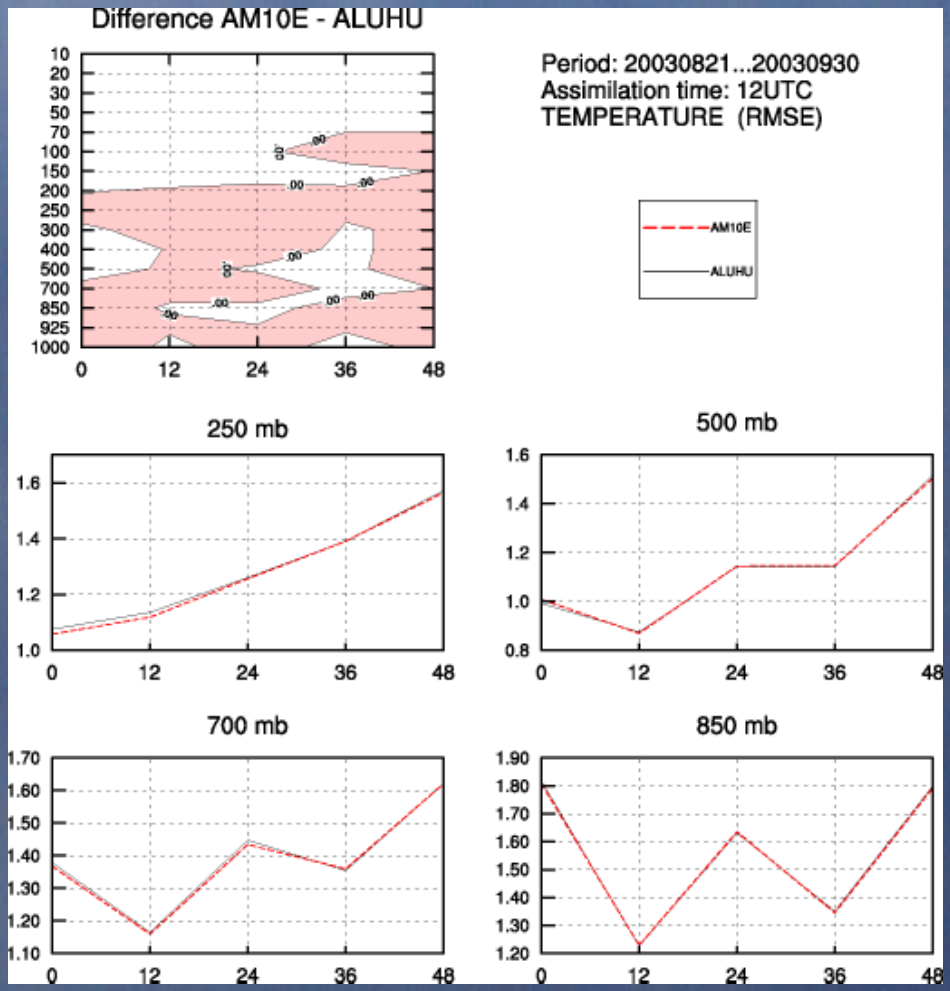




***local AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

***EUCOS AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

# Root Mean Square Error of the temperature (AMDAR data are assimilated at 10 km)

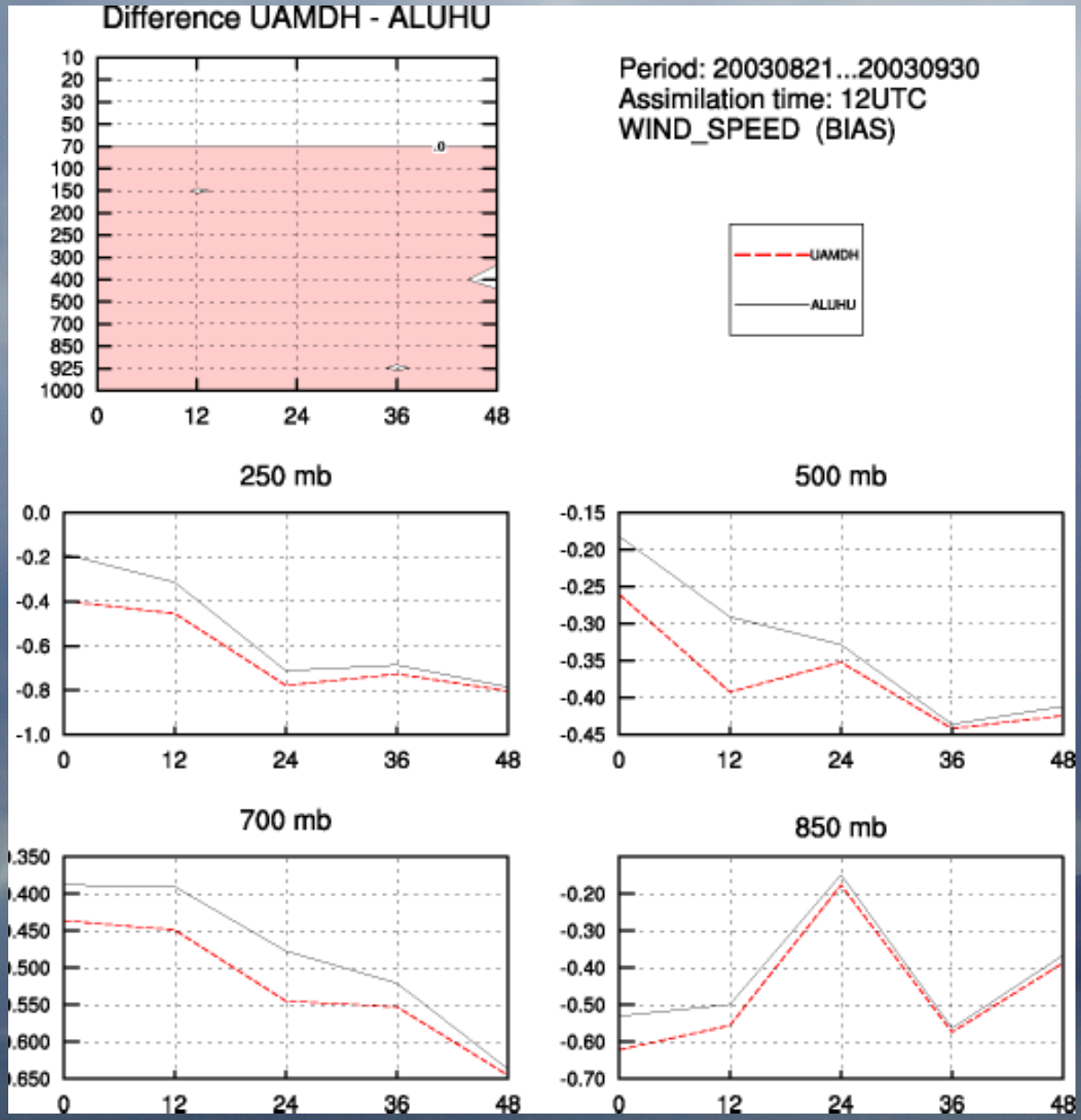



***local AMDAR*** **(10km, T ± 1 hour)** compared to the **CONTROL** run

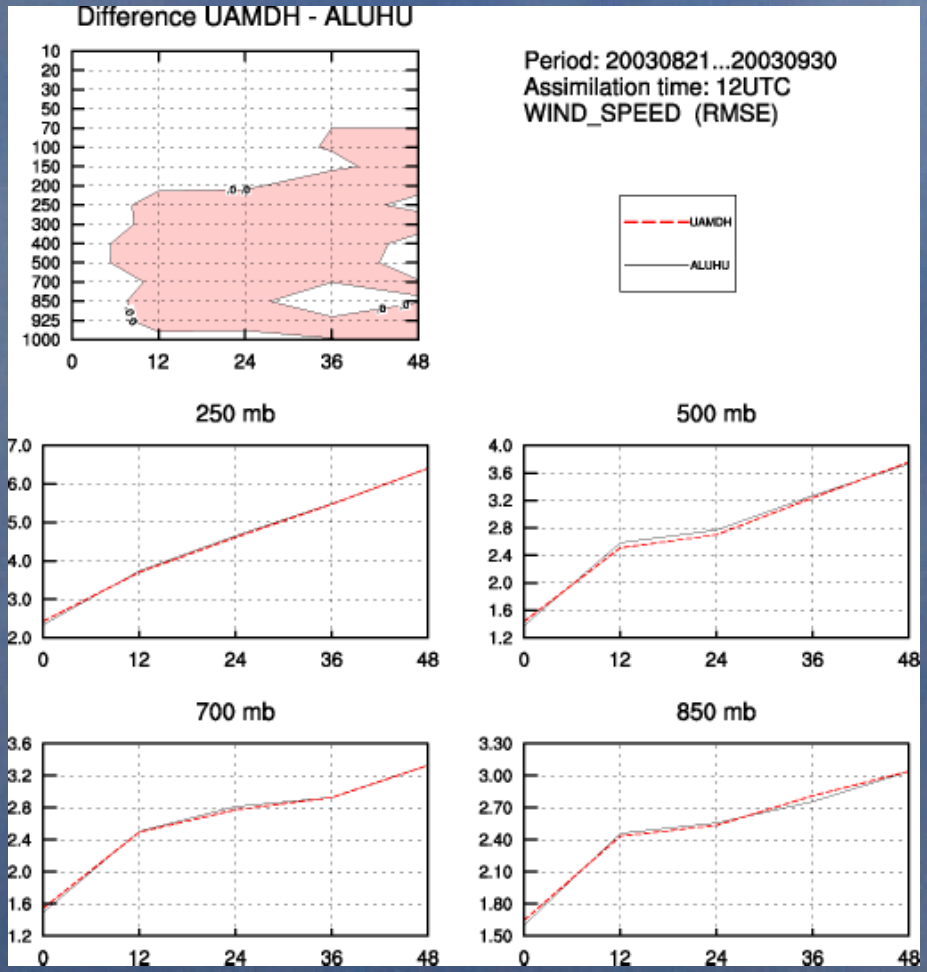
***EUCOS AMDAR*** **(10km, T ± 1 hour)** compared to the **CONTROL** run

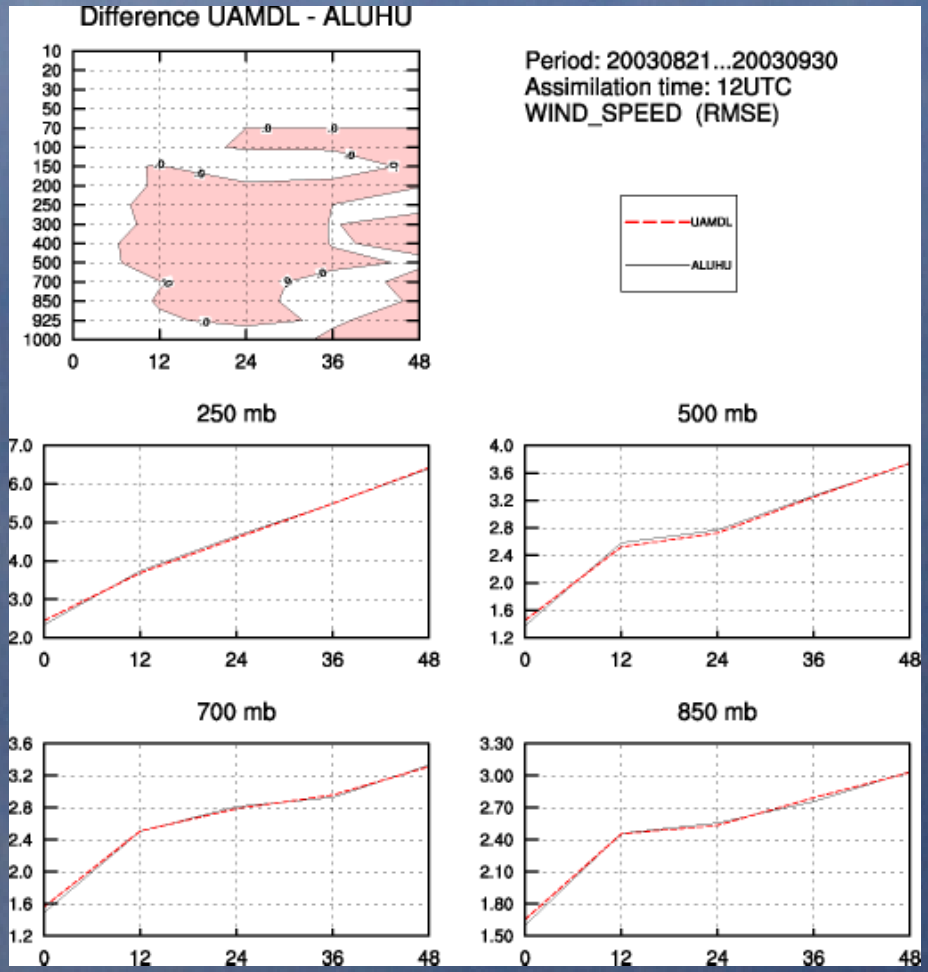
# Bias of the wind speed (AMDAR data are assimilated at 170 km)




*local AMDAR* (**170km**, T ± **3 hour**) compared to the **CONTROL** run

# Root Mean Square Error of the wind speed (AMDAR data are assimilated at 170 km)

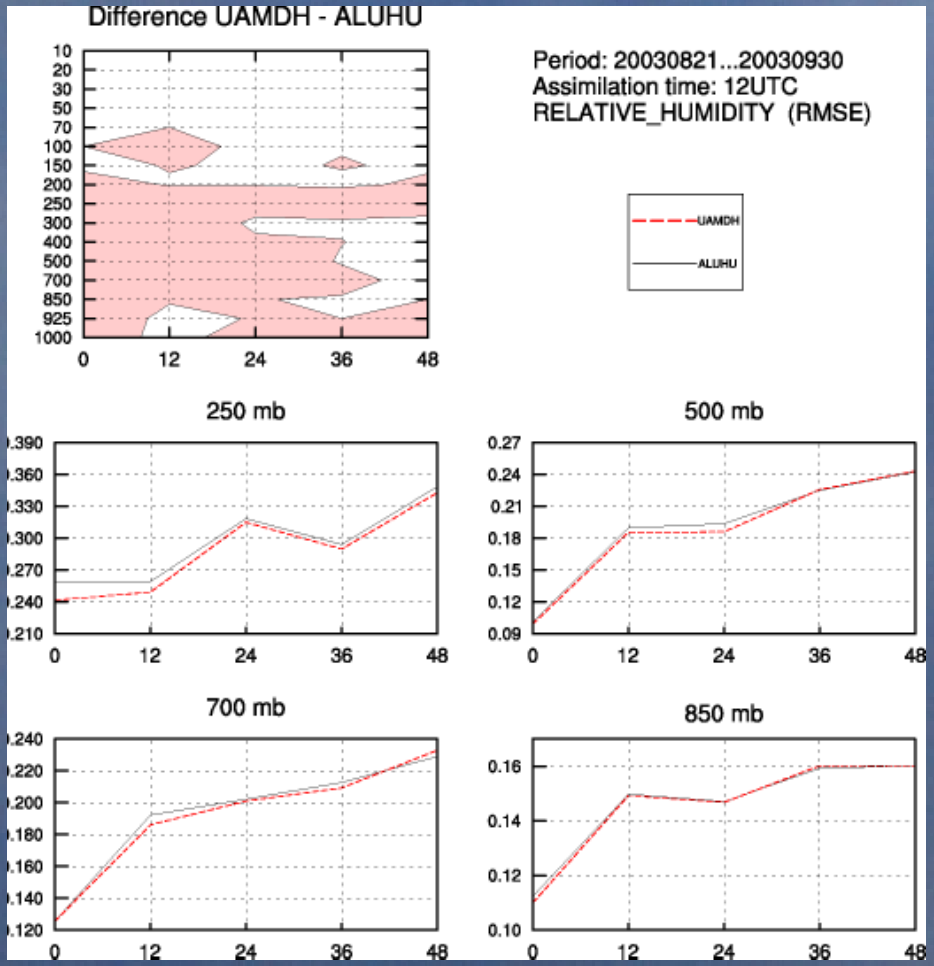


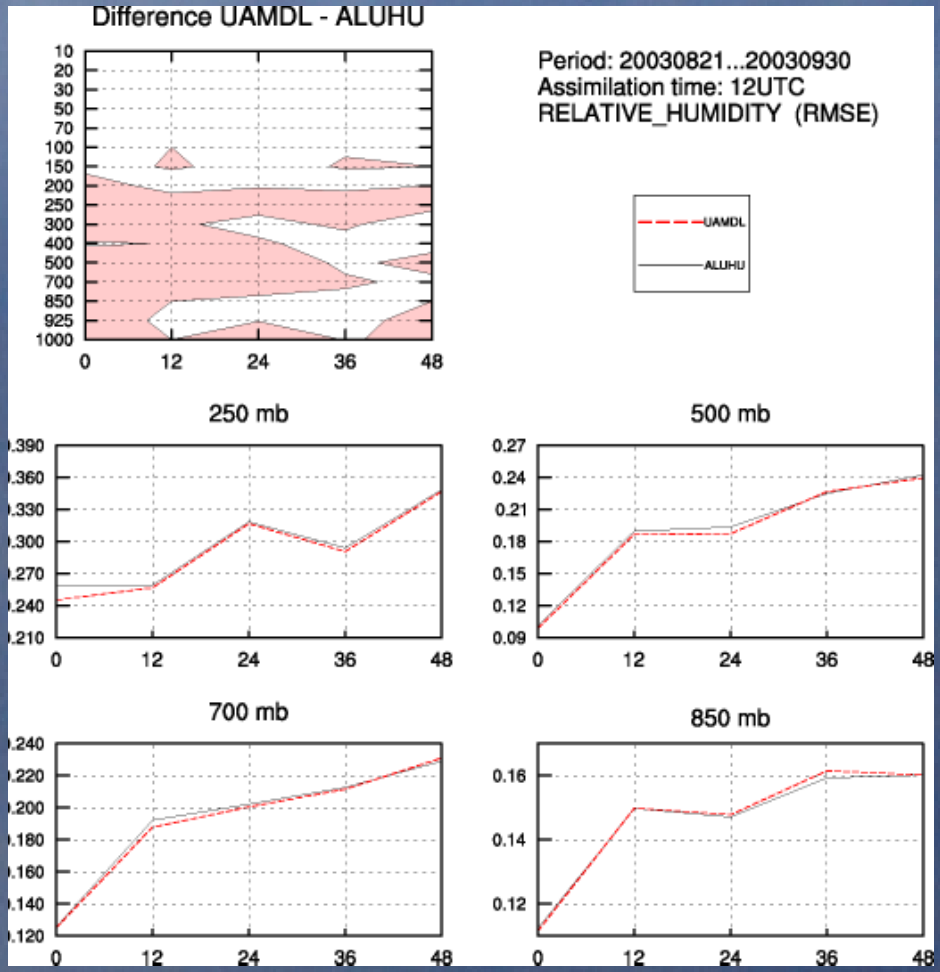




***local AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

***EUCOS AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

# Root Mean Square Error of the relative humidity (AMDAR data are assimilated at 170 km)

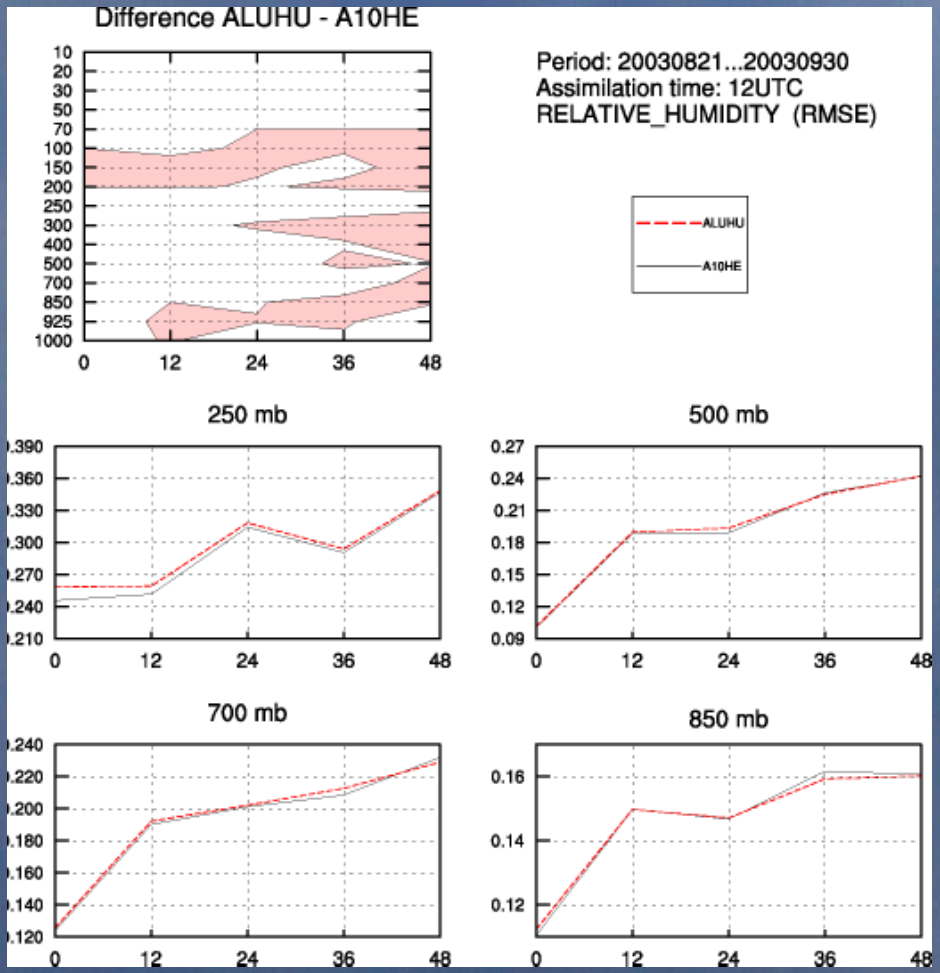


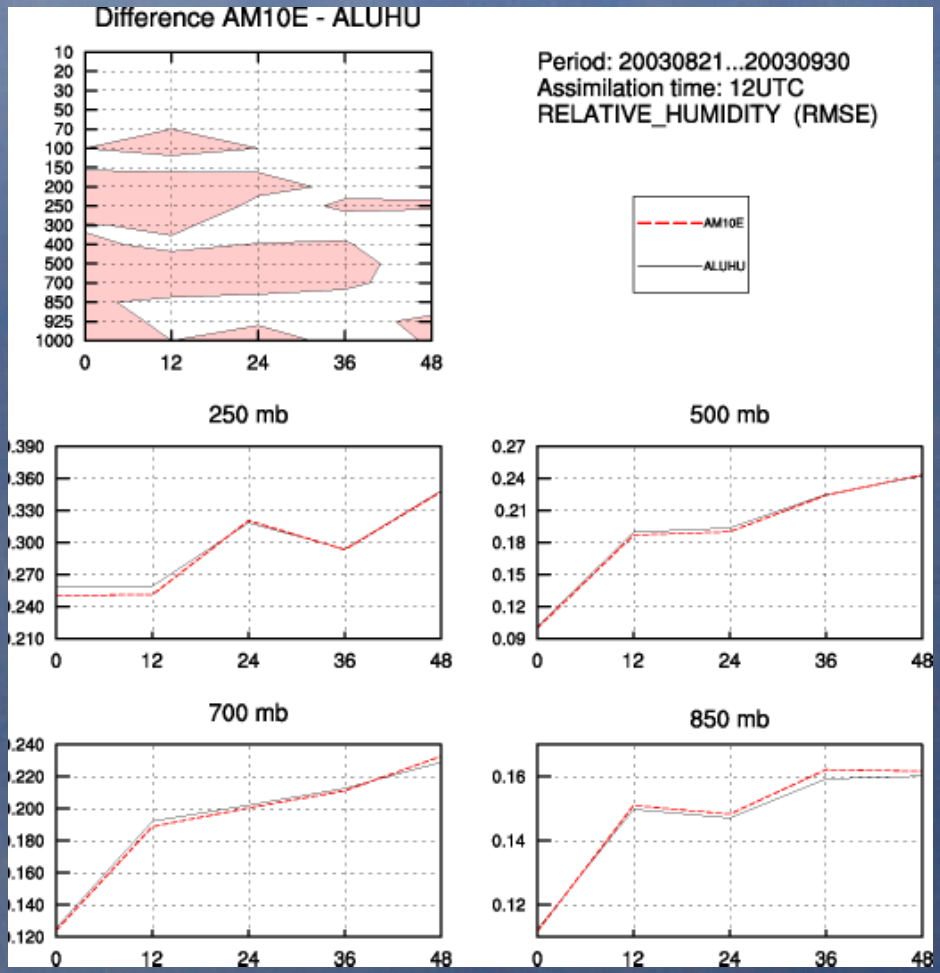




***local AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

***EUCOS AMDAR*** **(170km, T ± 3 hour)** compared to the **CONTROL** run

# Root Mean Square Error of the relative humidity (AMDAR data are assimilated at 10 km)




***local AMDAR*** **(10km, T ± 1 hour)** compared to the **CONTROL** run

***EUCOS AMDAR*** **(10km, T ± 1 hour)** compared to the **CONTROL** run

# Comparison

# of the forecast against

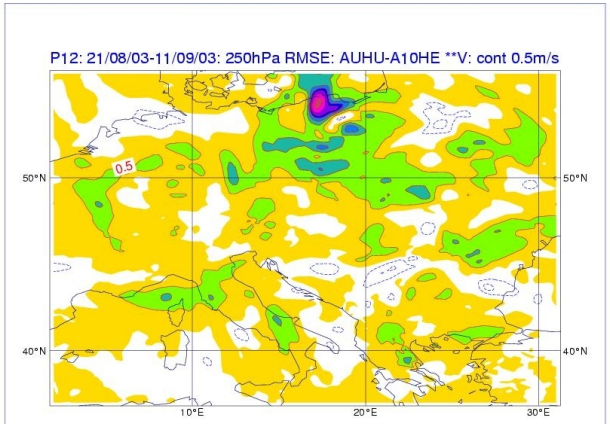
# the ARPEGE long cut-off analysis

**Period: 2003.08.21. – 2003.09.11.**

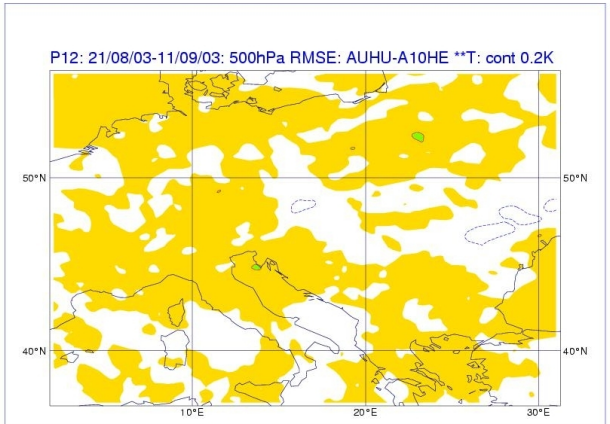
**(22 days)**

# *local AMDAR* (10km, T ± 1 hour) compared to the CONTROL run

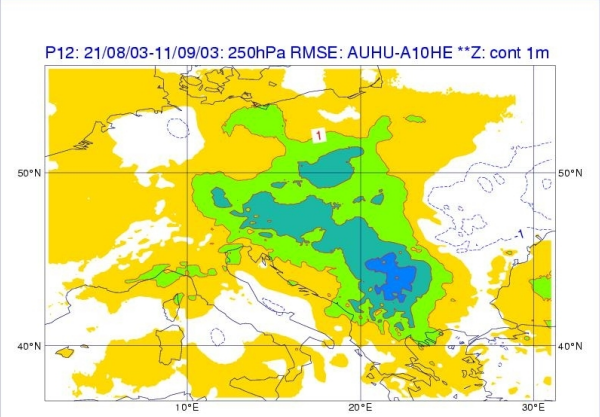
**Wind speed**
**12 h forecast**
**250 hPa**



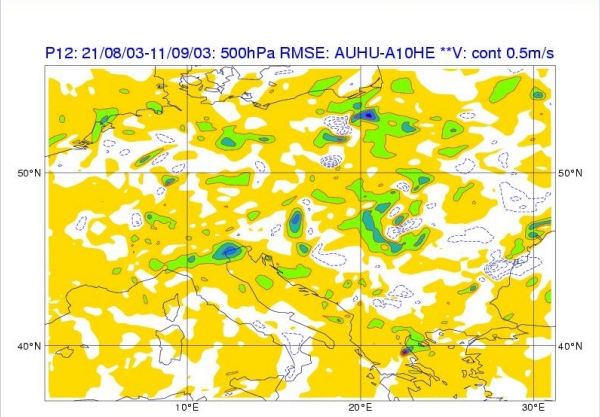

**Temperature**
**12 h forecast**
**500 hPa**



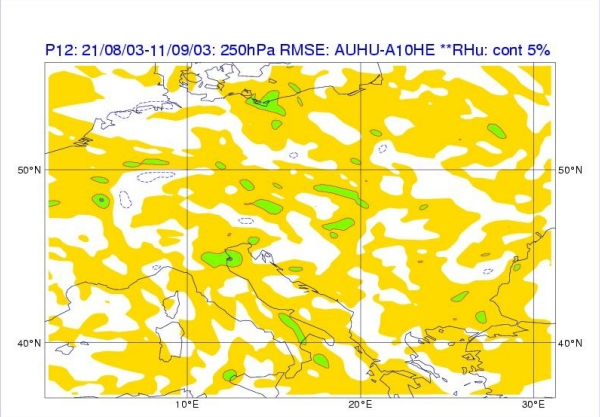

**Geopotential**
**12 h forecast**
**250 hPa**



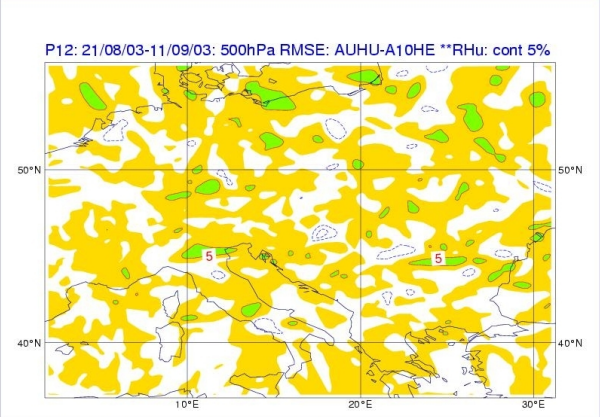

**Wind speed**
**12 h forecast**
**500 hPa**



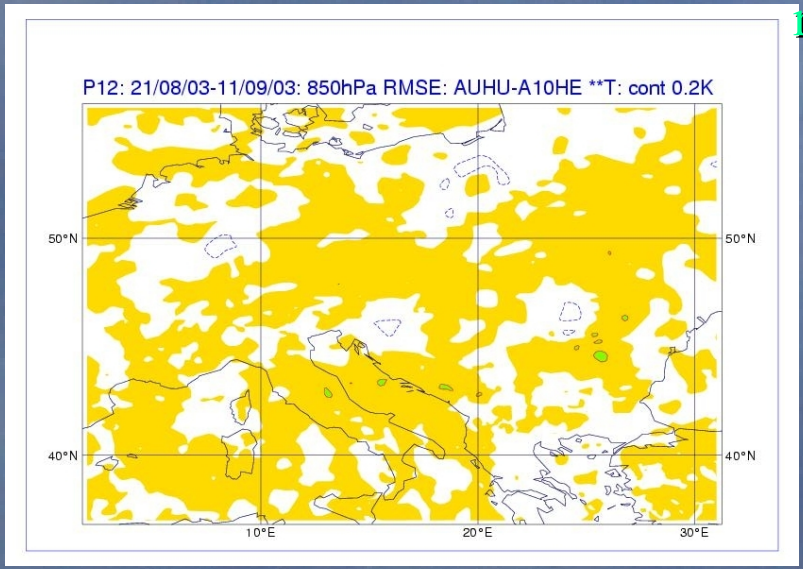

**Rel. humidity**
**12 h forecast**
**250 hPa**



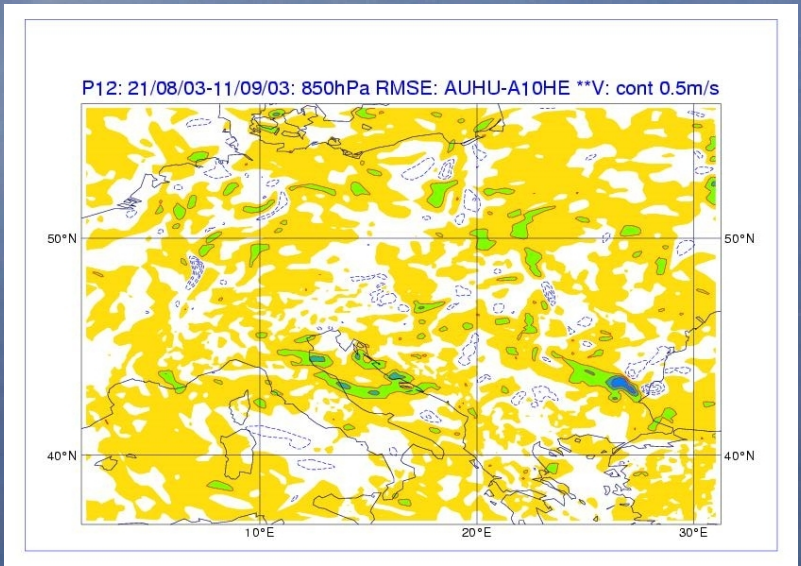

**Rel. humidity**
**12 h forecast**
**500 hPa**



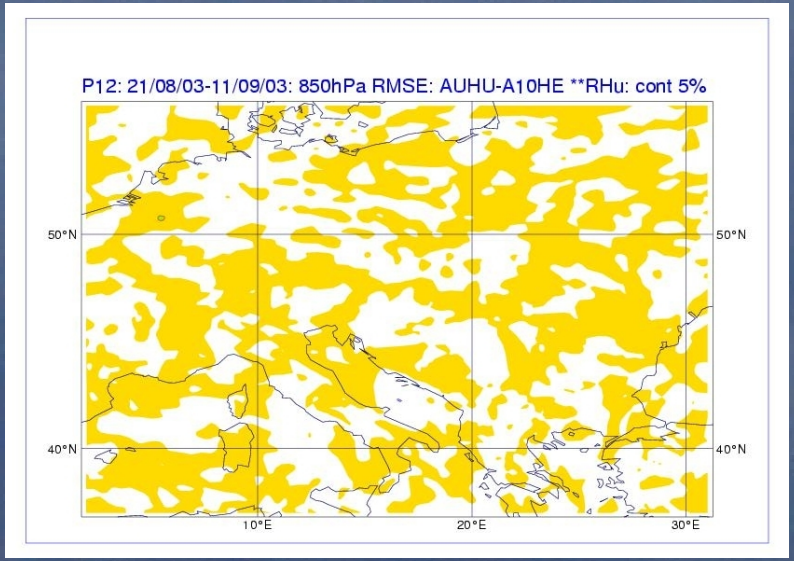
# *local AMDAR* (10km, T ± 1 hour) compared to the CONTROL run



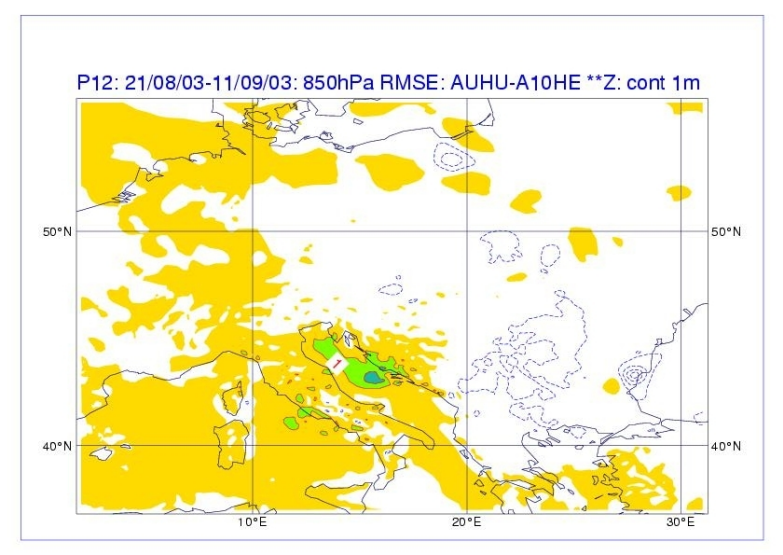

Temperature, 12 h forecast, 850 hPa




Wind speed, 12 h forecast, 850 hPa



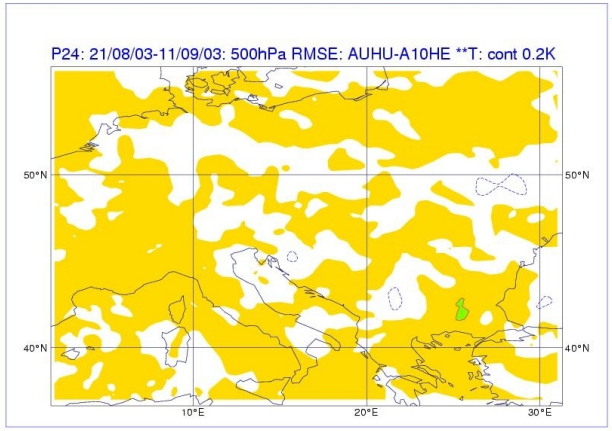

Relative humidity, 12 h forecast, 850 hPa



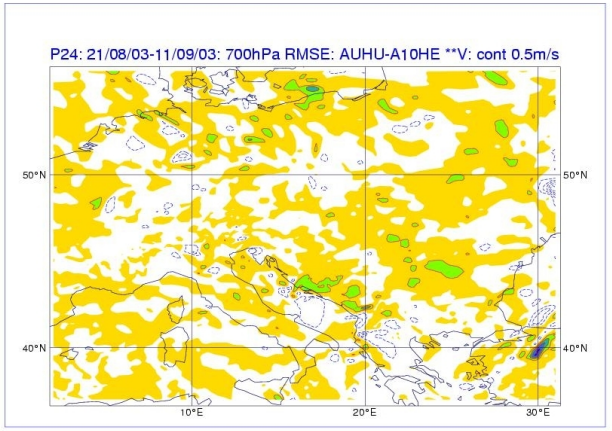

Geopotential height, 12 h forecast, 850 hPa

# *local AMDAR* (10km, T ± 1 hour) compared to the CONTROL run

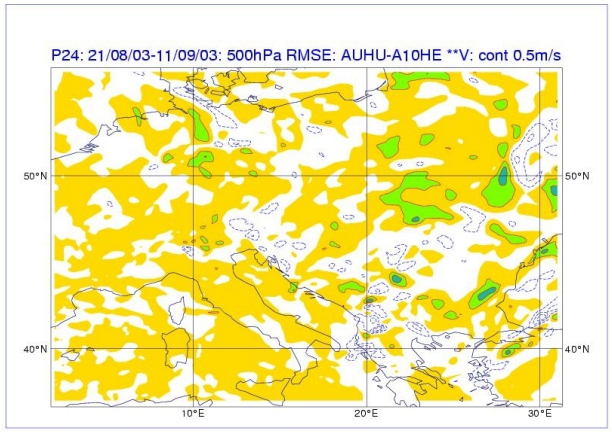
**Temperature**
**24 h forecast**
**500 hPa**



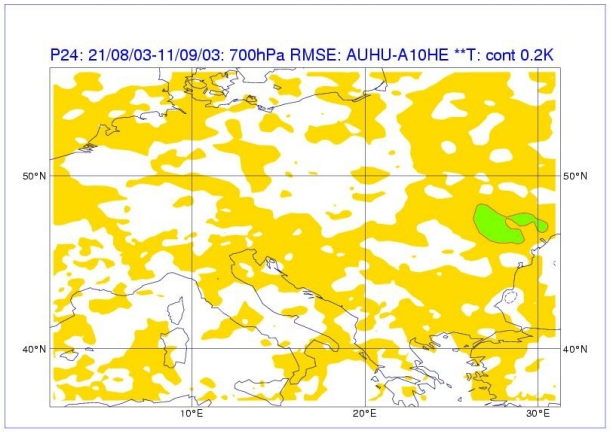

**Wind speed**
**24 h forecast**
**700 hPa**



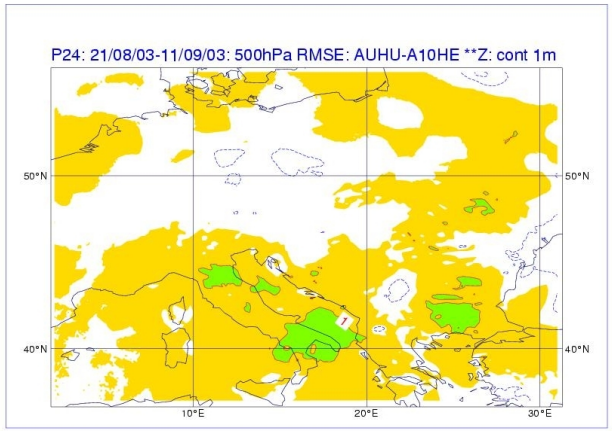

**Wind speed**
**24 h forecast**
**500 hPa**



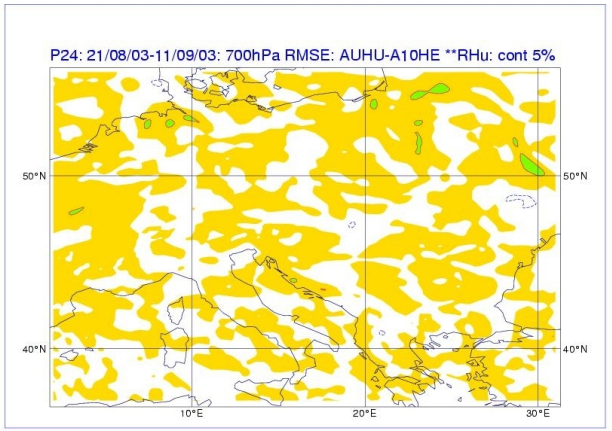

**Temperature**
**24 h forecast**
**700 hPa**




**Geopotential**
**24 h forecast**
**500 hPa**

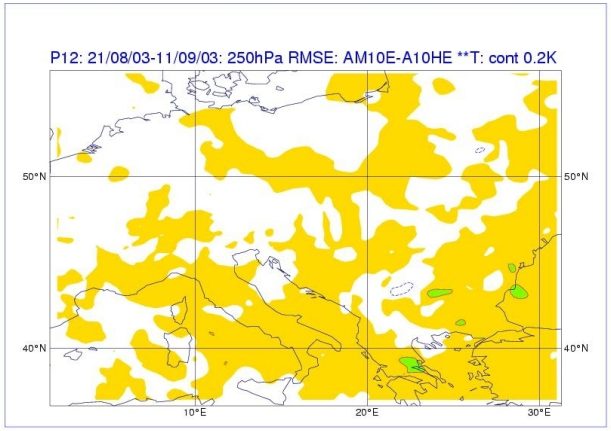


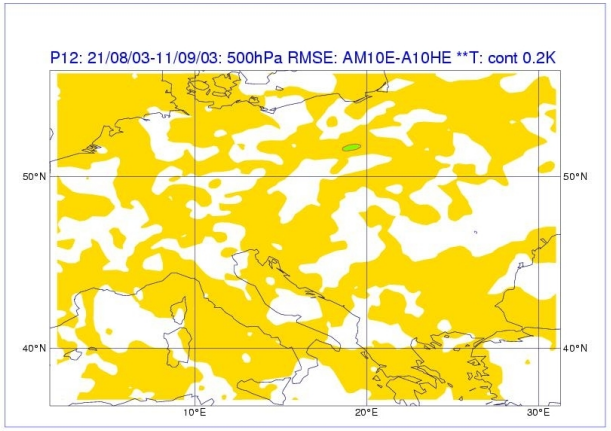

**Rel. humidity**
**24 h forecast**
**700 hPa**



# *local AMDAR* compared to the *EUCOS AMDAR* assimilated at 10 km

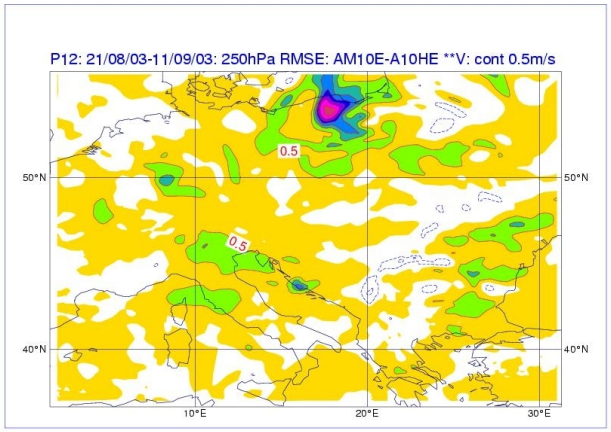
**Temperature**
**12 h forecast**
**250 hPa**

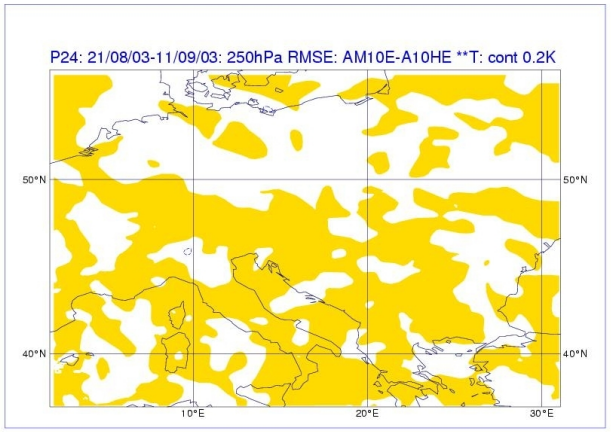



**Temperature**
**12 h forecast**
**500 hPa**

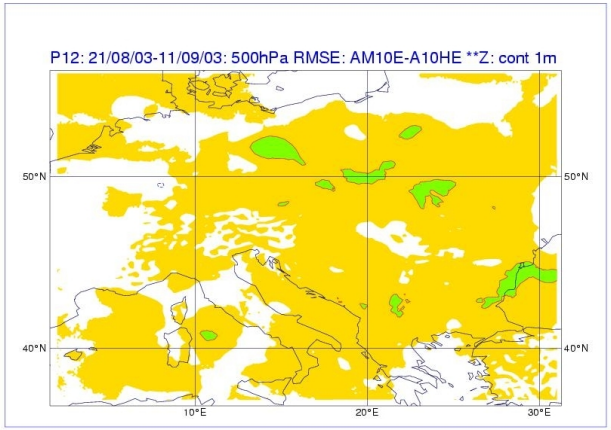
**Wind speed**
**12 h forecast**
**250 hPa**

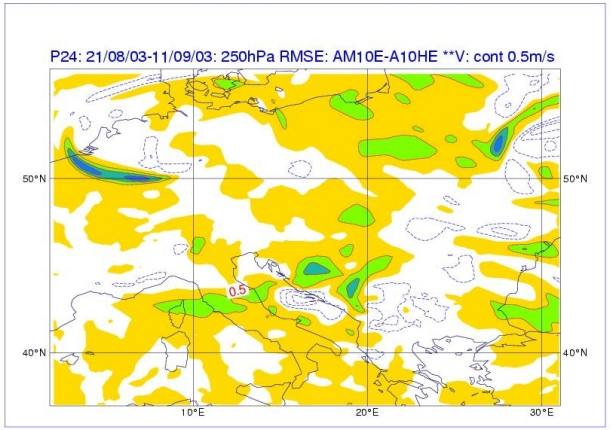



**Temperature**
**24 h forecast**
**250 hPa**

**Geopotential**
**12 h forecast**
**500 hPa**

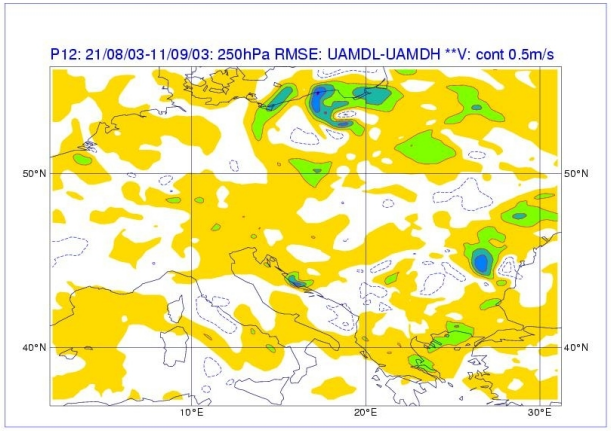


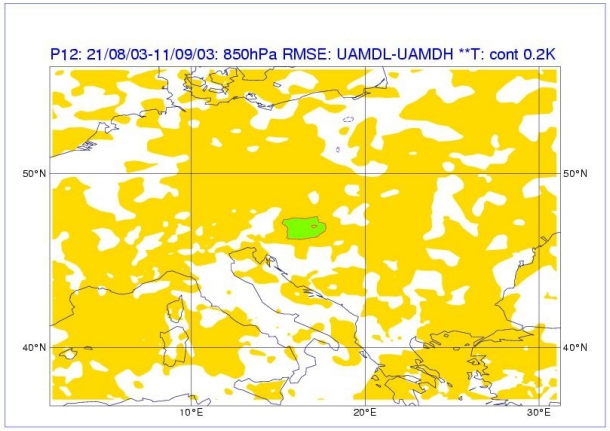

**Wind speed**
**24 h forecast**
**250 hPa**

# *local AMDAR* compared to the *EUCOS AMDAR* assimilated at 170 km

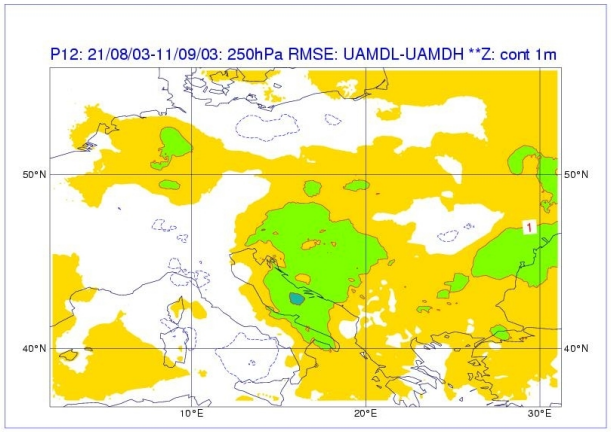
**Wind speed**
**12 h forecast**
**250 hPa**



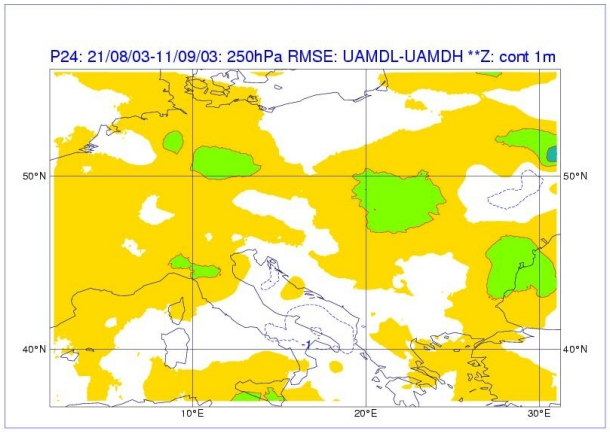

**Temperature**
**12 h forecast**
**850 hPa**



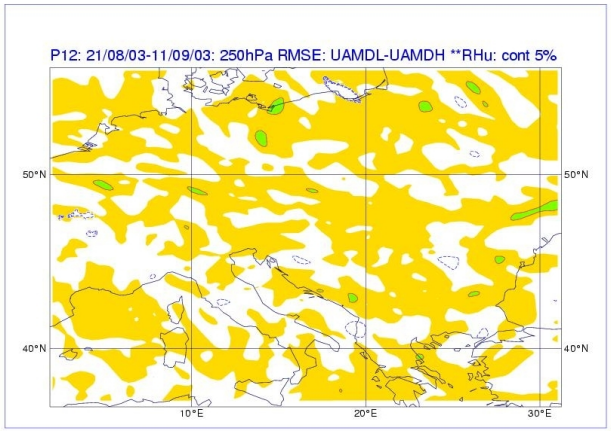

**Geopotential**
**12 h forecast**
**250 hPa**



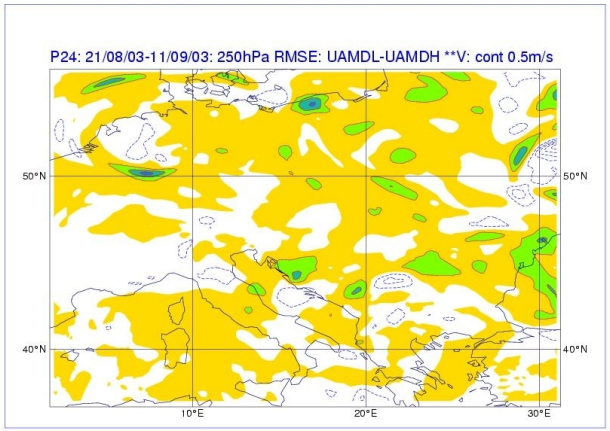

**Geopotential**
**24 h forecast**
**250 hPa**




**Rel. humidity**
**12 h forecast**
**250 hPa**




**Wind speed**
**24 h forecast**
**250 hPa**

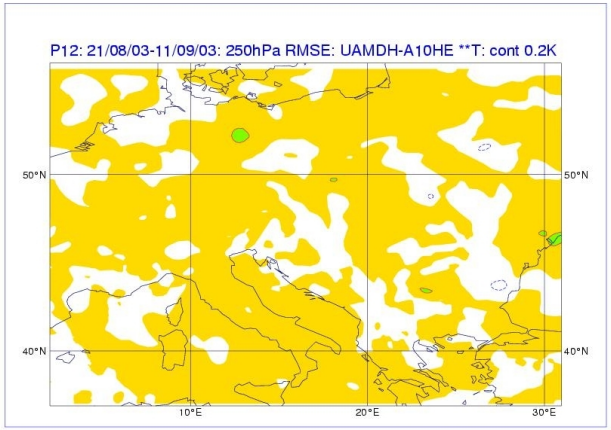


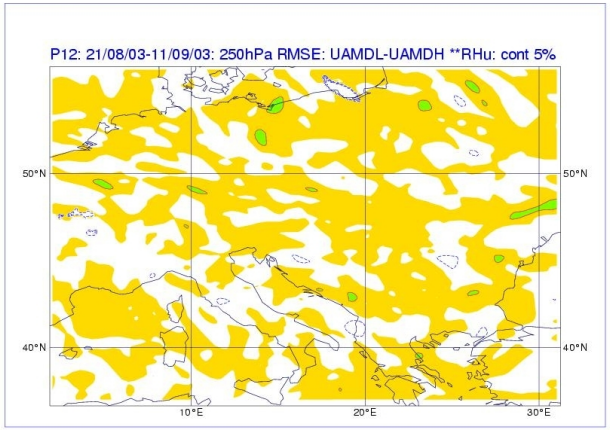
# *local AMDAR* compared at two different (10 km and 170 km) thinning dictances

**Temperature**

**12 h forecast**

**250 hPa**




**Rel. humidity**

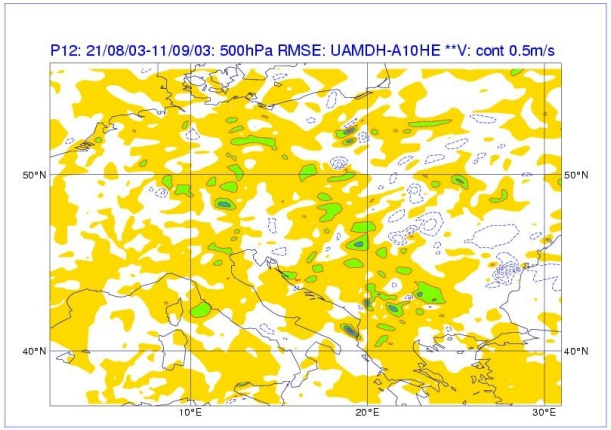
**12 h forecast**

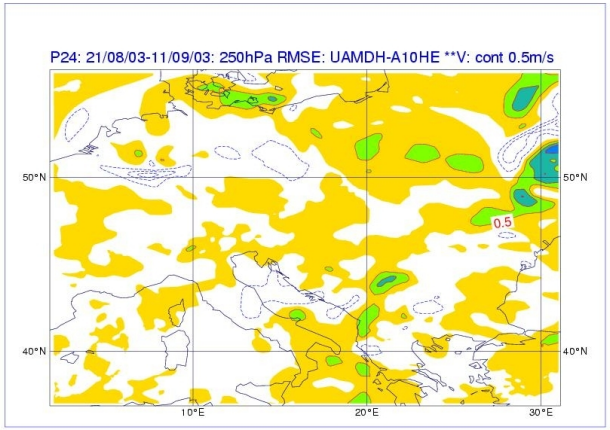
**250 hPa**

**Wind speed**

**12 h forecast**

**500 hPa**




**Wind speed**

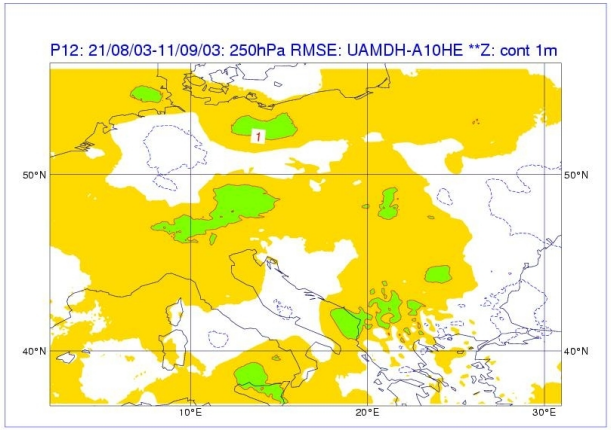
**24 h forecast**

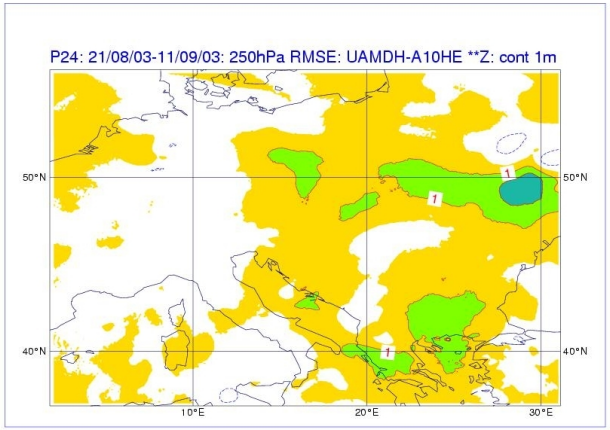
**250 hPa**

**Geopotential**

**12 h forecast**

**250 hPa**



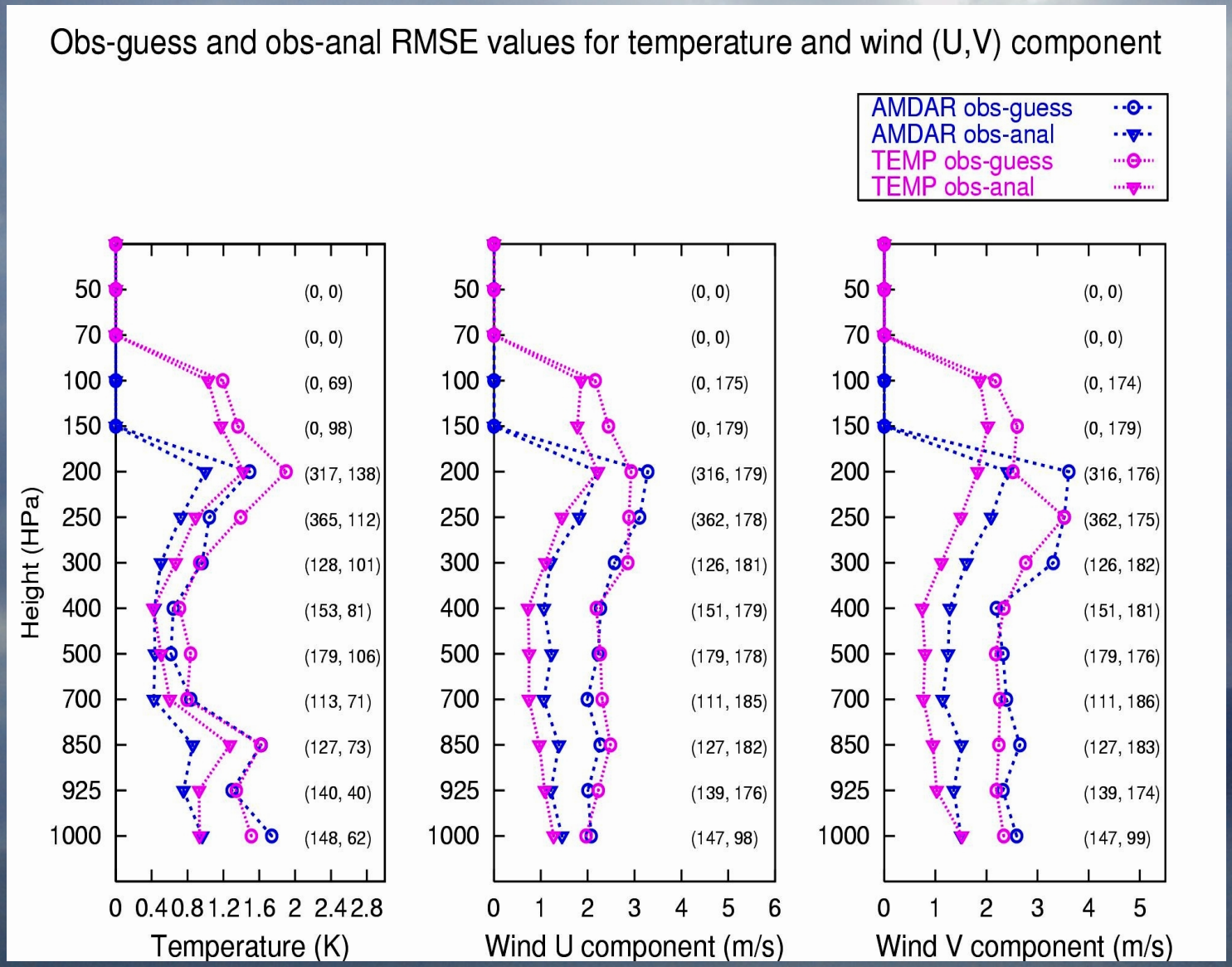




**Geopotential**

**24 h forecast**

**250 hPa**

# RMSE values for temperature and wind components



Our choice for next observations to be assimilated

➔ATOVS AMSU-B (locally received and pre-processed data)

- Retransmitted radiances from EUMETSAT

(***we are waiting for CY28T1***)

➔MSG clear-sky radiances (locally pre-processed)

(***we are waiting for CY28T1***)

➔Wind profiler data (local measurements + from GTS)

(***Regina had already started to "recognise" the available data***)

➔SATOB cloud motion wind data

- We will probably use the output of the SAF NWC package (locally pre-processed data, NOT from GTS)

(***the work will start as soon as data are available***)

# Summary

- More stable results were guaranteed by the LAMbias correction file when assimilating the ATOVS data
- Although some problems, related to the pre-processing of AMDAR data have been solved, solution should be found to handle multiple profiles from the same airport at the same assimilation time
- Positive impact of the AMDAR data on temperature, windspeed, humidity and geopotential height fields were found in the short-range forecasts of the ALADIN/HU model
- Further studies should be performed regarding the observation errors specific to AMDAR data


Thank you for your kind attention !
Balaton lake at Tihany