On the use of bias correction method and full grid AMSU-B data in a limited area model

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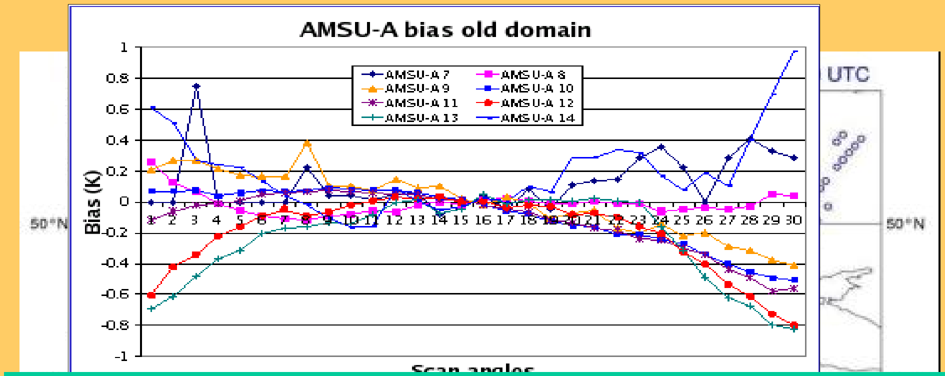
- Studies related to radiance-bias correction for a limited area model (LAM)

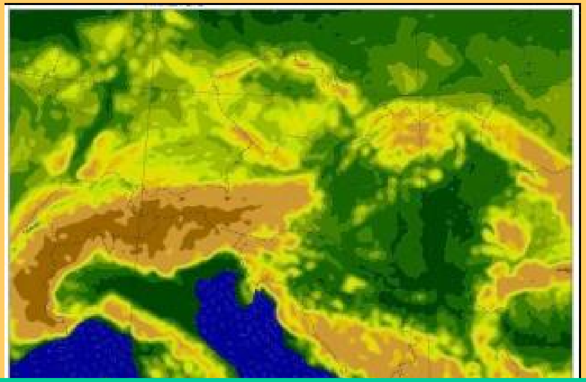
- Investigation of full grid AMSU-B data in LAM

The problem of the use of Harris and Kelly's method in LAM

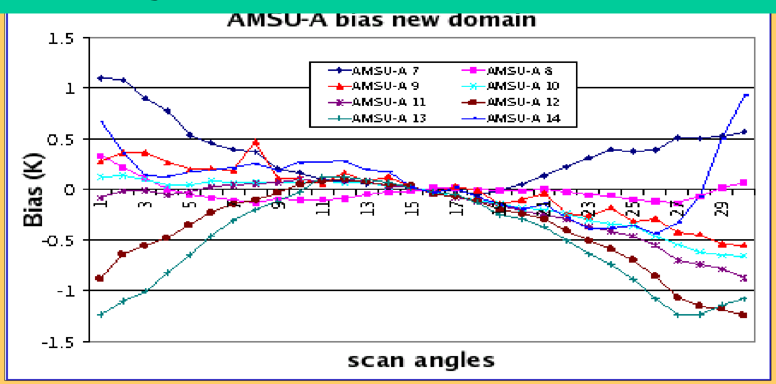
computed scan angle bias



LAM domain



Is it necessary to compute bias correction file in LAM?
Why don't we use the file computed for the global model?



ALADIN/HU model and its assimilation system

Model: - Hydrostatic (AL15/CY24T1)

- Horizontal resolution: 12 km
- 37 vertical levels

3D-Var: - Background error covariance matrix "B": computed using "standard NMC" method

- RTTOV as forward model
- 6 hour assimilation cycling: 00, 06, 12 and 18 UTC
- coupling every 6 hours: ARPEGE long cut-off analysis
- Satellite data (AMSU-A) from NOAA-15&16 [ch. 5-12]

OI: - surface fields analysis

Forecast: - 48h from 00 UTC

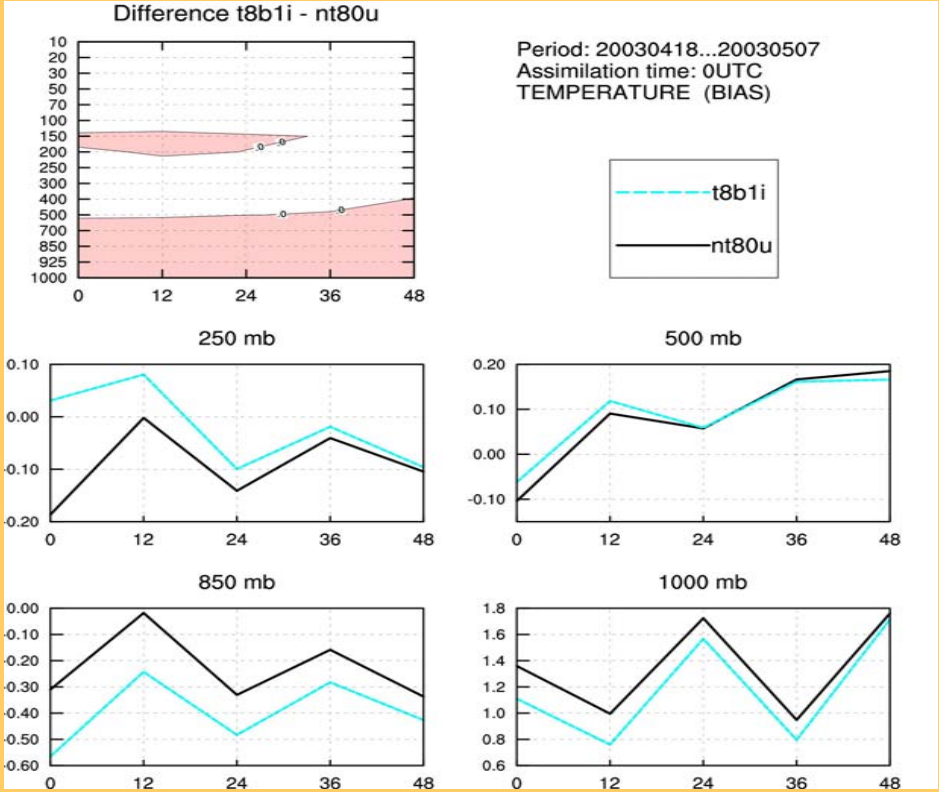
The performed experiments: (during two weeks)

- **NT80U**: ALADIN/HU bias correction file (control run in this study)
- **T8B1I**: ARPEGE bias correction file
- **T8B2I**: ARPEGE scan angle bias and NO air-mass bias
- **T8B3I**: ARPEGE scan angle bias and ALADIN air-mass bias

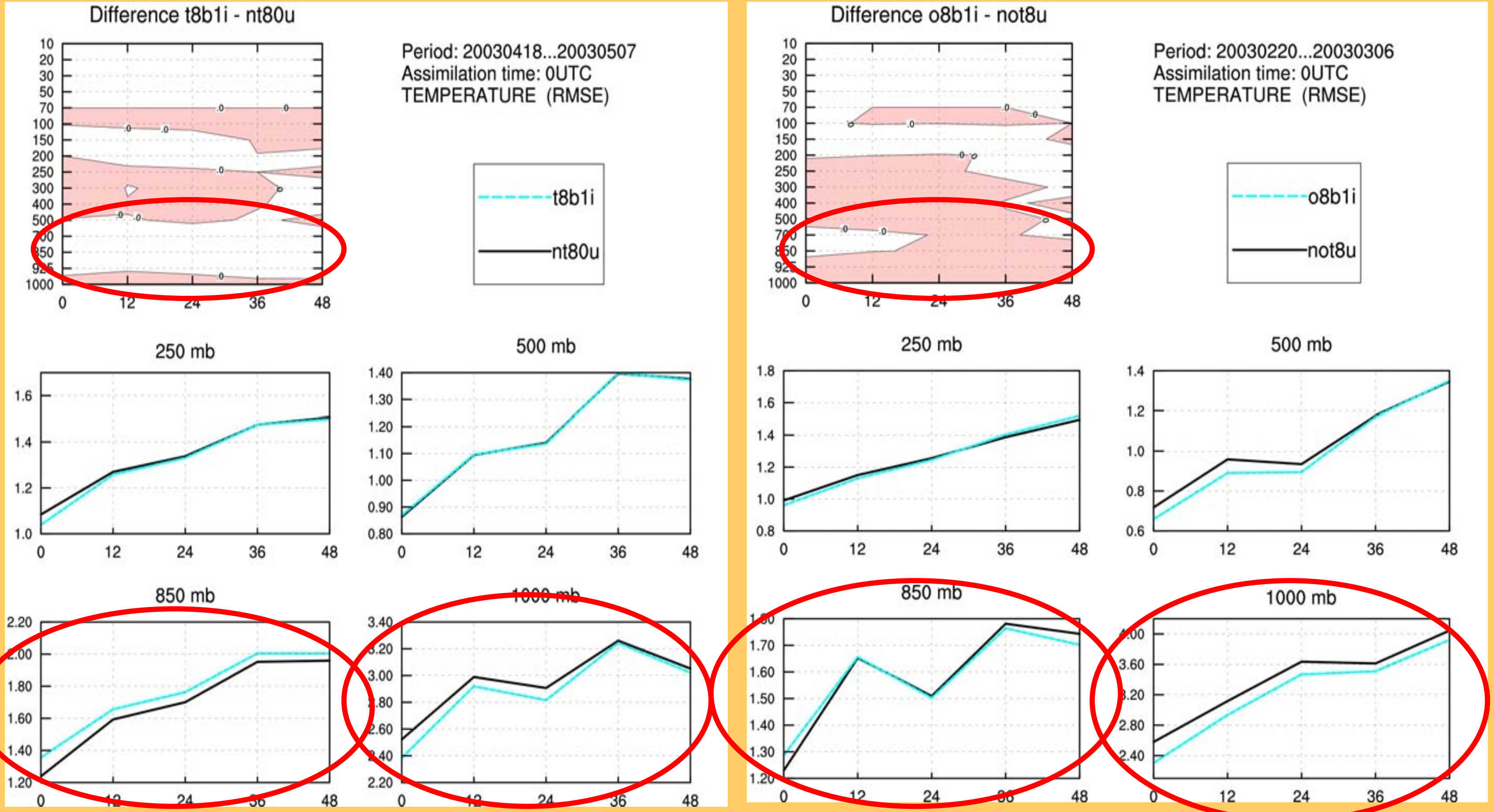
- **NOT8U**: The same as NT80U for the second period
- **O8B1I**: The same as T8B1I for the second period
- **O8B3I**: The same as T8B3I for the second period

Results

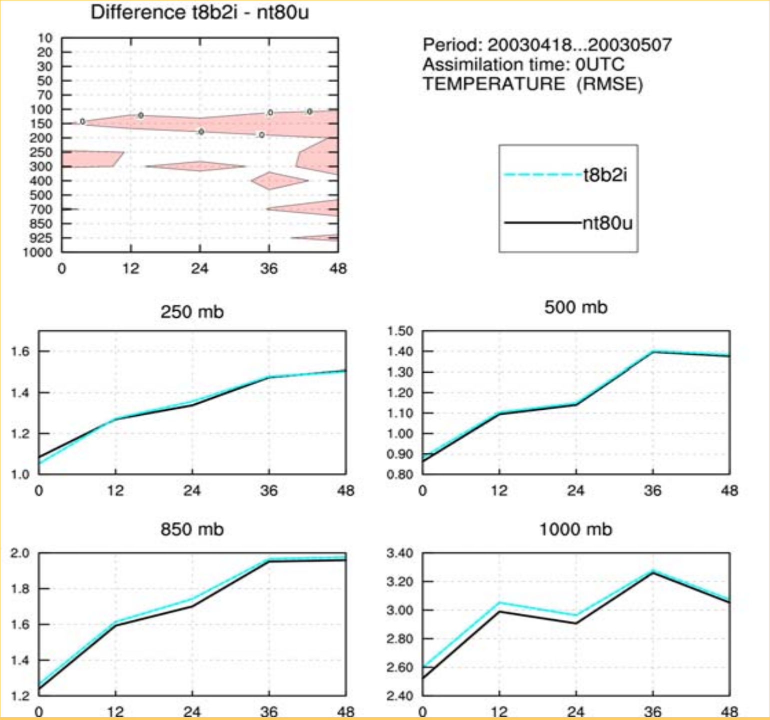
BIAS (ARPEGE bc vs ALADIN bc)



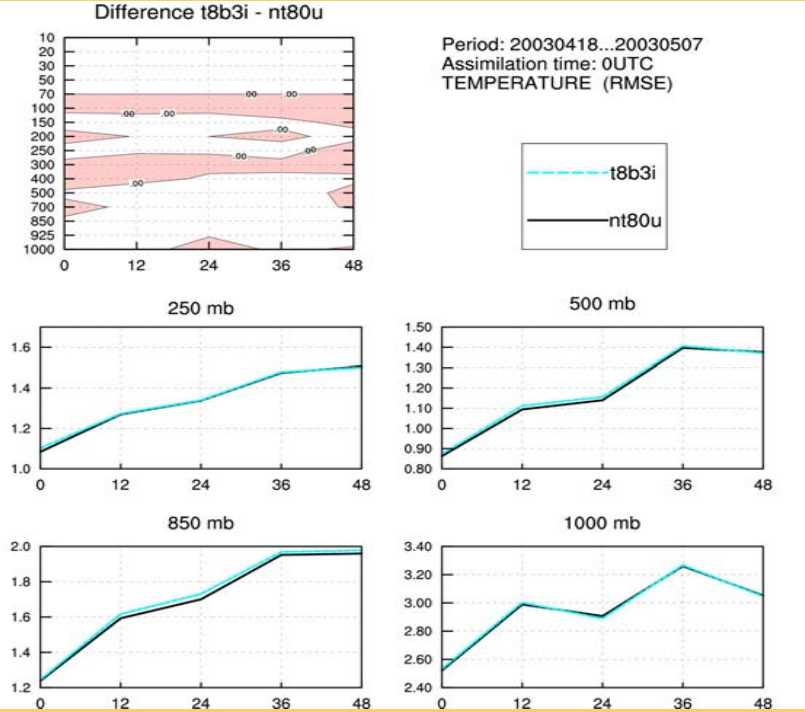
RMSE (ARPEGE bc vs ALADIN bc)



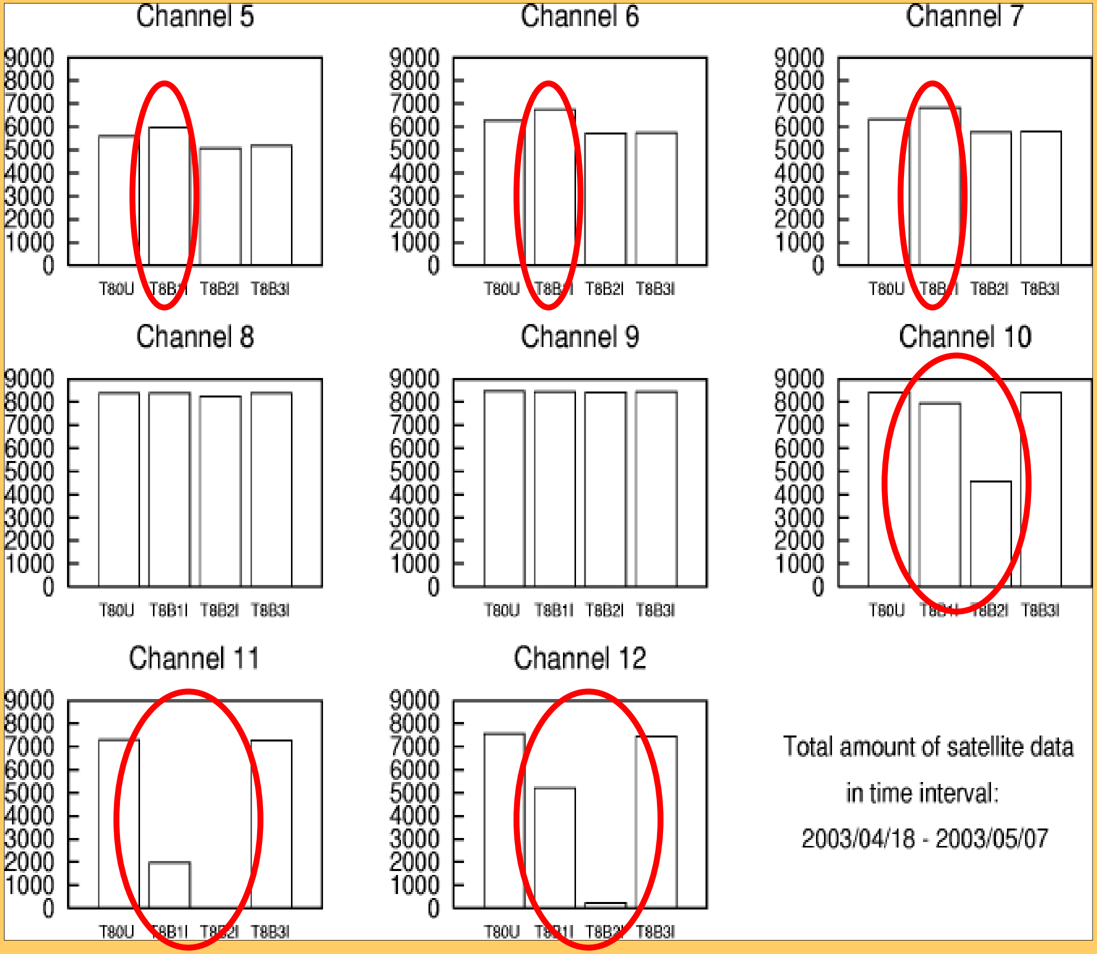
RMSE (ARPEGE scan angle NO air-mass bias)



RMSE (ARPEGE scan angle ALADIN air-mass bias)



Total number of active sat. observations:18.04.2003 - 07.05.2003



Conclusions

- ARPEGE and ALADIN models use basically the same parameterisation of physical processes. Nevertheless, we have to compute the bias correction file for ALADIN to have better processing of the AMSU-A data in the analysis system

- The air-mass bias correction must be included in the processing of AMSU-A data in the limited area model

- Channels 10-12 in LAM are very sensitive to the bias coefficients computed for the global model

Operational ALADIN/HU model and its assimilation system:

Model: - Hydrostatic (AL28/CY28T3)
- Horizontal resolution: 8 km
- 49 vertical levels

3D-Var: - Background error covariance matrix "B": computed using "standard NMC" method
- RTTOV as forward model
- 6 hour assimilation cycling: 00, 06, 12 and 18 UTC
- coupling every 3 hours: ARPEGE long cut-off files

Obs: surface, radiosondes and aircraft (AMDAR)
sat. data (AMSU-A) from NOAA-15&16 [ch. 5-12]

No OI: - **S**ubstitution of the surface fields by those from ARPEGE

Forecast: - 48h from 00 UTC & 12 UTC

Investigation of full grid AMSU-B data

ALADIN/HU model and its assimilation system

Model: - Hydrostatic (AL28/CY28T3)

- Horizontal resolution: 12 km
- 37 vertical levels

3D-Var: - Background error covariance matrix "B": computed using "standard NMC" method

- RTTOV as forward model
- 6 hour assimilation cycling: 00, 06, 12 and 18 UTC
- Coupling every 3 hours: ARPEGE long cut-off files
- Sat. data (AMSU-A: NOAA15&16 [ch. 5-12]; AMSU-B: NOAA16&17 [ch. 3-5])
- new bias correction to process full grid AMSU-B

No OI: - substitution of the surface fields by those from ARPEGE

Forecast: - 48h from 12 UTC

We performed two weeks experiments

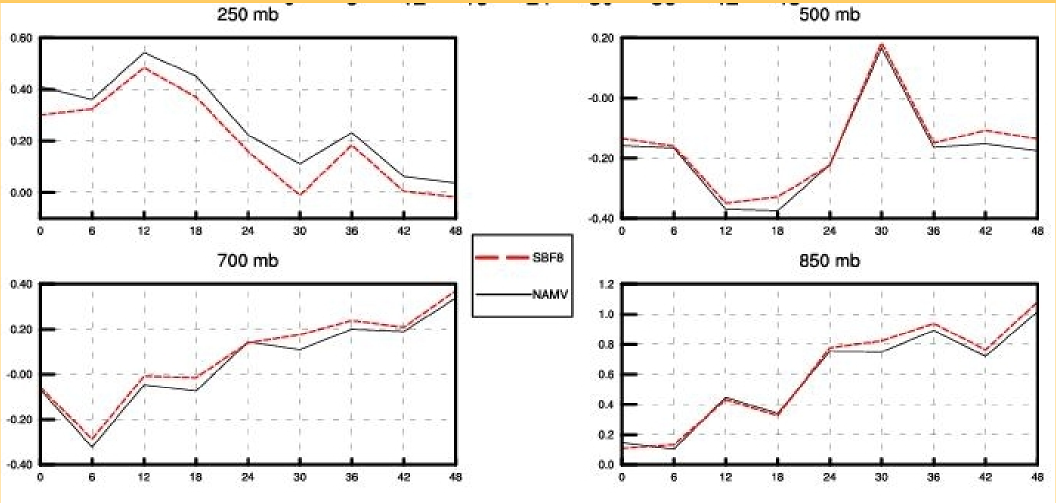
- **NAMV –** Run with TEMP, SYNOP, AMDAR and AMSU-A → **control run**
- **SBX3 – control obs.** + AMSU-B (3x3 FOV) (**thinning: 80km**)
- **SBF8 – control obs**. + full grid AMSU-B (**thinning: 80km**)
- **SBF6 – control obs**. + full grid AMSU-B (**thinning: 60km**)
- **SBF1 – control obs**. + full grid AMSU-B (**thinning: 120km**)

Results

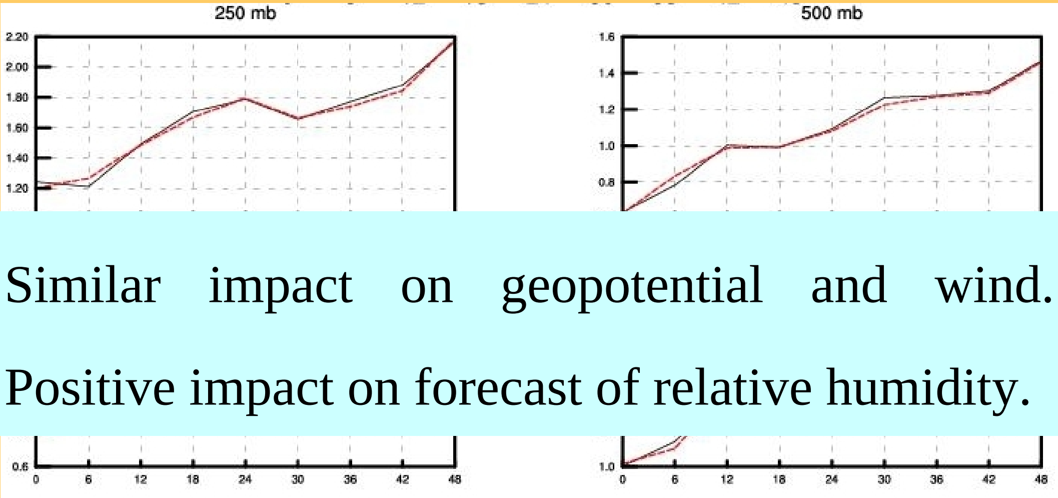
Temperature **bias**

SBF8

NAMV



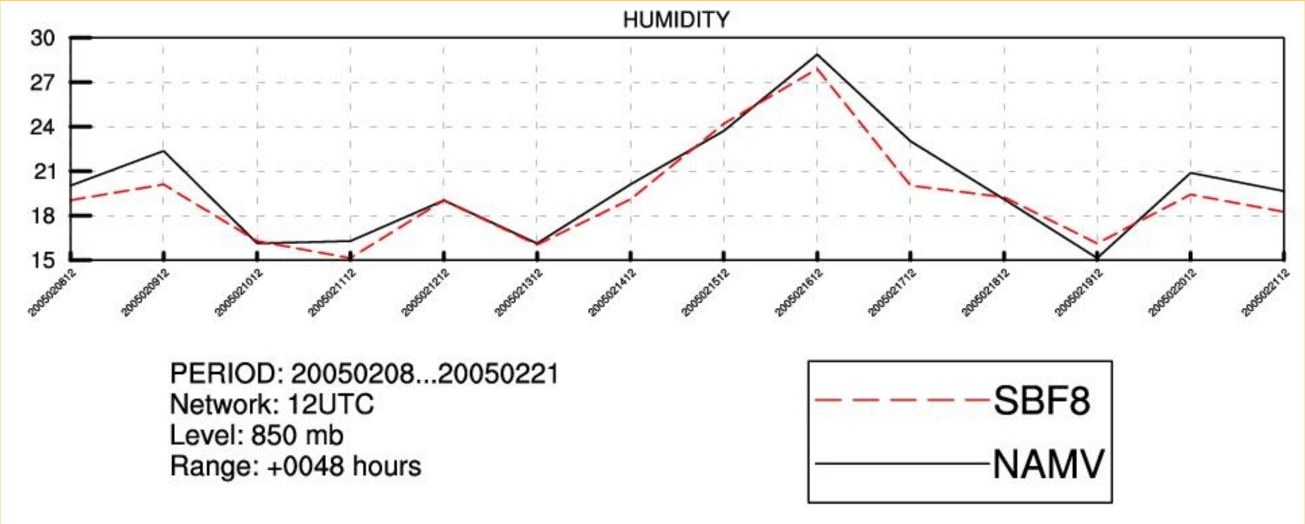
Temperature **RMSE**

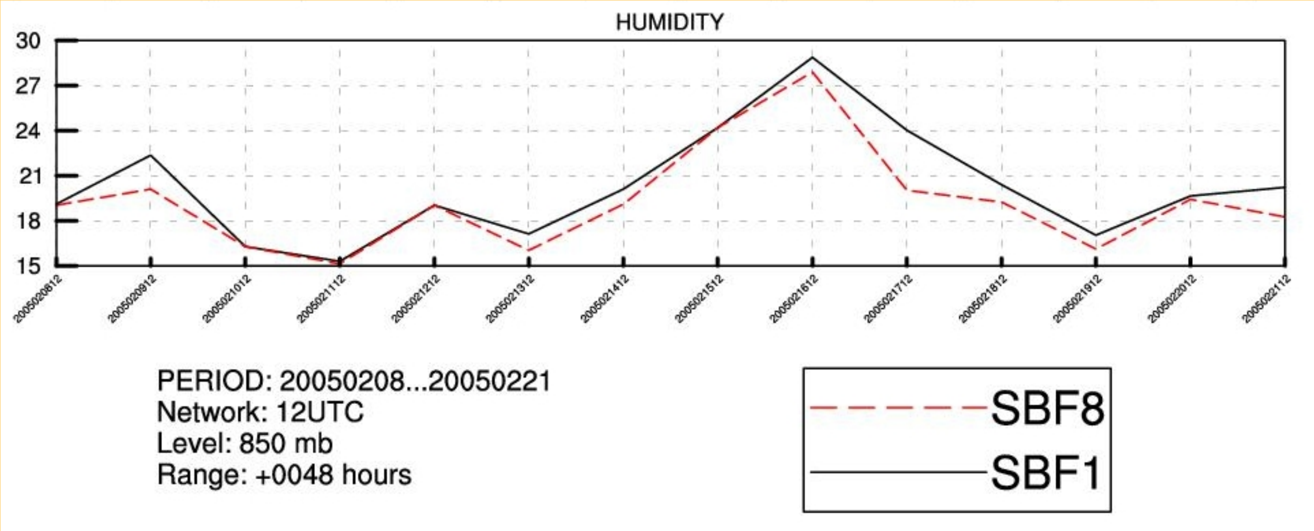


Similar impact on geopotential and wind.

Positive impact on forecast of relative humidity.

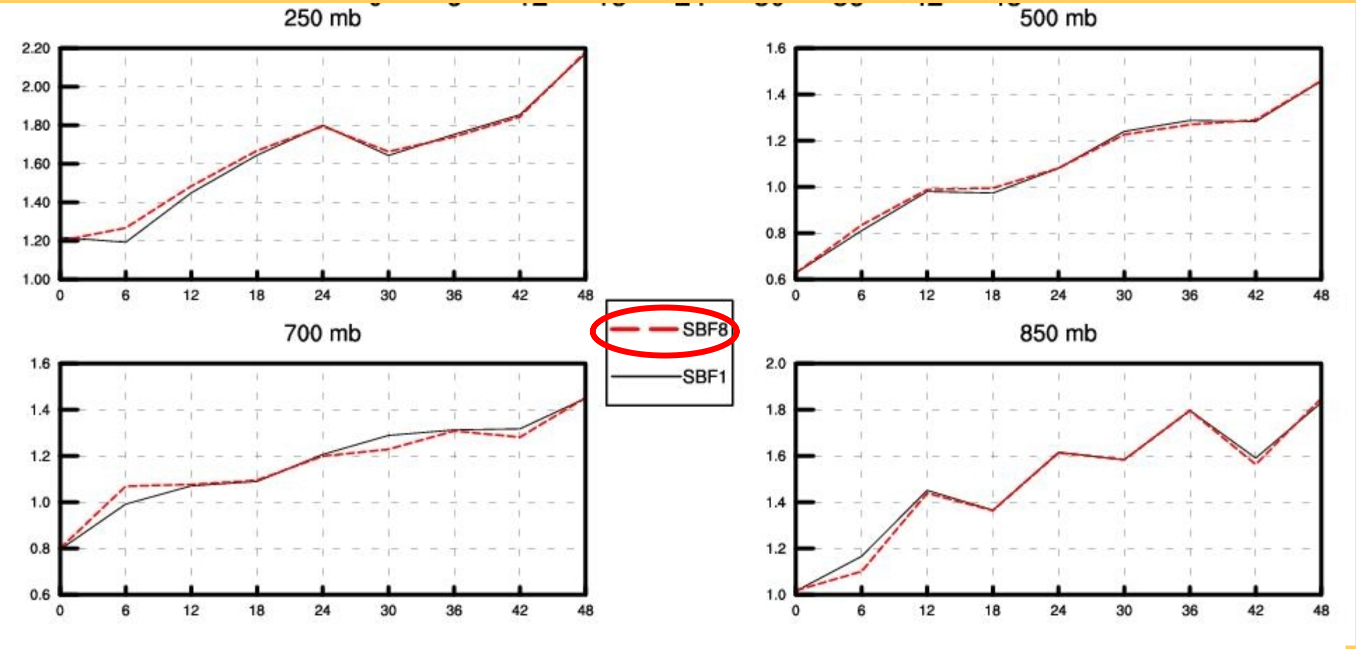
48h. Forecast Relative Hum. **RMSE**





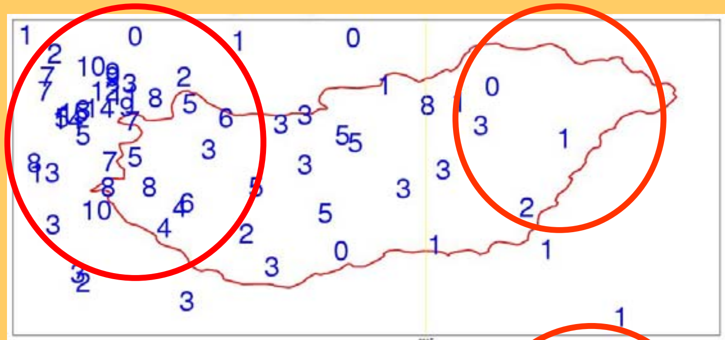
Temperature

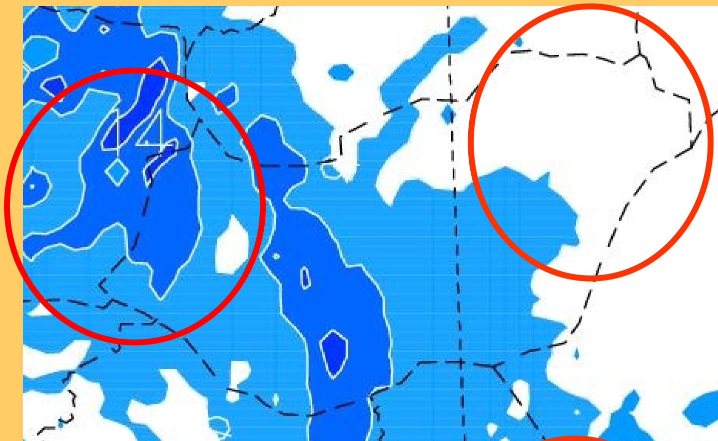
RMSE



Observed 6h.cum. Precipitation (mm):
05/02/21:18-05/02/22:00

Contour interval: 0,1,5,10,30,.. mm

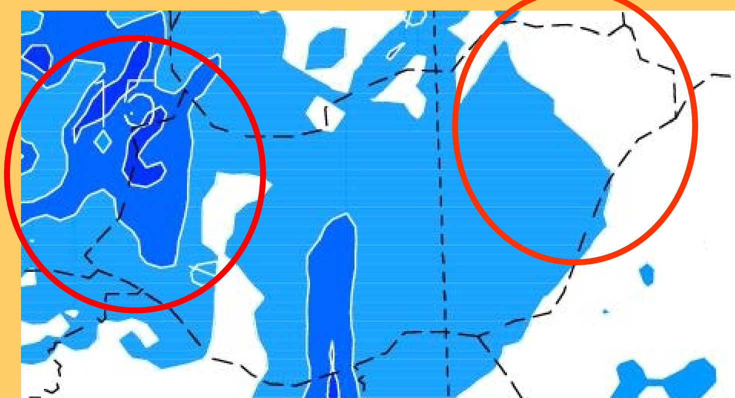




SBF1
120km

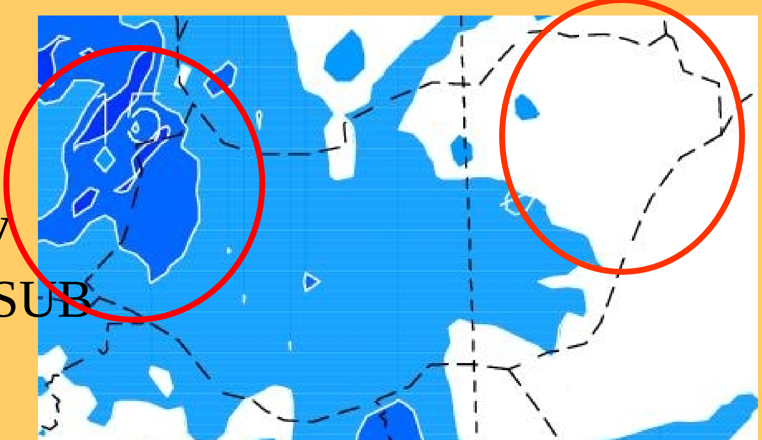
30h.
Forecast

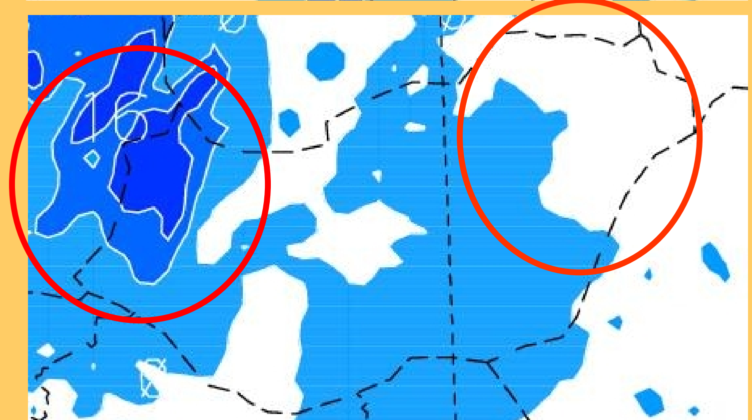
SBX3
80km



SBF8
80km

NAMV
noAMSUB

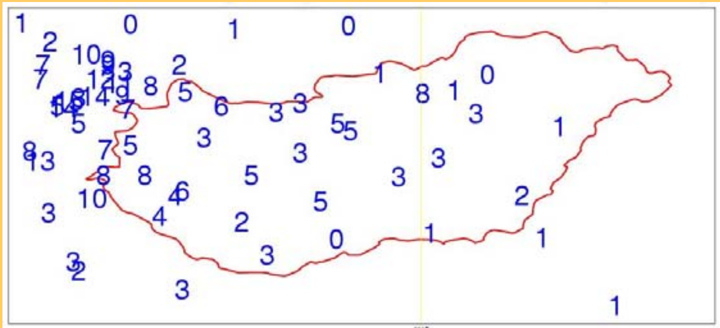




SBF6
60km

Observed 6h.cum. Precipitation (mm):
05/02/21:18-05/02/22:00

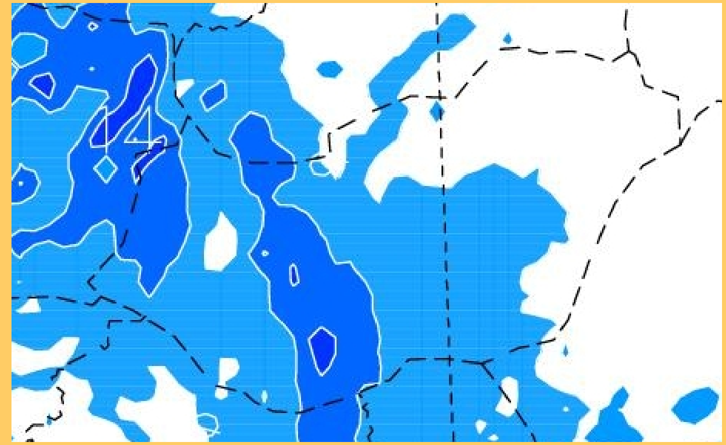
Contour interval: 0,1,5,10,30,.. mm



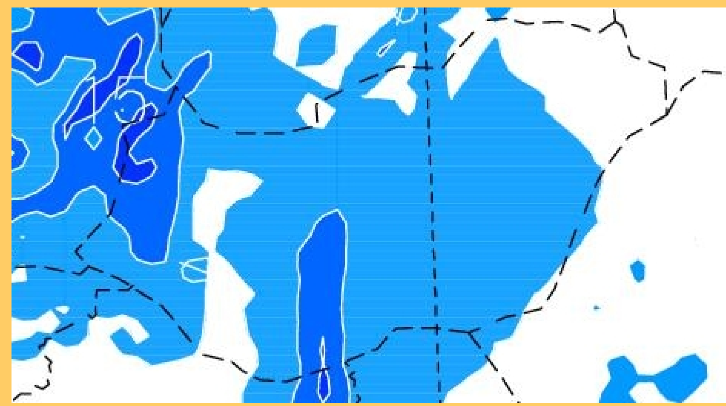
30h. Forecast

SBX3
80km

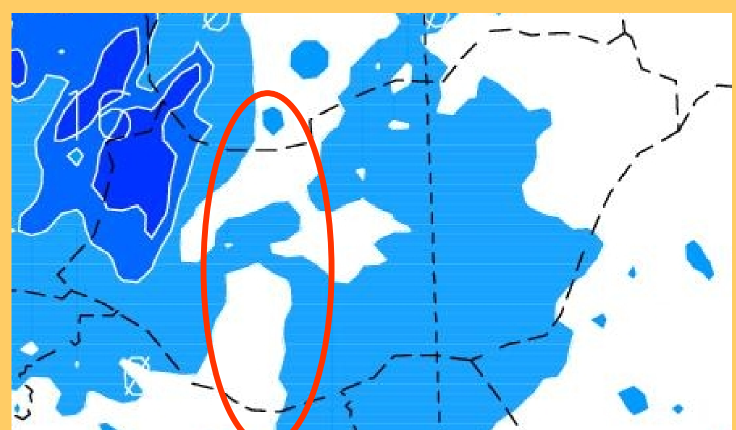
NAMV
noAMSUB



SBF1
120km



SBF8
80km



SBF6
60km

Conclusions

•The resolution of the input AMSU-B data is important for their better use in a limited area model

→full grid data is preferable compared to sparse ones

•Our preliminary investigation shows that the “optimal thinning distance” for our system is 80km

•The impact of AMSU-B is rather slightly positive than neutral on the analysis and short-range forecasts of temperature, geopotential and wind fields

•Positive impact in forecast of relative humidity have been observed

•Further investigation with more case studies is needed before making decision

Thank you for your attention!