Estimation of satellite observations bias correction for limited area model

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ITSC-XV, Maratea, Italy, 4-10 October 2006
Outline of the presentation

- The ALADIN/HU model and its experimental data assimilation system
- Investigation of different predictors in the estimation of the bias correction
- Investigation of different periods in the computation of the bias correction for LAM DAS
- Preliminary conclusions
The ALADIN/HU model and its assimilation system

- **ALADIN/HU model**

  **Configuration of the model (CY28T3)**

  **Main Characteristics**

  - 12 km horizontal resolution
  - 37 vertical levels
  - 3D-VAR for the upper air fields
  - 6 hour cycle
  - substitution of the surface fields with the ARPEGE ones
  - B matrix: NMC method
  - LBC: long cut-off ARPEGE analysis
  - 3 hour coupling frequency
  - 48 hour forecast twice a day

  **Satellite data**

  - full grid rad1C (1x1 FOV) AMSU-A (N15 & N16) and AMSU-B (N16 & N17) assimilation in 80 km resolution
Conclusion from the previous ITSC

... The air-mass bias correction must be included in the processing of satellite radiances in the limited area model ...

Harris and Kelly (2001)

Air-mass predictors for ARPEGE/ALADIN models:

- 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

(SBF8)

- model first guess thickness (850-300 hPa)
- model first guess thickness (200-50 hPa)
- model first guess surface skin temperature
- model first guess total column water vapour

(SB4P – 4 predictors)

- model first guess thickness (850-300 hPa)
- model first guess surface skin temperature
- model first guess total column water vapour

(SB3P – 3 predictors)

- model first guess thickness (850-300 hPa)
- model first guess thickness (200-50 hPa)
- model first guess surface skin temperature
- model first guess total column water vapour
Investigation of different predictors in the estimation of the bias correction

Impact study during 2-week period

Verification against observations
BIAS of individual runs

PERIOD: 09.02.2005...19.02.2005
Network: 12UTC
Level: 500 hPa
Range: +00 hours

Verification against observations
RMSE of individual runs

PERIOD: 09.02.2005...19.02.2005
Network: 12UTC
Level: 500 hPa
Range: +00 hours
Investigation of different periods in the computation of the bias correction for LAM DAS
We investigated two different periods:

- relatively long (4-5 months)
  - summer (01.11.2005 – 27.03.2006)
  - winter (01.08.2005 – 27.11.2005)

- short (one month)
  - summer May 2006
  - winter November 2005

Importance:

In the estimation of the air-mass bias coefficients, with the global model we have almost all available meteorological conditions (cyclonic, anticyclonic, winter, summer etc ...) within a relatively short time.

WHILE

With the LAM we have only those meteorological events passing through the model domain and for only one season.
Investigation of different periods in the computation of the bias correction

Verification against analyses
BIAS of individual runs
PERIOD: 20051205...20051227
Network: 0UTC
SURFACE
Range: +00 hours

Verification against analyses
RMSE of individual runs
PERIOD: 20051205...20051227
Network: 0UTC
SURFACE
Range: +00 hours
Investigation of different periods in the computation of the bias correction

**Summer case**

**Mean RMSE difference BC01–BC02**
Period: 20060609...20060625  Run:00,12 UTC
Variable: RHU 2m
90.0% two sided confidence interval

**Winter case**

**Mean RMSE difference BC03–BC04**
Period: 20051205...20051227  Run:00,12 UTC
Variable: RHU 2m
90.0% two sided confidence interval
Investigation of different periods in the computation of the bias correction

Cumulated precipitation for the last 6-h of the 12-h forecast (mm/6h)

Period 09.06.2006 - 28.06.2006
Statistics for the whole ALADIN domain

- short period (BC01)
- long period (BC02)
Investigation of different periods in the computation of the bias correction

Cumulated precipitation for the last 6-h of the 12-h forecast (mm/6h)

Period 09.06.2006 - 28.06.2006
Statistics for Hungary

- short period (BC01)
- long period (BC02)
36-h forecast from 9.06.2006 00UTC

12-h forecast from 10.06.2006 00UTC

Forecast for 12 UTC 10.06.2006: 6-h cumulated precipitation

Long period (BC01) - 36h Forecast

Long period (BC01) - 12h Forecast

One month (BC02) - 36h Forecast

One month (BC02) - 12h Forecast
Wind gust during the last 6-h of the 12-h forecast (m/s)

Period 09.06.2006 - 28.06.2006
Statistics for the whole ALADIN domain

- short period (BC01)
- long period (BC02)
36-h forecast from 9.06.2006 00UTC
12-h forecast from 10.06.2006 00UTC

Forecast for 12 UTC 10.06.2006: Wind gust
Preliminary conclusions

- The presented results showed the importance of the air-mass bias correction in the assimilation of satellite radiances in LAM.
  - Changing the predictors we got encouraging results …
    In addition to our results, excluding the model first guess surface skin temperature and total column water vapor among the predictors, Bjarne Amstrup improved the bias correction in DMI HIRLAM model (HIRLAM newsletter 51)
    … to continue our investigation

- We observed some differences in the results from summer and winter cases when investigating the impact of the period for the computation of bias coefficients.

- We observed better forecast of wind using the monthly update, but better forecast of precipitation using long term computation of the bias correction.

- Is the difference between the summer and winter cases coming from the fact that there was one common month in the periods for the computation of bias correction coefficients for the winter cases?
  - additional experiments are needed
International TOVS Study Conference, 15\textsuperscript{th}, ITSC-15, Maratea, Italy, 4-10 October 2006