Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Data assimilation activities at CHMI

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Operational Setup at CHMI

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- **ALARO-1, CY43t2 (cy43t2_op2):**

  - **domain: $\triangle$x 4.7km, 529x421GP, lin. trunc. E269x215**

  - **87 vertical levels, mean orography**

  - **time step 180s,**

  - **3h space consistency coupling ARPEGE synchronous**

  - **forecasts up to +72/+54h at 00, 06, 12 and 18 UTC**

  - **weak IDFI of short cut-off production analysis**
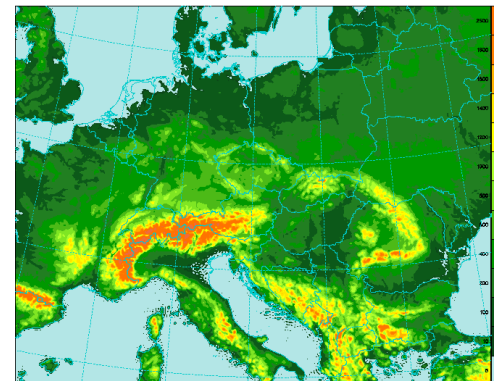
- **Upper air analysis** – BlendVar scheme

  - **BlendVar = DF Blending (filter. at trunc. E87x69) followed by 3D-Var**

  - **6h assim cycle, no IDFI in the next +6h assim guess**

  - **$\pm$1.5h assim window, spin-up ensemble B, VARBC 24h cycling**

  - **REDNMC=1.7, SIGMAO_COEF=.67, SIGMAO_COEF(AMDAR)=2.8**

  - **Assimilated observations - SYNOP (Ps), TEMP (t, q, u, v), AMDAR (t, u, v), AMV, SEVIRI (channels: 2, 3, 4, 6, 7), Mode-S MRAR CZ (t, u, v), Mode-S EHS from KNMI (t, u, v)**

- **Surface analysis** – OI based on SYNOP (T2m, RH2m)

  - **SST from ARPEGE**

Migration to New HPC

- **Operational suite shifted from SMS to ecFlow**

- **New Machine**

  - **NEC LX series** HPC cluster

  - 320 computing nodes connected through high-speed Mellanox EDR InfiniBand

  - each node consists of two **Intel Broadwell** CPU (12 cores, 64GB RAM)

  - **7680 computational cores** in total

  - operating system is CentosOS 7.2 Linux OS

  - more than 1 Petabyte of storage capacity based on Luster technology with bandwidth of more than 30 GB/s

  - SLURM scheduler

Assimilation of Mode-S observations

- **High resolution aircraft Mode-S EHS observations from KNMI (airspace of Germany, Belgium and the Netherlands) were investigated in collaboration with B. Strajnar (SI)**

- **Quality is comparable to AMDAR, no need for pre-selection**
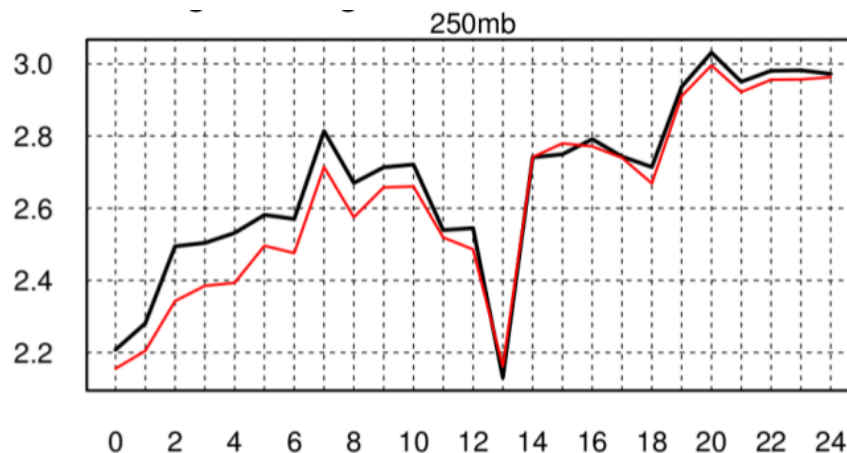
- **Operational use from May 2018**

Figure 1: Time evolution of **RMSE for wind speed at 250hPa** verified against aircraft observations for period of 11 Jan − 9 Feb 2017 12UTC. **Reference** and Mode-S EHS experiment.

VarBC - dedicated talk

- **Patrik Benacek (CZ) is proposing a new configuration of VarBC suitable for LAM.**

- **An article related to the new configuration of VarBC is close for submission.**

- **new VarBC configuration is able to adjust the bias correction to instrument bias changes on a shorter time-scale than other methods**

VarBC for GNSS ZTD - stay
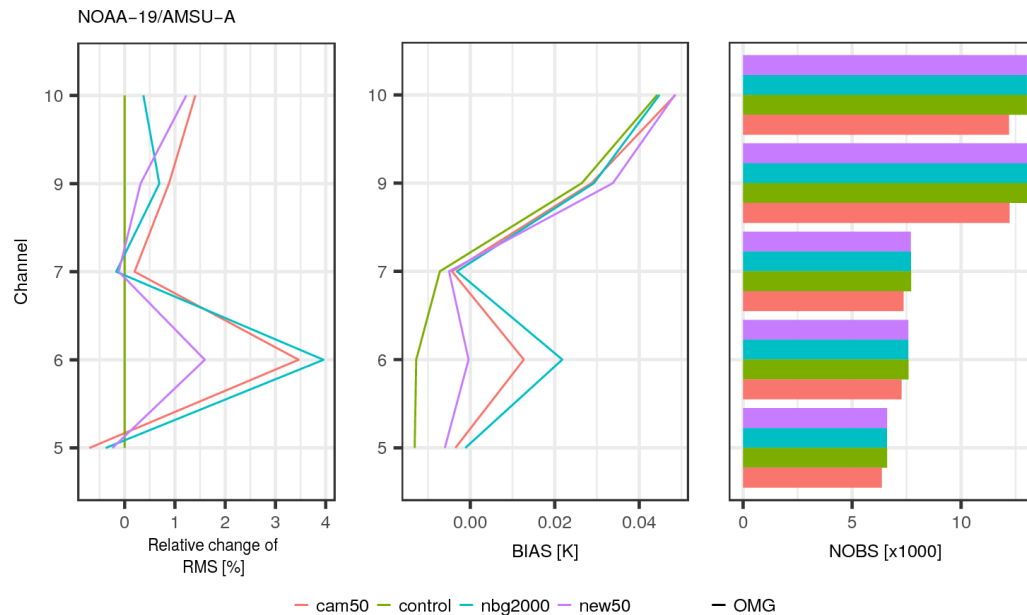
- **Patrik Benacek (2017) was tuning bias correction for GNSS ZTD in AROME/Hungary**

- **Bias for GNSS ZTD is mainly caused by:**

  - **difference in altitude between GNSS stations and model orography**

  - **an atmospheric contribution to the ZTD above the model top**

- **Average ZTD observation bias is about 4.6 mm**

- **Average observation error is about 14.4 mm**

- **Each GNSS stations has specific bias – separate estimation of VarBC coef.**

- **Using additional predictors (p2, p3, p4, p9) beside p0 (constant offset) decreases variance of OMG slightly**

- **significant code changes for application of predictors**

Bug in festat cy40t1
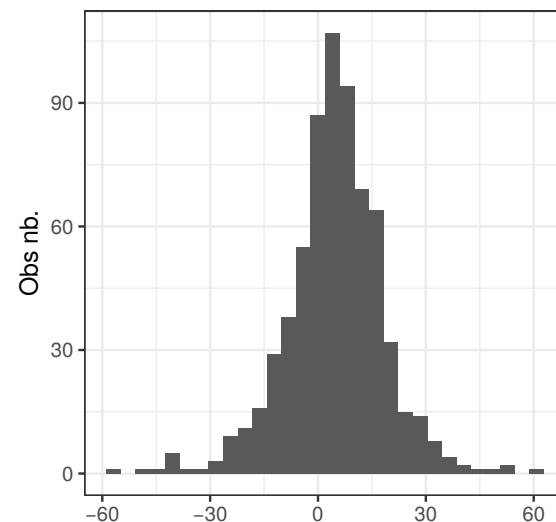
- **On cy40t1 there is scaling of covariances by 10^6** (spotted by Turkish colleagues)

- **The bug is related to the f-plane horizontal balance between vorticity and geopotencial, which is scaled!**

- **In cascade of balances the other variables (Div, t, ps, q) depends on geopotencial (Pb) through linear regressions.**

$$Div \;=\; \mathbf{M} * Pb + Div_u \tag{1}$$

$$\mathbf{M} \;=\; \frac{< Div * Pb^T >}{< Pb * Pb^T >} \tag{2}$$

$$Div \;=\; \frac{< Div * Pb^T >}{< Pb * Pb^T >} * Pb + Div_u \tag{3}$$

- **No meteorological impact on analysis!**

BUFR data handling

- **BUFR SHIP&BUOY handling**
    - pre-processing of the data
    - evaluation of BATOR handling of SHIP&BUOY in collaboration with M. Monteiro
    - for more details see Monteiro (2018)

- **BUFR TEMP handling**
    - **BATOR CY41/CY43 offers the use of updated time & trajectory information**
    - tested in collaboration with A. Satouri, see Satouri (2017)

RMSE at 200hPa
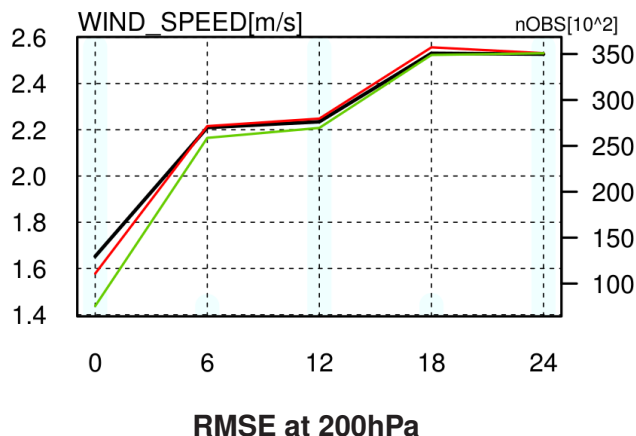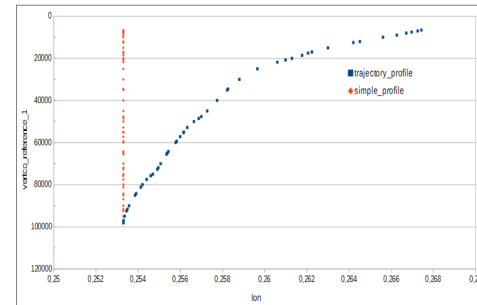
- impact on 3DVAR analysis and forecast
    - tested in collaboration with D. Ustuner
    - improved fit to observations at analysis
    - very small positive impact for +6h of wind above 400hPa

Plan 2019

- **Increase resolution: ALARO 2.2km 87 levels BlendVar system**

- **Sampling of B matrix for high resolution**

- **Change to 3h cycling**

- **Retune the DF Blending part of BlendVar scheme**

- **Focus on Radar data assimilation**

DAWD + DAsKIT, Bucharest 2018

End

Thank you for your attention !

DAWD + DAsKIT, Bucharest 2018