

Data assimilation activities with focus on GNSS data

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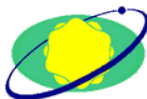
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Introduction

Overview of data assimilation activities in 2018:

- Technical implementation of AROME/SHMU cycling.
- A posteriori validation of GNSS whitelist stations based on long term first guess and analysis departures.
- Validation of ALADIN – LAEF 5km 3DVar data assimilation.
- GNSS **slant** total delays tomography.

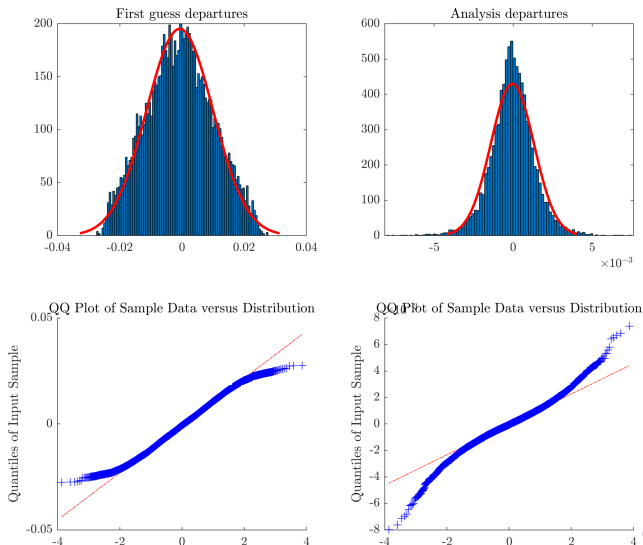
Technical implementation of AROME/SHMU cycling

Update from last year:

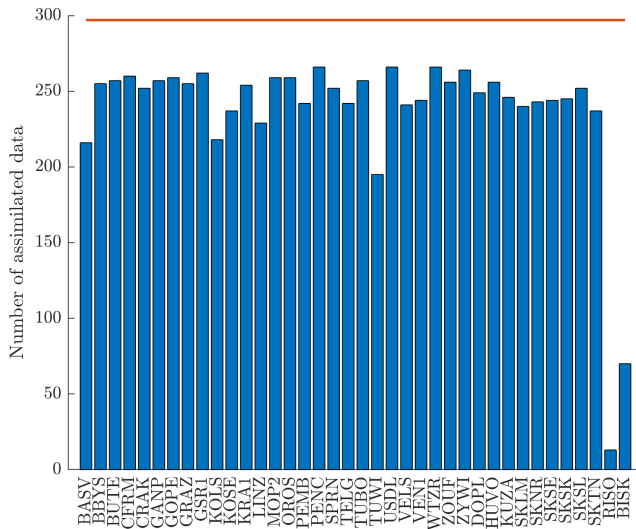
- Data types included to upper air assimilation: SYNOP, TEMP, AMDAR, HRWIND.
- 6 hour cycling step.
- Extraction of first guess and analysis departures after minimisation.

A posteriori validation of GNSS whitelist

Validation based on first guess departures from 27.06.2018 00UTC to 11.09.2018 00UTC.



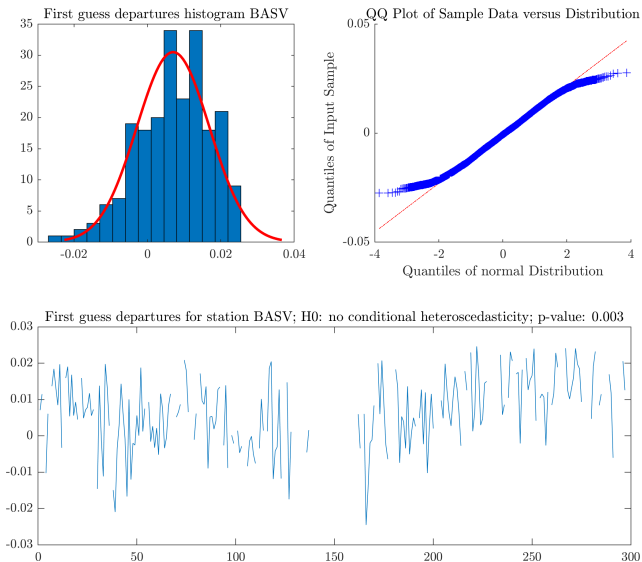
A posteriori validation of GNSS whitelist



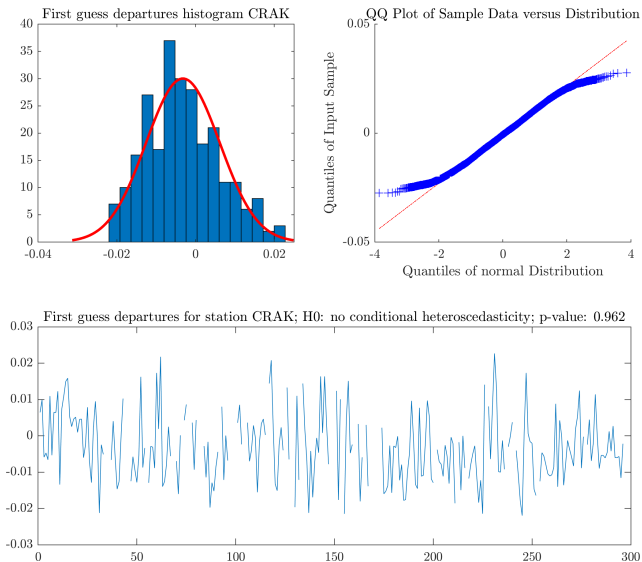
A posteriori validation of GNSS whitelist

- 6 whitelisted station were excluded.
- Jarque-Bera test (H_0 : residuals have normal distribution).
- Engle's ARCH Test for heteroscedasticity (H_0 : no conditional heteroscedasticity)

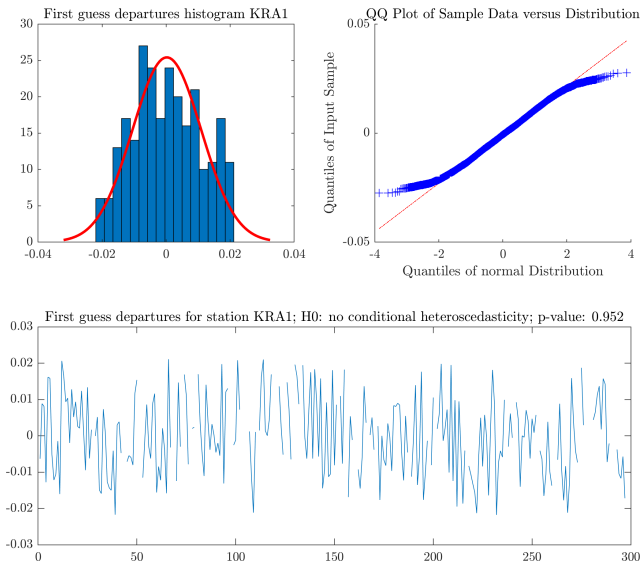
A posteriori validation of GNSS whitelist



A posteriori validation of GNSS whitelist



A posteriori validation of GNSS whitelist



Validation of ALADIN – LAEF 3DVar assimilation

- RCLACE stay at ZAMG 08/2018.
- Phase II.
- 16 ensemble members, 12 hour cycling.
- Cycle 40t1 with 4.8 km horizontal resolution and 60 vertical model levels.
- $\lambda = (351.80^\circ, 67.06^\circ)$, $\phi = (25.76^\circ, 52.85^\circ)$.
- ALARO – 1 physic.
- SYNOP, TEMP, AMDAR, GEOWIND and GNSS data were assimilated.
- Period from 16.05.2016 00 UTC to 31.05.2016 12 UTC.

Validation of ALADIN – LAEF 3DVar assimilation

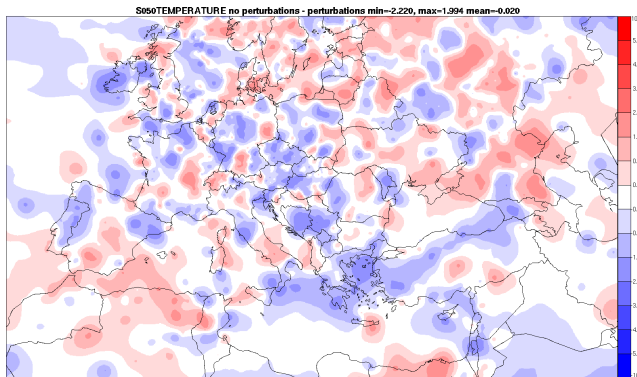


Figure: LAEF domain and impact of perturbation of all assimilated data in 3DVar upper air to temperature at 50th model level.

Validation of ALADIN – LAEF 3DVar assimilation

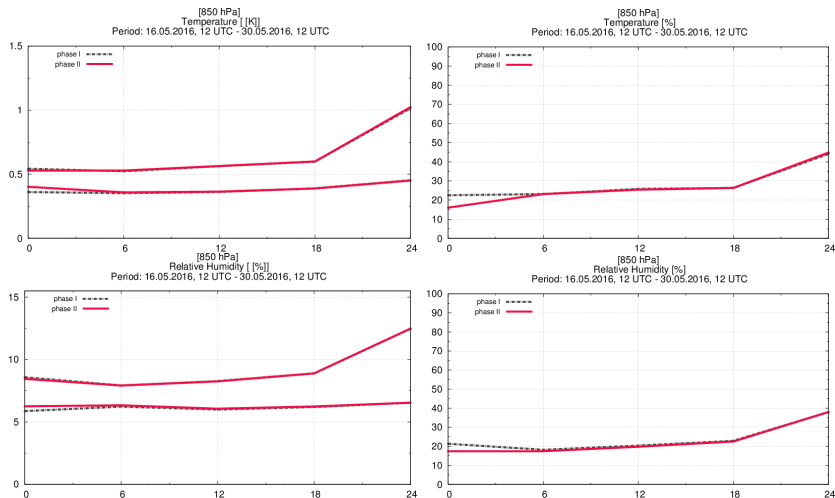
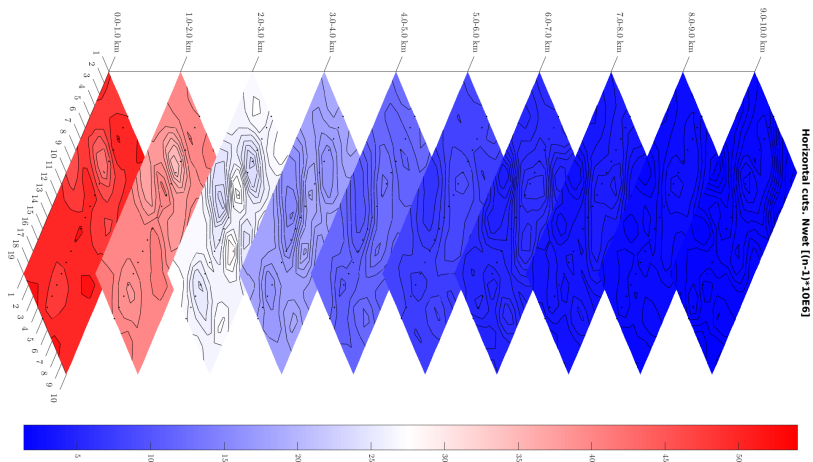


Figure: RMSE (upper line) and spread (bottom line) on left and outliers on right. Phase I – without 3DVar gray line; Phase II – with 3DVar red line.

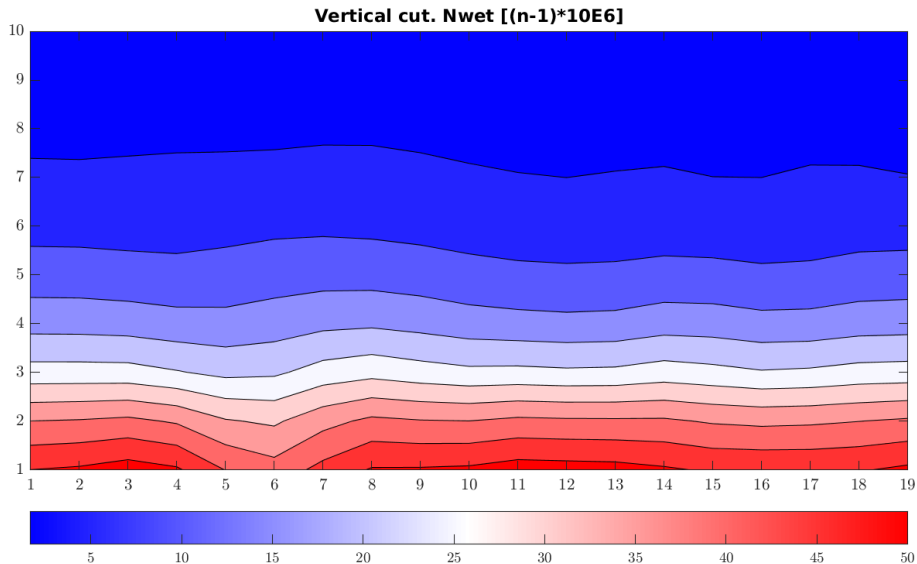
GNSS tomography

- Slant total delays are computed from North and East gradients of ZTD derived from Slovak NRT GNSS solution at SUT.
- A priori wet refraction index is estimated from Global model of pressure and temperature (GPT – climate spectral model).
- Spatial resolution is 25x25 km in horizontal and 1 km in altitude (area of Slovakia).
- Multiplicative algebraic reconstruction technique MART1 is used for estimation of wet refraction index of tropospheric voxels.

GNSS tomography



GNSS tomography



Conclusions

- Some GNSS permanent station show a posteriori non normal distribution of first guess departures. Implementation of variational bias correction is considered.
- Technical implementation and correctness of 3DVar was confirmed in ALADIN – LAEF ensemble system. Impact of 3DVar assimilation in most cases is neutral, for the outliers (decreased) and spread (increased) one can say that 3DVar has positive impact.
- Slant total delays and gradients are computed and ready for use for assimilation experiments.

Thank you for your attention.