*Regional Cooperation for*
*Limited Area Modeling in Central Europe*

LACE
nwp central europe

# Overview of LACE DA activities

Benedikt Strajnar & RC LACE DA teams

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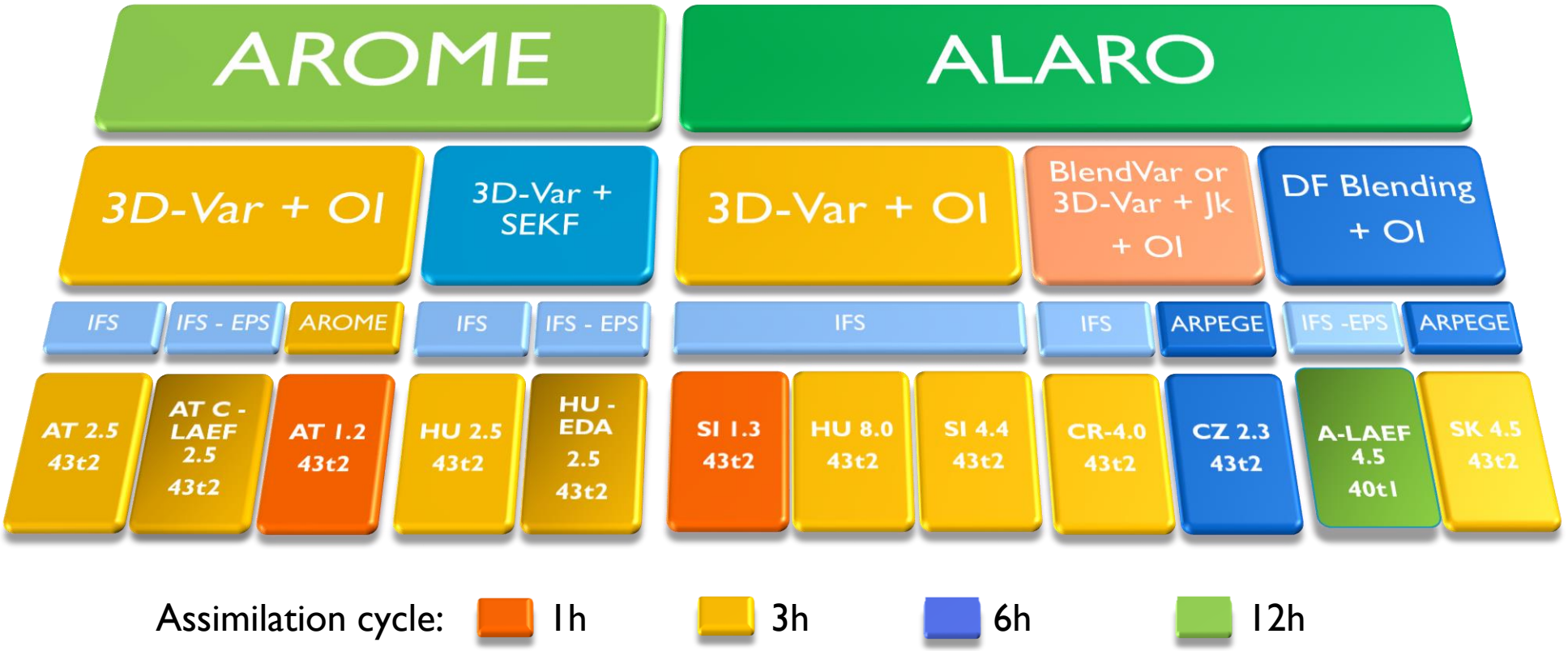
# Operational DA systems in RC LACE



# Recent activities and developments

- **Upper-air DA assimilation**
  - Radar reflectivity assimilation
  - Radial winds dealiasing (talk P. Smerkol)
  - High-resolution radiosondes
  - Assimilation of commercial microlinks
  - High-resolution radiosondes
  - Alternative GNSS from trains (talk. F. Weidle)
  - Validation of BlendVar
  - Progress with DAsKIT implementation
  - Progress on OOPS validation
- **Surface data assimilation**
  - Operational SEKF surface assimilation (talk H. Toth)
  - Offline simulation/assimilation of leaf area index
  - Tuning of soil analysis activity in OI

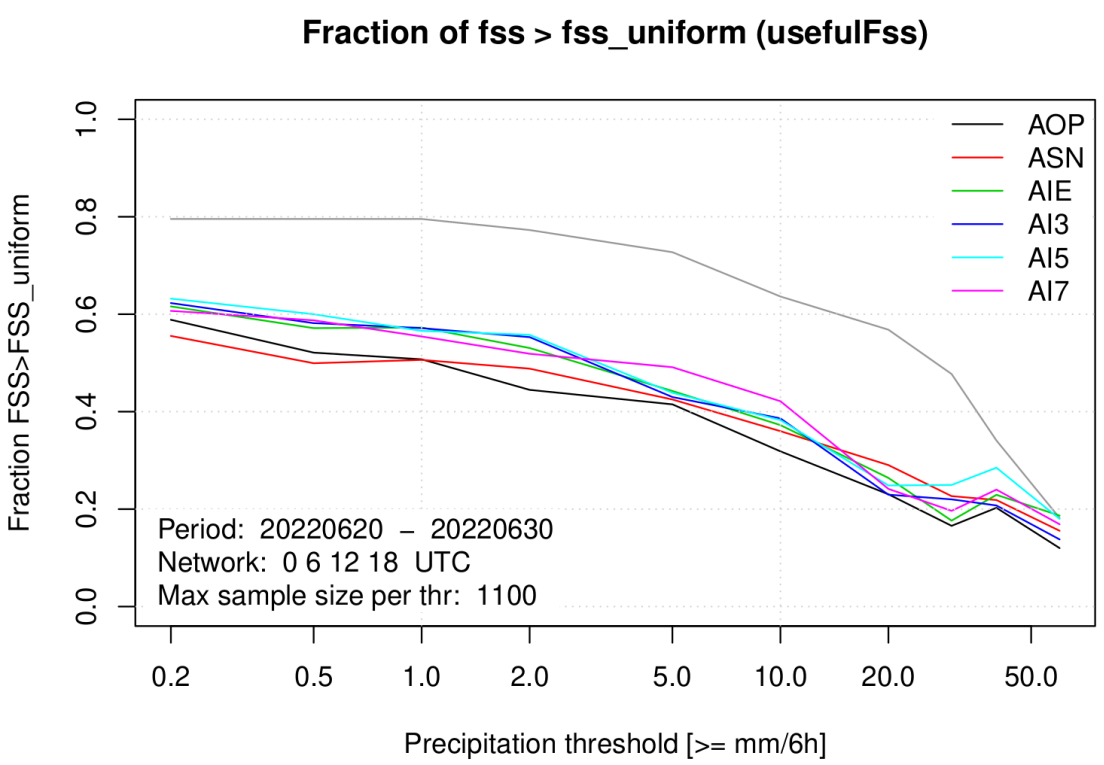
# Impact of radar reflectivity in ALARO

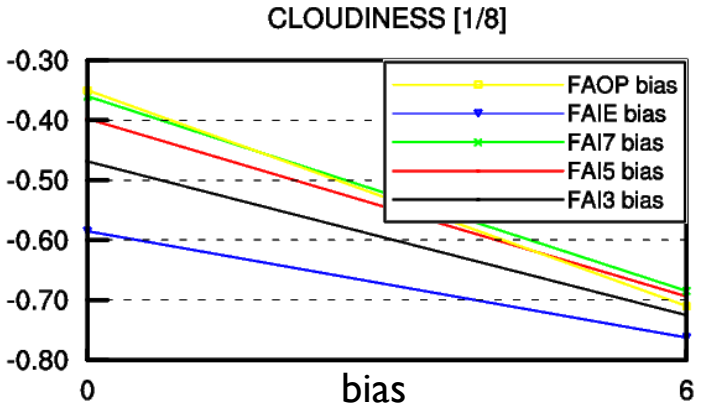
- Tuning of Bayesian inversion for ALARO-based systems and OPERA data
- Proposals to suppress drying effect:
  - Replace diagnosed radar sensitivity replaced by a climatologic estimate (expressed as MDRF + offset). Ongoing discussion with OPERA if a reliable information on sensitivity can be provided.
  - Avoid using „no rain“ observations if first guess is also non-rainy (threshold-based)
  - Increase the obs. error for dry observations (compensation for unknown obs. value)

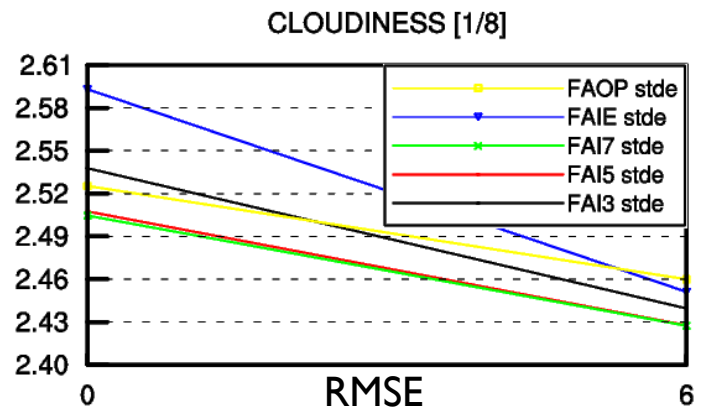
$$\sigma_o^{RH} = 0.15 + \frac{0.25 \times r}{160} + offset$$

S. Panežić, A. Trojakova, A. Bučanek, B. Strajnar

# Inflating errors for dry observations in reflectivity DA




AOP = operational reference

ASN = default setup

S. Panežić, A. Trojakova, A. Bučanek

# Impact of radar reflectivity in AROME-HU

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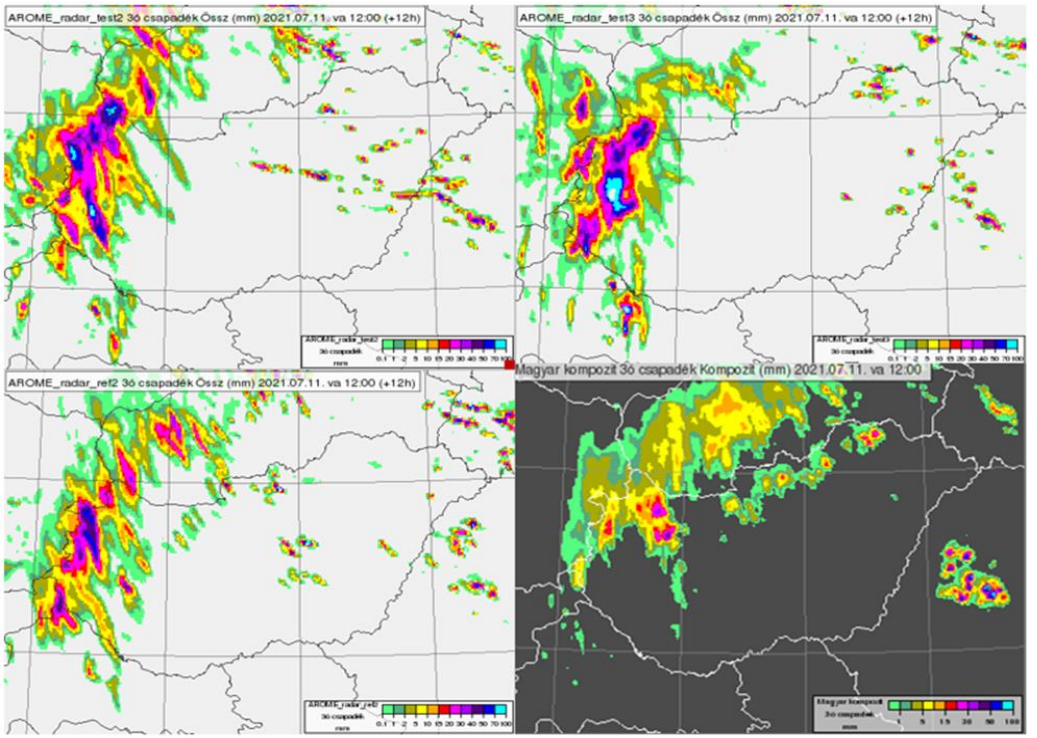
- Assimilation of OPERA radar reflectivity in AROME-HU (July 2021)
- Increased the radar data set (previously only Hungarian and Slovenian)
- Overestimation of amount and intensity od precipitation (shown by SAL and
- Confirmed by case studies

HU, SI radars

All radar sites over domain




Reference - no radar DA

Radar observations

3-h precipitation accumulation (12h forecast)

K. Szanyi



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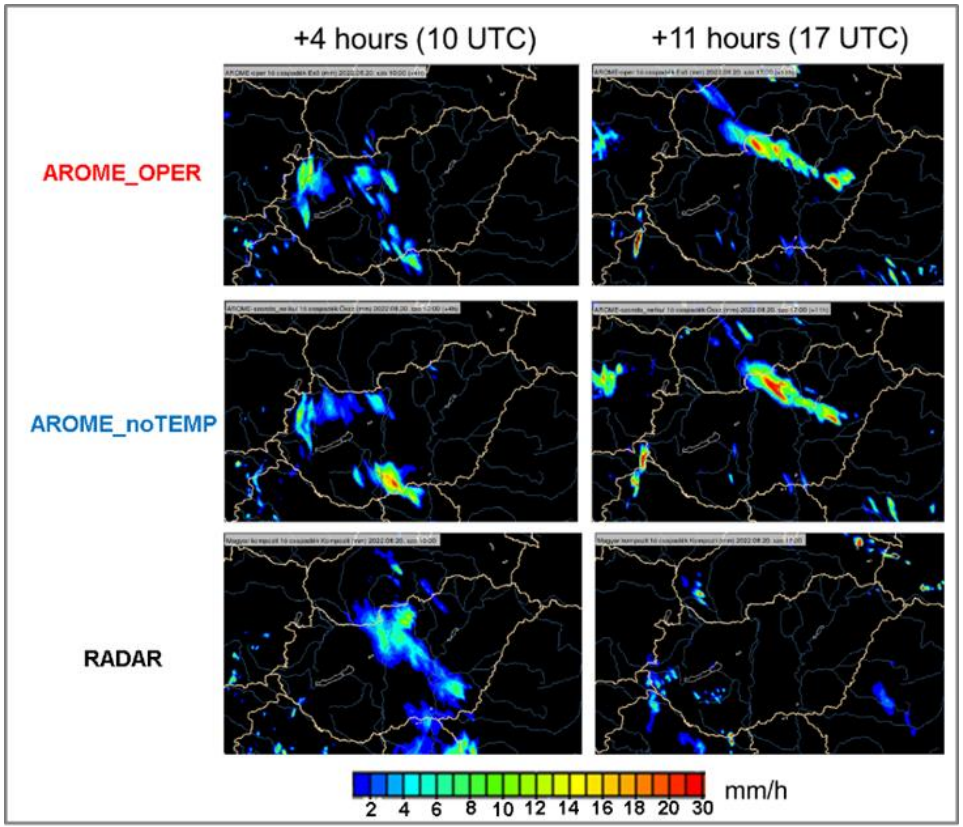
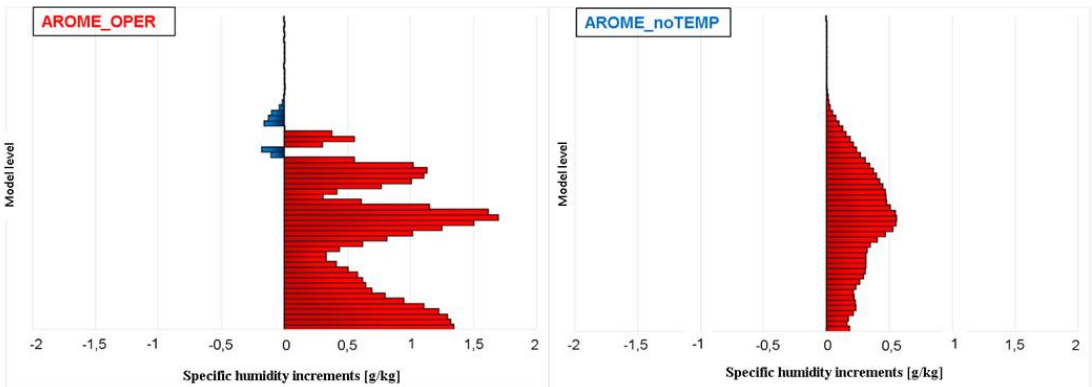
# Impact of (additional) radiosonde data

- Additional measurements in Hungary to support forecast for 20th August celebrations
- Impact of additional data evaluated in a separate experiment
- Short-range impact marginally positive (additional moisture added), but not as hoped for +11h




**Vertical structure of analysis increment over Hungary**



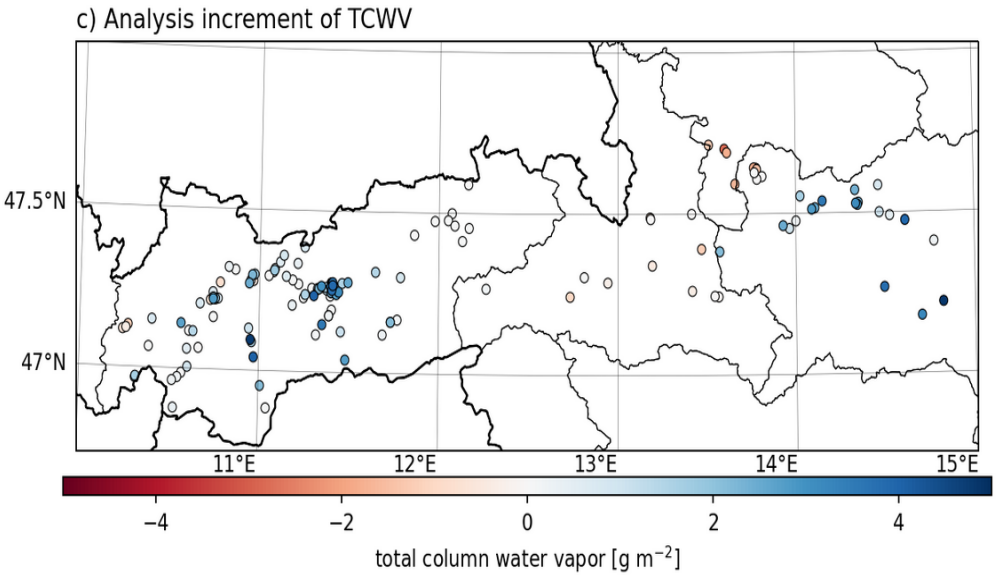

With extra 6,18 (14) UTC soundings  Without extra data

A. Varkonyi, D. Lanch

# Use of microlinks for DA

- 1D+3D-Var method (potential demonstrated in AROME for satellite and ANTILOPE rain estimates)
- Quantitative rain rates now provided to GeoSphere Austria (also 80 GHz links)
- First guess profiles extracted at observation points as input to 1D-VAR code by P. Lopez to obtain temperature and humidity profile (pseudo-obs)
- The humidity injection is spread over a thicker layer - less extreme increments in the lower troposphere
- Observations can now also decrease humidity

**Total column water vapour analysis increments at observation locations (centres of microlinks)**




P. Scheffknecht

# Validation of BlendVar for operational DA

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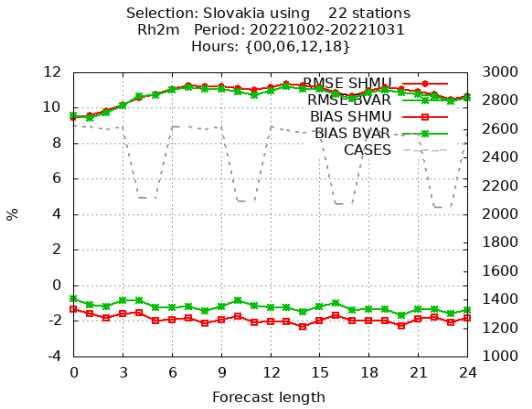
**SHMU**: **e-suite BlendVar (4.5 km)**

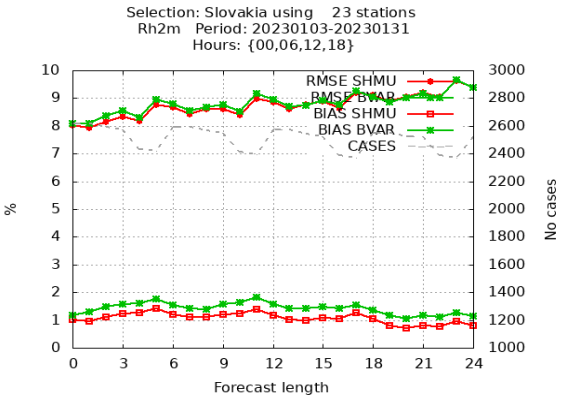
- General improvement wrt. operational blending
- Screen-level degradation in winter
- Issues with dew point temperature around 300 hPa

**BlendVar or VarBlend?**

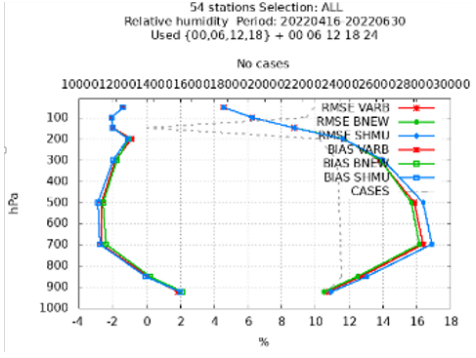
- No significant differences in terms of spinup
- Scores: BlendVar slightly better than VarBlend




October 2022: BVAR better than SHMU OPER




January 2023: OPER outperforms BVAR




M. Derkova, M. Imrišek



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# Progress with DA at Meteo-Romania (DAsKIT)

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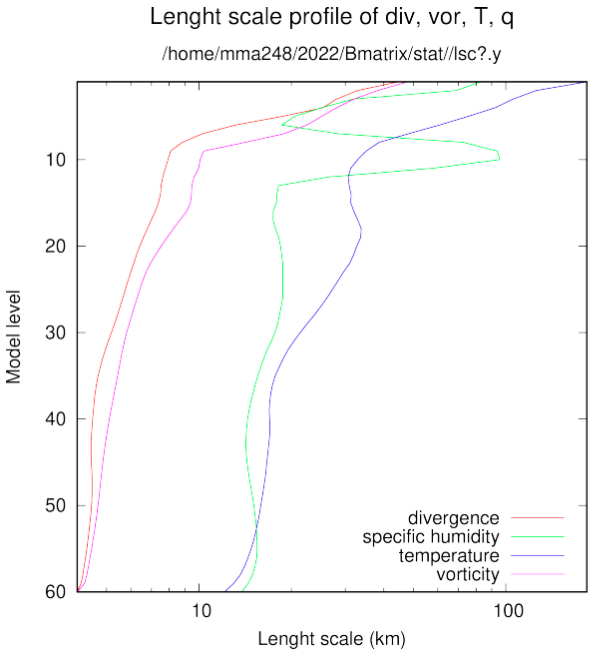
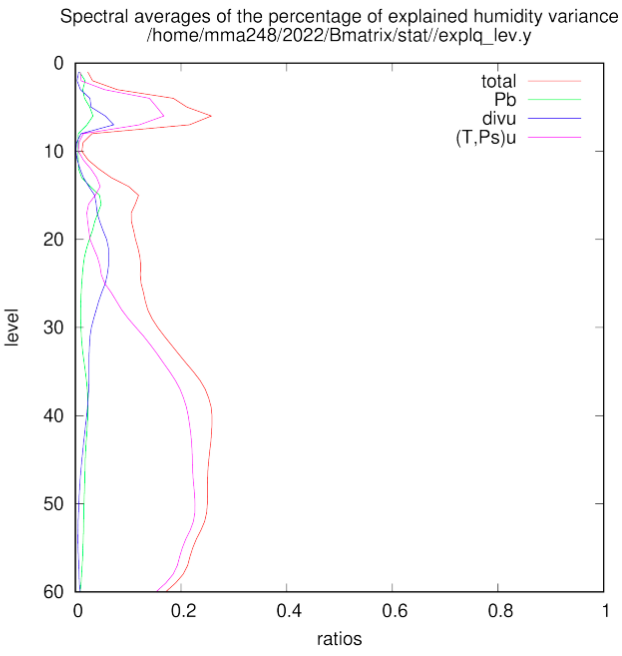
- Downscaled AEARP ensemble B-matrix for 4 km resolution (stay in Prague) - 30 days in different seasons
- Evaluation of diagnostic tools (length scales, multivariate balance)
- 10-day test period with conventional observations (SYNOP, TEMP, AMDAR)
- Tuning ob B by covariances of residuals (final REDNMC = 0.7)



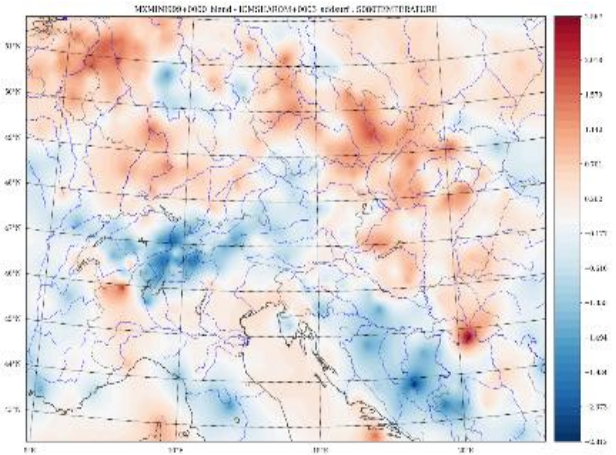




Length scales and % of explained variance of q background errors for ALARO-RO

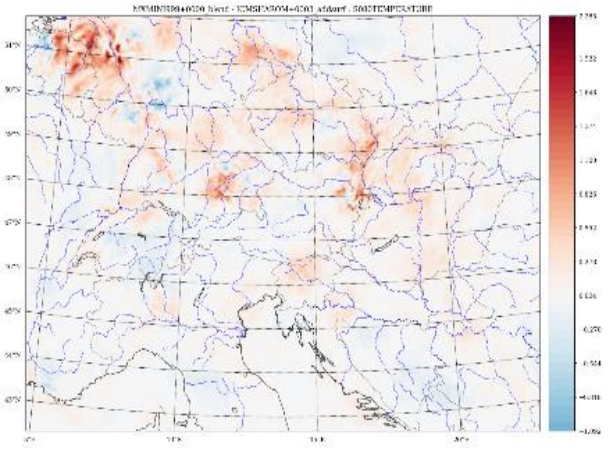
A. Dumitru, A. Trojakova

# Activities with OOPS DA configurations

- Initial scripts for 3D-EnVar (+ hybrid) in cy46t1, grid point ensemble information through ePyGram
- Screening configuration tested in Cy48t3 on ECMWF/Atos
- Case studies with a larger C-LAEF ensemble (ERA5 as LBC) and valid-time-shifting



3D-Var



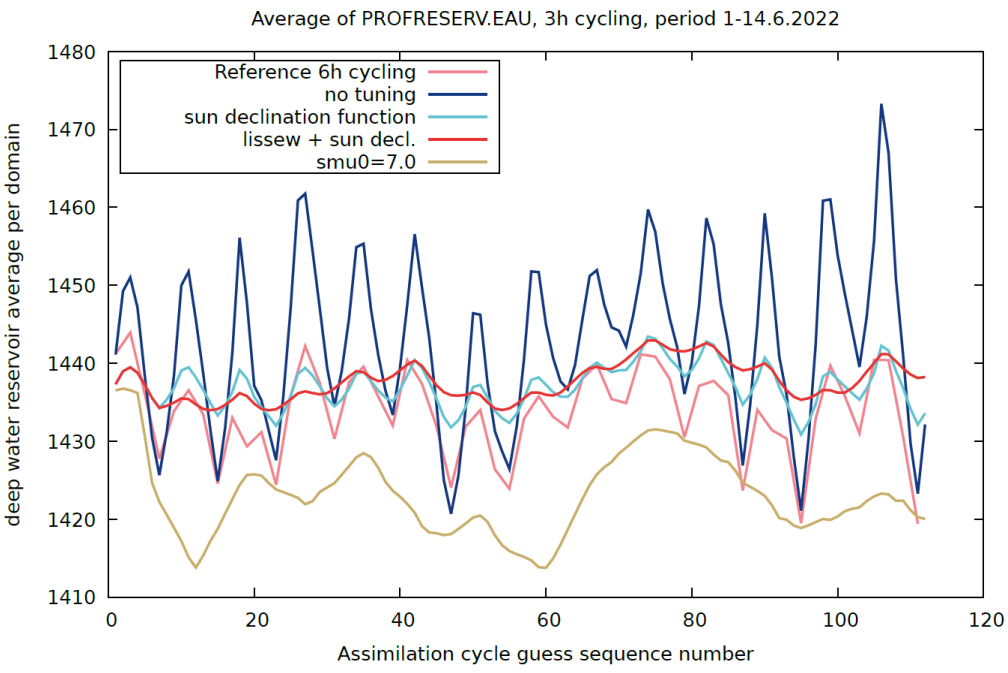
3D-EnVar

F. Meier, B.Strajnar

# Soil analysis oscillations in OI

- Deep soil water analysis activity in OI, feedback to screen-level parameters
- Clear daily oscillations in summer with the default setting (SMU0 = 0)
- Dependence on solar zenith angle (SMU0 = 7) - analysis inactive over night and in winter (cold T2m bias) and very active in summer daytime (warm T2 bias)
- Dependence on sun declination - modulates the daily cycle
- The amplitude of daily cycle of deep soil water reservoir not diminished sufficiently in summer => “LISSEW” option
- Averaging 8 analysis increments (3-hourly) => decreased jumpiness in forecast

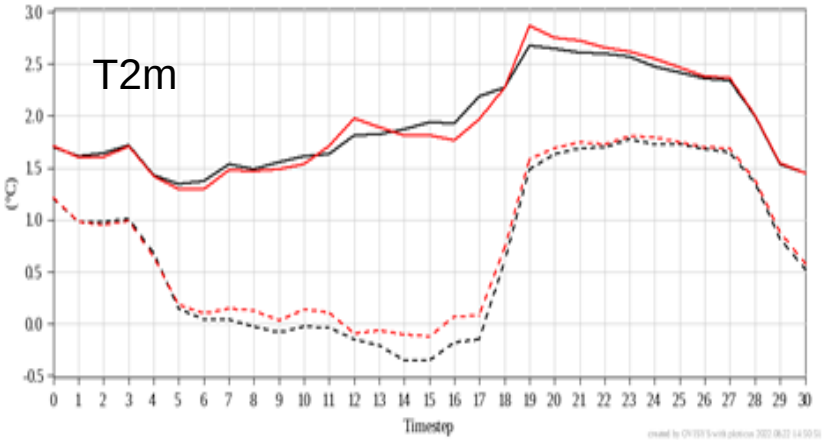
**Domain average of deep soil water reservoir in ALARO-CZ**



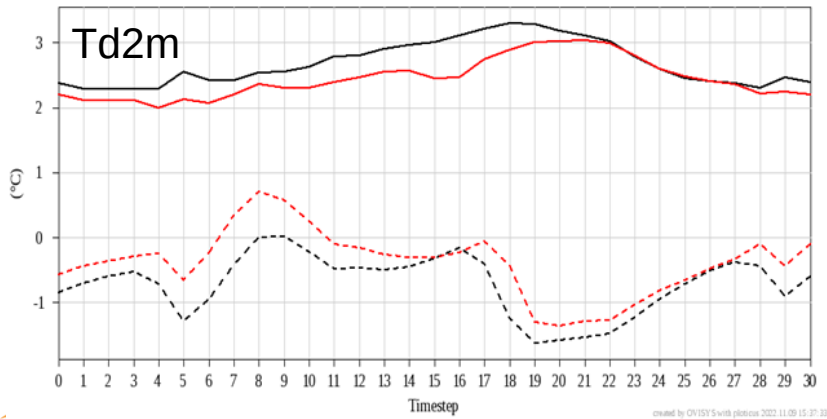

A. Bučánek, R. Brožková

# Offline assimilation of Leaf Area Index

- Daily updated LAI in AROME-HU (Sentinel-3 Copernicus GLS product), offline SEKF assimilation
- Investigation period: negative LAI anomalies in Hungary
- Neutral impact overall, significant differences only near the „event peak“ in Eastern Hungary.
- Slight improvement of T2m during daytime, deterioration during night
- Improvements of Td2m over the whole forecast range
- Results to be further analyzed prior to possible operational implementation




AROME ref, AROME prognostic LAI




B. Szintai

# Summary

- Radar data assimilation:
  - Radial wind - impact studies needed
  - Reflectivity – fine-tuning of Bayesian inversion and decision on final setup
- Feasibility studies with several non-conventional observation types
- Algorithms:
  - BlendVar (diagnostics, shorter assim. cycle)
  - RUC (observational upgrades, diagnostics)
- OOPS DA system (familiarization, early tests with EnVar)
- Surface assimilation:
  - SEKF applied for online and offline assimilation (LAI,…)
  - Diagnosis and refinements of OI, in context of short assim. cycles