Regional Cooperation for
Limited Area Modeling in Central Europe

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Data assimilation progress in RC LACE

Benedikt Strajnar & LACE DA teams

ZAMG DHMZ Czech Hydrometeorological Institute OMSZ IMGW METEO ROMANIA SHMU ARSO METEO Slovenia

Outline

- Operational status
- **Surface DA**
  - Performance of SEKF
  - Tuning of correlation functions in CANARI
- **Progress in upper-air DA**
  - Spin-up reduction in RUC with IAU
  - B-matrix optimizations
  - Radar reflectivity DA
  - Mode-S DA assimilation
  - Towards the enhanced use of AMVs
- Outlook

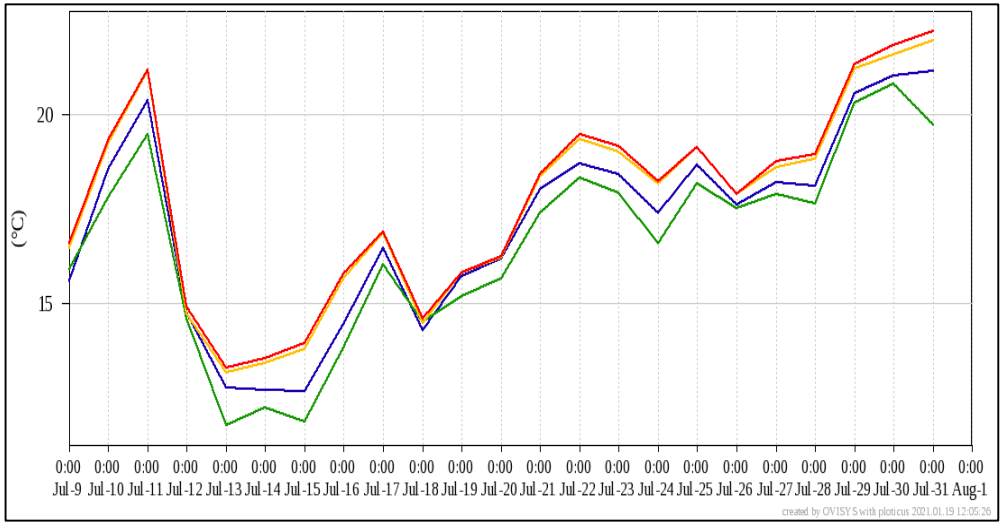
Operational status

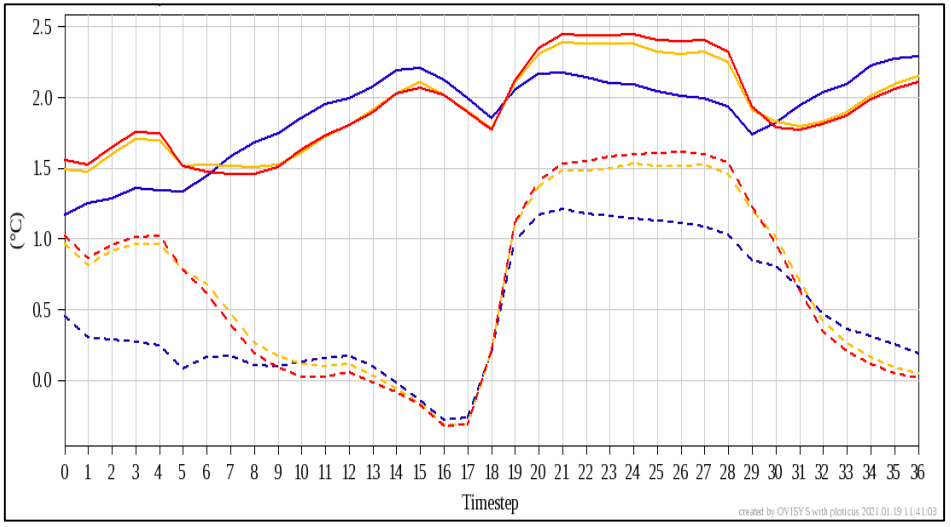
- 9 operational DA systems with AROME (1.2 to 2.5 km) or ALARO (2.3 – 8 km)
- 3D-Var/BlendVar/Blend + OI
- 2 hourly DA systems (AT, CZ)
- 2 EPS systems with DA (A-LAEF, C-LAEF)
- migration to cy43: intensive validation during 2020, operationalization in early 2021

Progress of surface DA

Towards operationalization of SEKF

- At HMS: AROME cy43t2_bf11 (2.5 km) with SURFEX 8.0+, 2 periods
- Main results:
  - reduced night-time T bias by SEKF in summer
  - small positive impact in winter





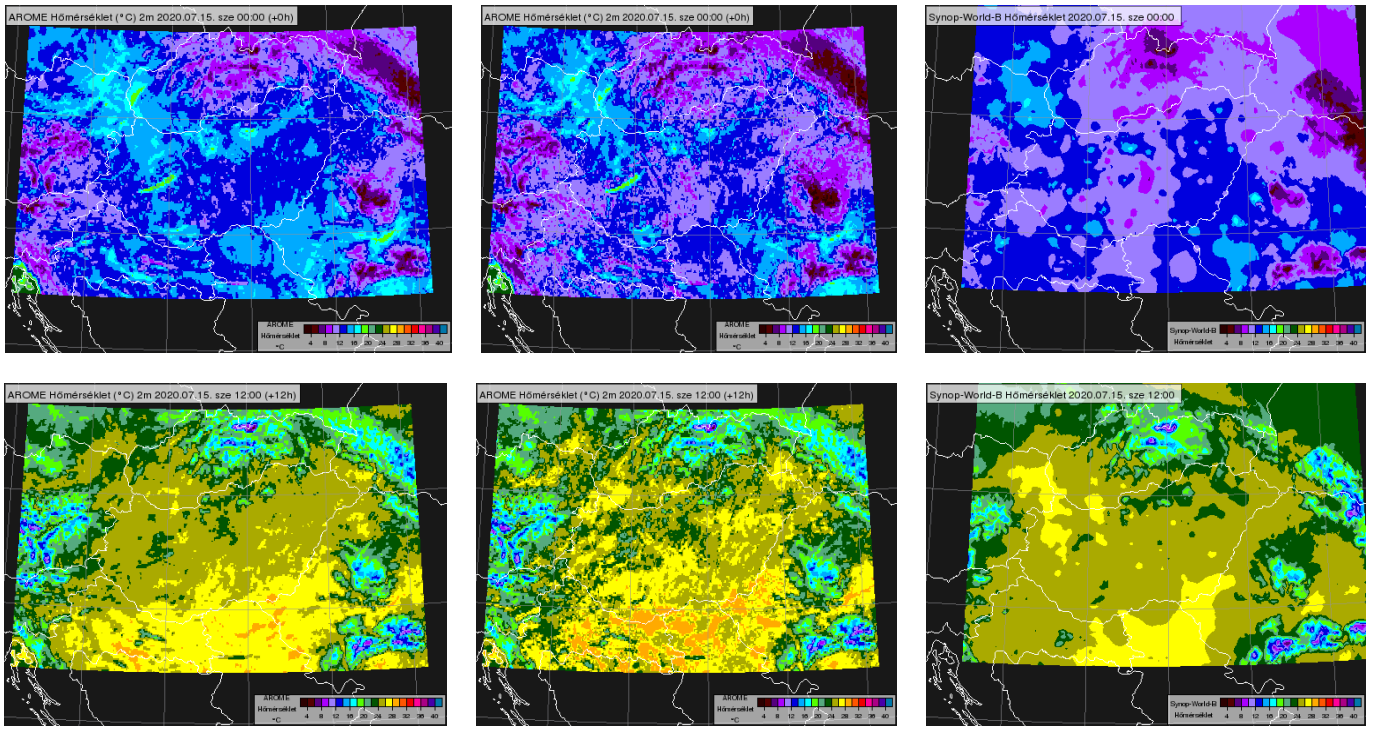
Evolution of analysis (OI_MAIN cy43, OI_MAIN cy 40, SEKF) and observation. T2m forecast.

by H. Tóth

Towards operationalization of SEKF

- Case study 15 July 2020: T 2m daily cycle

OI-MAIN | SEKF | SYNOP (REF)

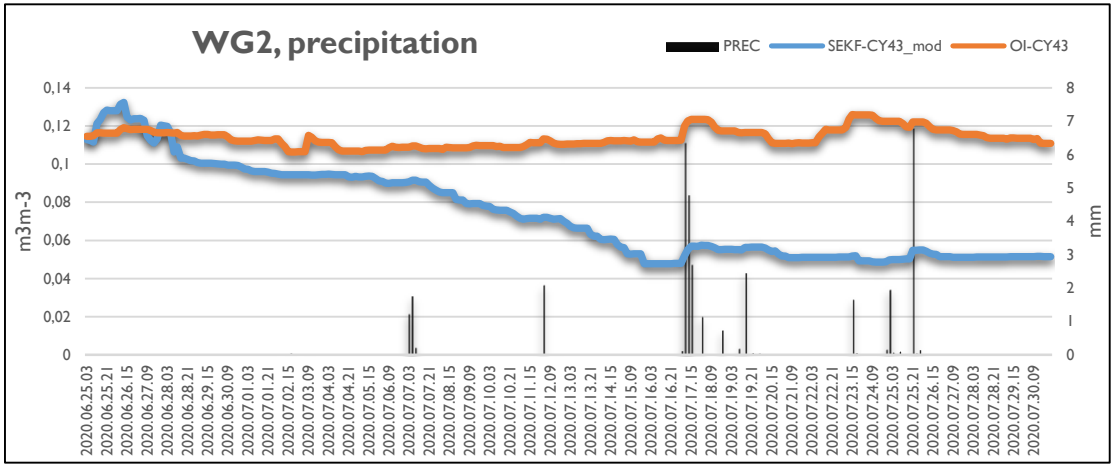


0 UTC – analysis and obs.

12 UTC:
- 12h forecast and obs.

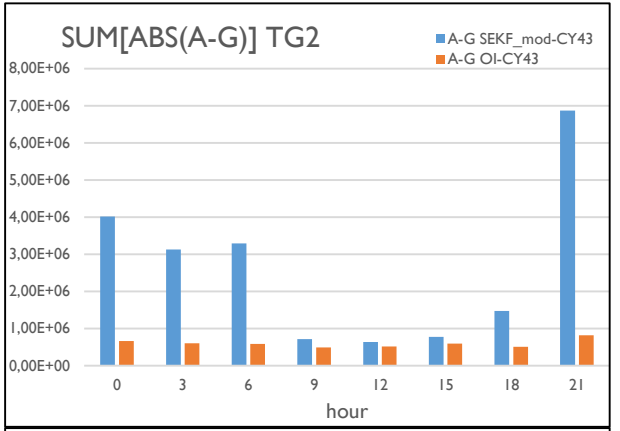
by H. Tóth

Towards operationalization of SEKF

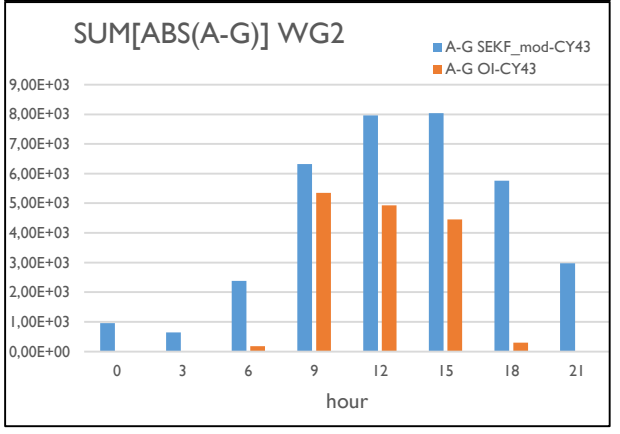


Soil water content (WG2) evolution – sandy point in southern Hungary

TG2



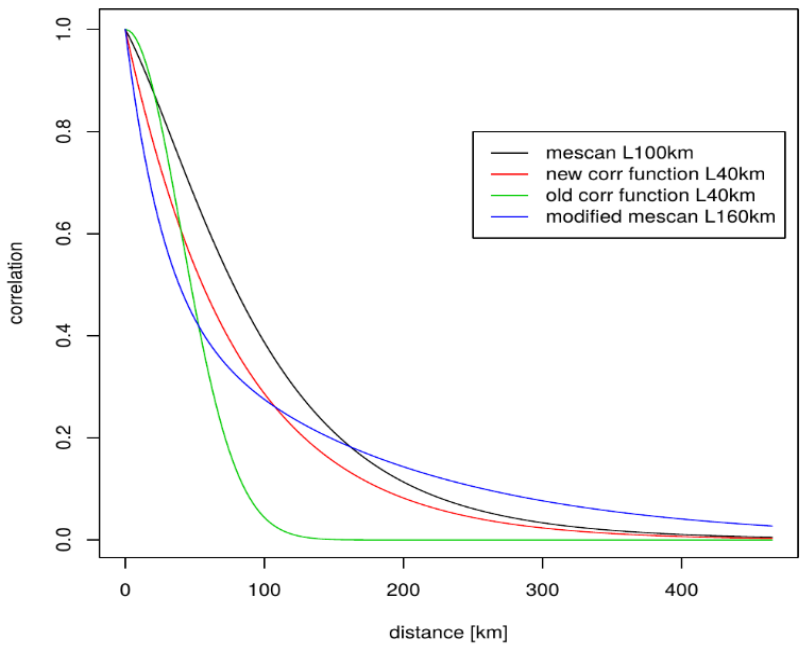
WG2

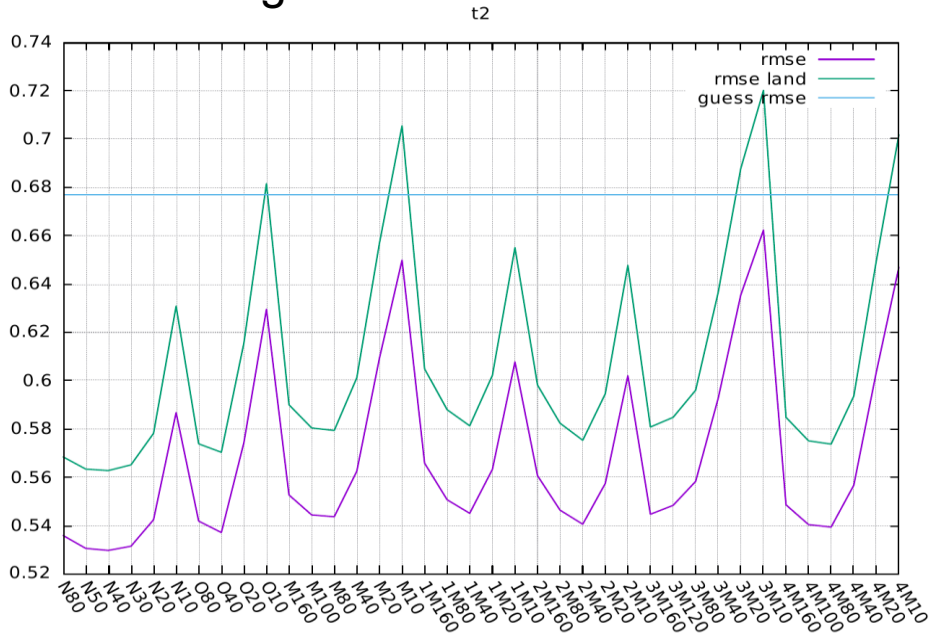


Accumulated increments by analysis time (whole period)

Tuning of correlation function in CANARI

- Czech Rep.: tuning of CANARI background correlation function for high. resolution surface observations
- Artificial test environment: tested several shapes, length scales and orography drop setting
- Best results with „new“ correlation function at 40 km length scale



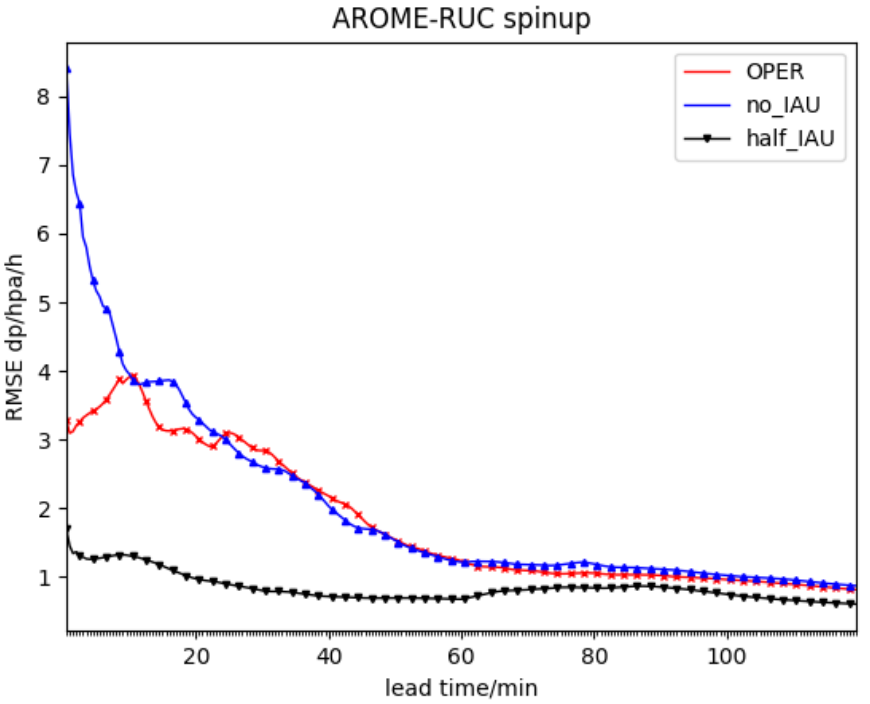


by A. Bučánek

Progress of upper-air DA

Spin-up control in hourly AROME-RUC

- IAU - a compromise between balance and accuracy
- Evaluation in the AROME-RUC:
  - [-45 - 0 min] IAU efficient in filtering, probabl inaccurate
  - Currently operational 2-step approach incl. IAU [0 - 7.5 min]
  - No IAU: more noise in the first time steps
  - Open loop (FG from AROME 2.5 km): most spin-up issues (interpolation)
- Most of the spin up gone until 60 min.



by F. Meier

Tuning of error covariances in 3D-Var

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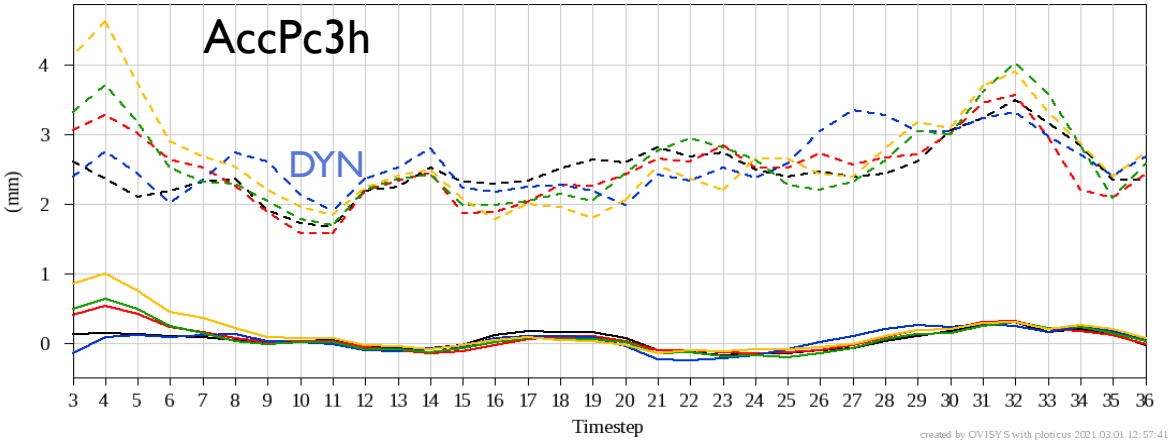
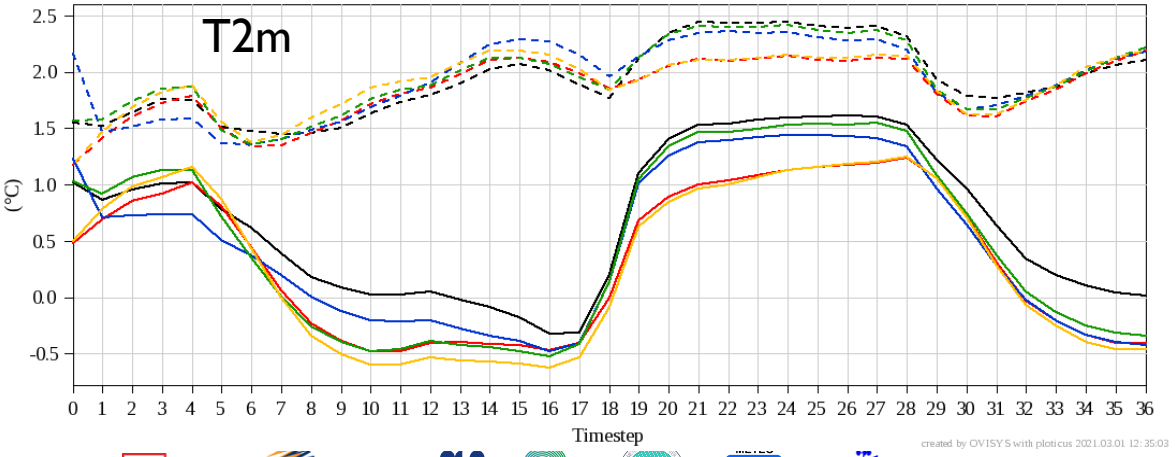
- Tuning of EDA based B for 90L (2.5 km) in Hungary
  - Desroziers‘ diagnostics
  - Sensitivity to use of Canopy scheme



Experiment	lev	CANOPY	REDNMC	SIGMAO_COEF	REDNMC_Q
REF	60	on	1.2	0.9	-
EXP1	90	off	1.26	0.71	-
EXP2	90	off	1.2	0.9	1.67
EXP3	90	on	1.2	0.9	1.67



by V. Hommonai

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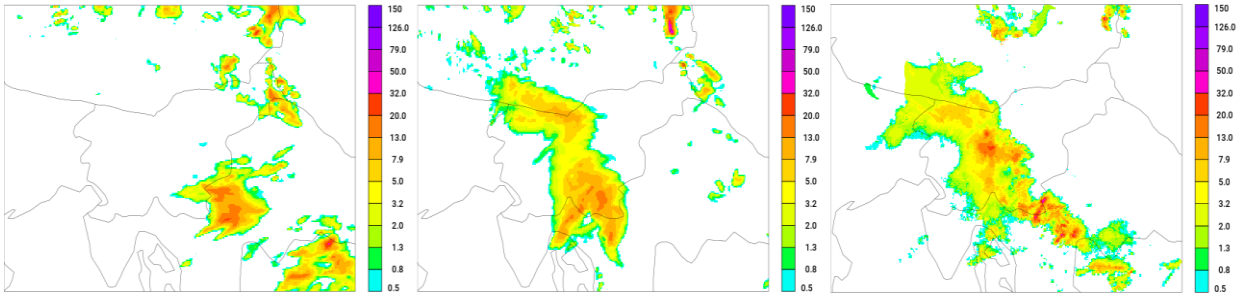
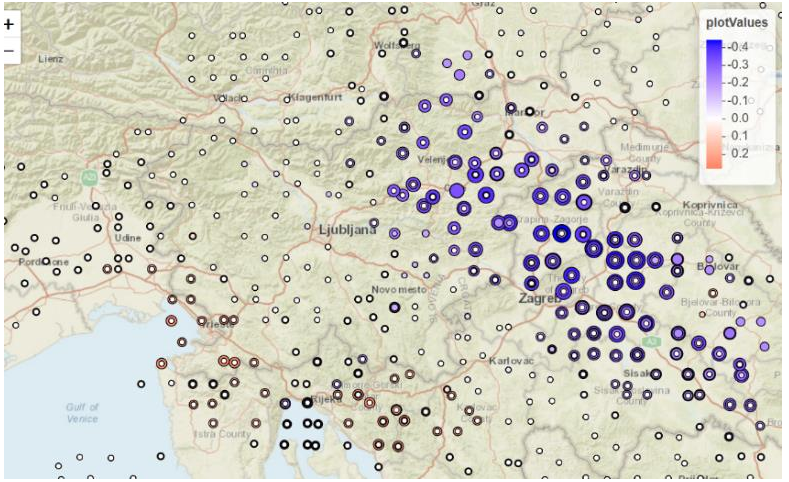
Assimilation of radar reflectivity

- Summer and winter period (15 days)
- At 4.4 km and 1.3 km res. with 25/10 km thinning
- Impact more visible at high resolution
- Successful in removal of spurious precipitation
- Adds moisture in larger systems
- Struggles with scattered/isolated convection (actively assimilates dry pixels)



guess REF guess REF+RADAR INCA analysis



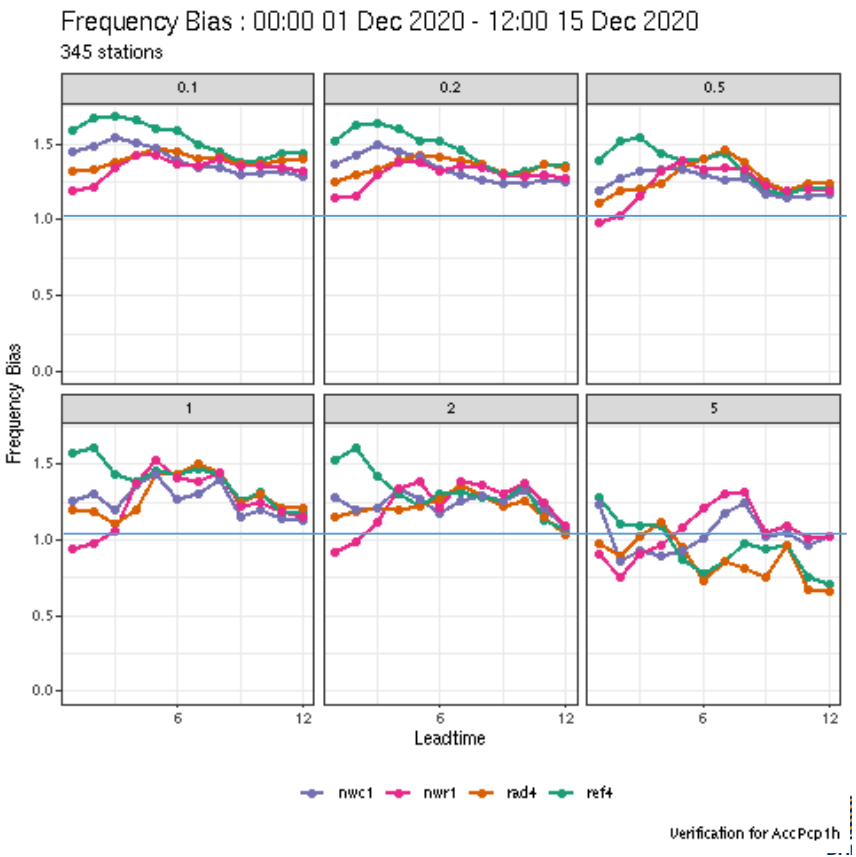
Analysis increment

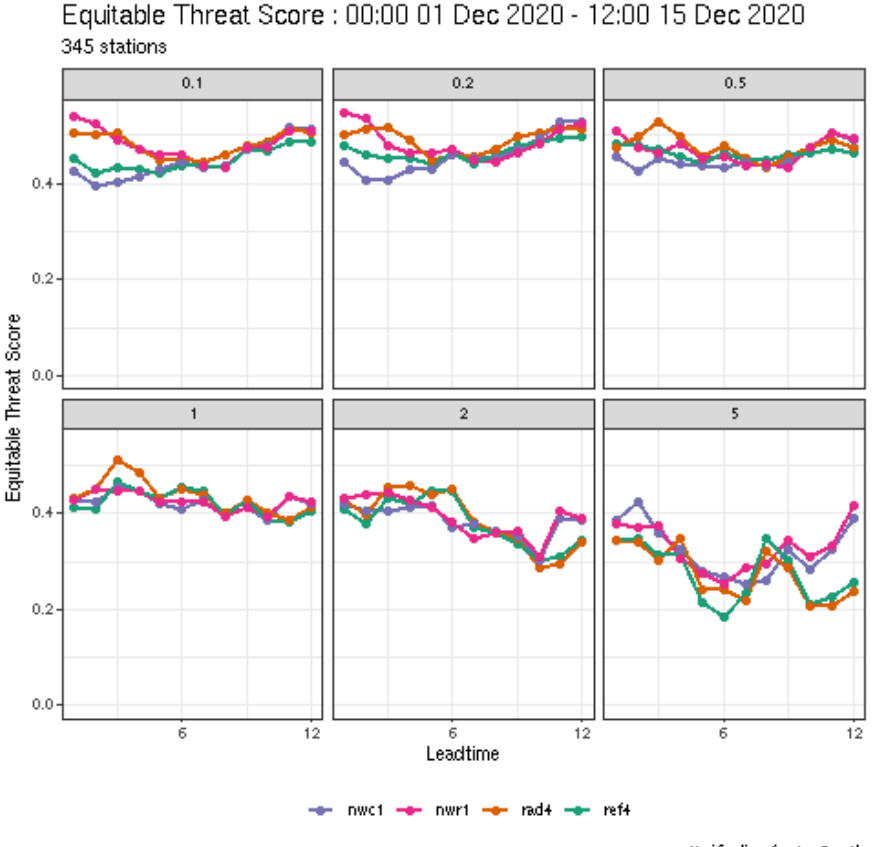
by B. Strajnar

Assimilation of radar reflectivity

- Noticeable positive impact on 1h precipitation at both resolutions (up to ~ 6h)

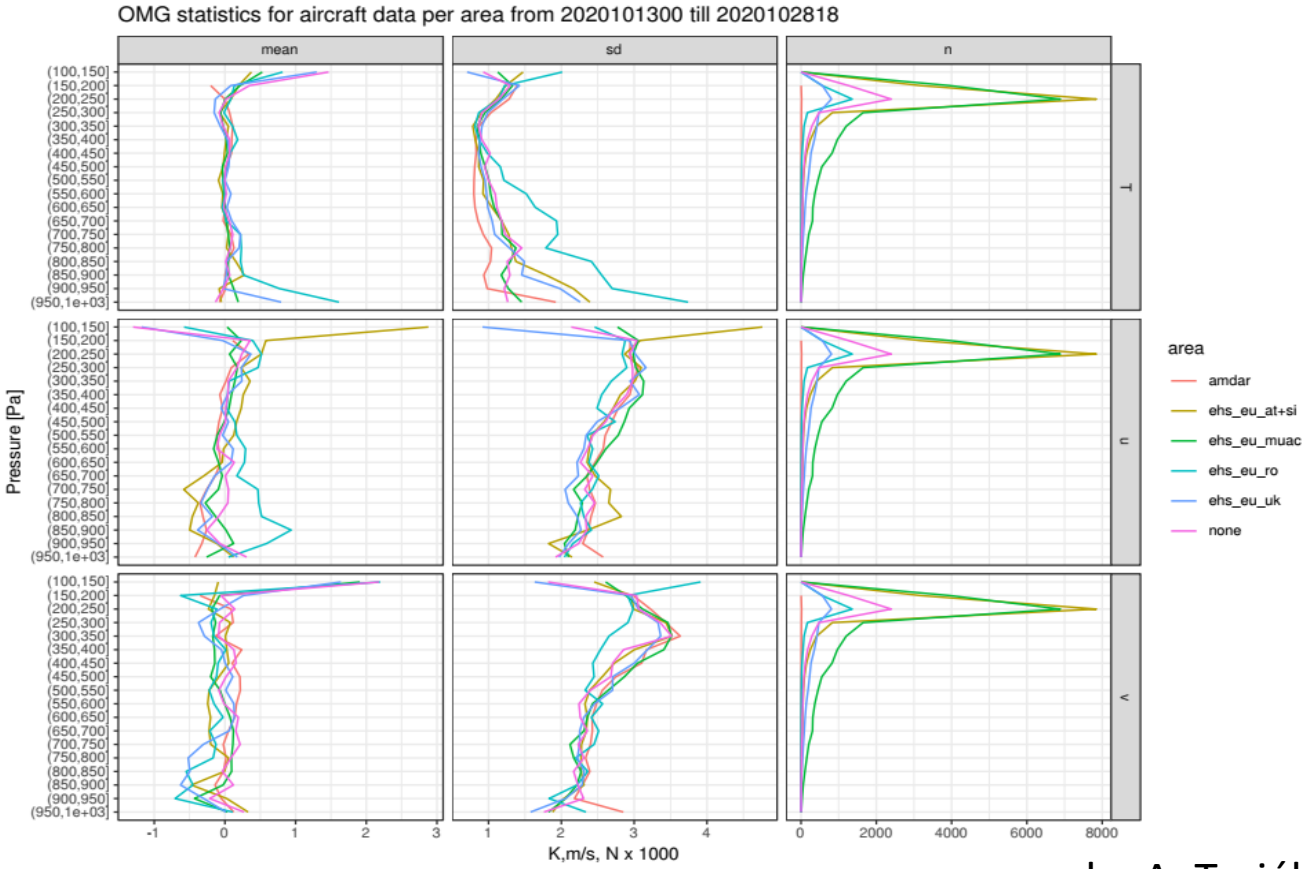
Experiments:
1.3 km
1.3 km + RFL
4.4 km
4.4 km + RFL





Mode-S EHS – quality of EMADDC data

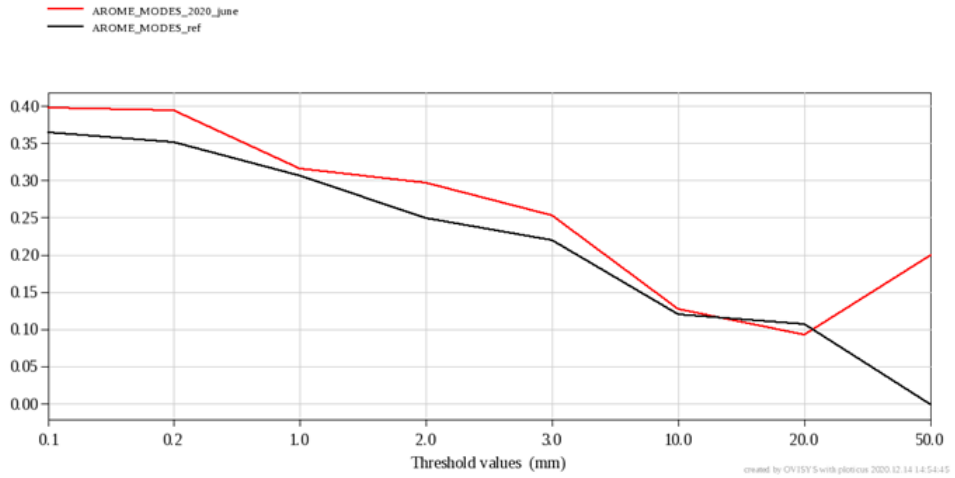
- Covid-19 impact mitigation: new releases of EMADDC EHS datasets with improved T processing
- Initial validation with quality issues, repeated validation in autumn 2020 – quality improved



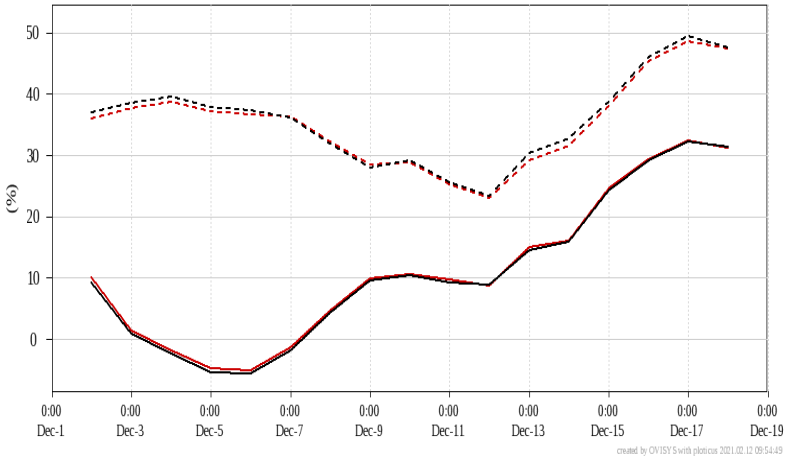
by A. Trojáková

Assimilation of Mode-S MRAR

- Evaluation of Mode-S in Hungary
- Czech MRAR: winter and summer period + cases, small positive improvements (TP) - operational
- Hungarian MRAR: tiny improvements in TP, CC, RH2m and T2m



Improved 12 h prec. ETS by using Czech MRAR data in AROME-HU.



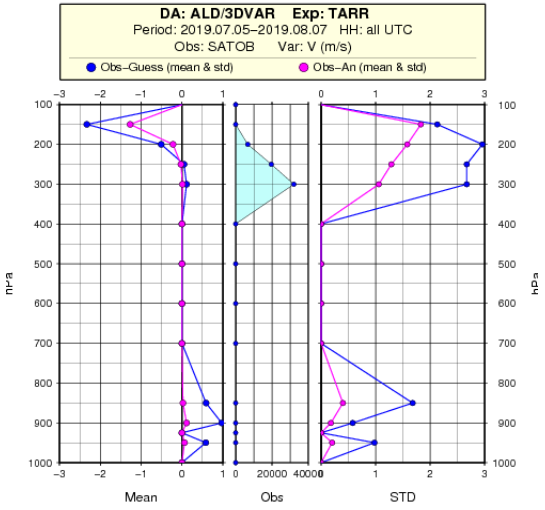
12h CC (%): reference and a run using Hungarian MRAR data.

by G. Tóth

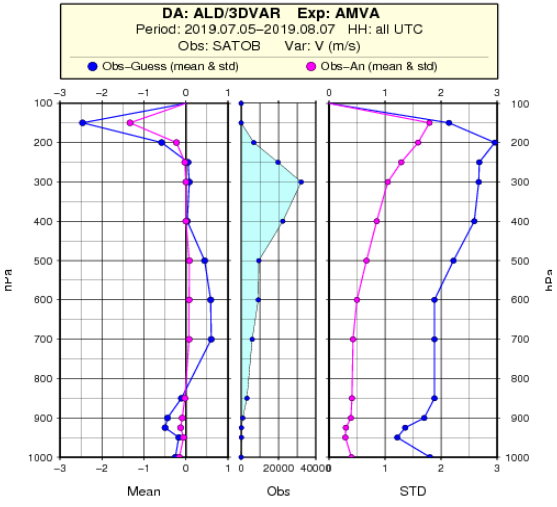
The use of AMV products

- Hungary: changed blacklisting to increase the number of active AMVs
  - EXP1: all AMVs with QI > 85%
  - EXP2: observations between 800 and 350 hPa added on top of REF (<700 hPa not used over land.

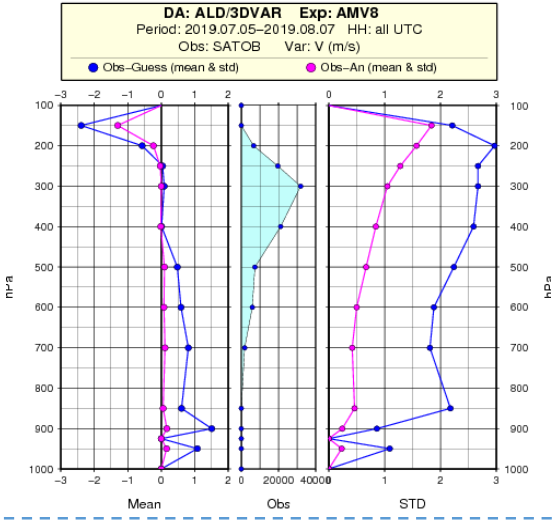
REF



EXP1



EXP2



by Z. Kocsis

Outlook

- Operational DA: final switch to cy43
- More impact studies with radar and operational application
- Use of more obs. types (e.g. GNSS data)
- Development of hourly DA systems
- Familiarization with OOPS DA codes

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Thank you for attention!

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