Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Data assimilation activities in RC LACE

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- Evolution of operational systems (RC LACE)
- Impact of Covid-19 on aircraft observations
- First operational hourly system: the AROME-RUC
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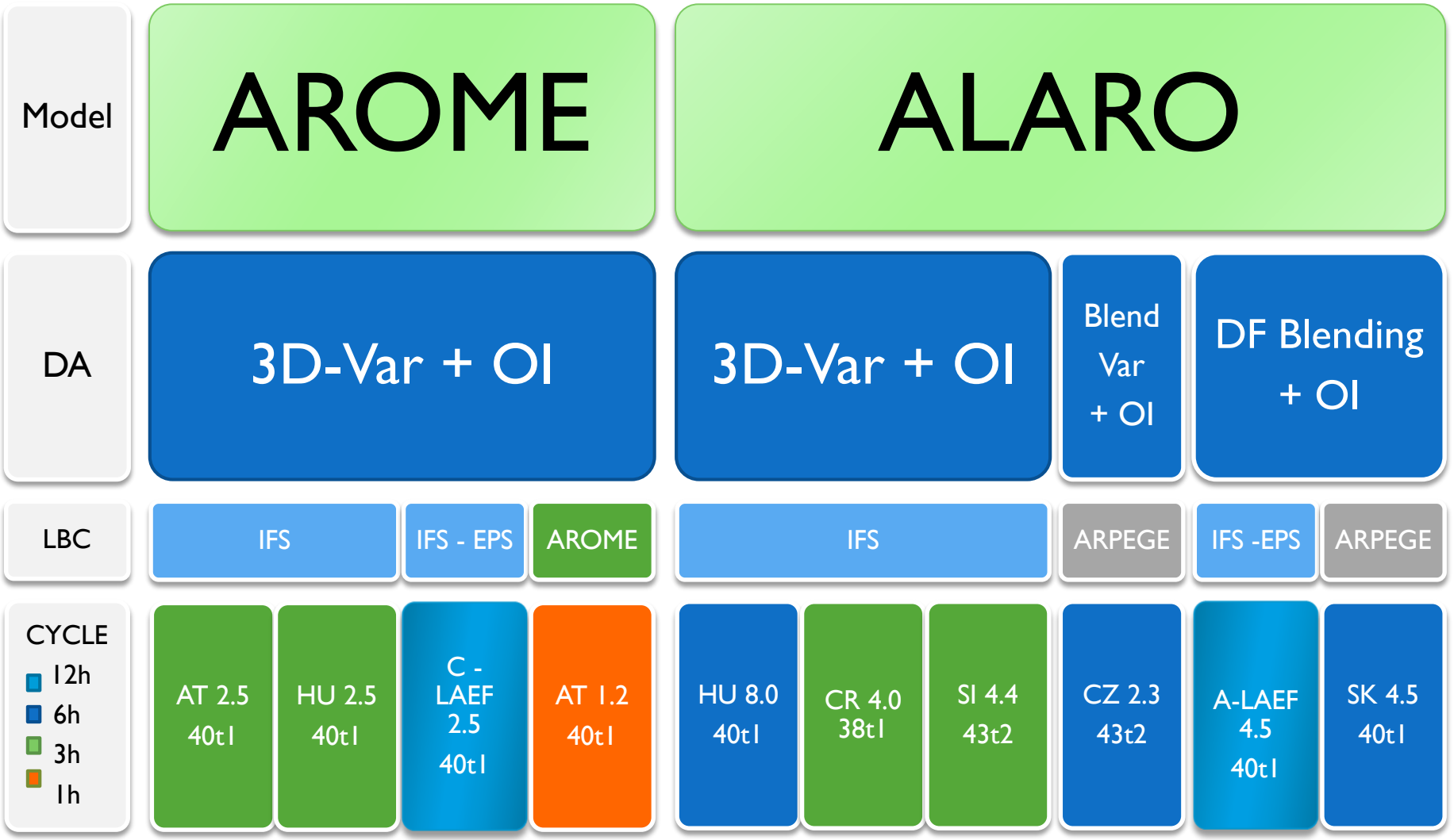
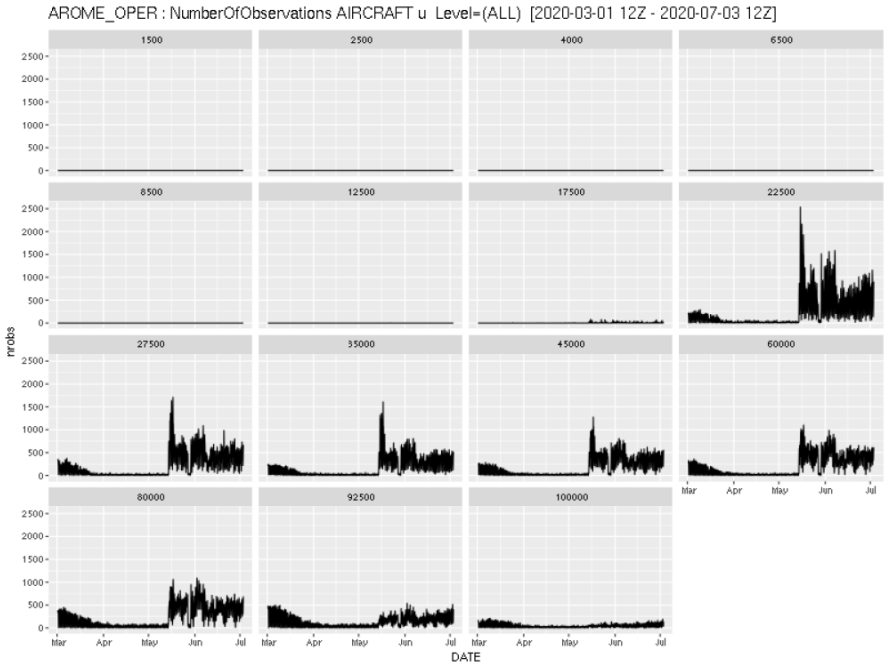
Operational DA systems in RC LACE

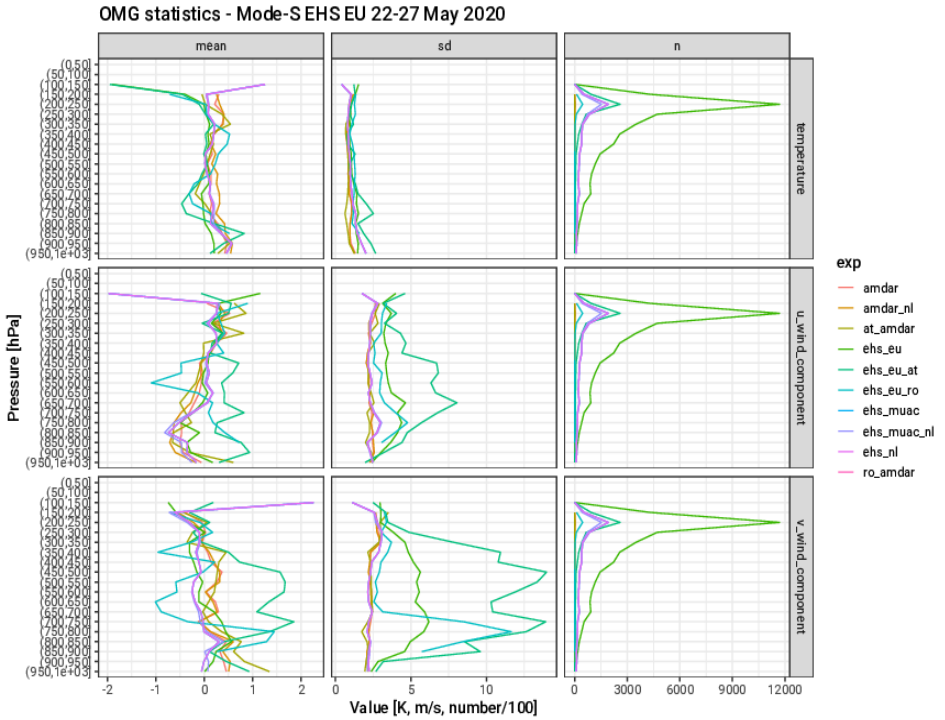


Observations

- Large variety of observations provided by OPLACE
  - Conventional (surface, aircraft, radiosondes) and satellite data (radiances, AMVs, scatterometers)
  - Local sources: additional surface data in LACE area, Mode-S
  - Mode-S sets from EMADDC
- Radar (OPERA and bilateral exchange, operational in AT)
- E-GVAP
- Operational upgrades in 2019/2020: national Synop reports, Mode-S EHS (EMADDC),ASCAT, OSCAT, wind profilers (after selection), more AMVs, more ATMS+IASI, GNSS-RO (ROMSAF)

Impact of Covid-19: EHS observations as replacement for AMDAR



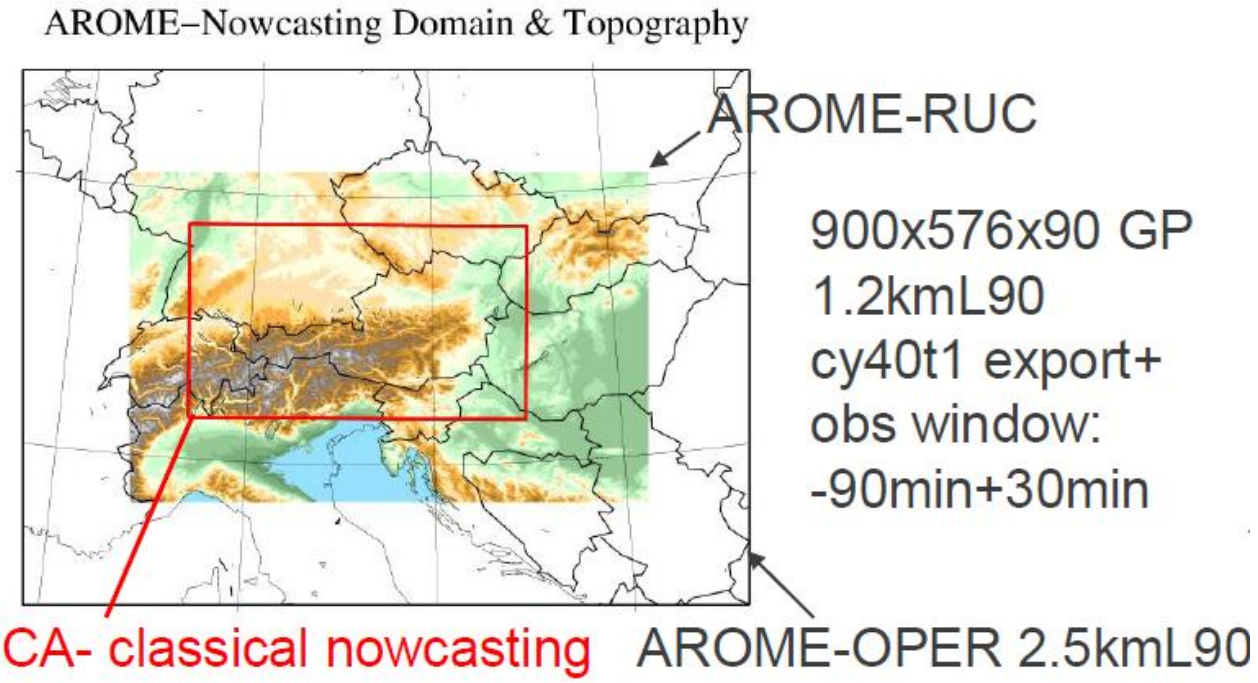


Increased use of MODE- EHS as a replacement for missing AMDAR in AROME-AT.

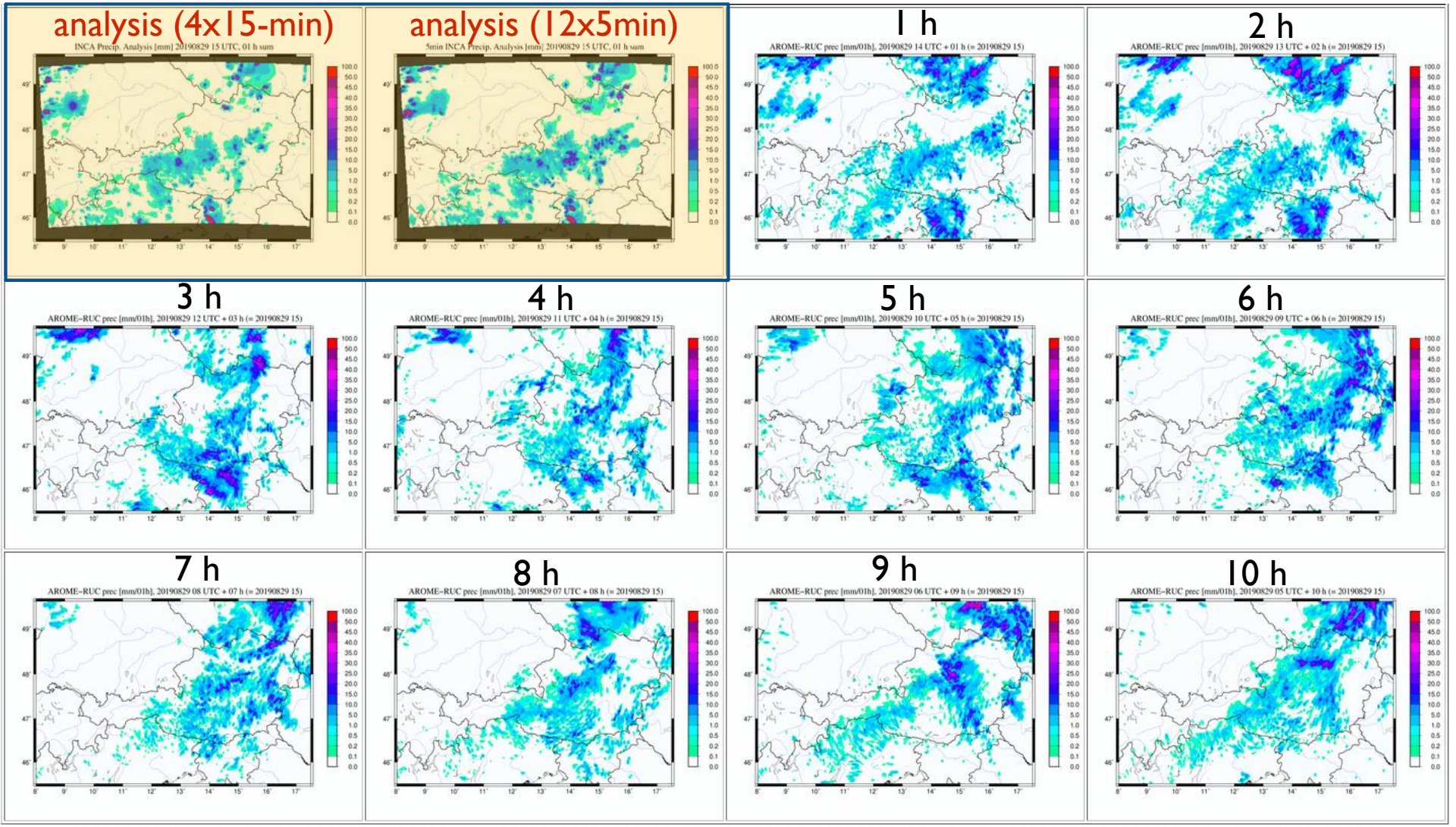
Validation of EMADDC EHS observations after release of additional test datasets. Issues with wind quality over some regions.

First operational 1h system: the AROME-RUC (ZAMG)

- Hourly-cycled system at 1.2 km, 30 min cut-off time, 120 min obs. window, high-res. observation (RADAR, Mode-S, ZTD, profilers)
- Spin-up control: hourly assim. cycle with backphased IAU [-1h to -15 min]
- Production cycle: 12-h forecast based on 1h assim/fg. trajectory plus IAU [0,+ 7.5 min], LHN (INCA RR analysis [0,+35 min]), FDDA nudging of surface station data [0,+30 min]

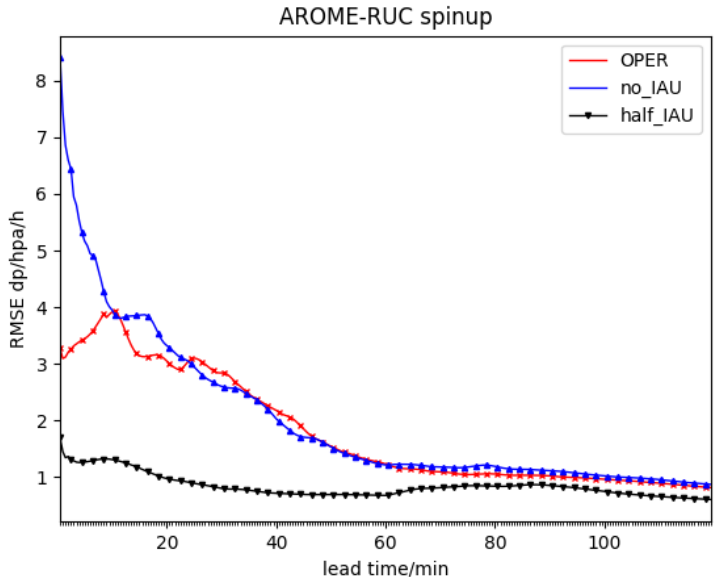


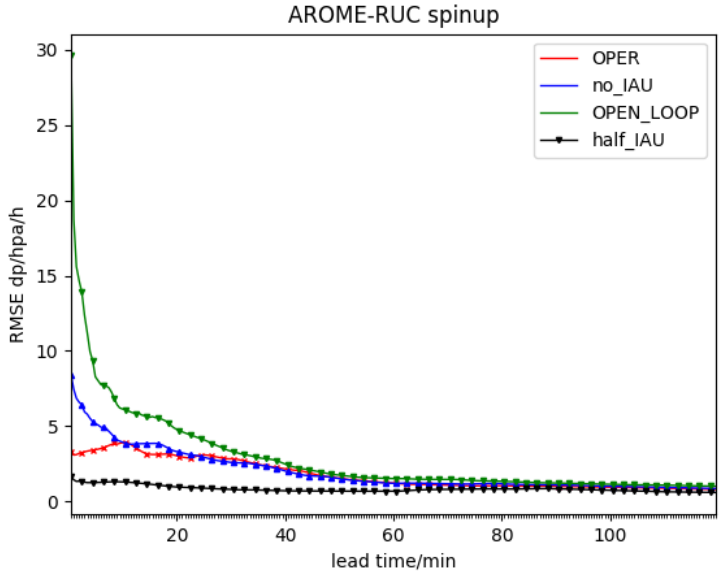
AROME-RUC precipitation nowcast



AROME-RUC – spin up control

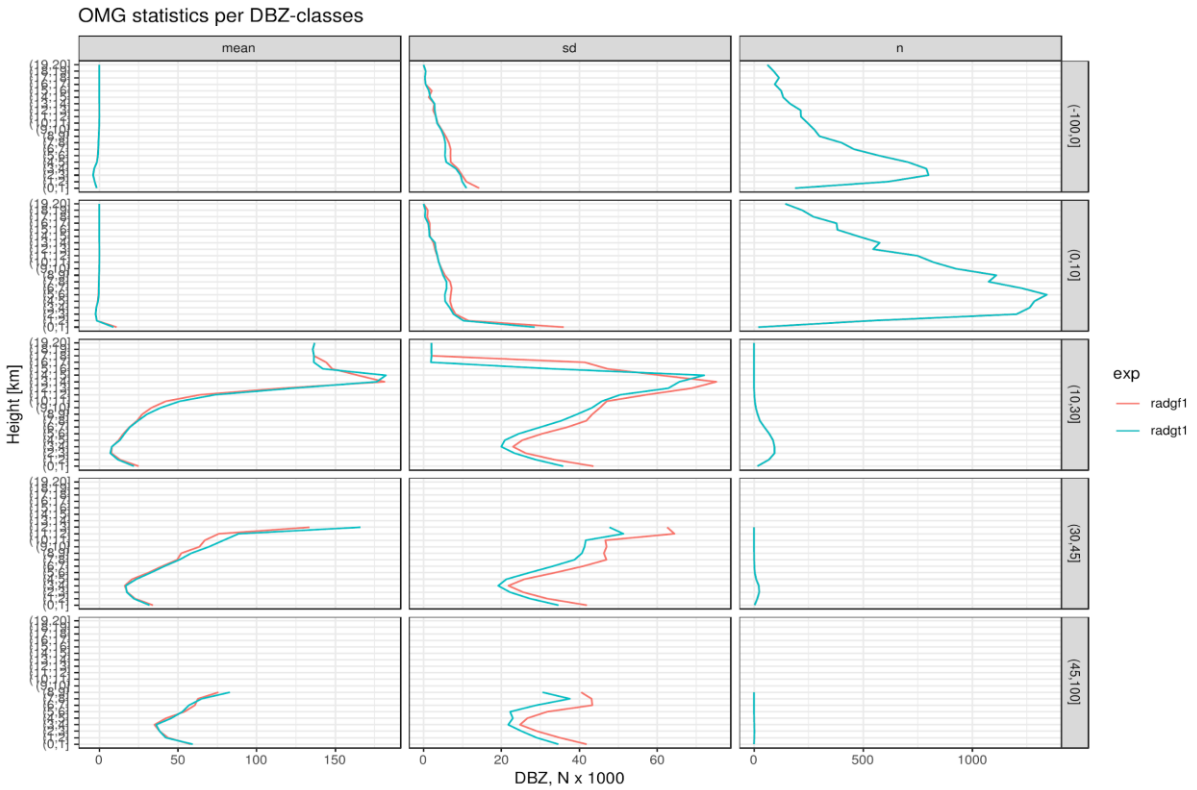
- Compromise between balance and accuracy
- Evaluation of several setups:
  - -45min to 0 min IAU is very efficient in filtering, probably inaccurate
  - Currently operational 2-step approach more accurate
  - No IAU: more noise in the first time steps compared to oper.
  - Open loop (FG from AROME 2.5 km) has most spin-up issues (interpolation)
- Most of the spin up gone until 60 min.





Progress in radar DA: reflectivity

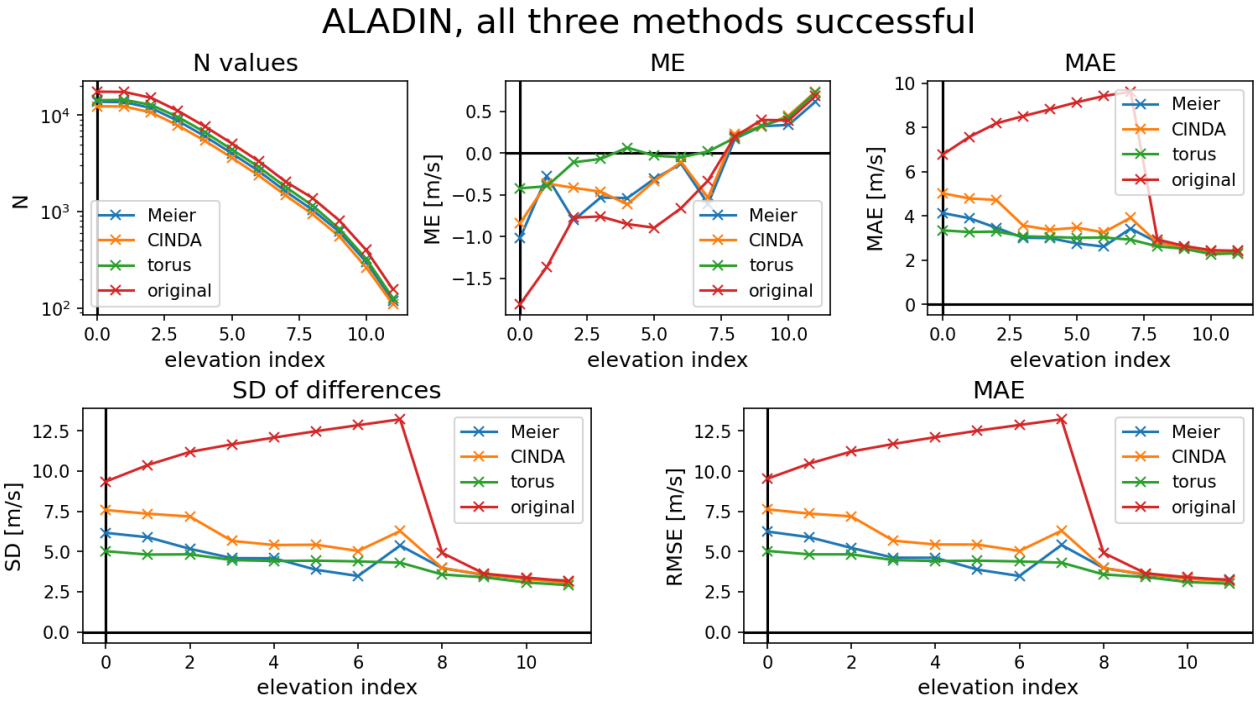
- Radar assimilation operational in AT (AROME, OPERA and bilateral)
- Validation of obs. operator with ALARO model (including graupel), 15-day OMG
- „Safety check“ comparison with AROME-FR - qualitatively similar results, expect for light rain in the upper troposphere.
- In-depth check of screening and generation of humidity pseudo-obs.



OMG departure stats. over ~15 days for all radars in ALADIN/SI domain
(~ 100 mio points)

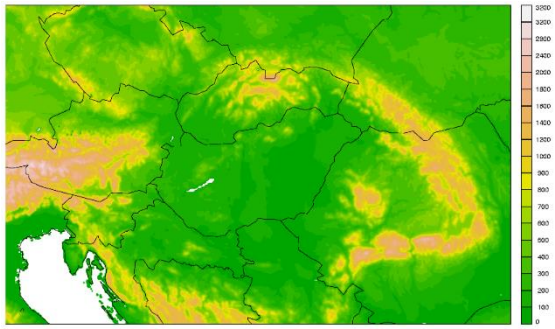
Progress with RADAR DA: winds

- Survey of methods for wind dealiasing: CINDA, method used in Austria, torus mapping
- Tests for precipitation cases over two years, validated wrt. ALADIN/SI first guess
- Methods generally effective but robustness to be increased
- Implementation in the pre-processing software HOOF

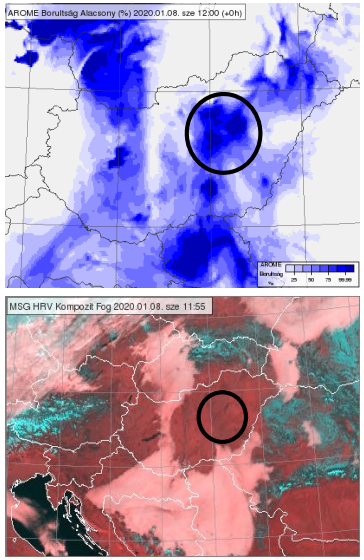


SEKF as alternative soil DA scheme

- Operational OI method very efficient but sometimes inaccurate
- Experimental SEKF for AROME 3D-Var
- OI analysis of T 2m and RH 2m to provide gridded observations
- SURFEX 7.3, 4 tiles, forcing from lowest model level (9m)
- Two cases studies (15-day warm up assim. cycle)
  - 8th January 2020: Overestimation of cloudiness, too low daytime temperature
  - 8th April 2020: To small temperature daily cycle, positive impact of SEKF
- Detailed study of surface and soil fields including Jaccobians



AROME Hungary: 2.5 km, 60 lev.

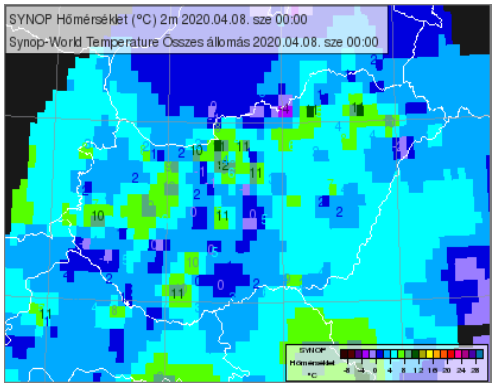


Case I: Overestimation of low clouds.

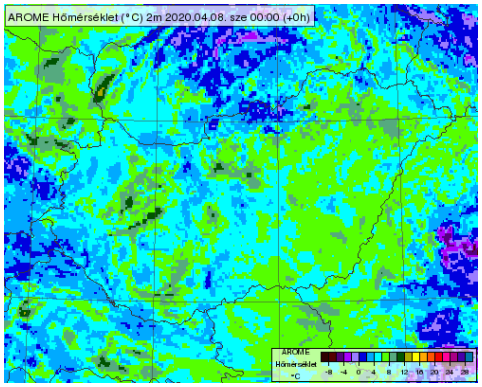
SEKF as alternative soil scheme

- Spring case: enhancement of daily cycle in stable AC conditions by using SEKF

SYNOP T2M

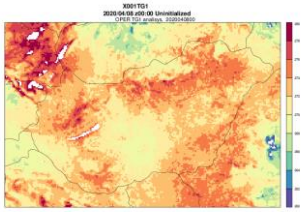


AROME OPER OI main

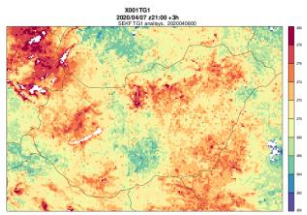


TG1 analysis

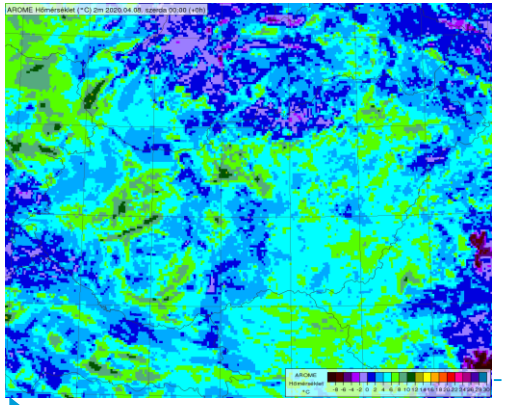
OPER

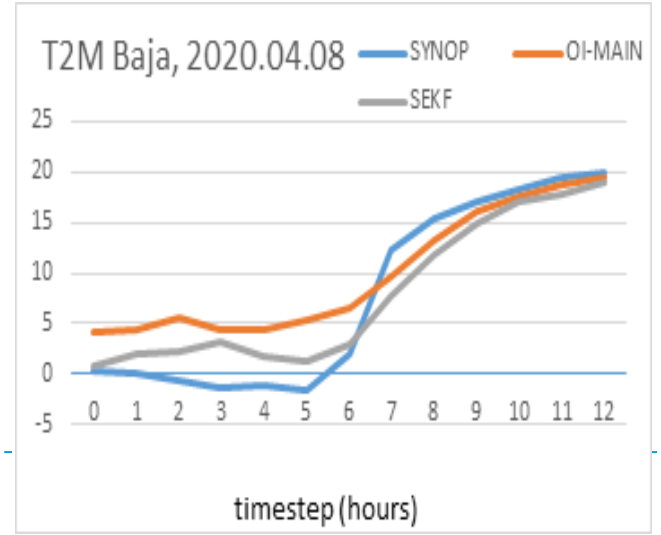


SEKF

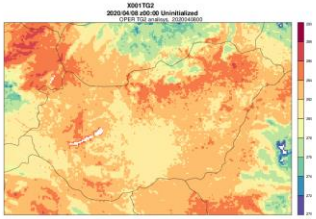


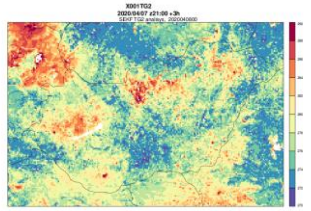
SEKF





TG2 analysis





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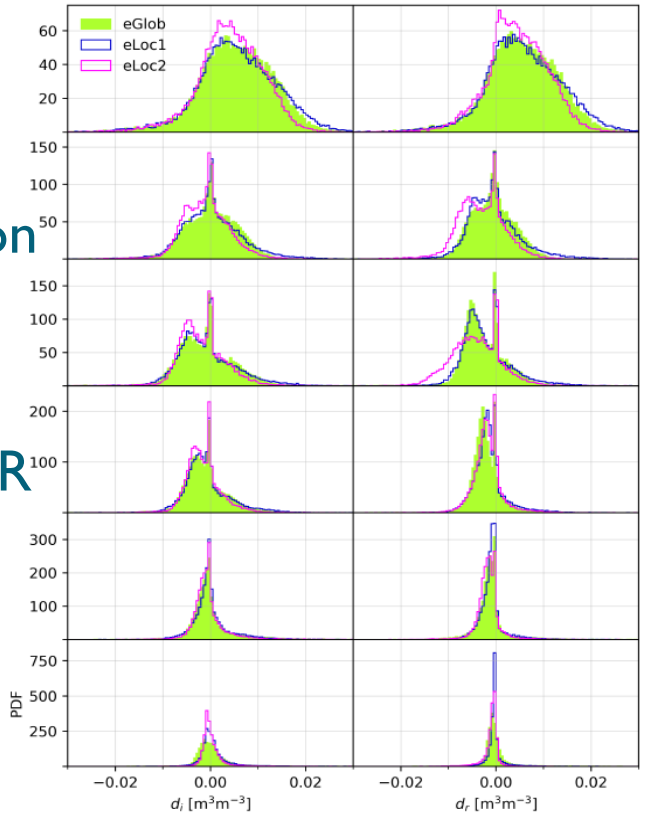
Remote-sensing observations for SEKF

- Soil wetness index (SWI):
  - Experiments with SCATSAR
  - Small benefit of locally sampled observation errors
- Land surface temperature (LST):
  - CDF matching: MSG+Sentinel to obtain HR product (1 km, 15 min)
  - Best results using hourly perturbation window and several soil layers
- Leaf area index (LAI):
  - Use of alternative HR physiographic fields + Sentinel-2 based LAI measurements



SWI assimilation: residuals using global (green), and locally sampled observation errors (blue, pink) for 6 soil layers. Vural et al., MWR

Outlook

- Hourly RUC system suited for nowcasting: AROME-RUC operational, more 3D-Var based rapid systems expected
- Extensive impact experiments with OPERA reflectivity and winds are planned
- De-aliasing and supperobbing (in cooperation with HIRLAM) to be added to the HOOF OPERA preprocessing package
- Refined use of observations (ZTD, Mode-S, radiances from polar satellites)
- Surface DA: experiments with SEKF in quasi-operational setups
- Further progress on other new observations (STD, microlinks)