AROME RADAR Data Assimilation

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and
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Hungarian Meteorological Service (OMSZ)

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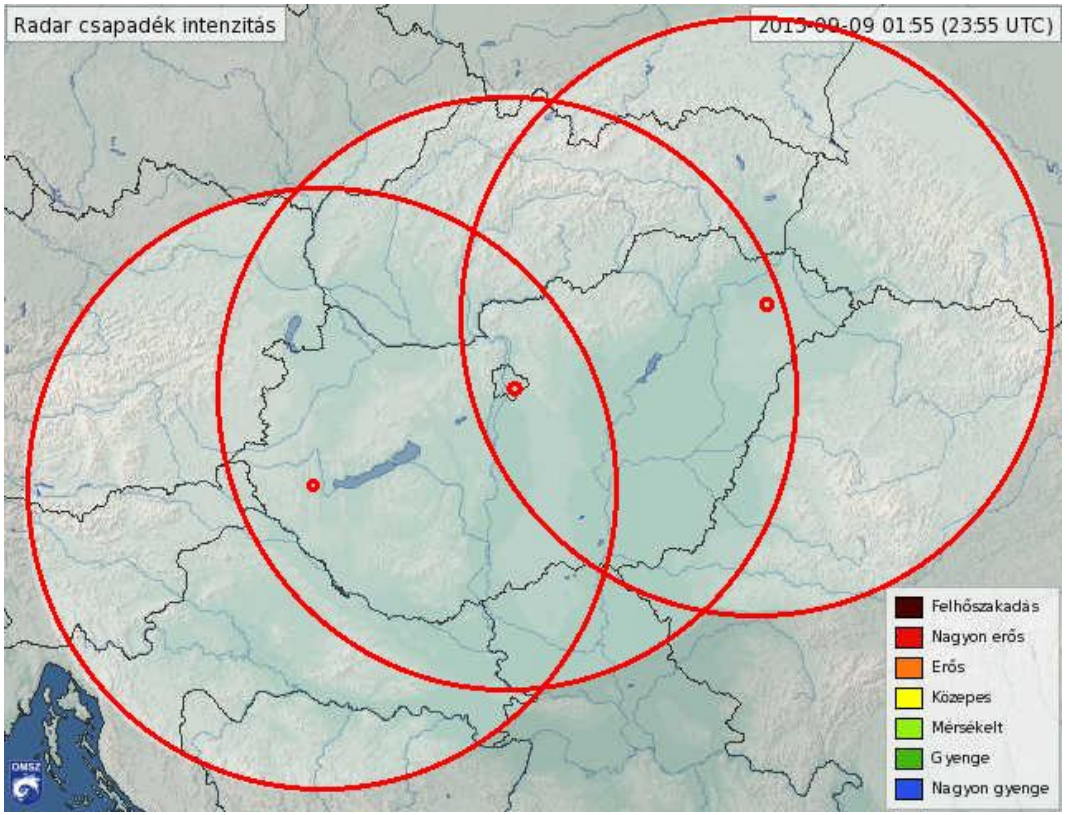
Outline

- RADAR data and stations in Hungary
- AROME DA system and RADAR data
- Results and Conclusions
- Future plans

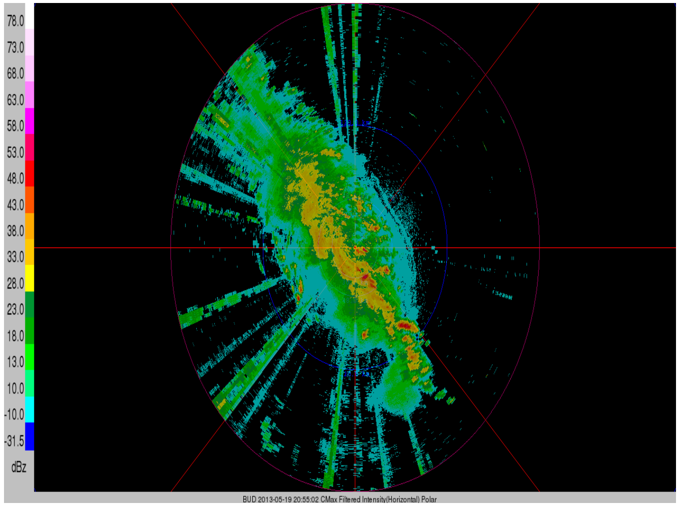
RADAR measurements

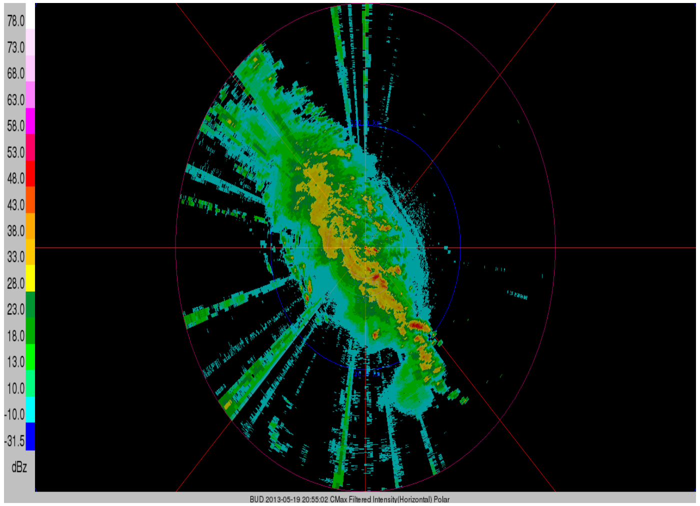
- 3 Hungarian stations of RADAR (EEC RADAR DWSR-2500C and DWSR-2501C types)
- Scanning in every 15 minutes of dual polarized reflectivity and single polarized doppler wind
- Elevation numbers:
  - 10(9) for Refl (Bp)
  - 5(4) for DOW (Bp)
- Ranges:
  - 240km Refl
  - 120km DOW

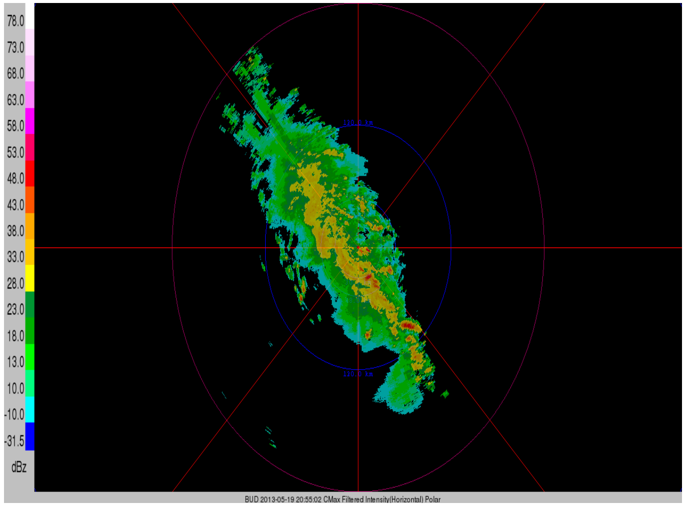


RADAR measurements

- OMSZ RADAR observations are post-processed and generated by Remote Sensing Division
- Locally developed converter so called HunBUFR is used to generate MF BUFR (512x512, Cartesian)
- Additionally in RADAR data, reflectivity under 7dBz is removed to avoid clear air echo and a RaySmooth procedure is also applied to smooth observations.
- Another applied tool, wifiFilter can help to reduce wifi signals.





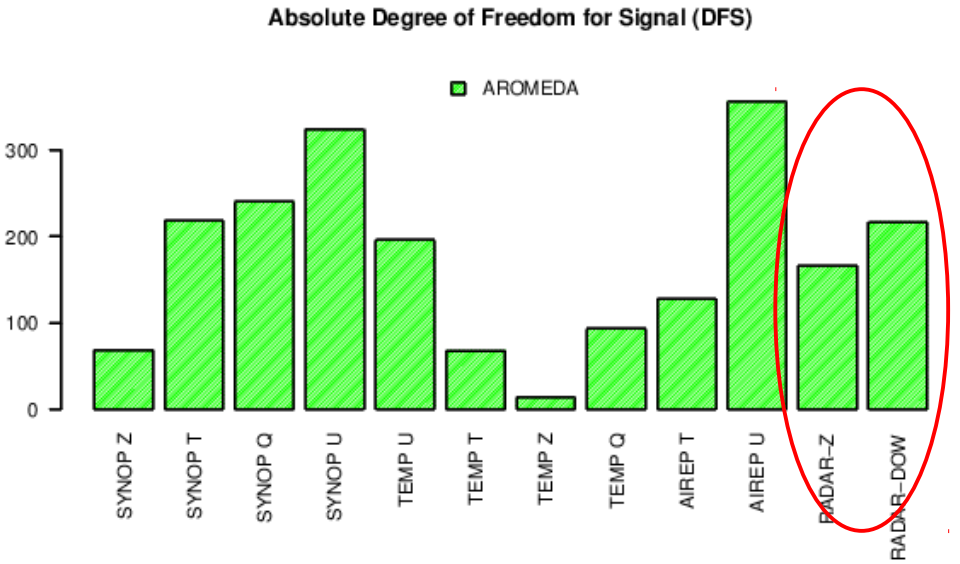


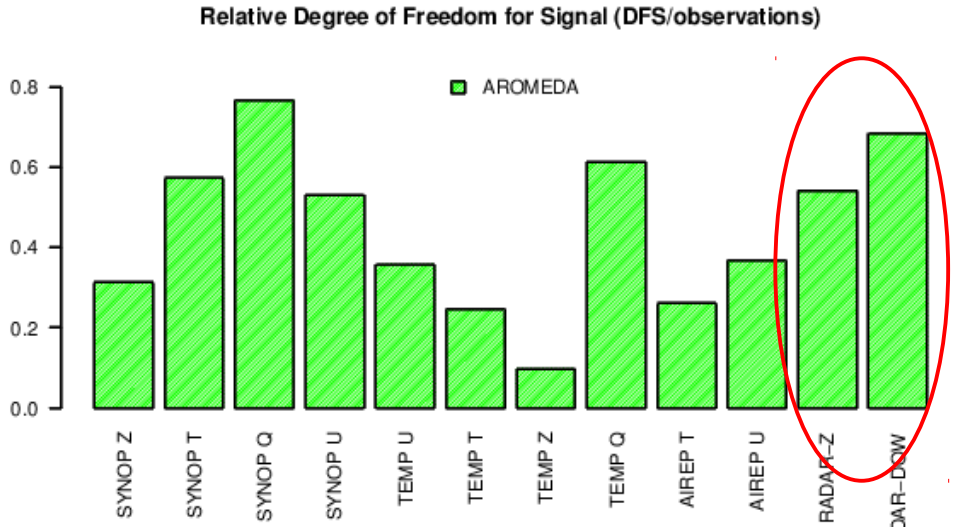
AROME model and experimental RADAR DA system

- Model version: CY36T1
- RUC applied → 8 analyses in a day
- In Bator the reflectivity and radial wind are read separately
- AROME CONV – operational AROME with conventional observations
- AROME RADAR FULL – AROME CONV + RADAR REFL,DOW without filtering
- AROME RADAR BLACKLISTING – AROME RADAR FULL with blacklisting measurement under 1000 meters (PRESS_RL <= 1000 FAIL(CONSTANT))
- Summer period was further investigated:
  - 15th May – 18th June 2012
  - 24h AROME forecasts from 00, 06, 12, 18UTC runs

AROME model and experimental RADAR DA system

- Degrees of Freedom for Signal for RADAR observations (analysis at 2012040712)
- Absolute DFS of RADAR REFL and DOW are not very much pronounced.
- Relative DFS of RADAR is much more considerable



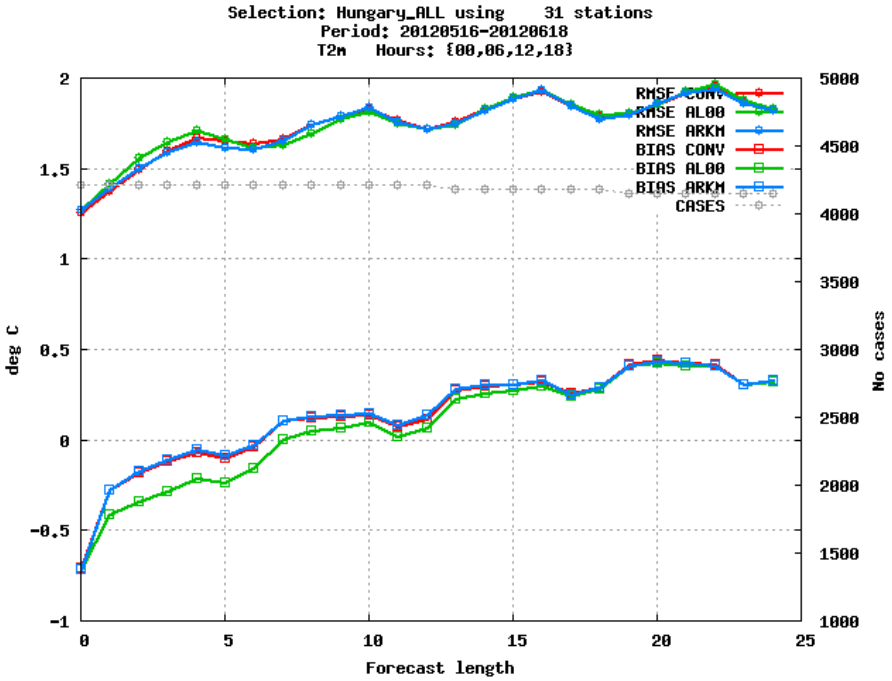


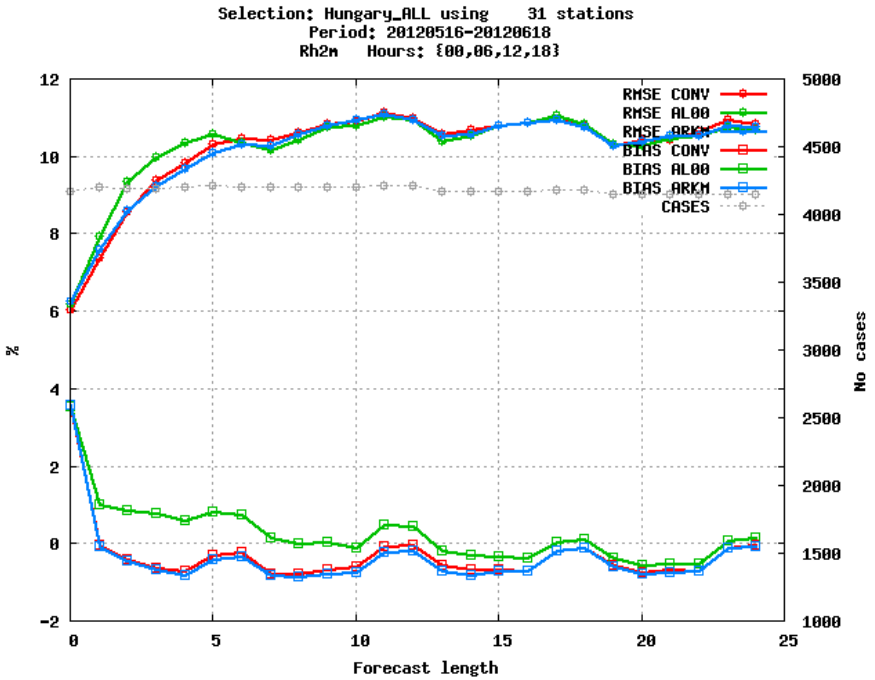
AROME oper vs AROME RADAR

Traditional verification scores: *RMSE-BIAS*

T2m and RH2m are degraded at very short ranges with AROME RADAR FULL.

With blacklisting low elevation RADAR REFL, scores are become slightly better.



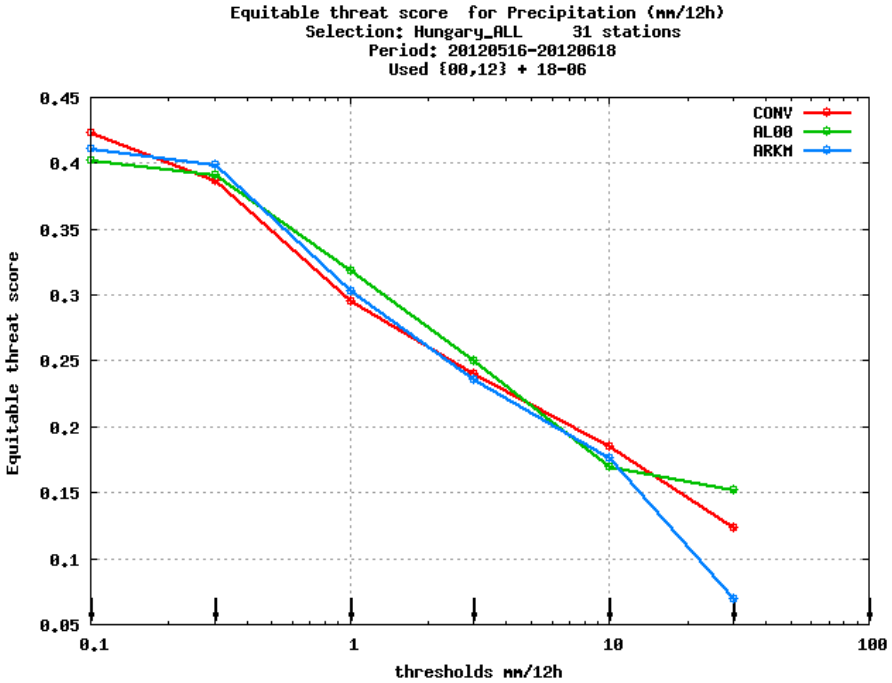


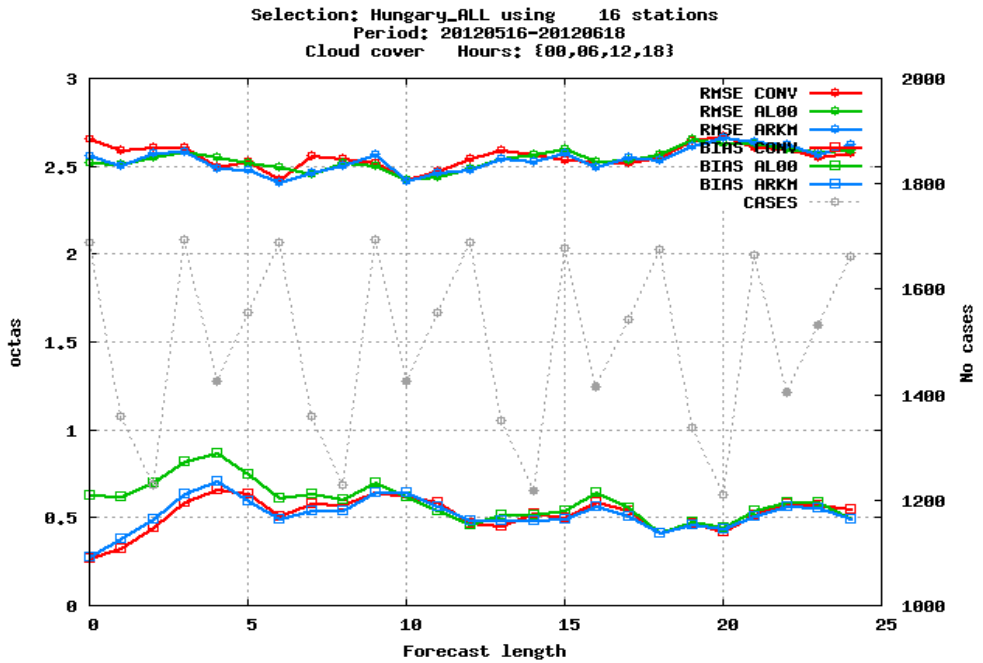
AROME CONV
AROME RADAR FULL
AROME RADAR BLACKLISTING

AROME oper vs AROME RADAR

The skill scores with RADAR assimilation are improved (*SEDI, ETS, etc*), but with black-listing this skill was almost lost.

RADAR assimilation is good to improve cloudiness forecasts against AROME CONV





AROME CONV
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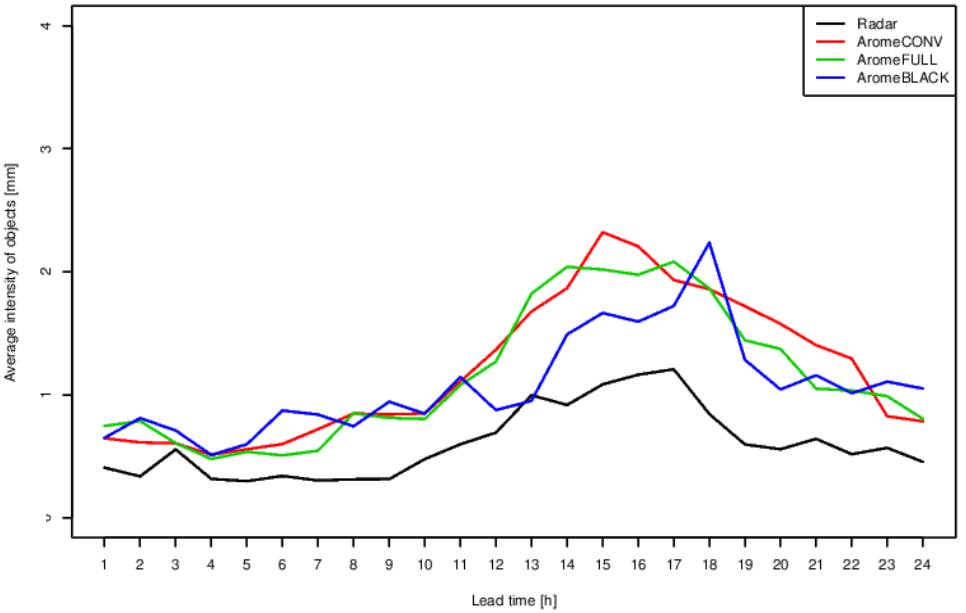
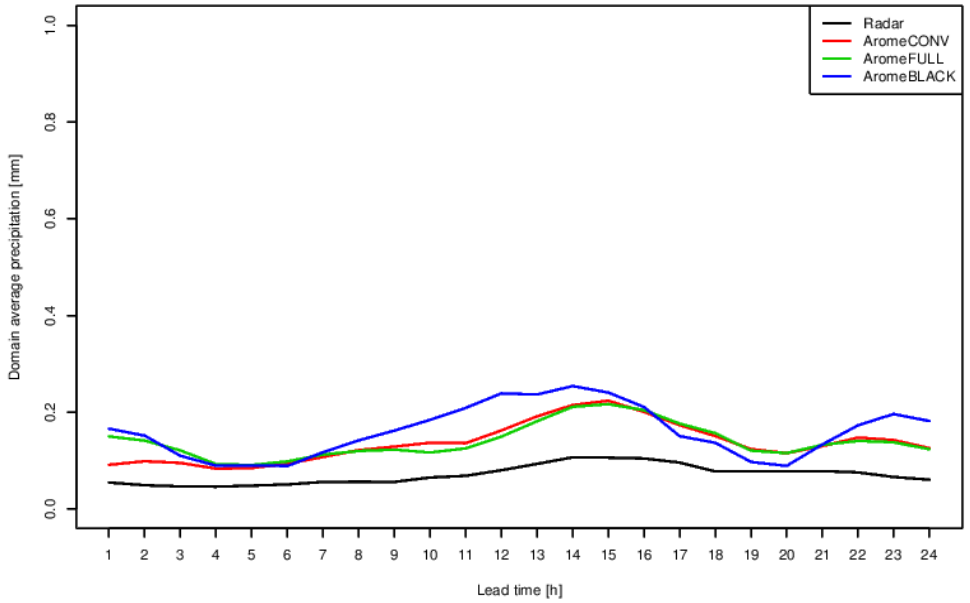
AROME oper vs AROME RADAR

Radar feature-based verification:

Average intensity of the objects – Better with blacklisting

Domain average precipitation – Best with full RADAR



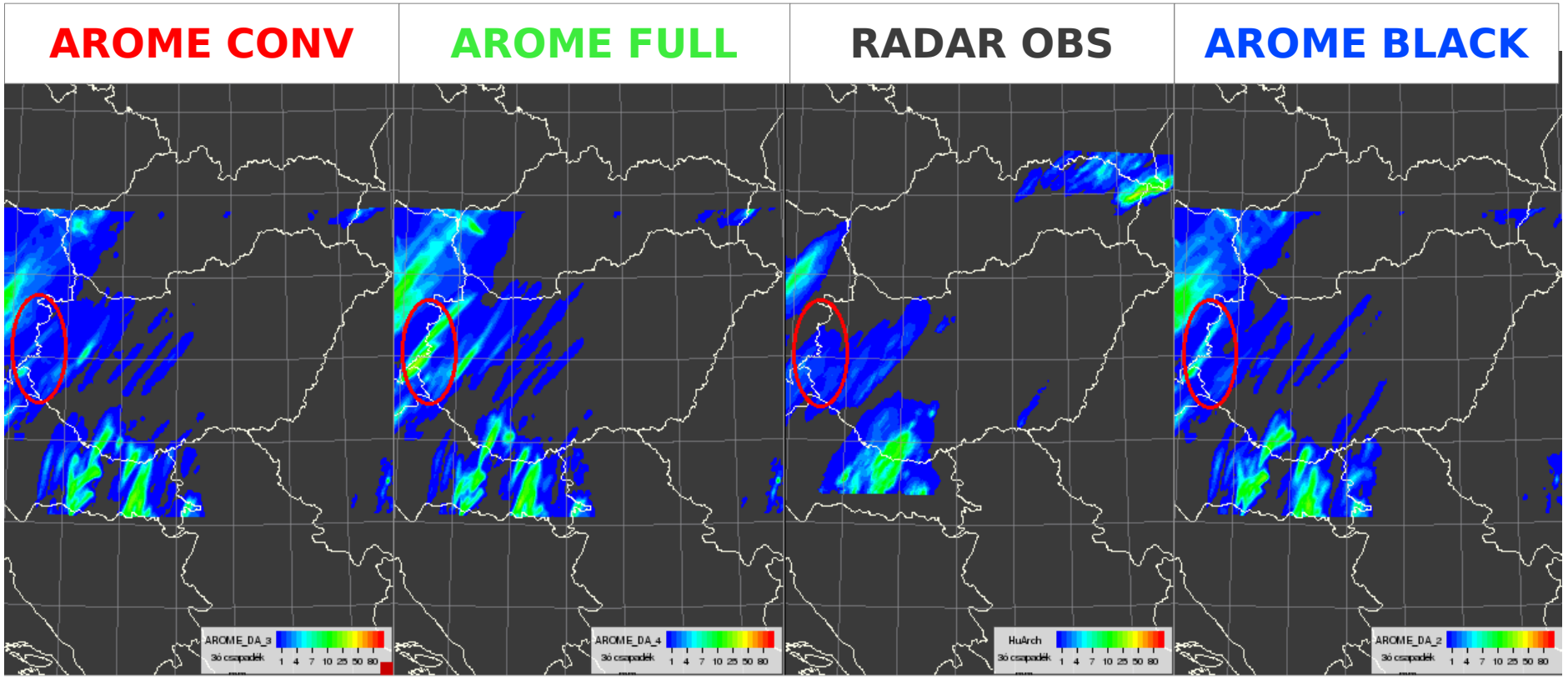


AROME CONV
AROME RADAR FULL
AROME RADAR BLACKLISTING

AROME oper vs AROME RADAR

AROME RADAR FULL is good to localize precipitation objects, but also over-estimate the sum of precipitation which results moist humidity and cold temperature BIAS-s.

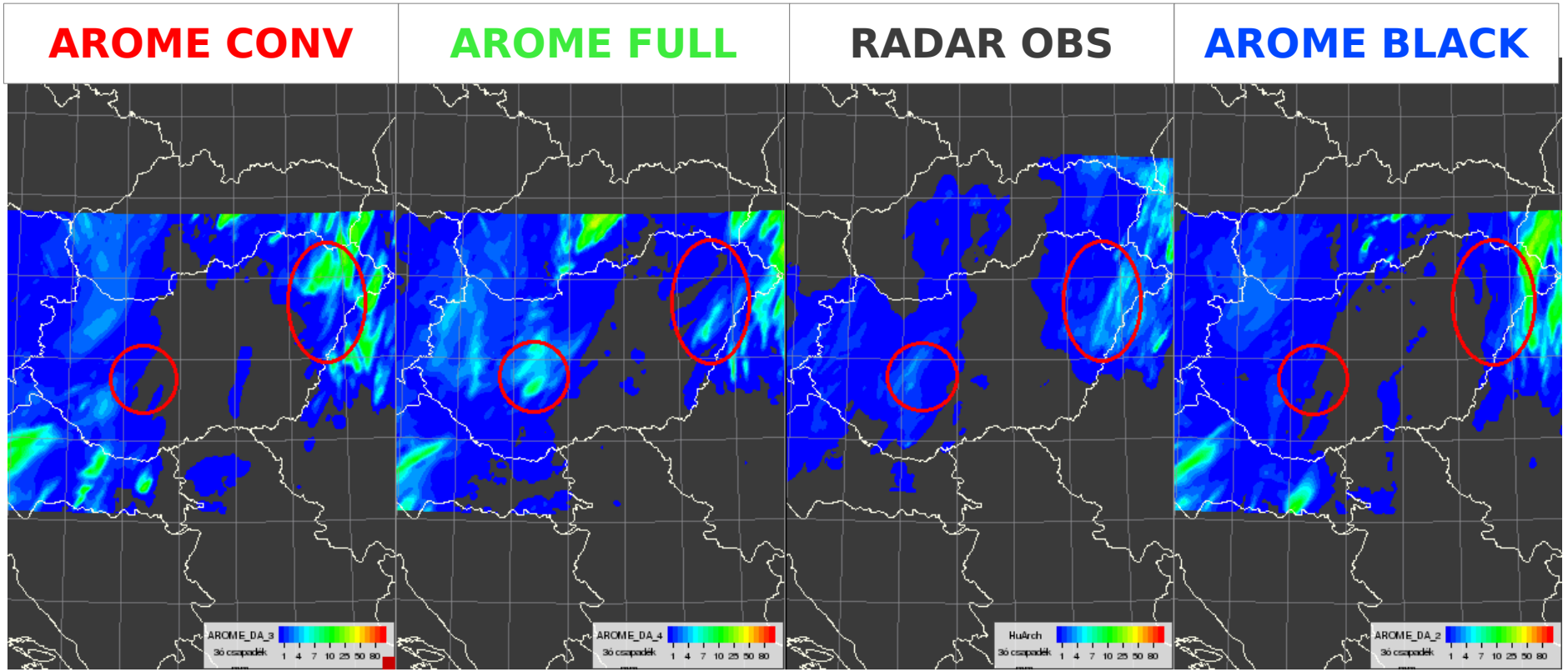
Blacklisting is efficient for some cases and too much for others.



AROME oper vs AROME RADAR

An example where RADAR assimilation can successfully remove false precipitation but overestimate small objects.

Blacklisting is still improve, but remove important feature as well.



Conclusion & Plans

RADAR data assimilation is important because the small scale contributions

RADAR data has high relative DFS

Assimilation of RADAR without filtering can improve wind, mslp and prec. Forecasts and slightly degrade T2m and RH2m

Assimilation of RADAR with low elevation blacklisting can improve T2m and RH2m, but important precipitation features are almost lost

Further investigation of case studies and optimal blacklisting are needed

Investigation on the land-surface processes might be on the list

Questions?

Thank you for your attention!
Thanks to those who contributed!

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