Regional Cooperation for
Limited Area Modeling in Central Europe

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Experiments with SEKF in AROME

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Motivation

- Spurious TG2 values in the Alps in winter

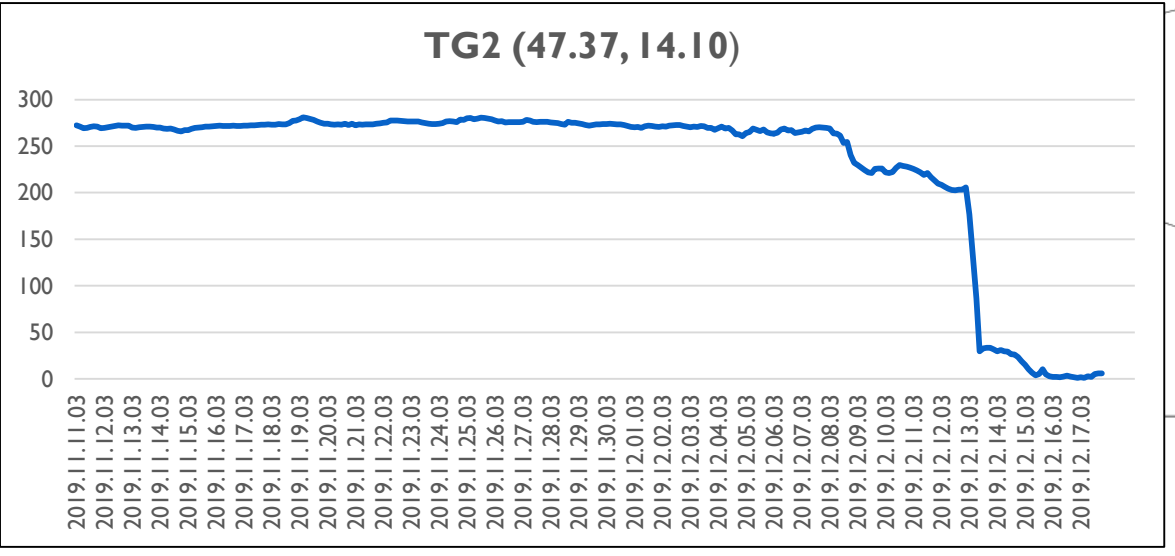
SEKF winter run (11. 25-12.17, 2019 from 11.11 spin up)

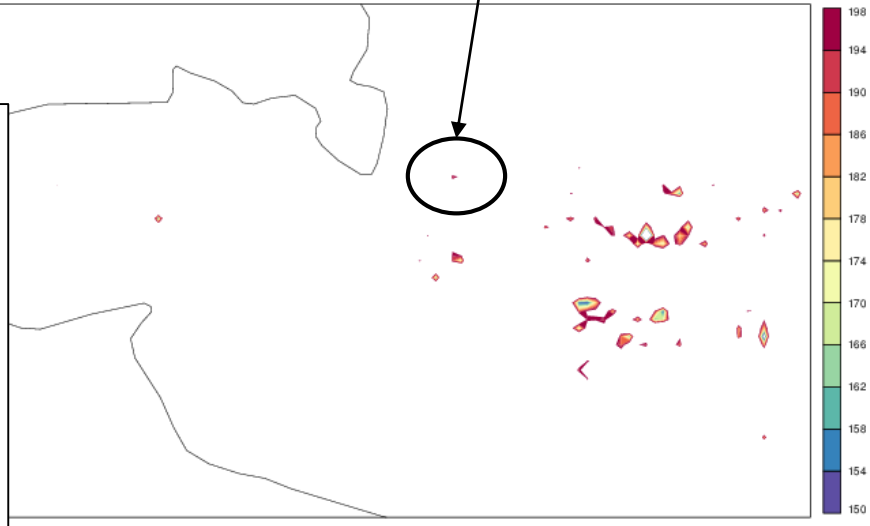
AROME CY43 + SURFEX 8.0

1 patch

3-L ISBA

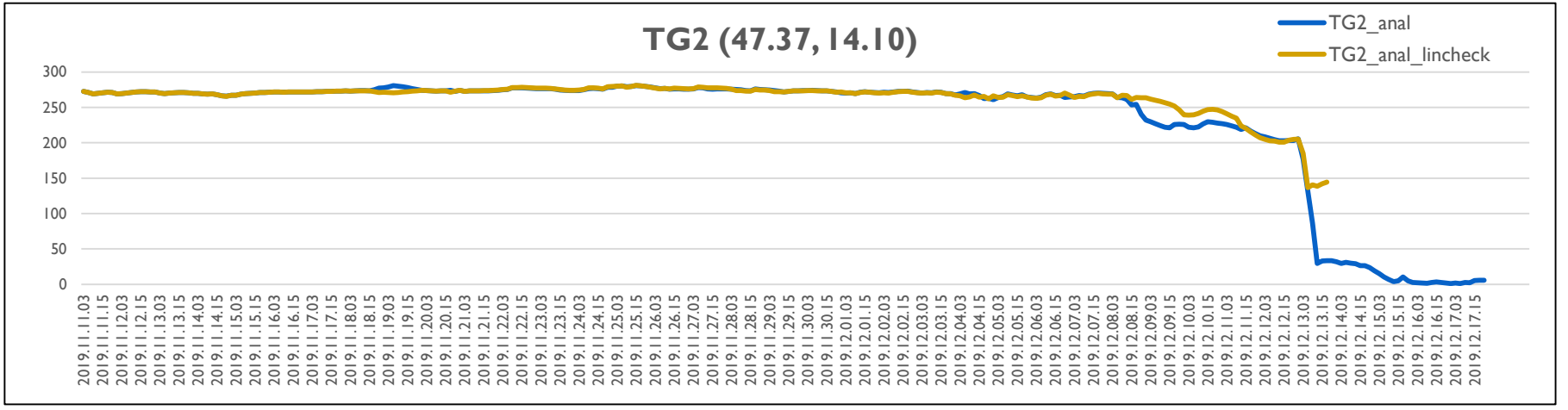
target point: 47.37, 14.10, 1503 m



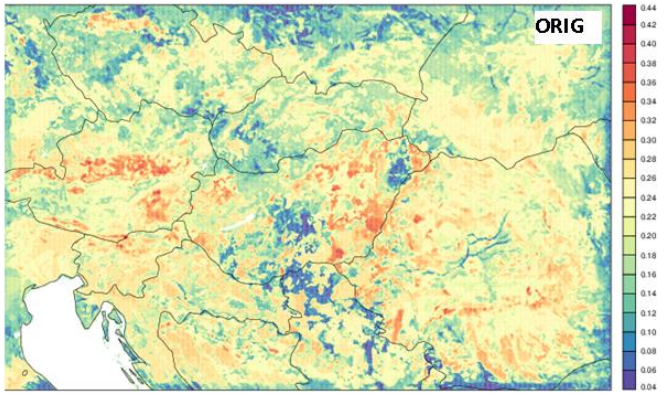


Investigation of the issue

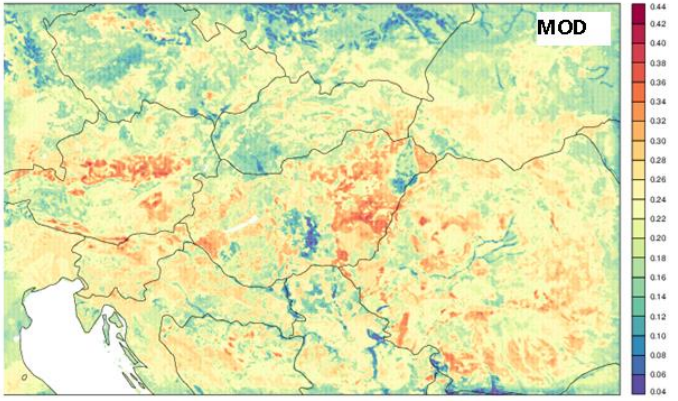
- Linearity check of Jacobians
  - **Target**: keep the large but valid Jacobians
  - Positive and negative perturbations for all control variables (TG1,TG2,WG1,WG2) => 9 OFFLINE runs, and check the linearity of the Jacobians with this conditions:
  - IF $|H^{+}+H^{-}| > 0.2*(|H^{+}|+|H^{-}|)/2.0$ => unlinear, H=0.0



- Blacklisting of synop station or limitation of SEKF equations (e.g. increments, Jacobians, innovation) => no solution
- The error related to the Assimilation settings (XERROBS, XSIGMA_M and XTPRT_M)
- On the other hand, bugfix was provided in the code - the innovation (obs-guess) was calculated from the offline reference run instead of the inline guess
  - The modified routines (*soda.F90, modd_assim.F90, assim_nature_isba_ekf.F90, read_isban.F90*)



=> non-negligible difference



Tests with different assimilation settings

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	EXP1	EXP2	EXP3	DEF	ECM	ECM_B	EXP4
XERROBS (T2M, HU2M)	0.5, 0.2	0.5, 0.2	1.0, 0.4	1.0, 0.1	1.0, 0.04	1.0, 0.04	1.0, 0.07
XSIGMA (WG2, WG1, TG2, TG1)	0.15, 0.1, 2, 2	0.15, 0.1, 2, 2	0.15, 0.1, 2, 2	0.15, 0.1, 2, 2	0.15, 0.1, 2, 2	0.01, 0.01, 1, 1	0.15, 0.1, 2, 2
XTPRT (WG2, WG1, TG2, TG1)	10^{-4}, 10^{-4}, 10^{-5}, 10^{-5}	10^{-3}, 10^{-3}, 10^{-4}, 10^{-4}	10^{-4}, 10^{-4}, 10^{-5}, 10^{-5}	10^{-4}, 10^{-4}, 10^{-5}, 10^{-5}	10^{-4}, 10^{-4}, 10^{-5}, 10^{-5}	10^{-4}, 10^{-4}, 10^{-5}, 10^{-5}	10^{-4}, 10^{-4}, 10^{-5}, 10^{-5}
TG2 acceptable?	NO	NO	YES	YES	NO	YES	YES

Summer exp. with: *DEF, EXP4, ECM_B*

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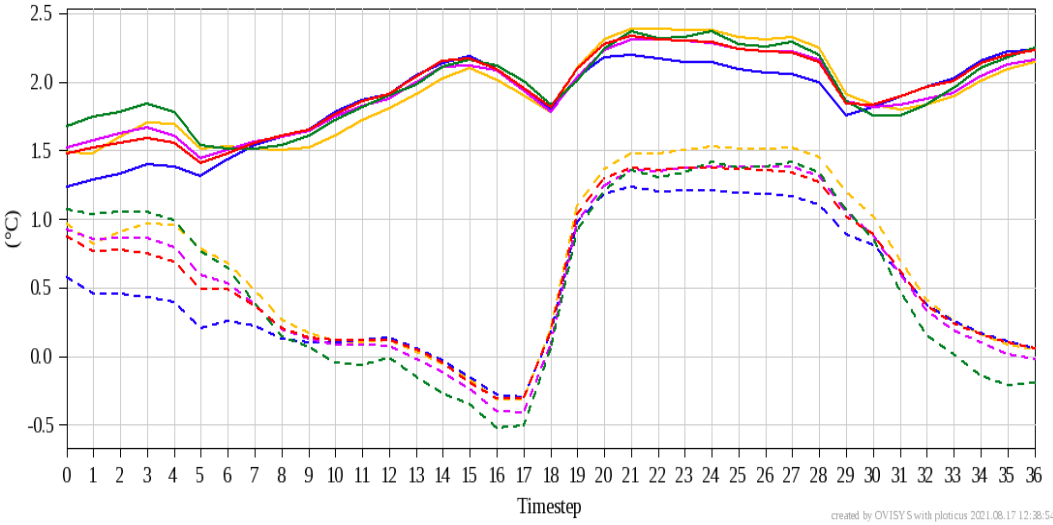
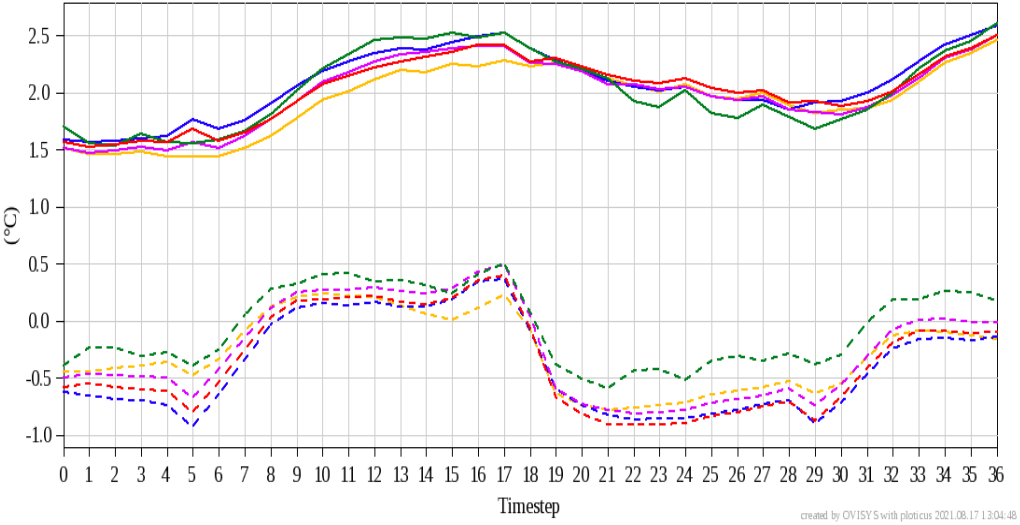
Summer run 9 to 31 July 2020 (with 2-week spin up from 25 June

Verification: ***OI-MAIN*, *EXP1*, *EXP4*, *DEF*, *ECM_B***

T2M



TD2M



=> Best T2M scores with EXP4

⇒ Best TD2M bias with ECM_B

⇒ RMSE is not obvious

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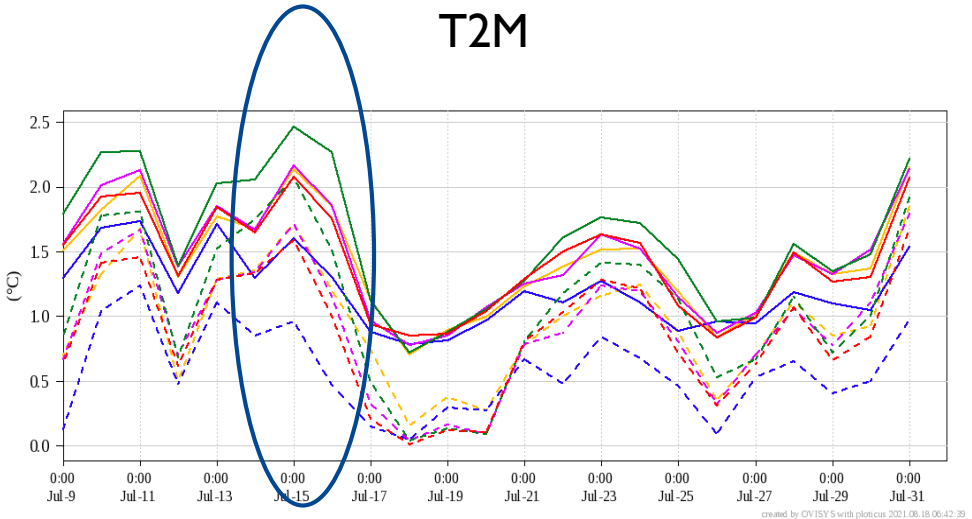
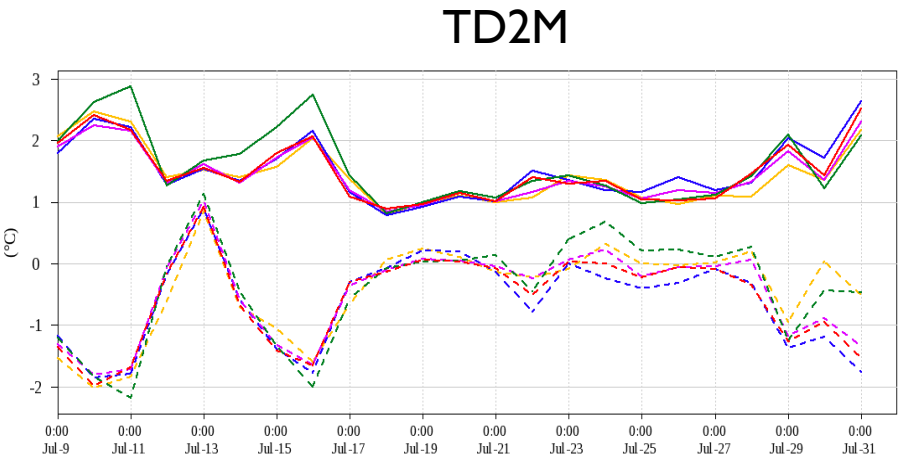
Time evolution of the analyses



OI-MAIN, EXP1, EXP4, DEF, ECM_B



T2M analysis at **2020.07.15 00 UTC + 00h**

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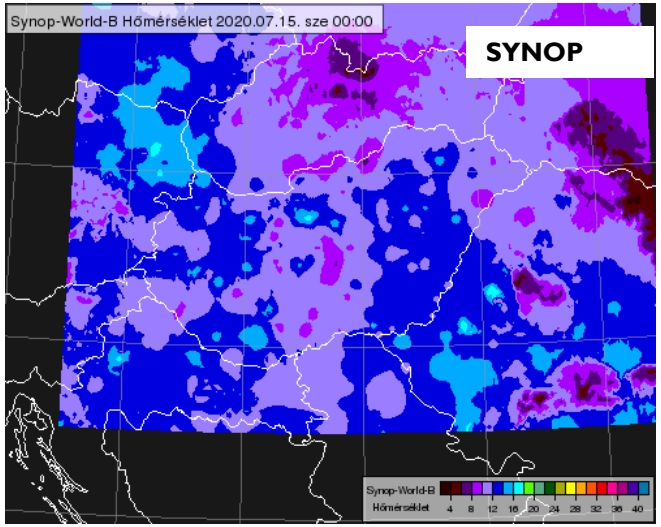

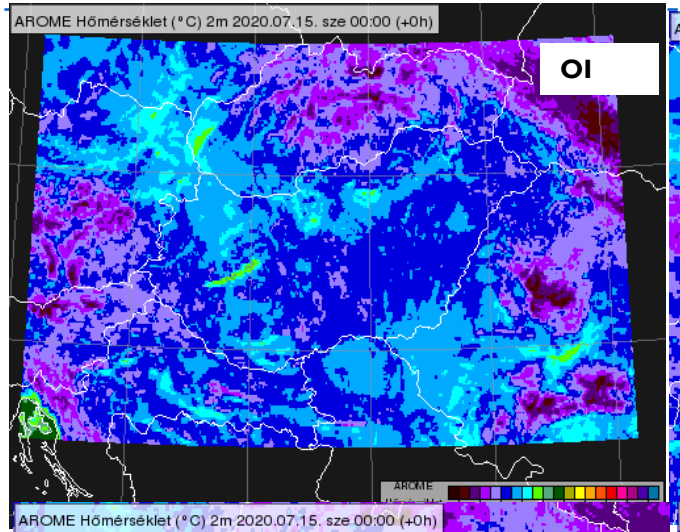

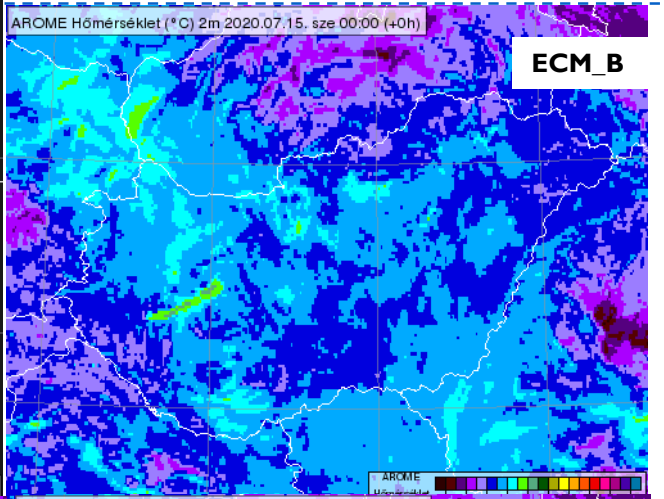

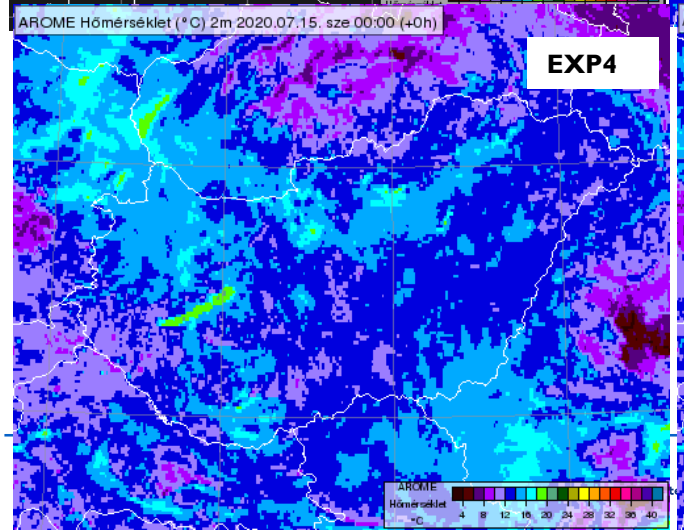

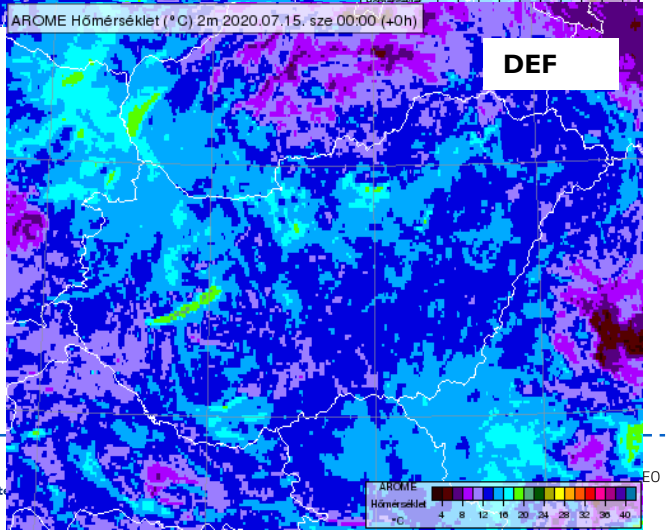

=> Small improvement by SEKF runs (EXP4 and DEF)

Soil Moisture (WG2) analysis at
2020.07.15 00 UTC + 00h

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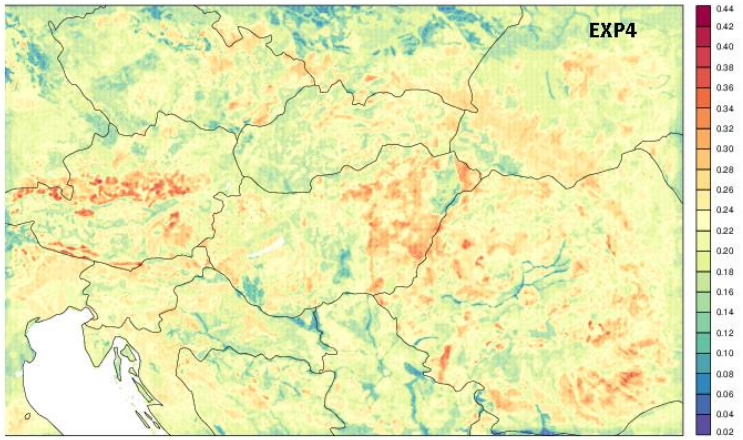

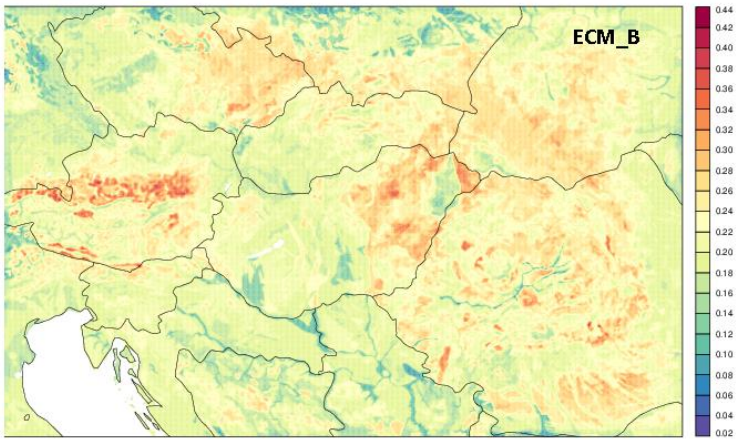

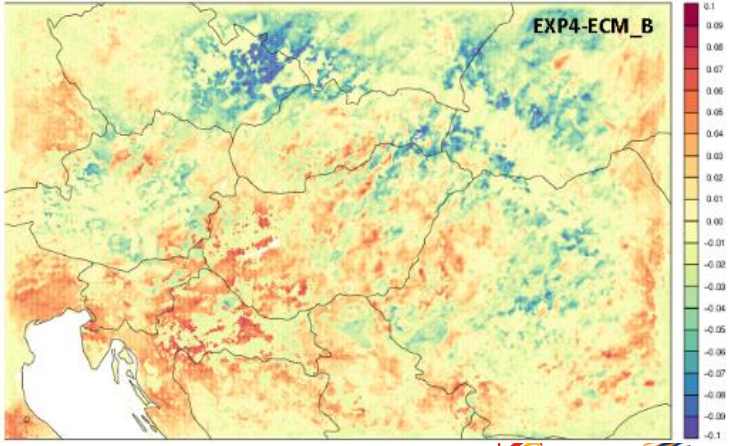

=> EXP4 is more inhomogeneous and wetter than ECM_B

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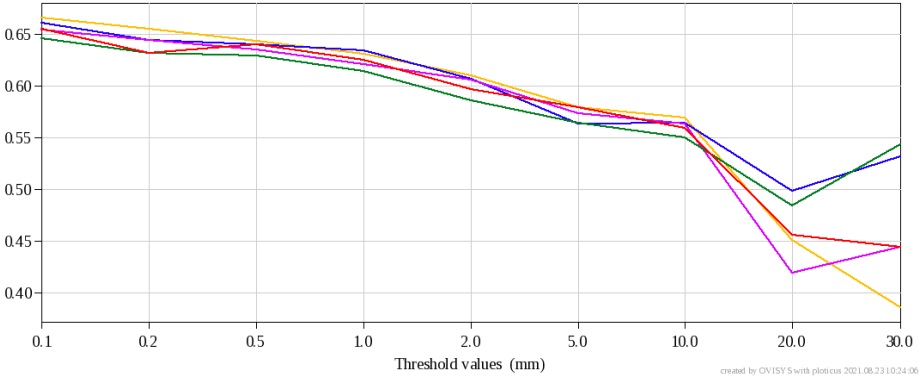
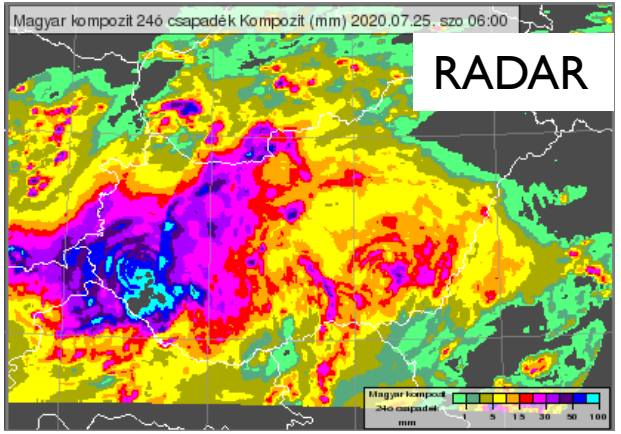
Precipitation verification

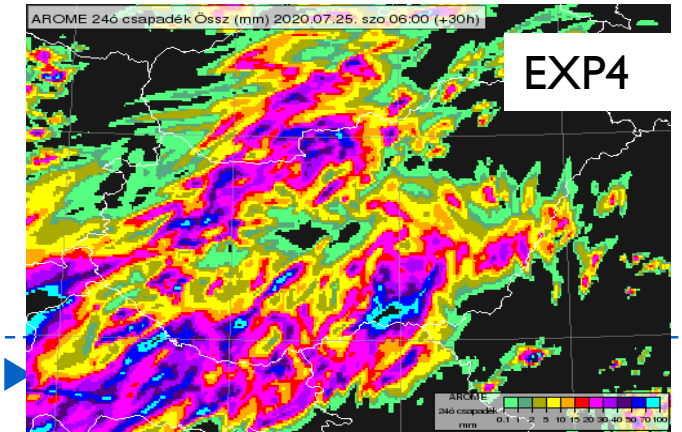
Prec24 SEDI

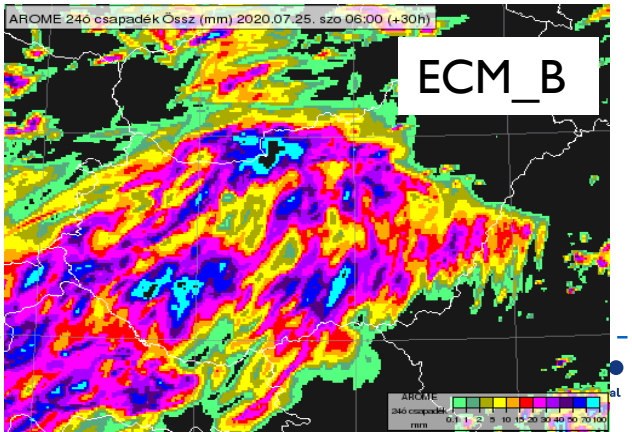
OI-MAIN, EXP1, EXP4, DEF, ECM_B

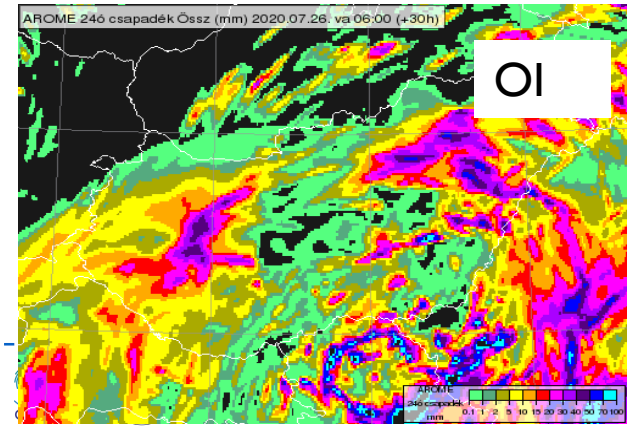




Case study – Prec24 (24. 07. 2020 + 30h)







Ongoing works

- Long assimilation run Febr.-Sept., 2021 with EXP4
- 36 h Forecast for Aug., 2021 => evaluation
- 4-weeks e-suite from Nov., 2021 => Forecasters
- Decision on the operational introduction of SEKF this winter at 2.5km, 60L

- Moving to finer resolution (1.3 km, 90L)

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Thank you for your attention.

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