Surface assimilation with EKF and conventional observations

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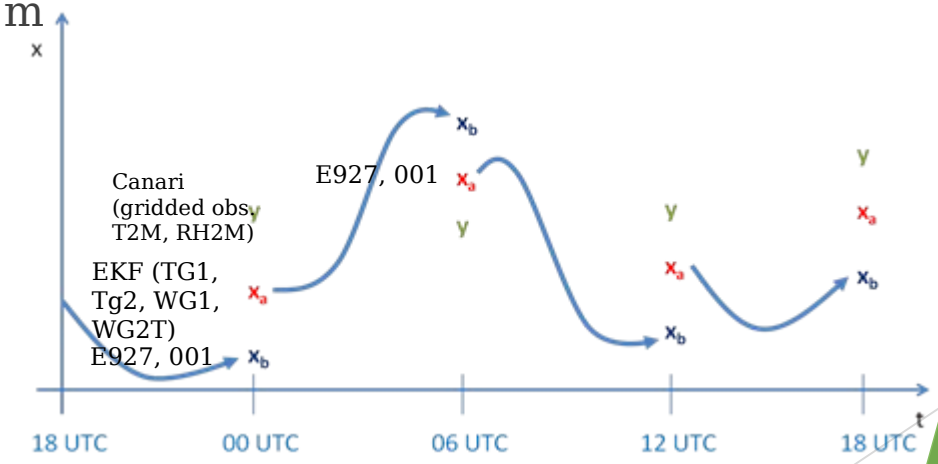
- Oper Arome-Hungary: 2.5 x 2.5 km horizontal resolution, 490 x 310 points, 60 vertical levels, cy 38 + Surfex V7.2
- Surface analysis in oper Arome-Hungary: downscaled ALARO-8 km surface analysis
- Experimental OI-MAIN (in parallel suit since 06.09.2016)
- EKF: Observation T2M and RH2M used => produce surface analysis (TG1, TG2, WG1 and WG2)
  - 1 assimilation (coldstart guess))
  - Forcings: inline fullpos from 17 m
  - Surfex: 4 tiles, 1 patch
    - ISBA: 3 layers, Canopy
    - B matrix: fixed



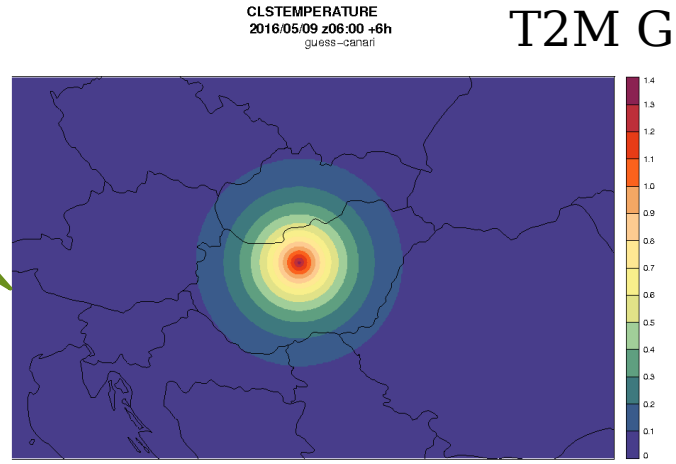
Increments

- Surfex v7.2 (offline + EKFAssim) installation at Jan. 2016
- Testing of the validation

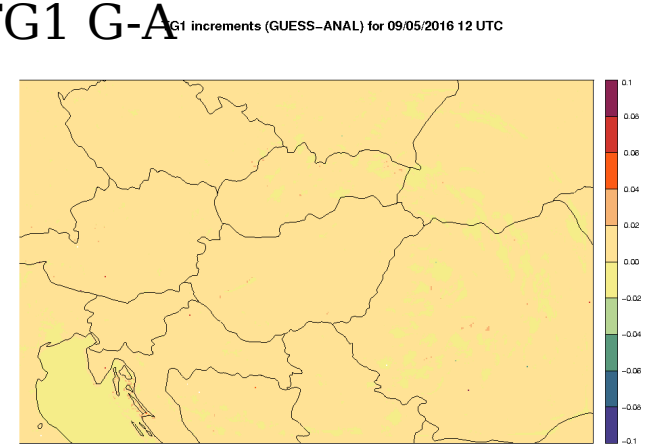
1. **Single obs:**

Guess warmer, than the canari obs.

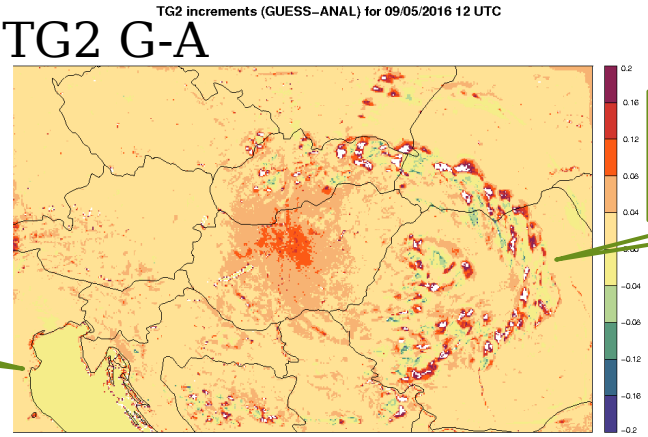
T2M G-C



TG1 G-A



TG2 G-A



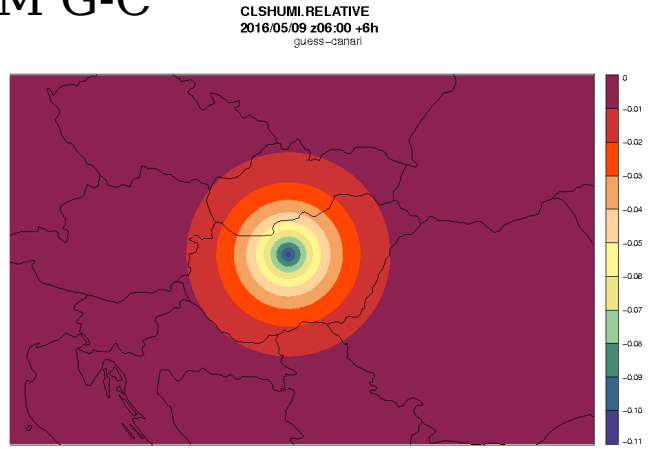
Problem: mountain effect

The impact on TG1 is smaller, than on TG2 (similar behav. with Surfex 6)

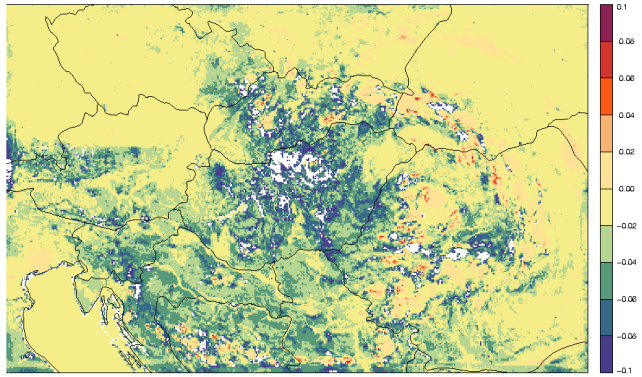
The analysis colder, than the guess

RH2M G-C

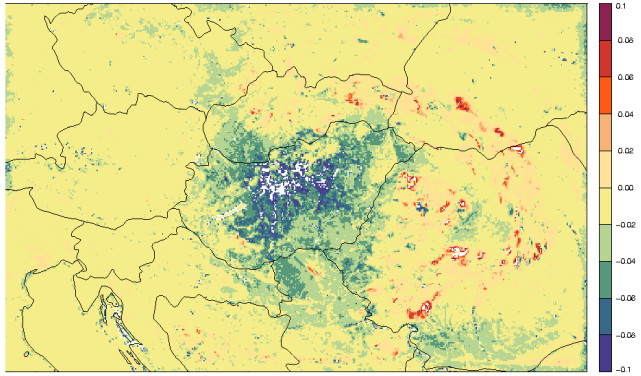
Guess is drier, than the Canari obs.



WG1 G-A



WG2 G-A



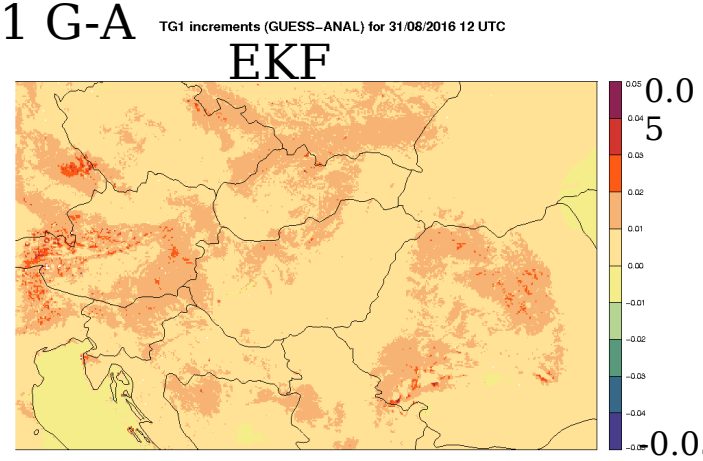
The soil analysis is wetter

The impact of the EKF on WG1 and WG2 are in similar order

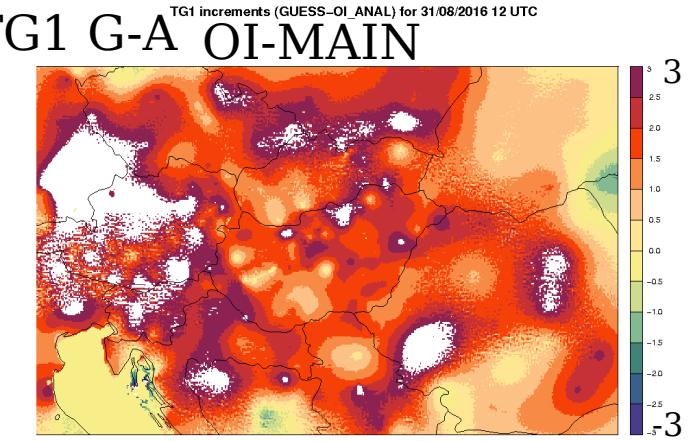
- **Tests with all obs.**

1. **31. Aug., 2016 12 UTC** (warm weather with long-life AC)
   - comparison with OI-MAIN

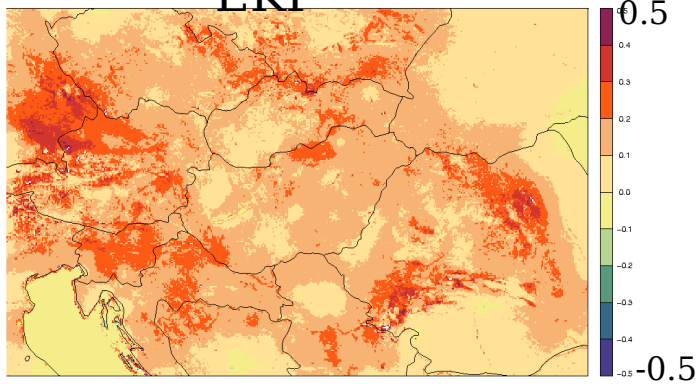
TG1 G-A EKF



TG1 G-A OI-MAIN

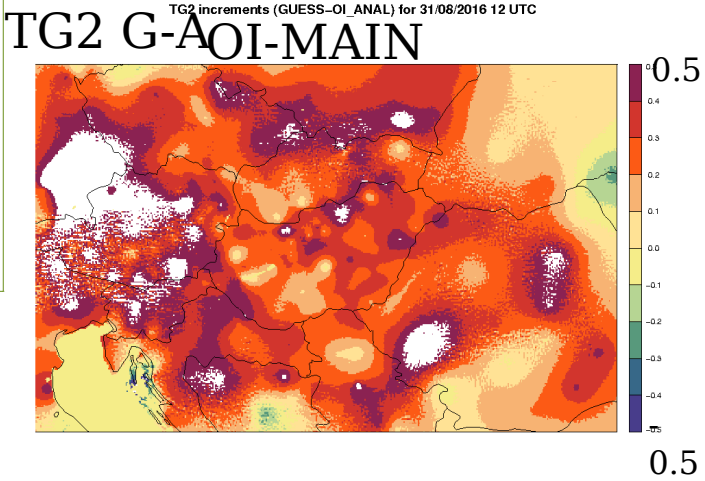


TG2 G-A EKF

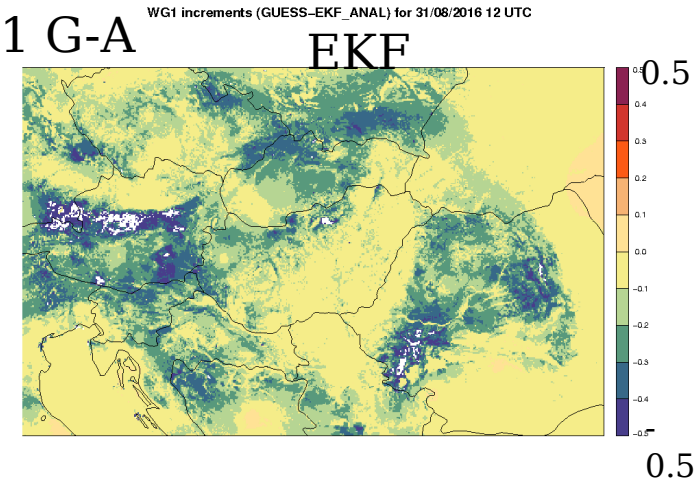


The soil temp. analyis is colder, than the guess, and the effect of OI-MAIN is larger!

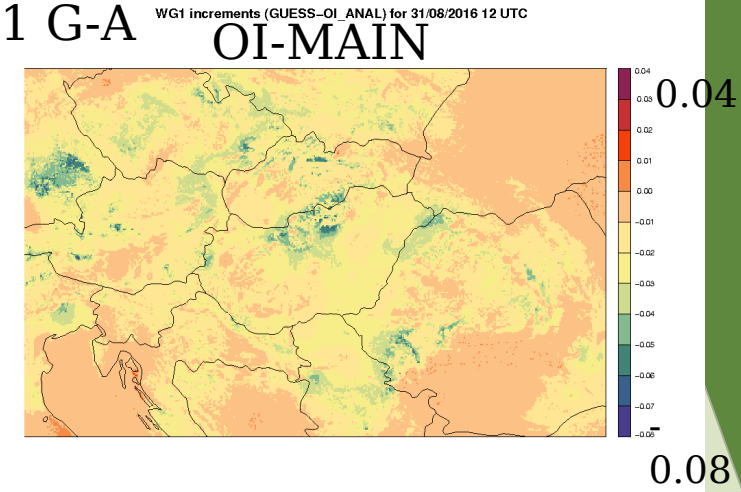
TG2 G-A OI-MAIN



WG1 G-A EKF

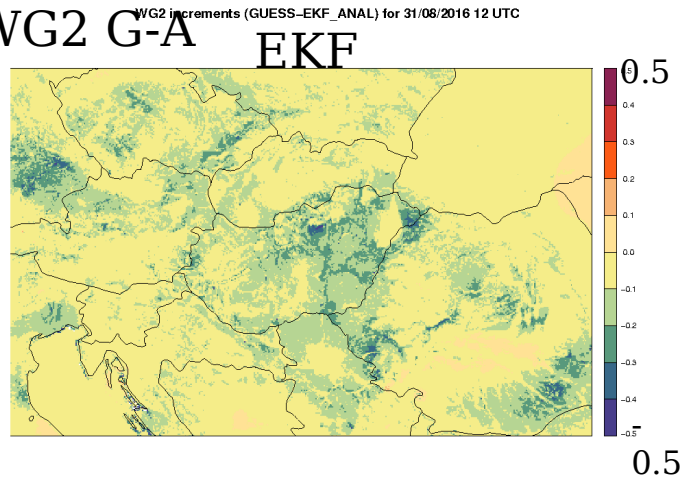


WG1 G-A OI-MAIN

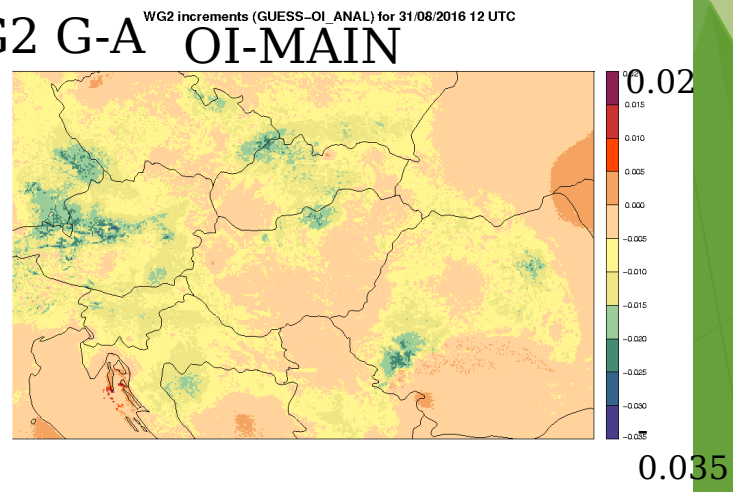


The analysis is wetter, and the effect of OI-MAIN is smaller

WG2 G-A EKF



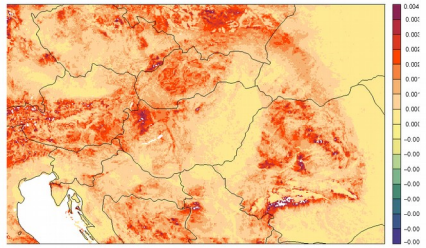
WG2 G-A OI-MAIN



OI-MAIN produced colder but dryer soil analysis, than the EKF

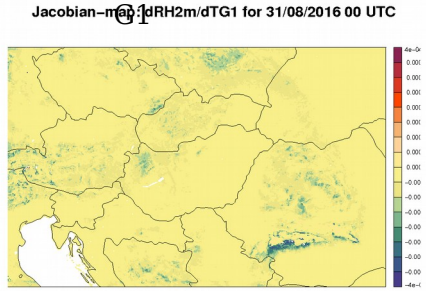
Jacobians:

dT2M/dTG1



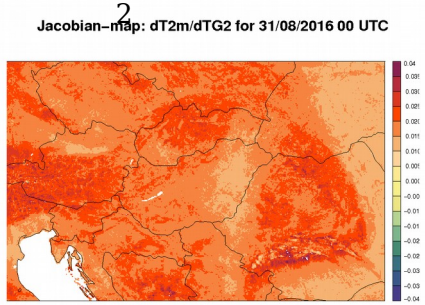
Incr. soil TG1 => incr. T2m

dRH2M/dTG1



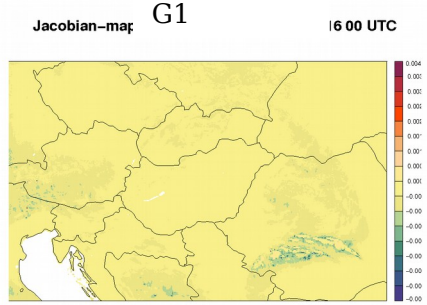
Incr. soil TG1 => decr. RH2m

dT2M/dTG2



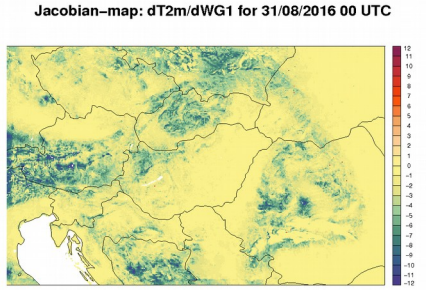
Incr. soil TG2 => incr. T2m (effect is larger, than TG1)

dRH2M/dTG1



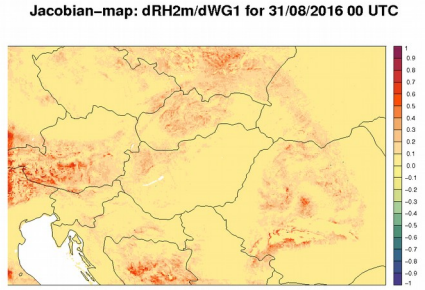
Incr. soil TG2 => decr. RH2m

dT2M/dWG1



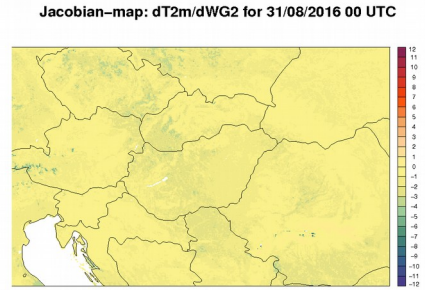
Incr. soil WG1 => decr. T2m

dRH2M/dWG1



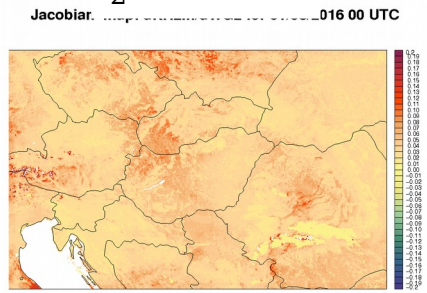
Incr. soil WG1 => incr. RH2m

dT2M/dWG2



Incr. soil WG2 => decr. T2m (effect is smaller then WG1)

dRH2M/dWG2

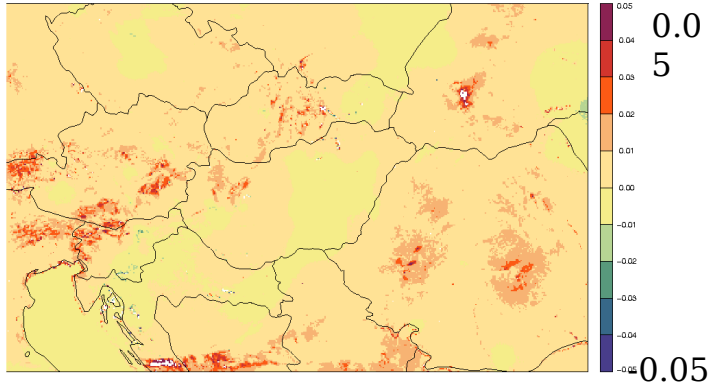


Incr. soil WG2 => incr. RH2m

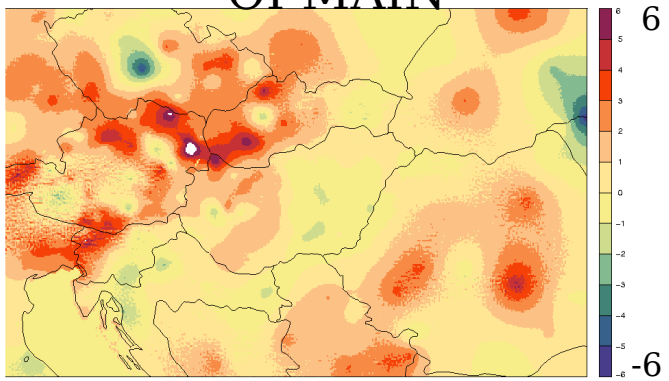
Jacobians seems OK

- **05. Sept., 2016 12 UTC** (cold front)

TG1 G-A EKF

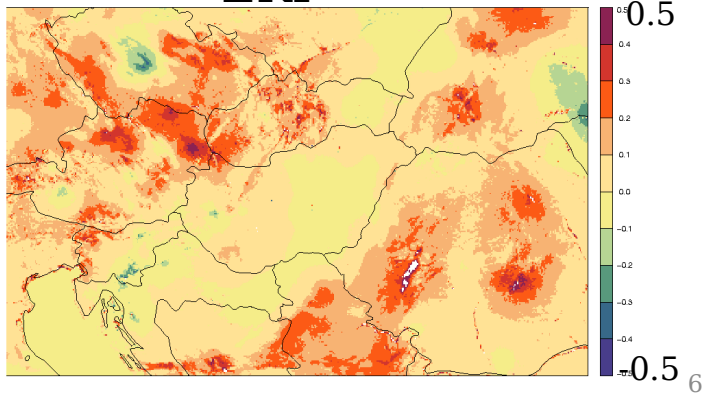


TG1 G-A OI-MAIN

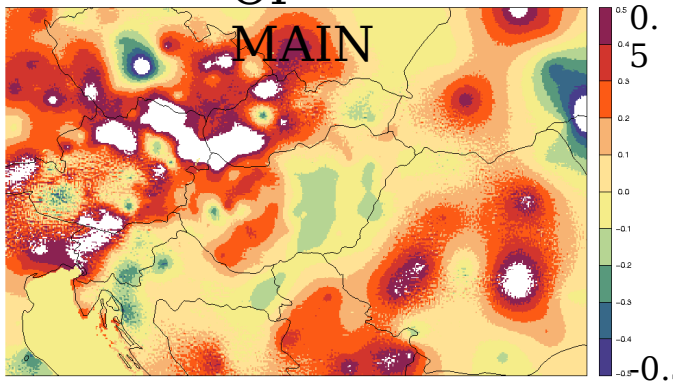


The structure of soil temp. increments are similar, but the effect of OI-MAIN is larger!

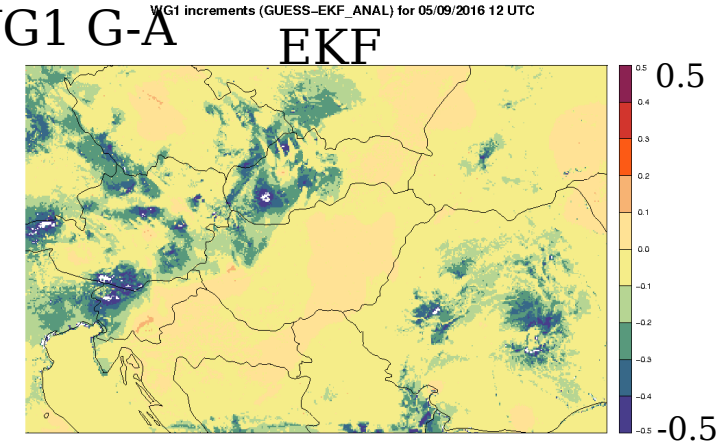
TG2 G-A EKF



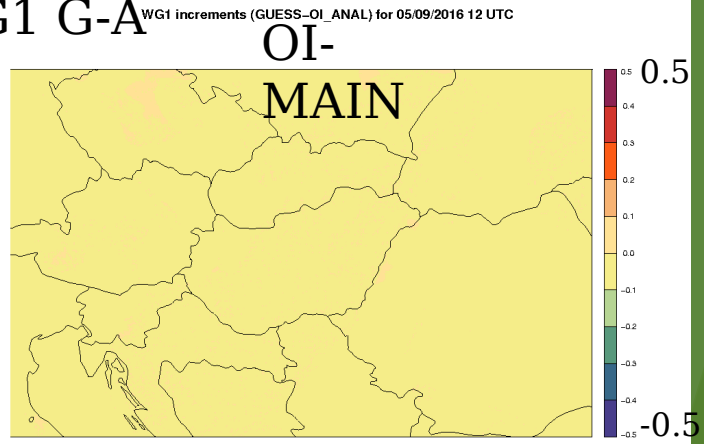
TG2 G-A OI-MAIN



WG1 G-A EKF

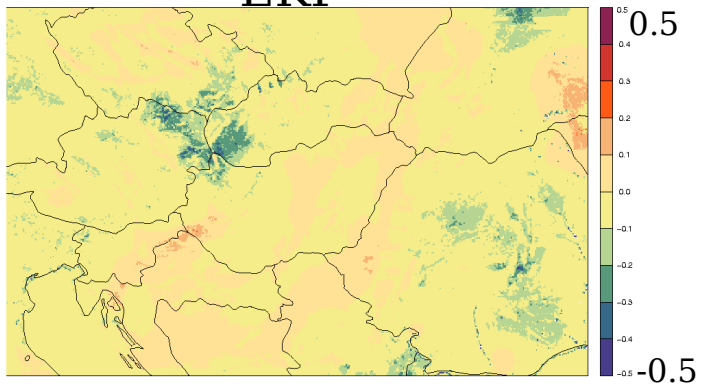


WG1 G-A OI-MAIN

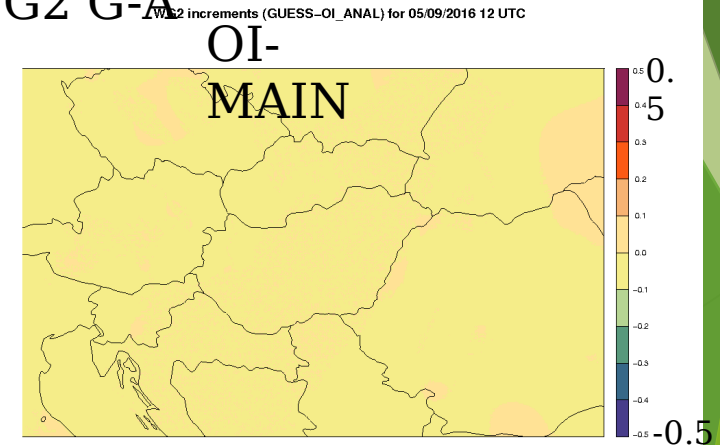


OI-MAIN produced smaller soil moisture increments than the EKF

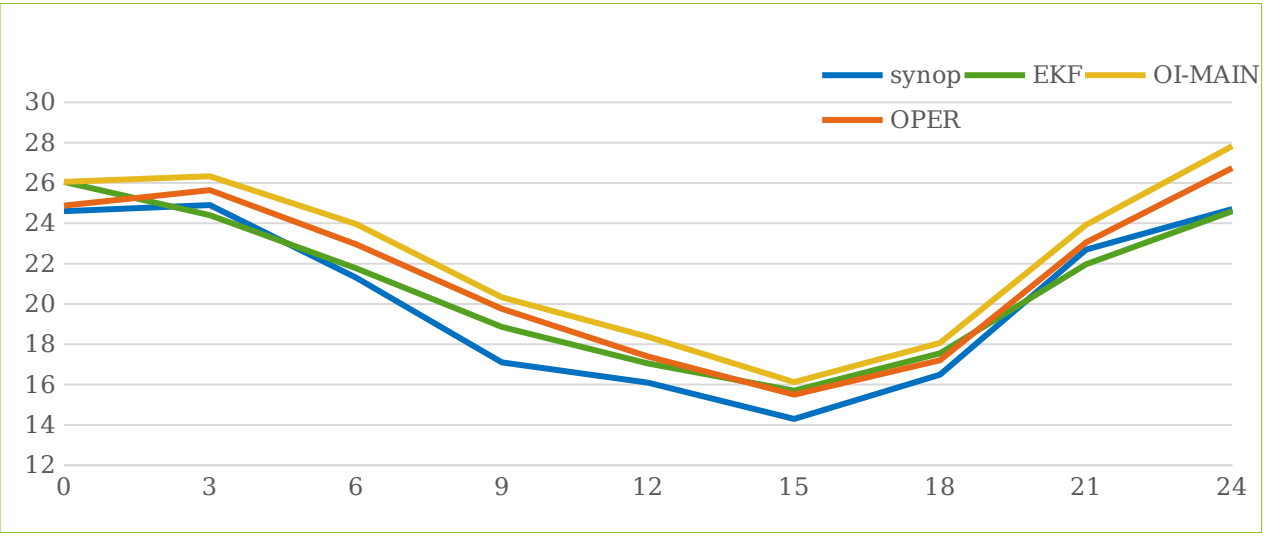
WG2 G-A EKF

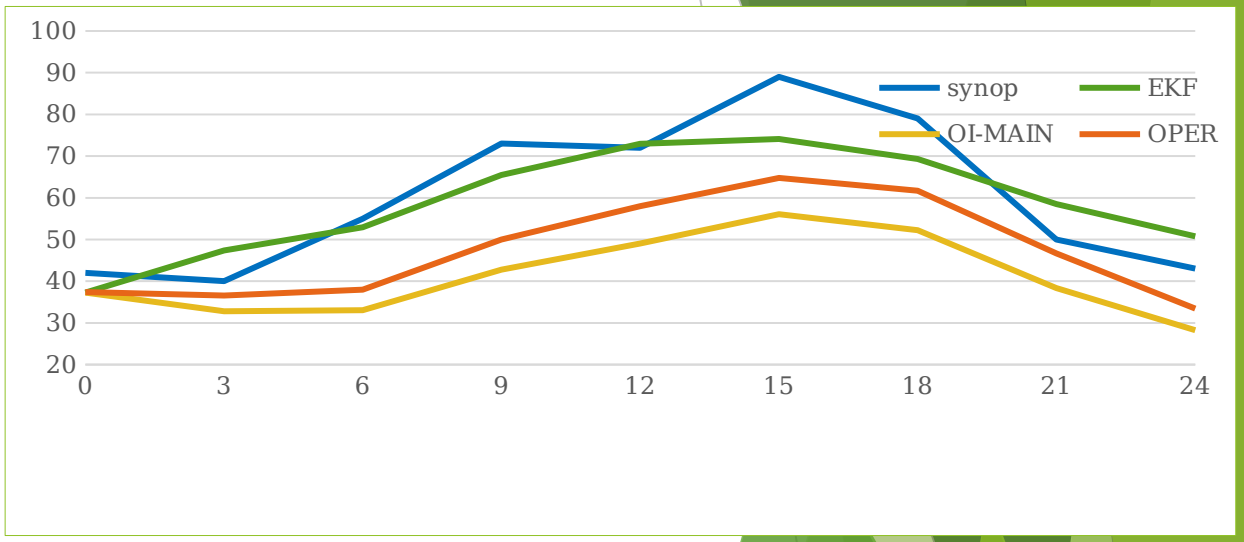


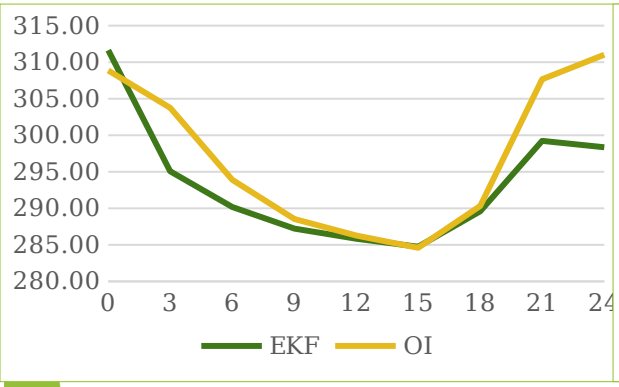
WG2 G-A OI-MAIN

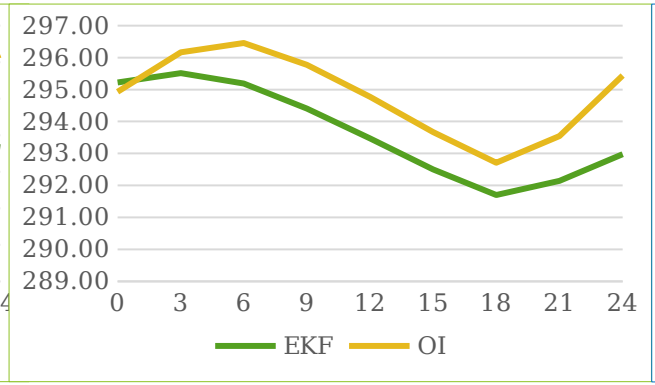


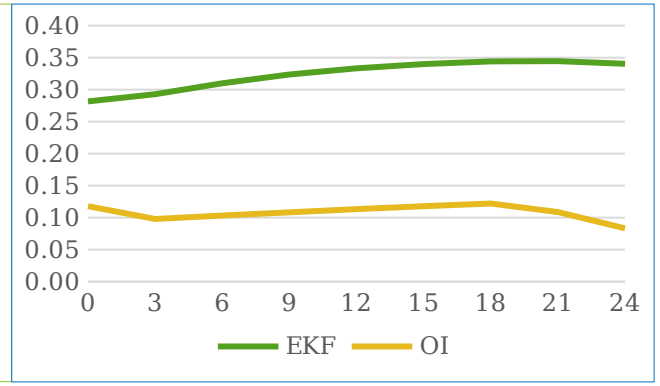
Impact on the forecast

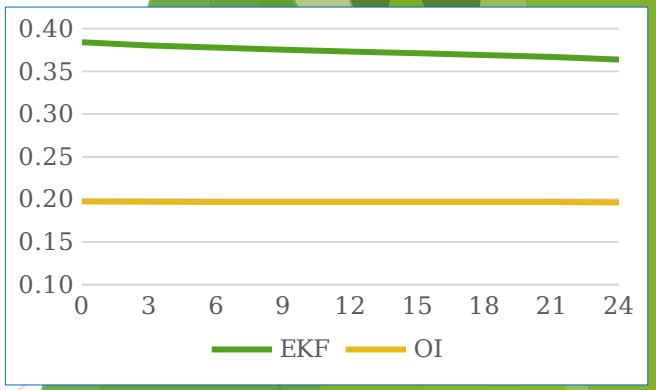




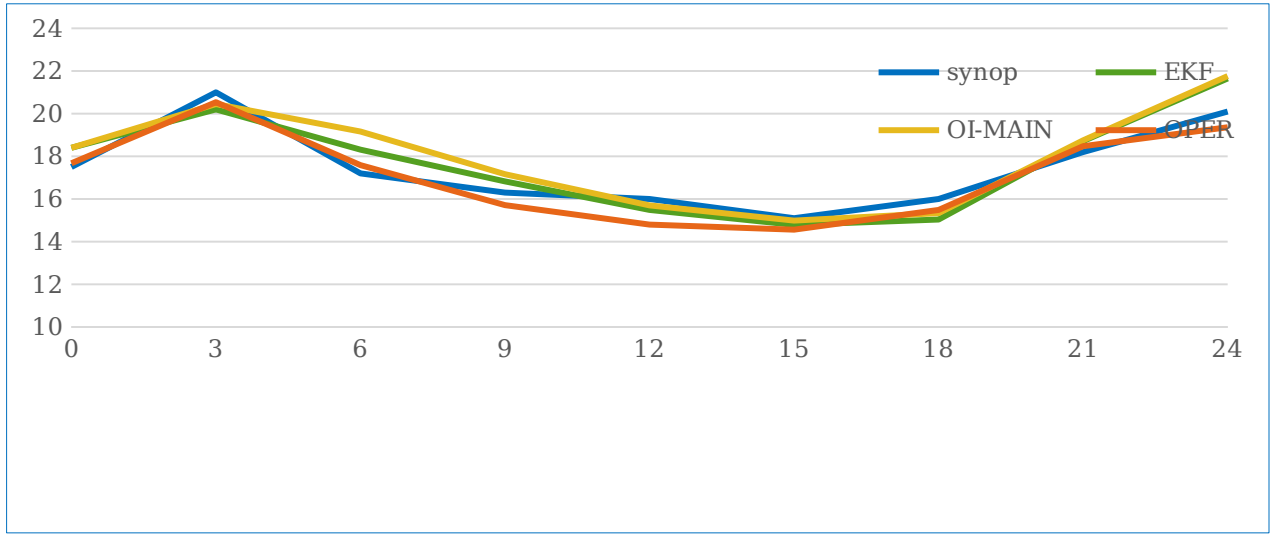


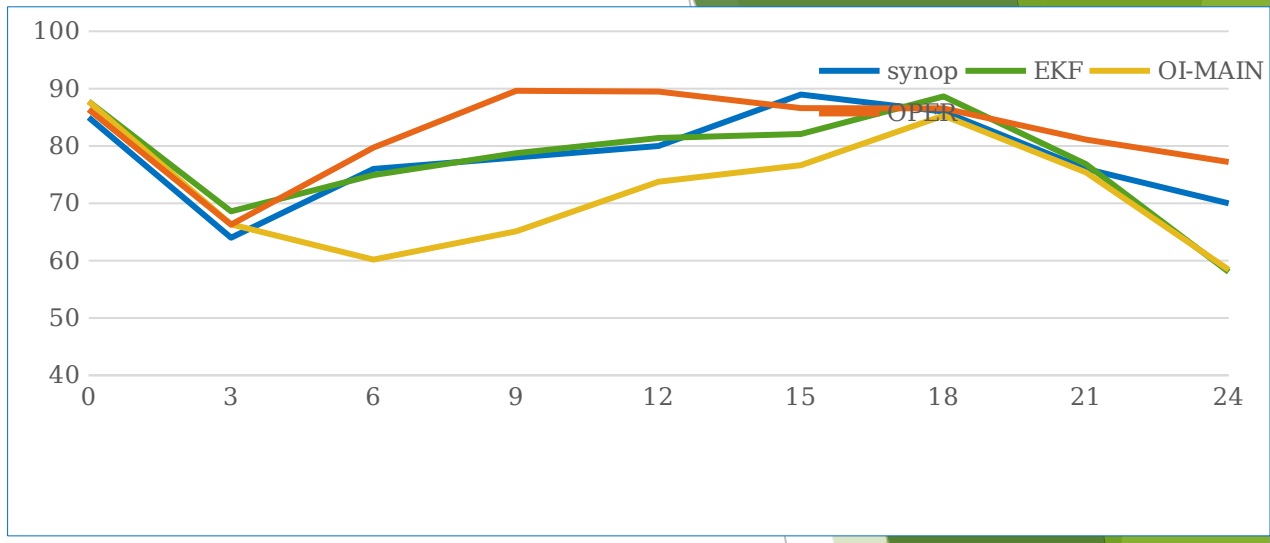


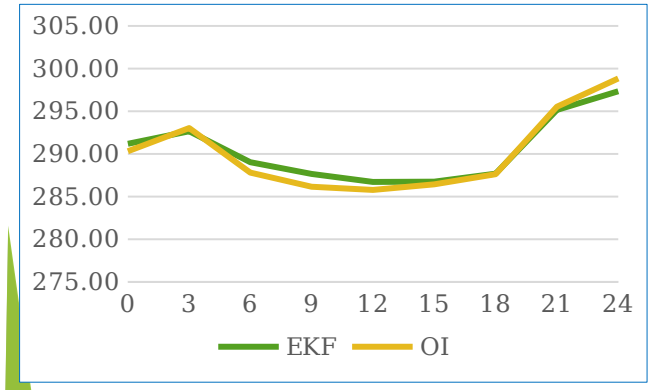


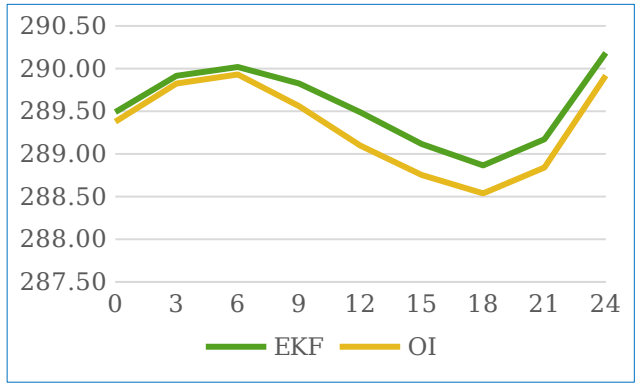


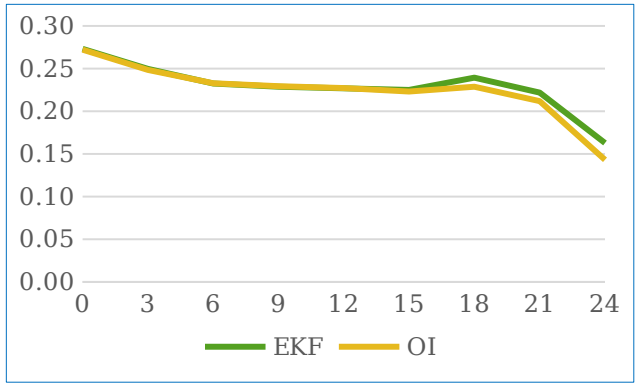
EKF produced more correct T2M and RH2M forecasts, than the OI-MAIN. + soil moisture predictions differ greatly

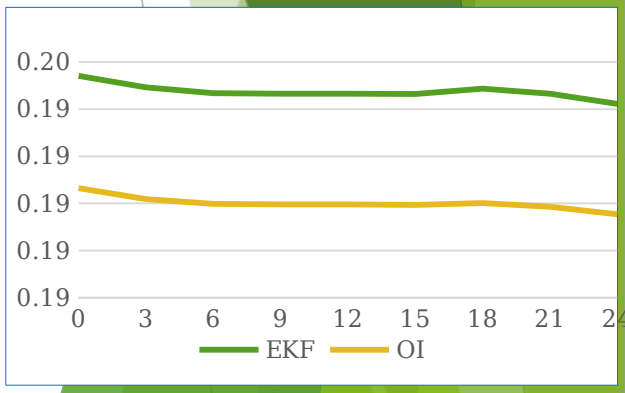












T2M forecasts are similar, and EKF produced more correct RH2M forecast, than the OI-MAIN. + deep soil moisture predictions differ greatly

Plans

- More tests in different analysis time (00, 06, 18 UTC), and in different weather situations
- Optimalization of the method: reference run + 4 perturbed runs in parallel
- EKF+3DVAR assim. + forecast for longer period (verification the forecasts)
- Assimilation at the end or at the beginning of the window?
- EKF of satellite WG1 observation