Data Assimilation activities in Hungary

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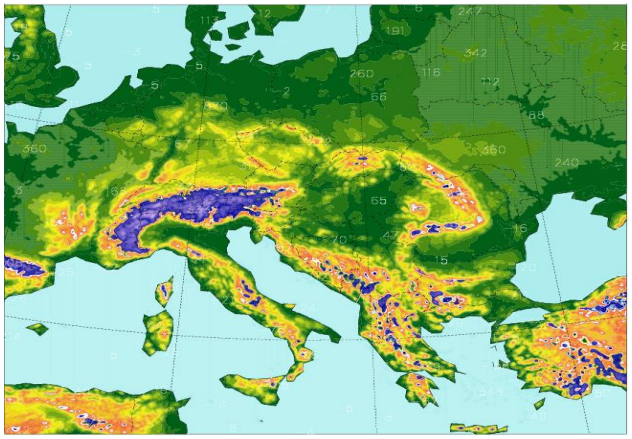
Outline

- Description of DA systems at OMSZ
- EDA background error simulation for ALADIN/ALARO
- Experiences with AROME DA
- Observation impact studies
- Future Plans
- Topics of the last DA WD

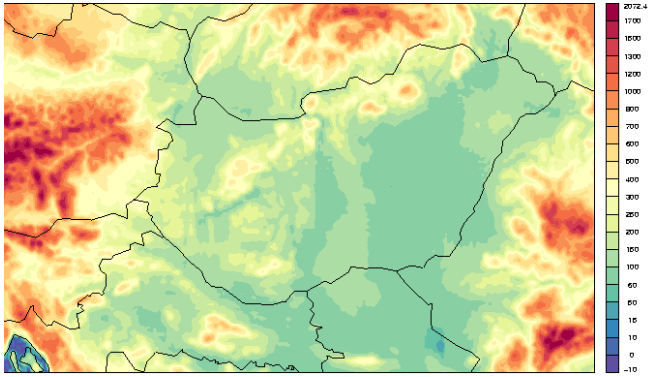
NWP systems

ALARO



- dx~8km
- 49 levels
- DFI initialization
- 4 runs/day, +60h (max)
- 3 hourly IFS LBCs
- ISBA
- operational 3DVAR/OI

AROME



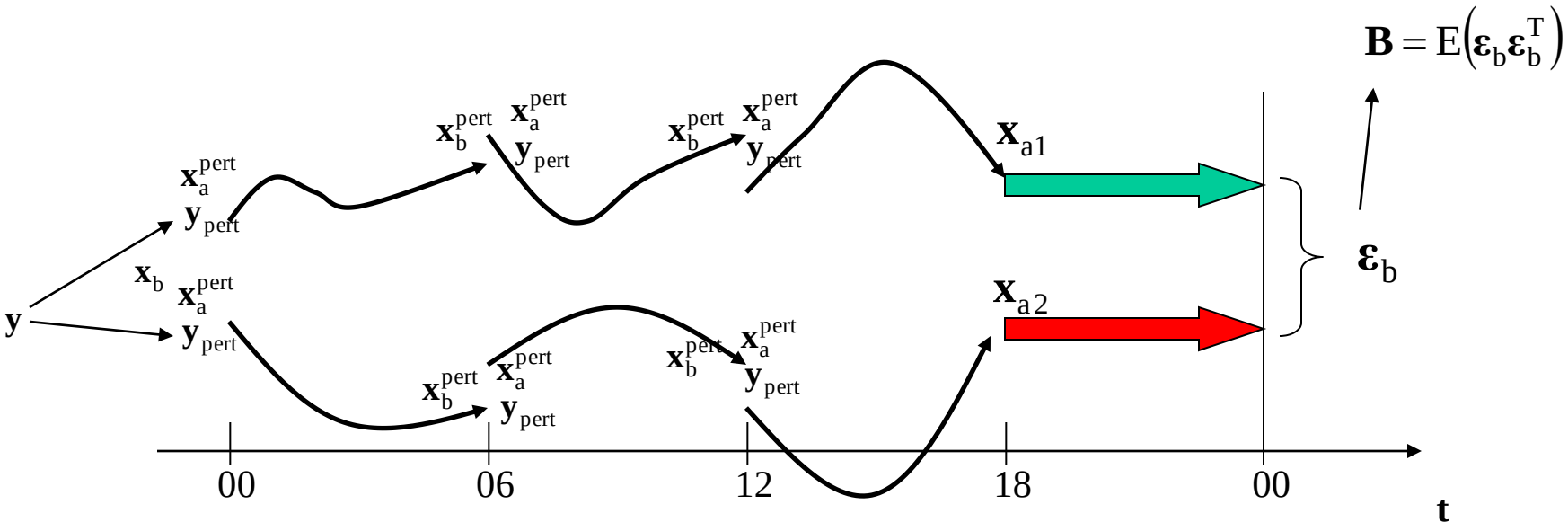
- dx~2.5km
- 60 levels
- No initialization
- 4 runs/day, +48h (max)
- 1 hourly ALARO LBCs
- ISBA in SURFEX
- dynamical adaptation from (ALARO) + 3DVAR/OI tests

Data Assimilation systems

	B matrix	**Cycling and initialization**	**LBCs**	**Observations**
ALARO	Ensemble: Downscaled AEARP EDA	6h cycling + DFI	3 hourly IFS – time consistent	SYNOP, SHIP, TEMP, AMDAR, ATOVS, AMV, SEVIRI
AROME	Ensemble: Downscaled ALADIN EDA	3h cycling, no DFI	1 hourly ALARO/IFS – space consistent	Tests with the above + radar reflectivity and wind

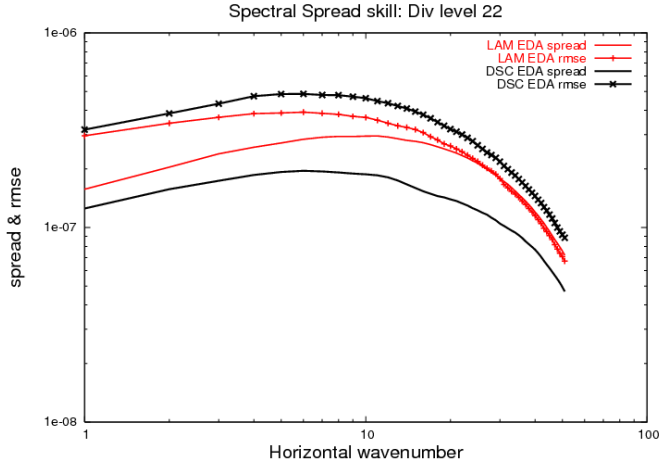
Background error simulation for ALADIN/ALARO

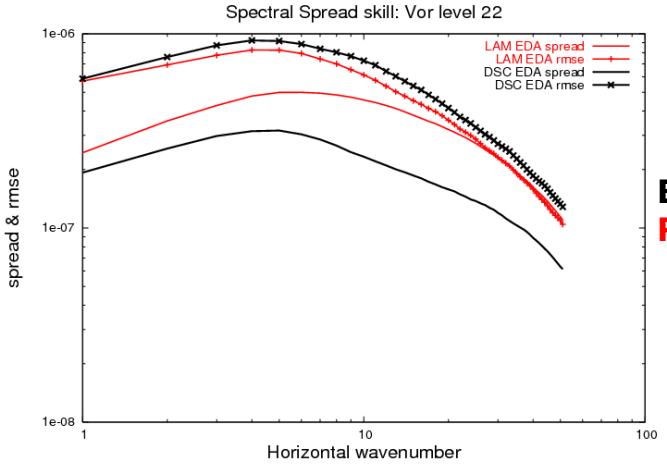
- 5 members Ensemble Data Assimilation in ALADIN
- Randomly perturbed observations (rescaled to obs error size) in 3DVAR and OI
- LBC perturbations by coupling to IFS EDA



Background error simulation for ALADIN/ALARO

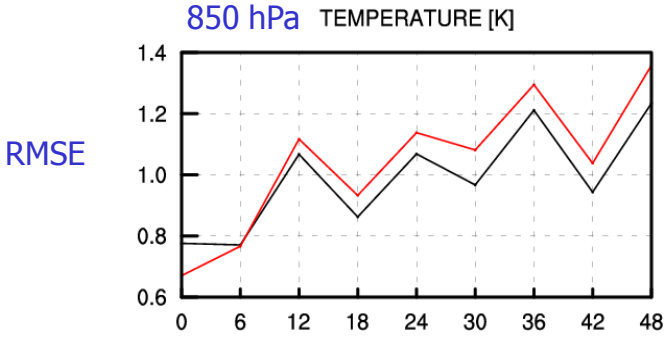
- Background error diagnostics

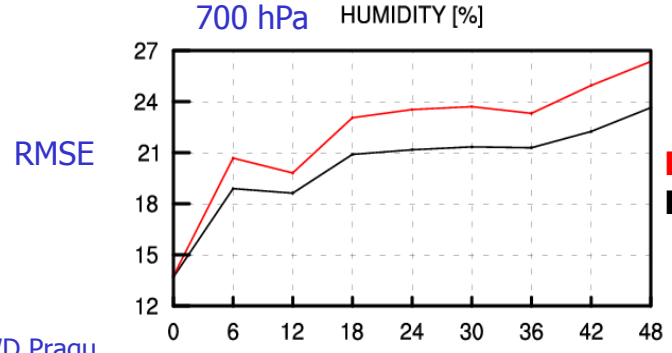




Black: OPER
Red: new B (EDA)

- Impact studies with the newly sampled B matrix





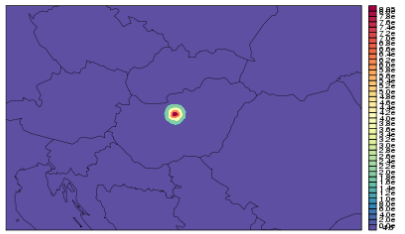
Red: OPER
Black: new B (EDA)

WD Pragu

Experiences with AROME DA

Background error statistics

„French" B

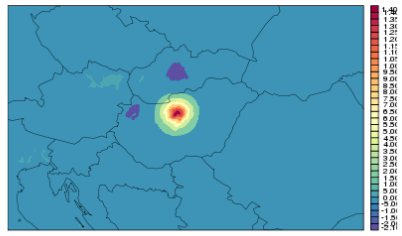


• Bug found in single observation experiments and later in the code for computing forecast differences (by Florian) due to G-P humidity in AROME files

• Try to use AROME/France B matrix in AROME/HU tests → shortcomings in the analysis due to different domain sizes (only the „flat" part of the spectra is seen, which mimics very short correlations)

• Recompute an AROME/HU B matrix after correcting the bug in the forecast difference computation

„Hungarian" B



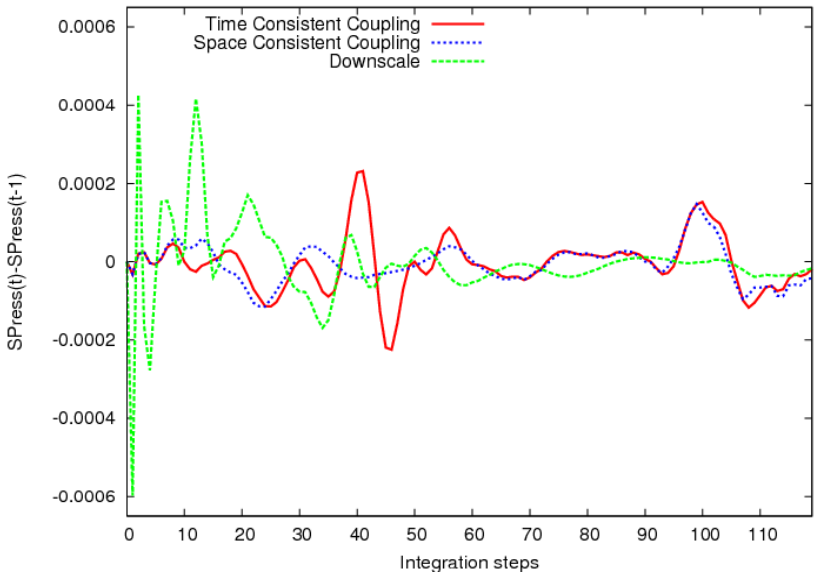
• Anisotropic structure of the humidity increments is observed after the bug corrections either the „french" or the „hungarian" B was used

Experiences with AROME DA

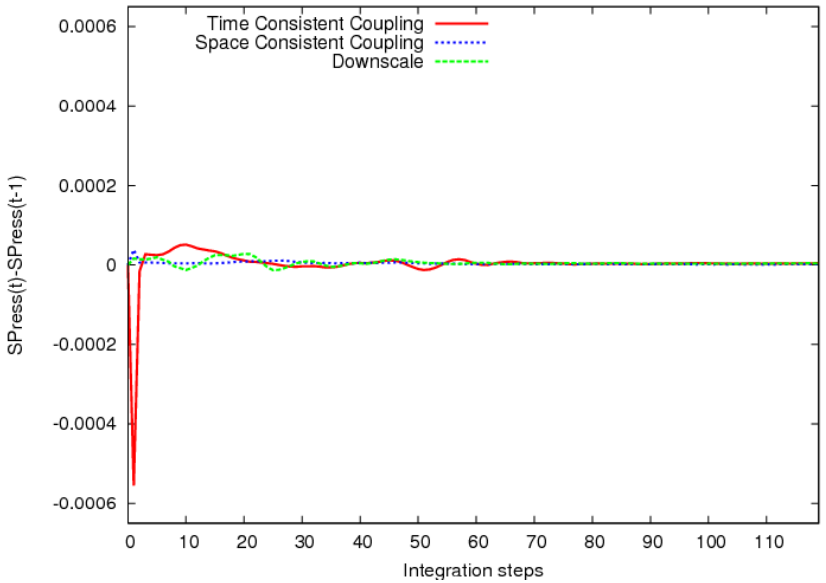
Spin-up: validation whether 3h cycling without DFI is a correct approach?

- yes, it is, a balanced Ps tendency is reached after 1.5 - 2 hours (not shown)
- dynamical adaptation implies more noise than 3DVAR
- if 3DVAR, a space-consistent coupling is more advantegous than a time-consistent one

Mountainous point



Point close to the domain border



Experiences with AROME DA

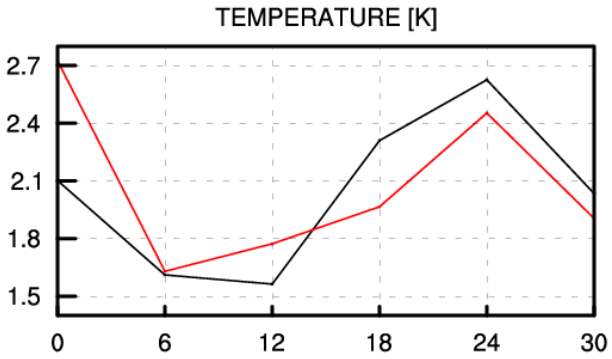
OI_MAIN

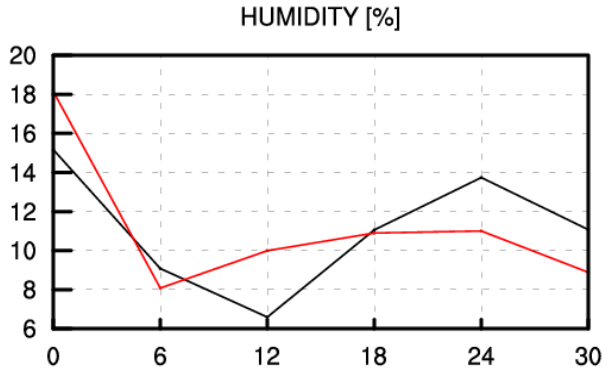
• Strategy chosen at first: apply surface analysis (OI_MAIN) operationally first in AROME (while 3DVAR tests are ongoing)

• in dry regimes OI_MAIN helps to correct the wet and cold bias present in our AROME dynamical adaptation (interpolated ALARO CANARI) → the first 12 hours are improved

• in wet regimes OI_MAIN alone is not able to beat dynamical adaptation, even some degradations are present

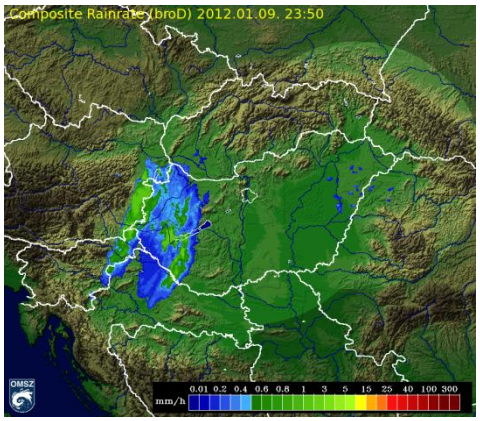
• probably OI_MAIN will be further tested together with upper-air 3DVAR





Observation impact studies

Radar composite

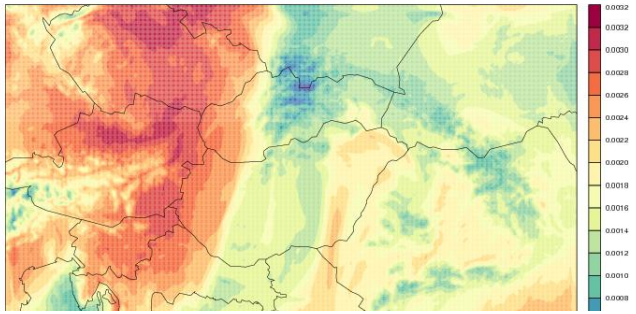


Radar assimilation

- reflectivity and radial wind assimilation from 3 Hungarian radars is done in AROME
- ODB preparations and screening statistics validated
- humidity and wind increments implied by radars look realistic in terms of increment shapes and amplitudes
- few case studies run: they show (see the figures) that radar observations speed-up frontal precipitation bands by moistening ahead and drying behind the front

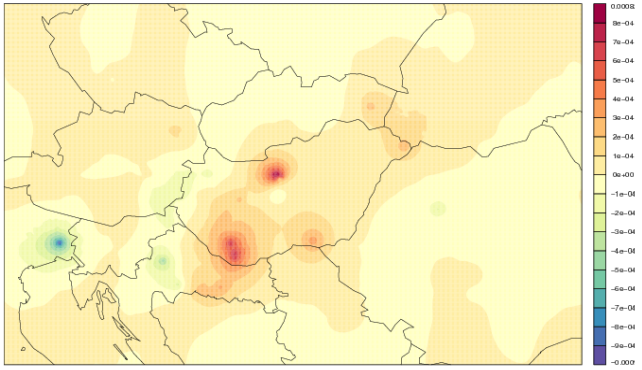
S040HUMI.SPECIFI
2012/1/9 z18:0 +6h

guess



S040HUMI.SPECIFI
2012/1/10 z0:0 Uninitialized

ana - guess



Observation impact studies

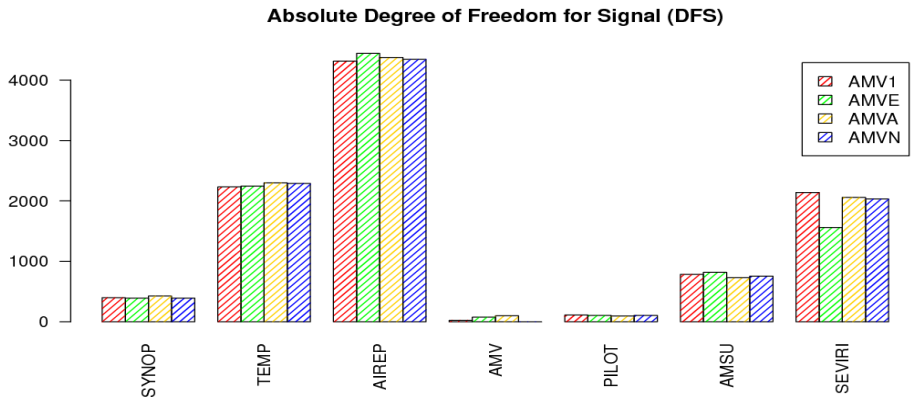
ATOVS channel selection

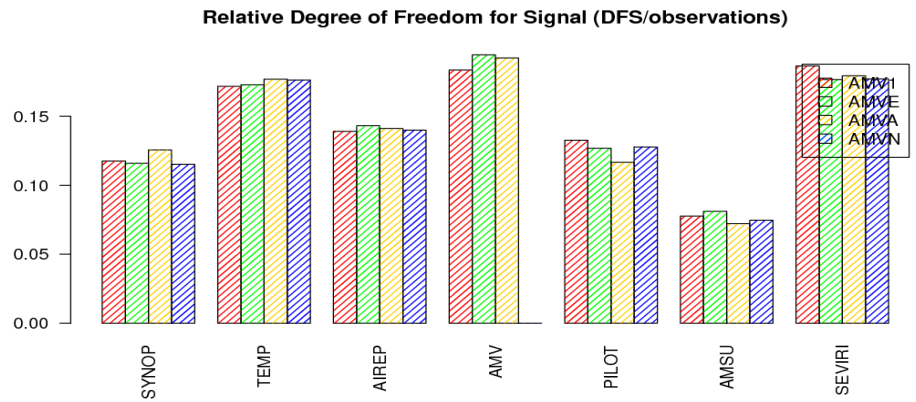
- Channel selection relaxed: some low and high-peaking channels kept → slight positive impact compared to the strict selection.

- Lower peaking channels are important

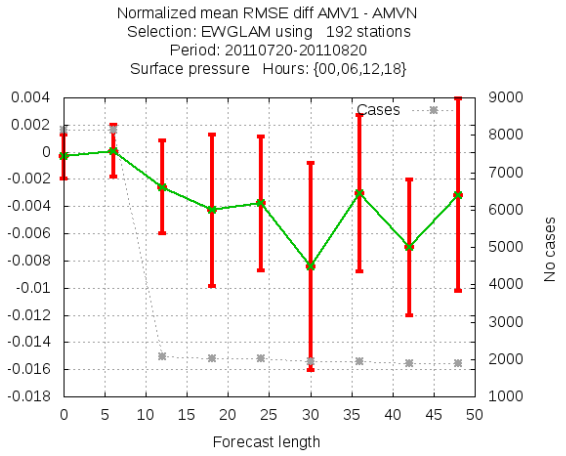
Observation impact studies

MSG Atmospheric Motion Vectors





- locally processed AMV data tested in a slightly higher resolution than EUMETCast obs
- DFS shows a small contribution of AMV data to the analysis increments (due to the relatively low amount of AMV observations) → DFS normalized by the no. of observations implies a rather high importance
- slight positive impact of the locally processed AMV-s (over without AMV)



Future Plans

- Operational data assimilation for AROME: 3h cycling, 3DVAR + OI_MAIN

- Improve B matrices: in ALARO apply the B matrix sampled from ALADIN EDA, create an AROME EDA for B sampling (when enough observations)

- Testing IDFI in ALARO

- Try to reduce CPU costs in AROME minimization: test the CONGRAD minimization for cheaper convergence in AROME 3DVAR

- Observations: include ATOVS from METOP and NOAA19, AMV in higher resolution, IASI and GPS. In AROME relax the thinning distances where possible.

- Include EDA perturbations to the LAM EPS system (presently downscaled from PEARP)

Topics of the last DA WD

Topics tackled at OMSZ:

• Testing the OI MAIN surface analysis in SURFEX: for our AROME model we have been testing OI MAIN intensively.

• Sort out E-GVAP data policy for LACE: presently only Croatia and Hungary are members of the E-GVAP programme, which means that they can have a free access to all E-GVAP data. We have been in contact with the E-GVAP programme manager (PM) to sort out whether other LACE countries can access (and if yes how) the E-GVAP data through OPLACE? Presently we are waiting for the answer of the E-GVAP PM.

We did not find time to progress in the following subjects:

• Investigate the lack of soil moisture increments in CANARI (SURFRESERV.EAU) depending on FA packing options.

• Test the decoupling of Pb (vorticity balanced geopotential) and temperature in the background error balances to see whether Ps/geopotential analysis increments harm temperature analysis increments through the balances.

• Try to reproduce negative specific humidity in AROME analysis fields

• Investigate whether GPS can be read directly from BUFR in BATOR and how the bias correction is applied.

• Inclusion of LandSAF albedo to OPLACE

Thank you for your attention!

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