Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

DA status - Slovenia 2021

Benedikt Strajnar with input from ARSO team

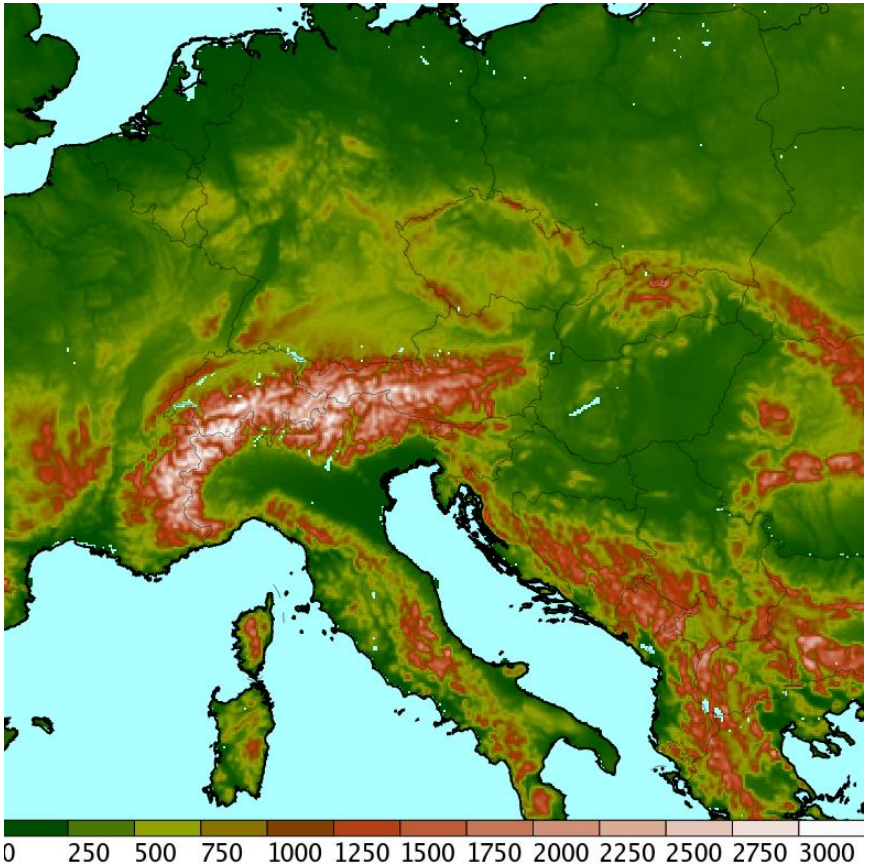
ZAMG DHMZ Czech Hydrometeorological Institute OMSZ IMGW METEO ROMANIA SHMU ARSO METEO Slovenia

Contents

- Operational and experimental setups
  - ALADIN/4.4 km, SEEMHEWS, RUC
- Radar DA activities
  - Reflectivity
  - Dealiasing of winds
- GNSS E-GVAP (passive use)
- Obsmon installation
- Plans

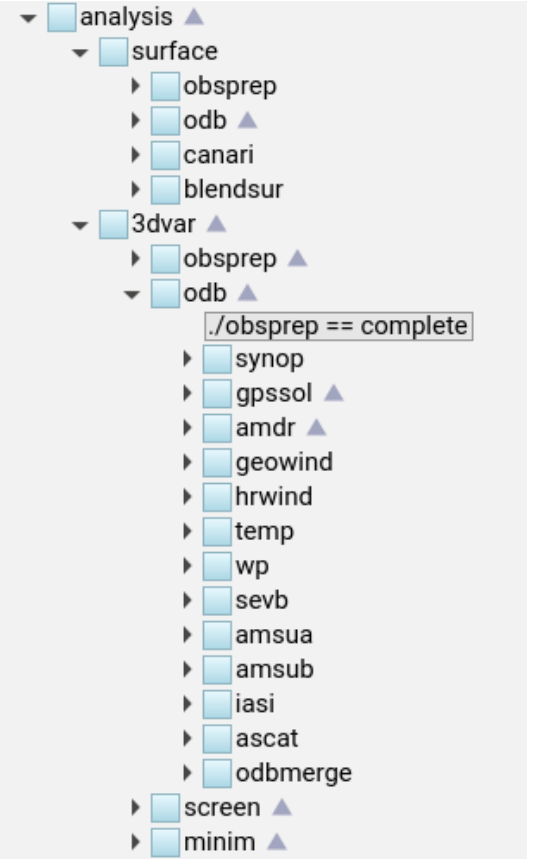
Main operational system (SIS4)

- Model: ALARO-v1B cy43t2_bf10
- 4.4 km, 87L, 432x432
- Timestep: 180 s
- Coupling: ECMWF (6h lag), 1h/3h
- Space-consistent LBC, no init.
- 72h/36h forecasts every 3h (cutoff 1.5 h)
- Upper-air DA: 3h 3D-Var, static ENS DSC B matrix
- Observations: SYNOP, AMV, HR-AMV, TEMP, AMSU&MHS, SEVIRI, IASI, ASCAT, OSCAT, Mode-S MRAR SI/CZ, MUAC EHS



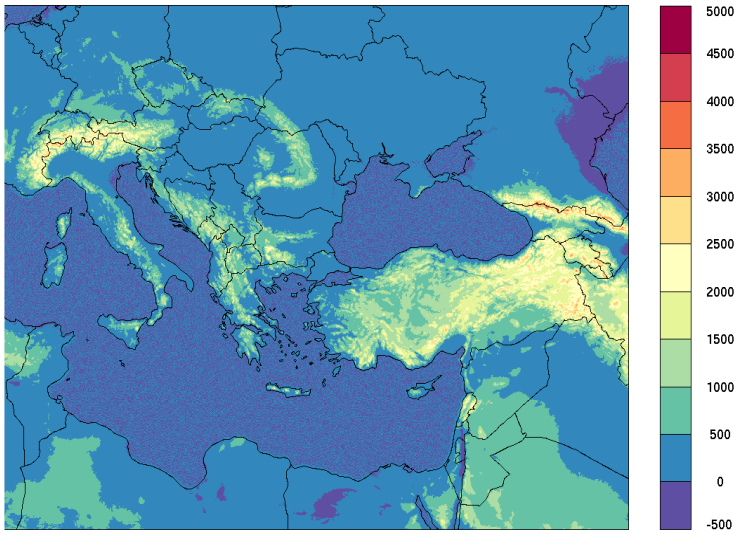
Changes in the assimilation step

- multiple ODB pools in one file: ODB_OI_METHOD=4
- reordering of assimilation: surface analysis first to improve Ts for radiance assimilation
- skipped BLEND (solution for GFL cycling within the minimization)



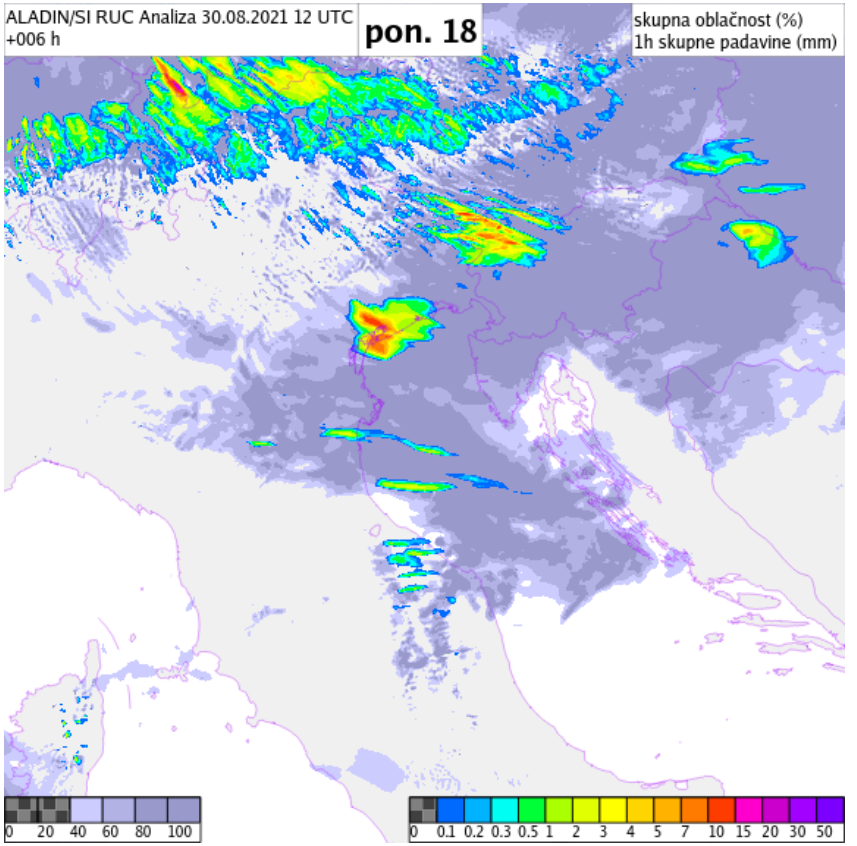
SEEMHEWS DA system

- Project financed by WMO/World Bank to increase flood awareness in SE Europe
- Runs at cca@ECMWF
- model: ALARO-v1B cy43t2_bf10
- 2.5 km, 87L, 1429x1141
- timestep: 90 s
- coupling: ECMWF (no lag), 1h/3h
- space-consistent LBC, no init.
- upper-air DA: 3h 3D-Var, static ENS DSC B matrix (600 cases)
- all obs. as in operational SIS4, observations from OPLACE
- production runs (72 h forecasts once per day) from late 2020
- TODO: additional observations from the project available in BUFR - to be included



RUC for nowcasting

- centered in the N Adriatic Sea
- Model: ALARO-v1B cy43t2_bf10
- 1.3 km, 87L, 589x589
- Timestep: 60 s
- Coupling: ECMWF (lag 6h to 12h), 1h/3h
- Space-consistent LBC, no init.
- Cutoff times:
- Assimilation: 70 min after nominal time
- Production: 35 mins after nominal times, 36h forecasts every
- Upper-air DA: 1h 3D-Var, static ENS DSC B matrix
- All obs in SIS4 + radar
- Output (in-line fullpos) every 5 min, plots and movies available for subjective validation



RUC evaluation

- Technical issues:
  - timeliness of OPERA data (solved)
- Scientific issues (subjective):
  - To much light orographic precipitation
  - ✗ Net drying observed by the reflectivity assimilation:
  - ✓ Important convective cases missed/damped
  - Spurious precipitation successfully removed from first guess

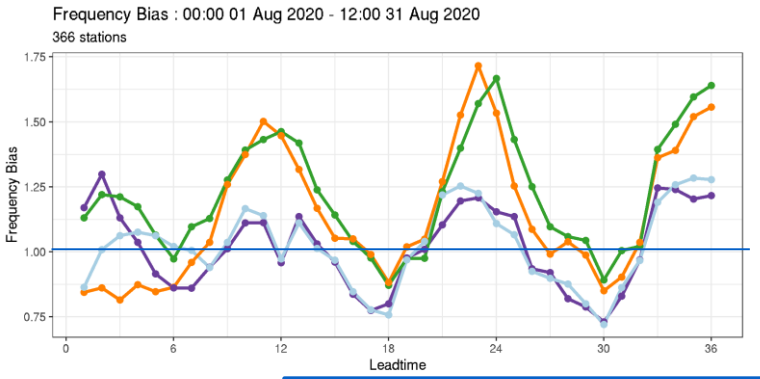
Objective validation RUC/radar DA

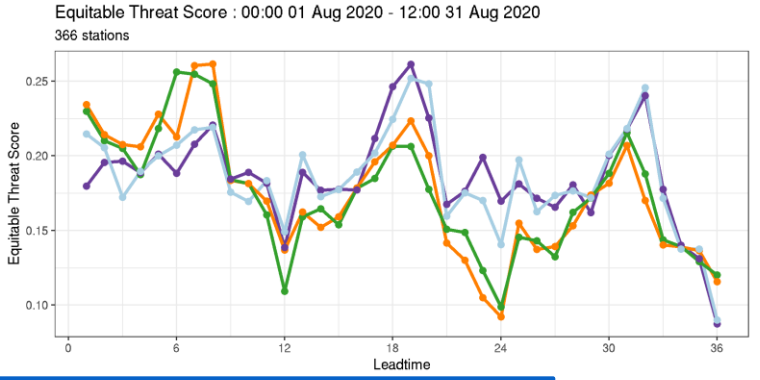
- 4 experiments – 1 winter and summer month:
  - 4.4km OPER (default obs.)
  - 4.4km OPER + radar refl.
  - 1.3 km NWCRUC (default obs.)
  - 1.3 km NWCRUC + radar refl.
- DA settings:
  - 1.3 km: 1h cycle, thinning 10 km
  - 4.4 km: 3h cycle, thinning 25 km

Performance of RUC/impact of radar DA

LACE nwp central europe

SUMMER

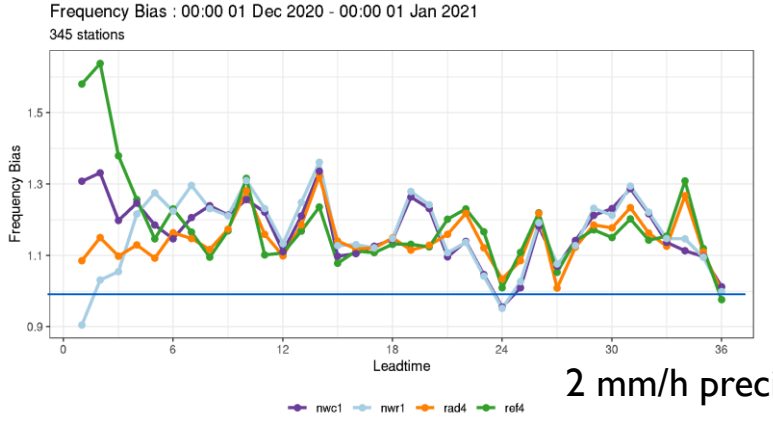


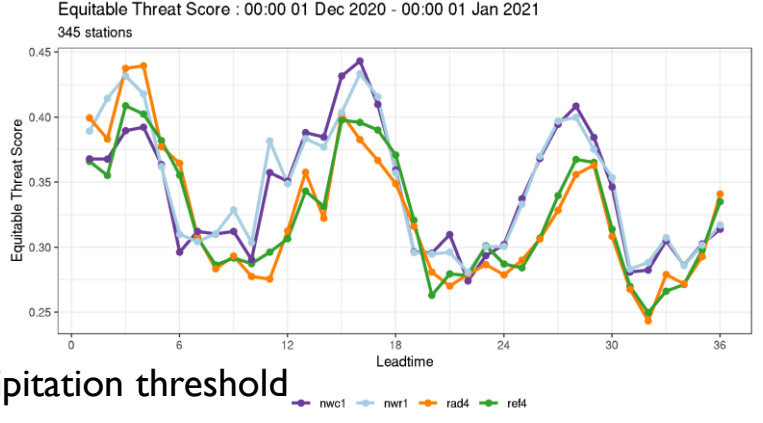


RUC RUC+RADAR OPER OPER+ RADAR

Verification for AccPcp1h

WINTER





2 mm/h precipitation threshold

Verification for AccPcp1h

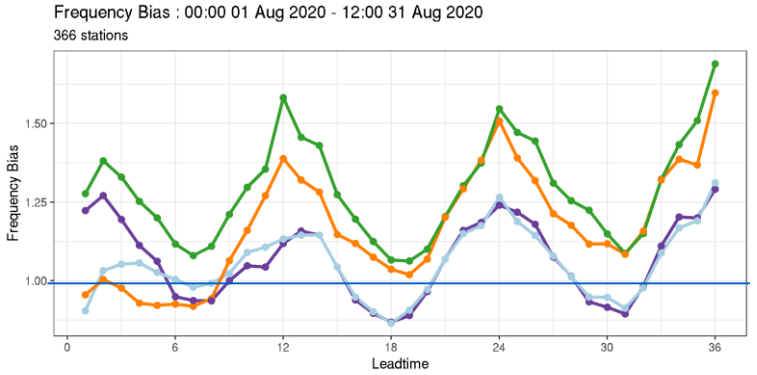
Verification for AccPcp1h

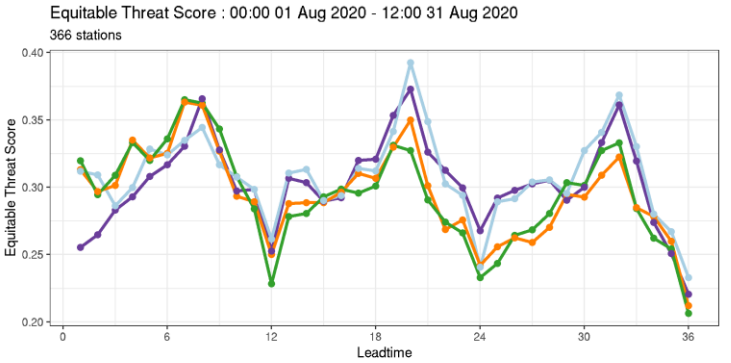
ZAMG DHMZ Czech Hydrometeorological Institute OMSZ IMGW METEO ROMANIA SHMÚ ARSO METEO Slovenia

Performance of RUC/impact of radar DA

LACE nwp central europe

SUMMER

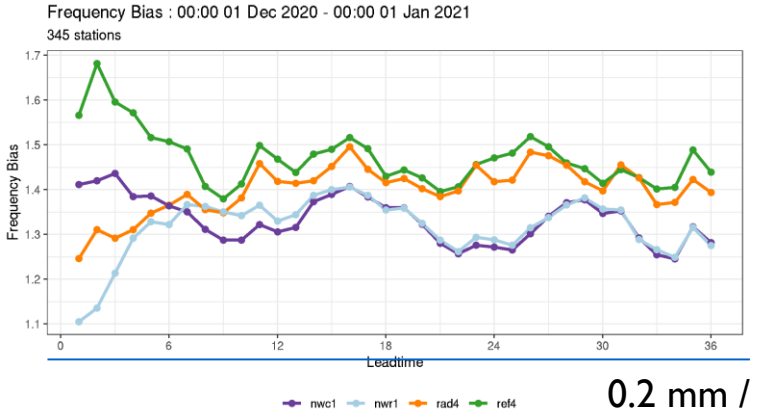


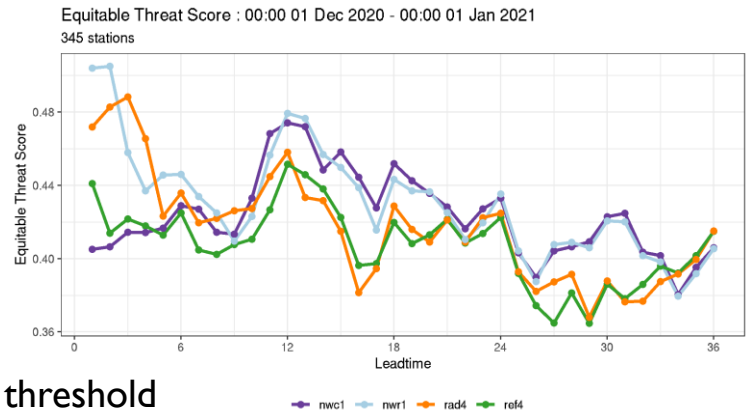


RUC RUC+RADAR OPER OPER+ RADAR

Verification for AccPcp1h

WINTER





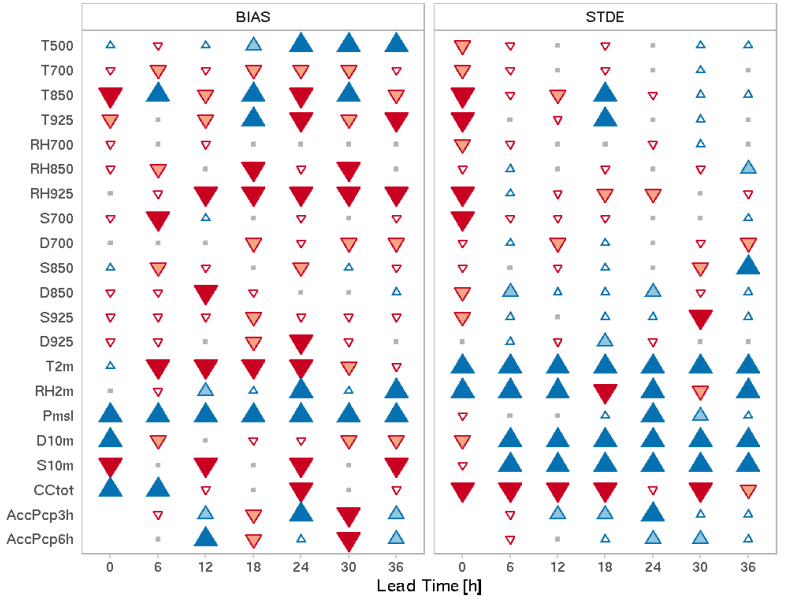
0.2 mm / h threshold

ZAMG DHMZ Czech Hydrometeorological Institute OMSZ IMGW METEO ROMANIA SHMÚ ARSO METEO Slovenia

Performance of RUC/impact of radar DA

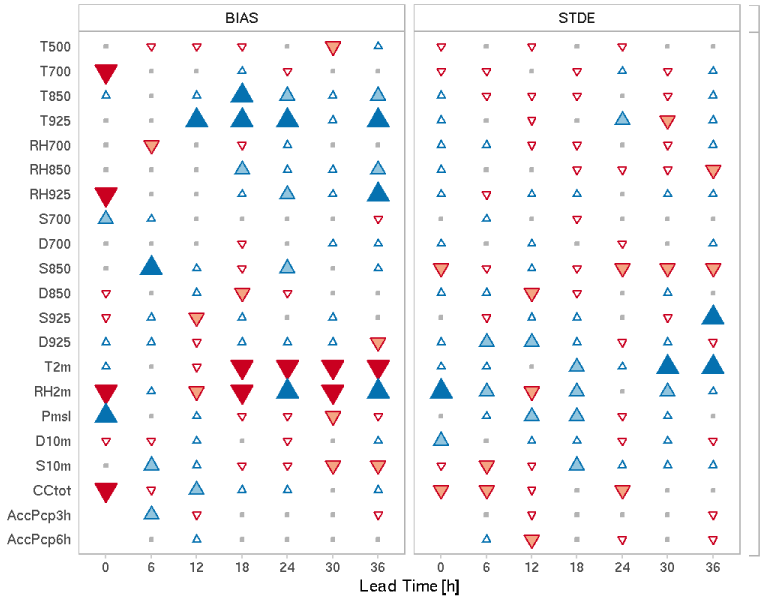
LACE nwp central europe

RUC (1.3 km) vs. OPER (4.4 km)



nwc1 worse than ref4 with signifcance > 99.7%
nwc1 worse than ref4 with signifcance > 95%
nwc1 worse than ref4 with signifcance > 68%
No significant difference between nwc1 and ref4
nwc1 better than ref4 with signifcance > 68%
nwc1 better than ref4 with signifcance > 95%
nwc1 better than ref4 with signifcance > 99.7%

RADAR DA vs. REF



nwr1 worse than nwc1 with signifcance > 99.7%
nwr1 worse than nwc1 with signifcance > 95%
nwr1 worse than nwc1 with signifcance > 68%
No significant difference between nwr1 and nwc1
nwr1 better than nwc1 with signifcance > 68%
nwr1 better than nwc1 with signifcance > 95%
nwr1 better than nwc1 with signifcance > 99.7%%

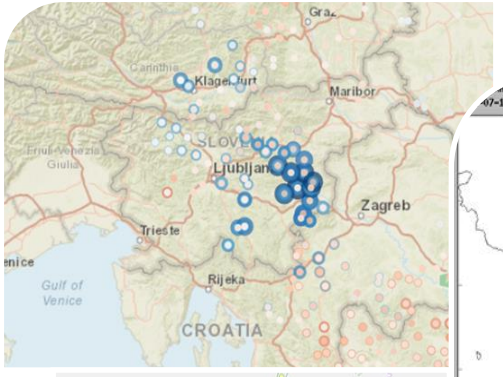
ZAMG DHMZ Czech Hydrometeorological Institute OMSZ IMGW METEO ROMANIA SHMÚ ARSO METEO Slovenia

Analysis of excessive drying by radar DA

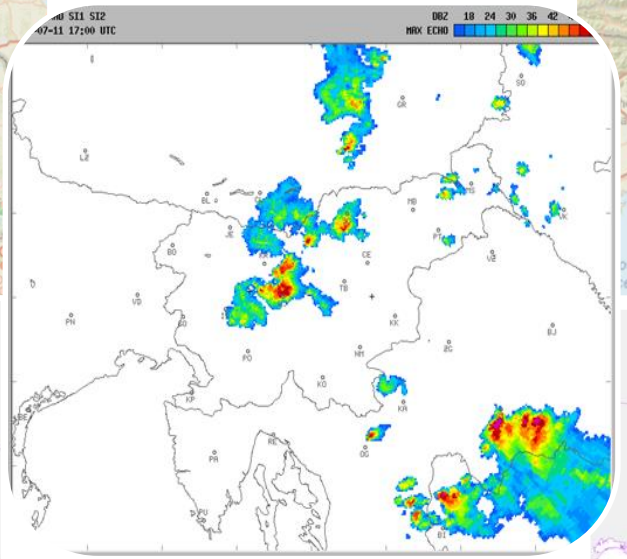
- Treatment of dry pixels with fg_depar = 0 (A. Bučanek):

  IF satbody%flgdyn_at_radar_body == 0 AND Mrefl < Orefl THEN redefine Mrefl (Mrefl = Orefl).

ANALYSIS



Large weight to dry pixels



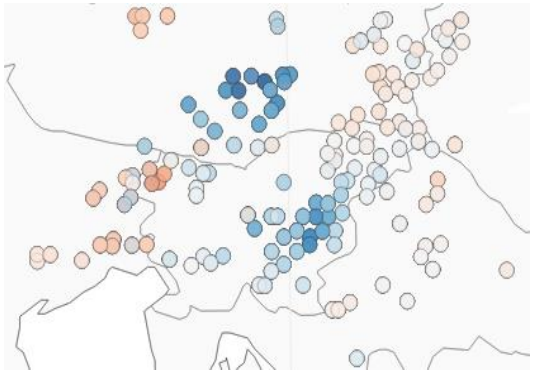
Dry pixels suppressed

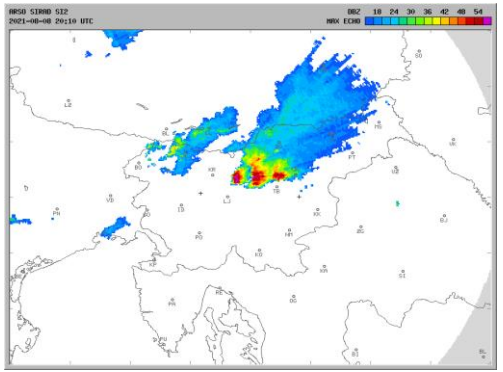
+ 1H FCST.

Analysis of excessive drying by radar DA (2)

LACE
nwp central europe

ANALYSIS

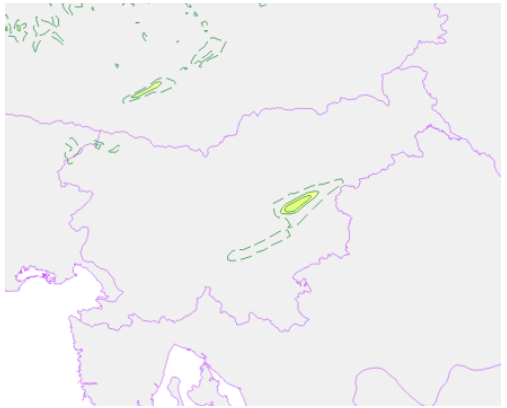


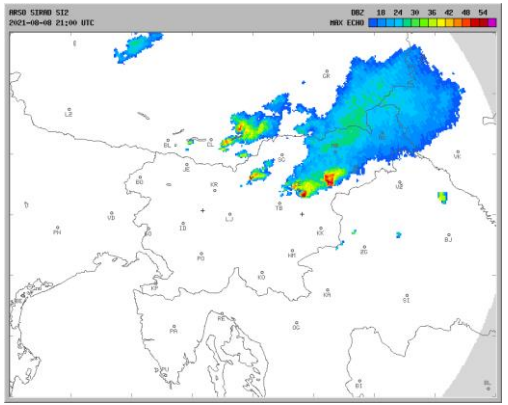


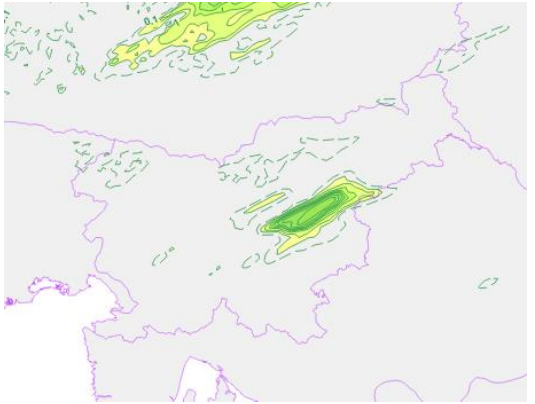
Large weight to dry pixels

Dry pixels suppressed

+ 1H FCST.



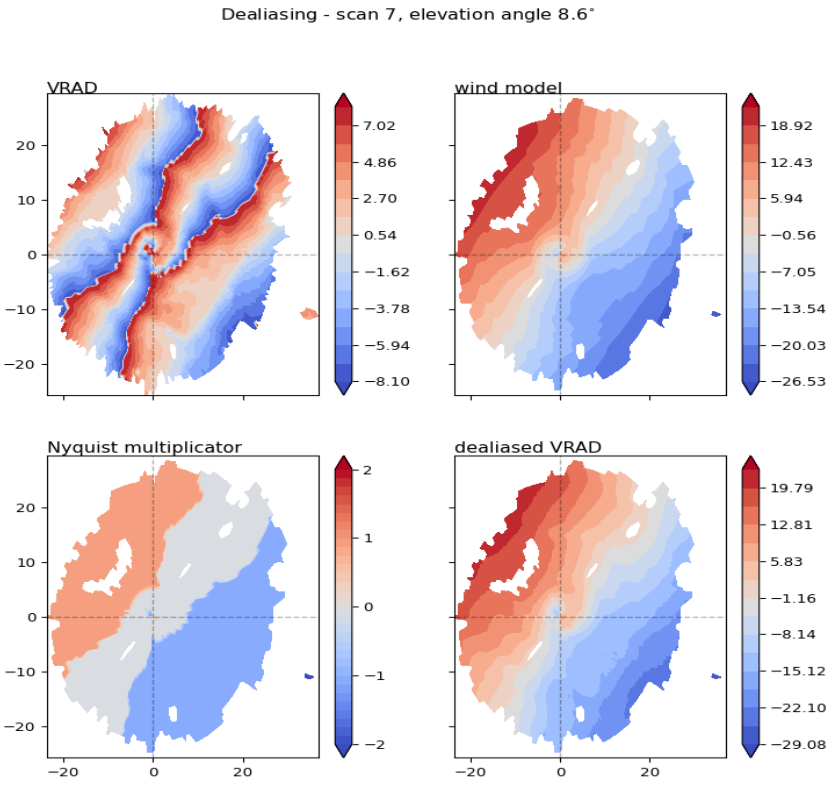




ZAMG DHMZ Czech Hydrometeorological Institute OMSZ IMGW METEO ROMANIA SHMÚ ARSO METEO Slovenia

Radar dealiasing: application of the torus method (in HOOF)

- Torus mapping chosen for implementation in HOOF
- Several fixes versus the initial implementation (pres. P. Smerkol)

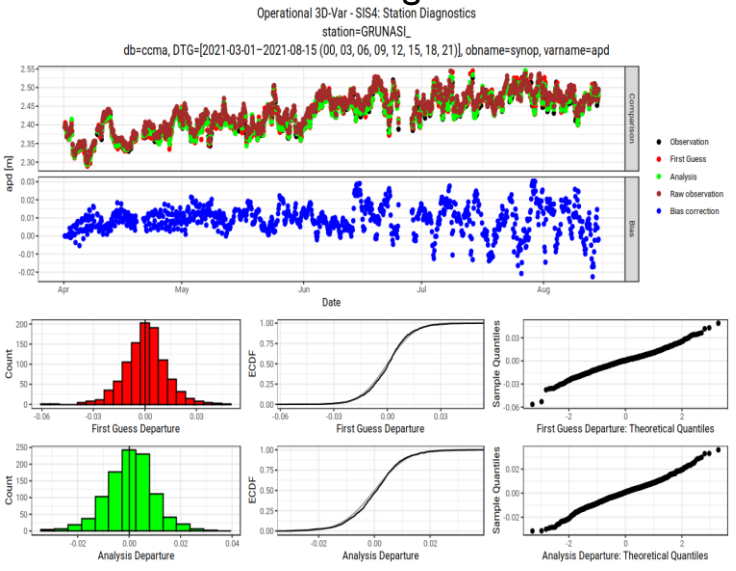


Passive assimilation of E-GVAP ZTD observations

- Passive use of E-GVAP (correction in upecma.F90, obs.error multiplied by 100)
- Jumpiness in bias correction during summer → decreased obs. error in passive assimilation

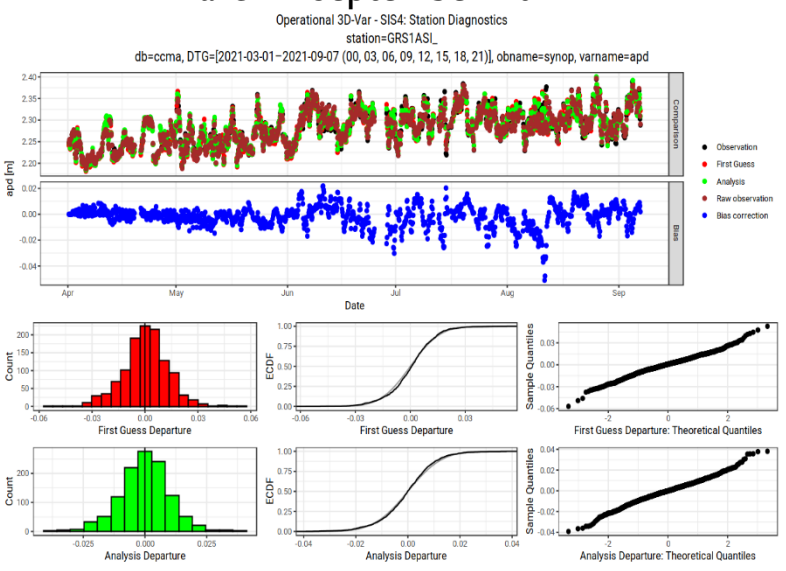
Gorizia (IT)

March – August 2021



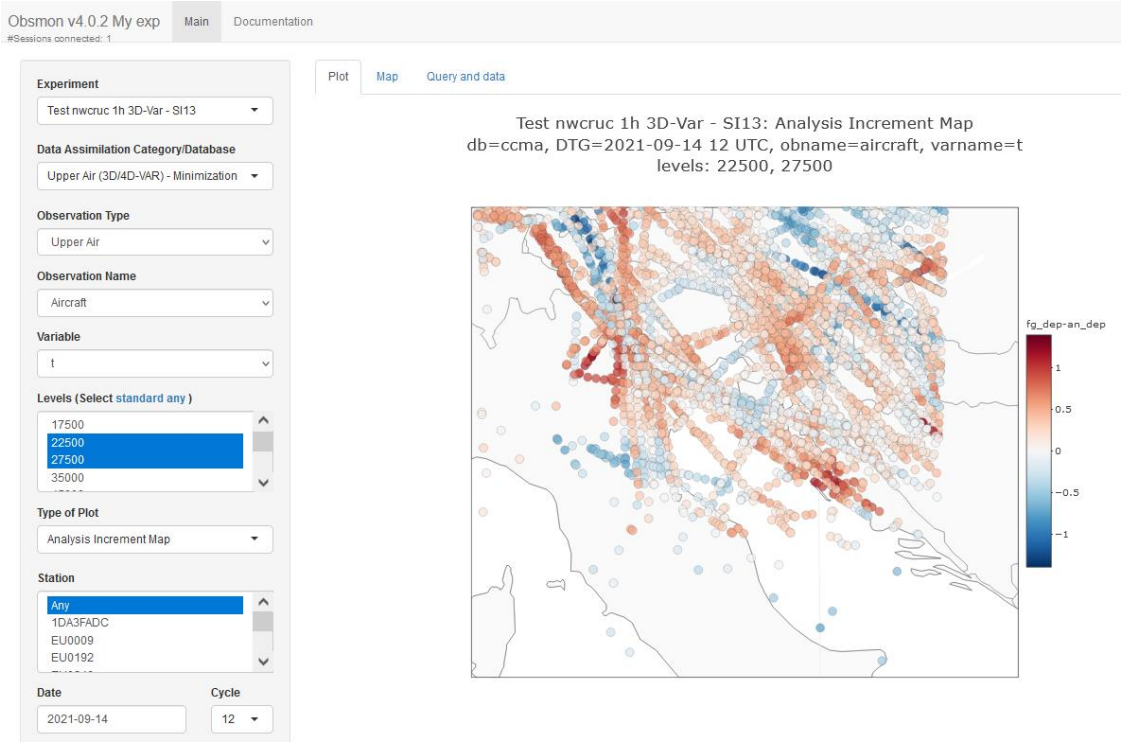
Ljubljana (SI)

March – September 2021



Operationalization of Obsmon

- Backend as a multitask job (32 processes)
- A fix (misplaced loop) provided by Antonio to compute all parameters of the obstype
- Implemented for 4.4 km and 1.3 km suites, incl. radar
- every morning for all runs of last day + missing times
- Front-end (v4) Shiny server to be containerized (outside HPC)



Plans

- RUC: optimization and operationalization
  - Reach satisfactory performance of reflectivity DA
- First tests with radial winds
- E-GVAP (currently passive) to be evaluated
- Increased work on microlinks (data to arrive soon)
- Work on coupled ALARO-SURFEX and later test of OI
- OOPS familiarization: continue to follow 3D-Var implementation, on the longer term try EnVar (+EDA)

Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Thank you for attention!

ZAMG DHMZ Czech Hydrometeorological Institute OMSZ IMGW METEO ROMANIA SHMU ARSO METEO Slovenia