Regional Cooperation for
Limited Area Modeling in Central Europe

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Data assimilation status and activities in Slovenia - 2024

Benedikt Strajnar with inputs from ARSO NWP team

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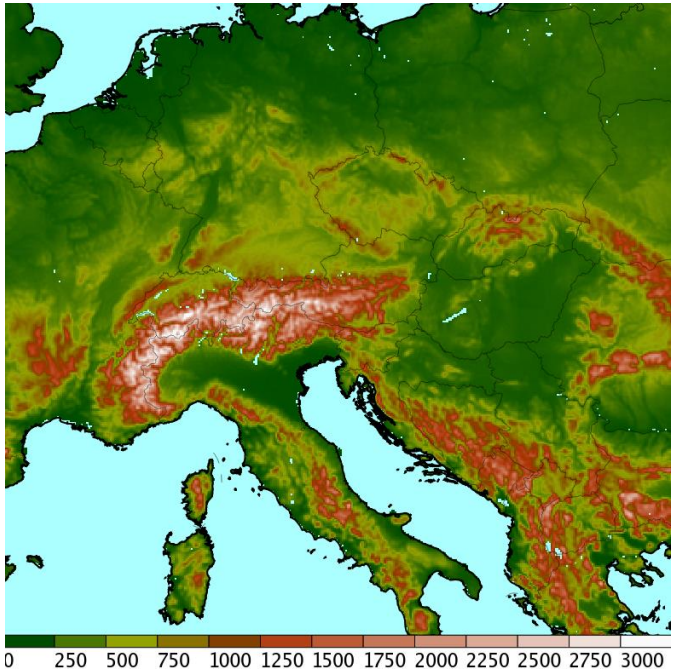
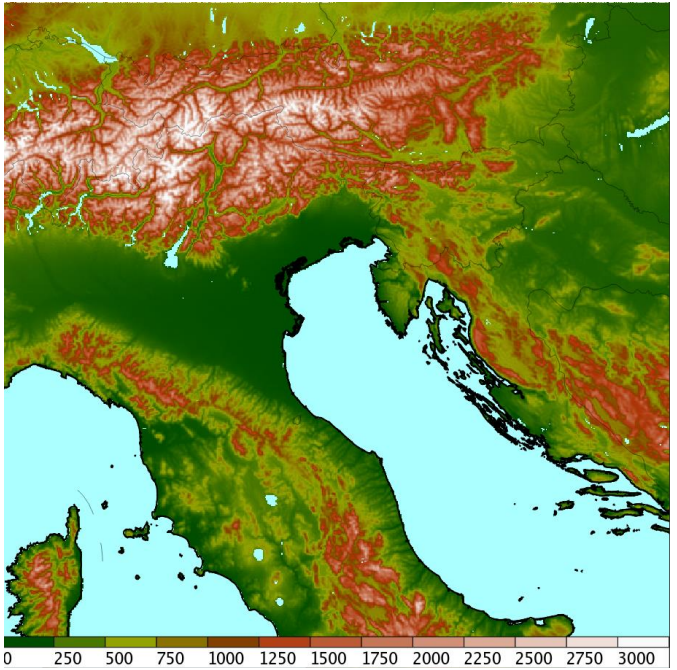
Operational DA systems at ARSO

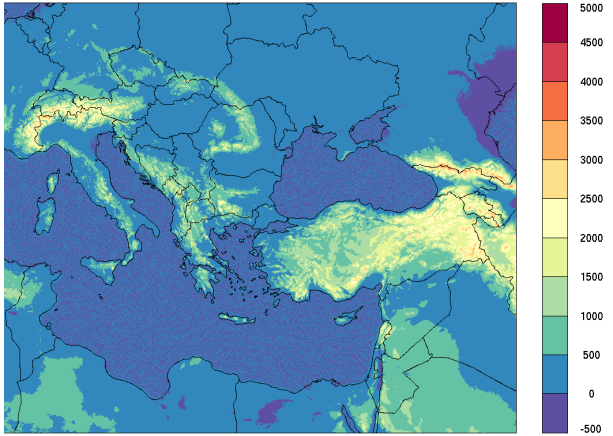


ALARO 4.4km 3h 3D-VAR + OI
cut-off time +110 mins,
4x72h, 4x36h forecast
Downstream apps: CAM-X, Nemo



ALARO 1.3km, 1h 3D-VAR + OI,
OPERA NIMBUS radar reflectivity,
cut-off time +35 mins, 24x36h

@Atos



ALARO 2.5 km, 3h 3D-VAR +
OI, ~10h cut-off
2x72h (for SEEMHEWS project)

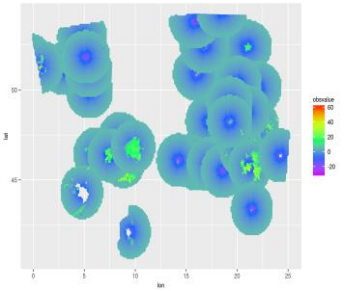
Use of observations

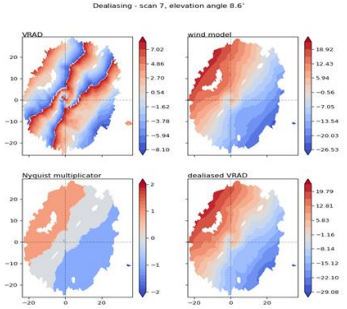
- Surface stations: SYNOP, OPLACE AWS (T2m, RH2m, U10m, P)
- GNSS data: EGVAP (ZTD), passive assimilation only
- Aircraft data: AMDAR/ACARS, Mode-S EHS/MRAR (T,U)
- Atmospheric motion winds: EUMETSAT, EUMETSAT HR (U)
- Radiosondes: OPLACE obsoul (T,U,q)
- Radiances: MSG SEVIRI, NOAA 19 (AMSUA, MHS), Metop A/B/C (AMSUA, MHS, IASI)
- Scatterometer data: ASCAT (U10m over sea)
- Radar data: OPERA (DBZH), only in RUC

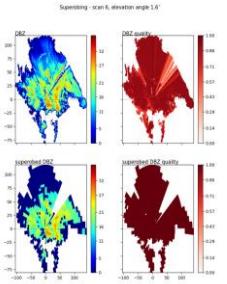
Technical updates

- Modernization of ecFlow suites (Python DA classes), maintainance of operations through git
- Radar reflectivities from NIMBUS production lines
  - Validation by Obsmon indicates same content for radars used in ALARO-RUC.
  - Issue with file sizes & updates (under investigation)
- SEVIRI in netcdf (operational in 2/3 suites)
- Additional Slovenian AWS stations on OPLACE

Status of HOOF for processing OPERA files







Homogenization

- add missing meta data (e.g. NI)
- select scans with required quantities and QC flags

Dealiasing

- apply torus mapping method by height sectors (tunable)
- update the QC flags

Superobservations

- create flexible super-observations
- add related QC flag
- create and outprint new geometry (hdf5)

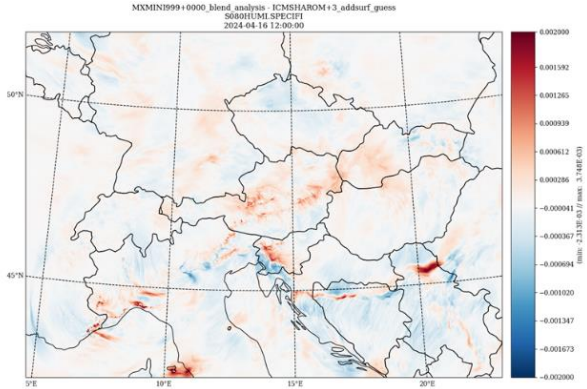
- Supported and recommended version v2:
  https://opensource.umr-cnrm.fr/projects/accord/wiki/HOOF
- Planned fixes (mainly updated h5py library or another solution, small fixes)

AI-based radar reflectivity inversion

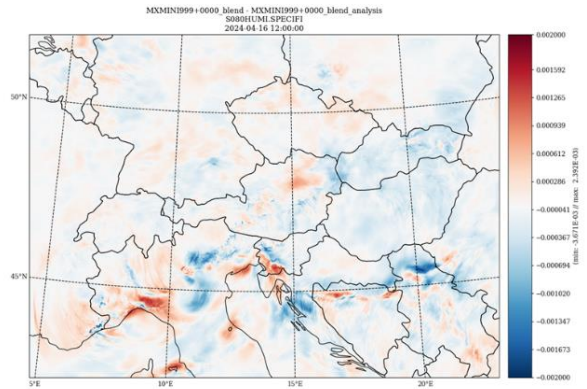
- Motivation: to learn how an AI/ML method can be plugged into NWP codes, to replace a statistical obs. operator.
- Training dataset: all data from Bayesian inversion process: observations (refl), guess (refl,rh), metadata
- OPERA radars on SI-RUC domain, year 2023
- Training target: profiles with good match between model and obs (refl)
- Neural network using spatial structure, ongoing.

EnVar testing: ensemble perturbations

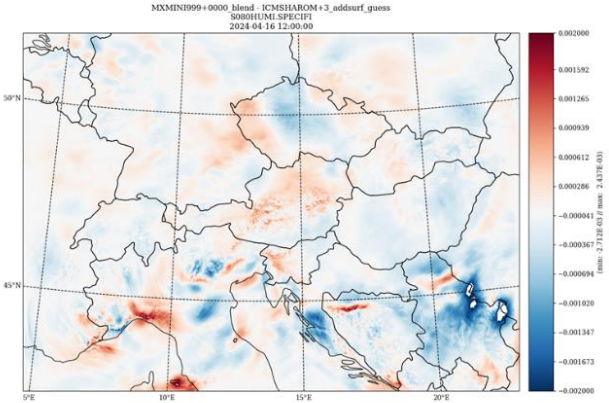
- Testing different options for ensemble information to EnVar (16 member Claef-1k):
  - 50-member C-LAEF1k ensemble for 16th April 2024 0 UTC cold front case as reference,
  - LAM perturbations, including second-last run,
  - global perturbations,
  - mixed perturbations.
- the flow-dependency is well-captured with EnVar
- combining LAM and global perturbation produces potentially unrealistic covariances over large areas + spurious ripples in the analysis fields



50 LAM members



50 interpolated IFS members



LAM/global (16+32) mixed members

Introduction of Surfex to ALARO DA cycle

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- Lace stay at ARSO by Anamarija Zajec (DHMZ)

- Comparison of operational ALARO assimilation cycle with ALARO w/SURFEX for a 7 day period

  * cy43t2 with SURFEX modset (which is included in AL cy49t1)

  * Operational suite: 1km domain RUC cycle with 1h assimilation window, 3DVAR upper air assimilation, surface fields updates via CANARI

  * Experiment: Same as operational, except using Surfex, TG1 and WG1 updates via CANARI/OI_MAIN

  * Initial .sfx file produced via EE927 run from ELSCF files, subsequently cycling of .sfx files

- Technical issues:

  * SFX.SST produced by CANARI clearly erroneous

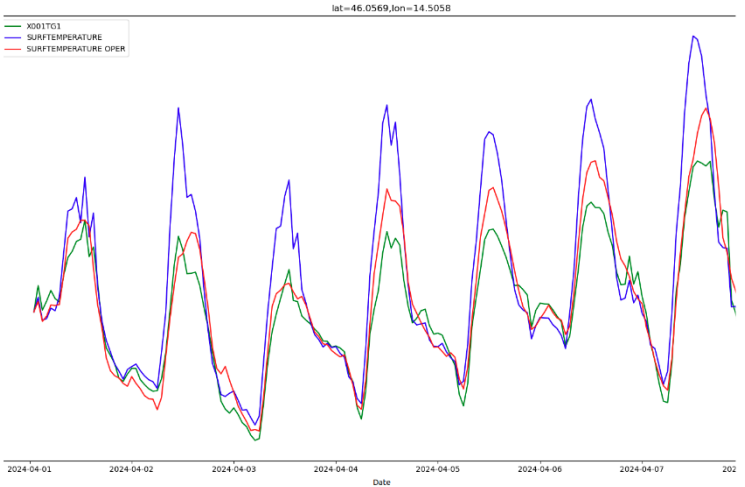
  * Certain (unknown) fields in CANARI sfx analysis produce segfault at integration (not repeatable)

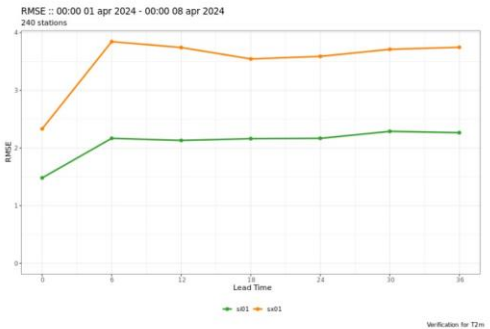
  * Issues mitigated with Python scripts and hacks

- Results:

  * Degradation of scores

  * Difference between X001TG1 in .sfx file and SURFTEMP in ICMSH file





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Plans

- Migration of RUC to a temporary HPC
- Improve routine verification (focus on regional AWS, hourly scale) with HARP
- Migration from cy43t2 to cy48t3 (export version), 3D-Var via OOPS
- Cooperation with Geosphere on Claef1k (convection-permitting ensemble, EnVar)
- Coorperation with DHMZ on all-sky IR radiances (IASI, IRS)

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Thank you for your attention.

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