ALADIN in Slovenia - 2018

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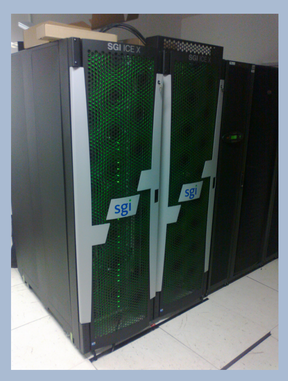
HPC system

Technical characteristics (SGI ICE X):

- 61 Intel Sandy Bridge compute nodes (976 cores, E5-2670 @ 2.6 GHz) - each with **64 GB** of memory,
- **11 Intel Broadwell compute nodes (308 cores, E5-2680 v4 @ 2.4 GHz)**,
- two Infiniband FDR networks,
- **500 TB of disk space (HA NFS)**,
- **Robot tape libraries.**



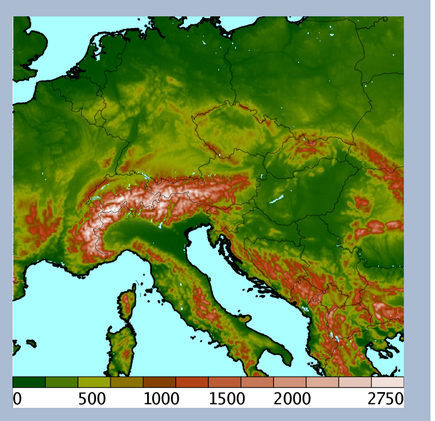
Software:

- OS: SGI ProPack on top of Suse Entreprise Server,
- Intel Fortran compiler, SGI mpt,
- Altair PBS job queueing system.

Operational suite

Model characteristics:

- **CY40T2_bf7, ALARO-v1B**,
- 4.4 km horizontal grid spacing, 87 model levels,
- linear spectral elliptic truncation,
- Lambert projection,
- 421x421 points, (with extension zone 432x432), E215x215,
- 180 s time-step,
- four production runs per day: 00, 06, 12, 18, forecast up to 72 hours, additionally four runs 03, 09, 15, 21 up to 36 hours,
- coupling at every 3 hours, LBC from ECMWF Boundary Conditions Optional project (time lagged coupling).
- a separate production run with ARPÈGE Boundary Conditions



ALADIN-Slovenia model domain.

Assimilation cycle:

- 3-hourly 3D-Var assimilation cycle (RUC),
- B-matrix sampled from downscaled ECMWF ensemble members,
- CANARI surface analysis using surface observations (T and RH at 2 m),
- coupling frequency 1 hour,
- space consistent coupling, no digital filter initialization,
- observations: OPLACE data (SYNOP + AMS, AMDAR, Mode-S MRAR, **Mode-S EHS**, GEOWIND, **HRWIND**, TEMP, wind profiler, AMSU, MHS, **IASI**, SEVIRI, **ASCAT coastal**) and localy recieved surface observations (SYNOP).

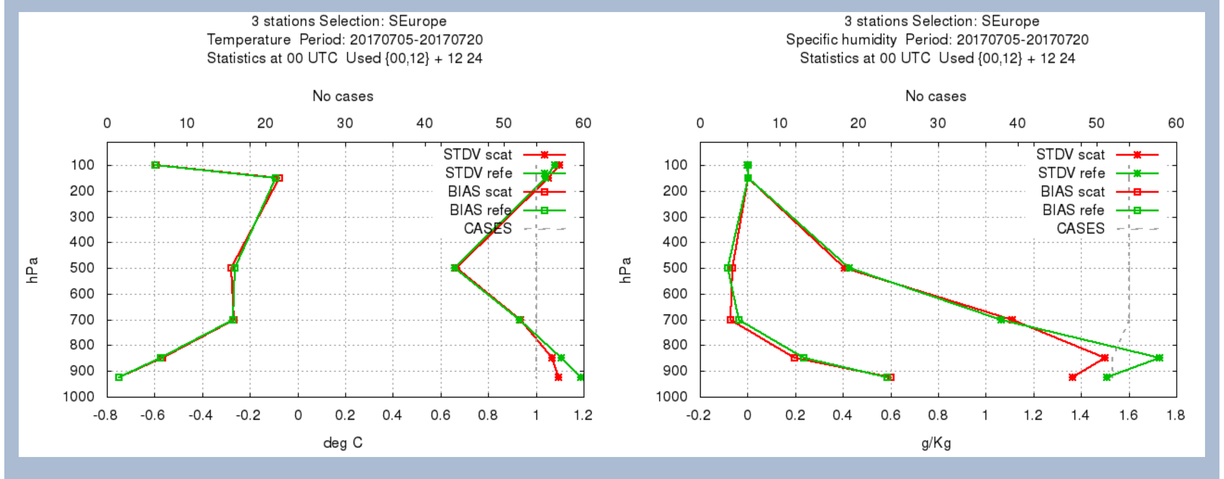
Observational sensitivity experiments

Extending local use of OPLACE provided observations.

- Several additional observation types were tested in ALADIN/SI and the impact was evaluated over 15 days in summer 2017,
- based on these scores and further evaluation, the use of observations in the operational suite was extended in April 2018,
- VarBC coefficients for IASI were initialized from ARPÈGE and cycled for two months in ALADIN.

observation	impact
Mode-S EHS	clear improvements in high-level wind and temperature for up 12 hours
AMDAR q	neutral/mixed impact
High resolution AMV	neutral impact
Wind profilers	neutral impact
IASI	neutral impact
ASCAT coastal winds Metop-A	small low-level improvements over S Europe
GPS ZTD (SI network)	negative impact for low level temperature and humidity

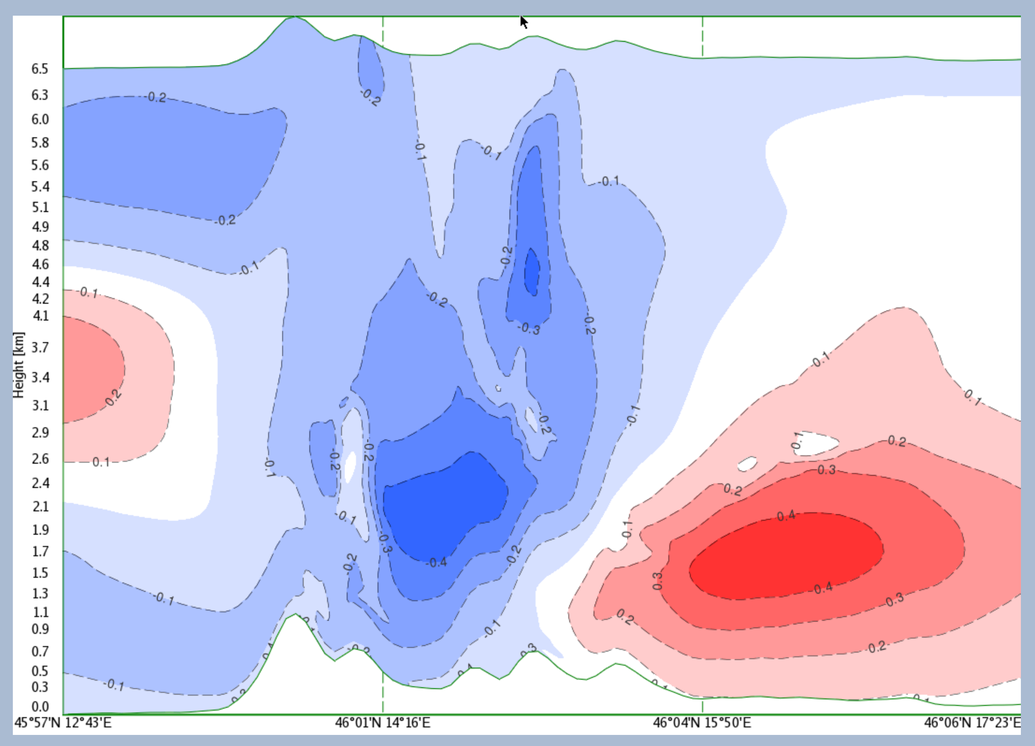
Summary of impact of different tested observations types, verified against radiosondes, SYNOP and AMDAR (Mode-S EHS, talk of Benedikt Strajnar).

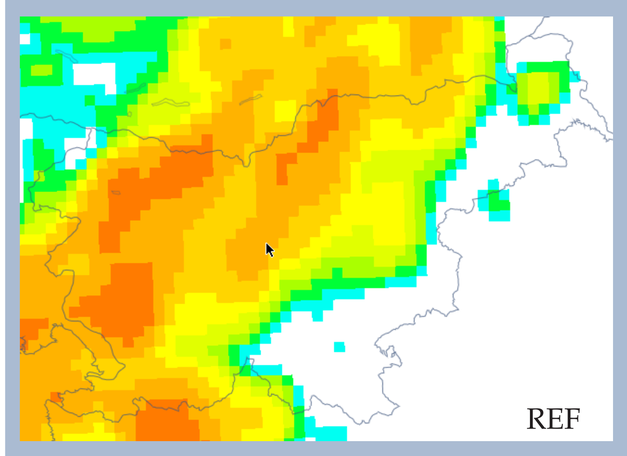


Temperature and wind verification over S Europe. Experiment using ASCAT coastal winds in red, reference in green.

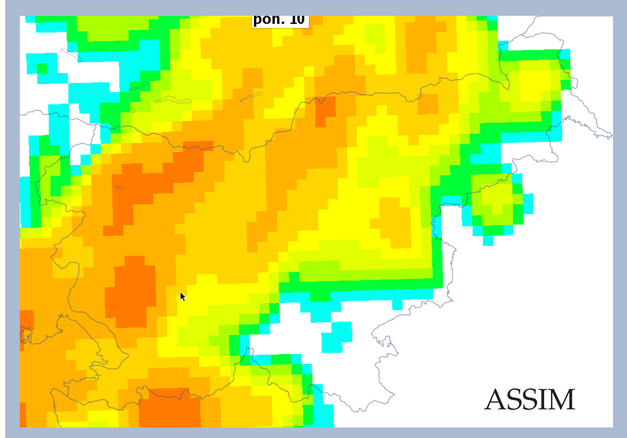
First steps towards radar DA

- Radar data assimilation development at ARSO has been started by regular downloading of Opera ODIM hdf5 data for Slovenian radars since summer 2017,
- the reflectivity observations were (only technically) implemented as input to 3D-Var data assimilation in the ALADIN,
- first tests using numerous European radars provide reasonable humidity and temperature analysis increments,
- special attention was devoted to quality information added by Opera and their preprocessing steps,
- these were compared to local radar QC procedures withing rapid analysis and nowcasting system INCA,
- a general increase of the incoming raw reflectivity at Opera was detected, occasionally resulting in very high (saturated) echos,
- the attenuation, RLAN detection and ground clutter identification procedures are comparable to the local ones,
- the more aggresive beam blockage correction algorithm at Opera presumably results in the above mentioned difference in the corrected reflectivity,
- Opera volume data needs further homogenization of metadata and file structure which is subject of current work.

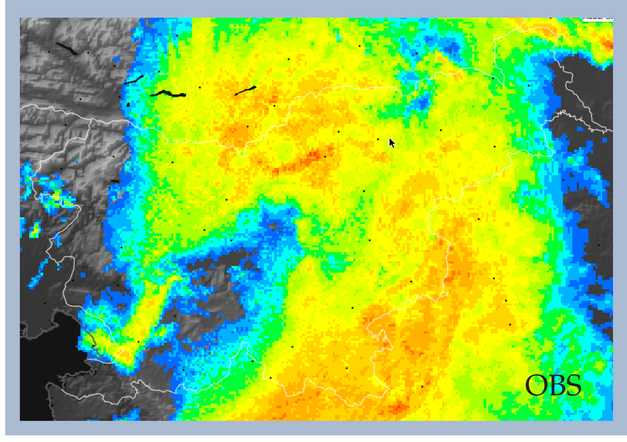




Above: A west to east vertical cross section of specific humidity increment over Slovenia due to assimilated radar reflectivities on 10 August 2017 0 UTC. Moistening (red) and drying (blue) correspond to areas with cooling and warming, respectively (not plotted).



Left: Model simulated reflectivity in 1 h forecast starting from operational analysis (REF), analysis using radar data (ASSIM) and a reference radar observation (OBS) at 10 August 2017 10 UTC. Radar assimilation slightly shifts precipitating area towards east (in direction towards observation) in ASSIM.



Applications using ALADIN forecast

- Analysis and nowcasting system,
- CROCUS snow cover model for snow water reservoir estimation and as an experimental tool for snow avalanche risk assesment,
- BOBER hydrological forecasting system for more than 250 river catchments in Slovenia and surrounding,
- ocean circulation models, wave models and storm surge models,
- CAMx photomchemical dispersion model.