ALADIN in Slovenia 2019

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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),
- two Infiniband FDR networks,
- 500 TB of disk space (HA NFS),
- robot tape libraries.

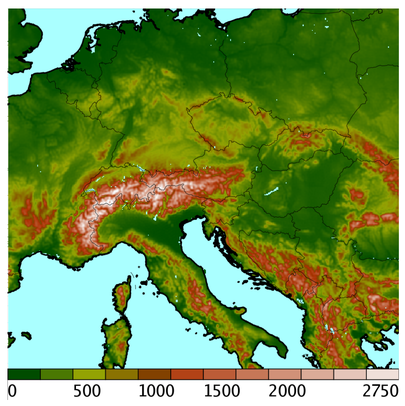
Software:

- OS: SGI ProPack on top of Suse Entreprise Server,
- Intel Fortran compiler v16, SGI mpt,
- Altair PBS job queueing system,
- EcFlow suite management.

Operational suite

Model characteristics:

- CY40T2_bf7, ALARO-1vB,
- 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.



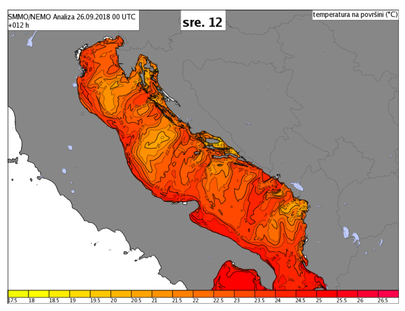
ALADIN-Slovenia model domain.

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, AMDAR, AMV, TEMP, AMSU, MHS, SEVIRI) and local observations (SYNOP, Mode-S MRAR),
- **observations added in last update: ASCAT Coastal, Mode-S EHS, HRWIND AMV, IASI**.

Ocean model:

- NEMO ocean model replaced POM in the operational suite,
- planing to implement weak coupling (only forecast mode) with ALADIN.



NEMO ocean model operational product.

Singularity Container Environment

Cooperation between Slovenian meteorological service and Slovenian national HPC grid initiative.

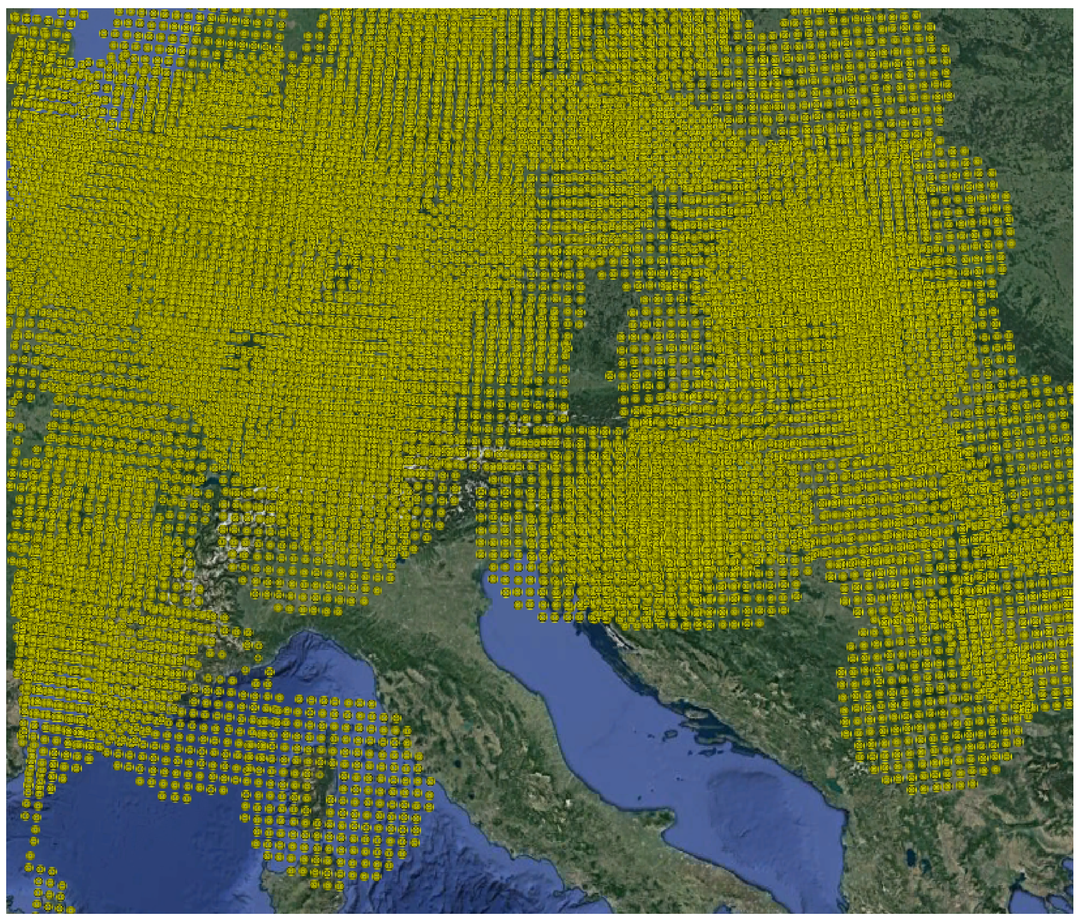
- Singularity is a container solution for scientific and application driven workload,
- ALADIN code compiled and successfuly run in a Singularity container,
- the container was stripped of model source code and moved to a freshly installed cluster - surprisingly it works!
- execution times only slightly ($\sim$ 1-3%) higher compared to running directly on the system,
- some difficulties with MPI when using more than one node,
- very suitable for running own code in own environment on remote infrastructure,
- easily portable and deployable,
- promising technology for HPC resources sharing and operational joint ventures.

Homogenization of OPERA radar data for 3D-Var

Opera OIFS data hub now provides volume radar data over large part of Europe (~150 radar sites). The data is provided in a common hdf5 data format, but needs further homogenization.
A new homogenization tool called HOOF developed in the framework of LACE RADAR Action enables:

- the preparation of a homogeneous file content and structure, prescribed via namelist,
- retaining only relevant metadata at proper position in the file,
- splitting files into individual measurements (as Opera only provides 15 min aggregates),
- defining or adjusting metadata for the whole dataset or individual radars via the namelist.

By using HOOF we are able to store assimilation-ready data from the complete Opera OIFS data set.

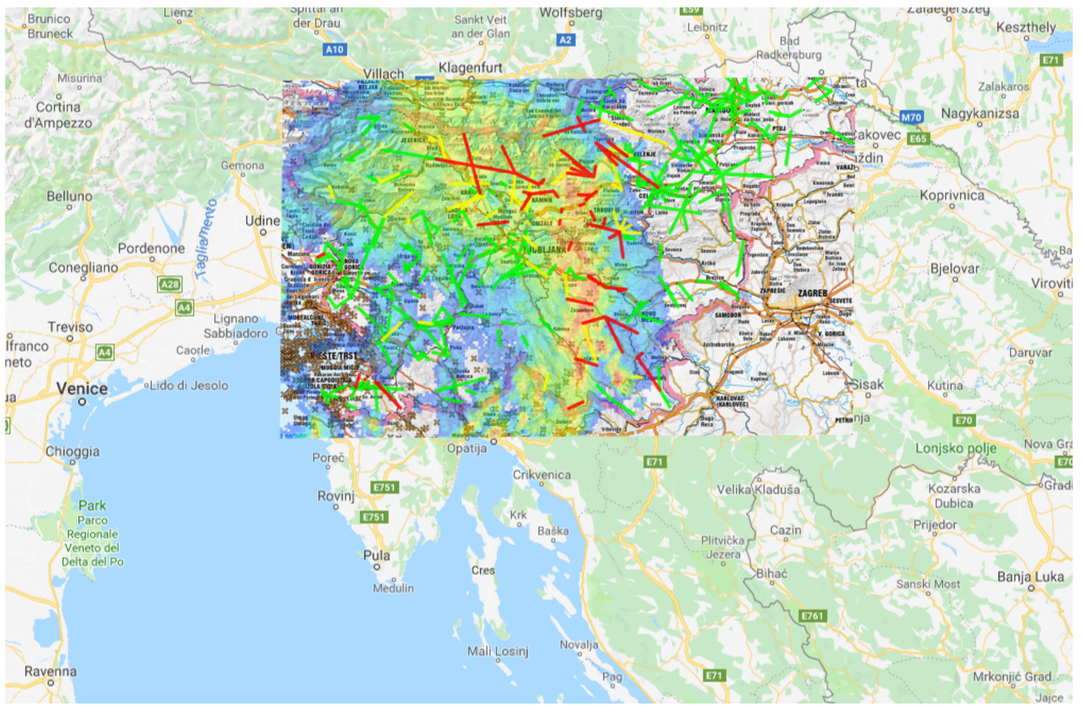


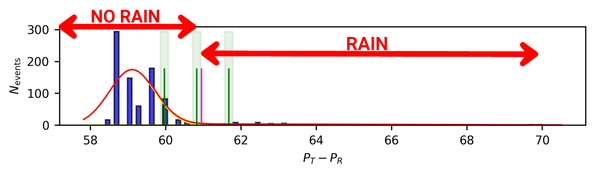
Radar observations preprocessed by the HOOF tool (not radars themselves) within Slovenian operational domain. Notice voids over Italy, Austria and the Balkans.

Feasibility study of using microwave mobile links for DA

A set of attenuation data (N$\sim$500) of microwave connections within a cellular-phone network was obtained from the biggest national mobile operator.

- a procedure to calculate rain rate from measurement of attenuation was applied (following paper by Heijnse et al., 2007),
- by fitting attenuation to analyzed precipitation data, the method was modified for operational needs: automatized dry/wet measurement selection and treatment of attenuation from unknown sources,
- a feasibility study is ongoing with the goal to assess the impact in ALADIN, initially by simple assimilation of only the data with rain signal as saturated humidity observation.



Locations and attenuations of microwave inter-antenna links in network of one Slovenian mobile provider on top of radar rainfall intensity image. The colors of the links (shorter or longer lines) represent the attentuation strength, which corresponds to rain intensity: green – no rain, red – heavy precipitation.

Histogram of attenuation distribution for one particular microwave link (blue). The bins related to no-rain events are towards the left, while the rain attenuations are more to the right side of the plot. The discrepancy between them can be obtained from 1.5 IQR test (magenta).