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

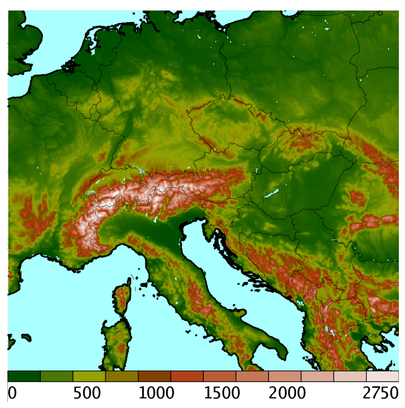
Software:

- 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.



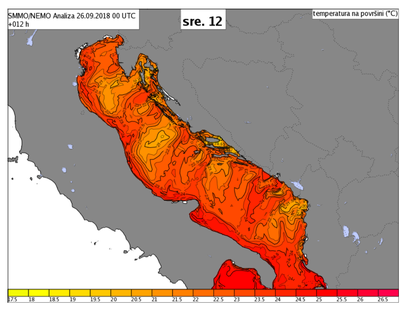
ALADIN-Slovenia model domain.

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),
- **recently added observations: 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 (Ĩ-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.

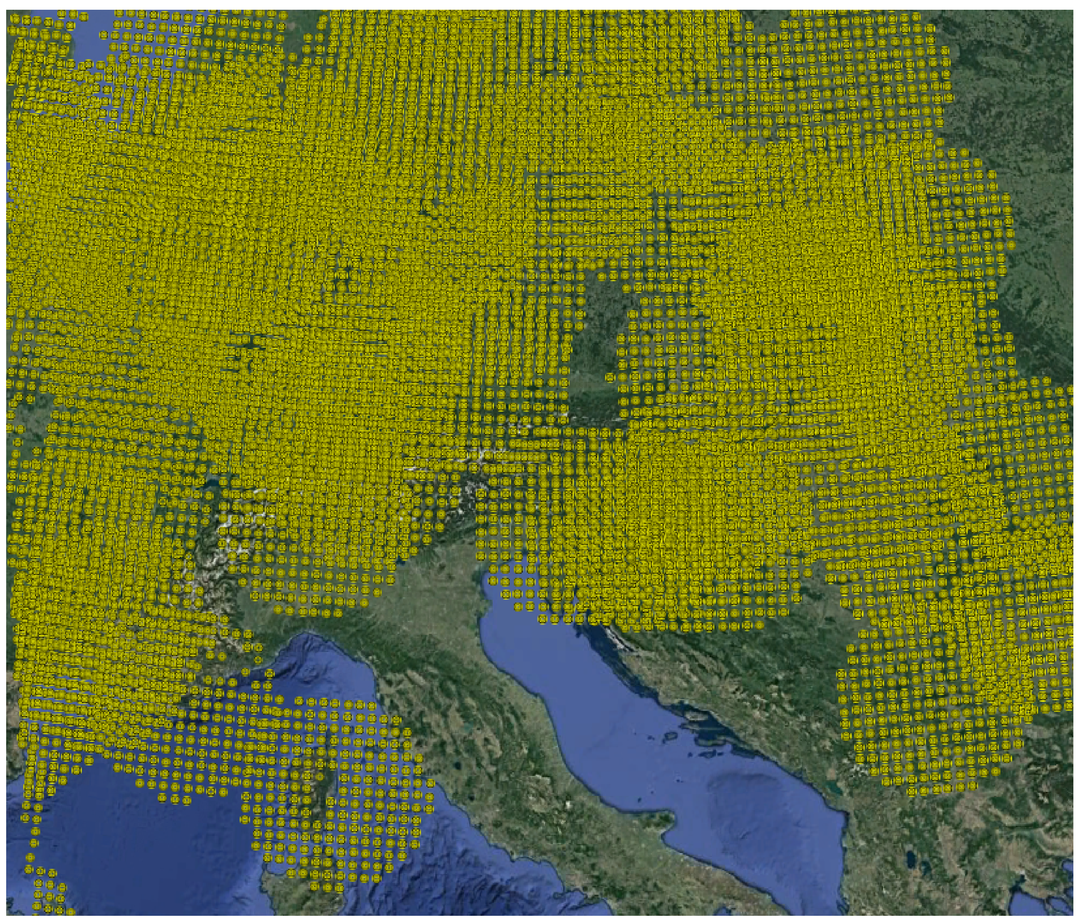
Homogenization of OPERA radar data for 3D-Var

Opera OIFS data hub now provides volume radar data over large part of Europe (Ĩ50 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.

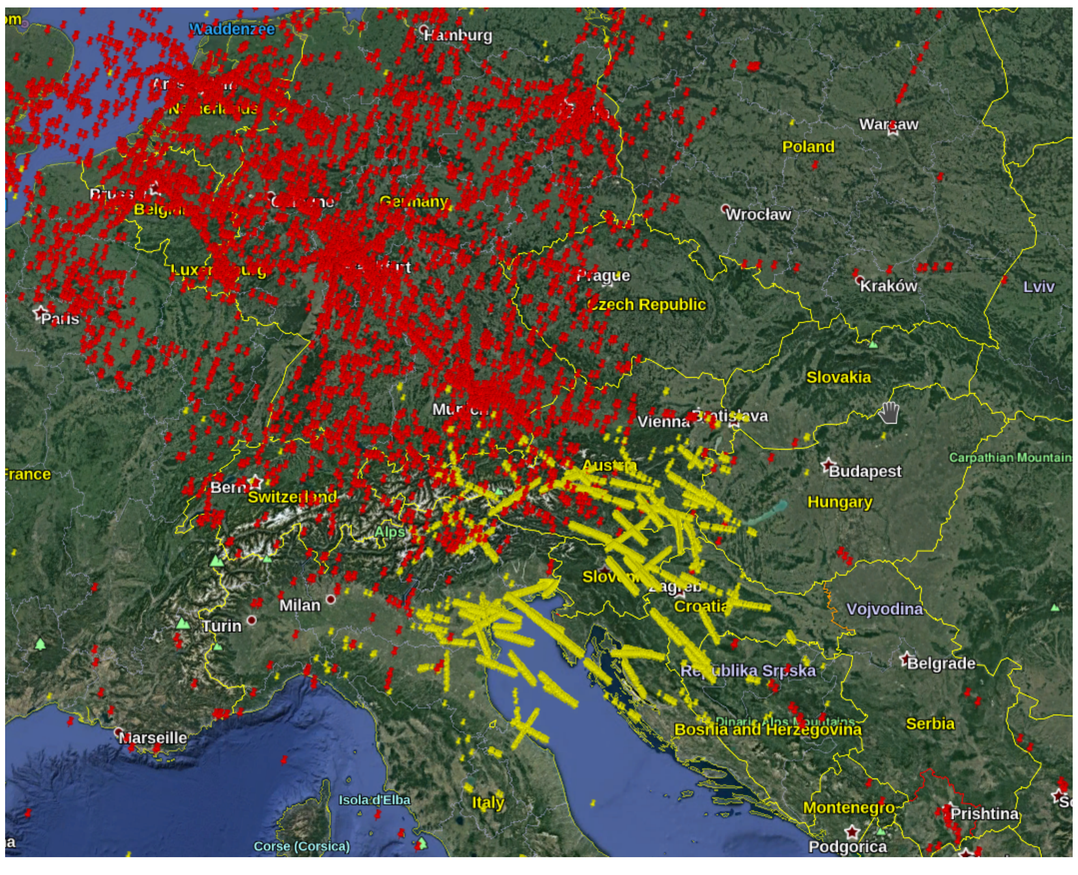
Assimilation of Mode-S EHS aircraft observations

Mode-S EHS high resolution aircraft observations, processed by KNMI and distributed through OPLACE observation preprocessing system, have been used operationally at ARSO since beginning of 2018.

Assimilation of Mode-S EHS in ALADIN/SI:

- significantly increased total observation number, slower 3D-Var convergence,
- positive impact on forecast for at least 12 hours,
- both wind and temperature proved to be useful (although temperature is less accurate).

Ongoing efforts are devoted to increasing the coverage with Mode-S EHS data over Slovenia, which would complement the better quality but smaller density Mode-S MRAR data already used operationally.



Operationally used Mode-S EHS data (red), additional EHS data to be soon added to assimilation (yellow).