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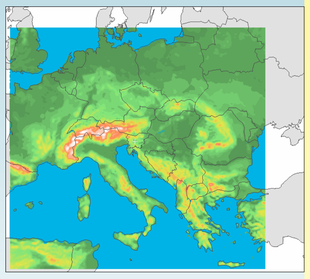
Environmental Agency of the Republic of Slovenia

ALADIN related activities in SLOVENIA - 2011

OPERATIONAL SUITES

si09: 9.5 km dynamical adaptation suite

Characteristics:
- model version: AL35T1 using ALARO with 3MT physics
- integration four times per day: 00 UTC (72 h), 06 UTC (72 h), 12 UTC (72 h), 18 UTC (60 h),
- 9.5 km horizontal grid spacing,
- 43 vertical model levels,
- linear spectral elliptic truncation (E134x127,258*244 points, with extension zone 270*256),
- Lambert projection,
- 400 s time-step,
- initial and lateral boundary conditions from ARPEGE,
- LBC coupling every 3 hours,
- digital filter initialization.



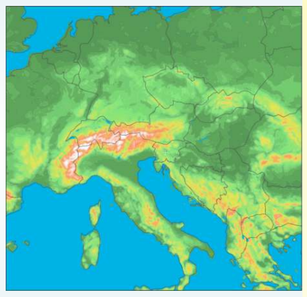
Operational ALADIN/SI domain9.5km

si09ec: 9.5 km dynamical adaptation suite

same as si09 except for:
- integration four times per day: 00 UTC (72 h),06 UTC (72 h), 12 UTC (72 h), 18 UTC (72 h),
- initial and lateral boundary conditions from ECMWF.

si04da: 4.4 km data assimilation suite

same as si09 except for:
- integration two times per day: 00 UTC (54 h), 12 UTC (54 h),
- 4.4 km horizontal grid spacing,
- linear spectral elliptic truncation (E224x215, 439*421 points, with extension zone 450*432),
- 180 s time-step,
- data assimilation.



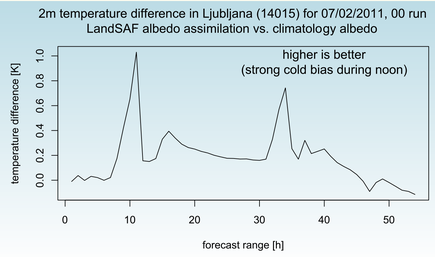
ALADIN 4.4 km domain 439*421 points

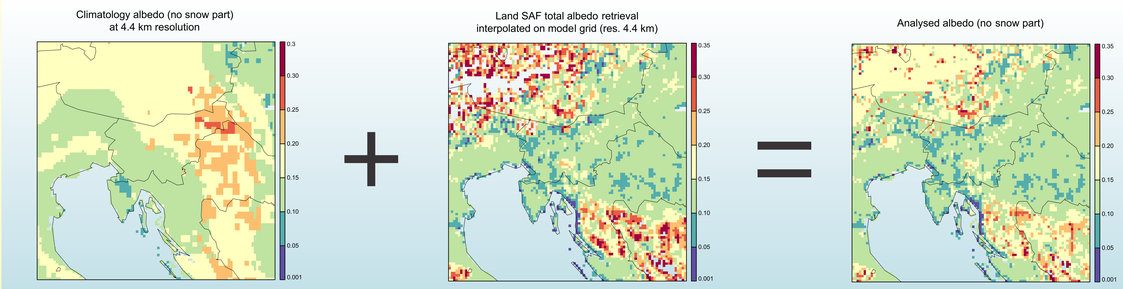
4.4 km Data assimilation
- B matrix (downscaled ARPEGE),
- CANARI surface analysis using 2 m temperature and 2 m relative humidity observations,
- 3DVAR upper air assimilation,
- surface blending step, which merges CANARI surface analysis over land, ARPEGE sea-surface analysis and 3DVAR analysis,
- cycling of microphysical and 3MT prognostic fields (initialization from first guess)
- first guess step using long cut-off ARPEGE lateral boundary conditions, digital filter initialization (DFI).

Observations usage:
- OPLACE pre-processed data: SYNOP (ps,T,q), AMDAR/AIREP aircraft data (T,u), METEOSAT SATOB cloud drifts (u), TEMP (T,u,q), WINDPROFILER (u), NOAA AMSU-A,AMSU-B (Tb), METEOSAT SEVIRI (Tb),
- local non-GTS data on surface level,
- web-based observation monitoring system developed by LACE.

Implementation of LandSAF albedo assimilation

A simple one-dimensional Kalman filter algorithm is used to obtain the best estimate of albedo (only snow free).
The analysis is performed once per day, at 06 UTC.
On the average, the analysed albedo is lower therefore the 2 m temperature is a few tenths of a degree higher; in particular cases, the impact can be much higher.

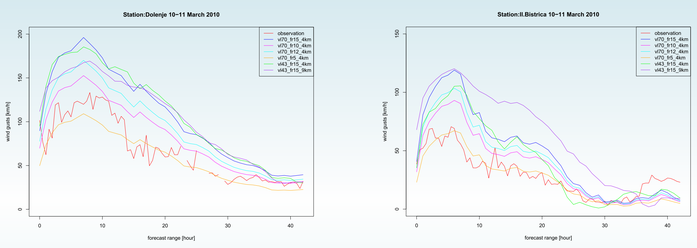




Model climatology and Land SAF retrieval are used as input. Land SAF retrieval has greater spatial variability and more weight is set on it.

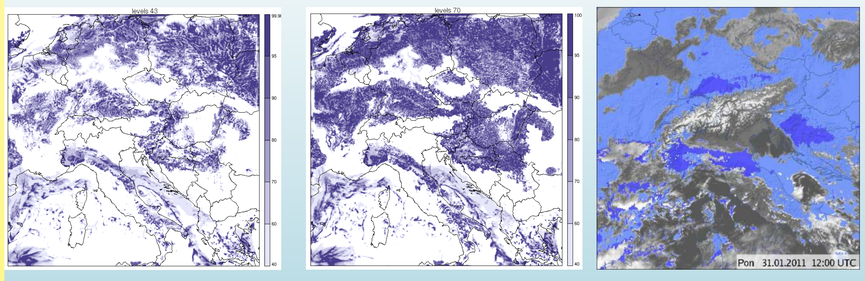
Tuning of the model for increased horizontal and vertical resolution

There are two types of hazardous winds in Slovenia, Bora (gusty NE wind) and SW wind. Gusts forecast depend on tuning parameter (facraf) which is difficult to tune due to discrepancy between real and model orography and wind characteristics.



Wind gusts at two location for Bora wind, depending on namelist tuning parameter (facraf), number of vertical levels and horizontal resolution.

Cloudiness is significantly improved with increased vertical resolution.



Total low cloudiness at 31 January 2011 12UTC obtained with 4.4 km model setup using 43 and 70 vertical levels, NWCSAF low cloudiness classification.

The computer system SGI Altix ICE 8200

Technical characteristics:
- 45 compute nodes in a single rack (360 cores)
- 16 GB of memory and 2 Quad core Intel Xeon 5355 processors per node,
- two Infiniband DDR networks, one for IO and the other for MPI communication,
- additional 7 service nodes for login, management, control and IO operations (388 cores all together),
- a dedicated NAS IO node with 48 TB FC disk array,
- 2.2 TB lustre scratch file system.

System software:
- OS: SGI ProPack on top of SLES 10 SP3,
- MPI: OpenMPI, SGI MPI,
- queuing system: Altair PBSPro queuing system,
- Intel 10.1. - 12.0 Fortran compiler,
- Totalview 8.9 with License for 4 process tokens.

Usage of ALADIN results in various applications

- **INCA** analysis and nowcasting system (status: operational).

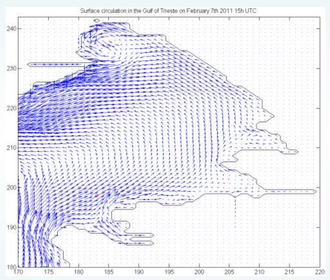
- BOBER hydrological forecast for Sava, Soča and Mura river catchments (status: pre-operational).

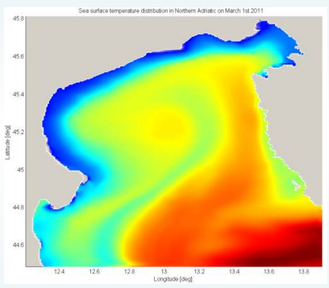
- A host model for WRF model at University of Ljubljana, Chair for meteorology (status: testing and validation).

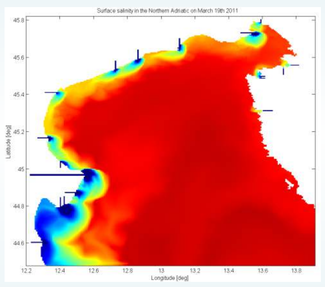
- **NAPOM (North Adriatic POM)** is a 3D sigma-coordinate ocean model set up in the Northern Adriatic by Marine Biology Station of National institute of biology and EARS.

  - ocean boundary and initial conditions from the Adriatic Forecasting System,
  - surface winds, heat fluxes and precipitation from ALADIN,
  - main products are ocean circulation and 3D temperature and salinity distributions.

  Status: regular daily simulations, validation is ongoing.



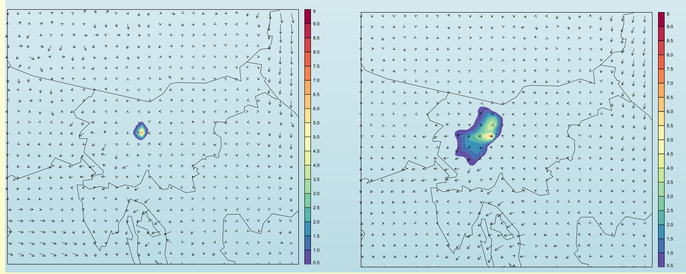




- **CAMx (the Comprehensive Air quality Model with extensions)** is an Eulerian photochemical dispersion model.

  - selected ALADIN fields as meteological input,
  - chemical boundary and initial conditions (MACC), gridded and point emissions (locally provided and MACC),
  - main product is a simulation of air quality (ozone, particulate matters and other chemical species).

  Status: testing of setup and flow of input data, first idealized simulations.
  Plan: daily simulation of concentrations over Slovenia.



First tests with single source, concentration of SO_2 [$\mu g/m^3$] after 5 and 10 hours of simulation.

High-resolution climate modelling

Climate change investigation over Slovenia with ALADIN model:
- ALARO physics with slight modifications of certain physical parameters;
- ARPEGE boundary conditions ;
- LACE domain, horizontal resolution of 15 km x 15 km.

SRES A1B emission scenario was employed for present (2001-2010) and future (2091-2100) calculations. The present period simulation was compared against several ground locations with measurements.

Simulated mean temperature is in general colder than observed values in the present period, but there is a slight warm bias in the summer.

Rainfall conditions in Slovenia are quite accurately simulated as there are no apparent systematic biases in the direction of over- or underestimation of observed values.

Summer rainfall amounts are underestimated due to deficient parameterisation of convectiverainfall.

Climate change intensities are highly spatially variable due to varied Slovenian terrain and its geographical position.

In accordance with the SRES A1B emission scenario air temperature is projected to increase in the range of 1.5 to 2.5C in the spring, winter and autumn, but up to 4.5 C in the summer.

There is a strong trend in the direction of reduced summer rainfall amounts throughout Slovenia, in particular in the SW (a reduction of up to 40 %).