ENVIRONMENTAL AGENCY
OF THE REPUBLIC OF SLOVENIA

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Limited Area Modeling in Slovenia - 2006

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The operational ALADIN

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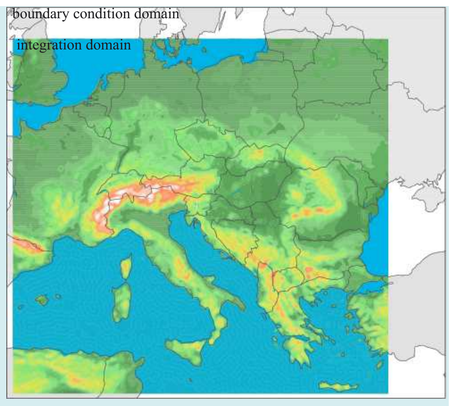
Characteristics of the operational ALADIN/SI model configuration:

- spectral, elliptic truncation E89x84 (258*244 points, with extension zone 270*256 points),
- Lambert projection,
- 9.5 km horizontal grid spacing,
- 37 vertical model levels,
- 400 s time-step, range of forecast 72 hour,
- initial and lateral boundary conditions from ARPEGE,
- coupling at every 3 hours,
- digital filter initialization,
- integration three times per day (00,12,18 UTC).



Operational suite is running in Supervisor Monitor Scheduler, ECMWF product. The computer system and operational suite are controlled by NAGIOS supervision system.

The computer system: (contact: jure.jerman@rzs-hm.si)

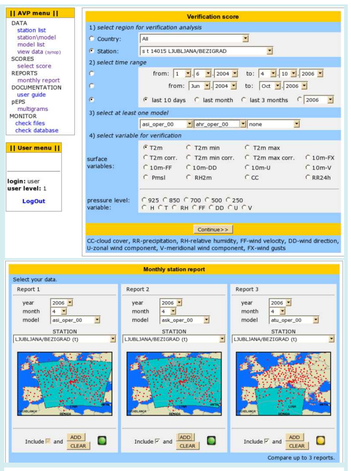
- a cluster system with 14 nodes (1 master and 13 computing nodes),
- each node has 2 Intel Xeon 2.4 GHz processors and 2 GB of memory,
- nodes are connected via gigabit fiber link
- 300 GB primary disk space, additionally 3.5 TB external disks array,

- Linux OS enhanced by SCore software (www.pccluster.org),
- queuing system, gang scheduling, check-pointing, parallel shell and simplified administration are available by SCore software,
- Intel Fortran compiler, Totalview debugger.

ALADIN verification project

(contact: neva.pristov@rzs-hm.si)

A common ALADIN software for objective verification at synoptic scale which can be used to produce time evolution and comparison of classical scores over various domains or model versions has been developed. A web service (www.arso.gov.si/verification) is available to the NWP community.



The main parts:

- the centralized data base is located in Ljubljana (Postgresql with Postgis extension),
- a software for preparing model data should be installed at each participating center,
- a web interface for on-line choosing and creating of products (Apache, PHP, Mapserver, JPgraph, R).

Products:

- various statistical scores computed and visualized for selected data,
- monthly station report,
- multigrams,
- information about the participating models.

First experiments with new physical parameterization

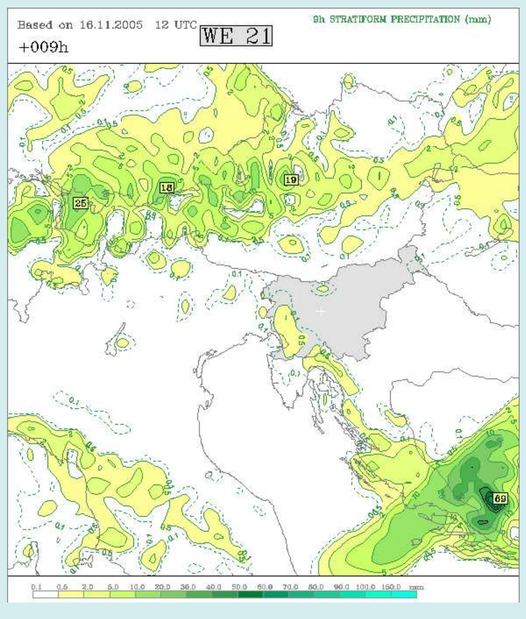
contact person: jure.cedilnik@rzs-hm.si

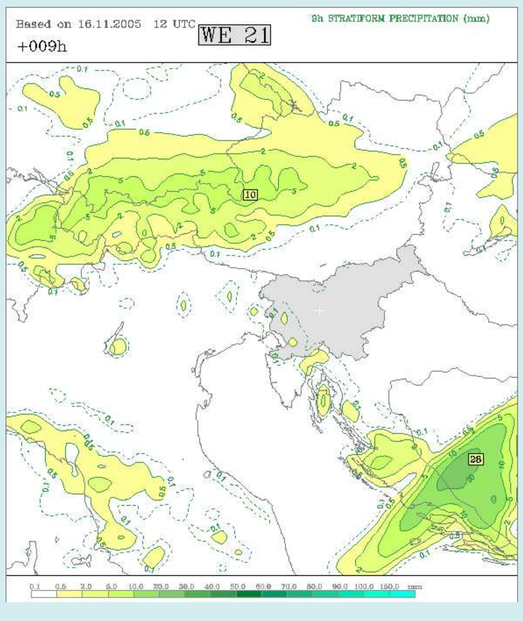
The following additions to the physical parameterization in ALADIN have been introduced (also known as ALARO-0) and tested:

- microphysical scheme with 5 water species and statistical treatment of rain and snow,
- modified radiation scheme including an optical cloud model,
- simplified prognostic TKE scheme (simplified TKE equation with advection and relaxation towards the diagnosed state compensating for the remaining terms).

First results indicate improvement in precipitation distribution due to advection of hydrometeors (leeward and windward sides of ridges, smoother fields).

In the figures below 9-hours accumulated stratiform precipitation from the reference model (operational ALADIN/SI, left) and ALARO-0 (right) are shown.





Some considerations on very high resolution (VHR) modelling of precipitation

(contact: mark.zagar@gov.si)

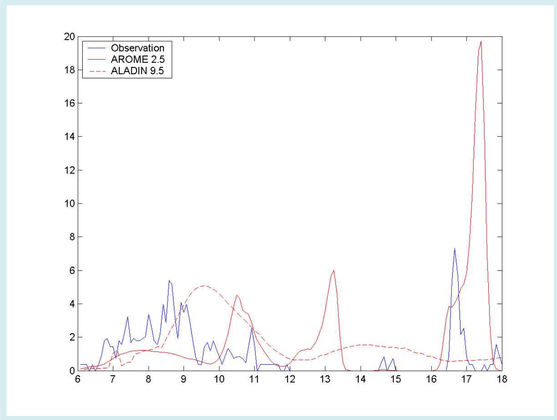
Everybody has great expectations from future operational NWP models, running at resolutions of 2km and above. It is, however, not trivial to show how accurate those predictions, performed with research tools as for example AROME model, really are. Dealing with spatial and temporal variability is important.

Two possible approaches for use and verification of VHR precipitation are presented here:

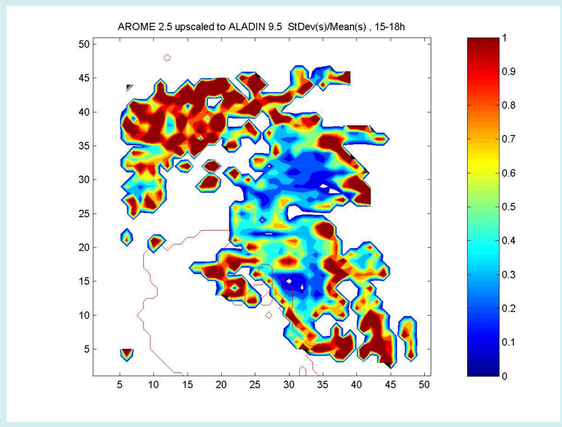
- new measures of temporal variability for application and verification against frequent measurements (1 minute),
  - standard deviation,
  - standard deviation normalized by maximal intensity,
  - duration of intensity above threshold, etc.
- upscaling, where sub-grid information is analyzed and presented.

To estimate similarity between the two is the challenge. Some measures enabling objective comparison between the model and observations have been tried:

- duration above 90% of maximum intensity between 15-18 (Obs. 0.08h, AROME 0.17h); usually indicates a non-steady rainfall,
- idem, except for 25% (Obs. 0.4h, AROME 0.75h); an estimation of the event character - large values mean steady rainfall,
- standard deviation normalized by mean intensity (Obs. 2.18, AROME 1.50),
- std. deviation normalized by maximum intensity (Obs. 0.24, AROME 0.28).



Observed precipitation, compared to simulated ones with AROME at 2.5km resolution, for one point, between 6 and 18 UTC on 27 April 2006. Both are given with 5-minute frequency.



Precipitation accumulation between 15 and 18 UTC on 27 April 2006, simulated by AROME model at 2.5km resolution, upscaled to 9.5km. Presented is the standard deviation of AROME rainfall within a 9.5km square (from around 16 values) normalized by the mean AROME rainfall within a 9.5km square. Large values indicate that rainfall occurred as localized showers, while small values indicate large-scale rain.

High-Resolution trajectory analysis of pollution cases

(contact: rahela.zabkar@fmf.uni-lj.si)

In Slovenia, tropospheric ozone concentrations occasionally exceed thresholds of 180 $\mu g/m^3$ per 1h. Maxima occur most often in urban and coastal regions. To determine the origins of ozone and its precursors, high resolution backward trajectories for selected days with ozone concentrations above 165 $\mu g/m^3$ were calculated for four measuring sites. Beside the number density and the residential time also the average time, average height and average velocity fields were calculated for trajectories reaching measuring sites at different heights above the ground.

Description of the method:

- computation 96-hour 3D backward trajectories with Flextra (http://www.forst.uni-muenchen.de/EXT/LST/METEO/stohl/flextra.html),
- input data from ALADIN/SI,
- resolution of meteorological fields: cca. 10 km spatial, every 1 hour,
- time period: days (32 total) with maximum ozone concentration above 165$\mu g/m^3$ in months from April to September 2004 and 2005,
- hours of arrival: 10, 12, 14, 16, 18, 20 UTC,
- arrival level: 50 and 200 m above ground, 1000, 1500, 3000 and 5500 m above mean sea level.

The figures below show the average number density and the average residential time of a trajectory in grid box (minutes) of polluted trajectories arriving at Ljubljana 50 m above the ground, for 32 days.