ENVIRONMENTAL AGENCY
OF THE REPUBLIC OF SLOVENIA

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Limited Area Modeling in Slovenia - 2005

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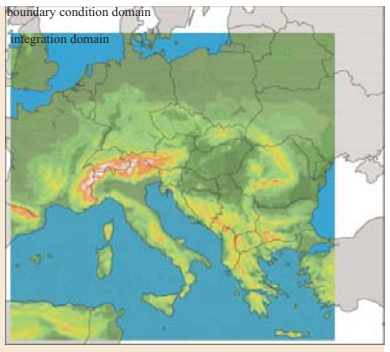
The operational ALADIN

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

Characteristics of the operational ALADIN/SI model configuration:

- spectral, elliptic truncation E89x84 (258*244 points, with extension zone 270*256 points on the collocation grid),
- Lambert projection
- 9.5 km horizontal grid spacing on the collocation grid,
- 37 vertical model levels,
- 400 s time-step, range of forecast 54 hour,
- initial and lateral boundary conditions from ARPEGE,
- coupling at every 3 hours,
- digital filter initialization,
- integration twice per day.



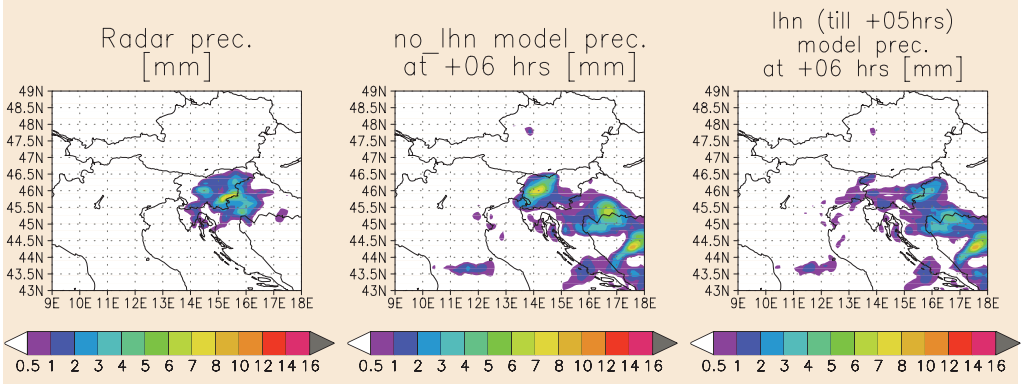
The computer system: (contact: jure.jerman@rzs-hm.si)

- 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 through powerful Entherasy SSR 8000 gigabit switch,
- 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, checkpointing, parallel shell and simplified administration are available by SCore software,
- Lahey and Intel Fortran compilers, Totalview debugger.

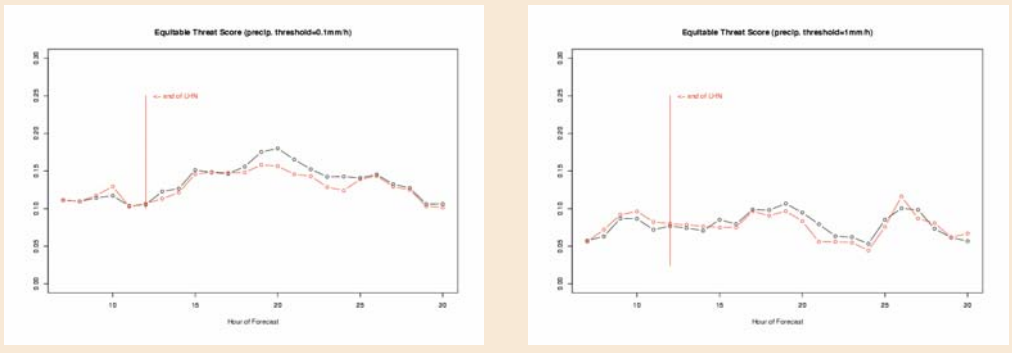
Latent Heat Nudging (contact: jure.cedilnik@rzs-hm.si)

Latent Heat Nudging (LHN) is a method of forcing an NWP model with measured precipitation rate from radar with the aim to improve analysis and short range forecast of precipitation.

Results show that LHN is quite strong in repositioning the spatial pattern of precipitation, but is not capable of altering the amount. In a case of only model precipitation and no precipitation measured, the LHN is trying to move the precipitation around instead of reducing the amount of it.



Hourly accumulations of precipitation between 6 and 5 hours UTC for October 24, 2002. Left figure shows interpolated radar image (combination of three radars), the middle one shows the results of model control run (without LHN) and the image to the right is the LHN run, where nudging was performed till +5 hours of forecast (model was initialised at 00 UTC). The LHN was successful in altering a bit the precipitation pattern and putting the rain where the radar had measured it.

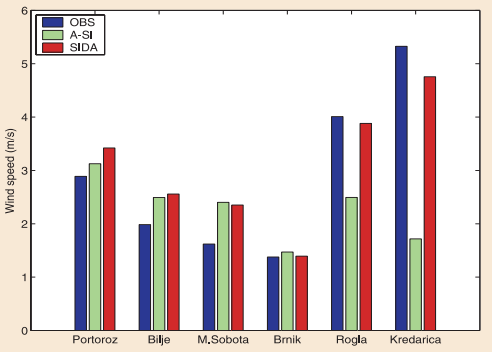


Equitable threat scores with two different thresholds. The red line is with LHN switched on till +12 hours of forecast and the black line is the control run. The positive impact of LHN is only seen in a higher threshold case and only up to a few hours ahead.

ERA-40 downscaling using ALADIN (contact: mark.zagar@rzs-hm.si)

Downscaling of the ERA40 data for the 10-year period (1992-2001) was performed with a goal of obtaining a high-resolution wind climatology for the topographically diverse Slovenian territory. The NWP model ALADIN was used in three steps:

- 60-hour simulations with 12-hour overlap, forced by the ERA40 fields at the lateral boundaries and with 30km horizontal resolution provided input for the second nest,
- a 10km resolution run, again 60-hour long integration with 12-hour overlap.
- in the final step, a 2.5km resolution ALADIN was run on each of 3-hourly output from the second nest and only until the wind field has adapted to the high-resolution orography, i.e. 30 minutes.



An 8-year average of the wind speed at six observing stations. Observed wind speed is shown in blue (OBS), modeled by the 10km ALADIN in green (A_SI) and using the 2.5km dynamic adaptation in red (SIDA).

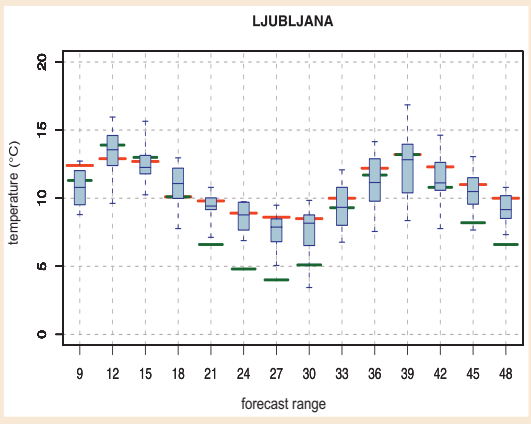
Average 10m wind speed over Slovenia, obtained with the mass-consistent model in 1km resolution, initialized and tied by the 2.5km ALADIN output. Scale is in m/s. Only areas shaded in red color, i.e. with the wind speed over 4m/s are potentially interesting for harvesting of the wind energy.

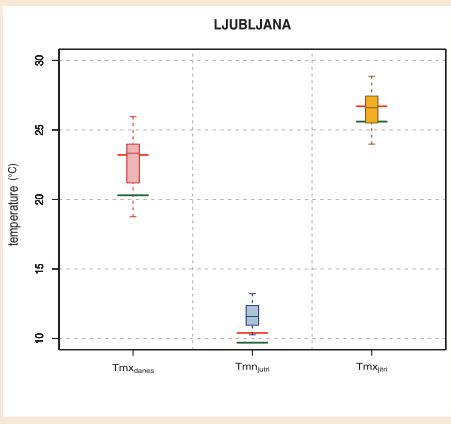
Probability forecast of temperature with quantile regression method

(contact: jasna.vehovar@rzs-hm.si)

Probability forecasting can also be done with a statistical model and not only with the ensembles. An advanced regression method, called quantile regression can be used as a statistical model. This method takes into account the true distribution of residuals, and combines probabilistic forecast and statistical adaptation of the NWP direct model output variables to the local conditions. The result is not only the forecasted value. We also obtain the estimation of the accuracy of the forecast. This method allows us to produce probabilistic forecast not only for discrete but also for continous variables. For development of such statistical model a learning data set is needed, sufficiently large to train the model.

The quantile regression method was tested on maximum and minimum daily temperature forecasts and 2 m temperature forecasts for different time ranges and for different locations in Slovenia. As predictors the observations and direct model output parameters from the operational ALADIN model were used. With comparison of verification scores for quantile regression and some other regression methods it was shown that the weighted local linear principle is the most privileged method among the tested.





An example of 2m temperature forecast for up to 48 hours ahead, every three hours (left).
An example of prediction of minimum and maximum temperature from a standard operational LAM run (right).
Green dash denotes the direct model output, red dash the observed value and the box with handles the output of the quantile regression method (median, quartile and 95% confidence).