ALADIN/SHMU R&D report

Maria Derkova (maria.derkova@shmu.sk)

1. <u>The work on case study of the 19 November 2004 windstorm (more details from andre.simon@shmu.sk and jozef.vivoda@shmu.sk)</u>

The work on case study of the 19 November 2004 windstorm (Simon and Vivoda, 2005) continued in the second half of the 2005. The ALADIN non-hydrostatic dynamics of cycles 25t2 and 29t1 were under investigation. The tests showed that the results of the non-hydrostatic run having a 2.5 km horizontal resolution are very sensitive to the choice of the prognostic variables. Correct results were achieved with cycle 25t2, using the prognostic variable d4 described by Bénard *et al.*, 2005. The forecasts of the 10 m wind (Fig.1) and wind gusts (Fig.2) are qualitatively similar to the performance of the hydrostatic run with the same horizontal resolution (Fig. 3 and 4), although the maximum predicted wind gusts (45 m/s at southeastern flank of High Tatras) were not as high as with hydrostatic integration (51 m/s). The computation with prognostic variable d3 (Bénard *et al.*, 2004) in cycle 25t2 was unstable and forecasted not realistic fields of mean sea level pressure and wind gusts (Fig. 5 and 6).

With more recent version of the ALADIN model (cycle 29t1) with different physical parameterisaton setup the start of the event is shifted forward, compared to the reference operational run (Fig. 7 and 8). This leads to differences in the wind field distribution of the 15 hour forecast, and to weaker wind gusts (maximum speed of 35 m/s). The forecast valid for 18 UTC shows already results similar to 2.5 km hydrostatic run and higher speed of wind gusts up to 50 m/s.

References:

- Bénard, P., Laprise, R., Vivoda, J., Smolíková, P., 2004: Stability of Leap-Frog Constant-Coefficients Semi-Implicit Schemes for the Fully Elastic System of Euler Equations. Flat-Terrain Case. *Mon. Wea. Rev.*, 132, 1306-1318
- Bénard, P., Mašek, J., Smolíková, P., 2005: Stability of Leapfrog Constant-Coefficients Semi-Implicit Schemes for the Fully Elastic System of Euler Equations: Case with Orography. *Mon. Wea. Rev.*, 133, 1065–1075.
- Simon, A., Vivoda, J., 2005: Severe windstorm in High Tatras on 19th November 2004, ALADIN Newsletter, 27

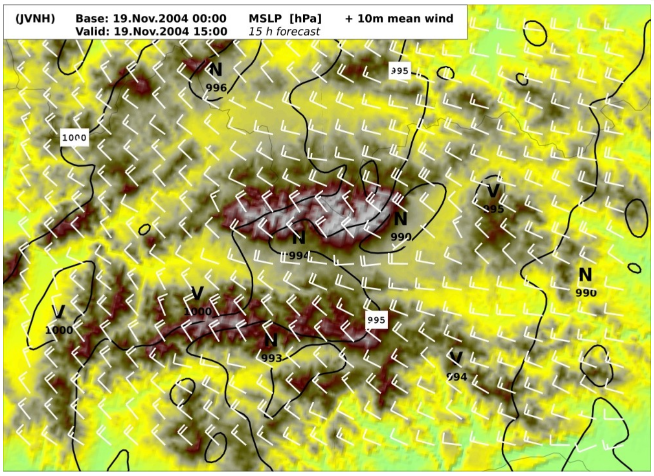

Figure 1: 15h forecast of the 10m wind and MSLP; 2.5km non-hydrostatic run with AL25T2 (d4 variable)

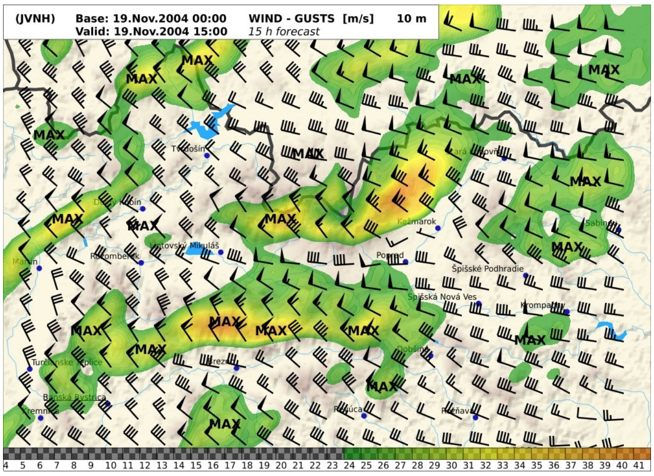

Figure 2: The same as the previous figure, but for wind gust

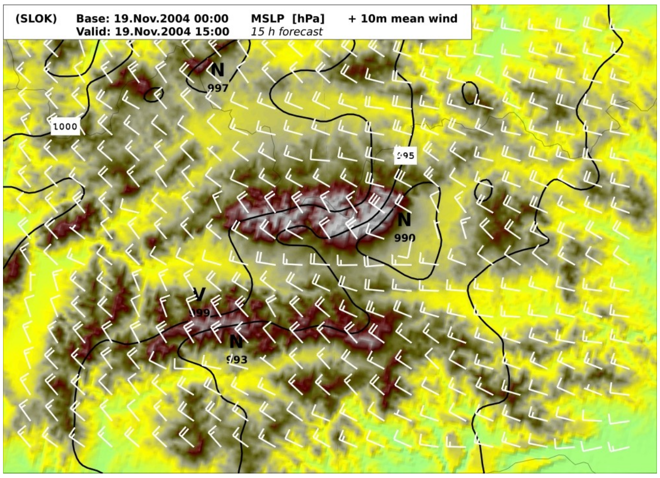

Figure 3: The same as figure 1, but hydrostatic run

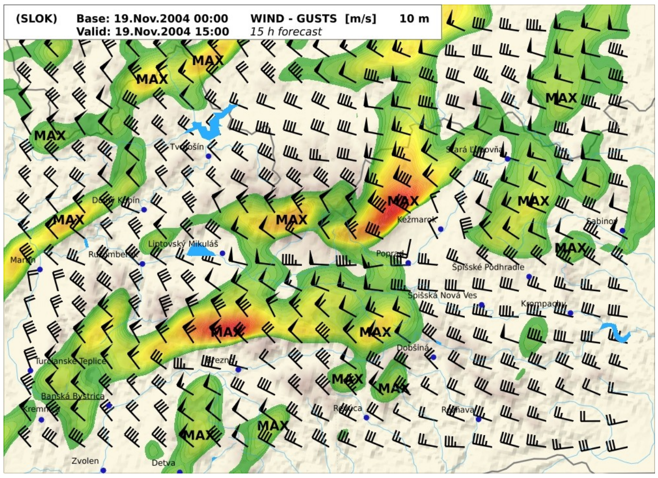

Figure 4: The same as the previous figure, but for wind gust

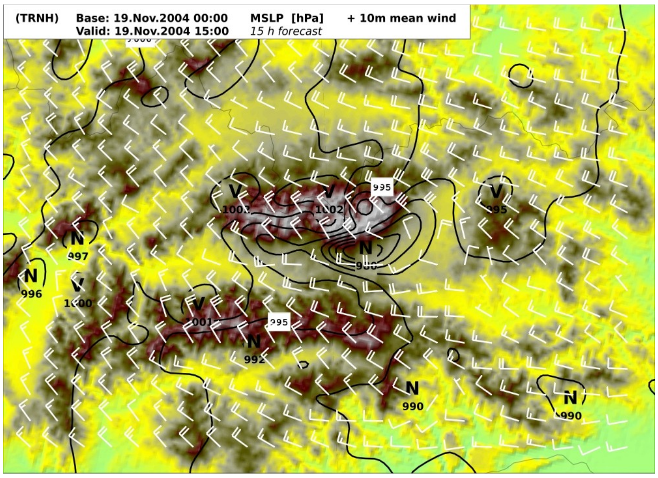

Figure 5: The same as figure 1, but with d3 variable

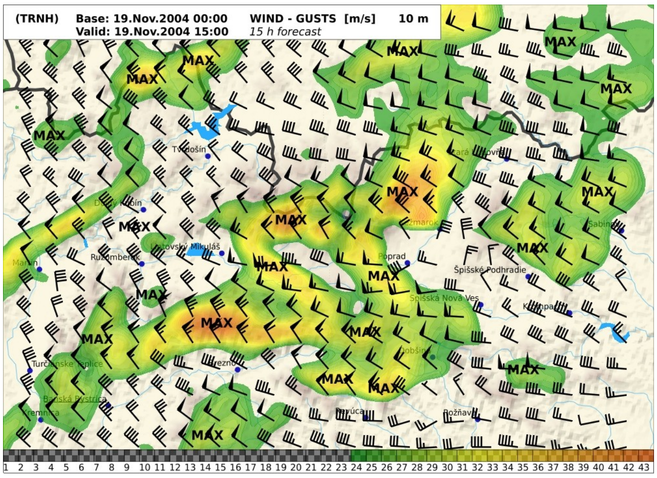

Figure 6: The same as the previous figure, but for wind gust

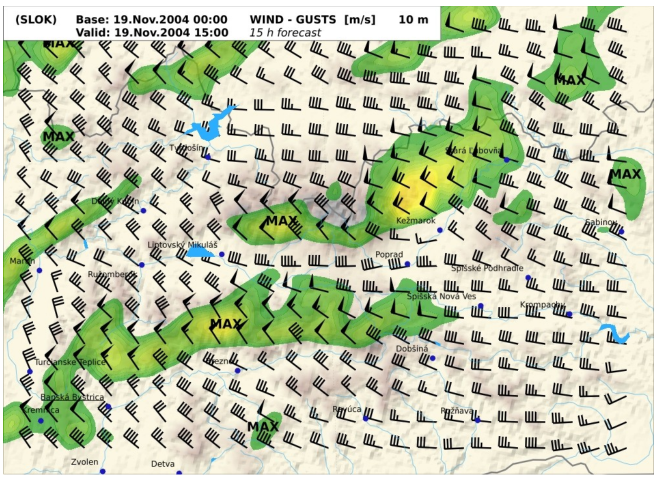

Figure 7: The same as figure 2, but with AL29T1

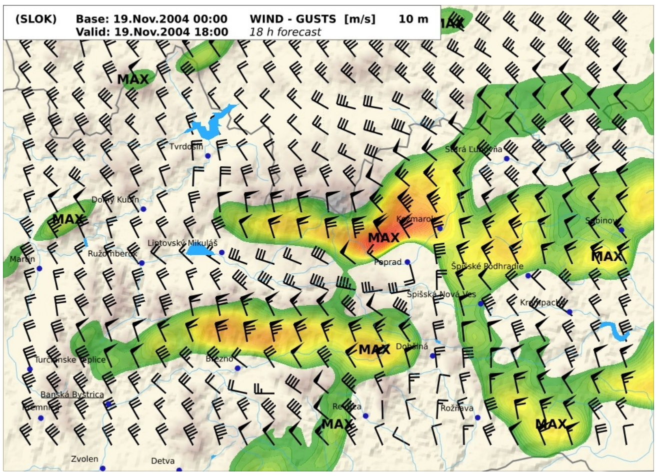

Figure 8: The same as figure 7, but +18h forecast

2. Verifications (more details from jozef.vivoda@shmu.sk and martin.bellus@shmu.sk)

Long term verification of the ALADIN precipitation forecast was made for 62 river catchments, as defined in the frame of the POVAPSYS Project (Flood Warning and Forecasts System in the Slovak Republic), over Slovakia (see fig. 9). Period from July 1996 till August 2005 was verified.

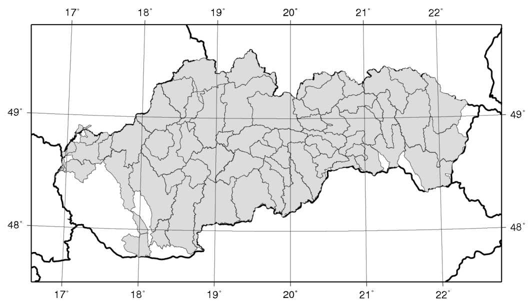

Figure 9: The river catchments

In the first step, the sensitivity of the scores to the size of the river catchment area was evaluated. Standard verifications scores (based on the contingency table) were computed for the areas between 250 and 1500km^2, for the 0.1, 5 and 20mm tresholds. No sensitivity was found for the river catchment areas larger than 500km^2. This is illustrated for BIAS and POD on figures 10 and 11.

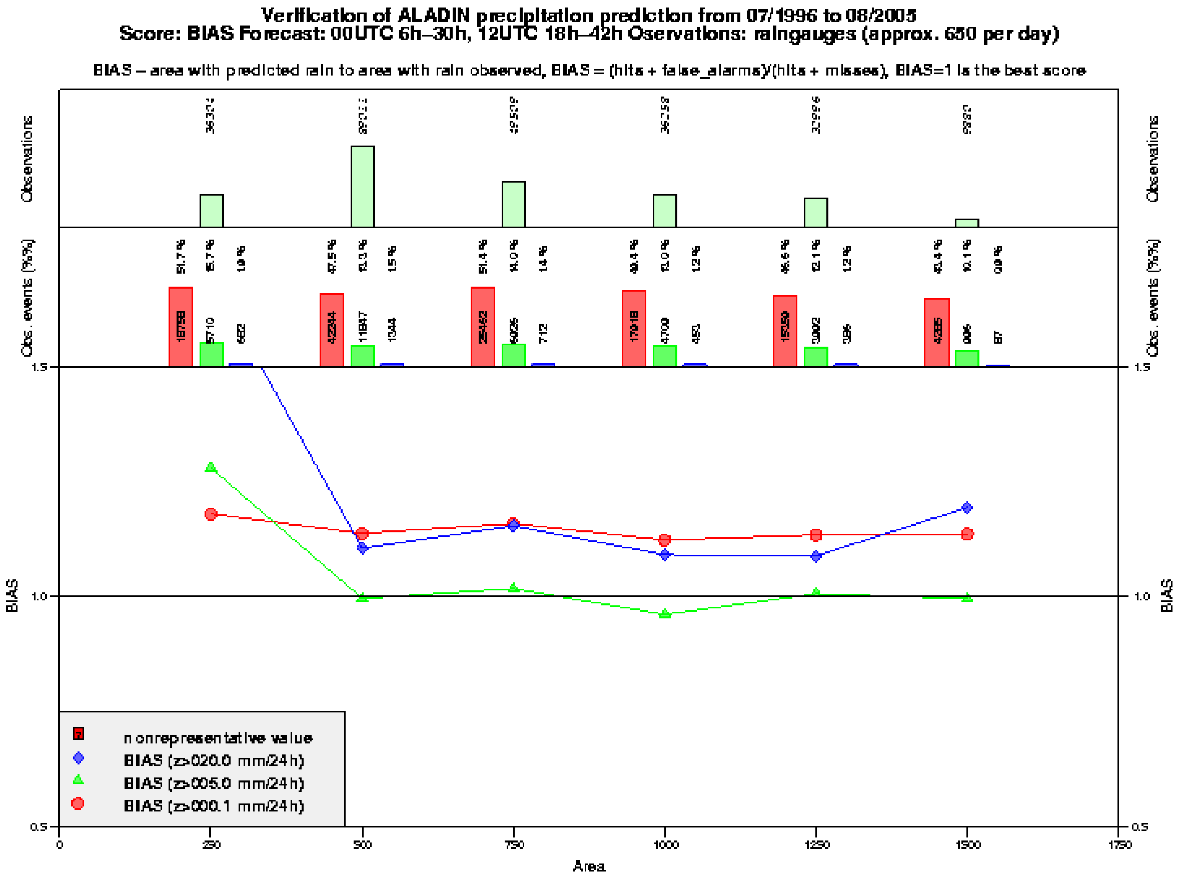

Figure 10: The precipitation score (BIAS) according to the size of verified area

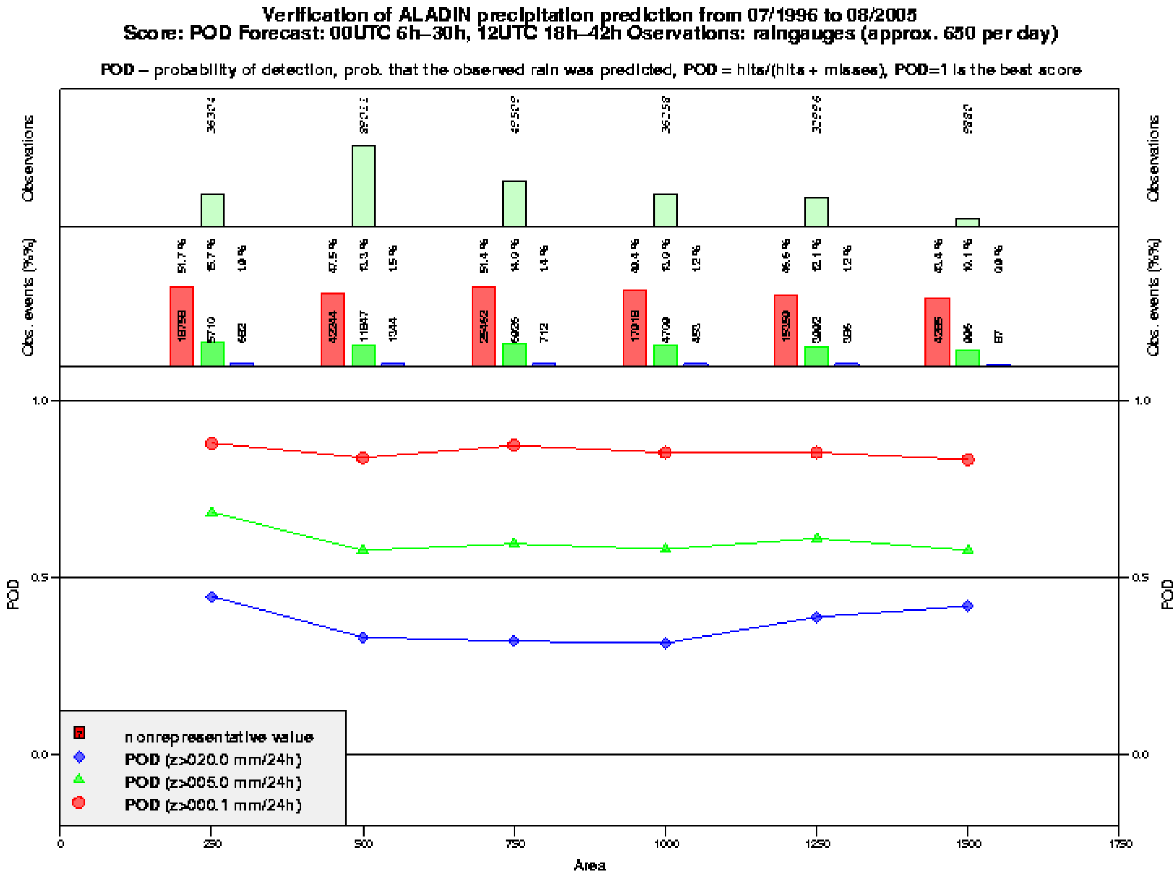

Figure 11: The same as previous figure, but POD (Probability of detection)

Then, for the river catchments displayed on fig. 9, the 24h precipitations cumulated between +06h and +30h, valid at 06UTC next day, were compared to the measurements - 24h cumulated precipitation from the 650 raingauges sites. Both predicted and measured precipitation were averaged over the river catchments, with the tresholds of 0.1, 5 and 10mm.

The results were presented in the poster form. Generally it was concluded, that the frequency of forecasted precipitation (more than 0.1mm) is overestimated in the summer, and underestimated in winter. Probability, that the predicted precipitations were measured, has significant annual variation: 90% in summer and 75% in winter. For the 5 and 10mm tresholds, the probability is about 50%. The false alarm rate was about 25% for 0.1mm treshold, 40% for 5mm and about 50% for 10mm treshold.

The future work will concentrate on the usage of radar precipitation observations.

Other local verification tool (POVER - POint VERification) used to compute scores of surface parameters for SYNOP stations was upgraded to MySQL technology, and runs very fast now. BIAS and RMSE scores of 2m temperature, 10m wind speed and total cloudiness are computed. Direct comparison of the forecast for the 1st and for the 2nd day to observations, scores by ranges and time evolution of the scores can be plotted. The tool and the results are available on intranet. The examples of the POVER outputs for Bratislava station, 2m temperature, are on figures 12, 13 and 14.

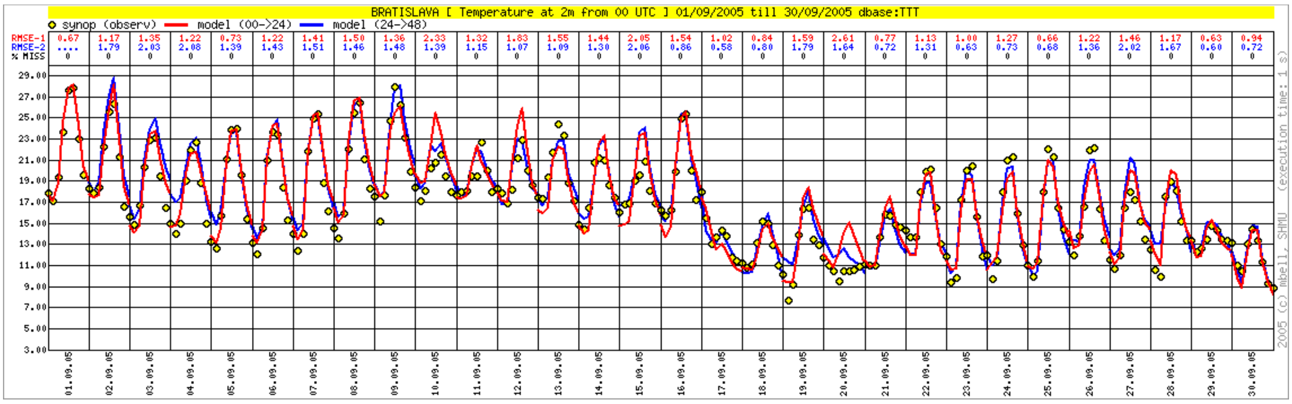

Figure 12: POVER - 2m temperature for Bratislava (1-30/09/2005) - direct comparison with observations. Forecast for the 1st day in red, for the 2nd day in blue, observations with dots

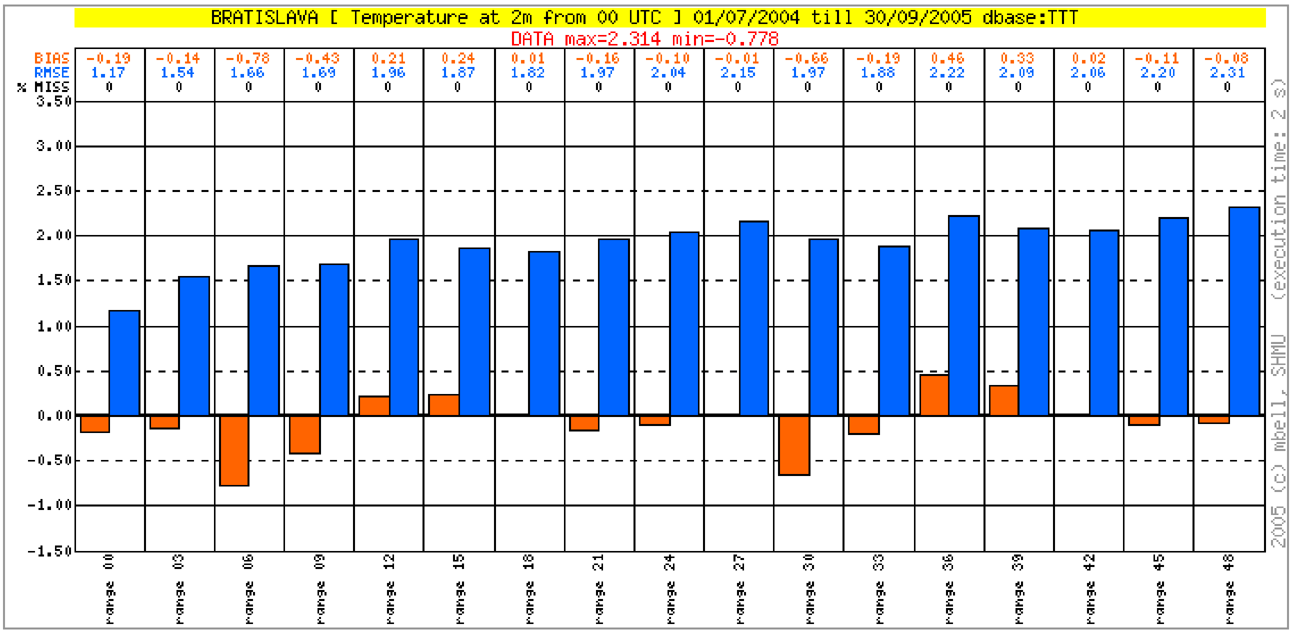

Figure 13: POVER - 2m temperature for Bratislava (01/07/2004 - 30/09/2005) - by forecast ranges. BIAS in red, RMSE in blue

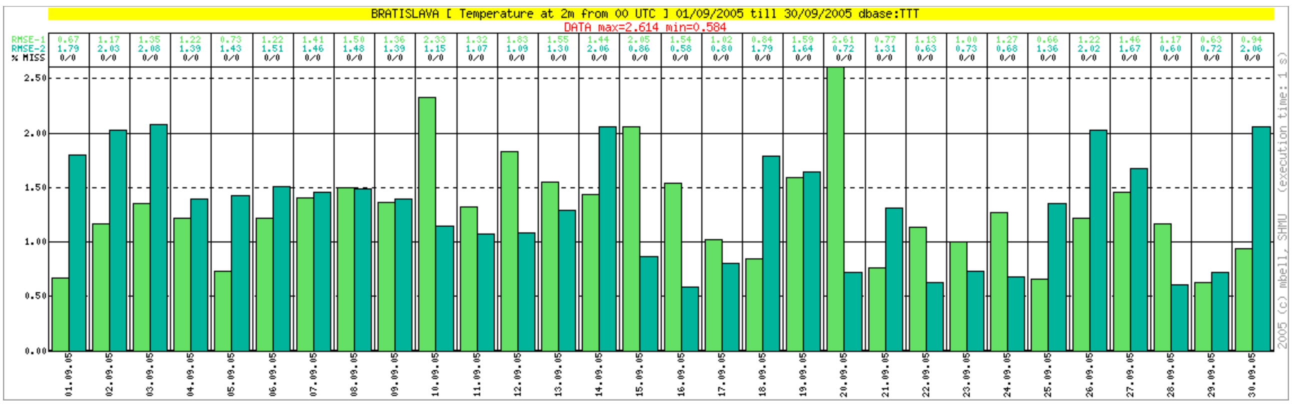

Figure 14: POVER - 2m temperature for Bratislava (1-30/09/2005) - RMSE by days. Forecast for the 1st day in light green, for the 2nd day in dark green.

3. Cloud optical properties (more details from jan.masek@shmu.sk)

During two month LACE stay in Prague (J. Masek, August-September 2005) new parameterization of cloud optical properties for ALARO-0 was proposed. There are two modifications with respect to old ACRANEB:

1) cloud optical properties depend on ice/liquid water content

2) saturation effect (weakening of broadband absorption/scattering coefficient with increasing optical depth) depends on cloud thickness and geometry

Since point 2 (namely the treatmnent of cloud geometry) was not fully finished during the stay, work continued locally in October. Final configuration of the new scheme and its coding into ALARO-0 should be done in early 2006.

4. Other local ALADIN-related work

The ODB software was succesfully implemented on our HPC, and the necessary tools to run verif.pack were tested (bator, mandalay, aladodb). Currently the programs to convert observations to OBSOUL format are being developed and the interface to veral.visr is being finalized.

New climate and coupling files have been extensively tested in order to prepare the switch scheduled for January 2006.

Other local work has been focused on the organisation of the **20th RC LACE Council** and **10th General Assembly of ALADIN Partners** (October 2005 in Bratislava). Both meetings successfully ended with the signatures of new Memorandums of Understanding.

J. Masek and J. Vivoda gave lectures on NH dynamics during the AROME training course in Brasov, the time needed for this preparation was surely not negligible.

CONTENTS