Verification in Croatian Meteorological and Hydrological Service

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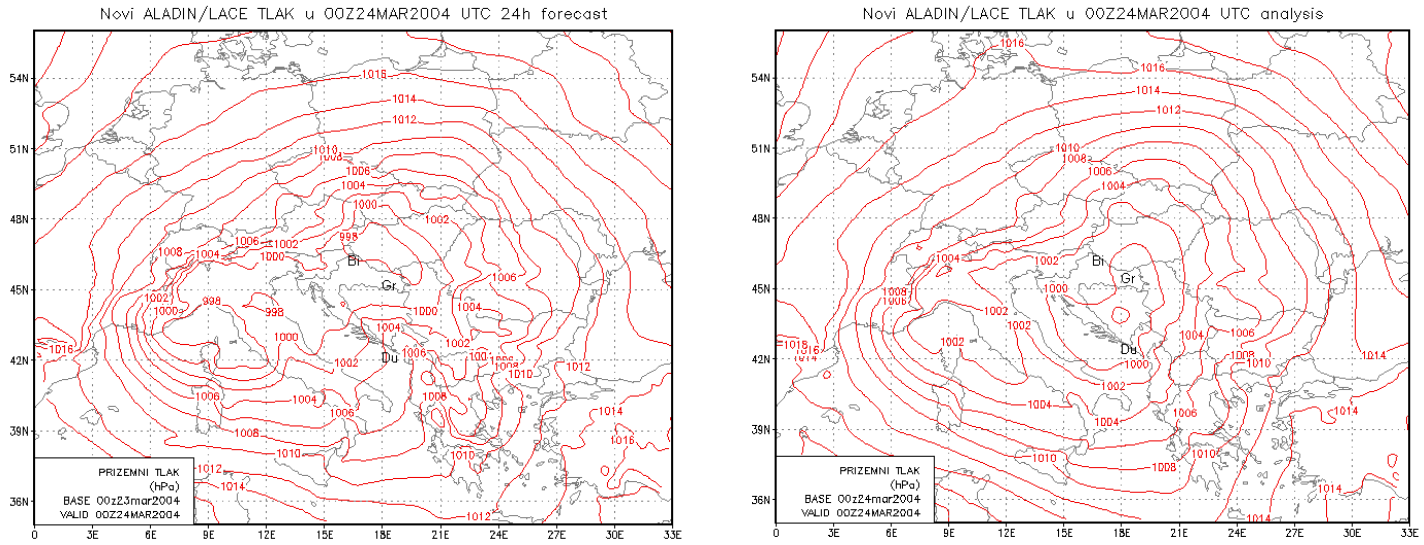
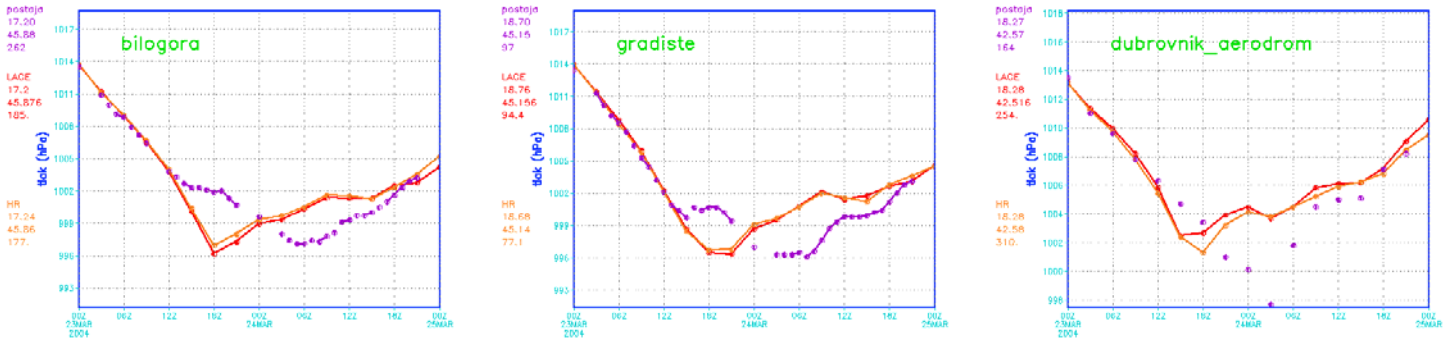
In the Croatian Meteorological and Hydrological Service in year 2004 quite a lot of time was dedicated to verification issues. For more than 3 year "graphical" verification to Croatian SINOP stations for ALADIN/LACE (12 km) and ALADIN/CROATIA (8 km) exist. Example is shown in case study of one extreme event not well forecasted with ALADIN model. From summer 2004 verification against checked hourly data exist, unfortunately with few month delay and just for main stations in Croatia.

Adriatic storm case on 24th March 2004

On 24th March 2004 03 UTC a cyclone stroke a southern part of Croatian coast in the Dubrovnik area. Unfortunately, the movement was forecasted too fast and the depth of this cyclone was severely underestimated. Model outputs have 3 hours interval. On verification figures 3-hourly forecast points are connected with lines and SINOP data are just points.



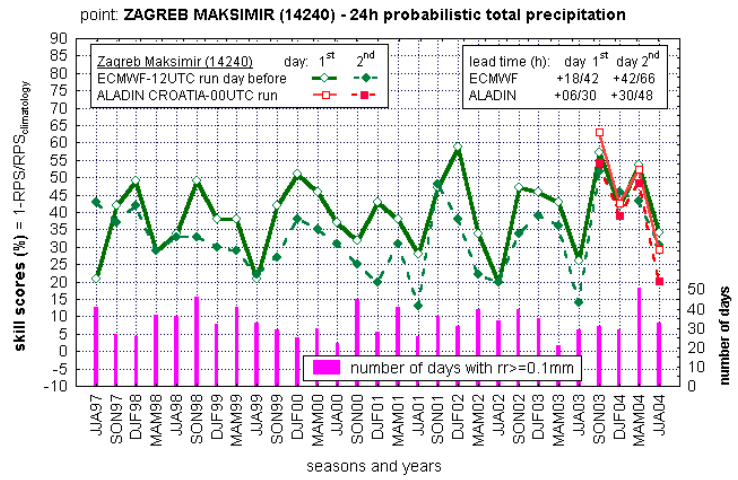
Mean sea level pressure 24 hrs forecast (left) and analysis (left) for 00 UTC 24th March 2004.



Comparison of the forecasted mean sea level pressure with 12-km (red) and 8-km (orange) with measurements from the SYNOP (violet dots) stations.

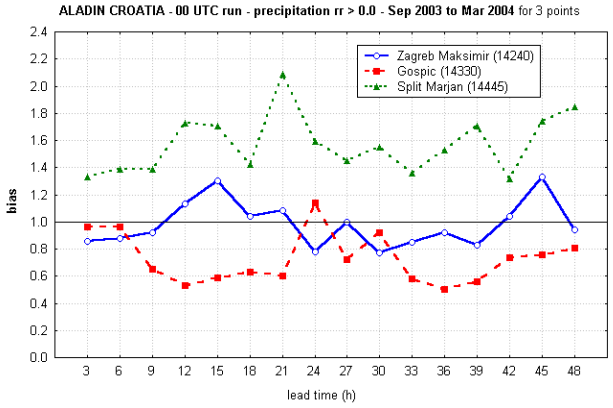
New verification products

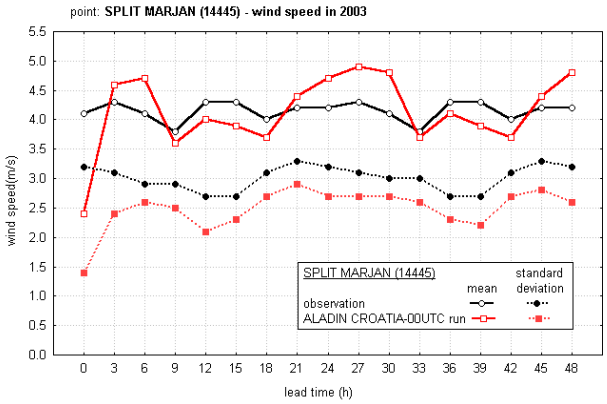
First new pre-operational verification results of ALADIN forecasts for meteorological stations are shown bellow. At the moment verification of extreme 2 m temperature (daily min & max), precipitation, 10-m wind from surface data are done monthly. As it was before, verification against sounding for station Zagreb Maksimir for ECMWF and ALADIN models are continued. In year 2005 verification against sounding in Zadar is planed.

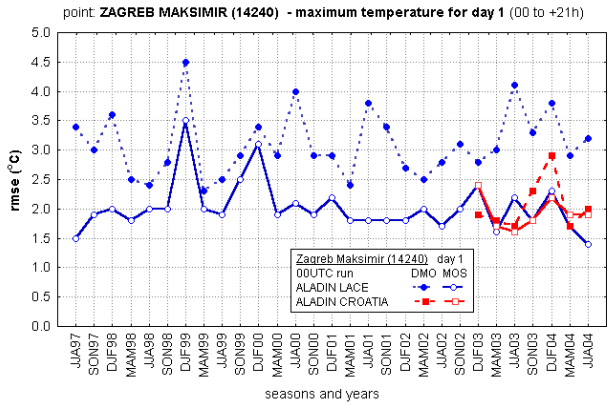


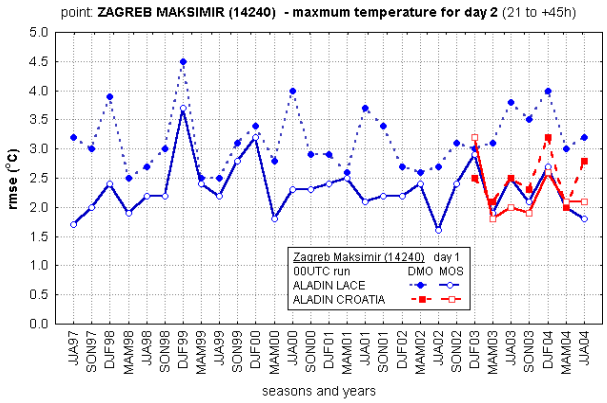
Skill scores for probability of precipitation made of ranked probability scores of quantitative ECMWF and ALADIN CROATIA precipitation forecasts for "1st" and "2nd" day for Zagreb Maksimir (14240), from summer 1997 to summer 2004 (left).

Bias of ALADIN CROATIA precipitation forecast (rain versus no rain) for Zagreb Maksimir (14240), Gospic (14330) and Split Marjan (14445) from September 2003 to March 2004 (bellow left). Mean errors and standard deviation of ALADIN CROATIA wind speed for Split Marjan (14445) for the year 2003 (bellow right).

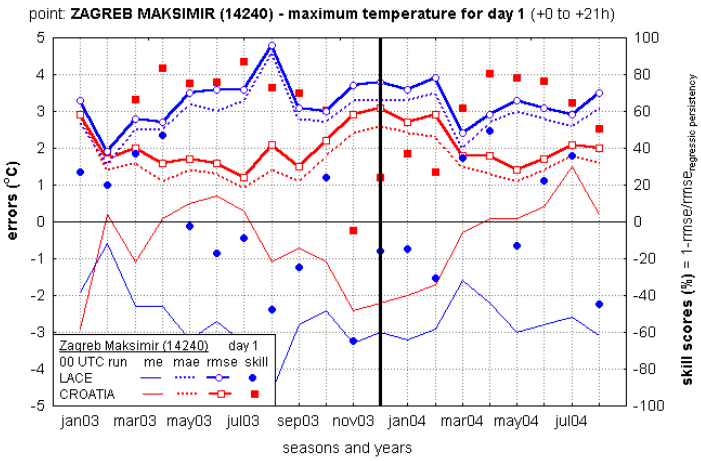








Root-mean-square errors of maximum temperature for day 1 (left) and day 2 (right) forecast of ALADIN LACE (12 km) and CROATIA (8 km) for direct model output and model output statistics, for Zagreb Maksimir, from summer 1997 to summer 2004. MOS are done using regression equations (y=ax+b) which were calculated from historic data for warm (April to September) and cold (October to March) part of the year.



Monthly mean errors, mean absolute errors, root-mean-square errors and skill scores (according root-mean-square error and regression persistency) for day 1 maximum temperature forecast of ALADIN LACE (12 km) and CROATIA (8 km) for direct model output, for Zagreb Maksimir (14240), from January 2003 to August 2004.

For this station forecast of maximum temperature for day 1 and 8 km resolution is better than 12 km resolution. Unfortunately that is not a case for all meteorological stations in Croatia.