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NWP activities in Romania

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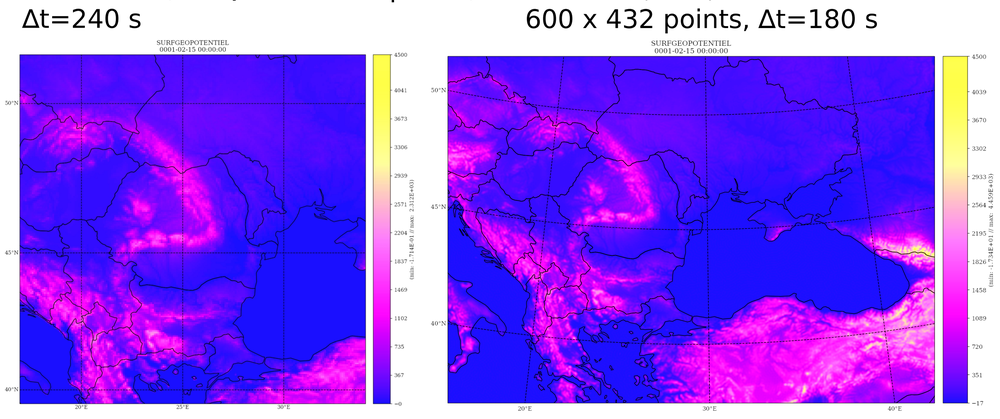
Operational configurations

1) ALARO 6.5: ALARO-0 baseline, Δx=6.5 km, L60**,** 240 x 240 points, Δt=240 s

2) ALARO 4: ALARO1 vB, Δx=4 km, L60, 600 x 432 points, Δt=180 s



- **cy43t2**
- semi-implicit semi-Lagrangian 2TL
- 60 vertical levels, linear grid
- Lambert projection
- LBC from ARPEGE (3h frequency)
- DFI Initialization
- 4 runs/day 00, 06, 12, 18 UTC; no DA
- forecast range: 78/54/78/54 hours
- **2 parallel configurations**

- **Post-processing**

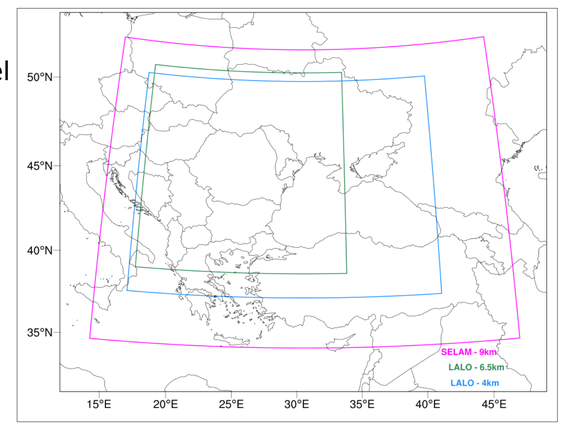
  FULLPOS in line – geographical grid (0.06° x 0.085°)

Downstream applications

Atmospheric input from ALARO for hydrological model

Visualization
Graphics based on package developed within NMA and RC-LACE, based on grib_api, perl and NCL-NCAR

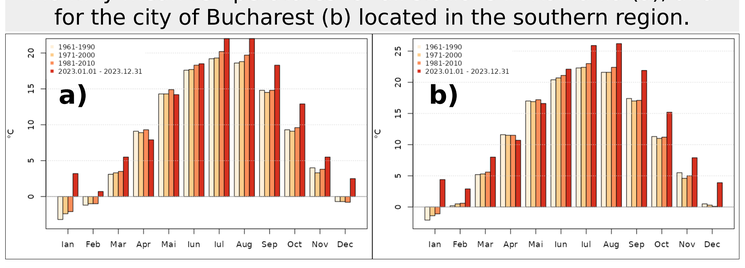
Statistical Adaptation
Verification

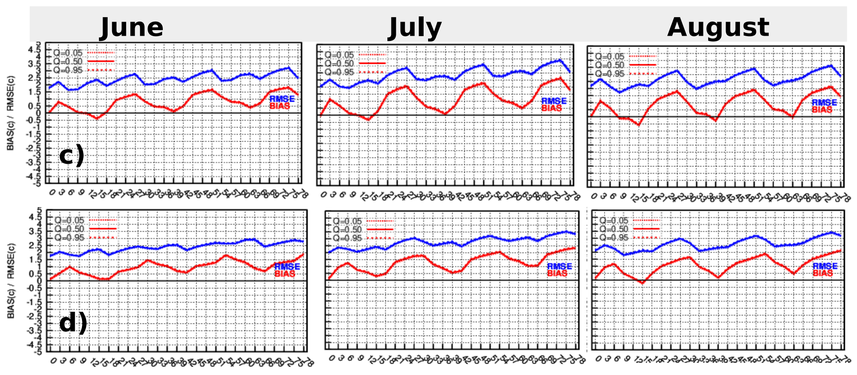


Evaluation of the ALARO temperature forecast for Romania

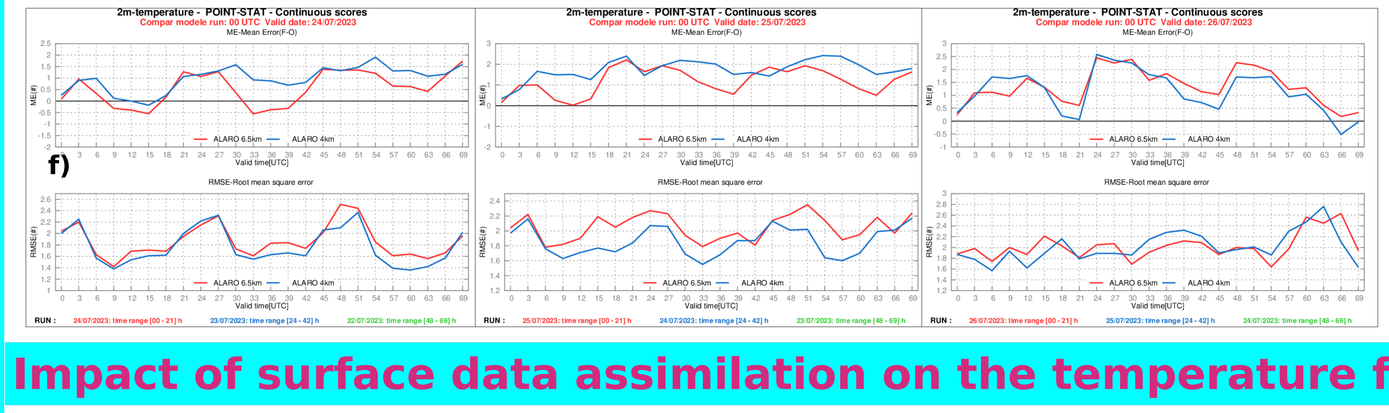
- In Romania, in summer, autumn and winter months, the average temperatures were significantly higher than the climatological norms (1961 - 2010), especially in southern regions. An evaluation was done using data from 166 meteorological stations, for both operational configurations for summer. A heatwave event from 26 July 2023 was analyzed (Figures f and g), when the maximum temperature reached 42° C in the southeastern region.

Monthly mean temperatures for all stations in Romania (a), and for the city of Bucharest (b) located in the southern region.

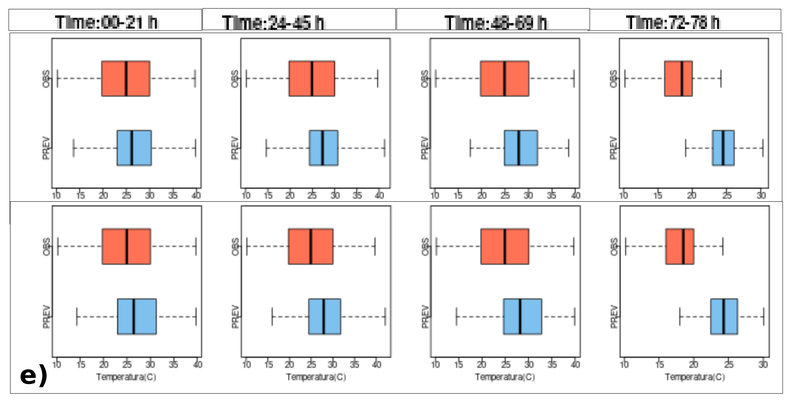




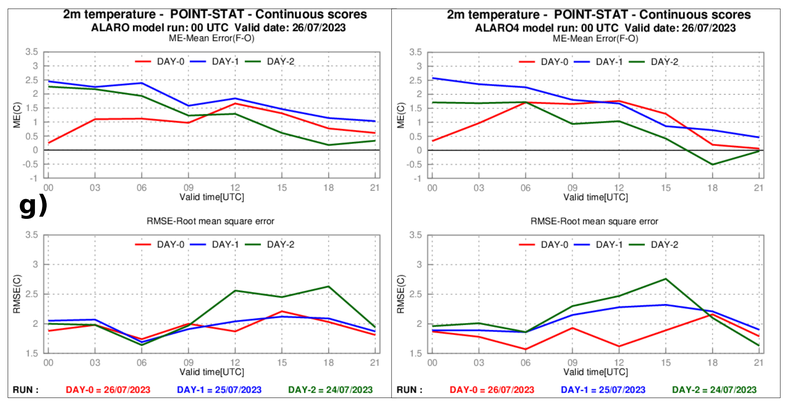
- Both versions generally overestimate the temperature, larger biases seen over nighttime, in the monthly bias and RMSE for ALARO 6.5 (Figure c) and ALARO 4 (Figure d). While there is a larger variation of the scores within a day for ALARO 6.5, these differences are slightly smoothed in the ALARO 4 forecast.



- The ME for ALARO 4 are slightly higher than ALARO 6.5, for the 26th July (differences up to 1.2° C).
- The RMSE show that the accuracy of ALARO 4 is slightly higher than ALARO 6.5 version.

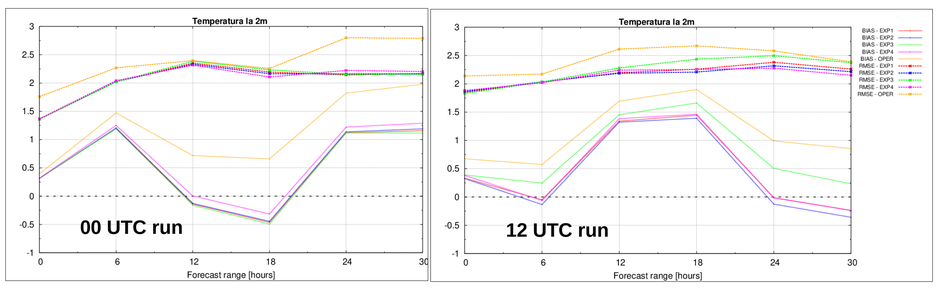


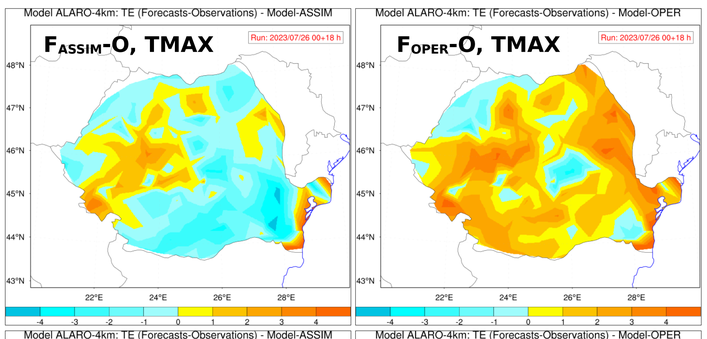
- For example, for Bucharest, in July, the forecast values are larger than the observations and the difference between the two increases with the forecast range (Figure e).



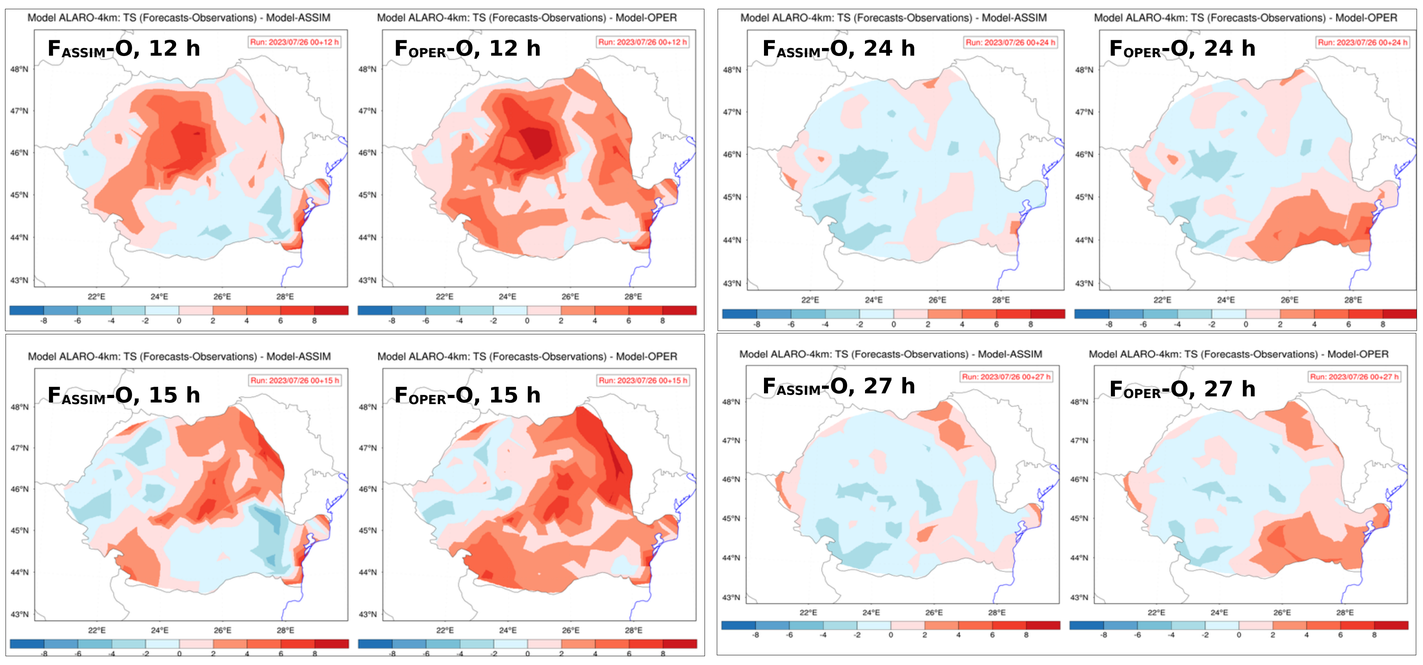
Impact of surface data assimilation on the temperature forecast

- Recent developments were done locally using the surface data assimilation system. Four experiments using CANARI were made with different versions of ISBA polynomes. They are based on the 4 km horizontal resolution model version (ALARO 4), have 60 vertical levels and a 6h assimilation cycle. They were run for July 2023, for all runs and for 30 hours forecast range. Monthly scores were computed for 2m temperature.





- There is an improvement that comes from the data assimilation experiments compared to the operational version, visible in both scores. EXP 2 seems to lead to the most accurate results.



- Good results are obtained also for the date of July 26th, visible on the maps that show the differences between the estimated and observed temperatures.

- The overestimation in the central and eastern parts of the southern region of the country is reduced with DA EXP2, for daytime and nighttime hours.

- The data assimilation forecast leads to a more realistic forecast as well for the extreme temperatures: the maximum and minimum temperatures of the day.

MOS forecast

- The statistical adaptation of the model forecast was analysed to see how it behaves for these situations and if it is able to reduce the defficiencies we encountered with the temperature forecast. The mean error and RMSE were computed for the summer months for 2m temperature and extreme temperature for all stations. Two MOS estimations are considered, obtained from each of the operational versions of ALARO.

- The ME is almost completely reduced with MOS; the values of the scores are very similar between the two versions, slightly larger values in the mean error appears in the MOS for ALARO 4 over daytime. Also, it seems that the maximum temperature is better estimated than the 2m temperature.

- For July 26th, the MOS forecast seems to overestimate TMAX over the south-eastern region, but for some stations the values are sligtly reduced compared to ALARO.