A-LAEF migration to Bologna and extreme weather forecasts

(ALARO-Limited Area Ensemble Forecasting - the common operational EPS of RC LACE)

LACE nwp central europe

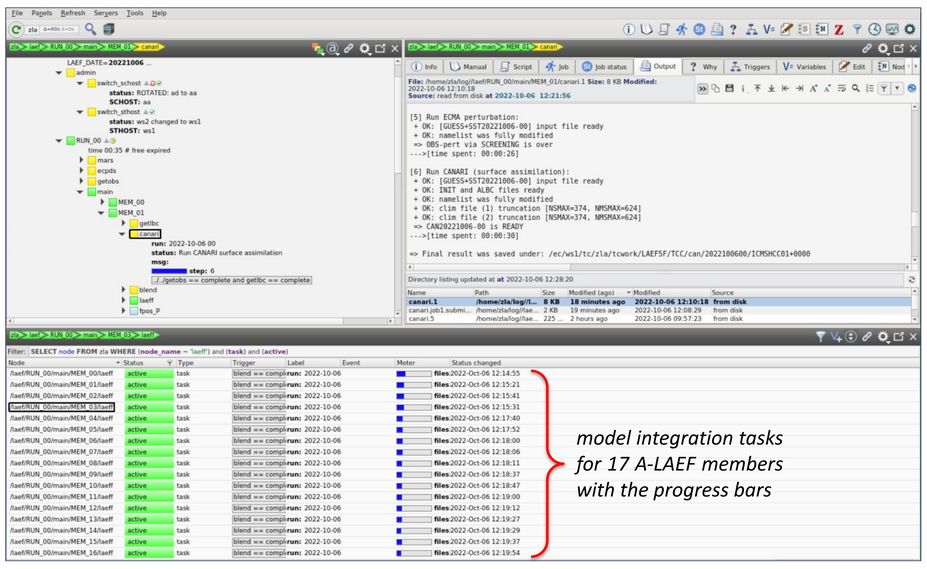
The 3rd ACCORD All Staff Workshop | 27–31 March 2023 | Tallinn, Estonia

Martin Belluš | SHMÚ, Slovakia (martin.bellus@shmu.sk)
André Simon | SHMÚ, Slovakia (andre.simon@shmu.sk)

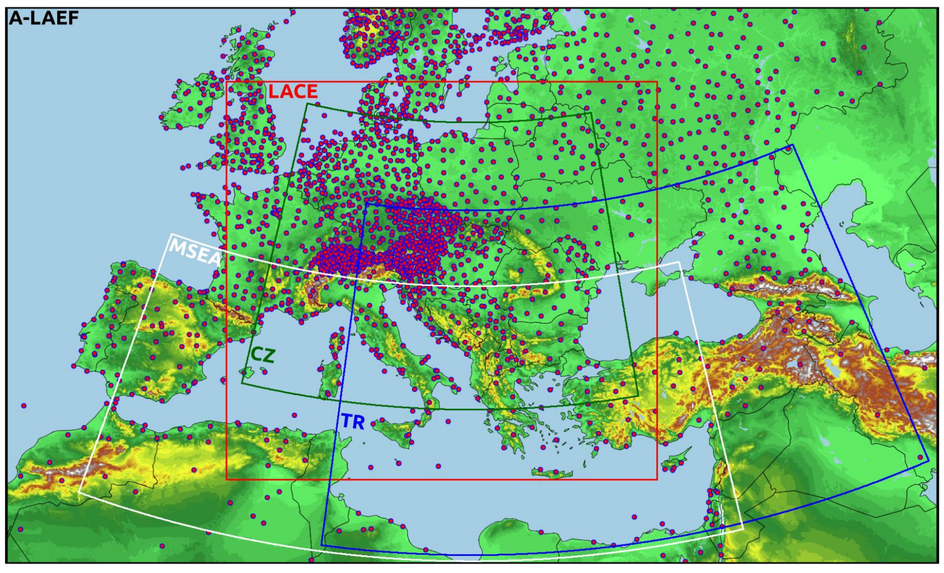
Special thanks to:
Xavier Abellan (ECMWF) and
Ryad El Khatib (Météo-France)

Migration from Cray to Atos

A-LAEF (ALARO-Limited Area Ensemble Forecasting) system was successfully migrated to the new HPCF of ECMWF in Bologna. Along with the migration, also several technical upgrades were done (LBC preparation via cy48t2, e001 live monitoring via child processes, upgrade of GRIBs production for Lambert and LATLON domains, increased number of OBS sites in the backup OPLACE files, etc.). The operational suite (TC2) is running on Atos complex since October 19, 2022. Migration from Cray platform (and to the new SLURM workload manager system) was quite challenging task, affected by delayed Atos HPCF availability. There were also some initial HW/SW stability issues on the new ECMWF clusters, eventually solved by several upgrades. Currently the system is running smoothly and reliably. As a bonus, the A-LAEF operational products are available to the 6 RC LACE partners (SI, SK, CZ, HR, RO, PL) and Turkey significantly sooner, in comparison with the previous operations in Reading (on Cray). The main purpose of A-LAEF system is to provide a short range probabilistic forecasts, especially in connection with the extreme weather situations (see below).



A-LAEF TC2 suite running on Atos HPCF in Bologna (ecflow UI monitoring).



A-LAEF integration and post-processing domains, with the OBS sites used in the assimilation (ESDA).

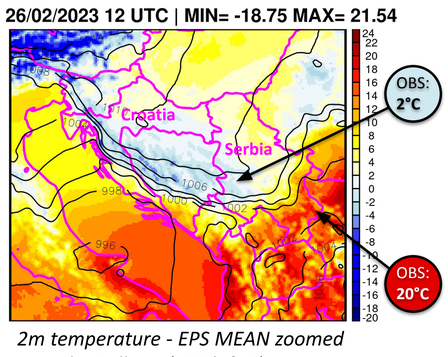
Code version	cy40t1
Horizontal resolution	4.8 km
Vertical levels	60
Number of grid points	1250x750
Grid	linear
Time step	180s
Forecast length	72 h (00/12 UTC)
Members	16+1
IC perturbation	ESDA [surface] spectral blending by DFI [upper-air]
Model perturbation	ALARO-1 multi-physics (4 clusters) + surface stochastic physics (SPPT)
LBC perturbation	ECMWF ENS (c903@cy48t2)

A-LAEF system specifications.

Heavy snowfall in Dalmatia

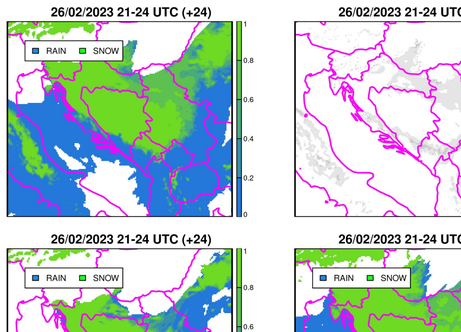
Croatia, 25-27/02/2023

Due to the huge amount of fresh snow and strong wind, traffic connection from Dalmatia towards the Croatian inland was cut off. On Sunday 26th, Croatian authorities closed all roads connecting the country's mainland with the Adriatic Sea coastline. Heavy snow and strong wind was present also in the neighbouring regions and countries. The abrupt onset of wintery conditions came after days of unseasonably warm weather. In Serbia, people in the country's west woke up to a snow-covered landscape, while temperature in the south reached as high as 22° C. These extreme weather changes were well captured by the A-LAEF forecast.

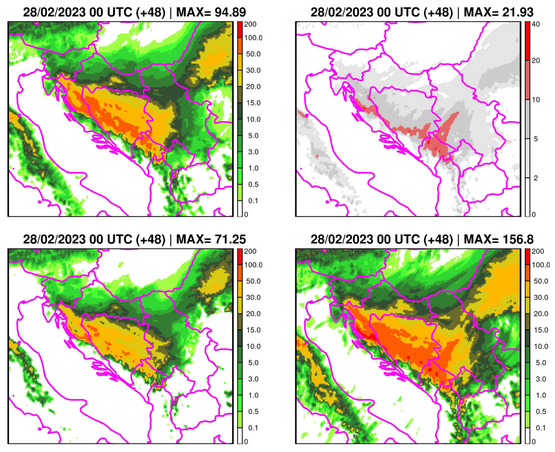


2m temperature - EPS MEAN zoomed over the Balkans (+12 h fcst).

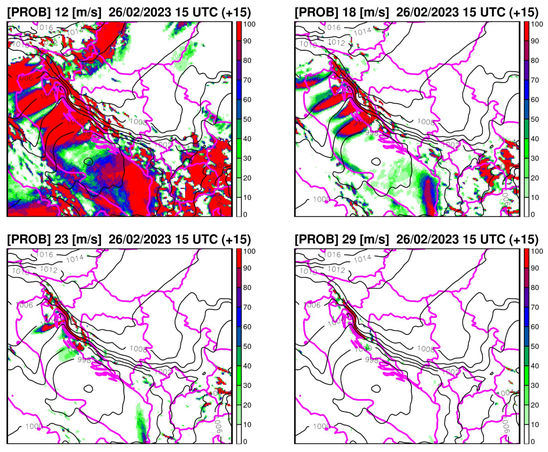
Source: internet.



Precipitation type - EPS MEAN, SPREAD, MIN, MAX zoomed over the Balkans (+24 h fcst).



Accumulated snow - EPS MEAN, SPREAD, MIN, MAX zoomed over the Balkans (+48 h fcst).



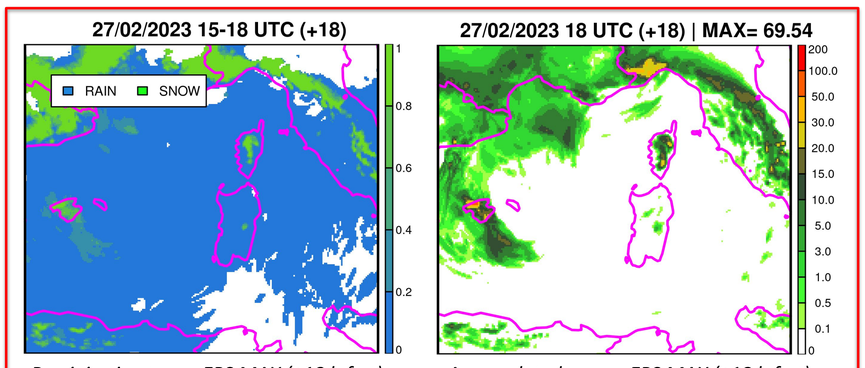
Wind gust probabilities for different thresholds (12, 18, 23, 29 m/s) zoomed over the Balkans (+15 h fcst).

Storm Juliette near Balearic Islands

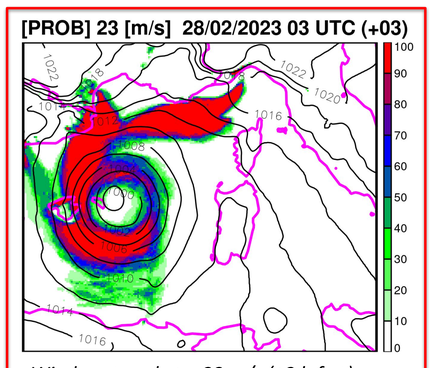
Mallorca, 27-28/02/2023

Wind gusts exceeding 100 km/h caused power cuts in various parts of the Mallorca island (with a peak gust of 119 km/h measured on 28 February at Capdepera station). Strong wind was accompanied by outbreak of cold weather and snow in coastal municipalities such as Felanitx, Manacor and Santanyi. The red alert for snow has been extended to the noon of 28 February. A-LAEF forecasted the storm and indicated significant (up to 70 cm) snowfall on the island.

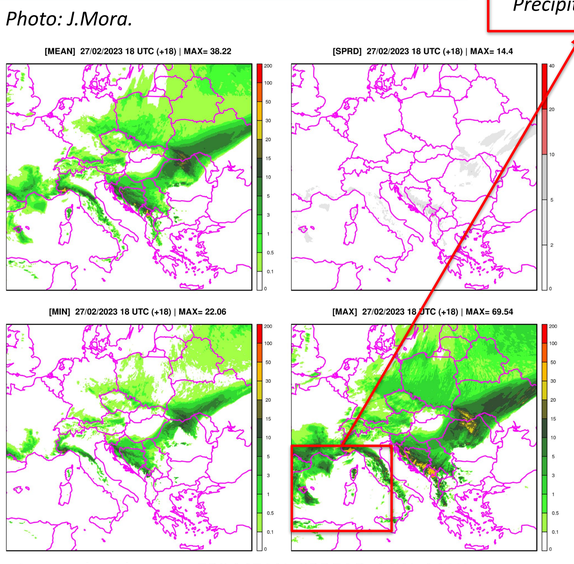
Photo: J.Mora.



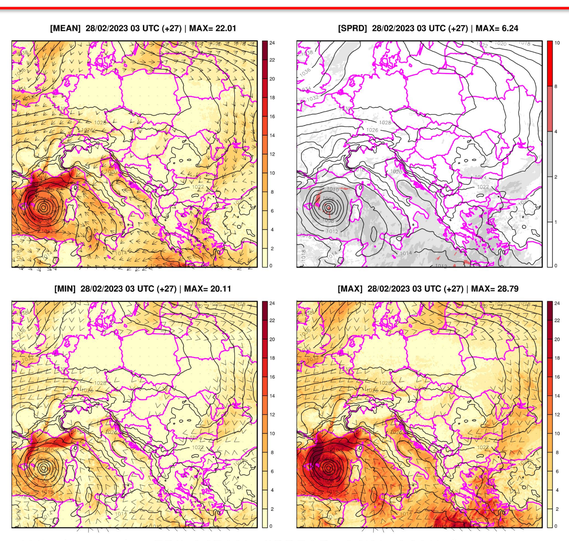
Precipitation type - EPS MAX (+18 h fcst). *Accumulated snow - EPS MAX (+18 h fcst).*



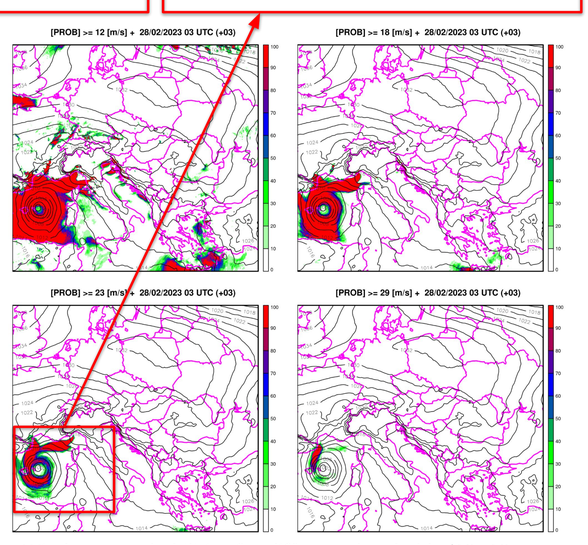
Wind gust prob. >= 23 m/s (+3 h fcst).



Accumulated snow - EPS MEAN, SPREAD, MIN, MAX for LACE postprocessing domain (+18 h fcst).



Wind speed - EPS MEAN, SPREAD, MIN, MAX for LACE postprocessing domain (+27 h fcst).

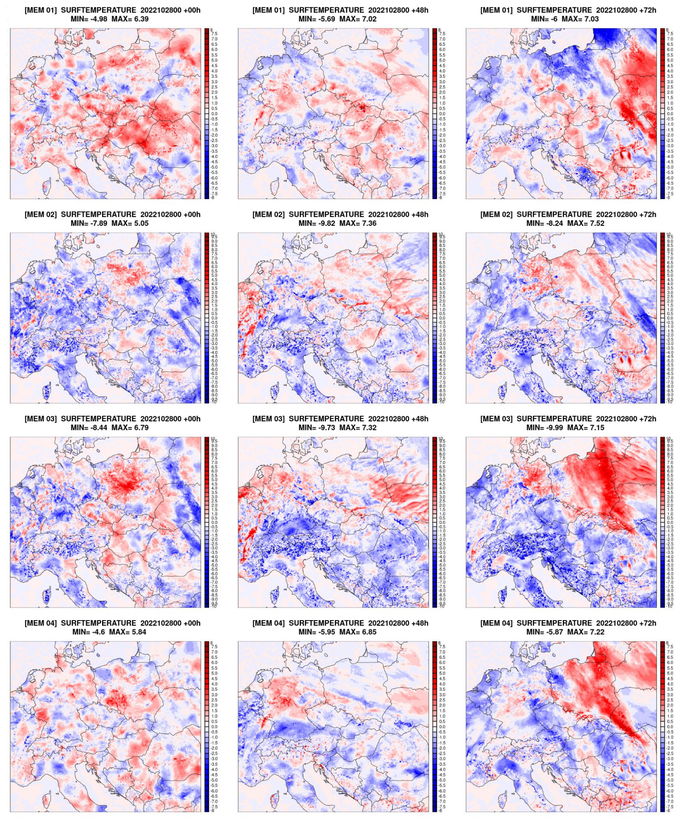


Wind gust probabilities for different thresholds (12, 18, 23, 29 m/s) for LACE postprocessing domain (+3 h fcst).

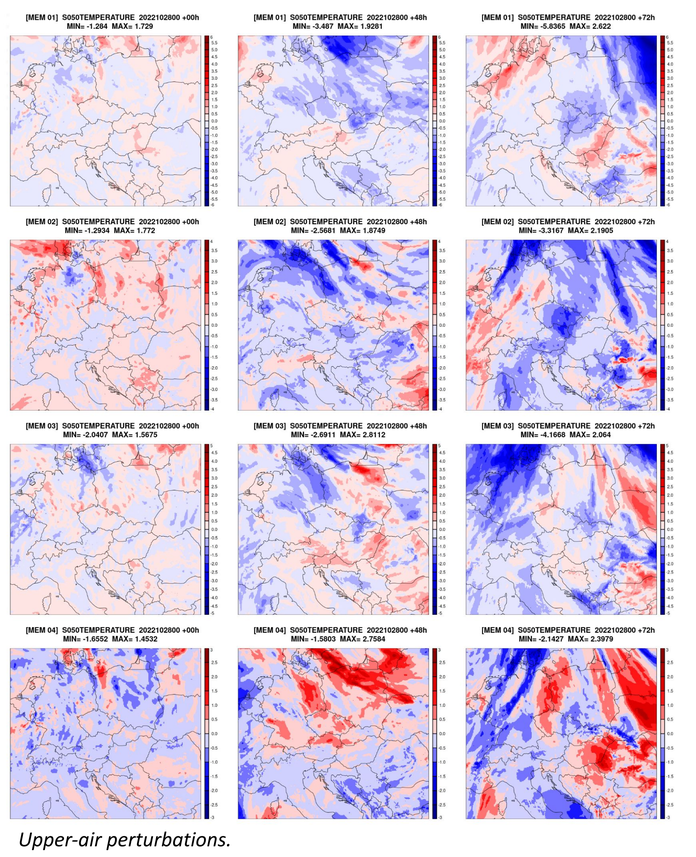
Convection-permitting EPS

Local EPS coupled to A-LAEF

To further improve the ability to forecast extreme weather events at very high resolutions, a convection-permitting EPS based on the scalable ALARO physics is planned at SHMU. This system will be coupled with the A-LAEF regional EPS. An example of perturbed boundary conditions generated by A-LAEF e-suite for SK24 (2.4 km) domain is shown below. The first 8-panel (top) depicts Tsurf perturbations for 3 lead times (+00, +48, +72) and 4 main ALARO physics clusters (in rows). The second 8-panel (bottom) is the same, but for T at 50th model level.



Surface perturbations.



Upper-air perturbations.

Further reading

Belluš, M., M. Tudor, X. Abellan, 2022: "The mesoscale ensemble prediction system A-LAEF", ECMWF Newsletter, No. 172 - Summer 2022, p27-34, DOI: 10.21957/xa927ug5k0

Regional Cooperation for Limited Area Modeling in Central Europe

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