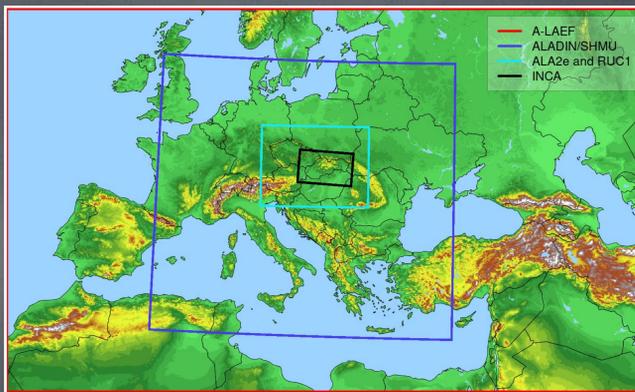


CSC	A-LAEF	ALADIN/SHMU	ALA2E	RUC1/ALA1
status	operational (common RC LACE)	operational		Regular runs (non-TC)
code version	CY40T1bf07+	CY46T1bf07	CY48T3	CY46T1bf07
physics	ALARO-1vB (multi-physics + surface SPPT)		ALARO-1vB	
dx	4.8 km	4.5 km	2.0 km	1.0 km
points	1250 x 750	625 x 576	512 x 384	1024 x 768
vertical levels	60	87	87	87
time step	180 s	180 s	90 s	30 s
forecast ranges + frequency	72/-/72/- hourly	102/72/72/72 hourly	84/-/84/- hourly	+7h hourly and up to +24h (at 00/12 UTC)
coupling model	ECMWF ENS (c903@cy48t2), 6h (time-lagged)	ARPEGE (long- & short cut off), 3h, SCC	ECMWF, 3h (time-lagged)	ARPEGE, 1h (time-lagged), SCC
surface data assimilation	ensemble surface data assimilation (ESDA) by CANARI	CANARI	A-LAEF CNTRL init downscaling	CANARI
upper-air data assimilation	spectral blending by DFI	Blending by DFI + 3D-Var		3D-Var
initialization	none	none	DFI	DFI
HPC	Atos Sequana XH2000 AMD (ECMWF)	NEC HPC - 240 nodes, 6230 Intel Xeon Gold Scalable Processors (Cascade Lake), Omni-Path, Linux		
nodes	85	40	40	40



**Operational highlights**  
Upgrade of ALADIN/SHMU to 87 vertical levels

**Near future plans**  
Maintenance of operational apps, RUC development, VHR, single precision, possible upgrades to CY49T2

### Highlights of the research and development

- Dynamics:** Single precision tests (VFE correction, etc.)
- DA:** GNSS ZTD data, smoothing of deep soil wetness (ALADIN/SHMU, RUC)
- RUC:** Case studies, radar data assimilation, single precision tests
- EPS:** A-LAEF e-suite with CY46T1+, new ALARO multiphysics (EL0, EL1, prognostic graupel, etc.), probabilistic calculation of the SPEI index for drought monitoring, case study of severe floods caused by the storm Boris (12.-16.9.2024)
- ALA2E:** 30 min. outputs, CY49T2 tests, severe weather case studies
- Climatological modeling:** Downscaling of ERA 5 reanalyses
- Physics and diagnostics:** Parameterization of wet snow ice on overhead wires in ap\_alaro, VIL diagnostics, reduction of oscillations in offline SURFEX
- Quality control:** HARP IO for Obsoul TEMP, higher vertical data density
- DE\_330\_MF (DEODE) project:** high resolution EPS, case studies, MTG LI data
- Technical implementation:** GIT environment for operational applications

### Massive exodus of the NWP/SHMU colleagues!



Original team consisted of 11 people (by end of March, 2025), 6 people left SHMU, including our head, Mária Derková (Mariska).

Staying: Martin Imrišek, Michal Neštiak, André Simon, Oldřich Španiel, Roman Zehnal

New contact:  
Head: Jozef Csaplár (jozef.csaplara@shmu.sk)

### Envisaged impacts on the operational applications:

- ALADIN/SHMU: Only maintenance planned, remains on CY46T1
- A-LAEF: should be carried out by the IMGW-PIB team in the future (2026 ->)
- ALA2E: Small upgrades envisaged (perhaps use of single precision)
- RUC1/ALA1: Maintenance, use of single precision, radar assimilation

### On international projects (DEODE, HARP):

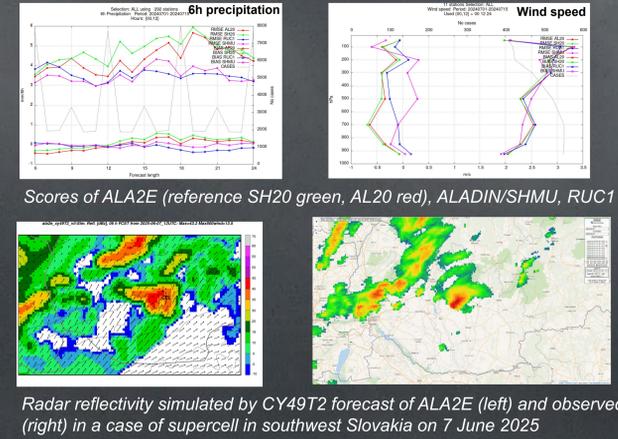
Continuation with the efforts in hectometric scale modeling (André Simon) and single precision (Oldřich Španiel). Other SHMU activities in the very high resolution EPS (Martin Belluš) or in hydrological applications (Martin Petras) will stop due to lack of manpower or will be limited. There is nobody to continue with verification (HARP) by now!

### Acknowledgement:

We would like to express a big **"THANK YOU!"** to colleagues, who left us after years/decades of hard work and we wish them a lot of success in their future career!

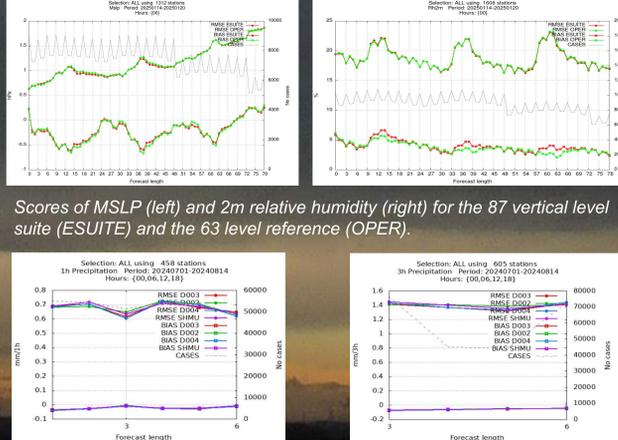
### ALA2E tested with CY49T2

The new version of CY49T2, bf\_sfx (containing ap\_alaro development but run still without SURFEX) was tested at SHMU on case studies and scores (denoted AL20) were calculated. The performance is comparable or somewhat better than the operational CY48T3 version (mainly for precipitation scores and wind).



### Upgrade of ALADIN/SHMU to 87 levels, etc.

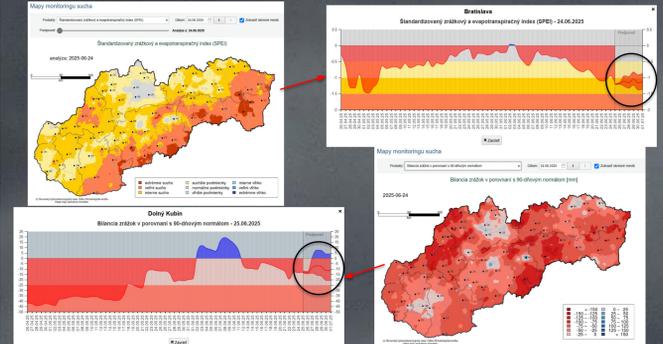
The ALADIN/SHMU model has been upgraded from 63 to 87 vertical levels after series of tests. Integration was prolonged up to 102 h ahead for the 00 UTC run, new parameters were tested and added to outputs (e.g. simulated METEOSAT satellite images). DFI step in blending and REDNMC coefficients in 3DVAR were returned and VARBC coefficients for ZTD were established. Tests with smoothing of the deep soil wetness in CANARI were performed but not implemented operationally yet. Outputs and products (mutigrib) are continuously upgraded to the GRIB2 format.



Experiments: D002: new climate files, D003, D004: CHMI modset for CANARI only, LISSEW smoothing of the deep soil wetness, SMUO tuning. The latter modification seemed to slightly improve the summer precipitation forecast.

### Monitoring of drought with probabilistic SPEI index

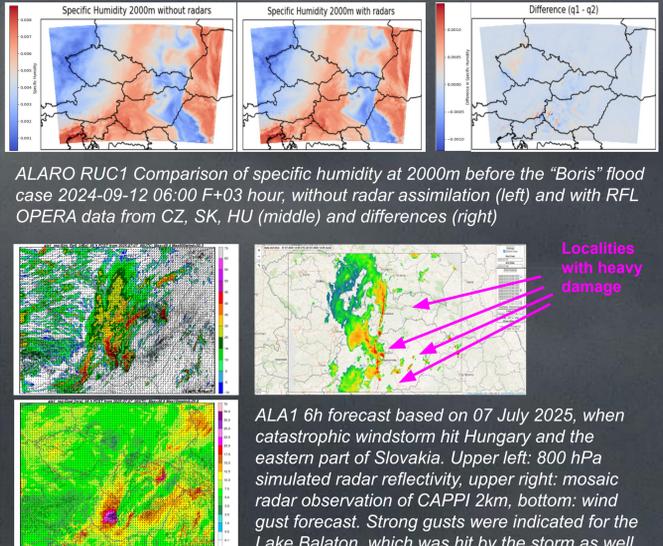
The Standardized Precipitation and Evapotranspiration Index (SPEI) characterizes drought conditions with respect to both precipitation and potential evapotranspiration (PET). The length of the accumulation period is 30 days. At SHMU, the forecast part of SPEI was calculated in probabilistic manner, using both A-LAEF and ECMWF-EPS models. Since 28 March 2025, the SPEI maps started to be uploaded on the SHMU website and new maps and highcharts (see figures below) became available since 9 June 2025.



Drought monitoring maps and highcharts for the SHMU website: SPEI index map (upper left), course of SPEI for Bratislava (upper right), precipitation budget in comparison with the 90 day normal for the Dolný Kubín city (lower left) and the same in map form for the entire Slovakia (lower right). The end of the graphs are probabilistic forecasts (emphasized with circle).

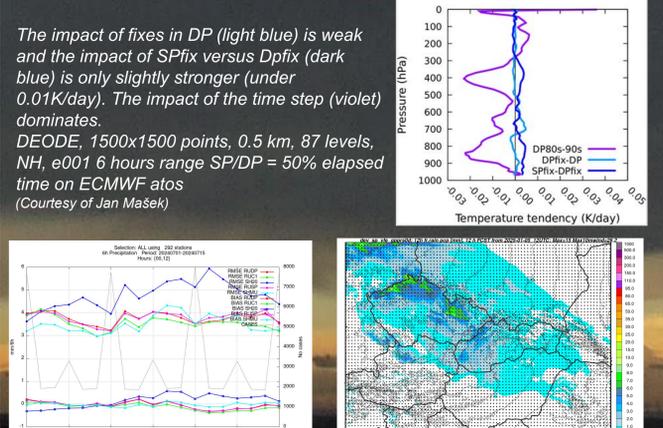
### ALA1: Radar assimilation test suite

The development of a rapid update cycle (ALA1) with assimilation of radar data at 1 km horizontal resolution continued. The data are processed by OPERA in the NIMBUS hub. Currently, ALA1 is still in test-mode but already regularly cycled with 6h frequency, producing +6h forecasts.



### Single precision development

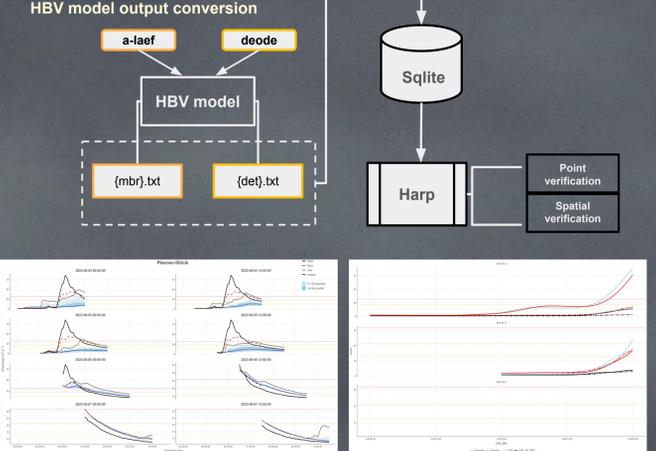
A code, based on CY46T1 cycle and CHMI modset, with single precision, was intensively tested in non-hydrostatic models, several problems (e.g. in VFE, radar reflectivity diagnostics, NaN production in NODE outputs) were detected and solved or fixed. It was shown that the impact of single precision on the model outputs is relatively small at short range, which could be demonstrated in comparison with experiments of changing the model time-step (90 and 80s) - see figure below. The impact is rather neutral even in cases with deep convection and in long-term scores.



Left: Precipitation scores of RUC1 with single precision (RUSP) and double precision (RUDP) vs regular RUC1. Right: Forecast of freezing rain precipitation with SP, for a severe event of 05 January 2025.

### DE-330 project: A-LAEF data for the HBV hydrological model

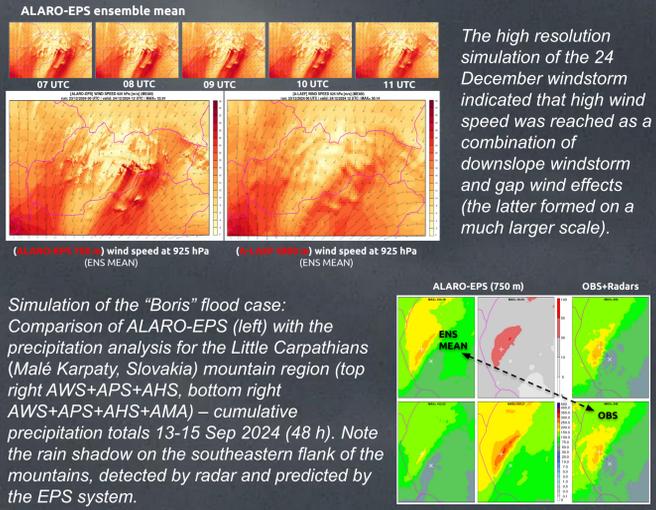
A-LAEF data were used as inputs to the HBV hydrological model and tested on cases with flood (Central Slovakia, 4-7 August 2023 and "Boris", 12-14 September 2024).



Left: Hydrological model HBV outputs (HBV + a-laef), box/ribbon plot for the situation of 4-7 August 2023. Simulated discharge is in dashed, observed in solid lines. Right: HBV + deode simulation vs forecast for the 12-14 September 2024 flood

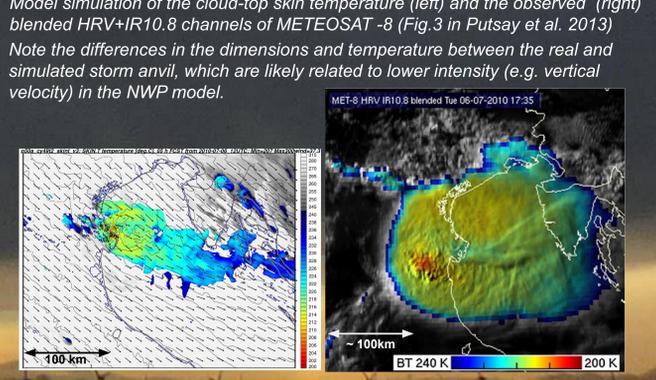
### DE-330 project: ALARO-EPS system at hectometric scale

An ALARO-EPS system was developed with 750 m horizontal resolution and tested on cases with severe weather. One was the windstorm case of 24 December 2024 in Slovakia, which occurred at the lee side of the mountains. The second event was the simulation of the flood "Boris" and investigation of orographic effects on precipitation in the area of Little Carpathians.



### DE-330 project: Severe convective storm simulations

A 500m horizontal resolution, deterministic ALARO model was used to study the impact of various settings of dynamics, physical parameterization, etc. on forecasts of severe storms. On 6 July 2010, such storm occurred over Northern Italy, which was described in detail with the aid of satellite imagery (Putsay et al., 2013). Some cloud-top properties (brightness temperature, overshooting tops, plumes) are good indicators of the convection intensity and this opens a good possibility to compare the model outputs with observation.



### Acknowledgement:

The work presented in this column and denoted as DE-330 project is funded by the EU under agreement DE\_330\_MF between ECMWF and Météo-France. The on-demand capability proposed by the Météo-France led international partnership is a key component of the weather-induced extremes digital twin, which ECMWF will deliver in the first phase of Destination Earth, launched by the EC. We also acknowledge our colleagues Lubostav Okon, Jan Kaniák and Ladislav Měří from the Department of Remote Sensing for their support.