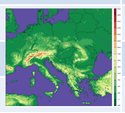
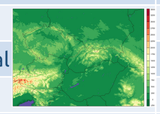
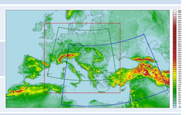
NWP activities @SHMU

the 1st ACCORD ASW, 12.-16. April 2021, videoconference

(www.shmu.sk) nwp@shmu.sk => Martin Belluš - Katarína Čatlošová - Mária Derková - Martin Dian - Martin Imrišek - Michal Neštiak - Martin Petraš - Ivan Prcúch - André Simon - Oldřich Španiel - Viktor Tarjáni - Jozef Vivoda - Roman Zehnal

ALADIN systems run at or by SHMU			
label	**ALADIN/SHMU**	**ALARO 2**	**A-LAEF**
CSC	ALARO 	ALARO 	ALARO 
status	operational	experimental	operational TC2
code version	**CY43T2bf11**	CY43T2bf11	CY40t1bf06
physics	ALARO-1vB	ALARO-1vB	ALARO-1 multi-physics + surface stochastic physics (SPPT)
horizontal resolution	4.5 km	2.0 km	4.8 km
points	625 x 576	512 x 384	1250 x 750
vertical levels	63	87	60
tstep	180 s	120 s	180 s
forecast ranges	78/72/72/60 (a' 1h)	78/72/72/60 (a' 1h)	72/72 (00 and 12 UTC, a' 1h)
coupling model & freq.	ARPEGE, 3h	ARPEGE, 1h	16+1 members of ECMWF EPS, 6h
upper air data assimilation	spectral blending by DFI (long- & short cut off)	downscaling	spectral blending by DFI
surface data assimilation	CANARI OI	none	ESDA based on CANARI OI
initialization	no initialization	DFI	no initialization
HPC	HPC2	HPC1	ECMWF HPCF

	HPC2 (main operational)	HPC1	soon to come
HPC	IBM Flex System p460	IBM p755 running with IBM Flex System p460	NEC HPC1804Ri 2
HW	4x Power7+ 8 core CPUs (3.6 GHz), 256 GB RAM	4x Power7 8 core CPUs (3.6 GHz), 256 GB RAM	2x Intel Xeon Gold 6230 20 cores CPUs
nodes	12	8	240
File system	GPFS, shared		LUSTRE (1.2 Pb)
queueing system	loadleveler, shared		SLURM
OS	Red Hat Enterprise Linux	Gentoo Linux	CentOS linux
compiler	gfortran 4.9.3 (xlf 15.1.0)	gfortran 9.3.0	Intel FORTRAN Compiler

Common RC LACE operational ensemble A-LAEF

martin.bellus@shmu.sk

A-LAEF operational suite reached TC2 status on 22/07/2020. New A-LAEF activities comprise:

- Multi-domain off-line LATLON fullpos for Turkey and Czech Rep was implemented and optimized, with possible extension for other domains. New Mediterranean Sea domain (MSEA) was set up and tested, to provide coupling files for the ocean models NEMO and SHYFEM (soon to become operational). Post-processed fields are defined for each of the LATLON domains separately, via new selection namelists.
- New tasks for the conversion of LATLON FA files to multi-GRIBs and their dissemination to Turkey and Czech Republic were added.
- New post-processed fields in A-LAEF Lambert multi-GRIBs (snow line, 0-isotherm height, and T, U, V, RH @100 m level) were activated.
- A parallel ecflow suite for testing A-LAEF upgrades & modifications was installed under kmxy user.
- An automatic download of VOBs files from ECMWF to SHMU was established for HARP verification.

A-LAEF operational data dissemination:

- via ECPDS: Slovenia, Slovakia, Romania, Czech Republic, Turkey
- via SHMU: Poland (because they are not ECMWF members)
- local usage of A-LAEF data at ECMWF servers: Croatia

3D-Var and BLENDVAR implementation

martin.imrisek@shmu.sk

The BLENDVAR setup has been introduced into the operational scripting system and technical e-suite is running using SYNOP, TEMP, AMDAR and HRWIND observations. Its validation and tuning is in progress. Example of 1 month verification of wind speed vertical profile is shown on top left figure below (***SHMU**: operational BLENDING, **P001**: BLENDVAR)*. RC LACE observations monitoring system has been implemented at SHMU. A distribution of assimilated SYNOP data is shown on bottom left figure. Implementation of GNSS ZTD with variational bias correction is ongoing. The status of assimilated ZTD is shown in the middle figure, the BIAS and STD of assimilated ZTD OMG and OMA departures are plotted on the right figure.

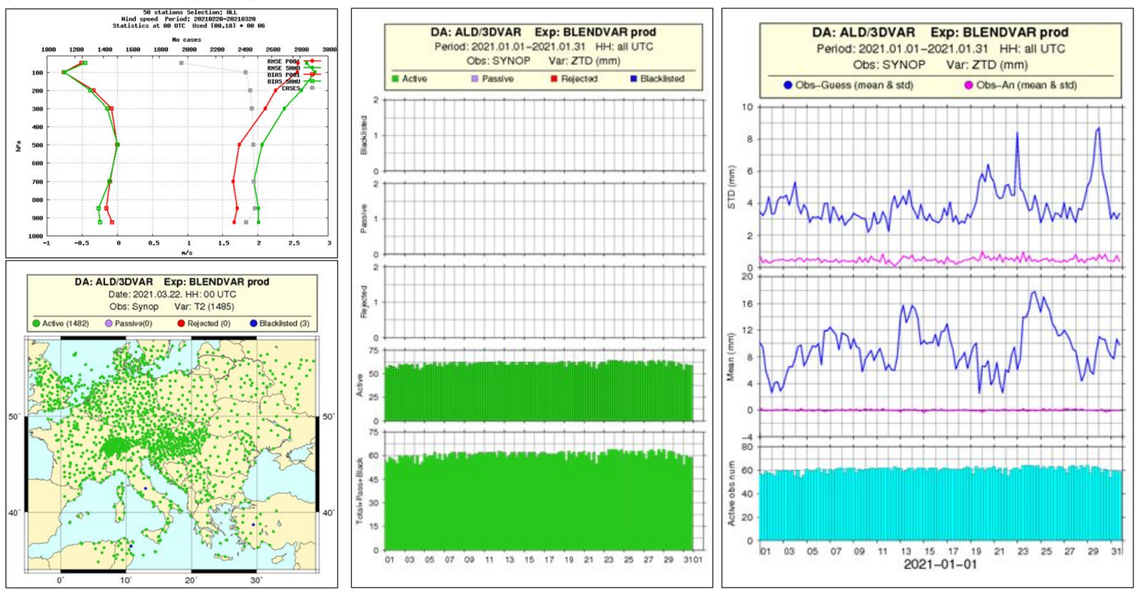


Illustration of the implementation of BLENDVAR at SHMU, as described above.

Local QC based on A-LAEF

michal.nestiak@shmu.sk

Utilisation of AWS and crowdsourced data (e.g. amateur RaspPi, Netatmo stations) for high resolution analysis requires quick and effective automatic QC of these data sources prior the preparation of local OBSOUL file. Physically consistent spread of the A-LAEF ensemble is used to check the measurements, setting the acceptance interval to (Tmin - n*(Tmax-Tmin)/2, Tmax + n*(Tmax-Tmin)/2). Tuning of automatic greylisting is under development.

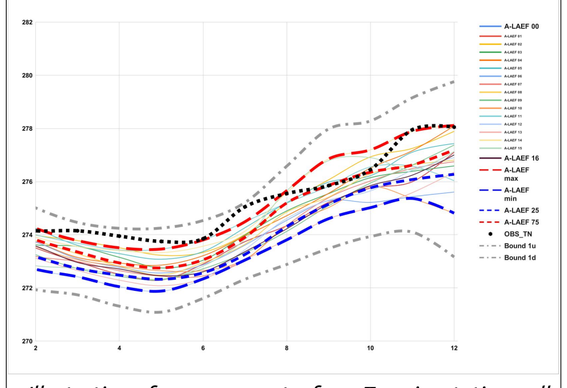
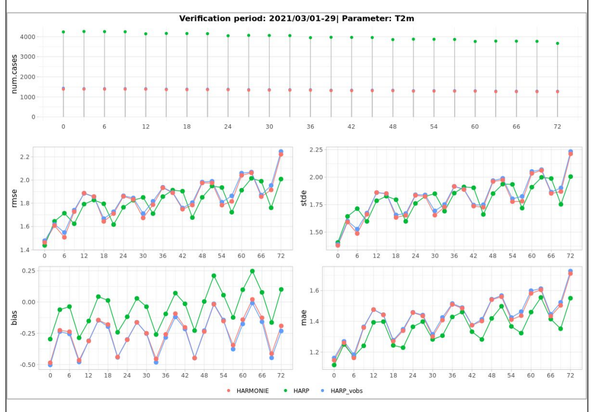


Illustration of measurements from Trencin station - all lay within the A-LAEF 2021-04-06 00 UTC fcst bounds.

Comparison of verification tools

martin.petras@shmu.sk

HARP and Harmonie verification tools and different observation sources were used to compare verification for operational ALADIN/SHMU forecasts for 1 month period 01-27/03/2021:
Harmonie: default monitor, vobs/vfldext data;
Harp: harp setup, grib aladin/SQL data, 96 stations;
Harp vobs: vobs/vfldext data interpolated and verified using HARP, observation stations selected to match vfldext stations list (25 stations).

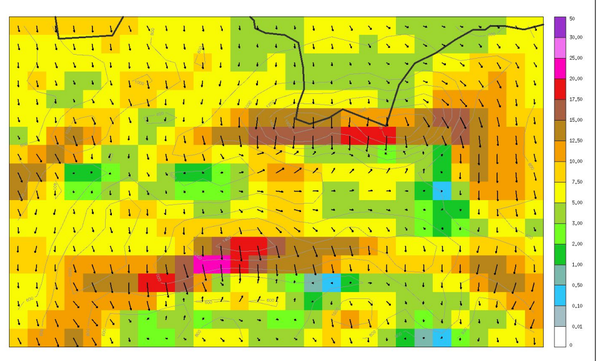


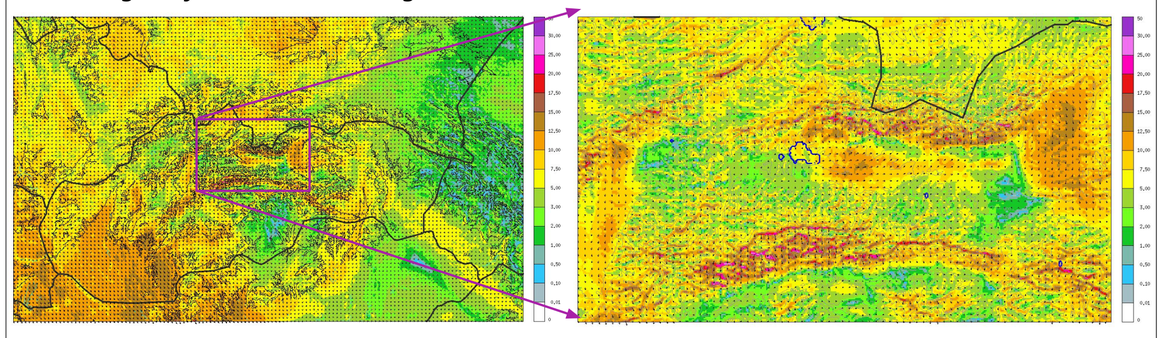
Example of verification of T 2m using different algorithms.

Very high resolution experiments

andre.simon@shmu.sk

Experimentally, a dynamic adaptation of the ALARO-1vB model has been run. The domain (1589x949 pts, 325m horizontal reso., 37 vertical levels) covers Slovakia. The 15 min. runs were using non-hydrostatic dynamics and full physics, surface roughness was taken from ECOCLIMAP II. Altogether 88 cases from the years 2016-2020 with various wind conditions were tested. Most of the features were already indicated in the lower resolution model but scaled to finer structure. The adaptation also frequently exhibited gravity waves of short length.



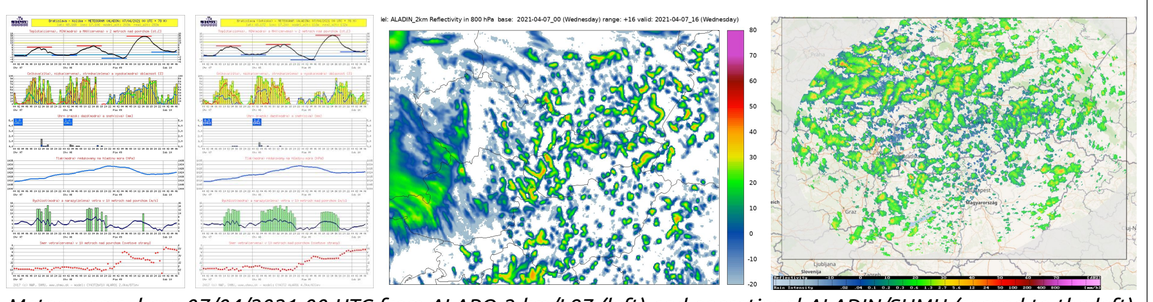


Operational wind speed & wind direction forecast 04/02/2020 12 UTC +03 h (top), and dynamic adaptation 04/02/2020 15 UTC +13 min. (bottom): full domain (left) and zoom over the Tatras mountains (right).

Alaro 2 km/L87 experimental setup for convection permitting scales.

martin.dian@shmu.sk, andre.simon@shmu.sk

New diagnostic parameters were activated to detect convective activity: total atmospheric water & ice, & simulated reflectivity. A forecast of snow showers with local thunderstorms is illustrating the latter.

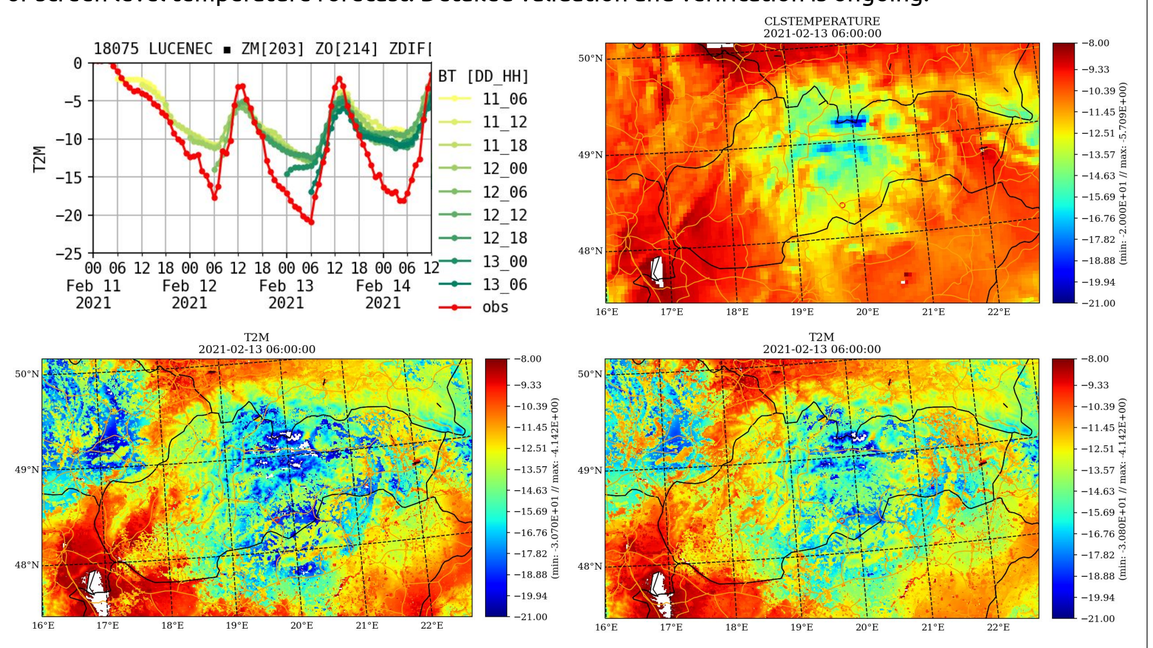


Meteograms, base 07/04/2021 00 UTC from ALARO 2 km/L87 (left) and operational ALADIN/SHMU (second to the left). +16h forecast of the simulated reflectivity at 800 hPa from ALARO 2 km/L87 and observed radar reflectivity at 2 km on 2021-04-07_16 UTC (right).

Offline SURFEX experiments

viktor.tarjani@shmu.sk

SURFEX offline is being tested for a case study for 11/02/2021 with cold arctic air mass entering Slovakia followed by subsequent 2m temperature drop well below -20 °C on several low-altitude stations. Operational ALADIN/SHMU T2m forecast was overestimated by up to 12 °C. This could possibly be due to snowpack being not well represented in ALARO/ISBA CSC having only single layer snow scheme which may be not enough to correctly represent temperature gradient within a snowpack as well as radiative exchange. SURFEX offers alternative multilayer snow schemes that were investigated: default single layer D95 and the explicit snow 3-L snow schemes using 3-L FR soil scheme; and Crocus with DIF soil scheme (14-L). General SURFEX setup: horizontal spatial domain is identical with INCA-SK system (501x301, dx=1km) and SRTM_250 orography was used. SURFEX was spin-up from operation ALARO on 10 day period and it was forced with the same ALARO model (30m level above ALARO surface) with turning on altitude correction in SURFEX. Preliminary results show improvement of screen level temperature forecast. Detailed validation and verification is ongoing.



T2m forecasts from several operational runs (greenish) and measurements (red) at Lucenec station (top left). ALADIN/SHMU forecast (top right). Bottom: T2m fcst using SURFEX offline with CROCUS (left) and 3-L (right) schemes.