NWP related activities @SHMU

41st EWGLAM & 26th SRNWP Meetings, 30.9.-3.10.2019, Sofia, Bulgaria

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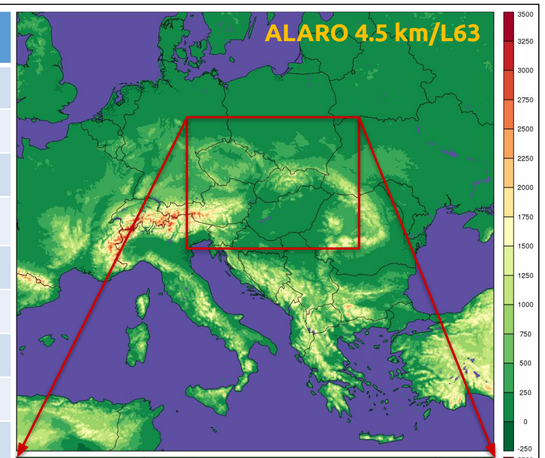
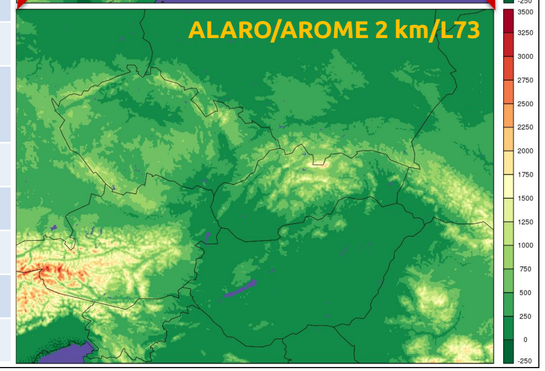
ALADIN/SHMU systems

CMC	**ALARO**	**ALARO**	**AROME**
status	operational	experimental	
code version	CY40T1bf07_export	CY43T2bf10	CY40T1bf07_export
physics	ALARO-1vB	ALARO-1vB	AROME-FRANCE
dx	4.5 km	2.0 km	
points	625 x 576	512 x 384	
vertical levels	63	73	
tstep	180 s	120 s	144 s
forecast ranges	78/72/72/60 (a' 1h)	+78h at 00UTC/+72h at 12UTC (a' 1h)	
coupling model	ARPEGE (long- & short cut off), 3h	ALARO-1vB (4.5 km), 1h	
assimilation	upper air spectral blending by DFI CANARI surface assimilation	downscaling	
initialization	no initialization	DFI	no initialization
HPC	IBM Flex System p460, linux	IBM p755 running with IBM Flex System p460	
HW	4x Power7+ 8core CPUs (3.6 GHz), 256 GB RAM	4x Power7 8core CPUs (3.6 GHz), 256 GB RAM	
nodes	12	6	
SW	Red Hat Enterprise Linux; gfortran 4.9.3 (xlf 15.1.0)	Gentoo 4.4.111 Linux, gfortran 7.3.0	





Implementation of local AWS in the CANARI surface assimilation in ALARO/SHMU

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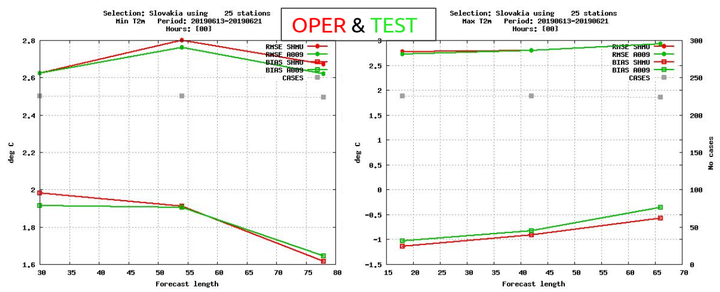
In attempt to improve too high near surface moisture leading to unrealistic CAPE values that were reported by SHMU forecasters full set of local AWS measurements available from LACE countries was experimentally assimilated into ALARO/SHMU 4.5 km/L63 CANARI analysis over 13-21/06/2019 period. Neutral to slightly positive impact was noticed, notably for T2m_min, T2m_max.



Testing of parameterization of visibility in ALARO

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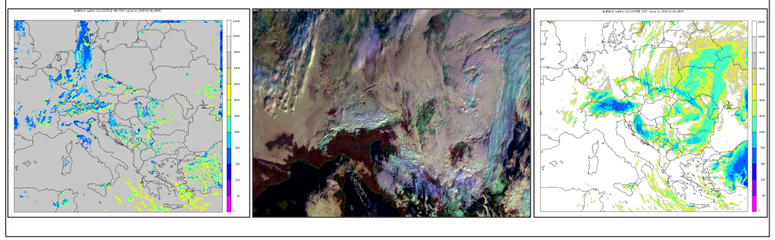
The visibility parameter originally coded for AROME (MF) and later implemented for ALARO (CHMI, ARSO) was tested. Both visibility with respect to cloud liquid water (fog) and precipitation were examined. Default parameters settings and their tuning according to literature review and real measurements were evaluated. Preliminary conclusions revealed that obtained visibility seems to be reasonable, but further validation and tuning is welcome. Results from the case of 06/01/2019 09 UTC are illustrated below for 9 h forecast of CLW based visibility (left) and precipitation based one (right), and corresponding satellite picture (middle).



Update of A-LAEF

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A-LAEF operational suite [4.8km/L60, 16+1 mem, ESDA+blending IC perturbation, surface SPPT+ALARO-1vB MP model perturbation, coupled to ECMWF ENS via c903] was implemented in ecFlow under TC user. It is regularly running since July 2019.

ESDA:

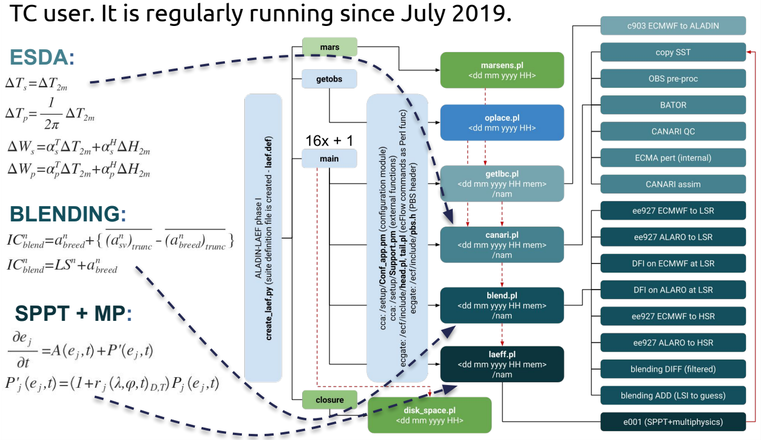
$$\Delta T_s = \Delta T_{2m}$$
$$\Delta T_p = \frac{1}{2\pi}\Delta T_{2m}$$
$$\Delta W_s = \alpha_s^T \Delta T_{2m} + \alpha_s^H \Delta H_{2m}$$
$$\Delta W_p = \alpha_p^T \Delta T_{2m} + \alpha_p^H \Delta H_{2m}$$

BLENDING:

$$IC^n_{blend} = a^n_{breed} + \{ (a^n_{sv})_{trunc} - (a^n_{breed})_{trunc} \}$$
$$IC^n_{blend} = LS^n + a^n_{breed}$$

SPPT + MP:

$$\frac{\partial e_j}{\partial t} = A(e_j,t) + P'(e_j,t)$$
$$P'_j(e_j,t) = (1 + r_j(\lambda,\varphi,t)_{D,T}) P_j(e_j,t)$$



Assimilation of ZTD data @SHMU

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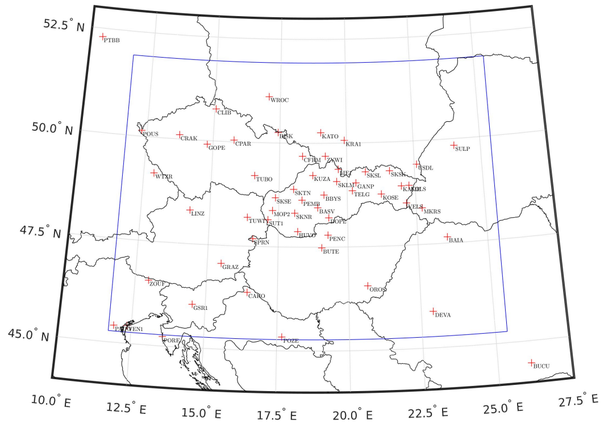
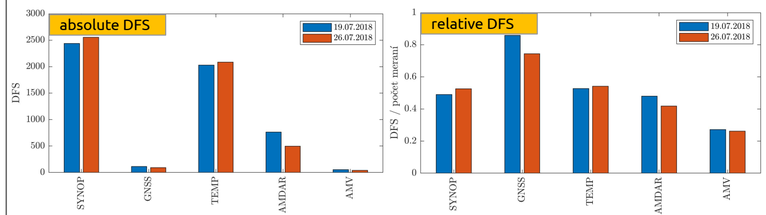
Work is carried out in cooperation with the Slovak University of Technology, Dpt. of Theoretical Geodesy, where the local independent near real-time processing system of GNSS network of permanent stations (figure below) is running. GNSS ZTD data are experimentally assimilated into AROME/SHMU 2 km/L73 model version (blue rectangle on figure below) together with SYNOP, TEMP, AMDAR and AMV data. Simple white list method and static correction based on OMG statistics was applied for each permanent GNSS station. Evaluation is ongoing.



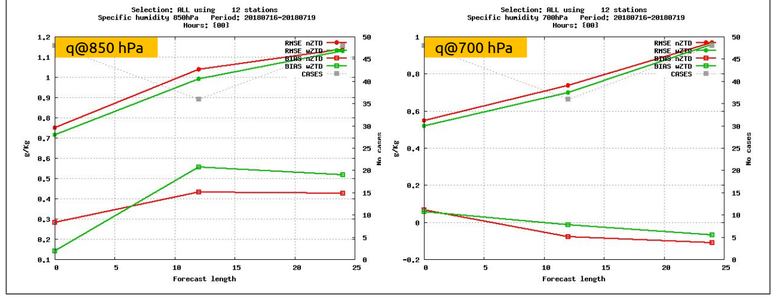
DFS statistics

Example of absolute (left) and relative (right) DFS for various observation types is shown on figure below for two days of June 2018. Absolute DFS for GNSS ZTD is small, but relative is high, that is in accordance with studies at other NMSs.



E-suite evaluation

5 days e-suite (16-20/07/2018) of 3D-Var with (+ZTD) and without (-ZTD) was run. Neutral to slightly positive impact was noticed, as illustrated on specific humidity scores with respect to TEMPs. Figure below shows BIAS & RMSE for 850 and 700 hPa levels.



Assimilation of Mode-S data @SHMU

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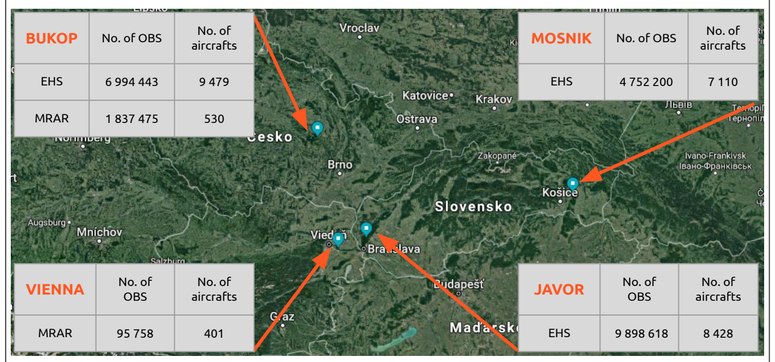
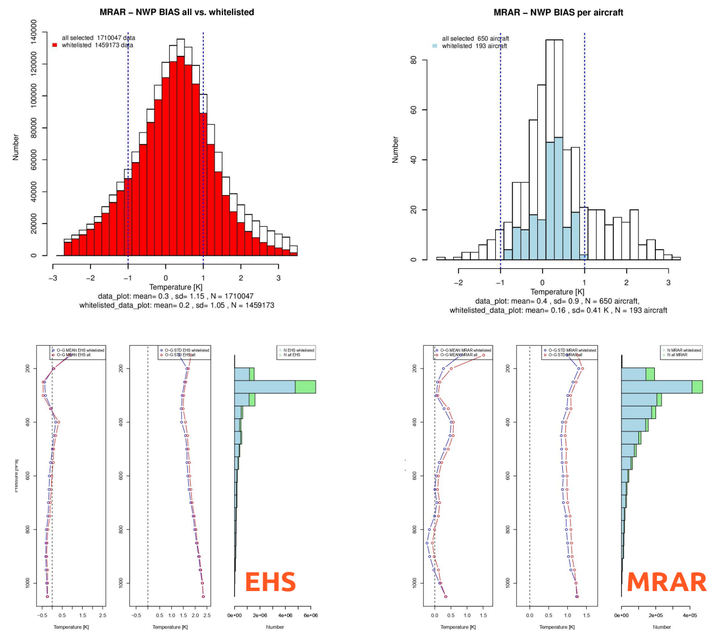
Two months (January-February 2018) data sample of Mode-S data (EHS & MRAR) from four radars provided by Slovak ATC was analyzed in frame of diploma thesis at the Faculty of Mathematics, Physics and Informatics, Dpt. of the Atmospheric Physics. Data sample is detailed in the figure below.



Statistical approach based on OMG departures using AROME/SHMU 2 km/L73 model was used to select reliable data. Then the aircraft whitelist was created based on ICAO addresses according to criteria below. Results for temperature are shown.

	OMG statistical thresholds		whitelisting criteria		
			No. of OBS	mean value	σ
temperature	± 10 K	2σ	1000	1 K	2 K
wind speed	± 20 m/s	2σ	1000	1 m/s	5 m/s
wind direction	± 45 deg	2σ	1000	10 deg	100 deg



Offline soil moisture analysis within the SURFEX-SODA framework

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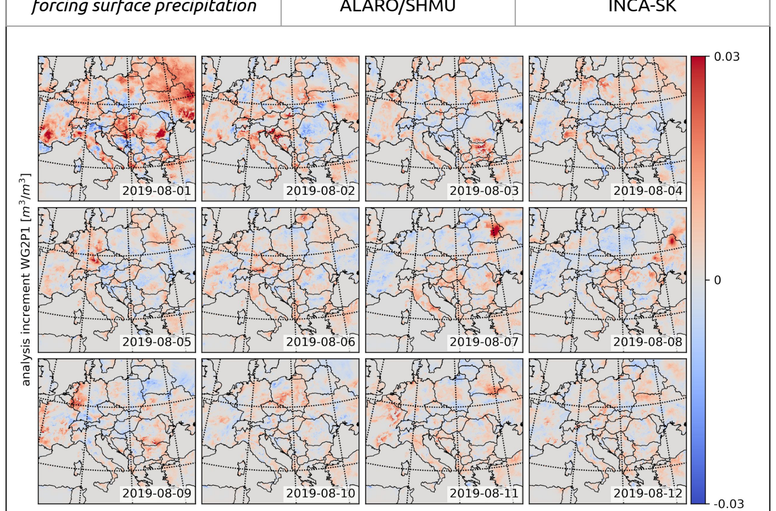
Offline surface assimilation cycling using the EKF method was implemented within SODA framework for *oper* and *inca* configurations (see table below) using SURFEX V8.1. Outputs from CANARI or INCA analyses of T2M and HU2M are used as gridded observations, having the same regular mesh as the target domain. Forcing (upper boundary condition for SURFEX) is taken from the level at 20 m above the surface (via fullpos).

EKF analysis cycling was carried out for 12 days of August 2019 with analyses performed daily at 12 UTC. The feasibility of cycled EKF analysis implementation was demonstrated. Temporal evolution of analysis increments and observation innovation show physical relevance. Thorough performance evaluation is planned.

	oper	**inca**
grid size & dx	614 x 565 pts/ 4.5 km	501 x 301 / 1 km
gridded observations	CANARI analysis	INCA-SK analysis
forcing (@ 20 m height): TA, QA, WIND, DIR, P_s	ALARO/SHMU	
forcing CO_2	0.000620=const.	
forcing surface radiation	ALARO/SHMU	ALARO/SHMU & GR_AVG
forcing surface precipitation	ALARO/SHMU	INCA-SK



Temporal evolution of WG2 increments (top) and RMS observation innovations (bottom)