ALADIN related activities @SHMU

28th Joint ALADIN Workshop & HIRLAM All Staff Meeting, 16-19 April 2018, Toulouse, France

(www.shmu.sk) nwp@shmu.sk => Martin Belluš - Mária Derková - Martin Dian - Richard Habrovský - Michal Neštiak - Martin Imrišek - Ivan Prcúch - Oldřich Španiel - Viktor Tarjáni – Jozef Vivoda – Roman Zehnal

ALADIN/SHMU systems

CMC	ALARO	ALARO	ALARO	AROME
status	operational	obsolete	experimental	
code version	CY40T1bf07_export	CY36T1_bf10	CY40T1bf07_export	
physics	ALARO-1vB	ALARO 3MT, SLHD	ALARO-1vB	AROME-FRANCE
dx	4.5 km	9.0 km	2.0 km	
pts	625 x 576	320 x 288	512 x 384	
vertical levels	63	37	73	
tstep	180 s	400 s	100 s	144 s
forecast ranges	78/72/72/60 (a' 1h)	72/72/72/60 (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 with CANARI surface assimilation		downscaling	
initialization	no initialization		DFI	no initialization
HPC	IBM Flex System p460, linux	IBM p755, AIX	IBM p755, AIX	IBM Flex System p460

ALARO 4.5 km

ALARO/AROME 2 km
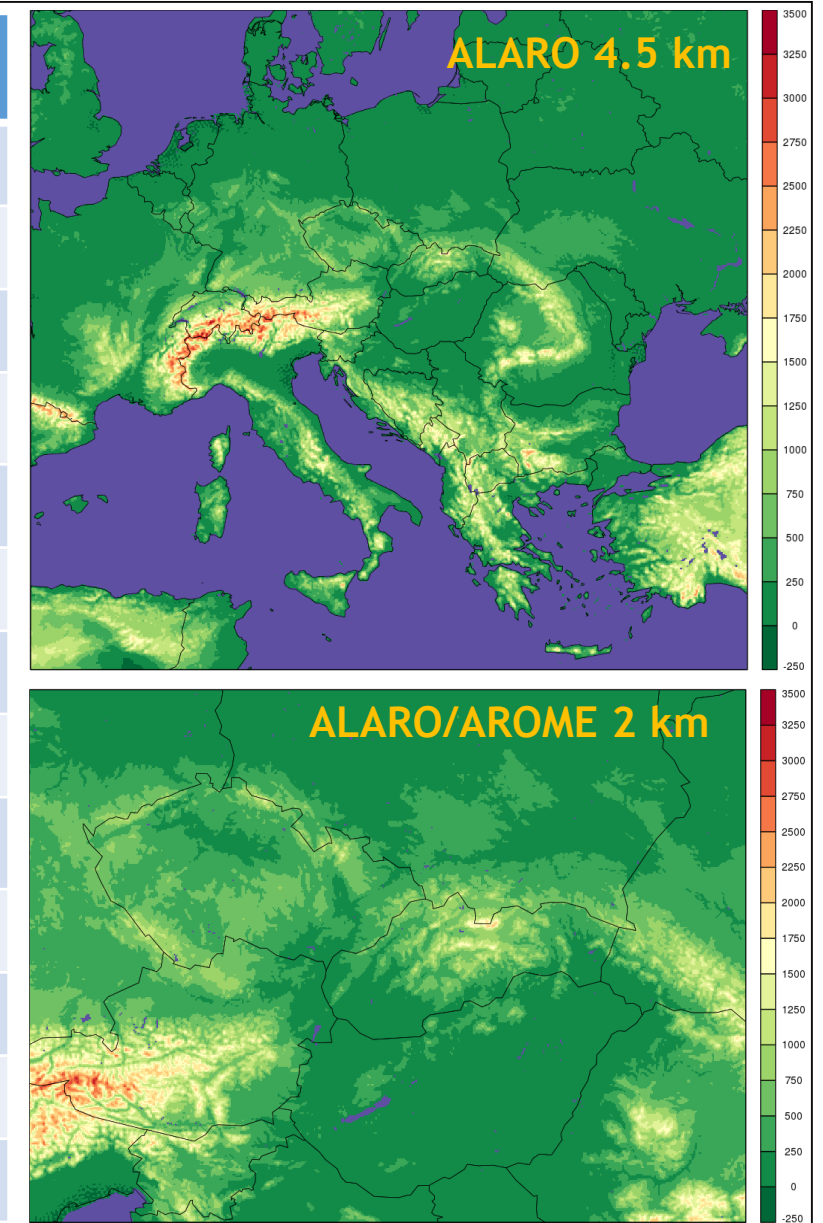
Easter case study - 01/04/2018 (no joke): low pressure system passing over Slovakia towards NE brought high precipitation totals => floods in East Slovakia and strong wind in the mountains. An interesting case of the downslope wind was recorded, with maximum wind gust in Skalnate pleso, 205 km/h. Models gave correct warnings, see on the 1st row the 12h precipitation 06-18 UTC from the 01/04/2018 00 UTC run, for ALARO 4.5 km, ALARO 2 km, AROME 2 km from left to right, and verifying INCA analysis. The windward precipitation amounts in northern Slovakia are overestimated. The wind gust for 01/04/2018 at 17 UTC is displayed on the second row. Maxima over the mountains tops are correctly indicated. Strange wind speed patterns for 2km NH models in SW Slovakia are not explained. The issued meteorological and hydrological warnings are displayed on the top right. On the bottom right the anemometer measurement from Lomnicky stit and Chopok mountain stations illustrate the wind speed. The ALARO 4.5 km vertical cross-section shows the maximum wind speed on the leeward of the Tatra mountains (courtesy of miroslav.singer@shmu.sk).

ALARO 4.5 km/L63 — 12h precipitation

ALARO 2.0 km/L73 — 12h precipitation

AROME 2.0 km/L73 — 12h precipitation

INCA analysis 1.0 km — 12h precipitation

ALARO 4.5 km/L63 — max wind gust

ALARO 2.0 km/L73 — max wind gust

AROME 2.0 km/L73 — max wind gust

INCA analysis 1.0 km — max wind gust
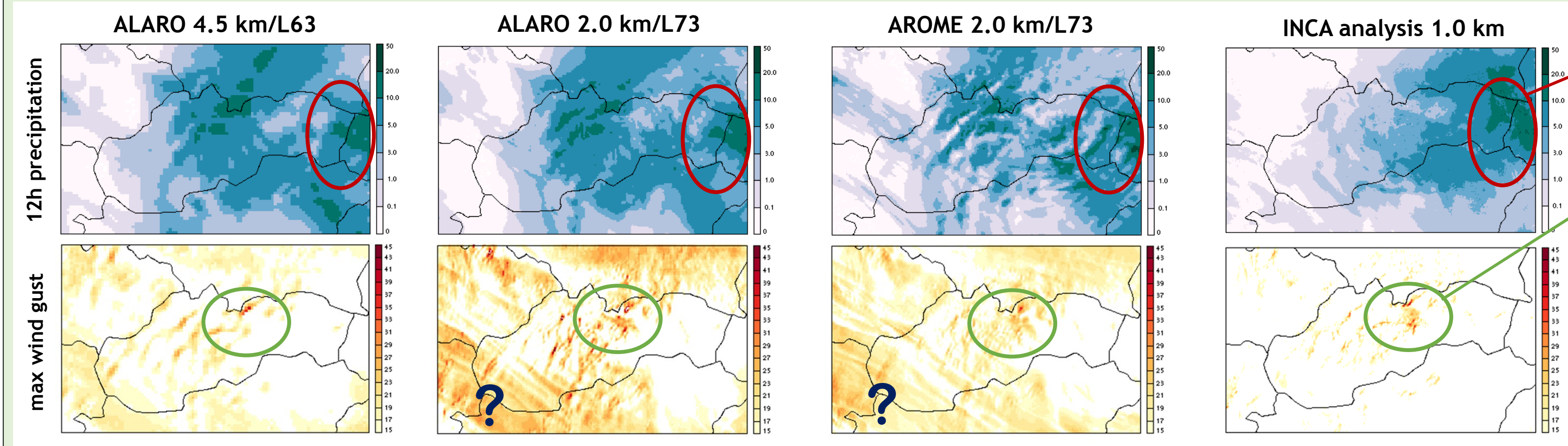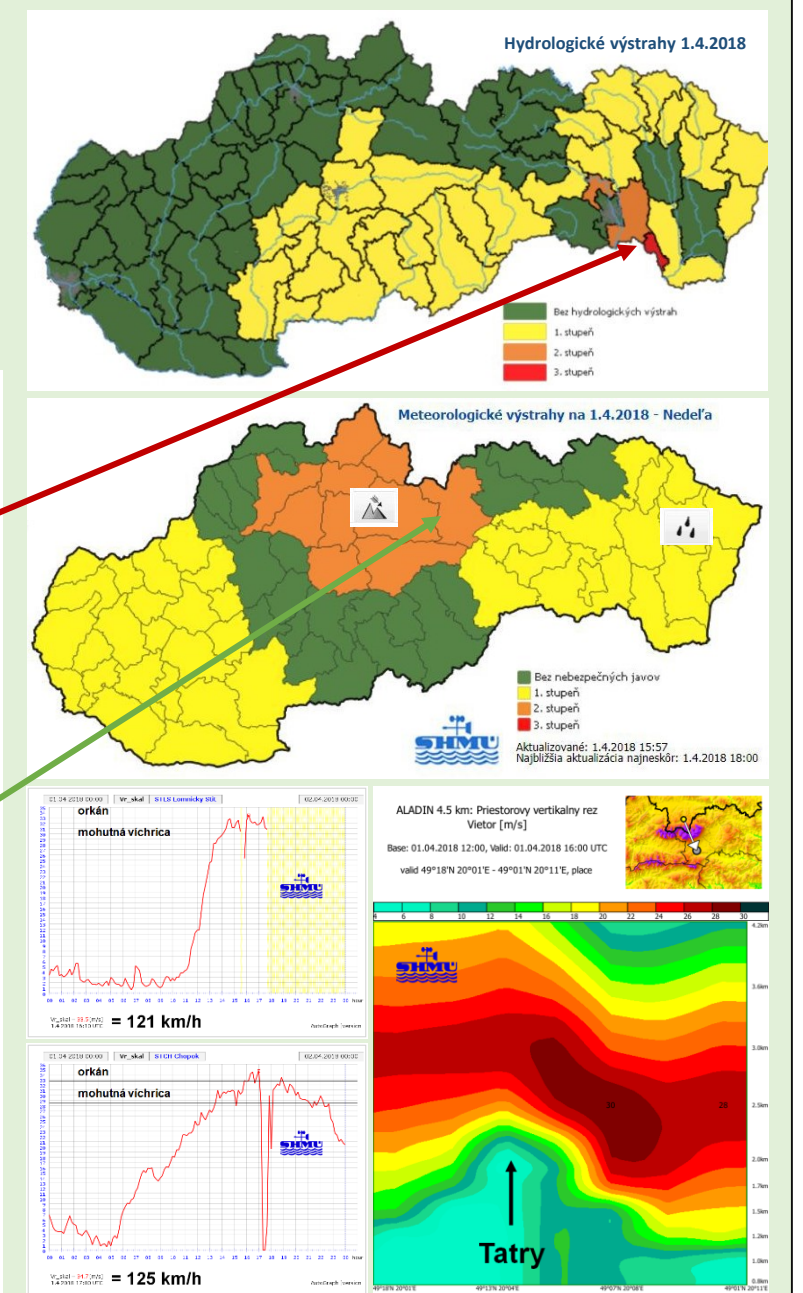
Validation of EKF surface assimilation scheme

viktor.tarjani@shmu.sk, RC LACE stay

Sensitivity analysis of 2-L and 3-L ISBA force restore scheme for soil volumetric water content has been started using the offline SURFEX and 1-column setup. New method was proposed which allows for efficient computation of EKF Jacobian matrices H and M in 1-column runs. This method was used to investigate the nonlinear behaviour of coupled ISBA-CANOPY (ISBA-DIAG) scheme acting effectively as observation operator in EKF analysis of soil moisture. Nonlinear behaviour was expected in the vicinity of extreme soil states as saturation, field capacity and wilting point, when linear approximation of extended Kalman filter may be violated resulting in wrong analysis increments. Preliminary results are shown in figure below for ISBA_CANOPY=F, ISBA=2-L. On y-axis is time from t0 till t0 + 48 hours, on x-axis is initial value of volumetric water content WG2(0) i.e. in bulk layer of 2-layer force-restore scheme <0.1 to 0.57 m3/m3>. Top-left: TG1, top-right: TG2, bottom-left: WG1, bottom-right: WG2. Qualitative change can be seen on both WG1 and WG2 near the soil saturation ~0.454 m3/m3. Soil moisture responds only slightly to further increase of initial soil moisture when soil is saturated. In WG1 plot another change in behaviour is visible when WG2(0) is approximately equal to field capacity (~0.249 m3/m3). In TG1 plot qualitative change can be seen near the wilting point (~0.161 m3/m3) especially for later times (top-left corner). All these qualitative changes in behaviour are quite obvious in view of physical processes in the soil and soil-vegetation-air interface (grid box was covered mostly by crops).
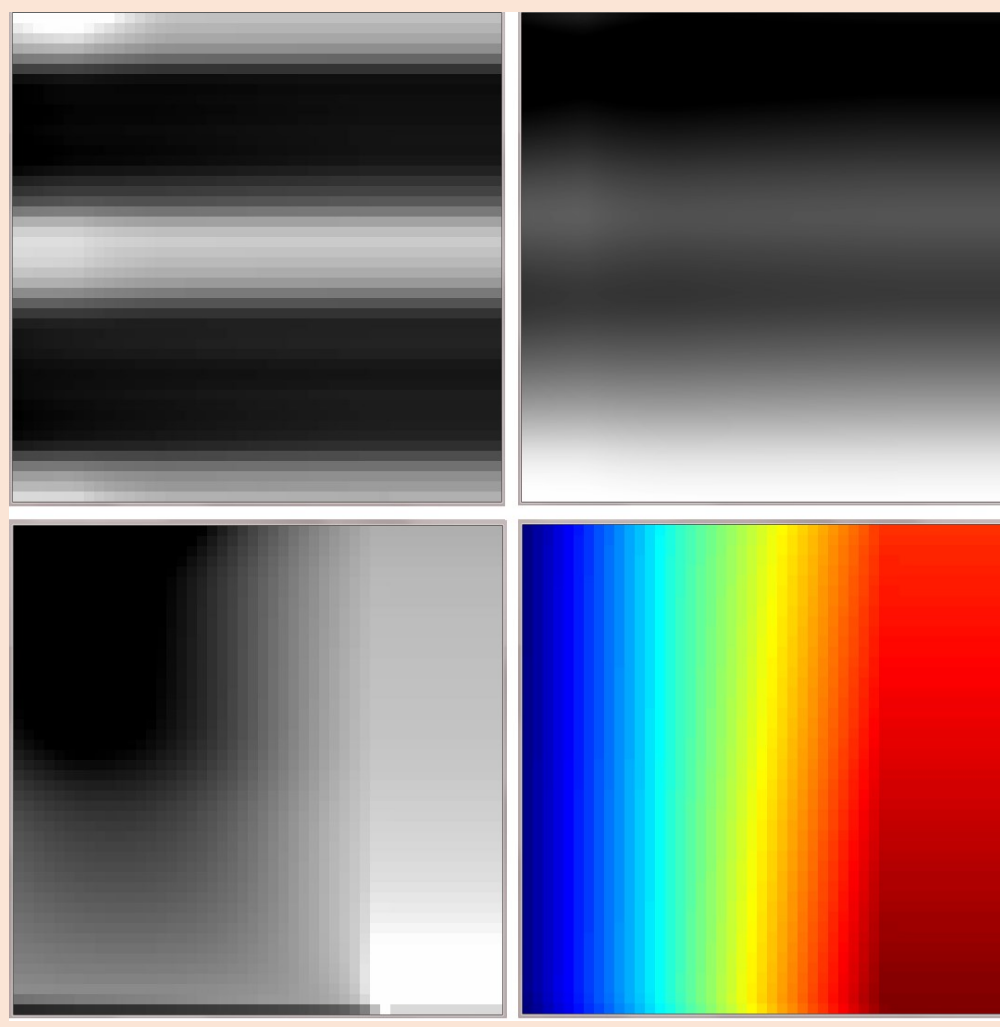
Dynamical PC scheme for NH kernel of AAA models

jozef.vivoda@shmu.sk, RC LACE stay

In calm non-convective weather conditionds the NH effects are rather neglibible => the cheaper SI scheme can be used for model integration. More expensive PC scheme is to be used only when its usage is dynamically identified. Such approach is suitable for small domains only where NH activity can be supposed to be uniform over whole domain. To test this hypothesis an implementation of SETTLS scheme with LPC_CHEAP in NH dynamics has been completed together with the development of mixed scheme with extrapolation and non-extrapolation predictor with dynamical determination of iterations of ICI scheme (NESC). The decision factor is being determined. Left figure below illustrates the percentage of points where SETTLS scheme was switched off for various parameters (U, V, PD, VD, SP). Right figure shows % of points with PC_NESC scheme switched off and replaced by SI SETTLS - happening dynamically during integration when decision factor reaches critical value for 90% of gridpoints.
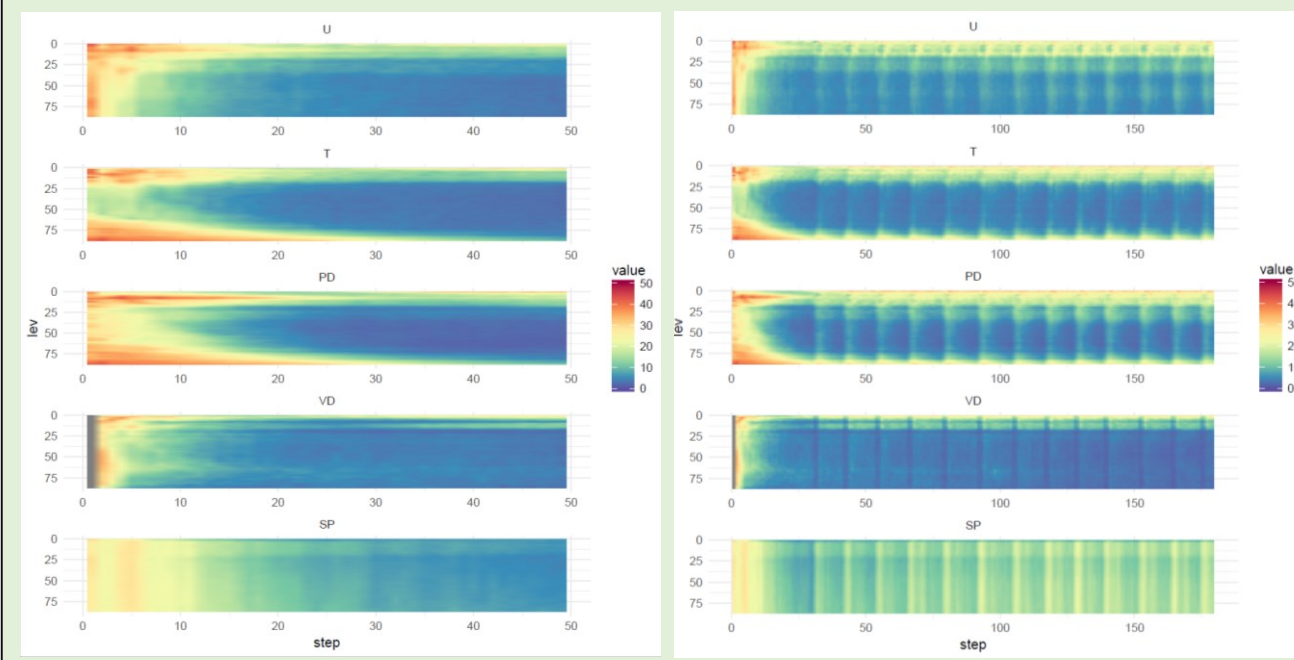
Tests of LBC from ARPEGE with SURFEX

maria.derkova@shmu.sk

Final technical testing of the last setup of the LBC form ARPEGE_sfx before becoming operational on Dec 05 2017. The treatment of soil frozen water and snow cover as proposed by D. Degrauwe and F. Bouyssel works reasonably well and is ready for operational implementation. Figures below show the scores of T2m and geopotential profile for the final solution *S005* compared to the initial version of the conversion algorithm *P005* and the reference *SHMU* operational scores
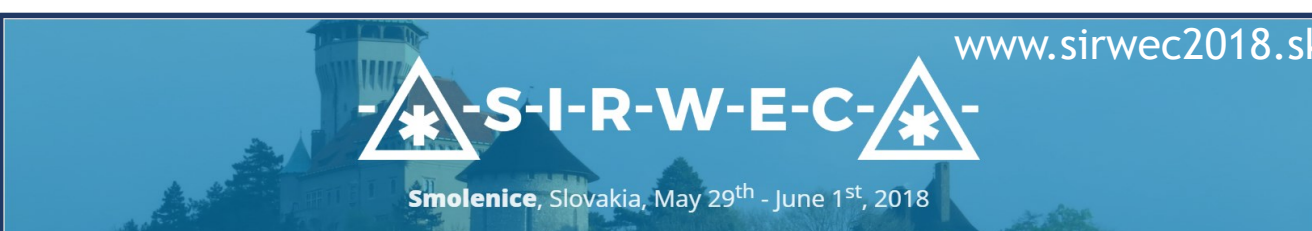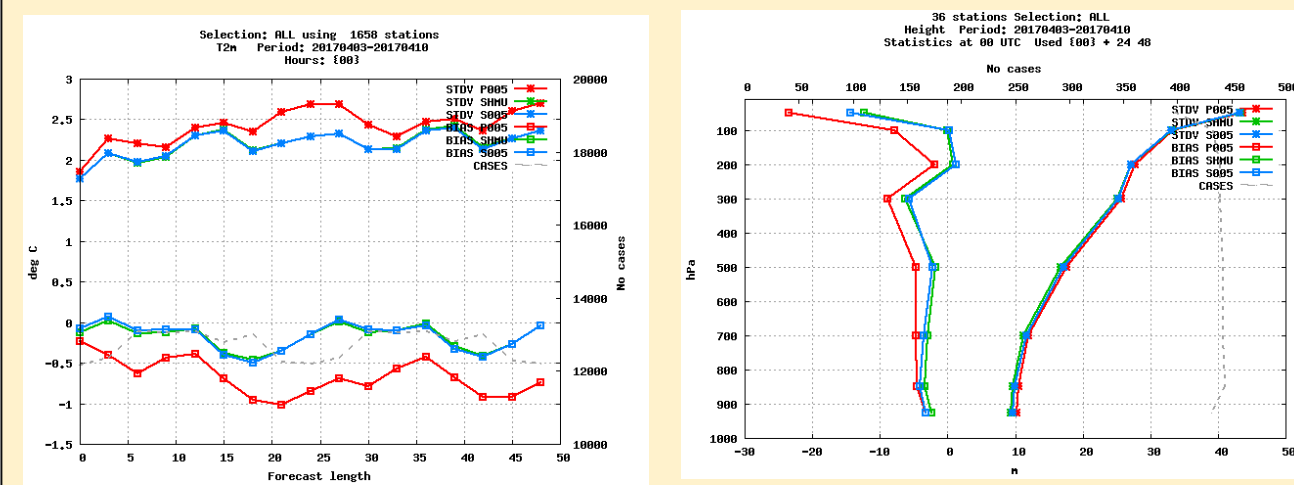
## Exploration of non-GTS weather stations

michal.nestiak@shmu.sk
martin.dian@shmu.sk
roman.zehnal@shmu

A network of amateur meteorologists stations is growing in Slovakia, consisting of commercial stations like DAVIS or NETATMO as well as the home-build solutions based on cheap sensors ensembled on Raspberry Pi. Such self-made station built by SHMU colleagues has been placed on the Inovec hill (1042m a.s.l.). The comparison of measurements of two different temperature sensors installed there displayed on the top figure points out the importance of correct sensors calibration.
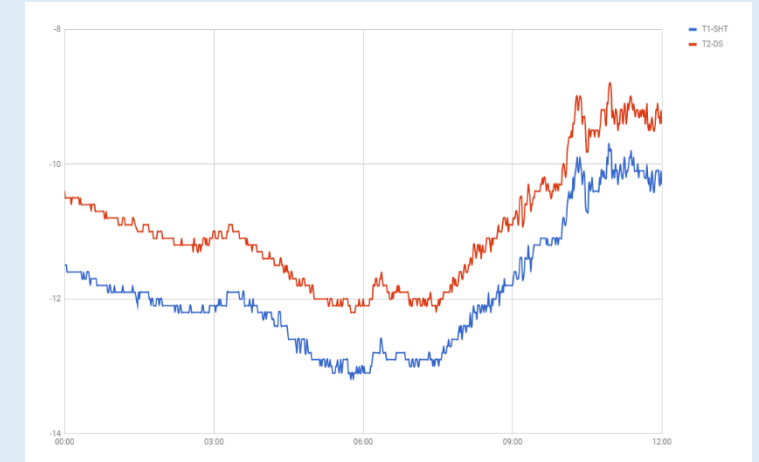
A regular data collection from amateur stations network has started at SHMU and their usage is being assessed. An example of temperature analysis increment based on CANARI+MESCAN with and without the amateur stations is shown for VHR ALARO configuration on the right bottom figure.
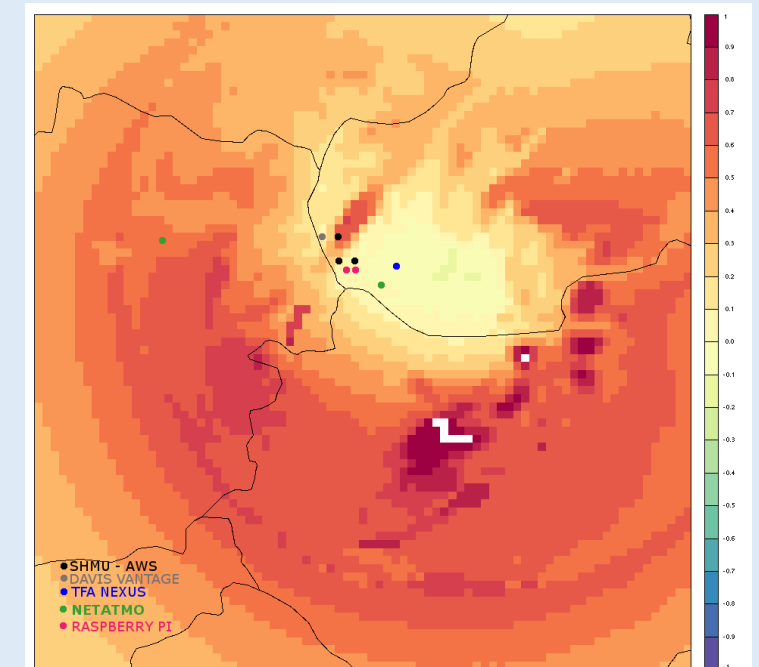
New ALADIN-LAEF, phase I

martin.bellus@shmu.sk, RC LACE stay

New ALADIN-LAEF phase I configuration was finally put together, tested and verified against the reference (corresponding 16 ECMWF-EPS members downscaled). It contains ensemble of surface data assimilation (ESDA) with internally perturbed screen-level observations, upper-air spectral blending, stochastic perturbation of physics tendencies (SPPT) for ISBA prognostic fields and new ALARO-1 multiphysics (additionally to the model upgrade from cy36 to cy40, increased horizontal and vertical resolution and redefined domain). The added value of new LAEF over the downscaled ECMWF-EPS is obvious for the surface parameters (see figure below), while it is rather neutral for the upper-air (see the stay report on www.rclace.eu). Due to the technical aspects (mostly due to enormous increase of consumed SBUs for its integration) the plans for its operational exploitations are delayed.