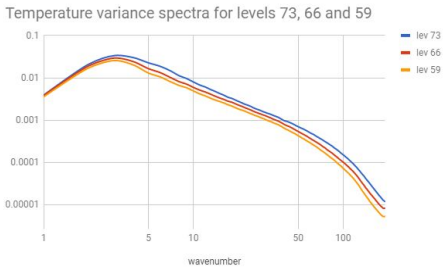
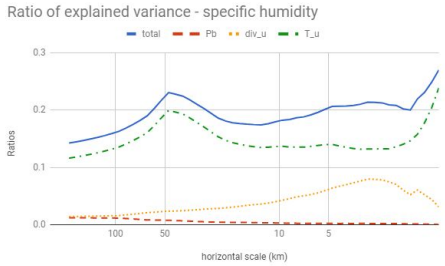
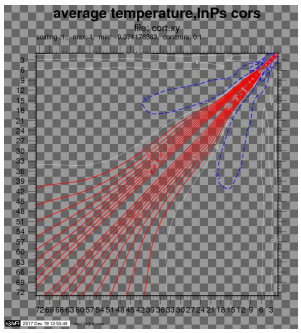
who	PM	topic
Maria Derkova	0.25	lecture about DA for air quality dept
	0.75	Bmatrix for AROME and single obs experiment to validate it
	0.25	Diploma thesis: topic definition(Mode-S), bibliography recherche and supervision (very preparatory phase)
Martin Imrisek		
Michal Nestiak		
Viktor Tarjani	0.7	Validation of EKF surface assimilation scheme

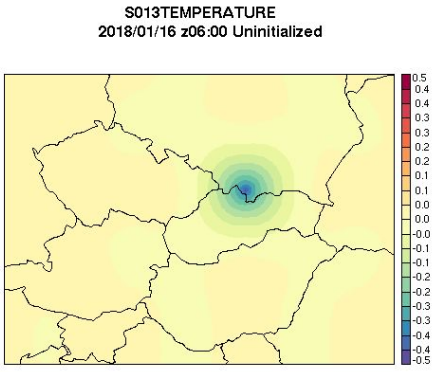
<u>Maria Derkova:</u>

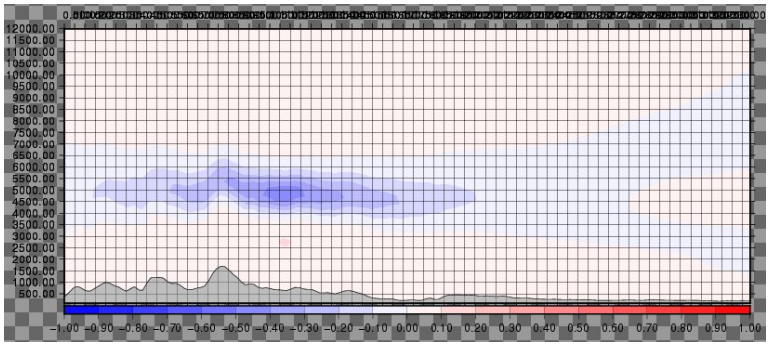
- Bmatrix for AROME 2km/73L was finalized and basic validation via single obs experiments was performed.







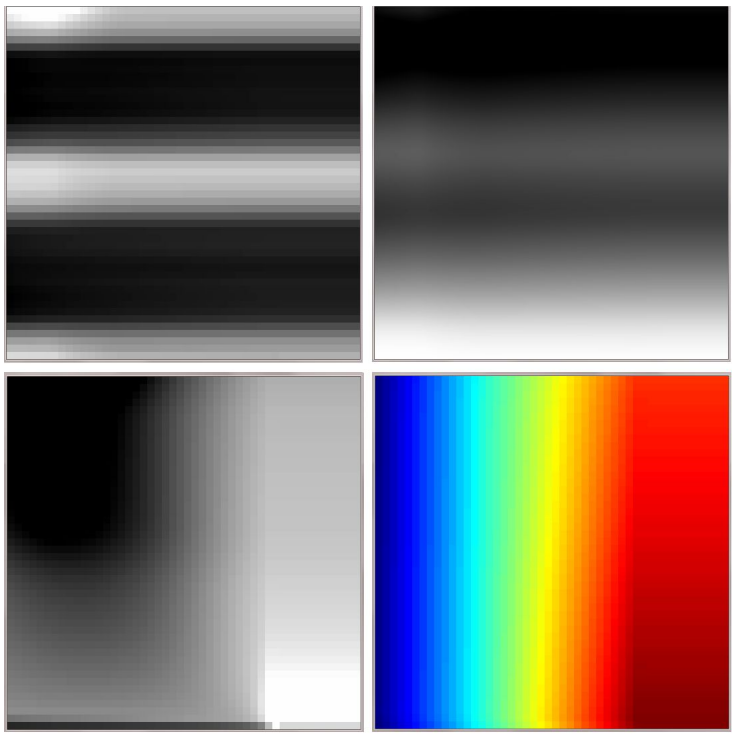




- An DA lecture was prepared and given for air quality department of SHMU, that is using ALADIN data as an input for their models and air quality reports
- A topic for diploma thesis was prepared that should focus on the Mode-S data usage.

Viktor Tarjani (Validation of EKF surface assimilation scheme)

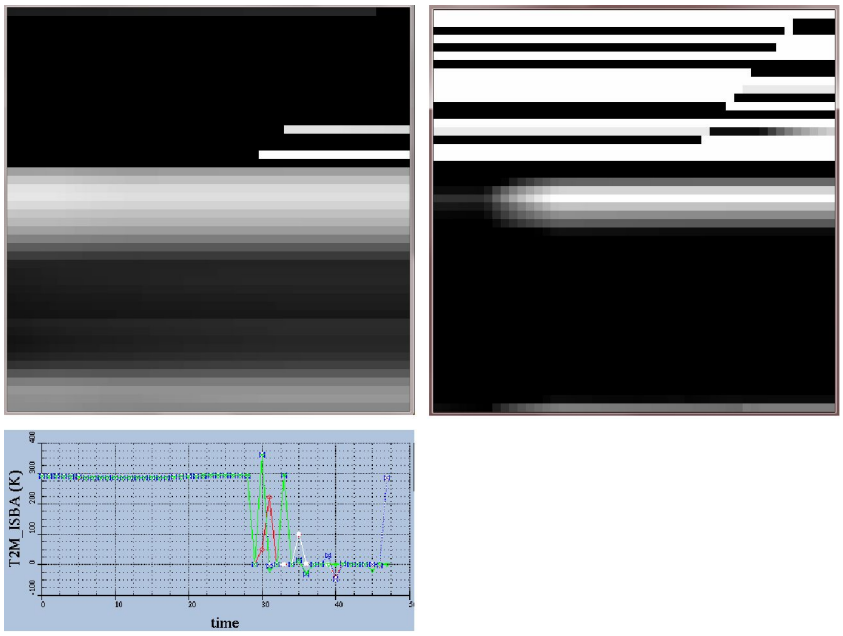
Sensitivity analysis of 2-L and 3-L ISBA force restore scheme for soil volumetric water content has been started using the offline SURFEX and 1-column setup. We proposed a new method which allows for efficient computation of EKF Jacobian matrices H and M in 1-column runs. It may be especially useful for higher dimensional control space like in diffusion scheme.
We used it 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. Such analysis can help determine the domain of validity of linear approximation and also the size of perturbation used in calculation of Jacobian matrices H or M.
Preliminary results are shown in figure 1. Initial time was t0 = 2017-09-25 12:00 UTC, ISBA_CANOPY=F, ISBA=2-L. On y-axis is time from t0 till t0 + 48 hours (Jacobian matrices are usually calculated over 6 hour time window), on x-axis is initial value of volumetric water content WG2(0) i.e. in bulk layer of 2-layer force-restore scheme (range is from 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).
From technical viewpoint we were faced with some strange behaviour when more than 1 CPU was used during execution of SURFEX executable from pack cy40t1. Output SURFEX fields were not properly written to SURFOUT.txt ASCII file nor time-series NETCDF file (without any warning). This can be seen as unphysical horizontal rectangles in figure 2 (left: ISBA T2M, right: ISBA surface specific humidity). Thus for subsequent runs we used only single CPU (figure 1) which is fine for 1-column runs.



Detailed validation of EKF-SURFEX scheme will be continued using also diffusion scheme, but first we plan switch to a newest official SURFEX version 8.1 merged with a SODA_8 branch which acts as a common test-bed for surface assimilation community in HIRLAM and RCLACE. The reported oscillations of Jacobian matrix will be also investigated.