ALADIN related activities @SHMU

29th Joint ALADIN Workshop & HIRLAM All Staff Meeting, 1-4 April 2019, Madrid, Spain

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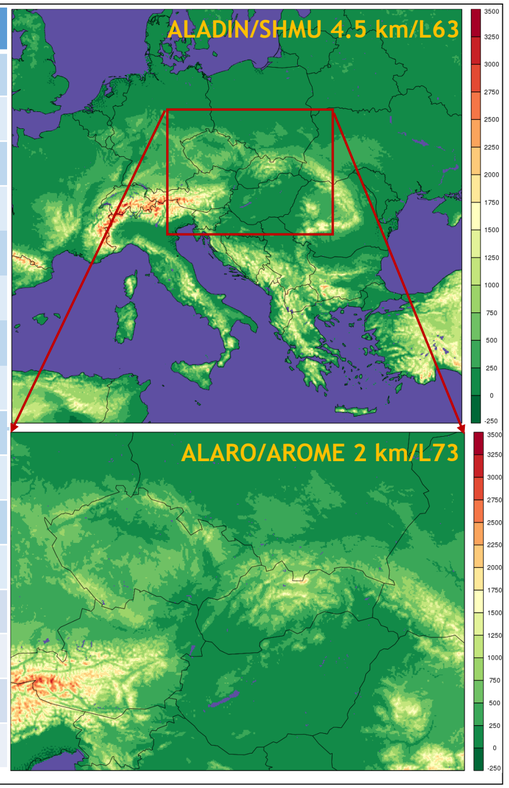
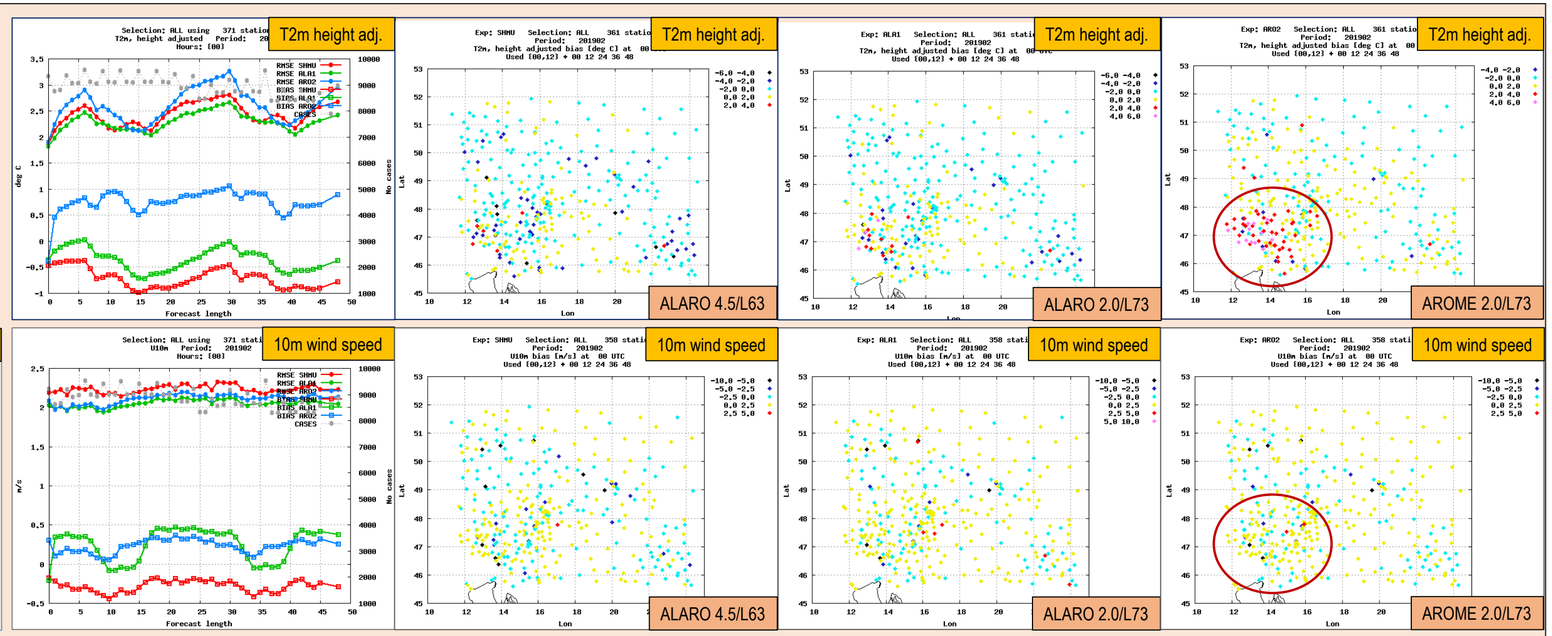
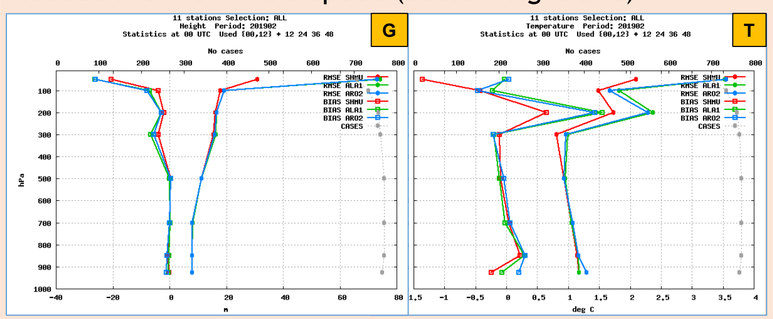
system	ALADIN/SHMU	ALARO-2km	AROME-2km
HPC	IBM Flex System p460	IBM p755 running with IBM Flex System p460	
HW	4x Power7+ 8core CPUs (3.6 GHz), 256 GB RAM	4x Power7 8core CPUs (3.6 GHz), 256 GB RAM	
nodes	12	5	
SW	Red Hat Enterprise Linux; gfortran 4.9.3 (xlf 15.1.0)	Gentoo 4.4.111 Linux, gfortran 7.3.0	
Status	operational	experimental	
model	CY40T1bf07_export	CY43T2bf10	CY40T1bf07_export
physics	ALARO-1vB	ALARO-1vB	AROME-France CMC
horizontal resolution	4.5 km, 625x576 pts	2.0 km, 512x384 pts	
spectral trunc & grid	312x287 linear	255x191 linear	
vertical levels	63	73	
time step	180 s	120 s	144 s
dynamics	hydrostatic	non-hydrostatic	
coupling model	ARPEGE (long- & short cut off), 3 h frequency	ALARO/SHMU (4.5 km), 1 h frequency	
assimilation	upper air spectral blending + CANARI surface analysis	downscaling	
initialization	no initialization	DFI	no initialization
forecast ranges	78/72/72/60 (a' 1 h)	+78 h at 00UTC/+72 h at 12UTC (a' 1 h)	



Verification of SHMU models ALARO 4.5/L63, ALARO 2.0/L73 and AROME 2.0/L73 for February 2019 against GTS stations. All models comparable against TEMPs (see below), upper air difference probably due to different vertical levels distribution. At screen levels AROME the worst for T2m height adjusted (top right line) and RH2m (not shown), difference coming from the foot of the Alps (SW domain corner). Reason unknown. Such pattern is not seen for 10m wind speed (bottom right line).





Evaluation of snow cover schemes within offline SURFEX

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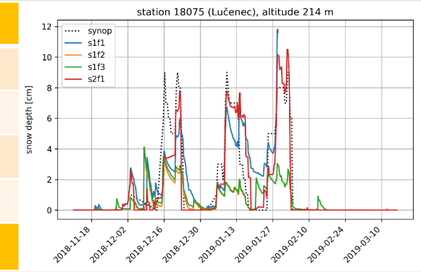
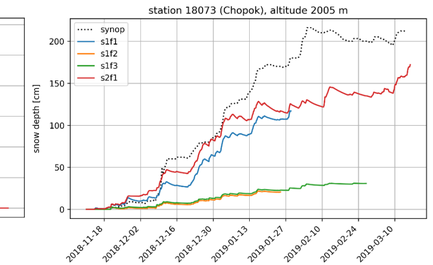
The aim of the work is modeling of temporal evolution of snow cover during winter 2018/19 using different offline SURFEX configurations and their validation against station observations (point verification) and satellite derived snow mask at 1 km resolution. How accurate could we be by using analyses fields (mostly precipitation) only in the forcing, i.e. without direct usage of snow cover analysis itself? Different snow schemes and forcing options are being tested (Tab) over so-called INCA-SK domain with 501x301pts @ 1 km. The experiments started on 11/11/2018, allowing models spin up to evolve till the last no-snow state day of 14/11/2018; and ended in 27/02/2019.

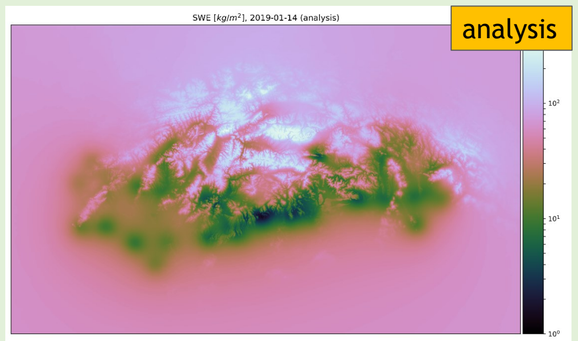
Preliminary results with D95 scheme and ALADIN (s1f1) or INCA (s1f2) forcing suggest that the spatial pattern of snow cover are rather similar for forcing with ALARO or INCA, however the SWE seems to be underestimated with INCA precipitation analysis (s1f2) especially for mountain regions – see Figs below. This feature is also illustrated with station verification of the snow depth evolution for mountain (Chopok) and lowland (Lucenec) stations – Figs right.

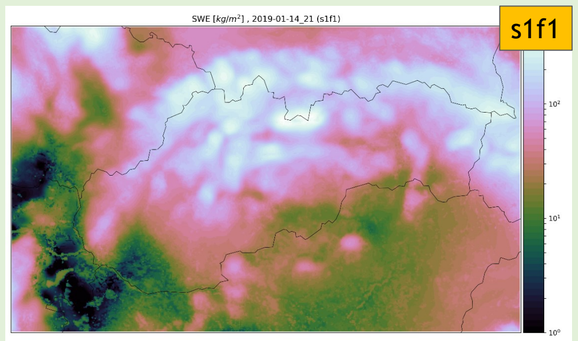
Snow scheme options	
s1	D95 (1-layer, default)
s2	3-L
s3	EBA
s4	CROCUS (multi-layer)

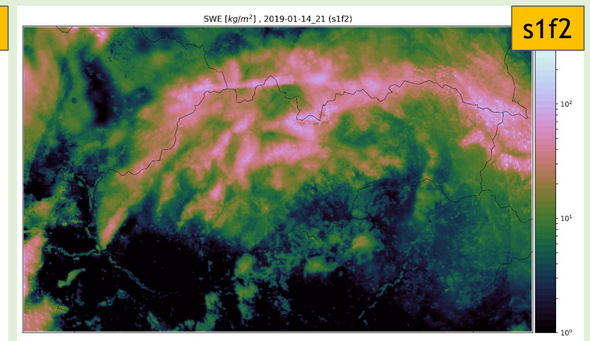
Forcing options	
f1	Forcing by ALARO hourly data from assimilation
f2	as f1, but RAIN and SNOW from INCA precipitation analysis
f3	as f2 but SW radiation from analysis of incident global radiation
f4	as f3 but TA, QA, WIND from INCA analysis

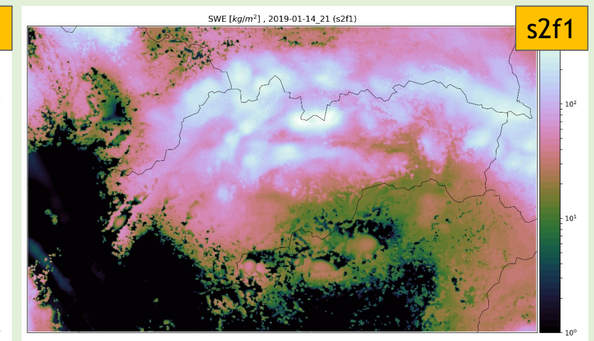












New ALADIN-LAEF scheme under ecFlow

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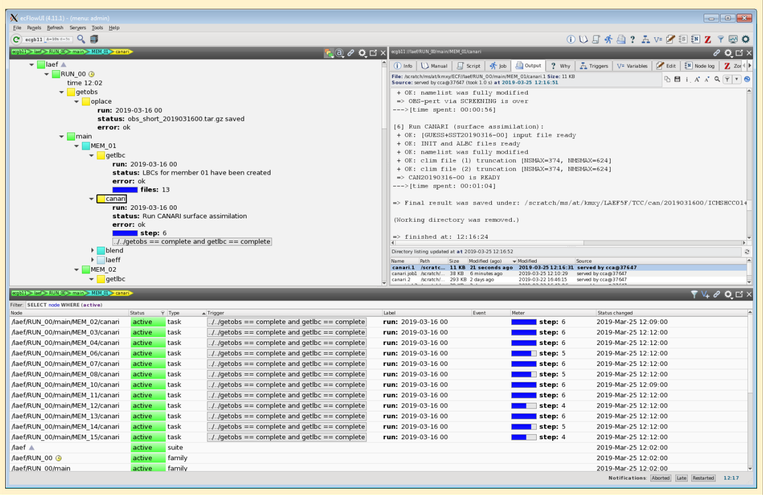
New ALADIN-LAEF setup (5 km/L60, since 2018) contains ensemble of surface data assimilation (ESDA) with internally perturbed screen-level observations, upper-air spectral blending, stochastic perturbation of physics tendencies (SPPT) for ISBA prognostic fields and new ALARO-1 multiphysics (additionally to the model upgrade from cy36 to cy40t1, increased horizontal and vertical resolution and redefined domain). LBC files are prepared via c903 directly from ECMWF gribs on octahedral cubic grid. Fullpos: LACE domain. Everything is running under ecFlow, ready for TC app status.



Case study with convection scale models

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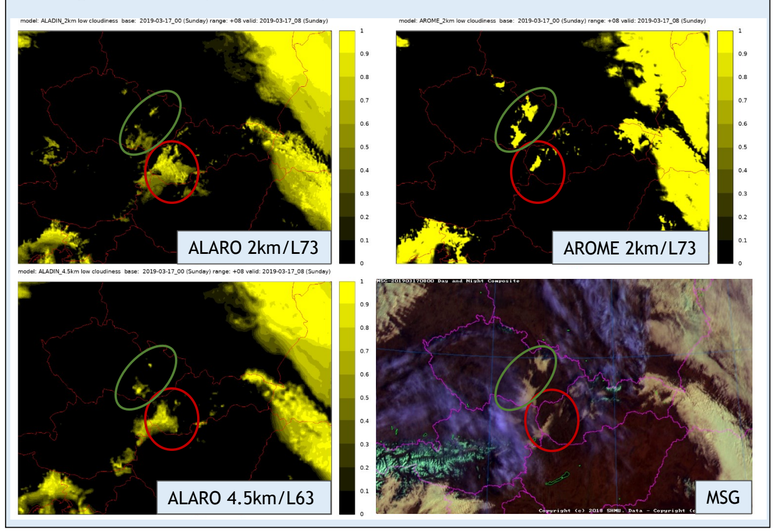
Albeit AROME 2 km/L73 is shown to be worse for standard screen level verification winter scores compared to ALARO 2 km/L73, it outperforms ALARO in various case studies. The case of morning fog and low clouds on 2019-03-17 at 08 UTC shows that the ALARO CMC family of models produced too much low clouds over SE Slovakia and not enough over Moravia. AROME got the cloudiness correctly – see the satellite picture. It seems to be attributed to insufficient mixing in ALARO (not shown).



Testing NH VFE integral operator in HY model core and further development of new vertical divergence variables.

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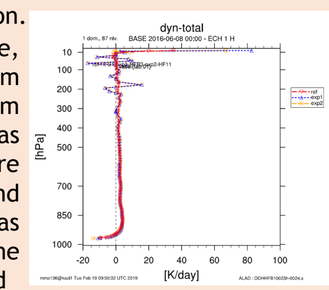
The VFE integral operator developed for NH dynamics was tested in HY framework with various orders of B-spline basis, various formulations of η coordinate (implicit in VFD but explicit in VFE scheme) and various definitions of boundary knots when BCs are involved in integral formulations. It was shown that ALADIN VFE integral operators are consistent with ECMWF ones, but they are more general. Longer term verification is needed to conclude which operator is the most appropriate for operational NWP. DDH balances of enthalpy (cpT) shows oscillatory behavior of dynamical core near model top when compared to VFD scheme, that are related to VFE formulation and they are independent on various choices made during operator definition.



Motivated by F. Voitus (AHW Toulouse, 2018) new gridpoint vertical momentum quantity gW with simple bottom boundary condition gWs=0 was introduced. Several formulations were proposed, with stability analysis and simplified academic tests performed as well as the real case test of extreme wind occurrence. The code was phased to CY46 and ongoing work is reported: *Vivoda, J., 2018: New vertical motion variables in the non-hydrostatic dynamical core of the ALADIN system. RC LACE stay report at CHMI* (www.rclace.eu)