ALARO experiences@SHMU

M. Derkova, A. Simon, M. Dian

with contributions from
M. Petras, M. Nestiak, V. Tarjani, M. Bellus

ALARO-1 working days, Prague, 13-15/06/2022

Outline

- setup of ALARO systems @ SHMU
- upgrade and porting - verification scores
- various issues
  - reproducibility issue (convection related?)
  - CANARI in ALA2
  - ALARO with SURFEX
- new developments
- future plans

ALARO CSCs @SHMU

CMC	**ALARO/SHMU**
status	operational
code version	CY43T2bf11
physics	ALARO-1vB
dx	4.5 km
pts	625 x 576
vertical levels	63
tstep	180 s
forecast ranges	78/72/72/60 (a' 1h)
coupling model	ARPEGE (long & short cut off), 3h
assimilation	upper air spectral blending by DFI & CANARI surface assimilation
	e-suite BLENDVAR+CANARI
initialization	none
HPC	NEC-LX, 240 nodes

ALARO CSCs @SHMU

CMC	**ALARO/SHMU**	**ALARO/2km**	
status	operational	experimental	
code version	CY43T2bf11	CY43T2_bf11	
physics	ALARO-1vB	ALARO-1vB	
dx	4.5 km	2.0 km	
pts	625 x 576	512 x 384	
vertical levels	63	87	
tstep	180 s	120 s	
forecast ranges	78/72/72/60 (a' 1h)	78/72/72/60 (a' 1h)	81/-/81/- (a' 1h)
coupling model	ARPEGE (long & short cut off), 3h	ARPEGE, 1h	ECMWF, 3h
assimilation	upper air spectral blending by DFI & CANARI surface assimilation	downscaling -> "CANARI"	downscaling of A-LAEF CTRL member
	e-suite BLENDVAR+CANARI		
initialization	none	DFI	
HPC	NEC-LX, 240 nodes		

ALARO CSCs @SHMU

CMC	**ALARO/SHMU**	**ALARO/2km**		**A-LAEF**
status	operational	experimental		operational (common RC LACE)
code version	CY43T2bf11	CY43T2_bf11		CY40t1bf06
physics	ALARO-1vB	ALARO-1vB		ALARO-1 multi-physics + surface stochastic physics (SPPT)
dx	4.5 km	2.0 km		4.8 km
pts	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)	81/-/81/- (a' 1h)	72/-/72/- (a' 1h)
coupling model	ARPEGE (long & short cut off), 3h	ARPEGE, 1h	ECMWF, 3h	16+1 members of ECMWF EPS, 6h
assimilation	upper air spectral blending by DFI & CANARI surface assimilation e-suite BLENDVAR+CANARI	downscaling -> "CANARI"	downscaling of A-LAEF CTRL member	16+1 spectral blending by DFI & ensemble data assimilation based on CANARI OI
initialization	none	DFI		none
HPC	NEC-LX, 240 nodes			ECMWF HPCF, 136 nodes

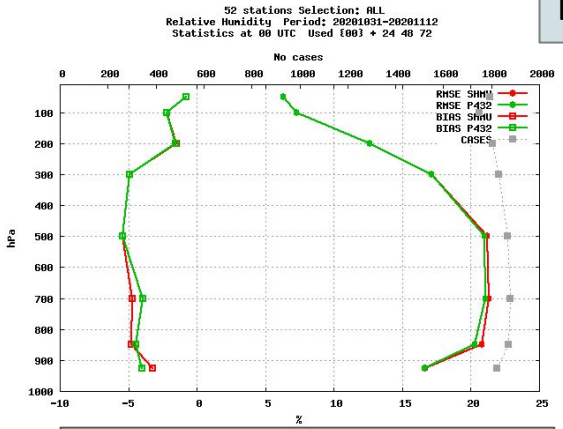
ALADIN/SHMU main oper. det. system

changelog since last ALARO-1 WD

- JAN 2021 - upgrade to CY43t2_bf11
- APRIL 2021- new diagnostics parameters added: wet snow, visibility
- 2021/2 - porting to new HPC
- MARCH 2022 - operational suite switch to new HPC

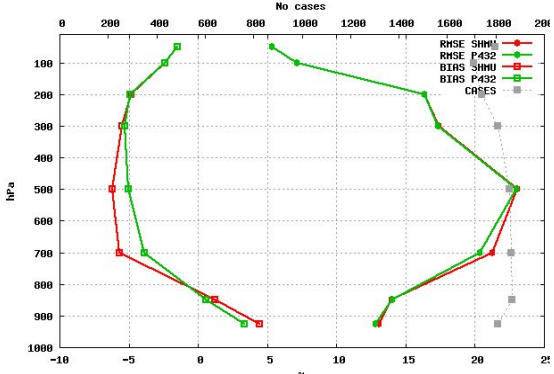
Validations - scores

RH



~winter

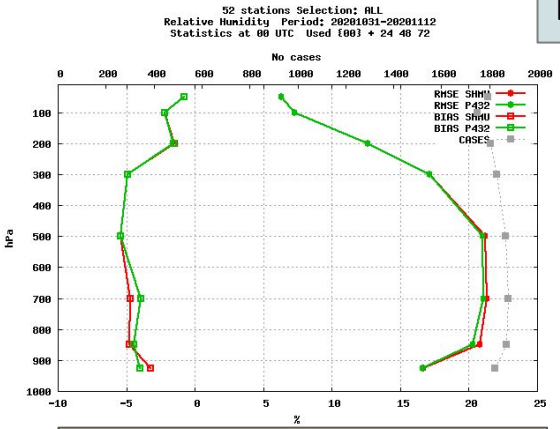
SHMU - oper; **P432** - CY43T2



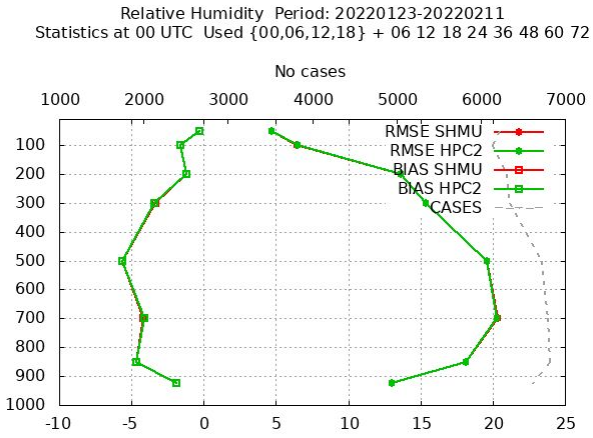
~summer

Validations - scores

RH

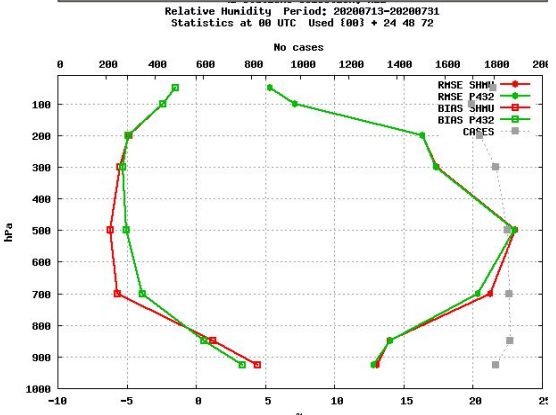


~winter

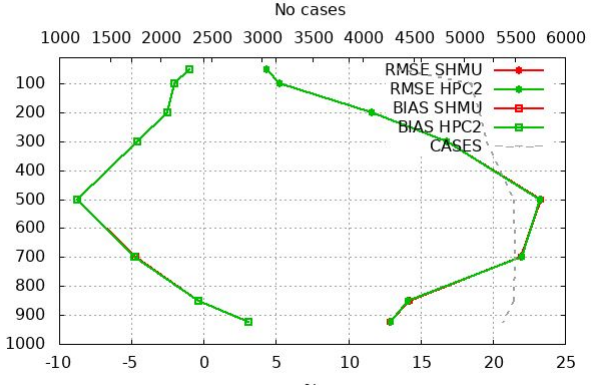


SHMU - oper; **P432** - CY43T2

SHMU - new HPC; **HPC2** - old HPC

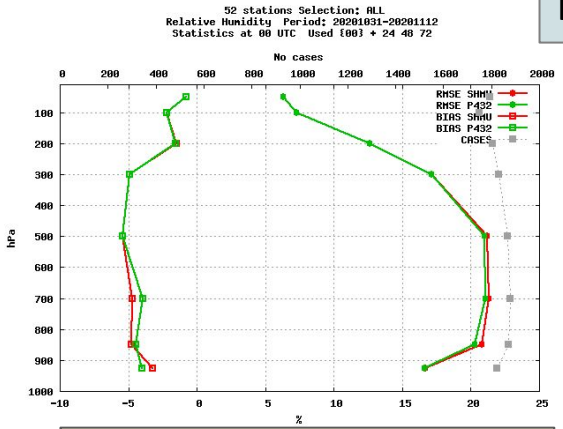


~summer

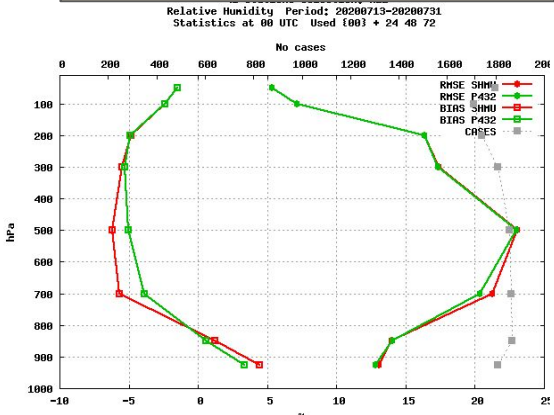


Validations - scores

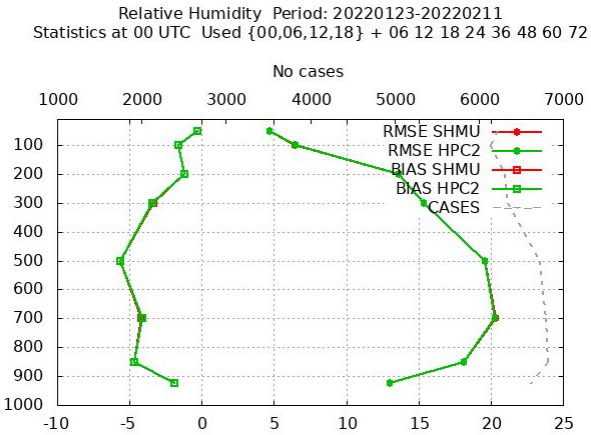
RH



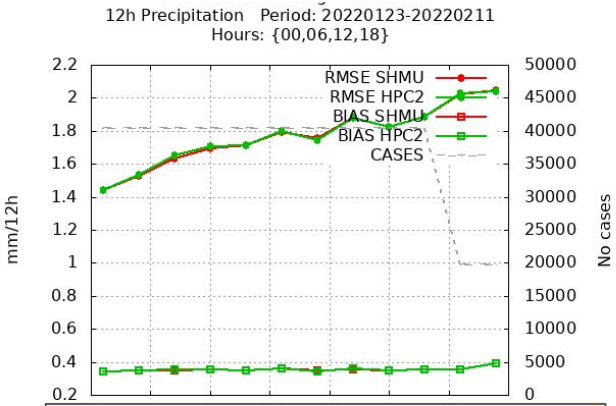
SHMU - oper; **P432** - CY43T2



~winter

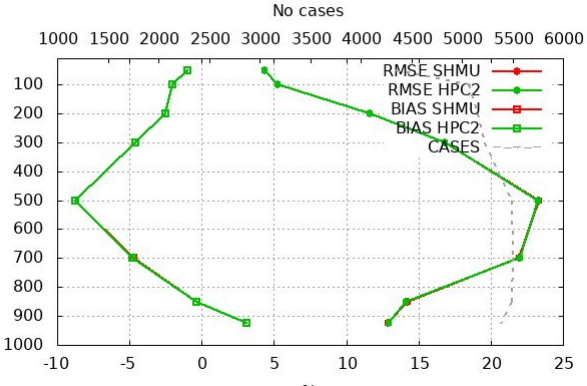


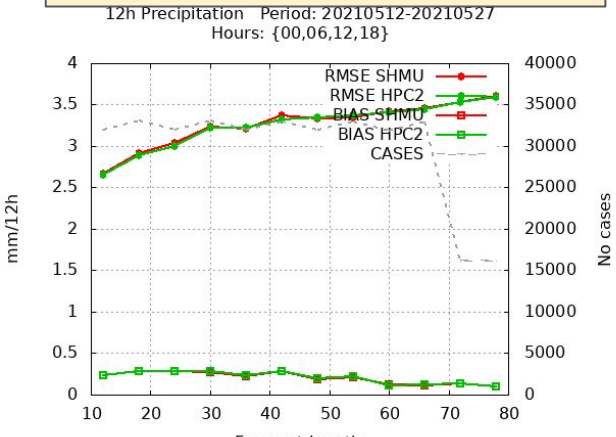
SHMU - new HPC; **HPC2** - old HPC



SHMU - new HPC; **HPC2** - old HPC

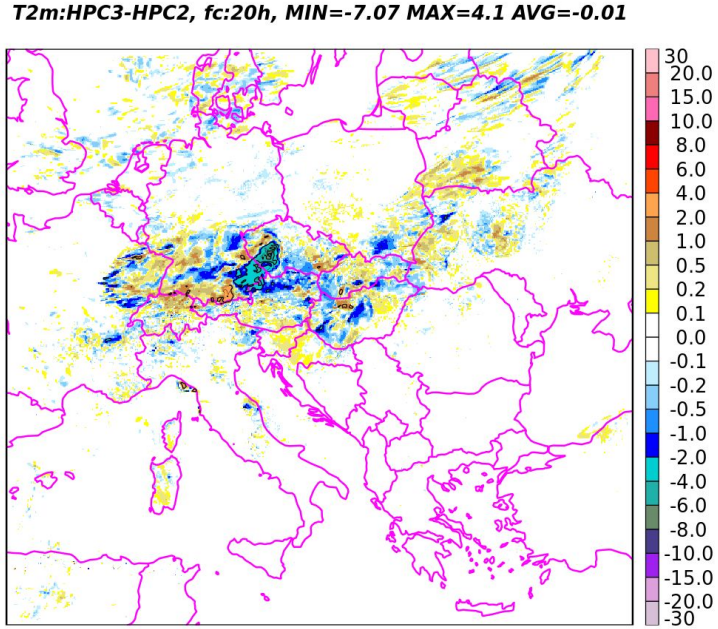
~summer





Validation new vs old HPC - case study

Significant 2m temperature differences (up to 6°C) were discovered in certain situations (V. Tarjáni, A. Simon) related to deep convection.



A. Simon, V. Tarjani

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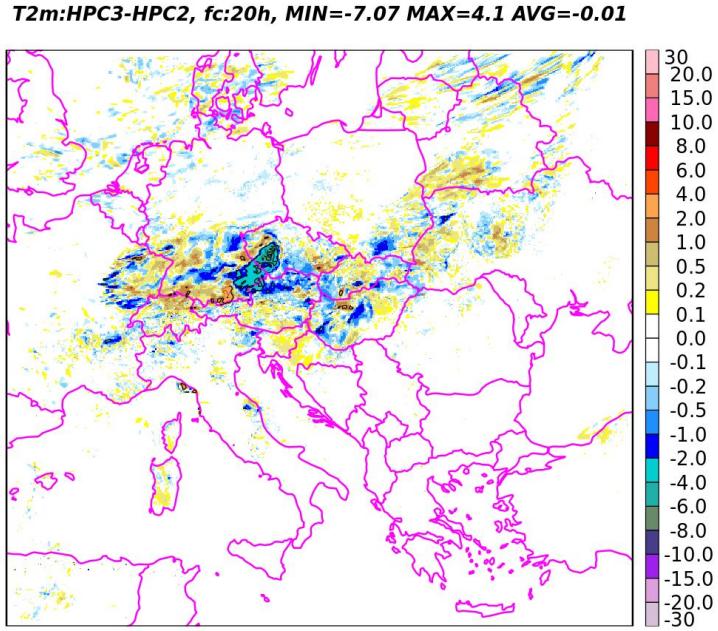
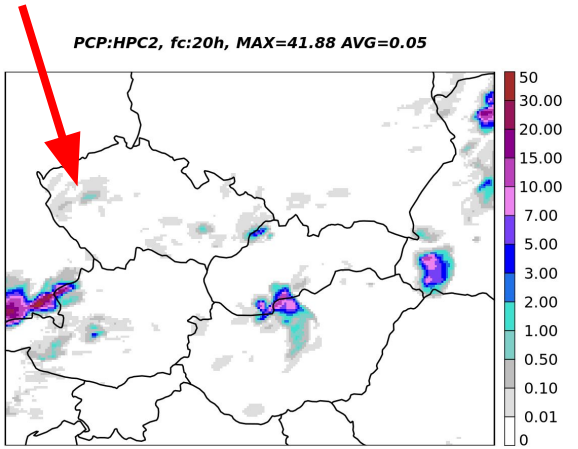
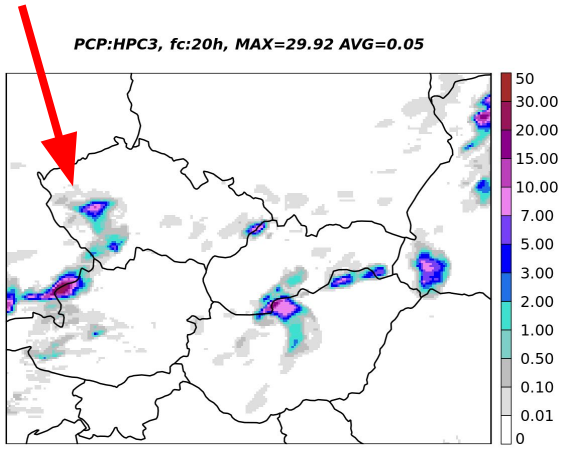




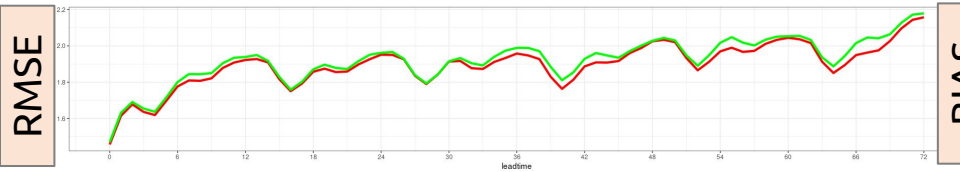


Absence of precipitation in the western part of CR

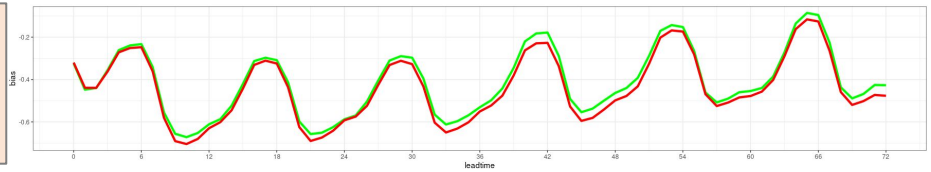
A. Simon, V. Tarjani

Validation new vs old HPC

RMSE



BIAS



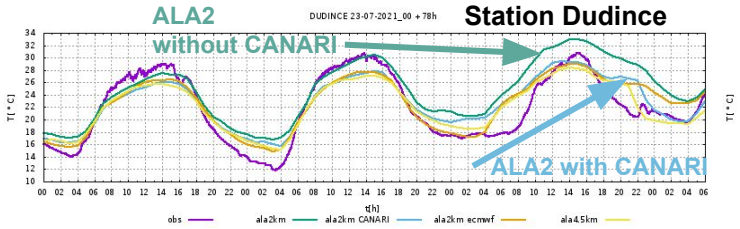
HARP SURFACE scores (M. Petras) - 2m T scores for 20/01-21/02/2022 over 95 Slovak AWS: new HPC vs old HPC : ~neutral

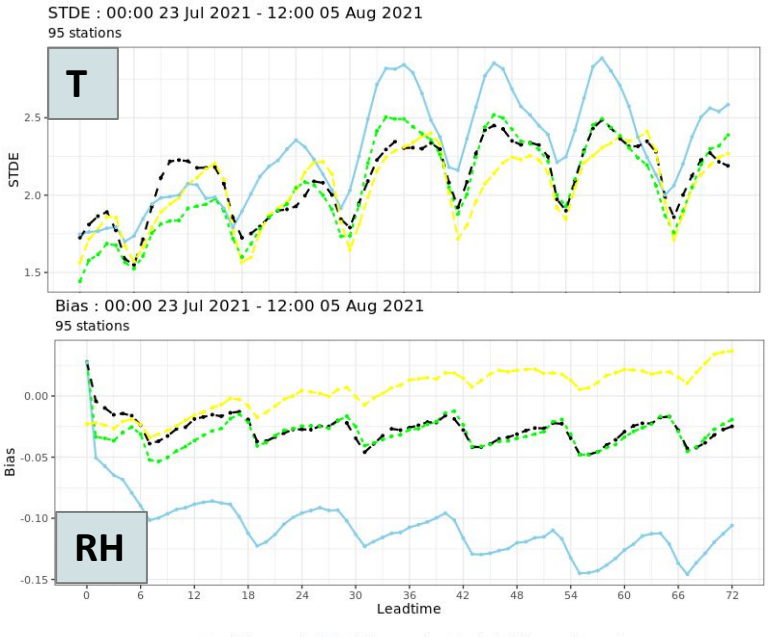
- Tests on the MF computer (Belenos) showed different results to both old/new HPCs.
- Non-hydrostatic runs (ALARO/2km) were provided as well, showing still differences (although smaller) when using explicit convection.
- Optimization tests (operational vs debugging mode) revealed temperature differences up to 4°C even on the same HPC (new) and again closely related to deep convection.
- It seems that the model forecast is extremely **sensitive** in deep convection cases, even to small numerical perturbations.

A. Simon

ALARO/2km summer issue

A deterioration of the 2m T and RH forecasts has been identified during summer 2021 in ALARO2 configuration with ISBA, coupled to ARPEGE in the dynamical downscaling mode (light blue). Utilization of analysis of surface parameters based on CANARI optimal interpolation showed to be sufficient to alleviate the deficiencies (green). Simple technical cycling approach was applied - the analyzed temperature and soil moisture fields are replaced in the initial conditions file - an ARPEGE analysis so that the upper air fields of the driving model analysis are preserved.

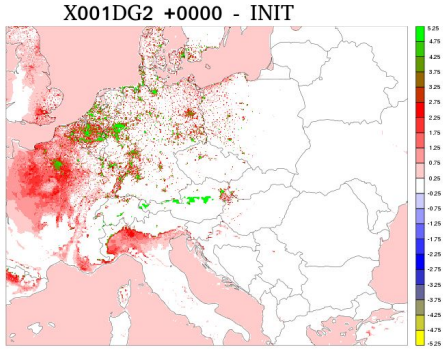


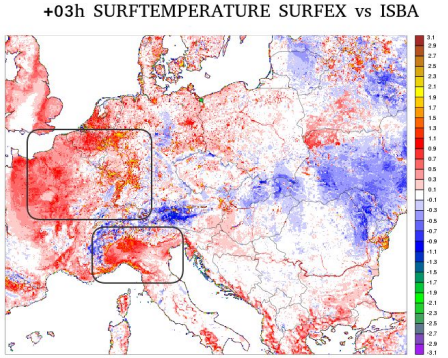


M. Dian (M. Derkova, M. Petras)

ALARO with SURFEX

- ➔ Inconsistency in SURFTEMPERATURE between ISBA and SURFEX
- ➔ Big difference in PROFTEMP (X001TG2) between +000 and init file
- ➔ Negative deep soil ice reservoir values were found => incorrect PROFTEMP in e001





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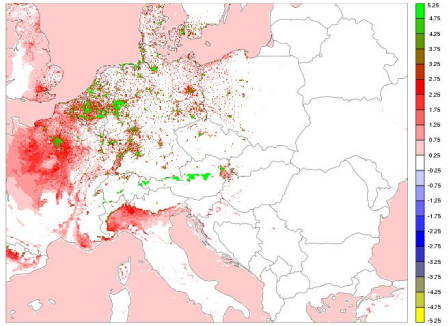
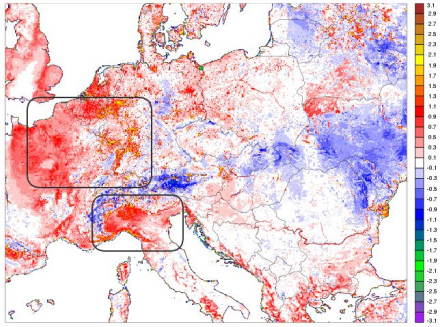
- ➔ Big difference in PROFTEMP (X001TG2) between +000 and init file
- ➔ Negative deep soil ice reservoir values were found => incorrect PROFTEMP in e001
- ➔ Reason: inconsistency between deep soil depth SURFEPAIS.SOL and X001DG2 used in conversion of volumetric ice reservoirs in e927 vs e001

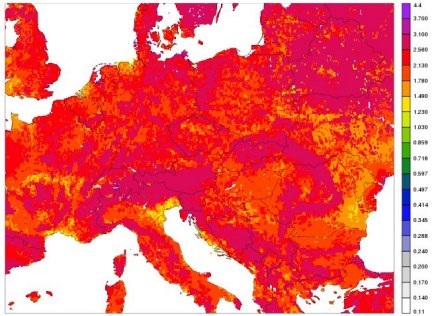
X001DG2 +0000 - INIT



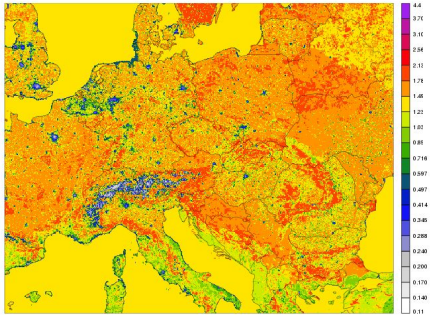
+03h SURFTEMPERATURE SURFEX vs ISBA



SURFEPAIS.SOL



X001DG2

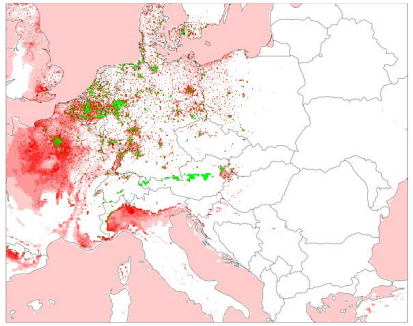


M. Dian (J. Masek, M. Nestiak)

ALARO with SURFEX

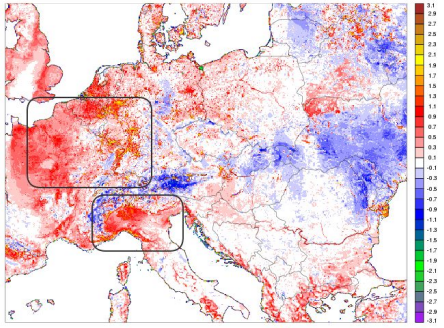
- ➔ Inconsistency in SURFTEMPERATURE between ISBA and SURFEX
- ➔ Big difference in PROFTEMP (X001TG2) between +000 and init file
- ➔ Negative deep soil ice reservoir values were found => incorrect PROFTEMP in e001
- ➔ Reason: inconsistency between deep soil depth SURFEPAIS.SOL and X001DG2 used in conversion of volumetric ice reservoirs in e927 vs e001
- ➔ Dirty Fix: Hard coded depth SURFEPAIS.SOL in SURFEX routine ice_soilfr from aplpar routine
- ➔ Issue still open

X001DG2 +0000 - INIT

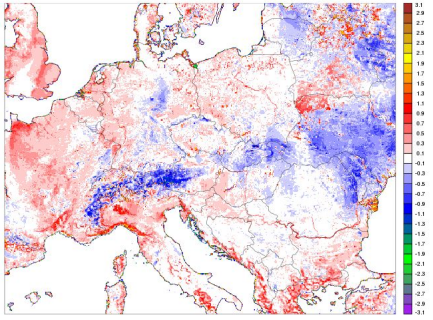


X001DG2 +0000 - INIT fixed soil depth

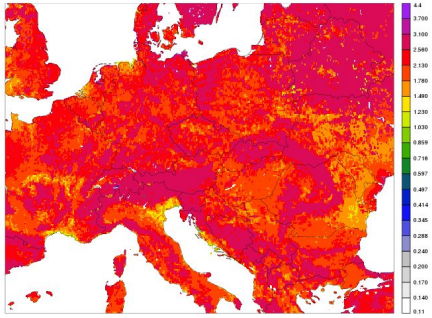
+03h SURFTEMPERATURE SURFEX vs ISBA



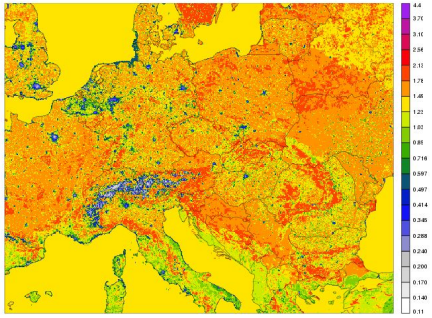
+03h SURFTEMPERATURE SURFEX vs ISBA



SURFEPAIS.SOL



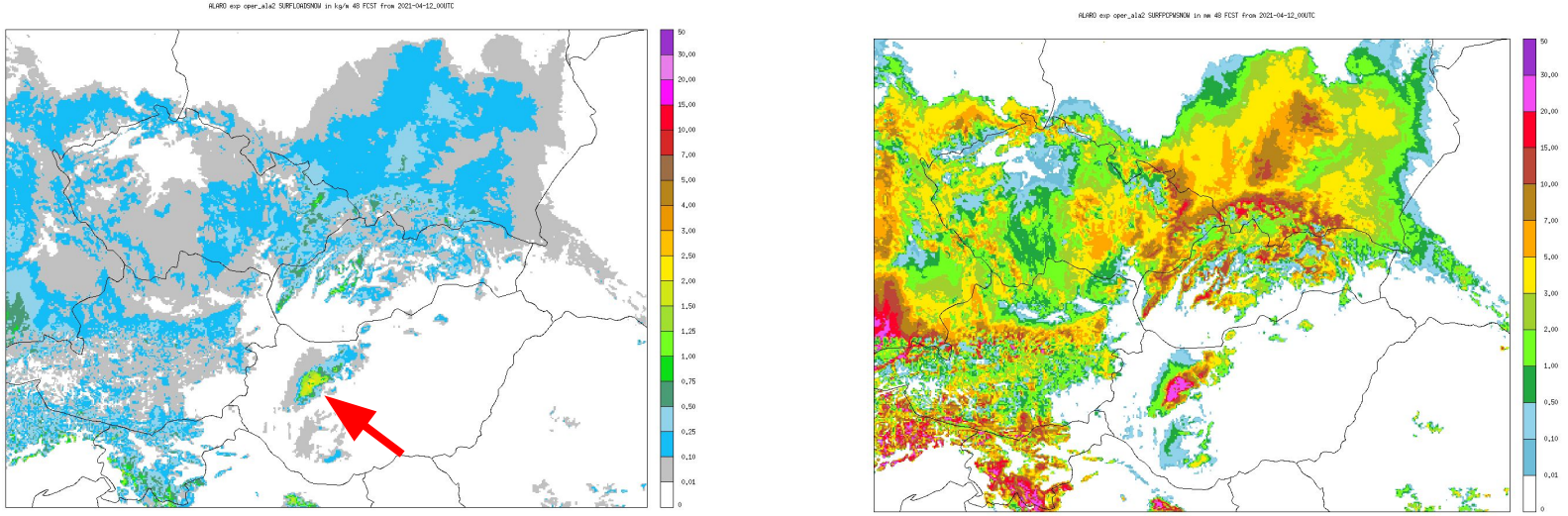
X001DG2



M. Dian (J. Masek, M. Nestiak)

Diagnostic parameters: wet snow, freezing rain

Parameterization of the wet snow and ice accretion on power lines (Simon et al., 2020) was introduced to both ALARO2 and ALADIN/SHMU, operational from 2021. Several characteristics (load, diameter of accreted precipitation) can be derived.



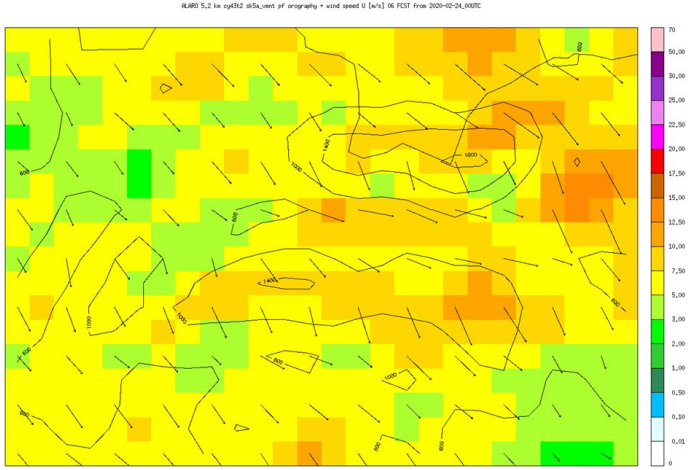
48h forecast of cumulated wet snow load (kg/m, left) and precipitation (mm, right) from the 12 April 2021 00 UTC run. Minor problems occurred in western Hungary as indicated by forecasts.

A. Simon

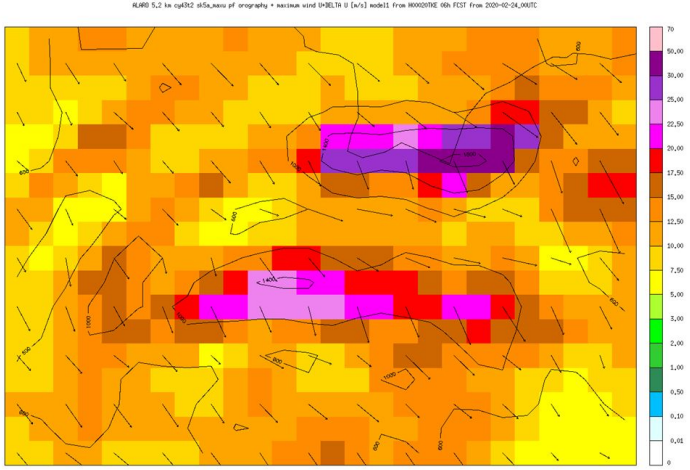
Maximum subgrid wind estimation

Purpose: Improve underestimated wind forecasts, above all in mountain areas and for models of ~ 5 km horizontal resolution (with lower model orography)

Method: Series of dynamic adaptation forecasts with 325m horizontal resolution (training set), study of possible wind distribution in the “subgrid” area. (Multi) linear regression used, coded in cy43t2 (currently tuned).



6h forecast of 10m wind of 5.2 km resolution ALARO from 24 February 2020 00 UTC



The same, but for estimated maximum subgrid wind

A. Simon

Ongoing work and future plans

- building of 1km ALARO version
  - RUC nowcasting (hourly runs up to +12 h)
  - high resolution real-time analysis (surface)
- convection-permitting EPS ~2km, smaller domain, coupled to A-LAEF

References

- Simon et al., 2020: Forecasting of wet snow and freezing rain accretion on power lines. Joint 30th ALADIN Workshop and HIRLAM ASM 2020 online
- Dian, M, Derková, M., Petraš, M., 2022: Algorithmic amelioration of the deficiencies in the screen level parameters forecast based on a dynamical downscaling approach, 2nd Accord newsletter, 91-95.
- Simon et al., 2021: Numerical simulations of June 7, 2020 convective precipitation over Slovakia using deterministic, probabilistic, and convection-permitting approaches. Idojaras, DOI: 10.28974/idojaras.2021.4.3