Data assimilation activities@SHMU

Mária Derková

with contributions from
M. Imrišek, M. Neštiak, A. Simon

RC LACE DA working days, Prague, 18-20/09/2019

Outline

- Operational and experimental setups of ALADIN systems
- Checks on CANARI settings
- GNSS ZTD data assimilation
- Summary and future plans

ALADIN/SHMU systems

CMC	ALARO/SHMU
status	operational
code version	CY40T1bf07_export
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
initialization	no initialization
HPC	IBM Flex System p460, linux

ALADIN/SHMU systems

CMC	ALARO/SHMU	ALARO/2km	AROME/2km
status	operational	experimental	
code version	CY40T1bf07_export		
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pts	625 x 576	512 x 384	
vertical levels	63	73	
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forecast ranges	78/72/72/60 (a' 1h)	+78h at 00UTC/+72h at 12UTC (a' 1h)	
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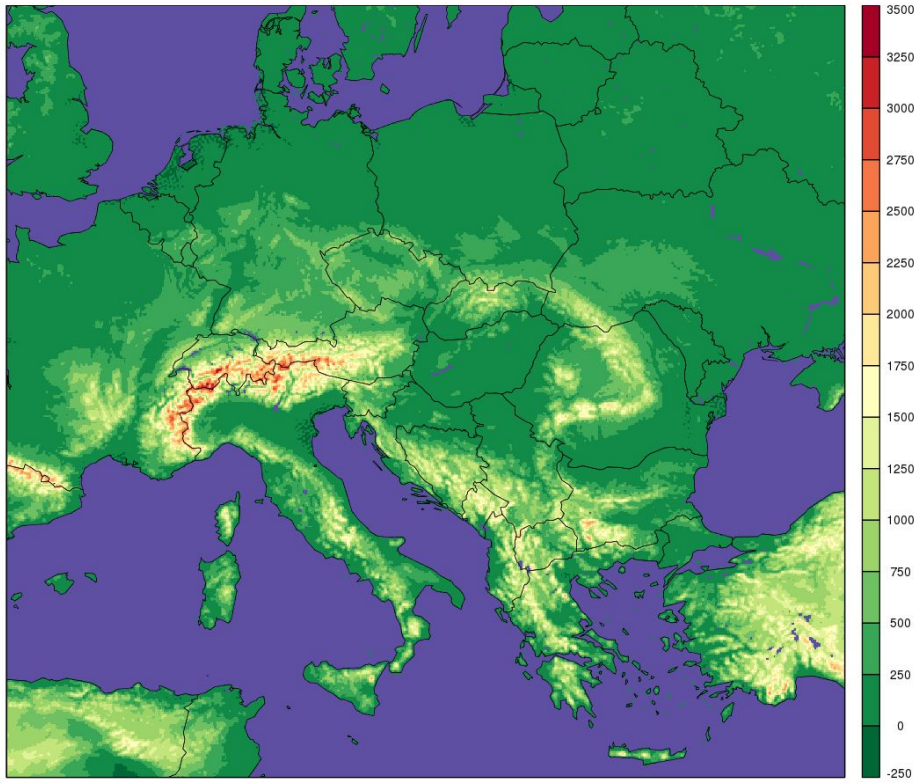
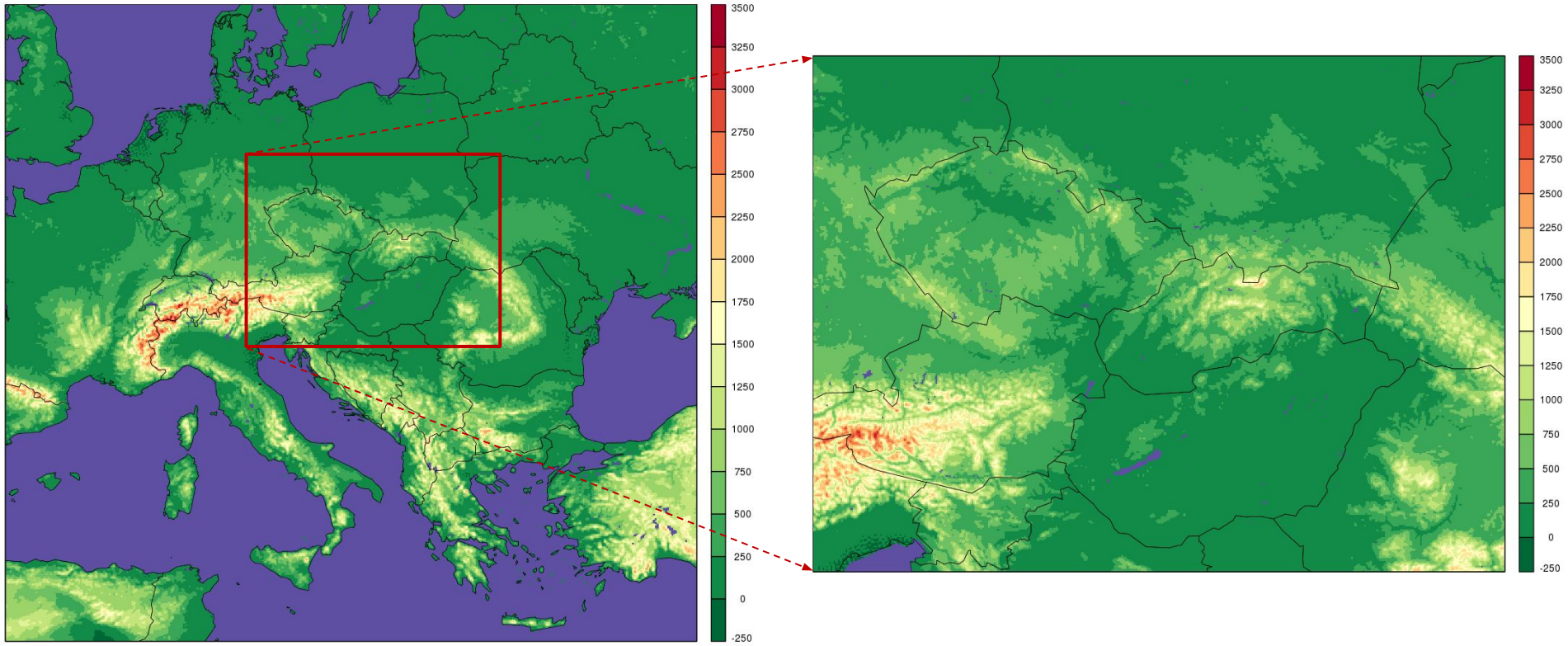
ALARO/SHMU operational domain



ALARO 4.5 km/L63

Operational & HR models domains



ALARO 4.5 km/L63

ALARO/AROME 2.0 km/L73

Verification of SHMU models (vert)

ALARO/SHMU
4.5 km/L63

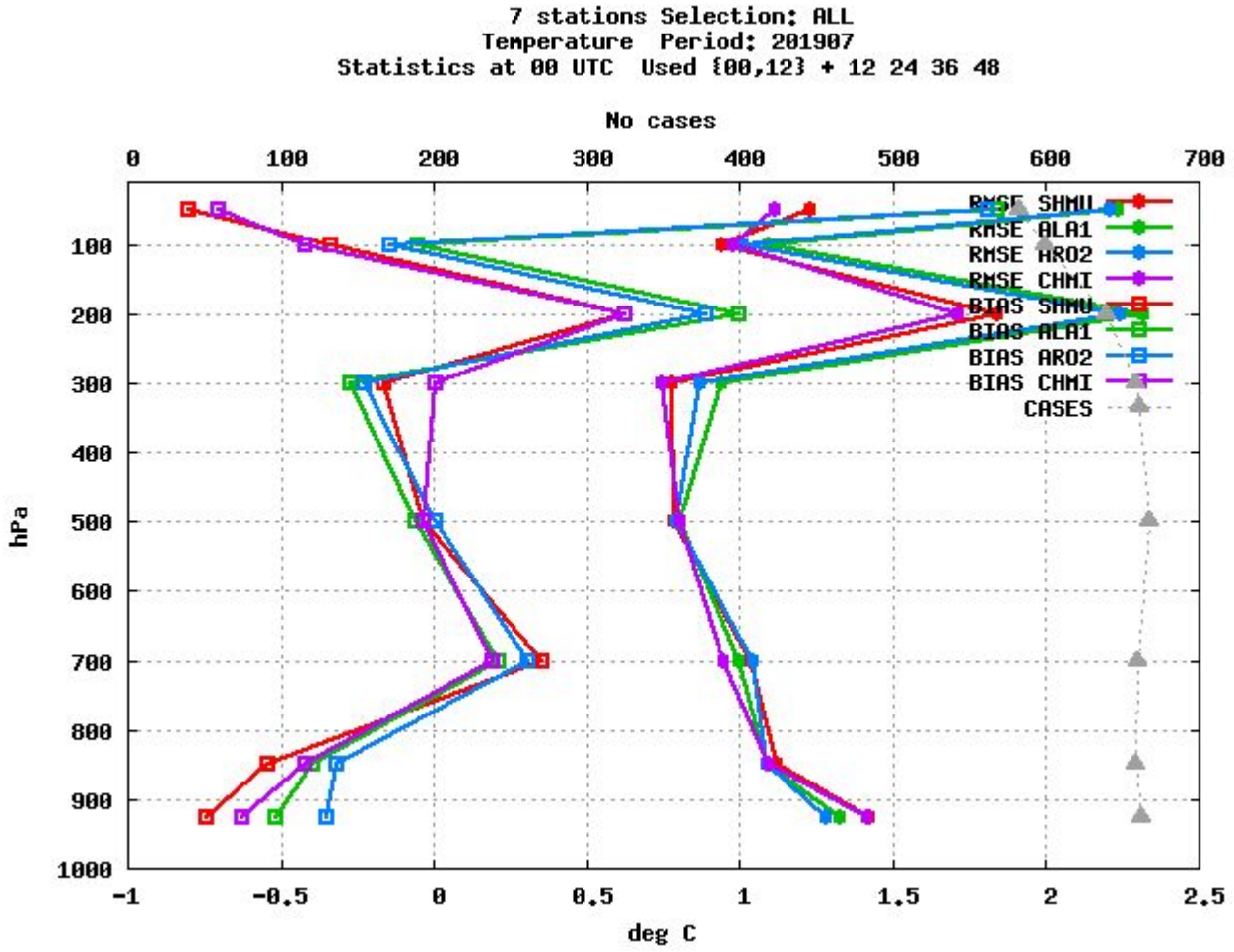
ALARO/SHMU
2 km/L73

AROME/SHMU
2 km/L73

ALARO/CHMI
2.3 km/L87

July 2019

temperature



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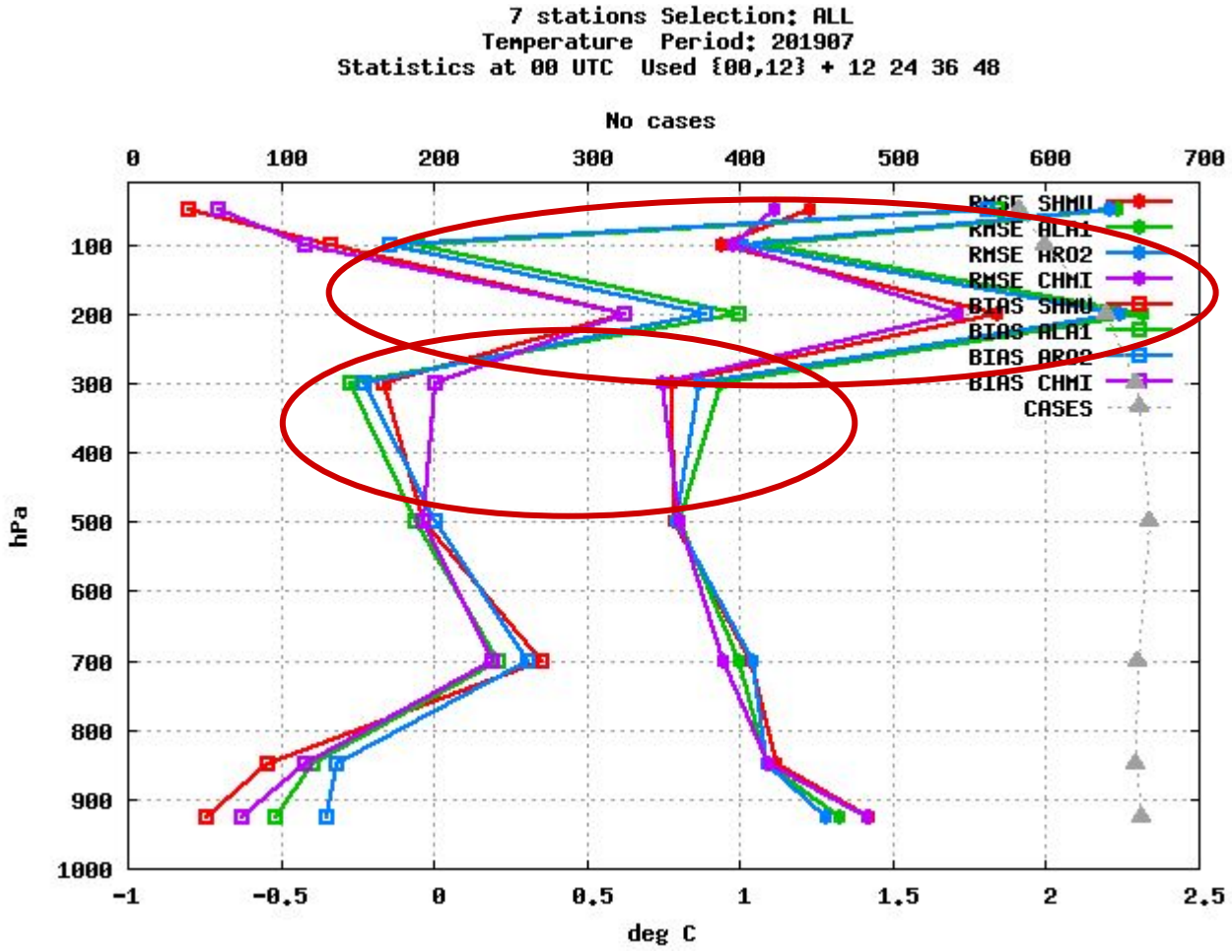

Suboptimal distribution of vertical levels of SHMU 2 km models near model top (impact on assimilation of AMDAR obs?)

Verification of SHMU models (surf)

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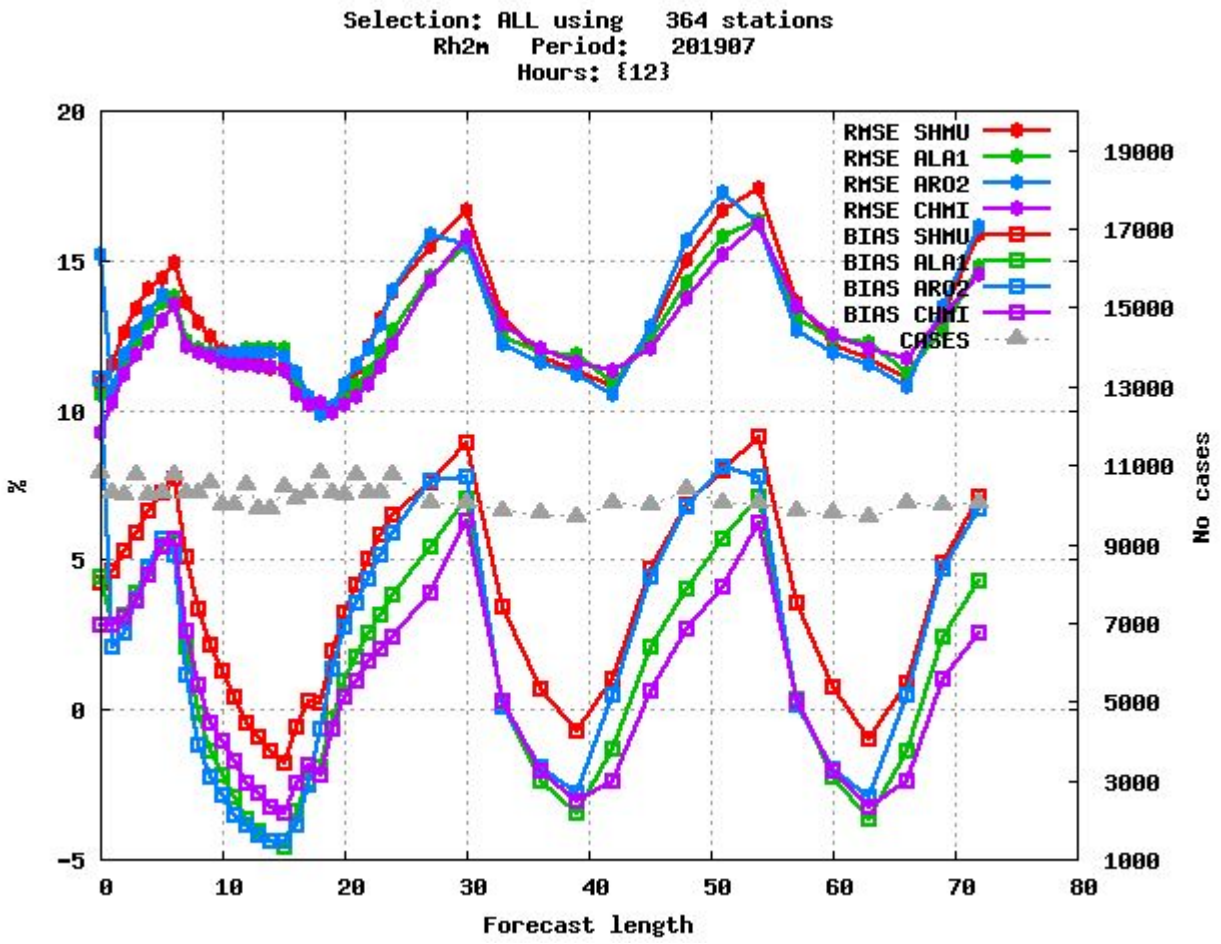
July 2019

RH2m 12 UTC



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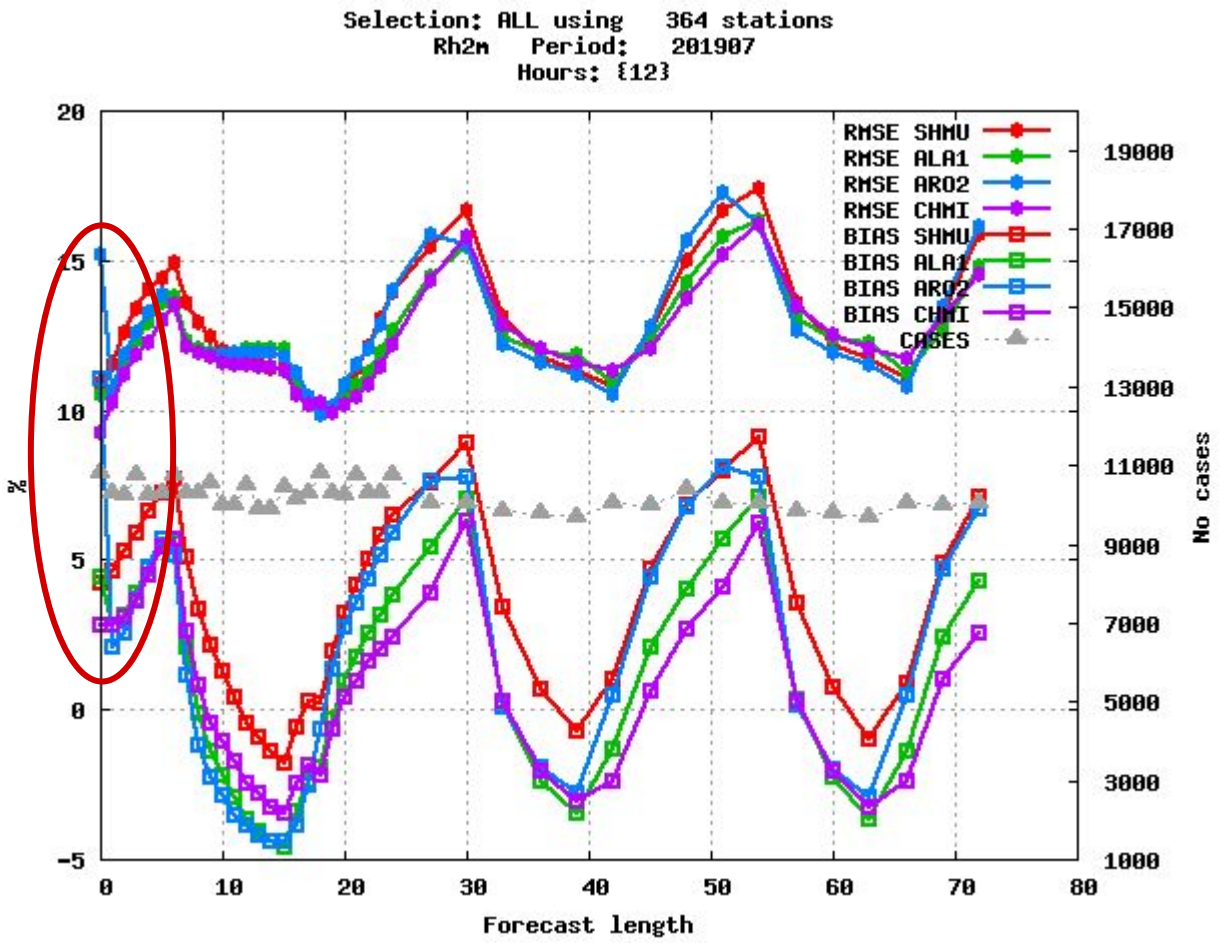
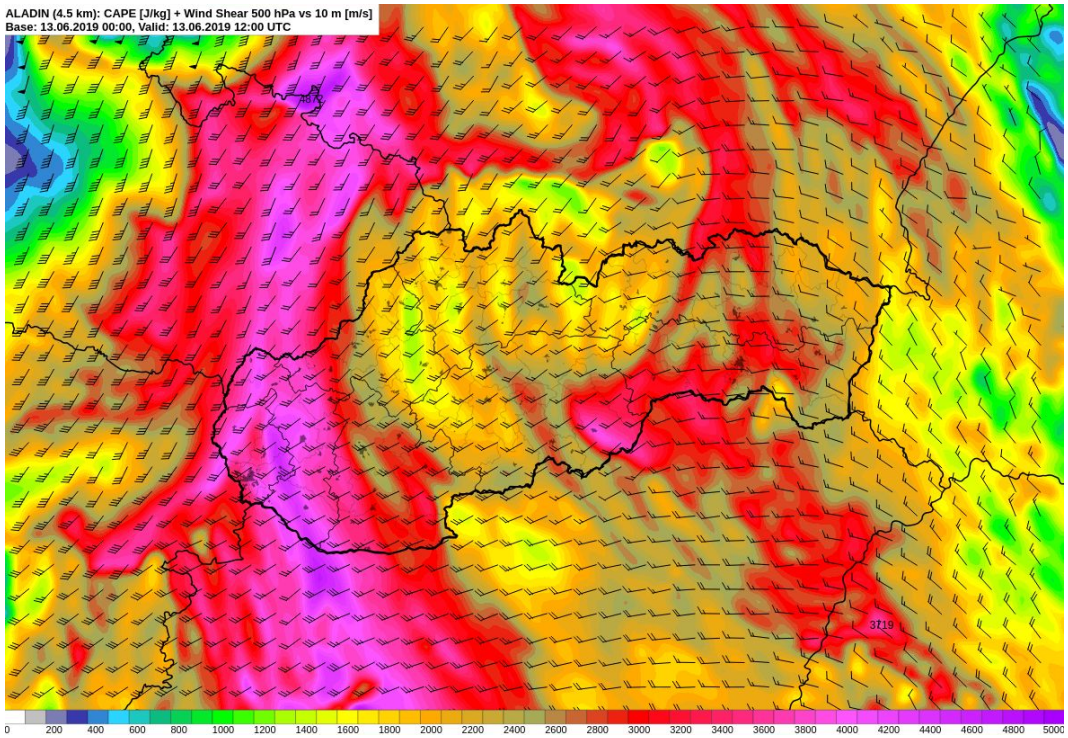


Arome INIT bad scores for moist parameters at 12 UTC NT - corr by assim?

CAPE pb => checks on CANARI settings

Motivation: forecasters' complaints about unrealistic CAPE values - case 13/06/2019 12 UTC (+12 h forecast) - too much moisture in ALADIN

Courtesy of Miro Singer



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- see Prostejov sounding & forecast

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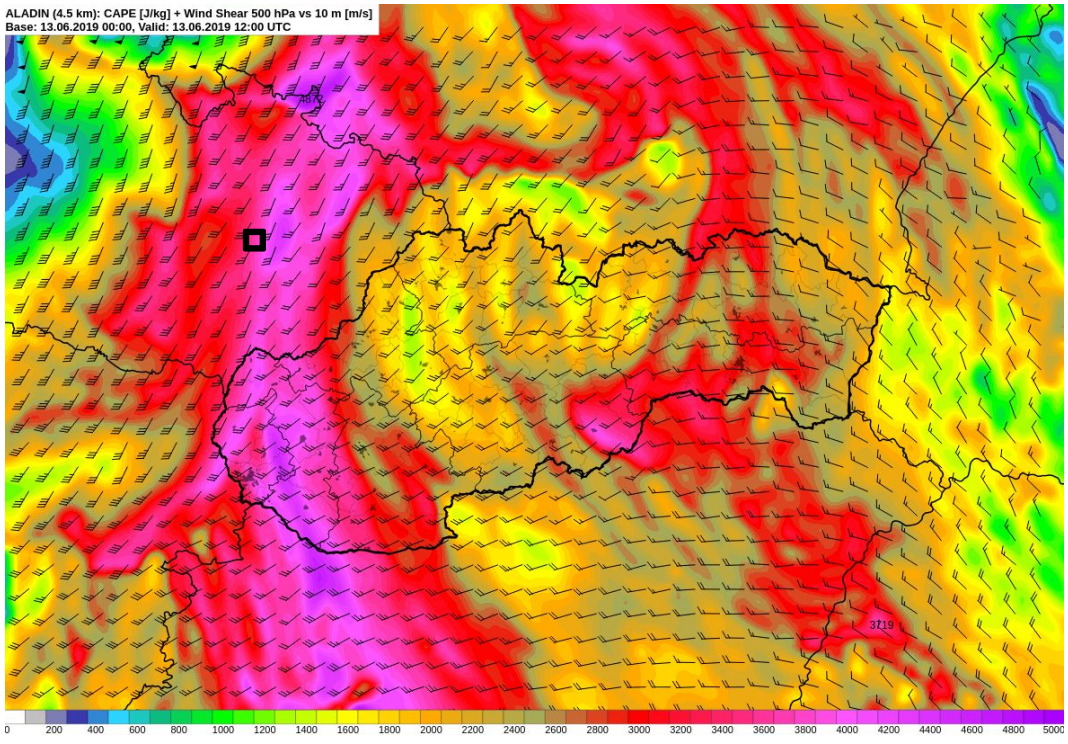
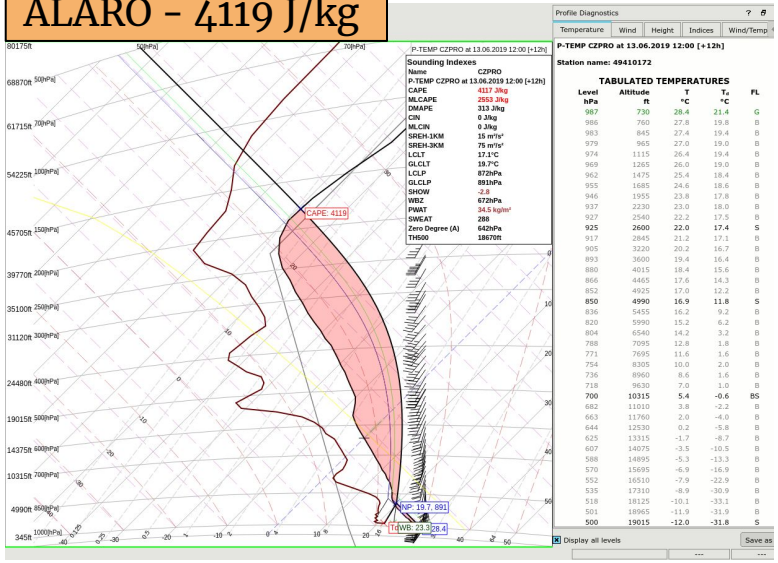
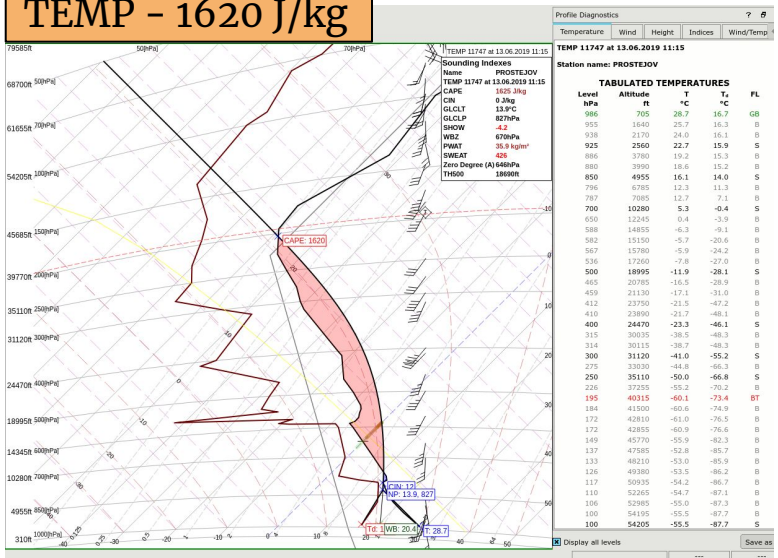


ALARO - 4119 J/kg

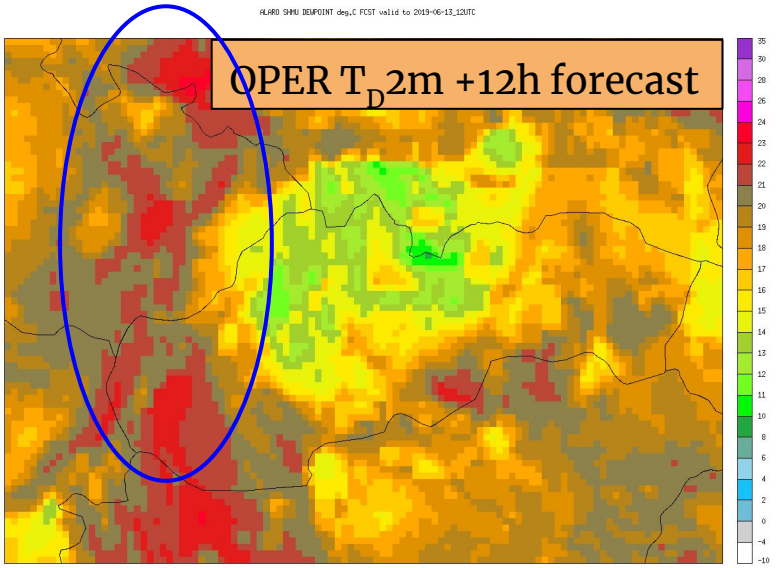


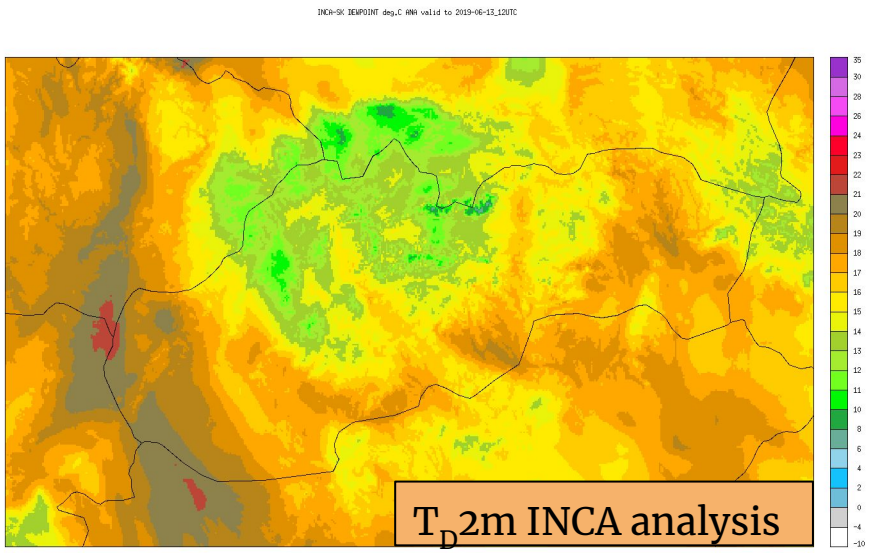
TEMP - 1620 J/kg



Checks on CANARI settings

- One of the potential source of problems = unrealistic values of near surface moisture





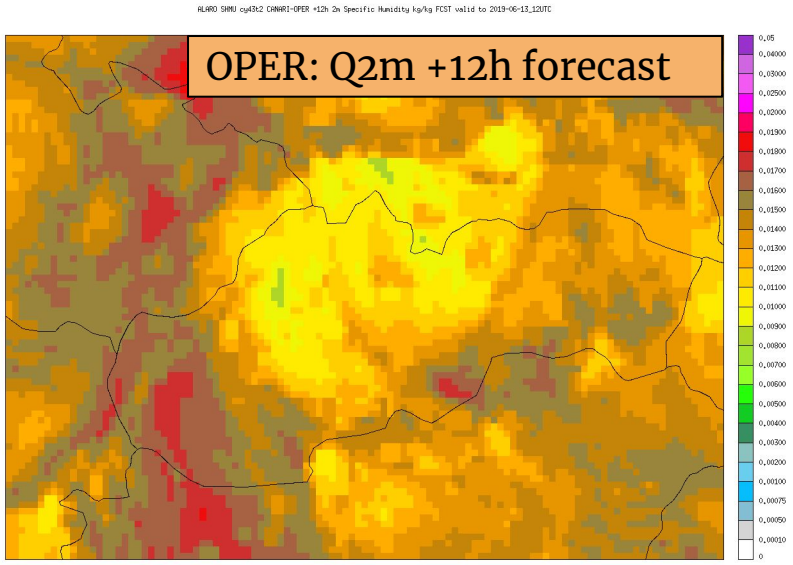
Checks on CANARI settings

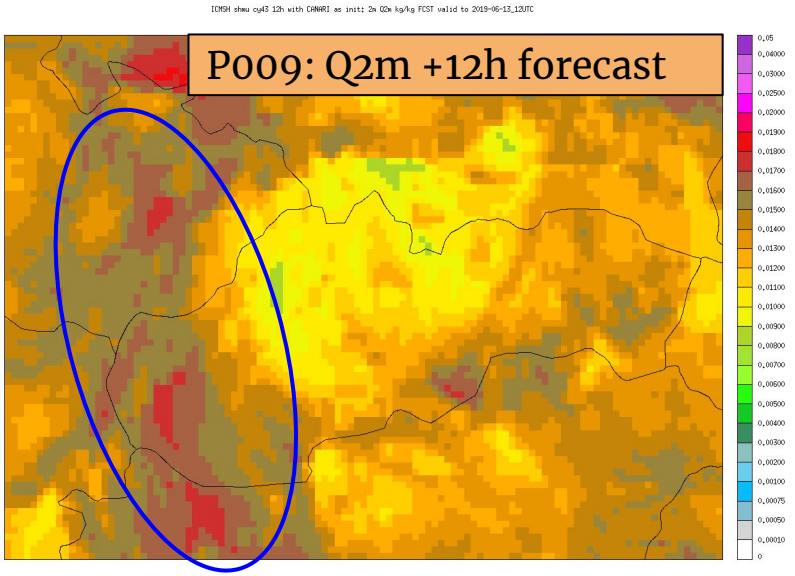
- One of the potential source of problems = unrealistic values of near surface moisture

- Bug in missing **LXSOIL=.T.** in the blending forecast to have evaporation fluxes in guess (forgotten in switch to ALARO-1vB)
- Testing LDIRCLSMOD=.TRUE.
  - More tests planned (check on wind treatment)
- Adding all available LACE AWS
  - Neutral -> slightly positive impact
- Plan: MESCAN

Q2m on 13/06/2019 12 UTC (+12 h F)

Courtesy of Andre Simon





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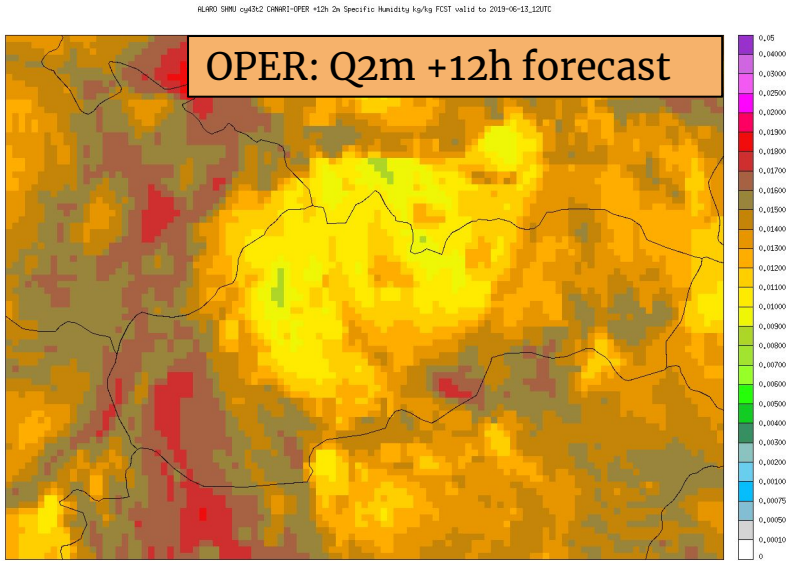
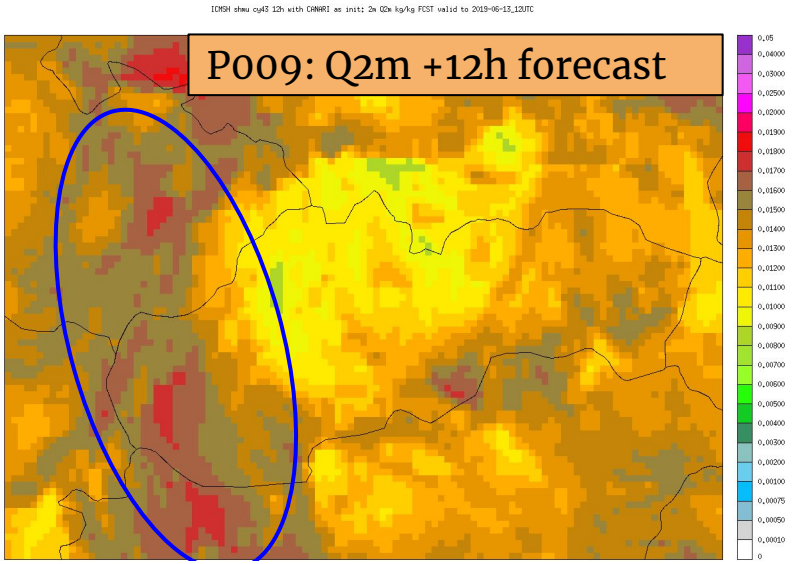
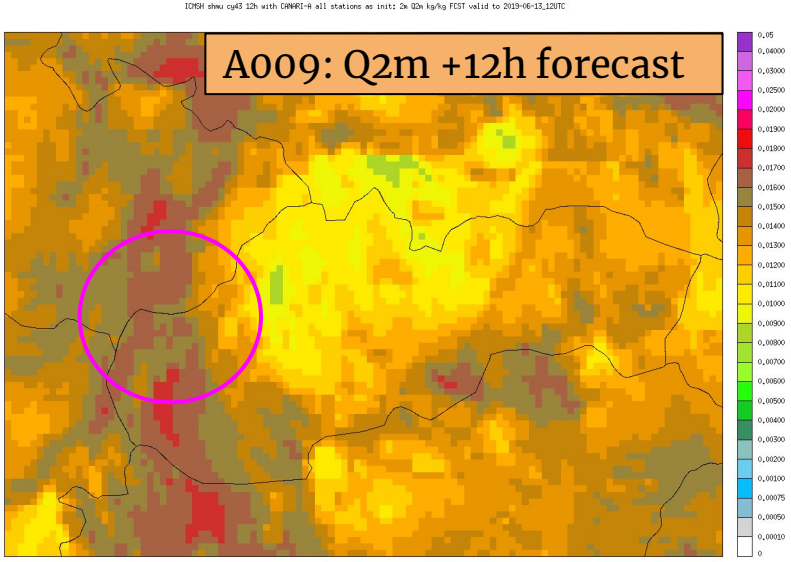
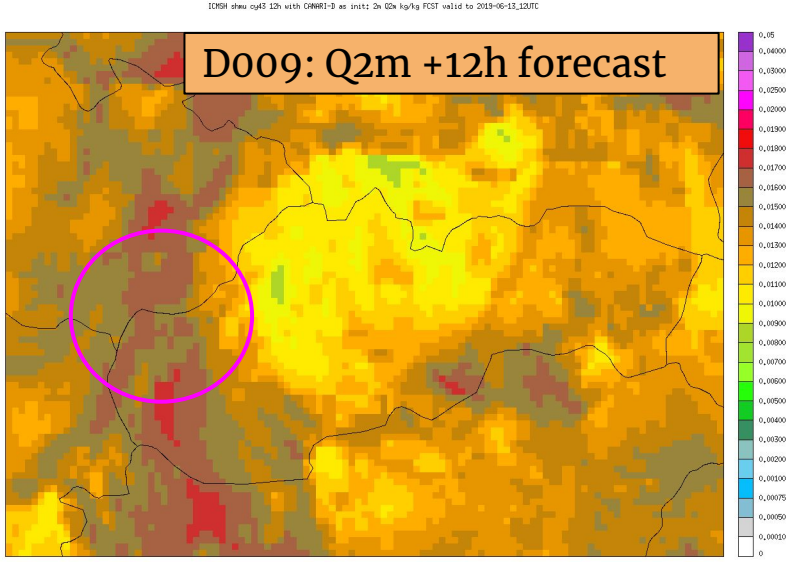




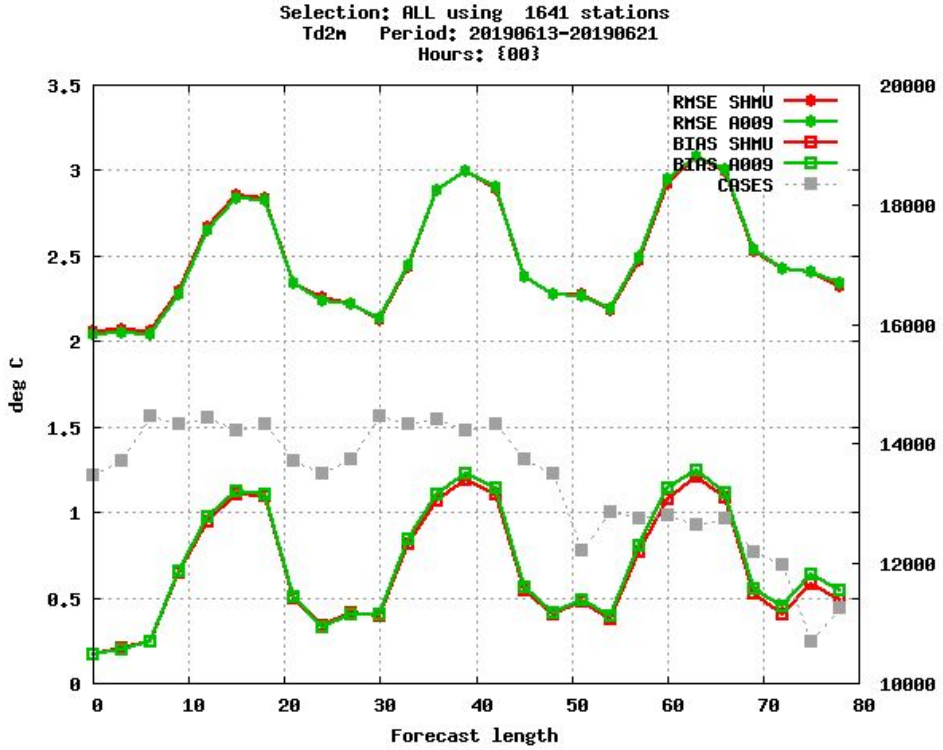




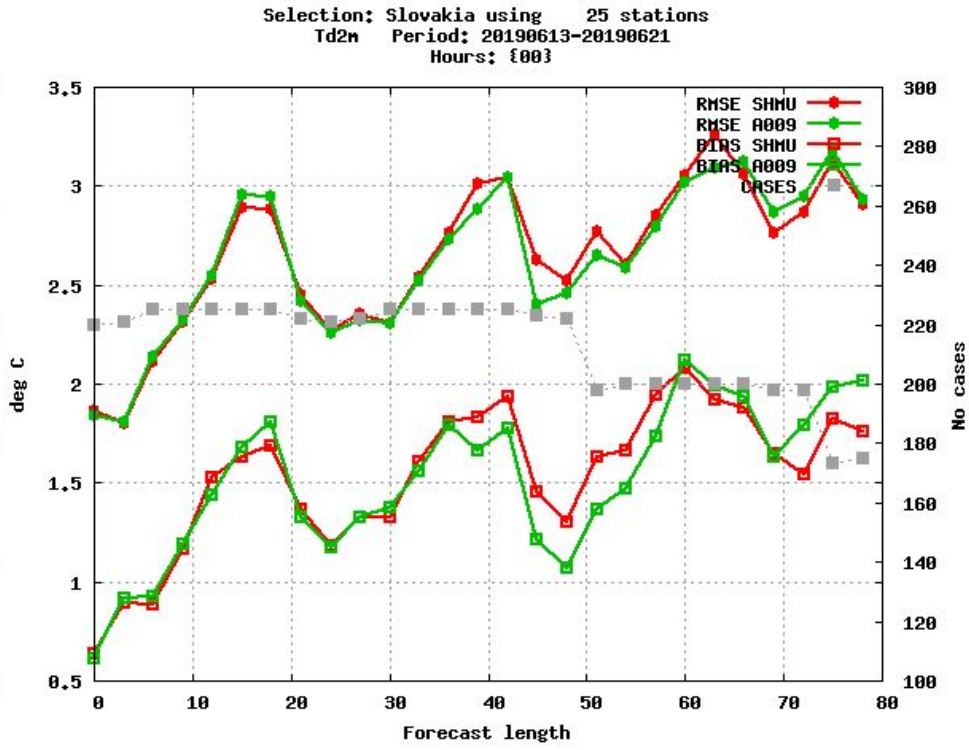
Scores with all local AWS (+ bug corr)

3 days assim => 8 days (13-21/06/2019), 00 forecasts only.

Td2m: OPER, TEST - generally neutral results, some improvement over SK



all stations



Slovakia

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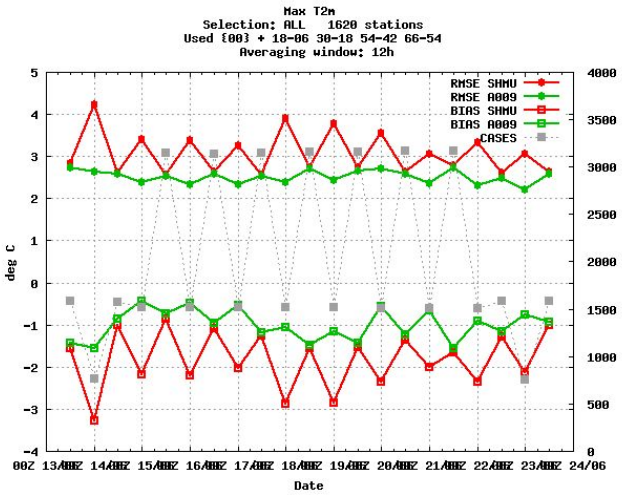
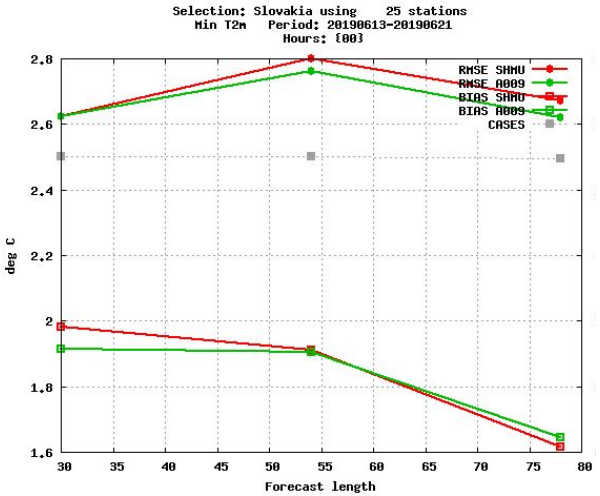
OPER, TEST - positive impact for T2m_min, T2m_max scores



all stations, daily scores



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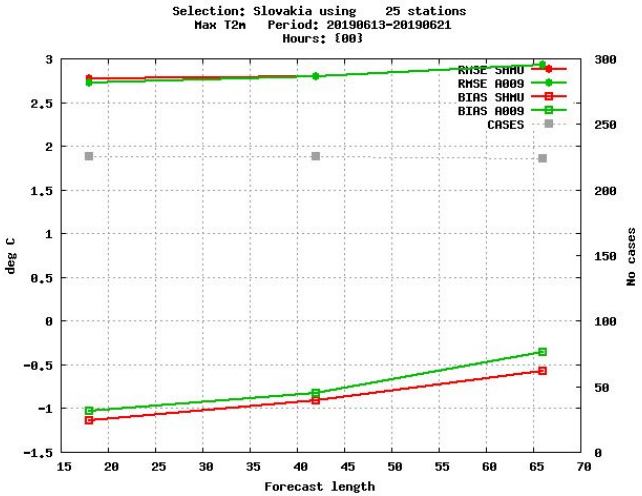

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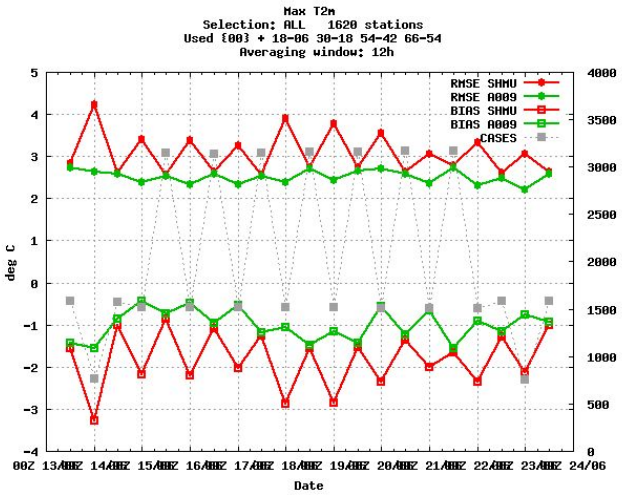

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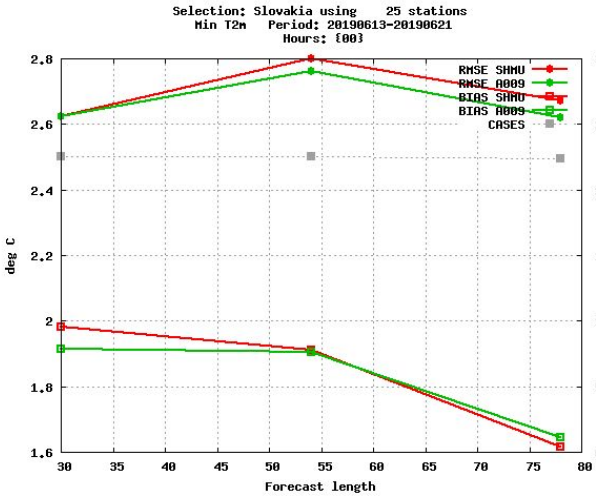

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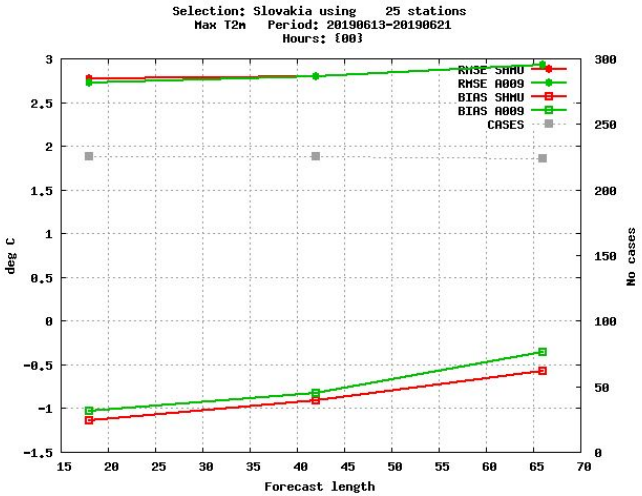


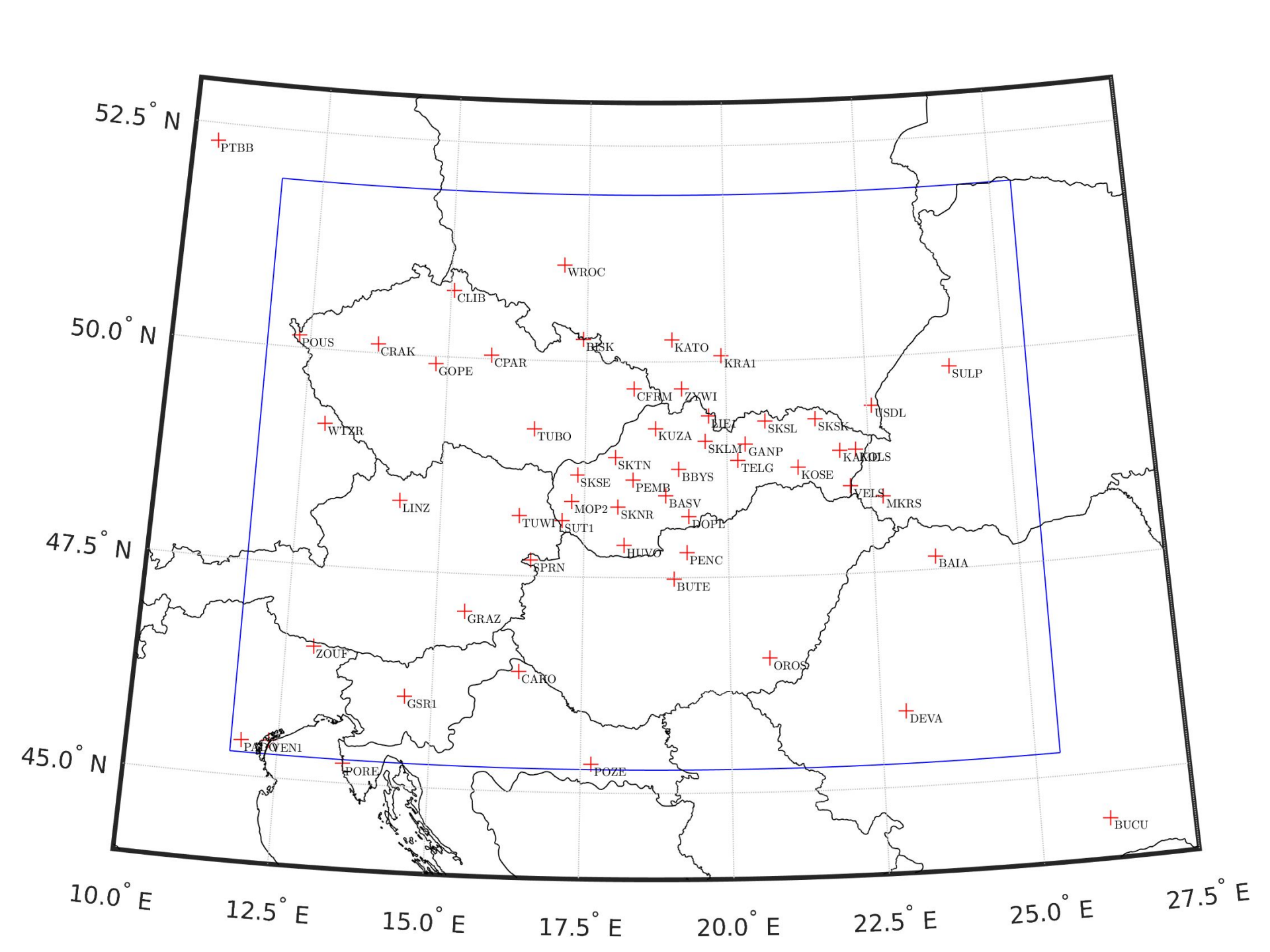
Slovakia

Not yet operational (waiting for AT+TB talk on Thursday)

Assimilation of GNSS ZTD @SHMU

REMINDER

- work of Martin Imrišek (PhD thesis) - cooperation with Slovak University of Technology, Dpt. of Theoretical Geodesy
  - local independent near real-time data processing of GNSS stations (only small portion of data goes to E-GVAP)
- AROME/SHMU 2 km/L73
  - 6 h assimilation cycling
  - B matrix downscaled from PEARP (2016 dataset by Tonda)
  - SYNOP, TEMP, AMDAR, AMV [ZTD]
- Simple white list method & static correction for each permanent GNSS station based on 15d OBS-GUESS statistics => selection of reliable stations (39/49)

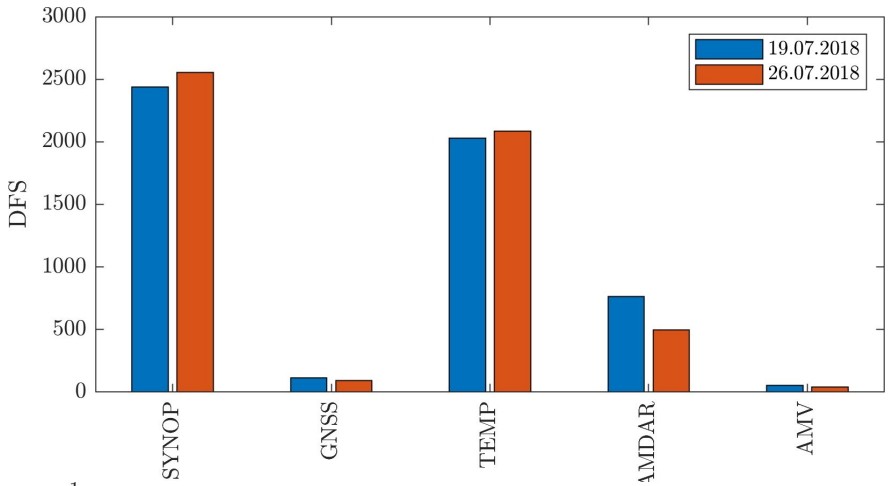

52.5° N
50.0° N
47.5° N
45.0° N
10.0° E
12.5° E
15.0° E
17.5° E
20.0° E
22.5° E
25.0° E
27.5° E
PTBB
WROC
CLIB
POUS
CRAK
GOPE
CPAR
BISK
KATO
KRA1
SULP
CFRM
ZXWI
USDL
BIEL
SKSL
SKSK
WTZR
TUBO
KUZA
SKLM
GANP
KARL
OLS
SKTN
TELG
KOSE
SKSE
PEMB
BBYS
VELS
MKRS
LINZ
MOP2
SKNR
BASV
TUWT
SUT1
DOPL
HUVO
PENC
BAIA
SPRN
BUTE
GRAZ
ZOUF
OROS
CARO
GSR1
DEVA
PAVEN1
PORE
POZE
BUCU

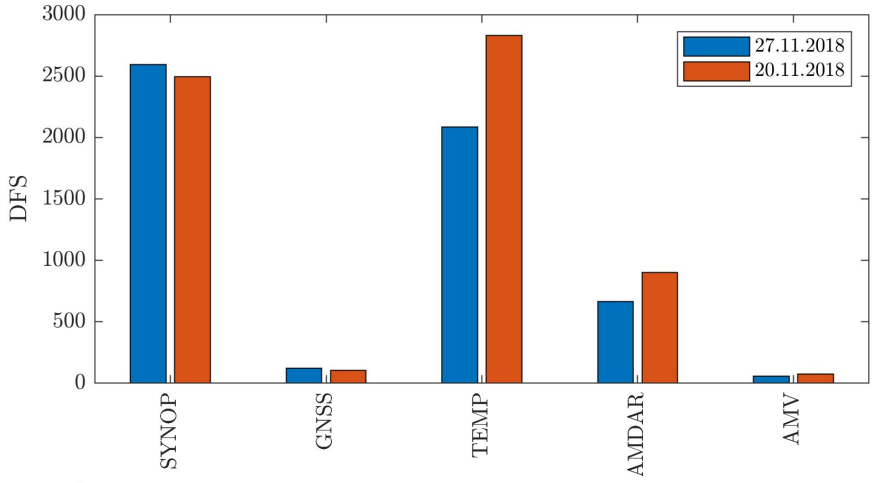
Assimilation of GNSS ZTD @SHMU

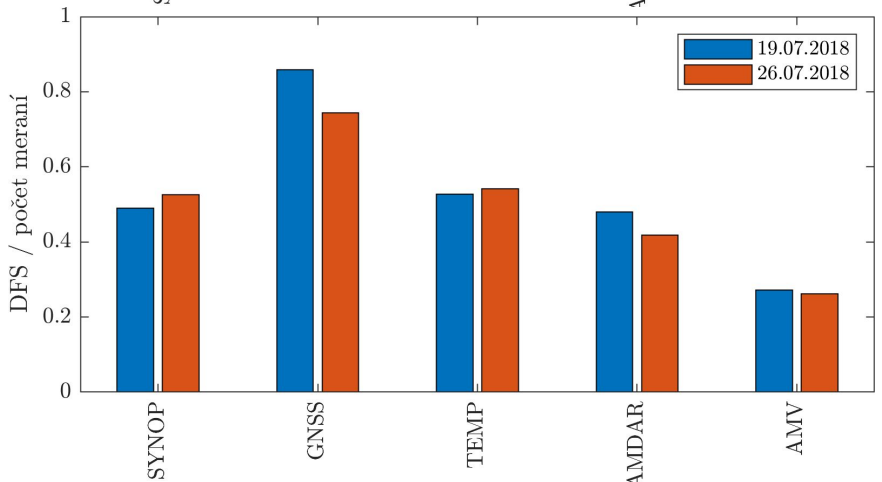
- Half year (01.07.2018 00 UTC do 31.12.2018 18 UTC) evaluation of OBS-GUESS and OBS-ANA departures
- Statistical evaluation (see Martin’s talk in Bucharest)
- DFS
- Scores wrt. ECMWF analyses
- Case studies
  - Scores wrt. observations
  - Precipitation forecasts

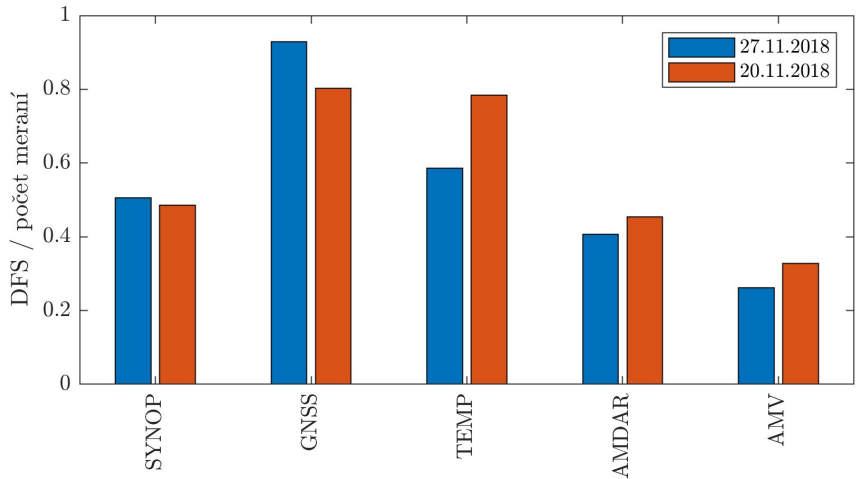
DFS statistics for ZTD experiments

Absolute (top) and relative (bottom) DFS for summer (left) and winter (right) day, 2 days selected - significant (blue) and non-significant (orange) weather









ZTD DA: statistics wrt ECMWF analyses

Mean specific humidity differences of AROME analyses and guesses of **+ZTD** and **-ZTD** experiments wrt ECMWF analyses over whole domain:

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Mean Q [1 × 10^4 kg kg^{-1}]		analysis			guess		
		925 hPa	850 hPa	700 hPa	925 hPa	850 hPa	700 hPa
July 2018	**+ZTD**	-41.38	267.34	13.29	151.69	361.83	-5.86
	-ZTD	-61.65	246.37	-27.77	133.12	347.35	-35.79
	incr	20.28	20.97	41.07	18.57	14.48	29.93
Nov 2018	**+ZTD**	-140.51	-103.76	-44.92	-173.75	-110.70	-27.22
	-ZTD	-144.22	-104.34	-41.23	-177.96	-113.22	-27.91
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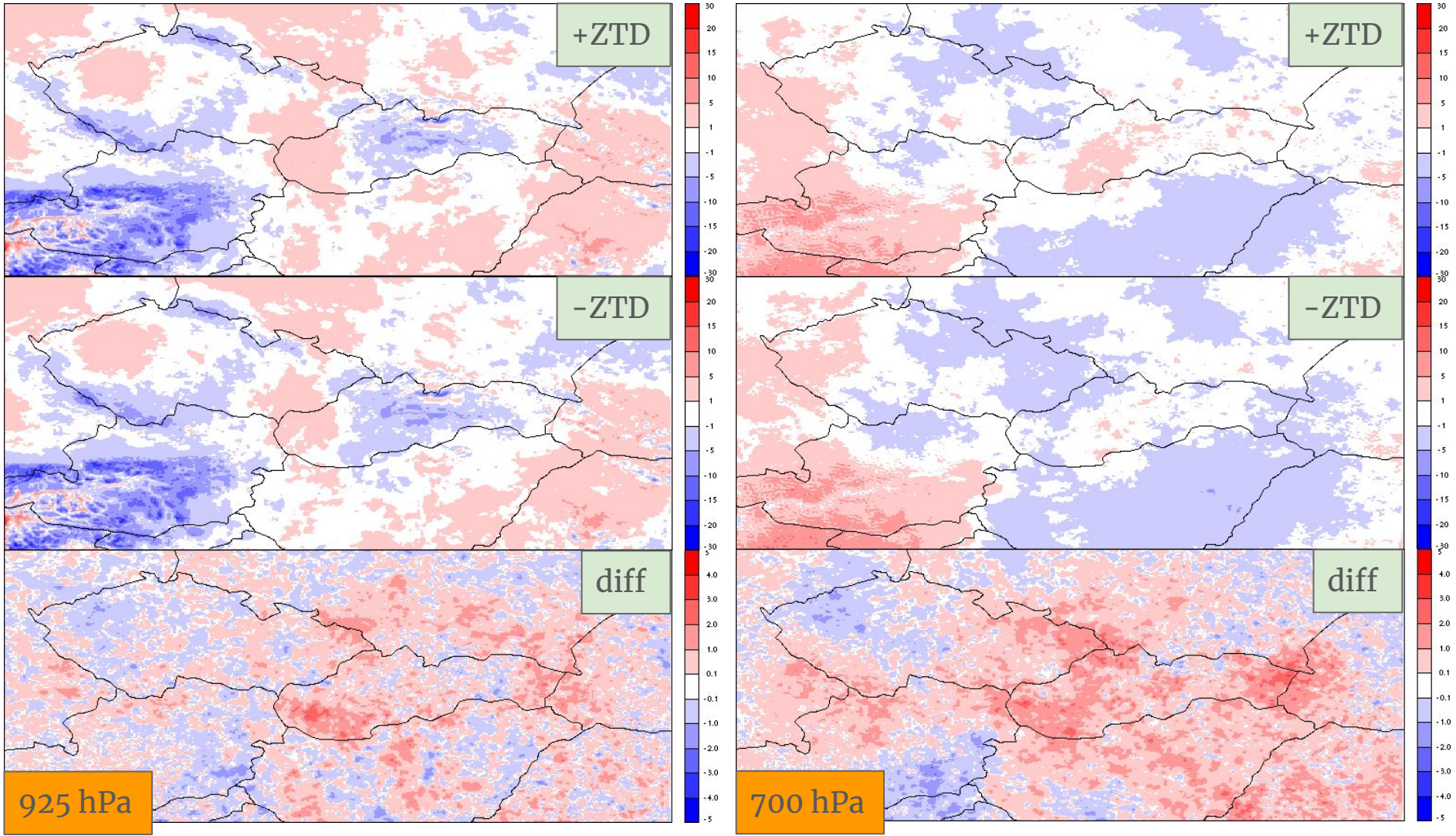
	incr	3.71	0.58	-3.70	4.21	2.52	0.69

Q_A diffs wrt ECMWF analyses - July 2018



ZTD DA verification scores

AROME 3D-Var +ZTD vs -ZTD

5 days period (16-20/07/2018)

00 UTC runs, +24h forecasts

Q wrt TEMP

ZTD DA verification scores

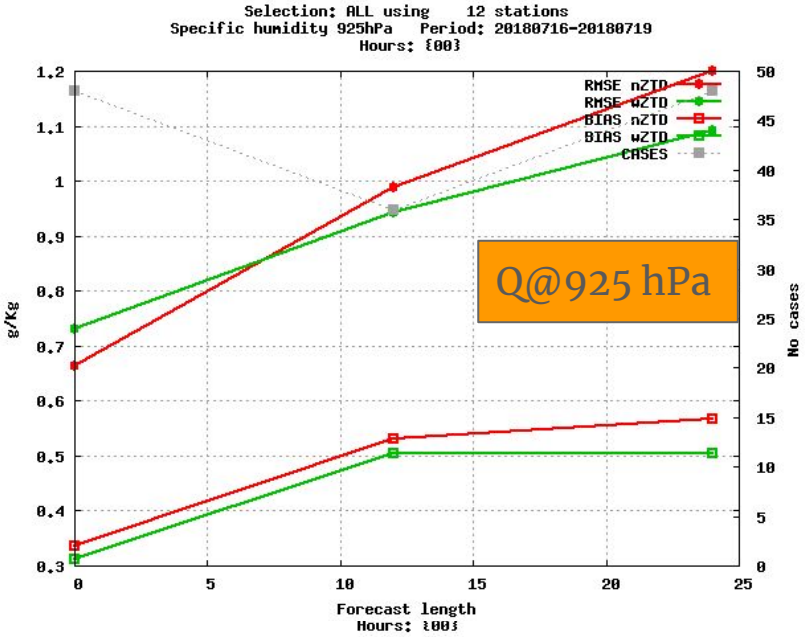
AROME 3D-Var +ZTD vs -ZTD

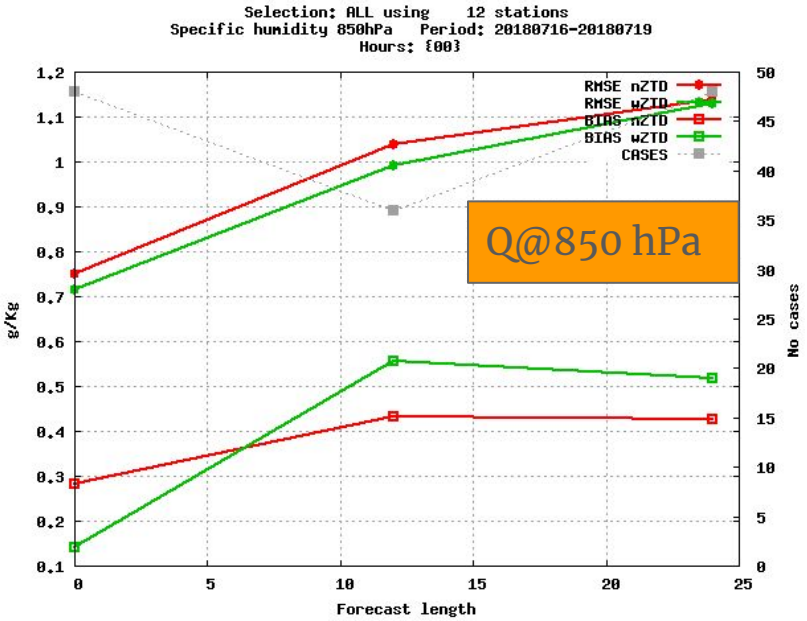
5 days period (16-20/07/2018)

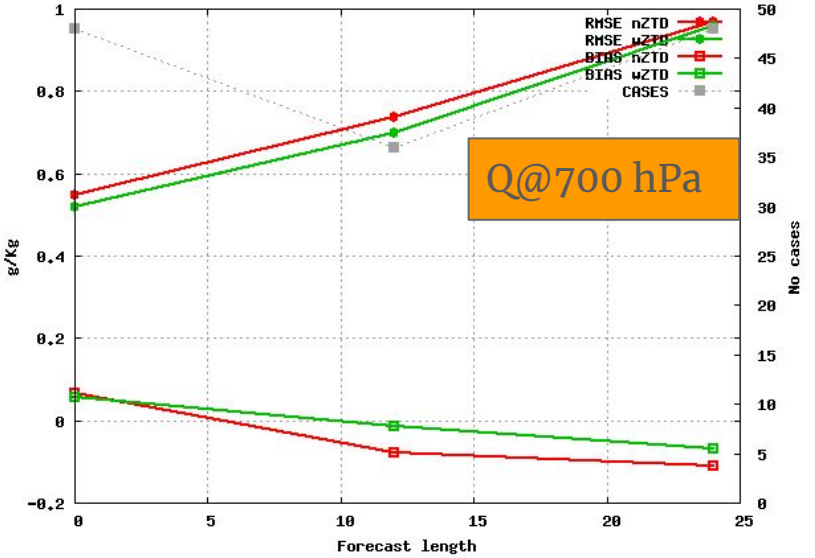
00 UTC runs, +24h forecasts

Q wrt TEMP

neutral -> slightly positive impact



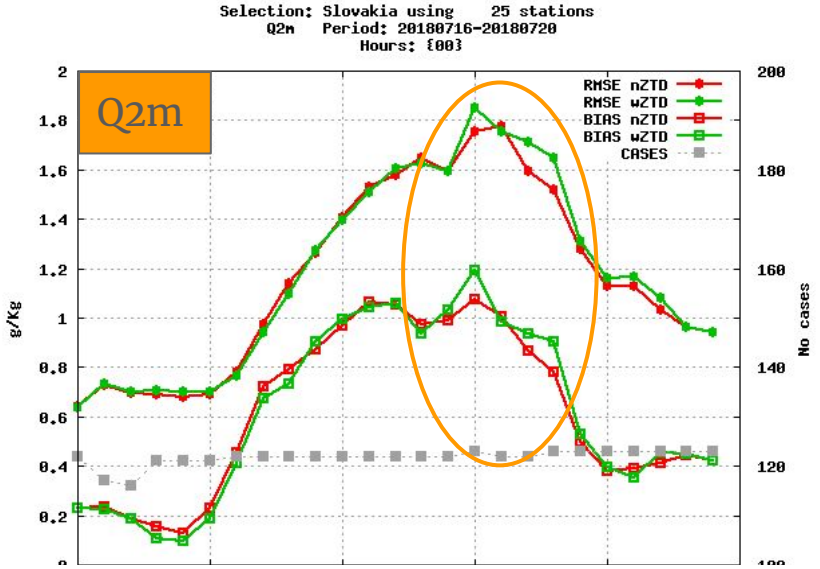


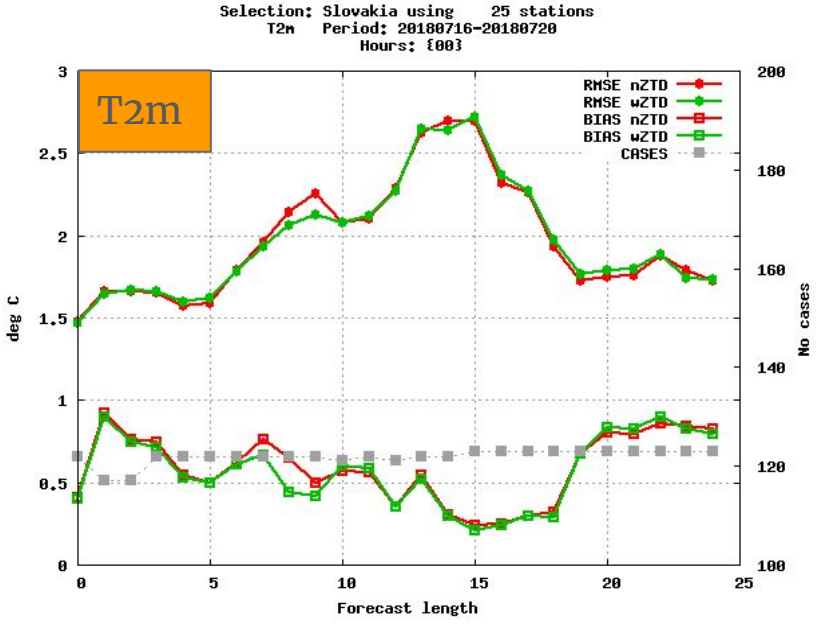


ZTD DA verification scores (over SK)

AROME 3D-Var +ZTD vs -ZTD

Q2m afternoon problem?



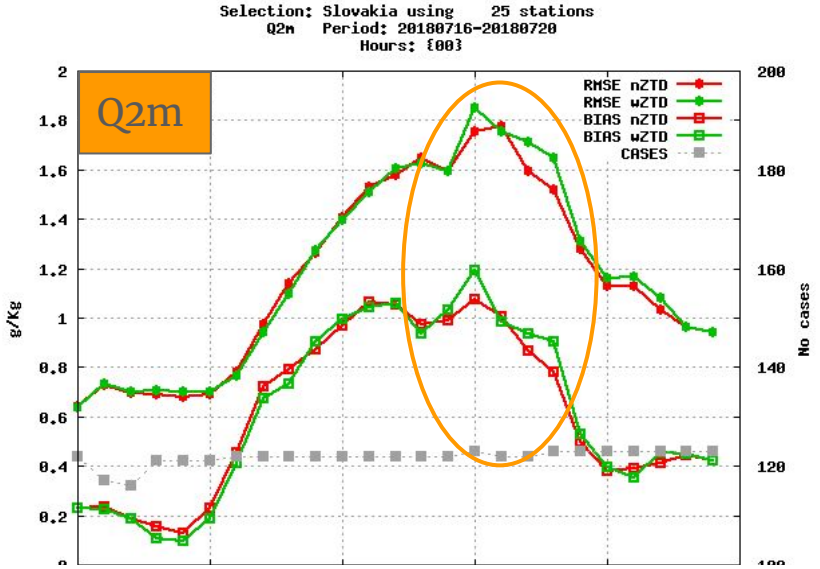


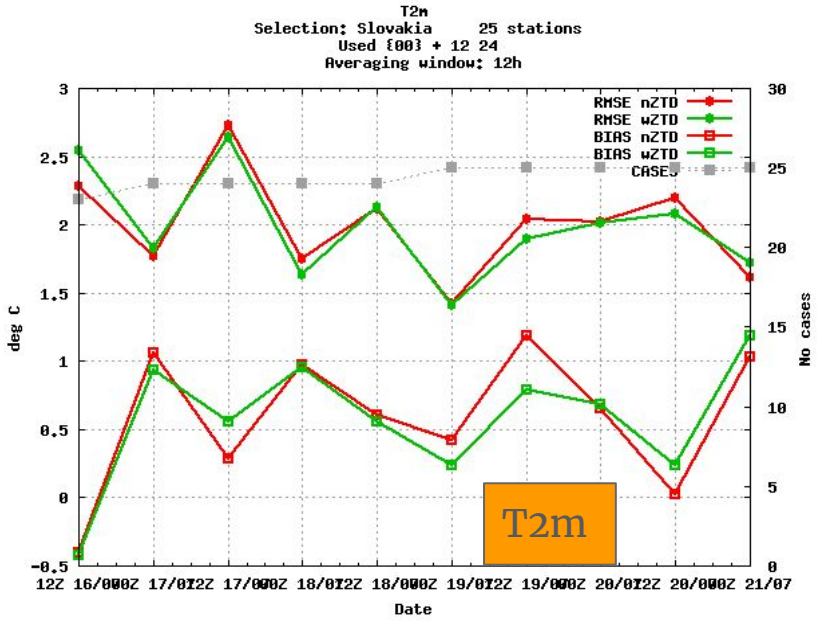
ZTD DA verification scores (over SK)

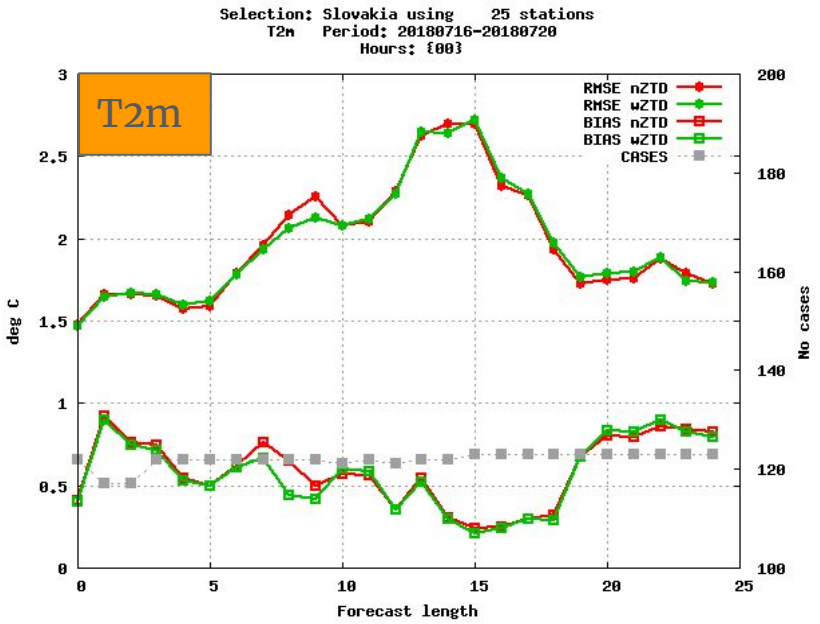
AROME 3D-Var +ZTD vs -ZTD

Q2m afternoon problem?

Variable impact in day by day scores (too short period)

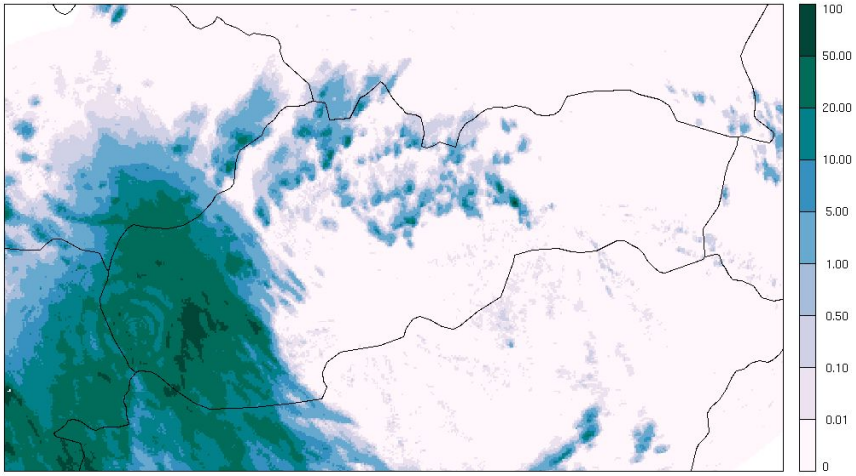




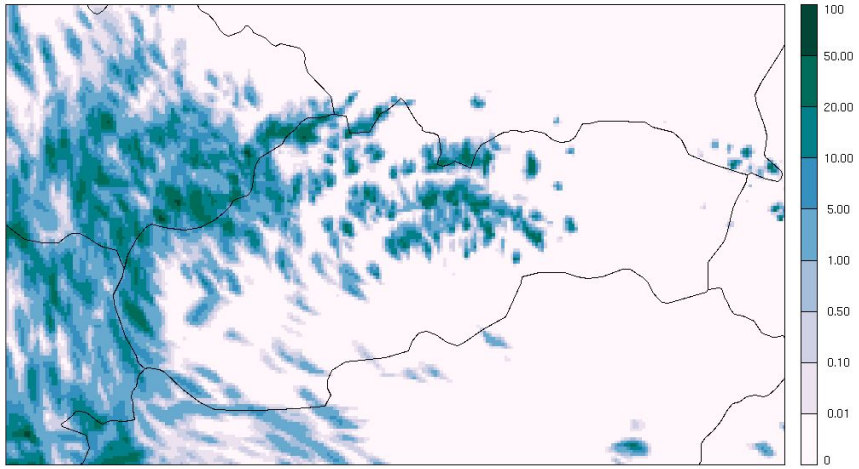


Precipitation case study 24/08/2019 12h

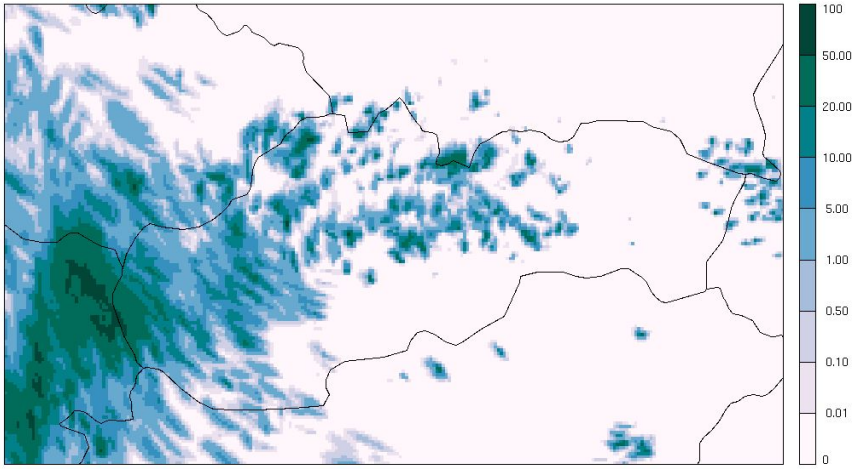
INCA precip 00-24h



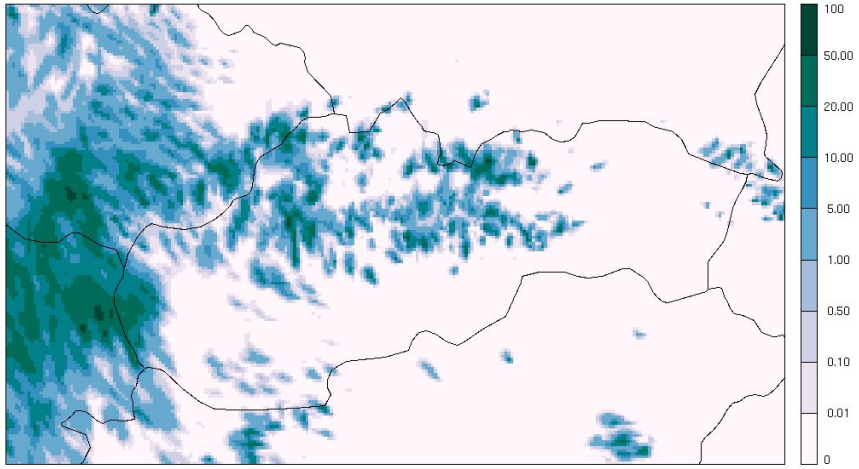
AROME 2 downscaling precip 00-24h



AROME 2 ZTD precip 00-24h



AROME 2 NOZTD precip 00-24h



Other ongoing work (HR data)

Katka dedicated talk (Mode-S)

Michal dedicated talk (RADARs)

Viktor dedicated talk (SURFEX-SODA)

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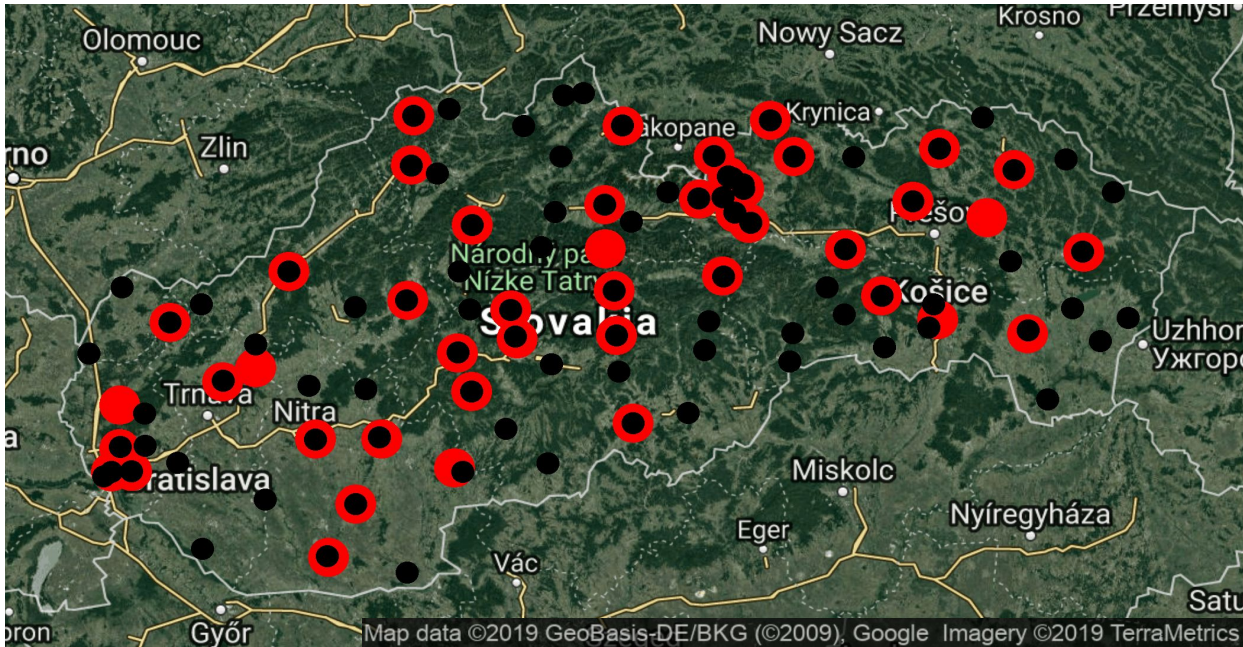
Katka dedicated talk (Mode-S)

Michal dedicated talk (RADARs)

Viktor dedicated talk (SURFEX-SODA)

Michal: OBSOUL from local SHMU AWS (soon in OPLACE)



Summary and future plans

- Several parallelly ongoing activities, mostly devoted to high resolution data processing and testing, or surface analysis

- No algorithmic issues tackled for the time being

Summary and future plans

- Several parallelly ongoing activities, mostly devoted to high resolution data processing and testing, or surface analysis
- No algorithmic issues tackled for the time being
- Future plans depend on new HPC - financed by air quality project => aim is to provide high resolution analyses and forecasts
  - ~ 2-3 km resolution forecast; 3DVAR with RUC (a' 3h)
  - ~ 1 km resolution (or better?) hourly reanalyses