Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Data assimilation work in Hungary

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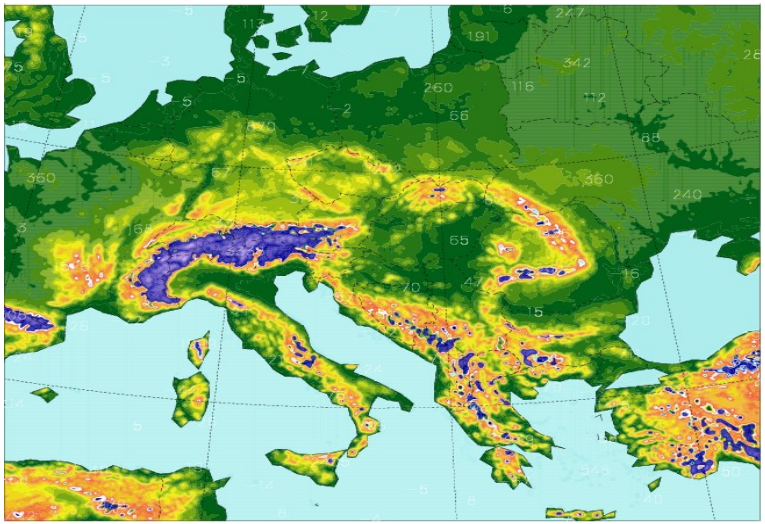
DHMZ SHMU OMSZ ZAMG ROMANIA ANM

Outline

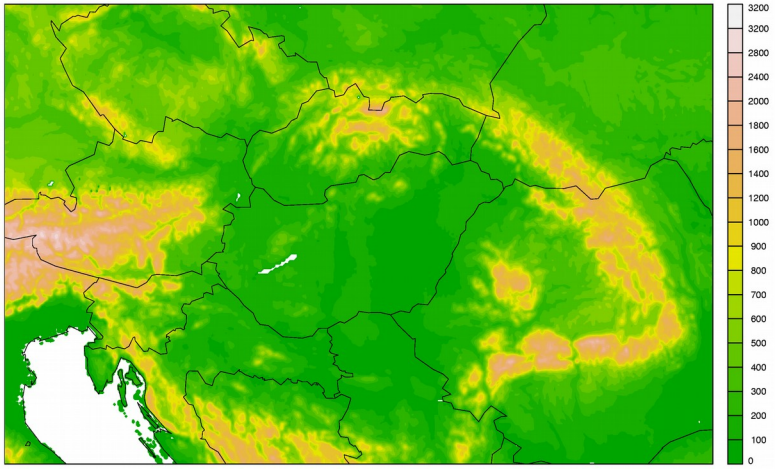
- Status of operational DA systems
- Validation of cy40t1 for data assimilation
- ALARO DA problems (VARBC errors, NOAA-18 MHS)
- ALARO DA CANARI+missing first guess fluxes
- AROME EKF surface assimilation (see Helga's presentation)
- AROME OI_main surface assimilation
- Investigation of AMDAR humidity observation (see Viki's presentation)
- Impact study of using Slovenian Mode-S MRAR observations (see Viki's presentation)
- Radiosonde observations valid at 02UTC
- GNSS ZTD assimilation in AROME 3DVAR
- OOPS related activities

Operational NWP and DA systems

- ALARO
  - 8km horizontal, 49L vertical
  - cy38t1_bf03
  - SMS environment
  - 4 runs/day up to 60 hours
  - 3 hourly coupling IFS global
  - Operational CANARI+3DVAR
  - Observations: SYNOP, AMDAR, TEMP SEVIRI, Geowind AMV, NOAA-18 AMSU-A, MHS



- AROME
  - 2.5km horizontal, 60L vertical
  - cy38t1_bf03
  - 8 runs/day up to 48 hours
  - 1 hourly coupling IFS global
  - Operational 3DVAR 3h RUC
  - Observations: SYNOP, AMDAR, TEMP



Validation of cy40t1

- The cy40t1 and its validation was started in Hungary
- The forecast model was successfully running for both ALARO and AROME
- The data assimilation is still not finished due to problems of the use of radiance observations
  - The conventional observations are fine
  - The correct create_ioassign is used

  - Error message

    2016/09/02 11:40:30 fatal in module rttov_checkinput.F90:0237
    invalid surface pressure (profile number = 1)
    2016/09/02 11:40:30 fatal in module rttov_direct.F90:0402

    WARNING: Problems in RTTOV call for NOAA 19 223 SENSOR=MHS

  - cy40t1_bf06 was also tested
  - Still very little time spent on this validation, therefore it can be a simple crash!

ALARO Data Assimilation (1)

- After NOAA-16 decommissioning there is no AMSU-B sensor in use, only MHS
  - However we are still using the code of AMSU-B sensor for NOAA-18 MHS (in namel_bator) TS_AMSUB(209)%T_SATSENS%MODSENSOR=4,
  - What is your practice?

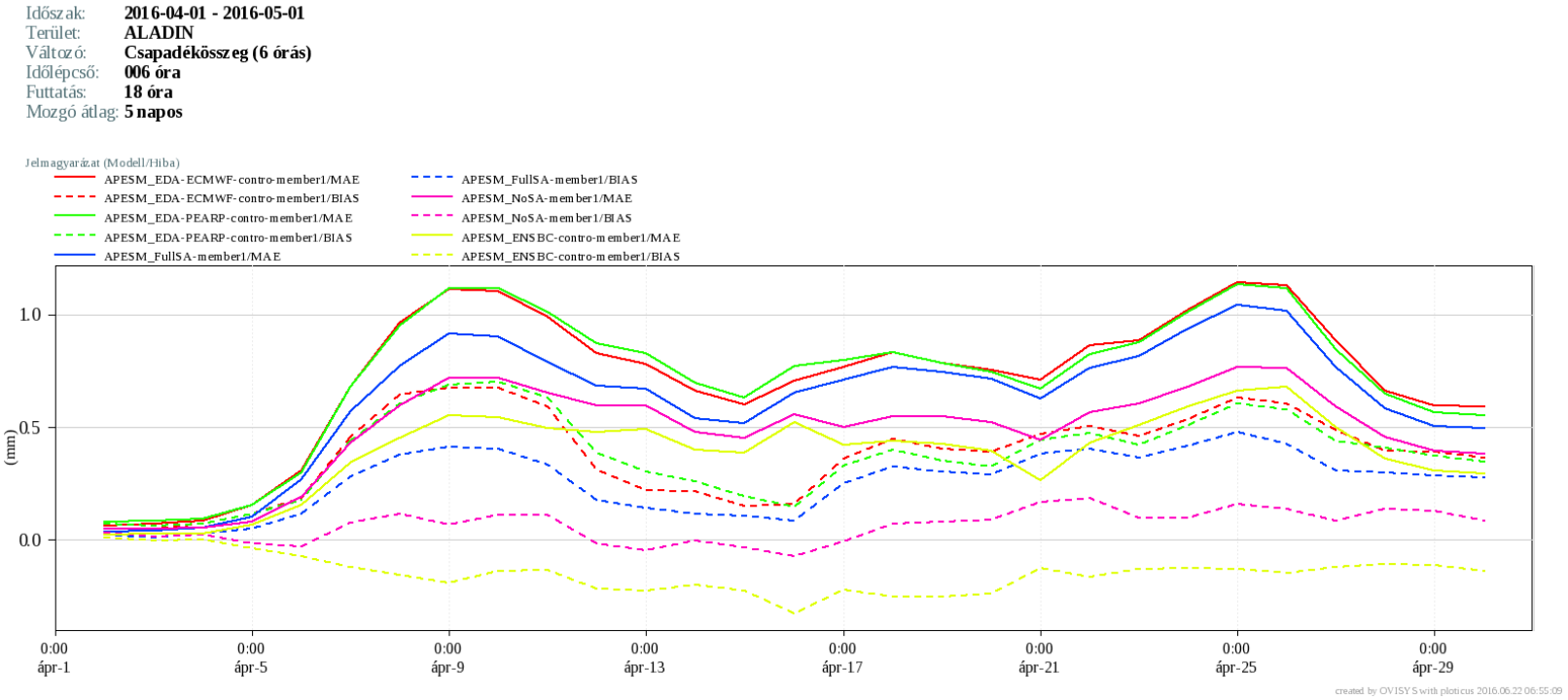
- Furthermore (NOT in connection with the previous issue) there is still rare crash in screening with the following error:

```
[myproc#44,tid#1,pid#29240]:  MASTER
[myproc#44,tid#1,pid#29240]:   CNT0
[myproc#44,tid#1,pid#29240]:    CNT1
[myproc#44,tid#1,pid#29240]:     CNT2
[myproc#44,tid#1,pid#29240]:      CNT3
[myproc#44,tid#1,pid#29240]:       CNT4
[myproc#44,tid#1,pid#29240]:        OBSV
[myproc#44,tid#1,pid#29240]:         TASKOB
[myproc#44,tid#1,pid#29240]:          TASKOB>KSET_LOOP
[myproc#44,tid#1,pid#29240]:           TASKOB>OBSGRP=AMSUB:00209.04.210.07
[myproc#44,tid#1,pid#29240]:            HRETR
[myproc#44,tid#1,pid#29240]:             RADTR
[myproc#44,tid#1,pid#29240]:              RTTOV_EC
[myproc#44,tid#1,pid#29240]:               RTTOV_CALCBT_BASIC
```

- Asking again do you experience such error in your system?

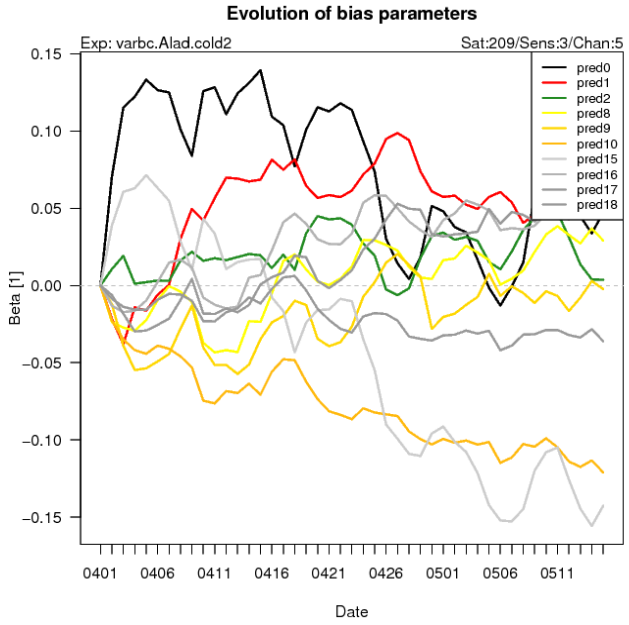
ALARO Data Assimilation (2)

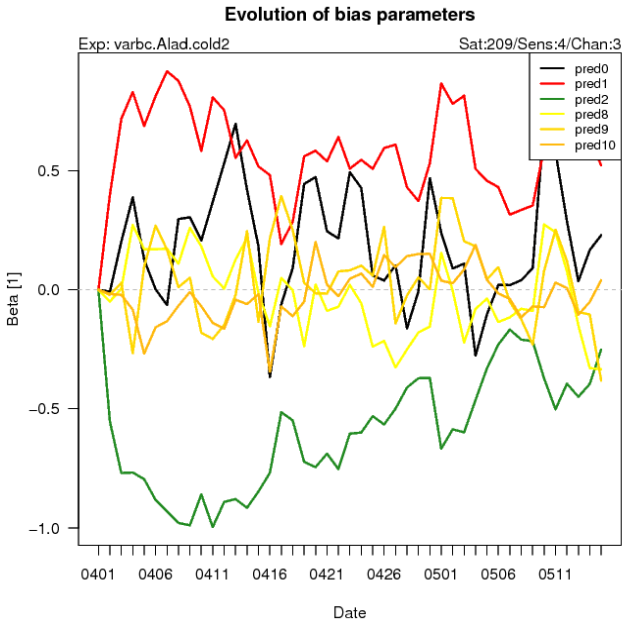
- Problems with ALARO precipitation forecasts reported by OMSZ forecasters and objective verification as well.
- The main source of the problem was identified as the malfunction of VARBC and the use of radiance observations in ALARO DA system.
- Different experiments were performed to analyze the precipitation case studies from April 2016.



ALARO Data Assimilation (2)

- Results from VARBC diagnostic program (coldstart passive assim. with the current VARBC settings):

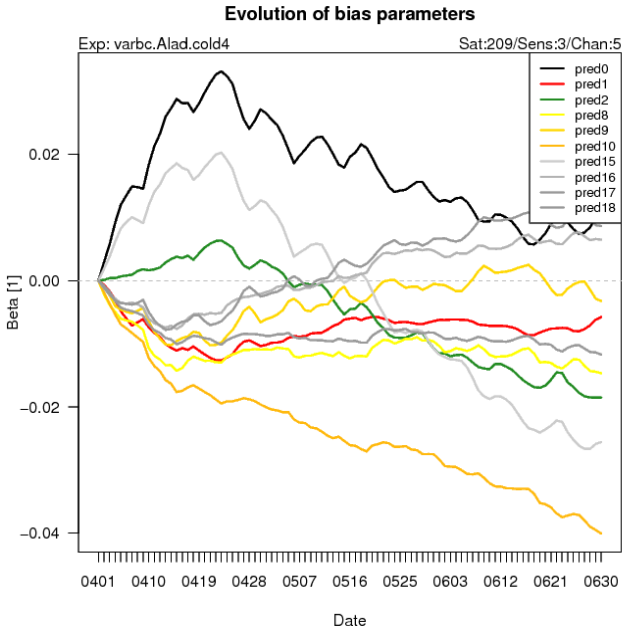


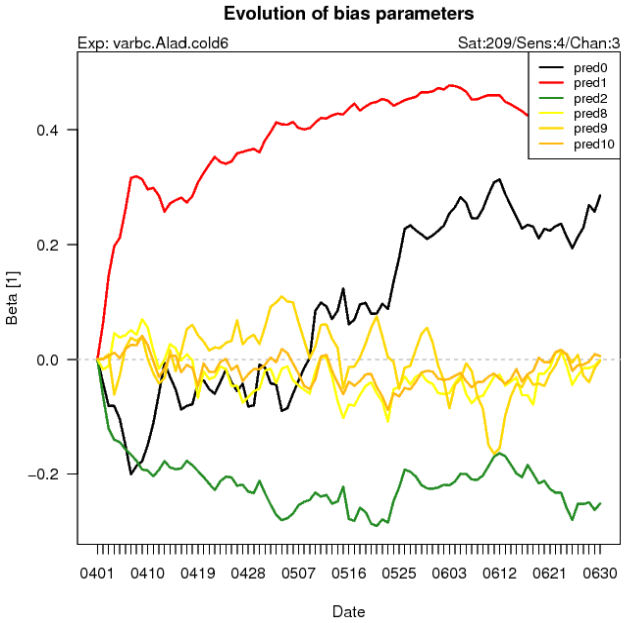


- NBG=5000

ALARO Data Assimilation (2)

- Results from VARBC diagnostic program (coldstart passive assim. modified LISTE_LOC and NBG parameters):



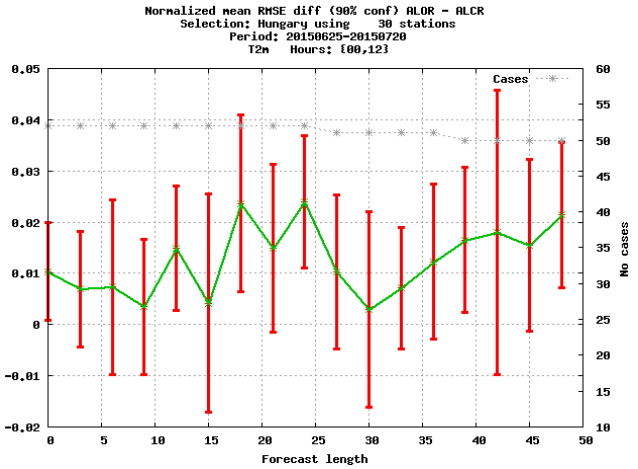


- NBG=120000
- AW reduced
- Network time dependent LISTE_LOC

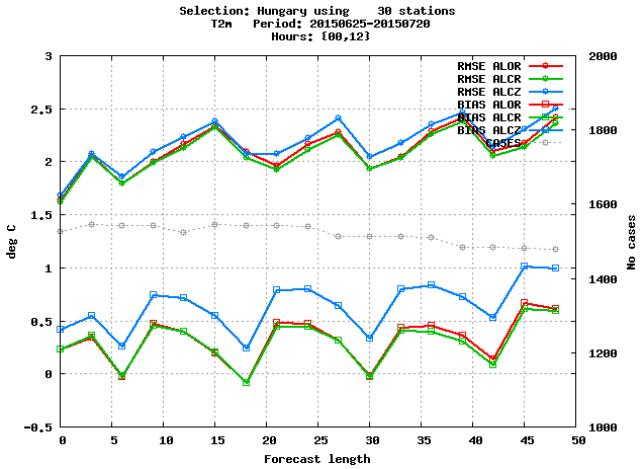
- Opinion?

ALARO Data Assimilation (3)

- Operational CANARI settings were checked after reporting problems from Prague with missing surface fluxes of first guess.
- In Hungary those fields are also missing and an experiment was executed with the correction.
- The solar angle dependency of CANARI increments (SMU0) was also tested in another ALARO DA experiment.



Temp 2m
RMSE Diff
Oper-AddFlux



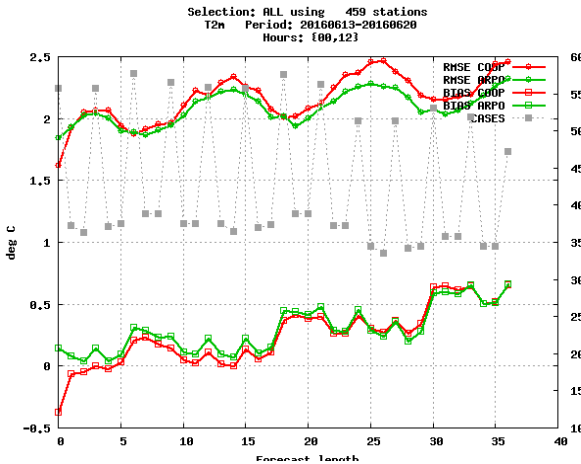
Temp 2m
RMSE-BIAS
Oper: red
AddFlux: green
SMU0=7: blue

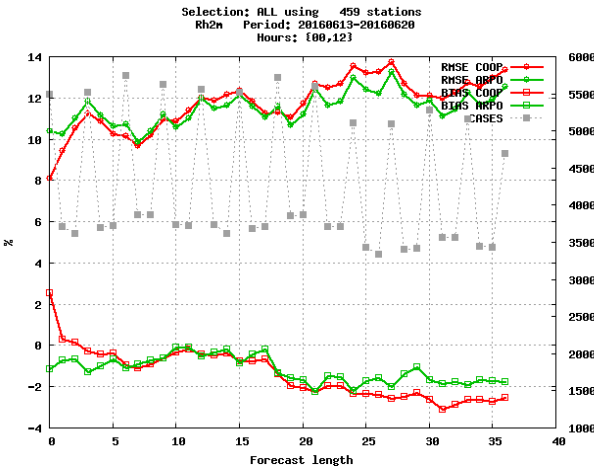
AROME OI_main surface assimilation

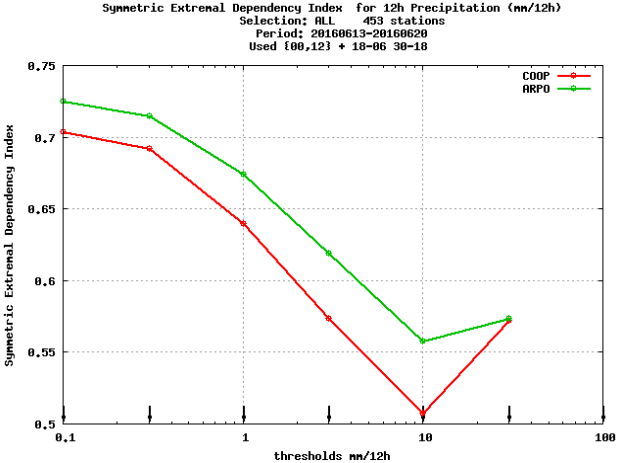
- The current operational AROME DA system uses downscaled ALARO surface analyses at main synoptic network times.
- AROME OI_main surface assimilation has been studied since 2011 (and the OI_main increments have been found realistic), but the results were not convincing compared to the current operational one.
- The modifications in OI assimilation settings slightly changed the performance of AROME forecasts (biggest effect of the solar zenith angle dependency: SMU0).
- It was also concluded that the ALADIN and AROME PBL parametrization is quite different and independent systems are strongly wished.

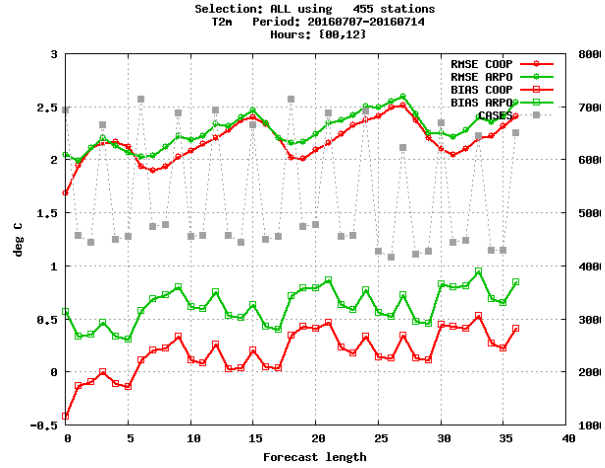
AROME OI_main surface assimilation

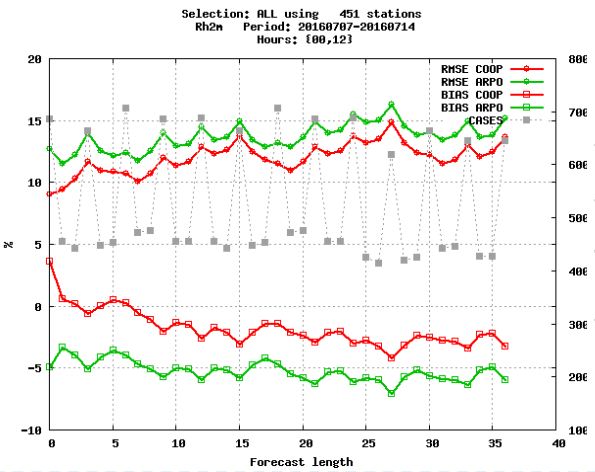
- Parallel OI_main surface assimilation cycle has been started at the beginning of this spring (very long spin-up) to make verification for this summer.

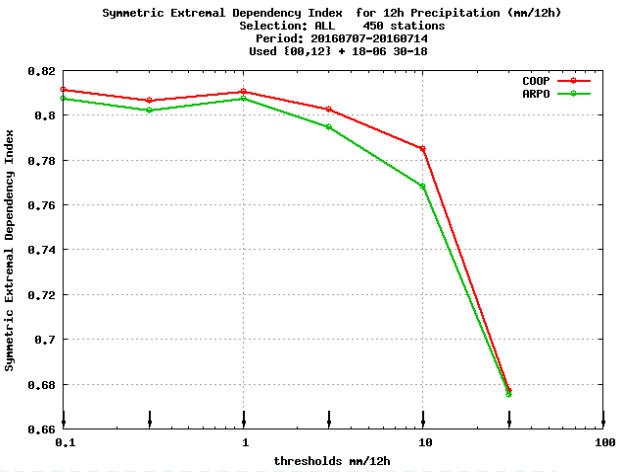






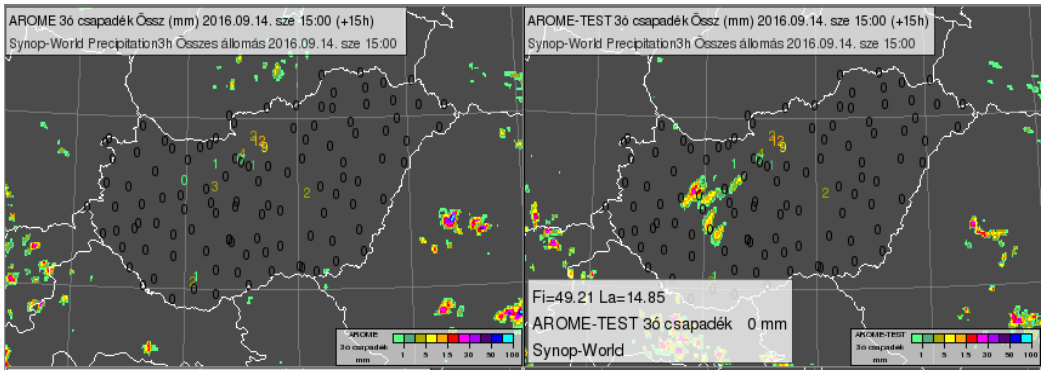


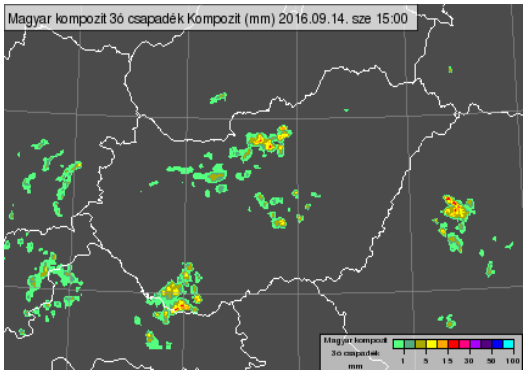


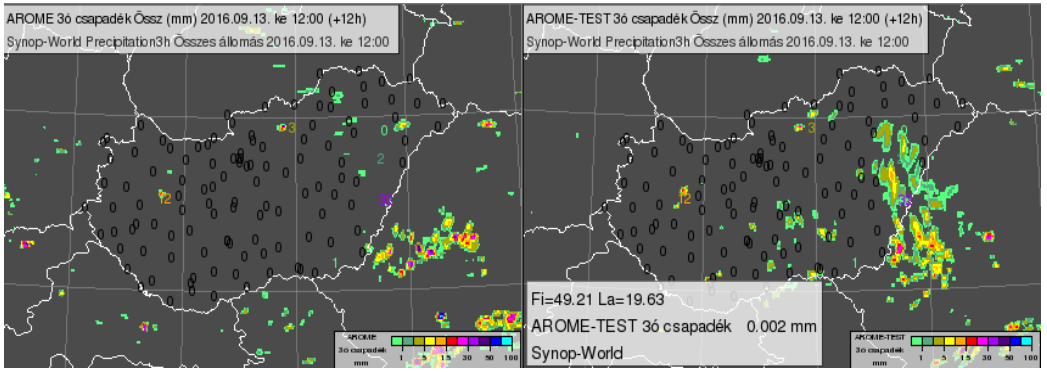


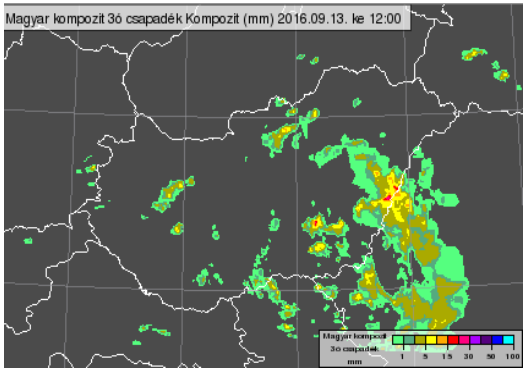
AROME OI_main surface assimilation

- The downscaled ALARO surface analysis provides cold and wet bias in AROME
- The OI_main based AROME surface analysis gives warm and dry bias in AROME



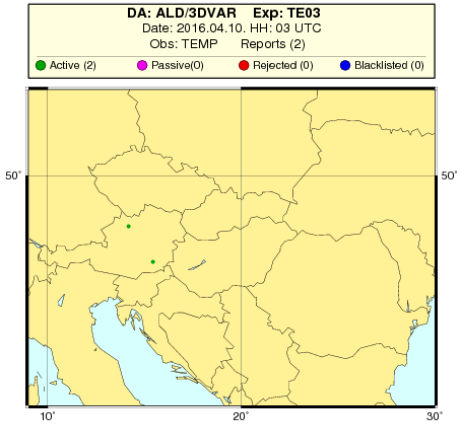






Radiosonde observations at 02UTC

- There are TEMP observations frequently valid at 02UTC and occasionally at 03UTC from Austria.



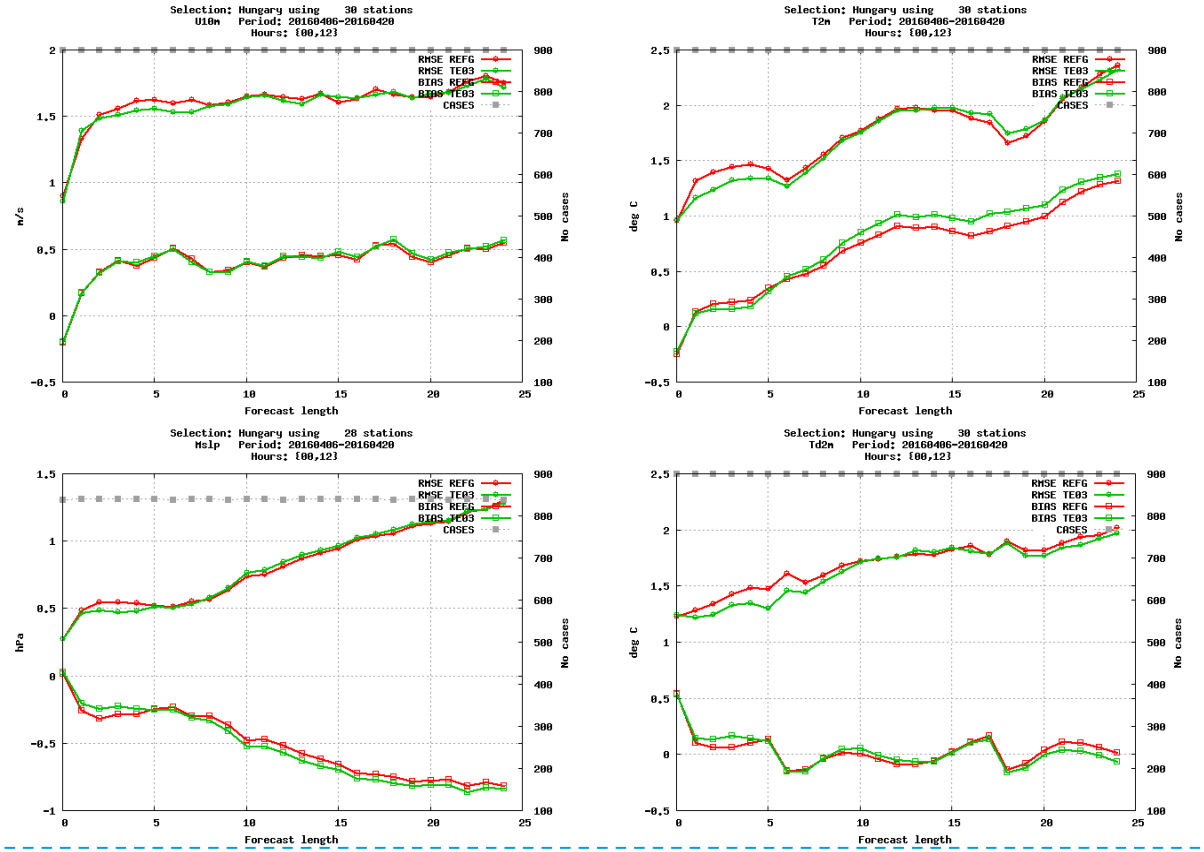

```
ncftp / > ls 02/5/obsoul/current/
obsoul_5_xxxxxx_xx_2016091702.gz
obsoul_5_xxxxxx_xx_2016092002.gz
obsoul_5_xxxxxx_xx_2016091802.gz
obsoul_5_xxxxxx_xx_2016091902.gz
ncftp / > ls 03/5/obsoul/current/
```

```
[mmate@blade12:/home/mmate]$ lcn /mnt/CDS4/OBS/cugt/*0300*
-rw-rw-r-- 1 nmoper 104 16384 Sep  9 03:23 /mnt/CDS4/OBS/cugt/cugt20160909_0300
-rw-rw-r-- 1 nmoper 104 16384 Sep 10 04:23 /mnt/CDS4/OBS/cugt/cugt20160910_0300
-rw-rw-r-- 1 nmoper 104 16384 Sep 12 04:13 /mnt/CDS4/OBS/cugt/cugt20160912_0300
-rw-rw-r-- 1 nmoper 104 16384 Sep 14 04:23 /mnt/CDS4/OBS/cugt/cugt20160914_0300
[mmate@blade12:/home/mmate]$ lcn /mnt/CDS4/OBS/cugt/*0200*
-rw-rw-r-- 1 nmoper 104 16384 Sep  7 04:13 /mnt/CDS4/OBS/cugt/cugt20160907_0200
-rw-rw-r-- 1 nmoper 104 16384 Sep  8 04:13 /mnt/CDS4/OBS/cugt/cugt20160908_0200
-rw-rw-r-- 1 nmoper 104 16384 Sep  9 02:53 /mnt/CDS4/OBS/cugt/cugt20160909_0200
-rw-rw-r-- 1 nmoper 104 16384 Sep 10 04:03 /mnt/CDS4/OBS/cugt/cugt20160910_0200
-rw-rw-r-- 1 nmoper 104 19008 Sep 11 04:03 /mnt/CDS4/OBS/cugt/cugt20160911_0200
-rw-rw-r-- 1 nmoper 104 19008 Sep 12 04:03 /mnt/CDS4/OBS/cugt/cugt20160912_0200
-rw-rw-r-- 1 nmoper 104 19008 Sep 13 03:53 /mnt/CDS4/OBS/cugt/cugt20160913_0200
-rw-rw-r-- 1 nmoper 104 16384 Sep 14 04:03 /mnt/CDS4/OBS/cugt/cugt20160914_0200
-rw-rw-r-- 1 nmoper 104 19008 Sep 15 04:03 /mnt/CDS4/OBS/cugt/cugt20160915_0200
-rw-rw-r-- 1 nmoper 104 16384 Sep 16 04:13 /mnt/CDS4/OBS/cugt/cugt20160916_0200
-rw-rw-r-- 1 nmoper 104 16384 Sep 17 04:03 /mnt/CDS4/OBS/cugt/cugt20160917_0200
-rw-rw-r-- 1 nmoper 104 16384 Sep 18 03:53 /mnt/CDS4/OBS/cugt/cugt20160918_0200
-rw-rw-r-- 1 nmoper 104 19008 Sep 19 04:03 /mnt/CDS4/OBS/cugt/cugt20160919_0200
-rw-rw-r-- 1 nmoper 104 19008 Sep 20 04:03 /mnt/CDS4/OBS/cugt/cugt20160920_0200
```

Radiosonde observations at 02UTC

- In 3 hourly RUC these are important observations, but in Hungary we are fetching TEMP observations valid at time of the analysis.
- Is it correct to use TEMP with -1,+1 assimilation window?
- We made one test:

Only conventional observations!

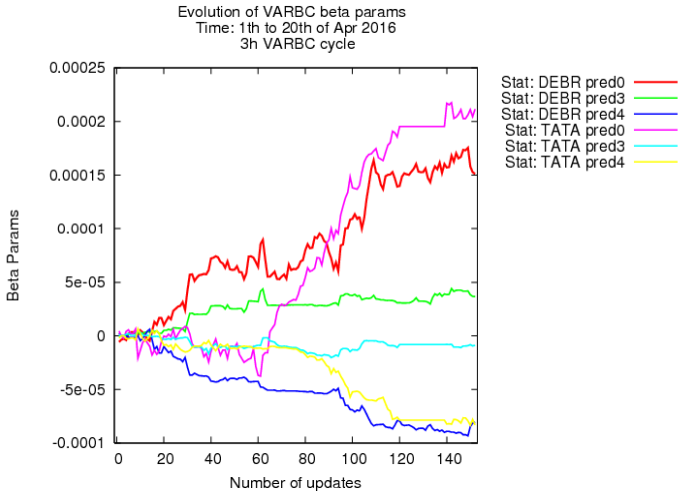


The assimilation of GNSS ZTD in AROME 3DVAR

- The use of GNSS ZTD was continued in AROME 3DVAR.
  - Revision of SGO1 EGVAP network and its measurements
  - Reassess the whitelist generation procedure (thinning 40km, biasmax 15mm, stdevmax 15mm)

  → The ZTDs from SGO1 network have good quality and coverage over Hungary

- For bias correction both static and VARBC were tested.
- VARBC with whitelist of active stations, but with zero initial bias information
- Additionally VARBC was extended with more predictors (pred3 and pred4) in varbc_pred.



The assimilation of GNSS ZTD in AROME 3DVAR

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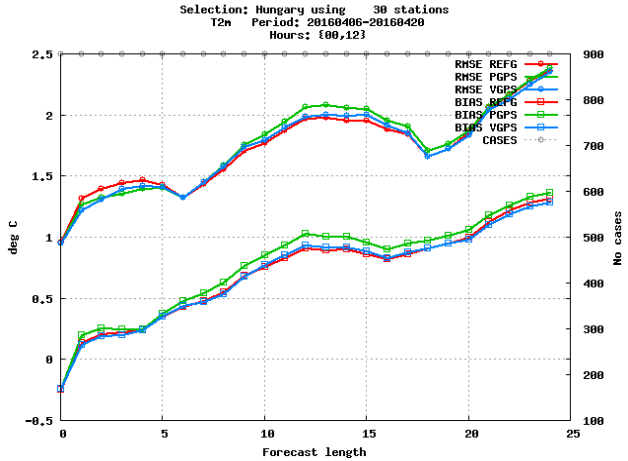
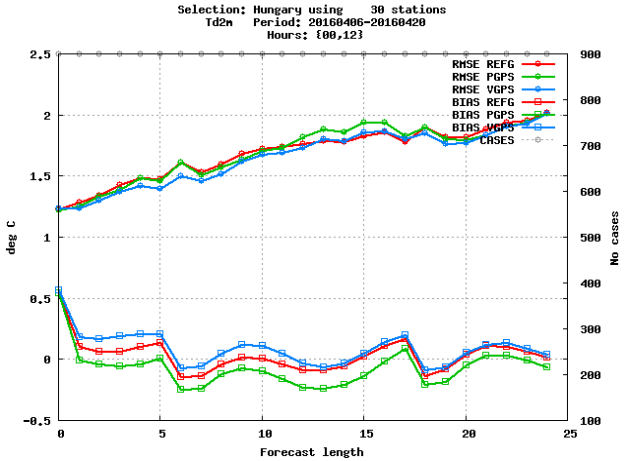
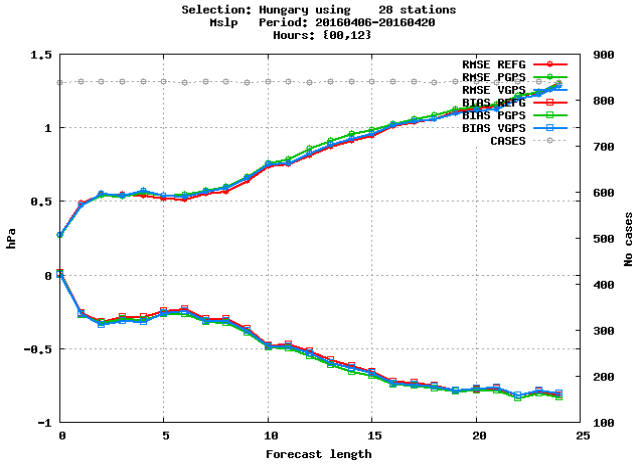
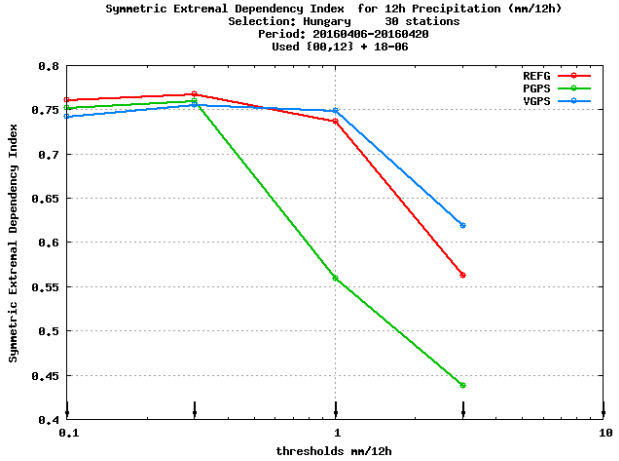






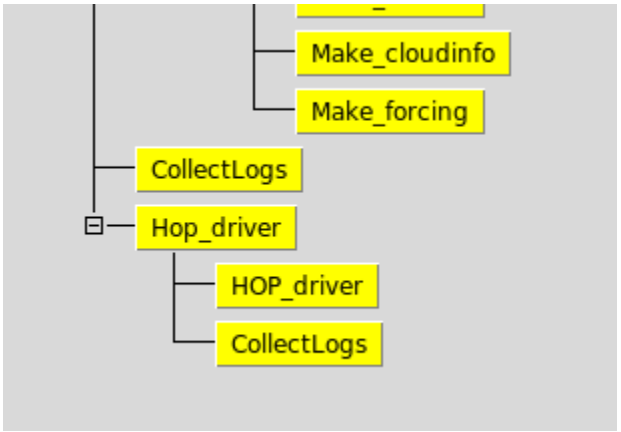


OOPS activities in Hungary

- The locally installed OOVAR was tested with more observation types, but the humidity increments was found to be erroneous.
- In 2016 the HOP driver was investigated mostly.
  - The reproduction of HOP driver was successful in HARMONIE scripting system (original framework has been done by Eoin)
  - The installation of HOP driver with gmkpack was not successful
  - Also the installation of cy42r2 on local platform was not finished due to platform dependency problems:

    *catastrophic error: **Internal compiler error: internal abort** Please report this error along with the circumstances in which it occurred in a Software Problem Report. Note: File and line given may not be explicit cause of this error.*

  - From HARMONIE's refactoring experiment:



The end

- Thank You for your attention!
- Questions?
- Answers?