Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Data assimilation work in Hungary

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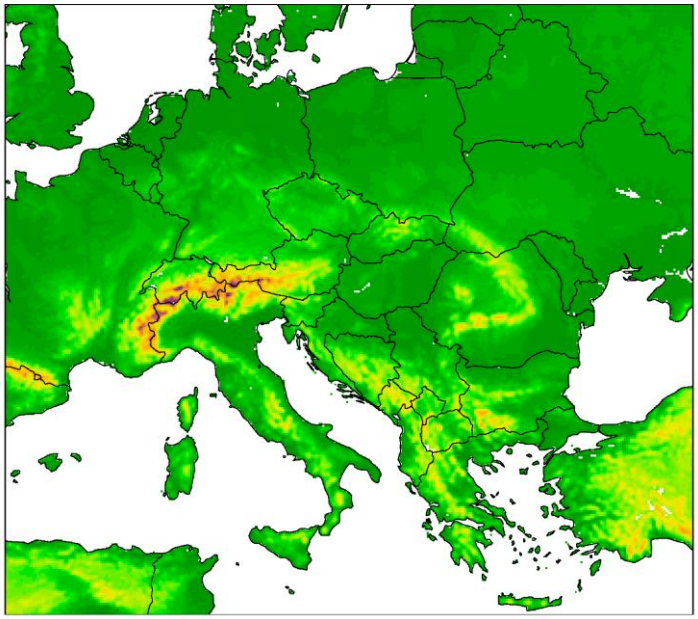
DHMZ SHMU ARSO METEO Slovenia OMSZ ZAMG ROMANIA ANM

Outline

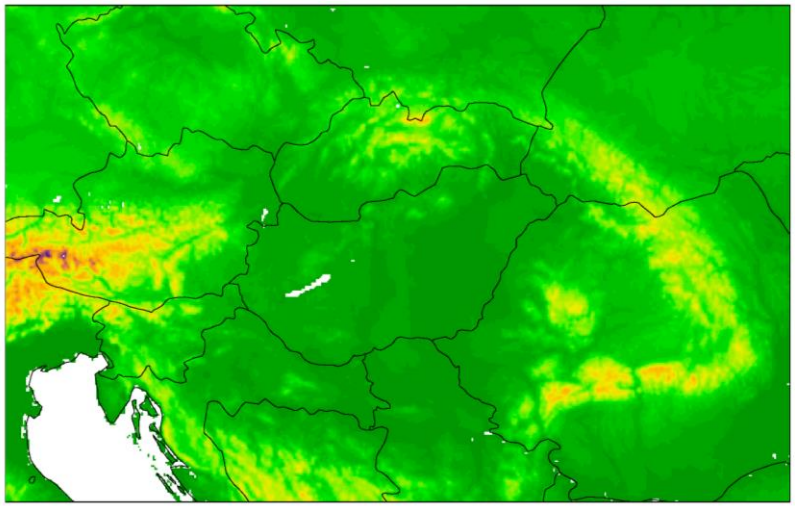
- Status of operational DA systems
- Implementation of cy43t2_bf10
- AROME RUC experiments
- Maintenance of the observation monitoring system
- B-matrix recalculation for 90 levels
- New observations:
  - Mode-S MRAR data – Czech and Hungarian data (see Kristóf's talk)
  - HRW AMV
- Surface assimilation:
  - SEKF studies (see Helga's talk)

Operational NWP and DA systems

- **ALARO**
  - 8km horizontal resolution/49 vertical levels
  - 300s timestep
  - cy40t1_bf05
  - SMS environment
  - 4 runs/day up to 60/48/60/36 hours
  - Coupled to IFS global
    - 3-hourly frequency
    - Time-lagged coupling for forecast
    - Direct coupling for DA cycle

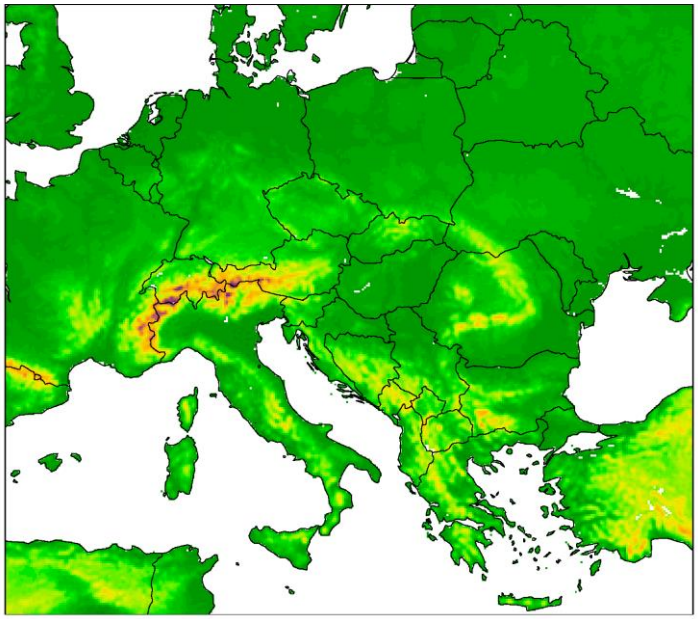


- **AROME**
  - 2.5km horizontal resolution/60 vertical levels
  - 60s timestep
  - cy40t1_bf05
  - SMS environment
  - 8 runs/day up to 48/36 hours
  - Coupled to IFS global
    - 1-hourly frequency
    - Time-lagged coupling for forecast
    - Mixed coupling in DA cycle

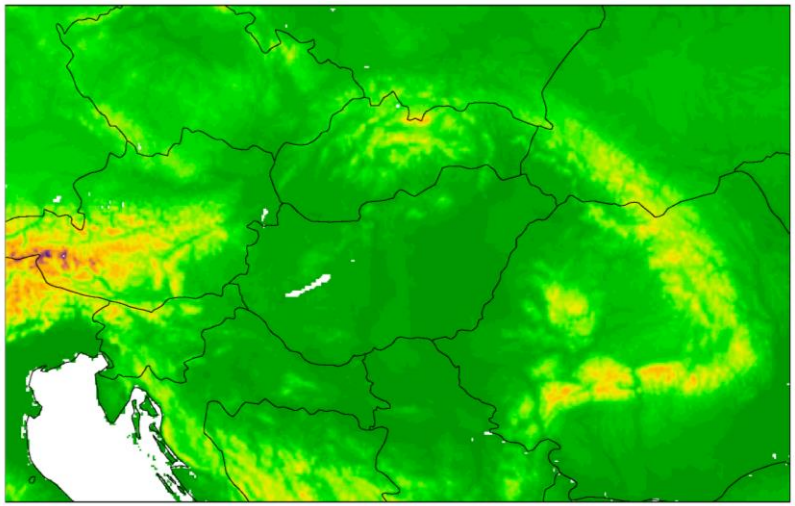


Operational NWP and DA systems

- **ALARO**
  - With digital filter initialization
  - 3DVAR + CANARI
  - 6-hour DA cycle
  - Observations: SYNOP, AMDAR, TEMP, SEVIRI, Geowind AMV, NOAA-18 AMSU-A, MHS
  - ALADIN EDA B-matrix

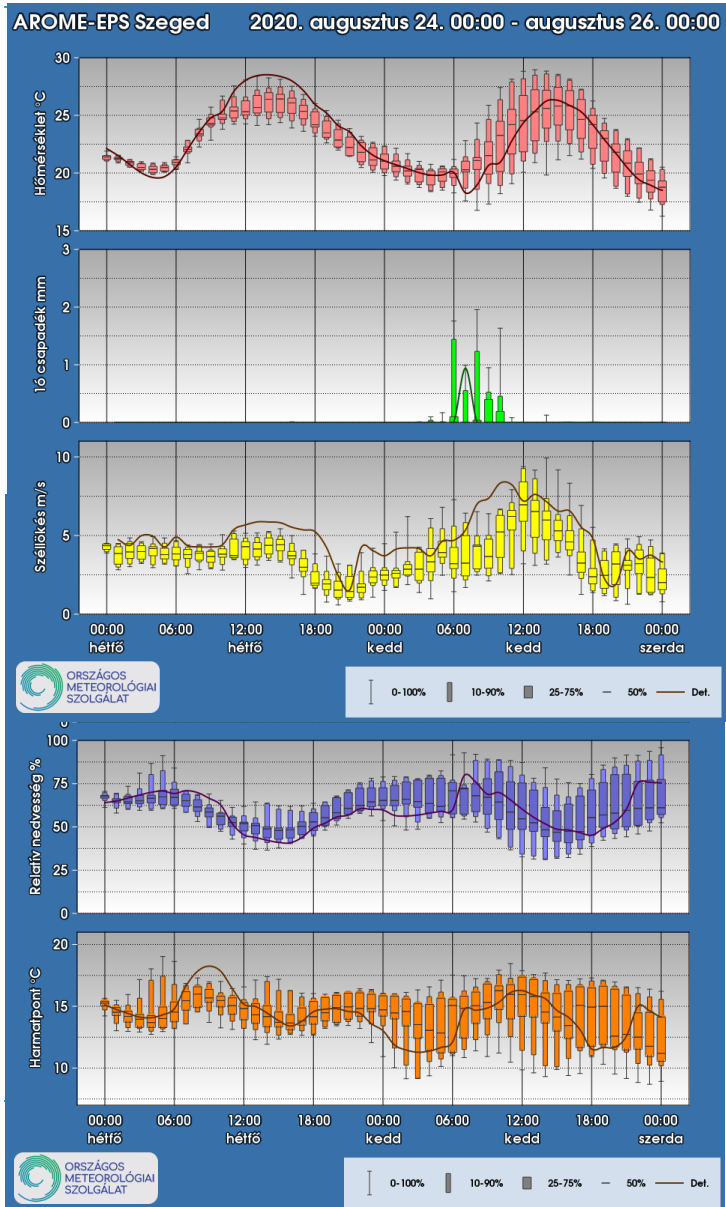


- **AROME**
  - Without digital filter initialization
  - 3DVAR +OI_main
  - 3-hour DA cycle
  - Observations: SYNOP, AMDAR, TEMP, GNSS-ZTD, Slovenian Mode-S MRAR
  - AROME EDA B-matrix



Operational NWP and DA systems

- **AROME-EPS (from February 2020)**
  - 11 members
  - 2.5km horizontal resolution
  - 60 vertical levels
  - cy40t1_bf05
  - SMS environment
  - 1 runs/day up to 48 hours
  - Coupled to IFS global
    - 3-hourly frequency
  - No data assimilation
  - Initial conditions:
    - ECM-ENS +AROME-det. surface



Implementation of cy43t2_bf10

- cy40: $N_{active}+N_{rejected}= N_{total}$; $N_{rejected} > N_{blacklisted}$
- cy43: ? $N_{rejected}$ smaller ; $N_{active}+N_{rejected}+N_{blacklisted} \neq N_{total}$

cy40

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 *** SCREENING STATISTICS
     ------------------
 *** FOR WHOLE OBSERVATION ARRAY

 STATUS SUMMARY OF REPORTS:

  OB.TYP      REPORTS       ACTIVE      PASSIVE     REJECTED  BLACKLISTED
!      1          517          513            0            4            0
       2            4            4            0            0            0
       3            0            0            0            0            0
       4            0            0            0            0            0
       5           13           13            0            0            0
       6            0            0            0            0            0
       7            0            0            0            0            0
       8            0            0            0            0            0
       9            0            0            0            0            0
      10            0            0            0            0            0
      11            0            0            0            0            0
      12            0            0            0            0            0
      13            0            0            0            0            0
      14            0            0            0            0            0
      15            0            0            0            0            0
      16            0            0            0            0            0
      17            0            0            0            0            0
      18            0            0            0            0            0
     ----------------------------------------------------------------------
!     TOT          534          530            0            4            0

 STATUS SUMMARY OF DATA:

  OB.TYP      REPORTS       ACTIVE      PASSIVE     REJECTED  BLACKLISTED
!      1         2328         2071          134          257          116
       2           12           12            0            0            0
       3            0            0            0            0            0
       4            0            0            0            0            0
!      5         4271         3187            0         1084         1062
       6            0            0            0            0            0
       7            0            0            0            0            0
       8            0            0            0            0            0
       9            0            0            0            0            0
      10            0            0            0            0            0
      11            0            0            0            0            0
      12            0            0            0            0            0
      13            0            0            0            0            0
      14            0            0            0            0            0
      15            0            0            0            0            0
      16            0            0            0            0            0
      17            0            0            0            0            0
      18            0            0            0            0            0
     ----------------------------------------------------------------------
!     TOT         6611         5270          134         1341         1178

 EVENT SUMMARY OF REPORTS:

  OB.TYP:        1        2        3        4        5        6        7        8        9
              16       17       18
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cy43

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 *** SCREENING STATISTICS
     ------------------
 *** FOR WHOLE OBSERVATION ARRAY

 STATUS SUMMARY OF REPORTS:

  OB.TYP      REPORTS       ACTIVE      PASSIVE     REJECTED  BLACKLISTED
!      1          517          516            1            1            0
       2            4            4            0            0            0
       3            0            0            0            0            0
       4            0            0            0            0            0
       5           13           13            0            0            0
       6            0            0            0            0            0
       7            0            0            0            0            0
       8            0            0            0            0            0
       9            0            0            0            0            0
      10            0            0            0            0            0
      11            0            0            0            0            0
      12            0            0            0            0            0
      13            0            0            0            0            0
      14            0            0            0            0            0
      15            0            0            0            0            0
      16            0            0            0            0            0
      17            0            0            0            0            0
      18            0            0            0            0            0
     ----------------------------------------------------------------------
!     TOT          534          533            1            1            0

 STATUS SUMMARY OF DATA:

  OB.TYP      REPORTS       ACTIVE      PASSIVE     REJECTED  BLACKLISTED
!      1         2328         2070          135          138          120
       2           12           12            0            0            0
       3            0            0            0            0            0
       4            0            0            0            0            0
!      5         4271         3192            0           29         1062
       6            0            0            0            0            0
       7            0            0            0            0            0
       8            0            0            0            0            0
       9            0            0            0            0            0
      10            0            0            0            0            0
      11            0            0            0            0            0
      12            0            0            0            0            0
      13            0            0            0            0            0
      14            0            0            0            0            0
      15            0            0            0            0            0
      16            0            0            0            0            0
      17            0            0            0            0            0
      18            0            0            0            0            0
     ----------------------------------------------------------------------
!     TOT         6611         5274          135          167         1182

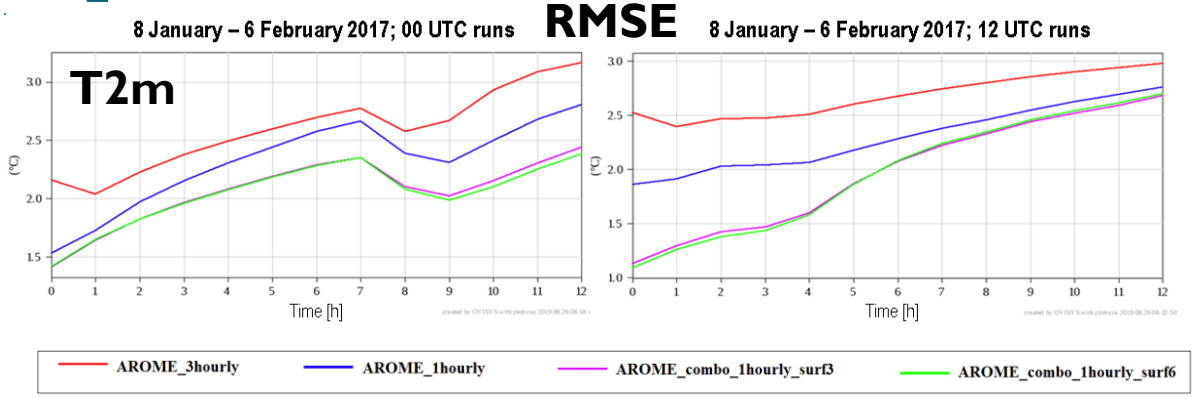
 EVENT SUMMARY OF REPORTS:

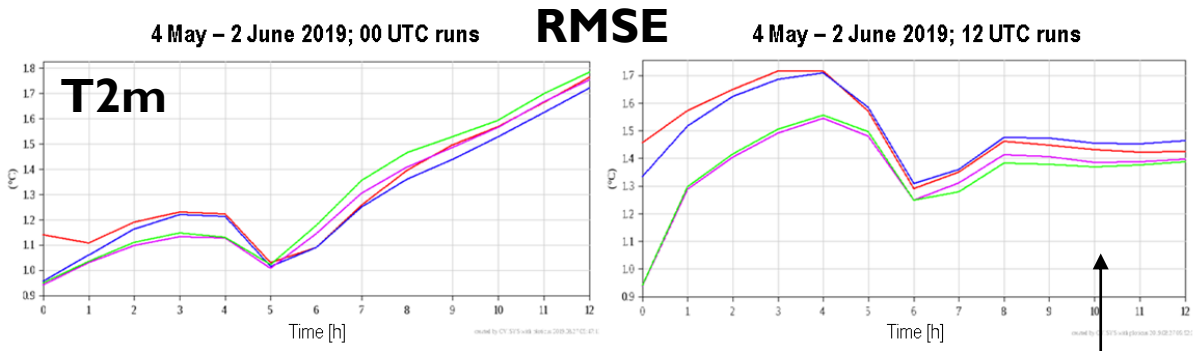
  OB.TYP:        1        2        3        4        5        6        7        8        9
              16       17       18
```

AROME RUC experiments

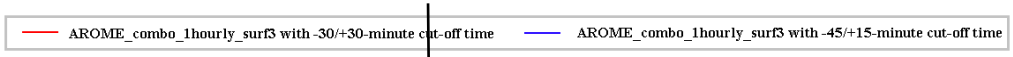
Conclusions:

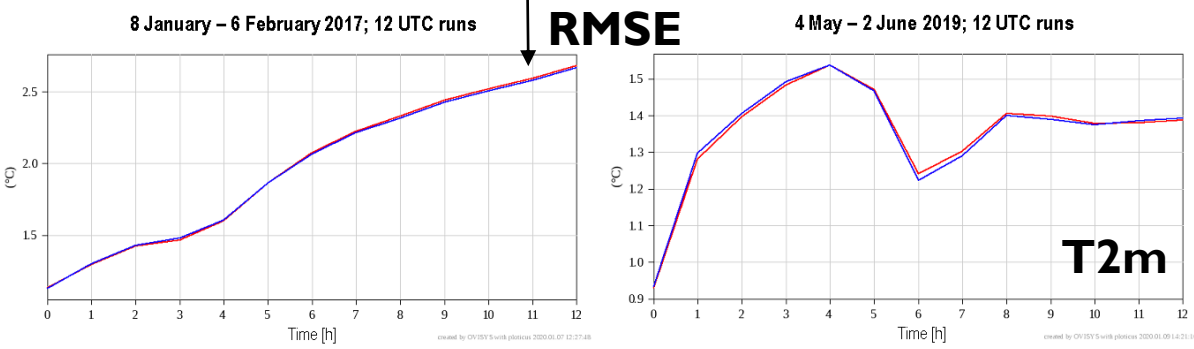
- one-hour upper DA cycle + three-hour surface DA cycle
- cut-off time: -45/+15 min





AROME_1hourly_surf3
— -30/+30 min cut-off time
— -45/+15 min cut-off time

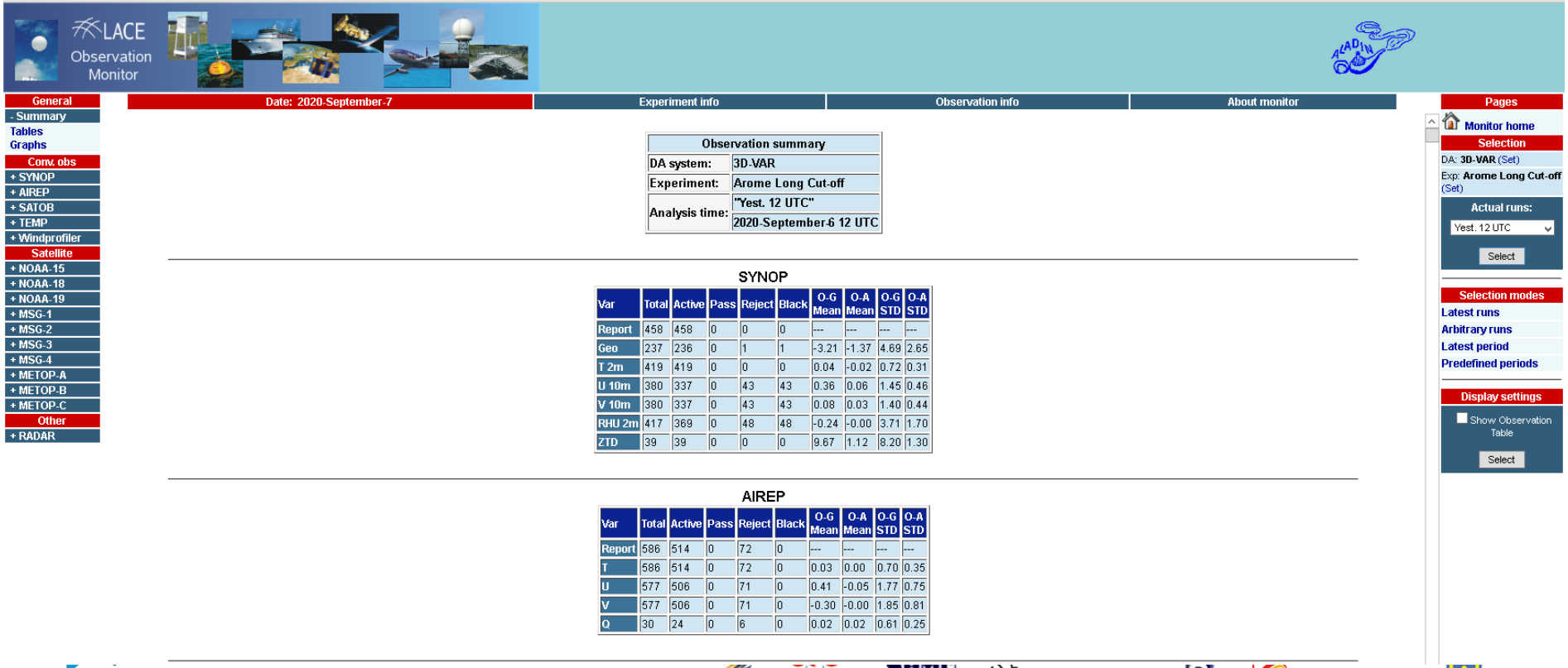




— AROME_3hourly
— AROME_1hourly
— AROME_1hourly_surf3
— AROME_1hourly_surf6

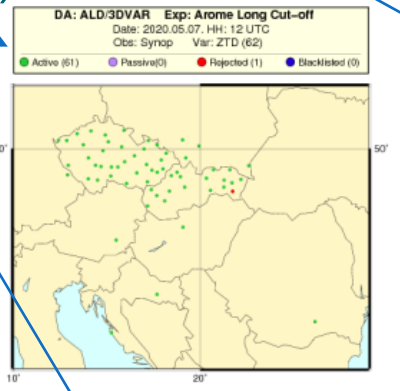
Maintenance of the observation monitoring system

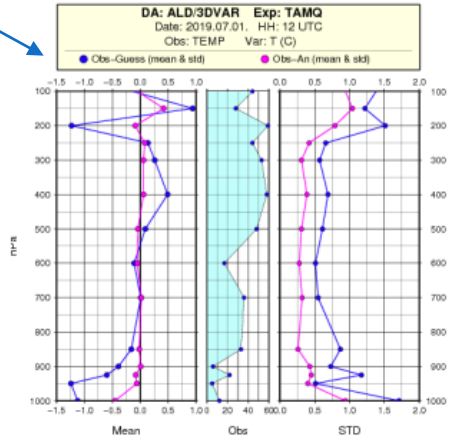
- It is working since 2005, mainly for ALADIN → outdated
- Implementation of new observations which used only in AROME → batch mode and web interface as well

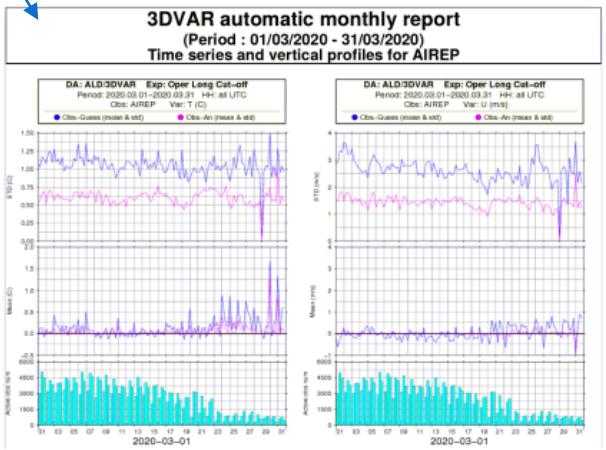


Maintenance of the observation monitoring system

- Implementation of new observations:
  - AMDAR humidity (used only in AROME)
  - GNSS ZTD (used only in AROME)
- monthly report for AROME
- additional effects:
  - missing TEMP from Austria (data arrives only in BUFR)
  - monitor of AMDAR due to COVID-19
  - wrong blacklist settings for AMV

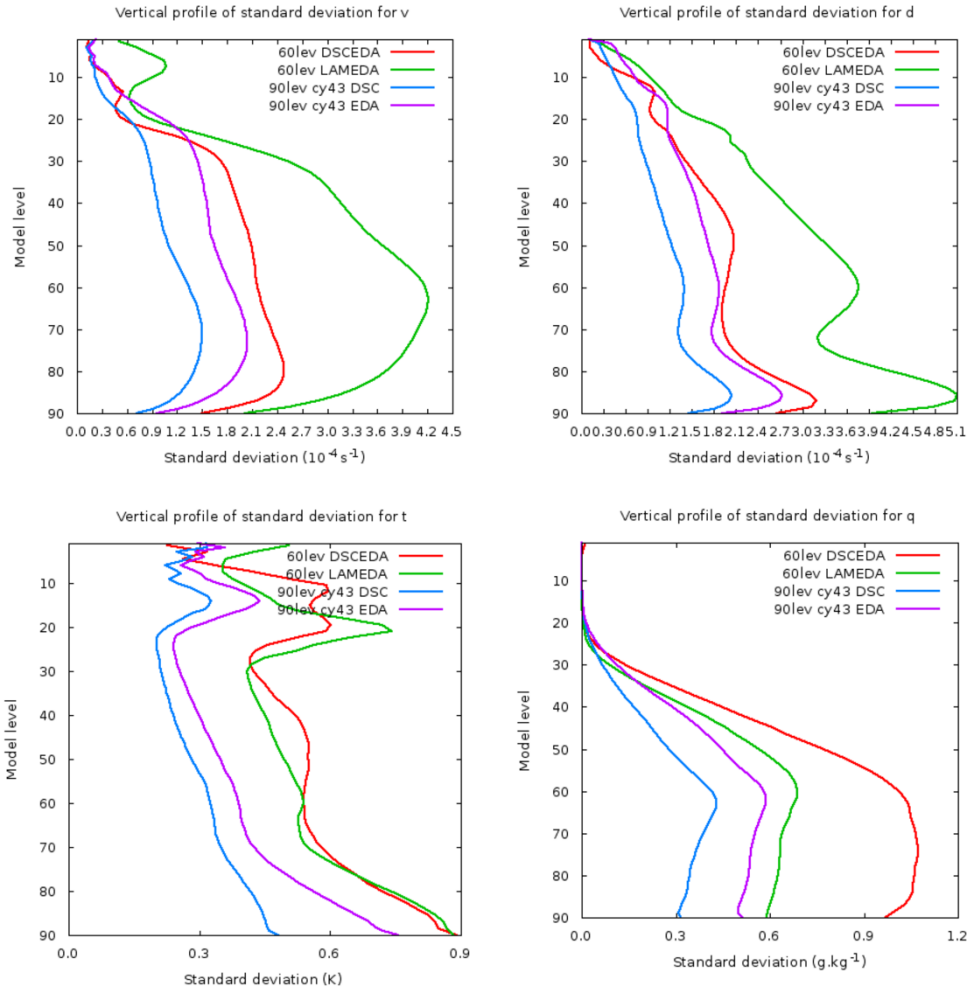






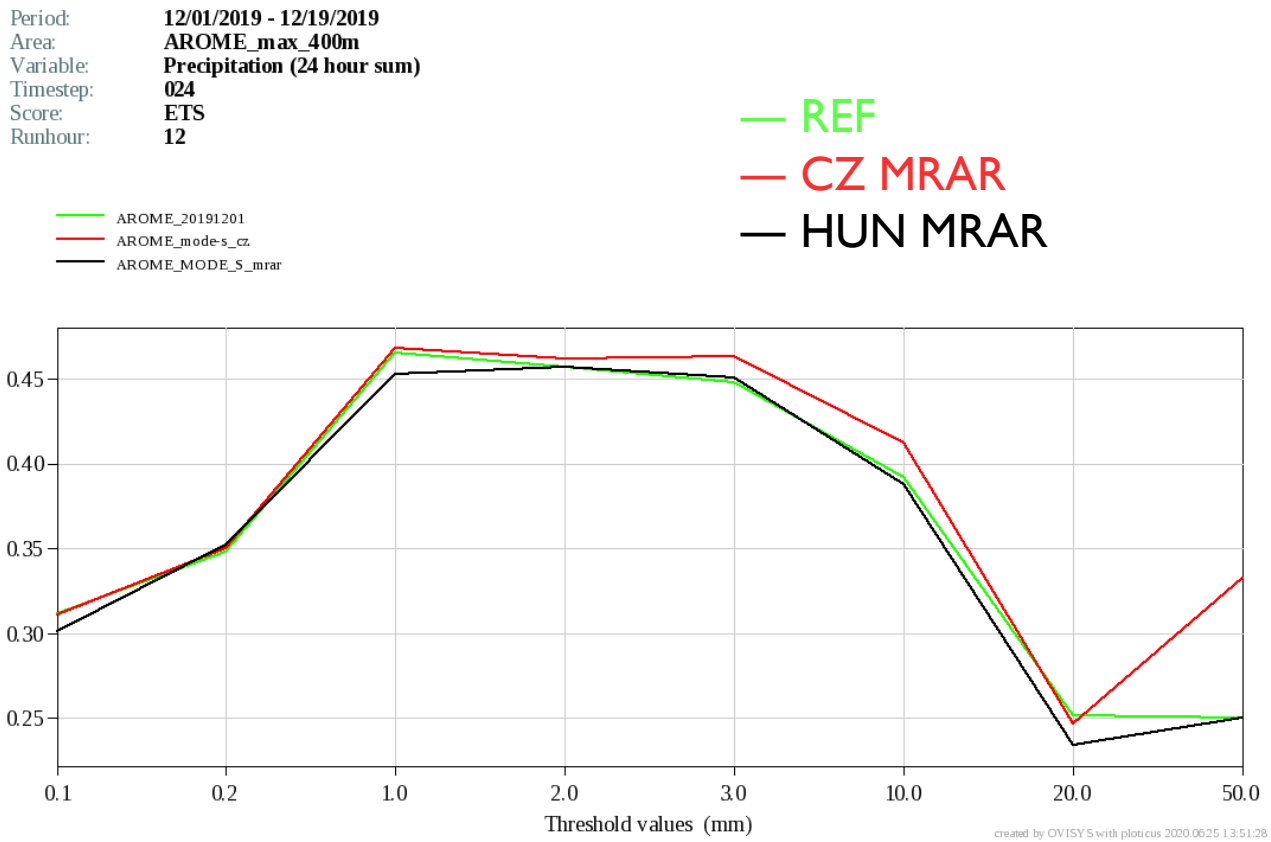
B-matrix recalculation for 90 levels

- There were instabilities with 60-levels AROME → we would like to change to 90-levels with different model top.
- downscaled EDA → spinup B-matrix → full EDA → EDA B-matrix
- experiments on a longer period
- tuning of **B** and **R** is needed
- Desroziers et al. (2005) → REDNMC = 1.26 SIGMA_COEF = 0.71 → deterioration



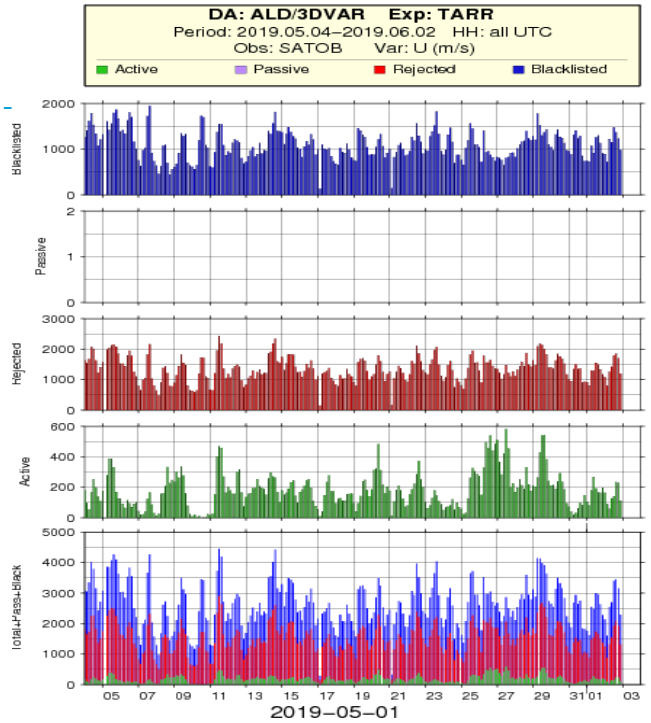
New observations: Czech and Hungarian Mode-S MRAR data

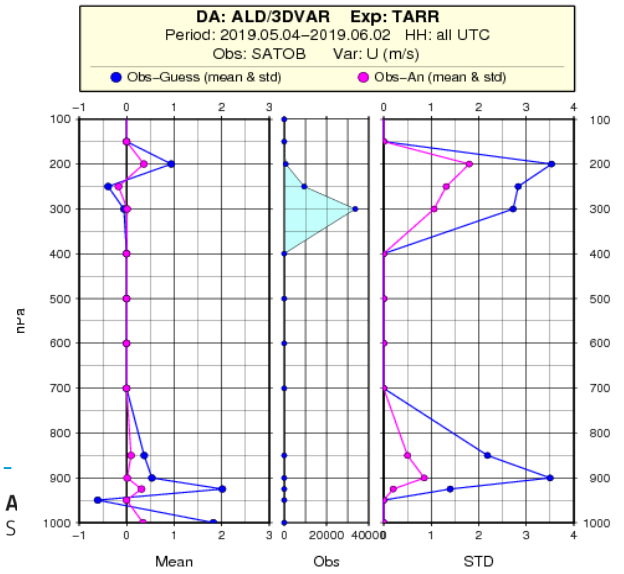
- Czech data with whitelist **see Kristóf's talk**
- Hungarian data without whitelist in the first experiment



New observations: HRW AMV

- geowind is operational in ALADIN
- experiments with geowind and hrwind in AROME
- Two different periods:
  - spring period with large-scale precipitation
  - summer period with deep convection
- mainly neutral impact during both periods
- most of the measurements are blacklisted
- Future plan:
  - winter period
  - revise the blacklisting setup





Surface assimilation: SEKF studies

see Helga's talk

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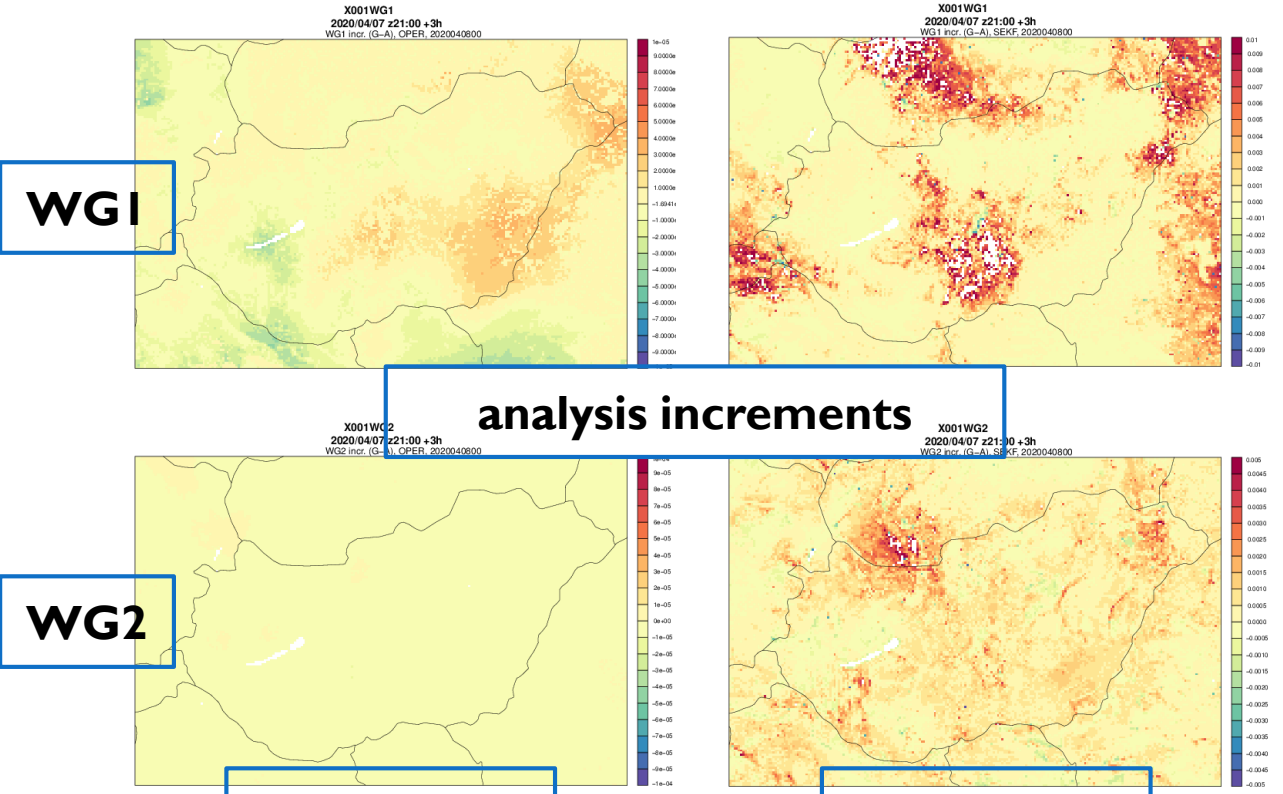
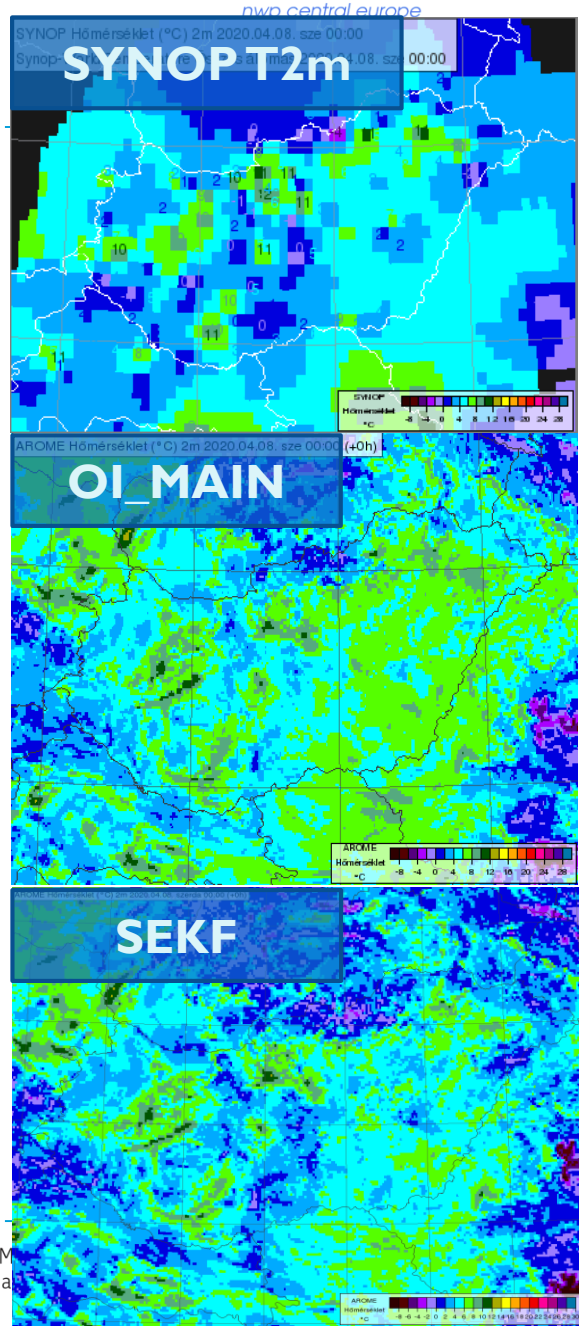
- 8th April 2020 00UTC– dry and warm case →
- minimum temperature is usually overestimated
- Soil moisture increments are usually bigger with SEKF than with OI_main (operational)





Plans for 2021

- Large project: AROME Nowcasting system with 1-hour RUC on 1.3 km horizontal resolution and 90 vertical levels → new supercomputer
- cy40t1 → cy43t2 in the operational AROME runs (ALADIN will not be updated any more)
  fullpos on lat-lon grid → new climate files are necessary
- Start to work on radar assimilation
- B-matrix calculation
- HRW AMV and Hungarian Mode-S MRAR → operational
- Further experiments with SEKF