Recent Developments within LACE DA Activities

Mate Mile (*mile.m@met.hu*)
with contribution from Benedikt Strajnar, Michal Nestiak, Xin Yan, Alena Trojakova, Patrik Benacek and others

Outline

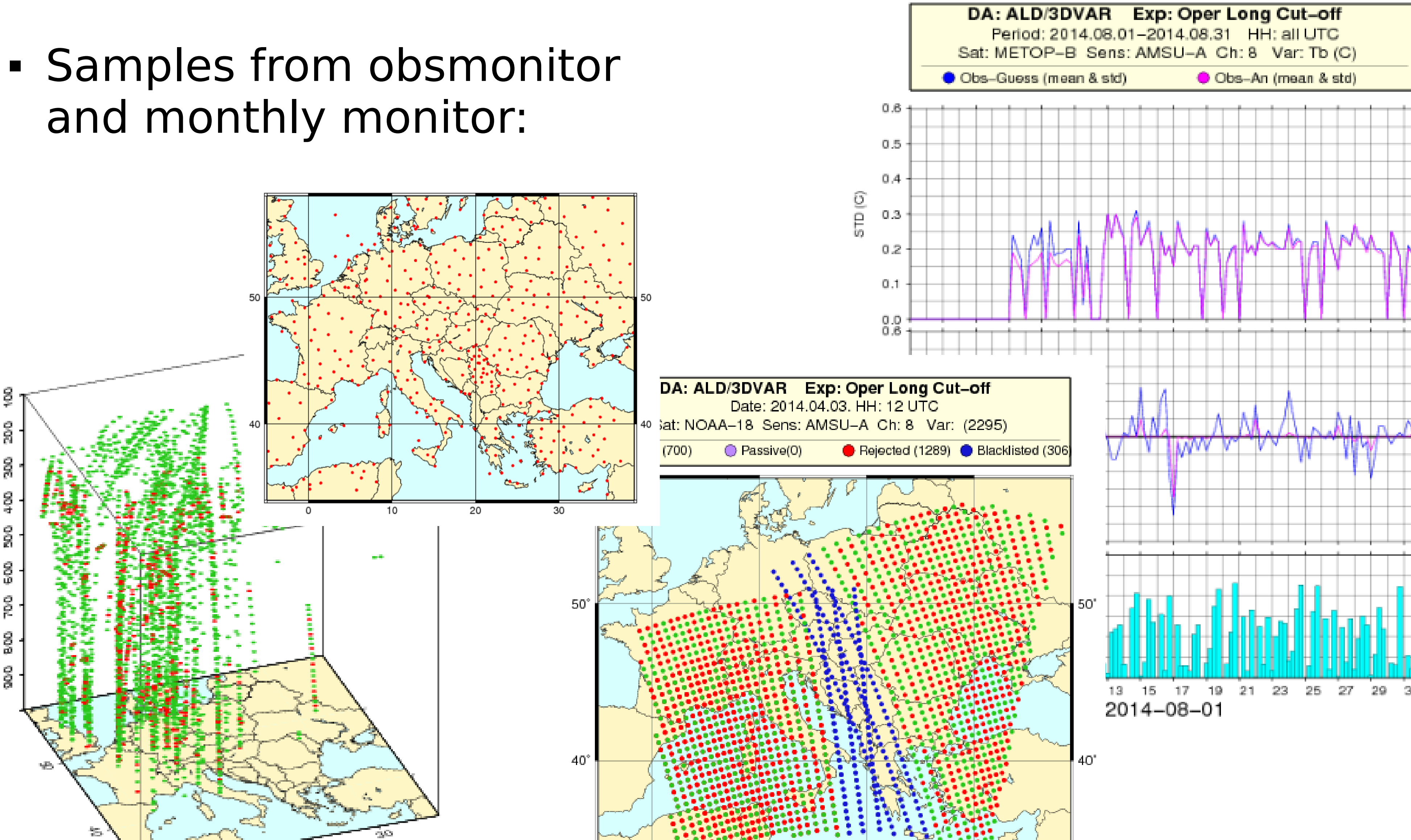
- OPLACE
- Use of observations
  - IASI radiance observations and VARBC
  - RADAR reflectivity and radial wind
  - GNSS ZTD
  - Mode-S MRAR

OPLACE

- Common Observation Pre-processing system for LACE countries
- System handles 6 observation types in real-time providing proper data format for DA purposes
  - Obstype1 – SYNOP – OBSOUL(ASCII)
  - Obstype2 – AMDAR – OBSOUL(ASCII)
  - Obstype3 – SATOB – BUFR
  - Obstype5 – TEMP – OBSOUL(ASCII)
  - Obstype6 – PROF – BUFR
  - Obstype7 – SATEM – BUFR, GRIB
- Regularly maintained and monitored data

OPLACE

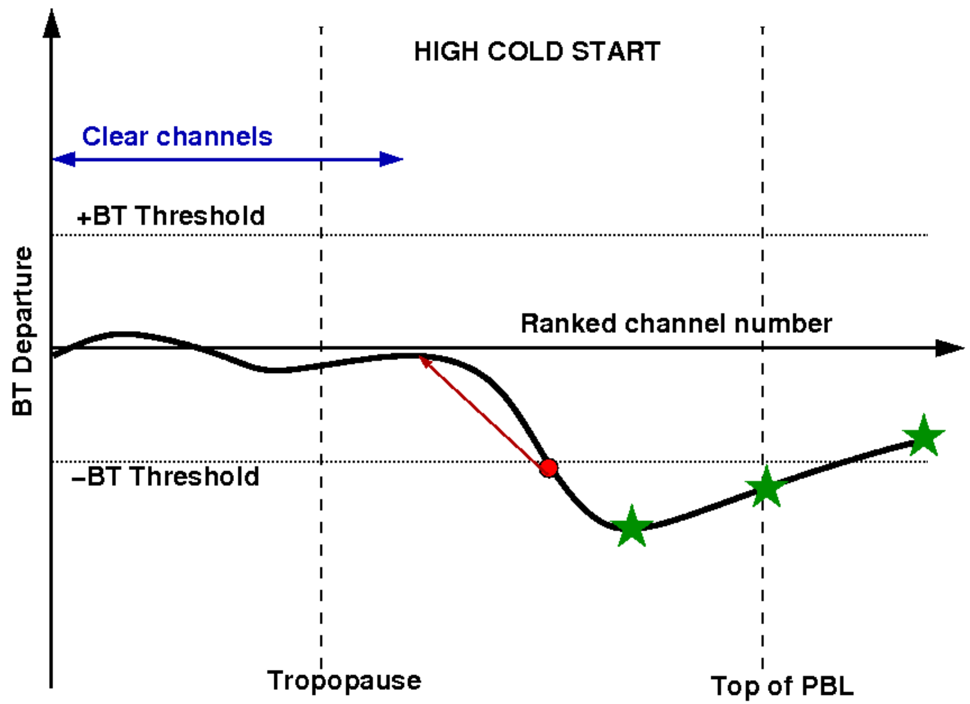
- Samples from obsmonitor and monthly monitor:



Use of observations

IASI Radiance observations

- A data assimilation study using clear-sky IASI radiance observations and initialization of variational bias correction have been investigated.
- Cloud detection scheme rejects cloudy channels (McNally, 2003)
    - Cloud contamination is determined on the basis of FG departures check and window gradient check in the scheme
    - Cloud detection scheme works correctly supposing unbiased satellite data



cloud detection algorithm as used for assimilation of AIRS, IASI and CrIS data by McNally and Watts (2003)
Source: nwpsaf.eu

Use of observations

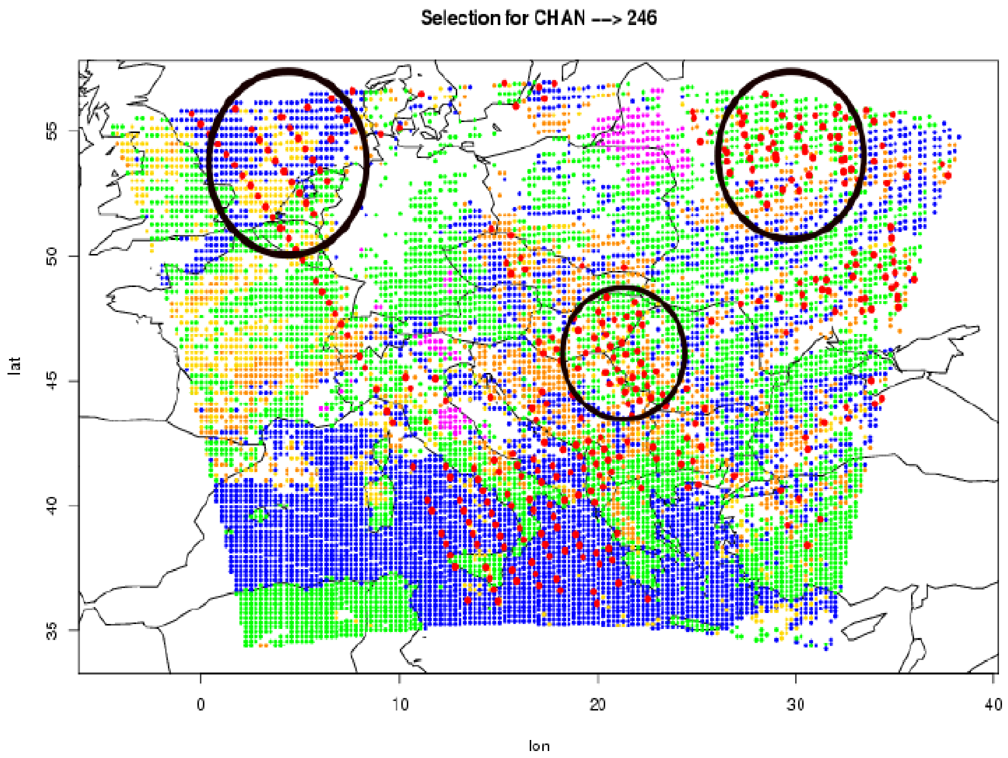
IASI Radiance observations

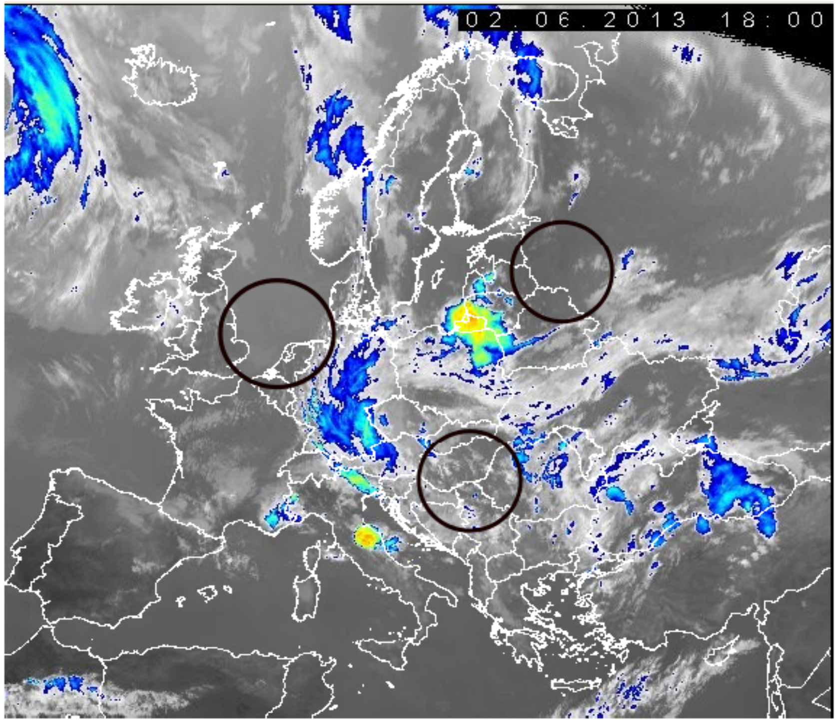
- In passive assimilation the low/middle tropospheric peaking channels have usually larger bias which leads to data rejection and takes long time to update VARBC coefficients for these channels.
- In order to avoid such data rejection in the system the following tuning of cloud detection scheme has been made:
  - Defining large extension of clear sky days in our domain (5-9 June 2013)
  - Estimate OMG departures for each IASI channel
  - Change BT threshold (according to the detected biases) to ensure clear radiances pass through quality control
  - IASI bias correction using fast adaptivity(NGB=500) for that particular clear sky days
  - BT thresholds were switched back to default values
- With this tunning of cloud detection scheme the low/middle peaking channels have not been rejected and regression coefficients were updated already at the beginning of VARBC calculation.

Use of observations

IASI Radiance observations

- To verify the functionality of the modified cloud detection scheme, the clear sky pixel selection from a random day was compared with cloud-type (CT) product of SAF/NWC.
- For middle peaking channel 246
  - Over clear sky conditions pixels are selected (red dots)
  - Data contaminated by high/mid level clouds are rejected (white/pink points)
  - Middle peaking channel was also selected over very low cloud (orange points)





Use of observations

IASI Radiance observations

- Therefore with the tuning of cloud detection scheme, it is easy to update the bias parameters of low/middle peaking channels early in passive assimilation.
- Fast adaptation of bias coefficients ensures reasonable bias parameters with a short tuning period.

Use of observations

RADAR reflectivity and radial wind

- LACE collected raw RADAR data samples from all LACE member countries.
- Goals:
  - Raw data in OPERA ODIM HDF5 format
  - Common Quality Control (INCA2 precipiation module)
  - Demonstrate benefit of data exchange and RADAR data assimilation
- Problems:
  - OPERA HDF5 format (and the content of it) is not uniform country by country
  - Conversion of Quality Indexes from QC to DA

Use of observations

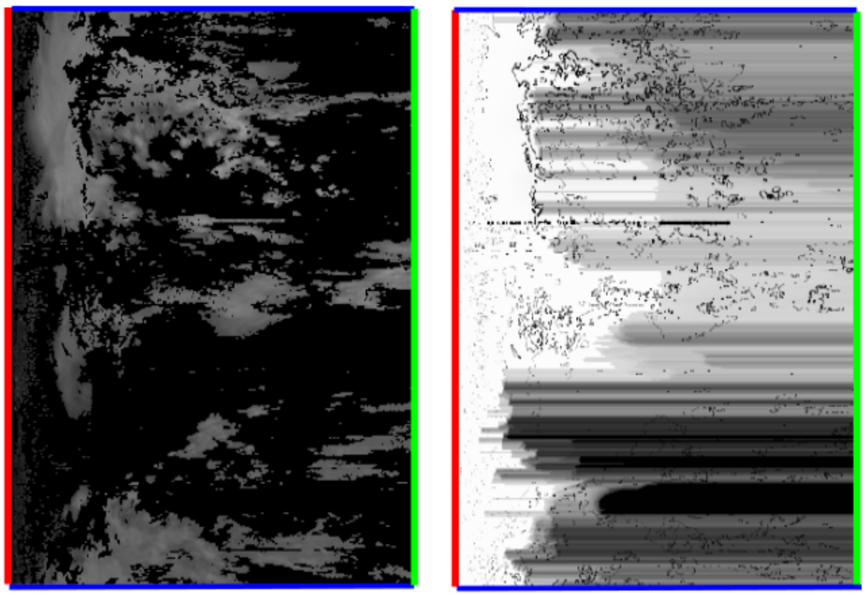
RADAR reflectivity and radial wind

- INCA2 precipitation module has been tested for Common Quality Control
- INCA2 Quality indexes:

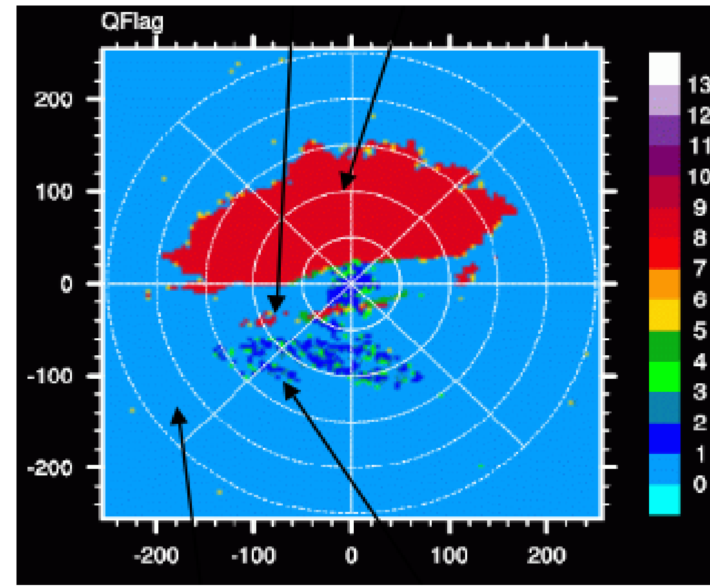
  Q1 – Laplace filter; **Q2** – RLAN filter; **Q3** – Attenuation; **Q4** – NWCSAF Quality index (CT,CTTH); **Q5** – Beam Blockage; **Q6** – Radar climatology based Qi; **Q7** – All Qi-s
- INCA2 Quality Control is flexible to use all set or subset of these quality indexes
- Quality indexes have to be converted to ones used in data assimilation → CONRAD tool

Use of observations

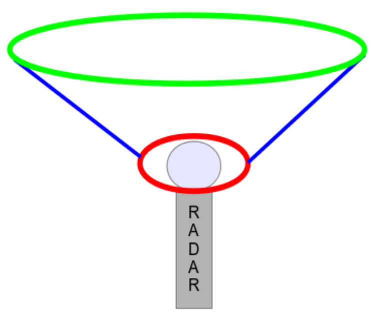
RADAR reflectivity and radial wind



CONRAD



INCA2 QC
quality indexes



- Q1 – Laplace filter
- Q2 – RLAN filter
- Q3 – Attenuation
- Q4 – NWCSAF Quality index (CT,CTTH)
- Q5 – Beam Blockage
- Q6 – Radar climatology based Qi
- Q7 – All Qi-s

MF BUFR
quality indexes for DA

0 : Noise
1 : static clutter
2 : dynamic clutter (sigma)
3 : close to clutter < 1 km
4 : clear sky (insects, birds...)
5 : military decoy, sea clutter
6 : sea clutter by vertical gradient and texture
7 : drizzle
8 : rain (in fact precipitation!)
9 : large dropplets
10 : rain/hail
11 : fine hail
12 : hail
13 : dry snow
14 : wet snow
15: crystals

Use of observations

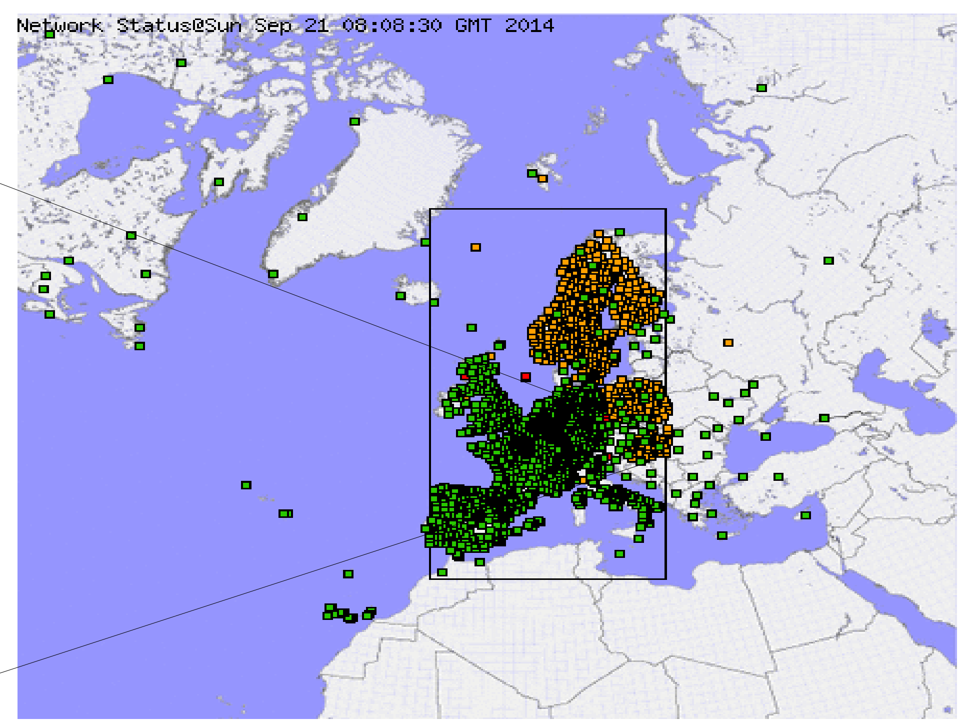
RADAR reflectivity and radial wind

- More efforts are needed to make
  - Further studies with INCA2 Quality Control
  - Comparison studies with other QC-s (e.g. BALTRAD)
  - Proper conversion of quality indexes for DA (develop CONRAD further)

LACE
nwp central europe

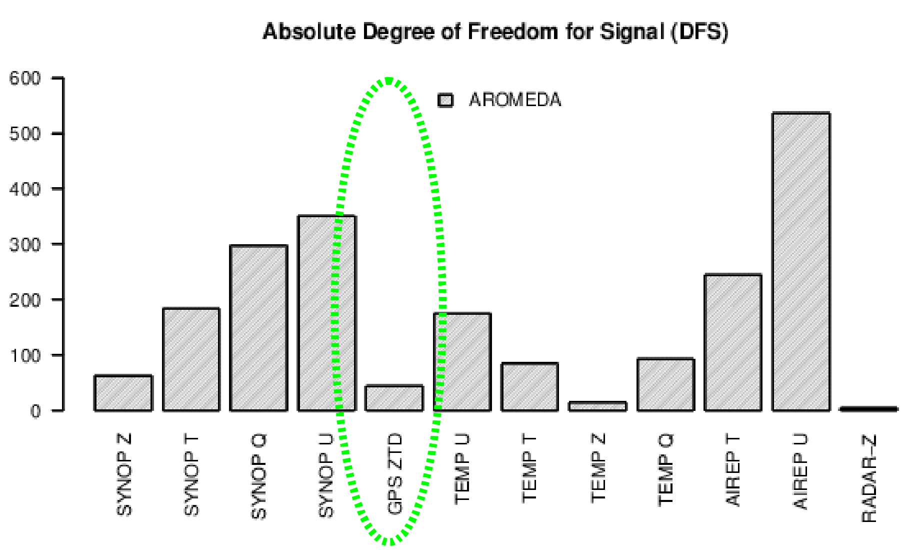
Use of observations
GNSS ZTD

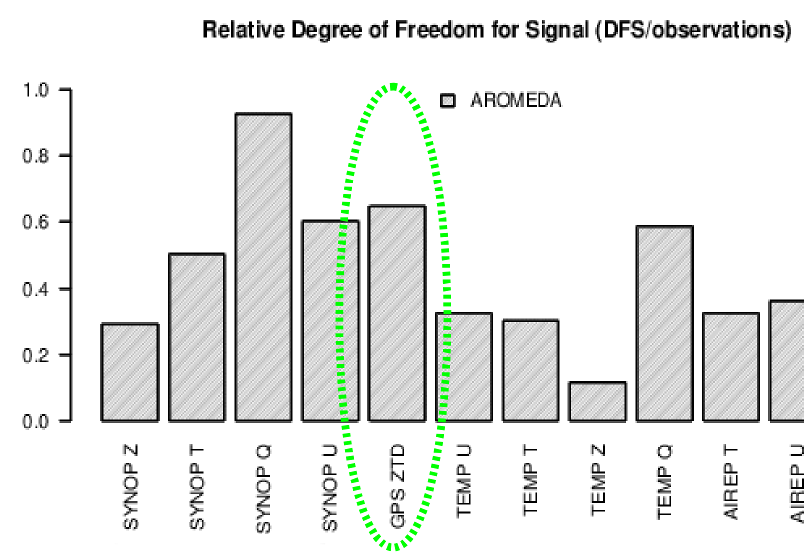
- EUMETNET EGVAP network has fast growing network which provides already dense station coverage over Central-Europe.
- ZTD observations have been studied in AROME 3DVAR data assimilation system for winter and summer period of 2014.



Use of observations
GNSS ZTD

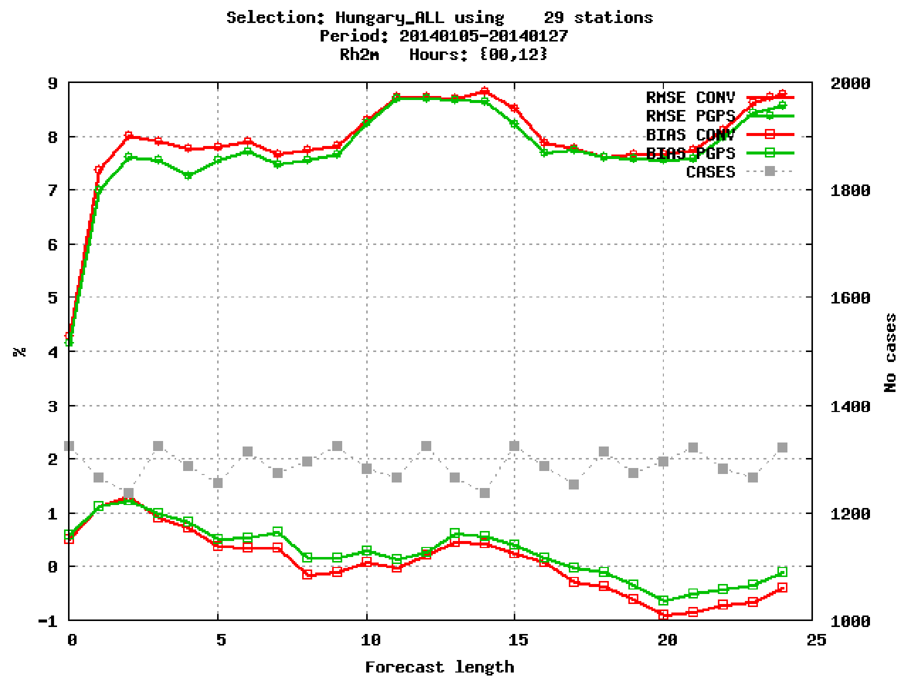
- To evaluate the impact of ZTD observation on analysis DFS has been computed. (analysis at 12UTC, 3rd of January 2014)
- Absolute contribution of ZTD is moderate
- But relative importance is high
- GNSS ZTD is an important component of the DA system considering SYNOP,AMDAR,TEMP,RADAR and GNSS in AROME 3DVAR

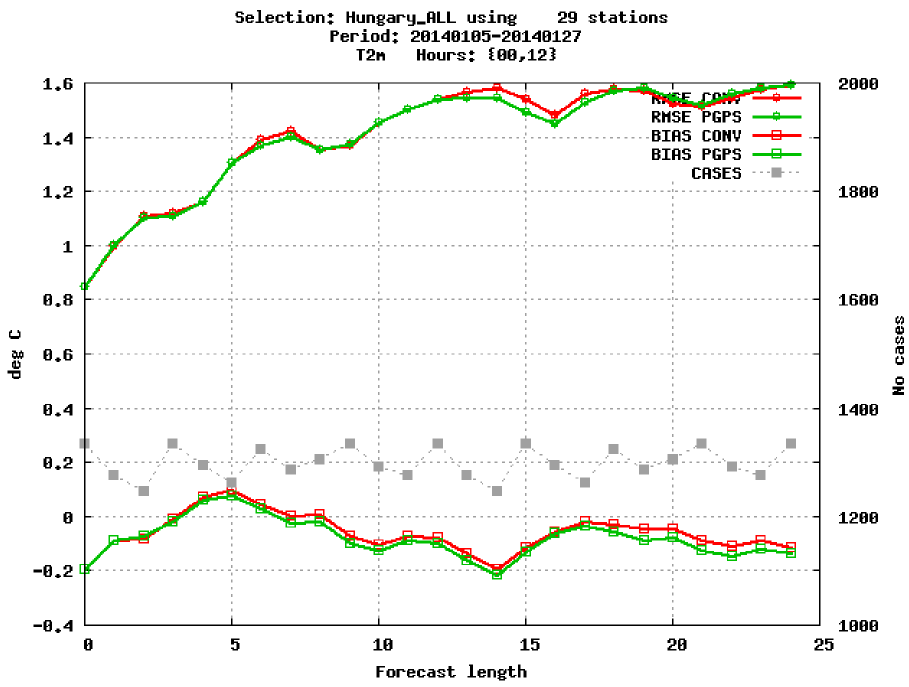




Use of observations
GNSS ZTD

- Verification results from **winter** period 05/01 – 27/01 2014
  - AROME CONV: AROME 3DVAR with conventional observations
  - AROME PGPS: AROME 3DVAR with conv. and ZTD





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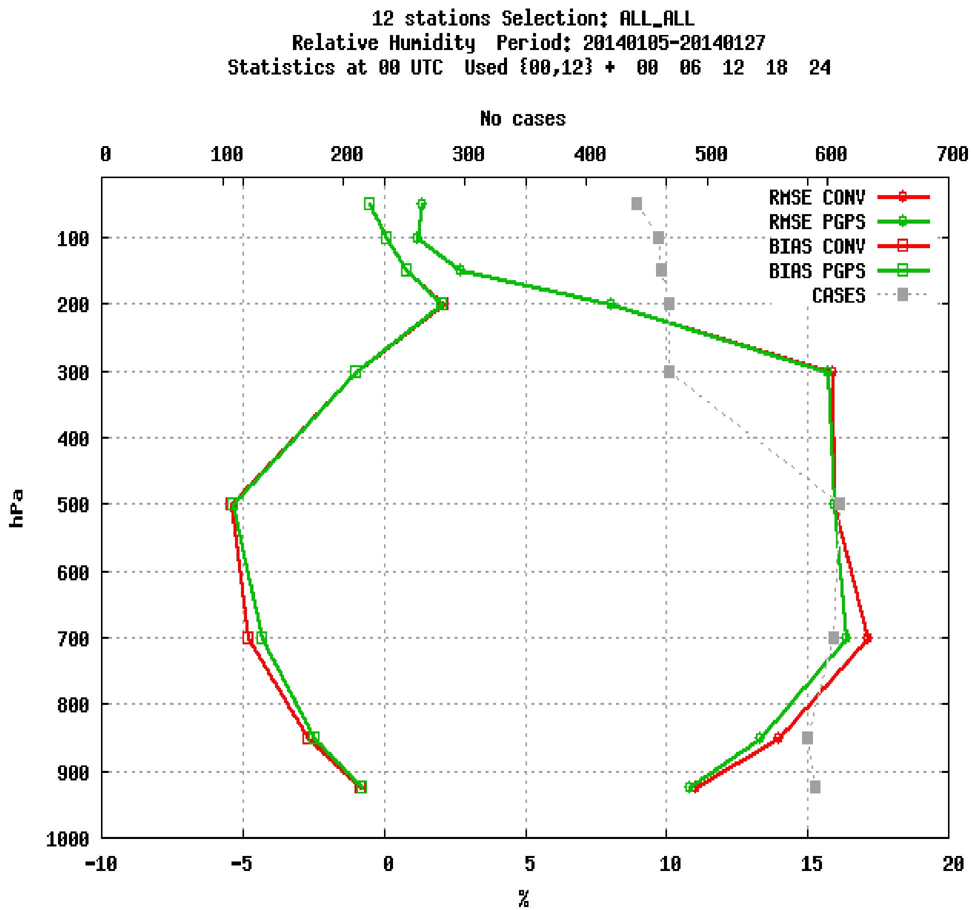

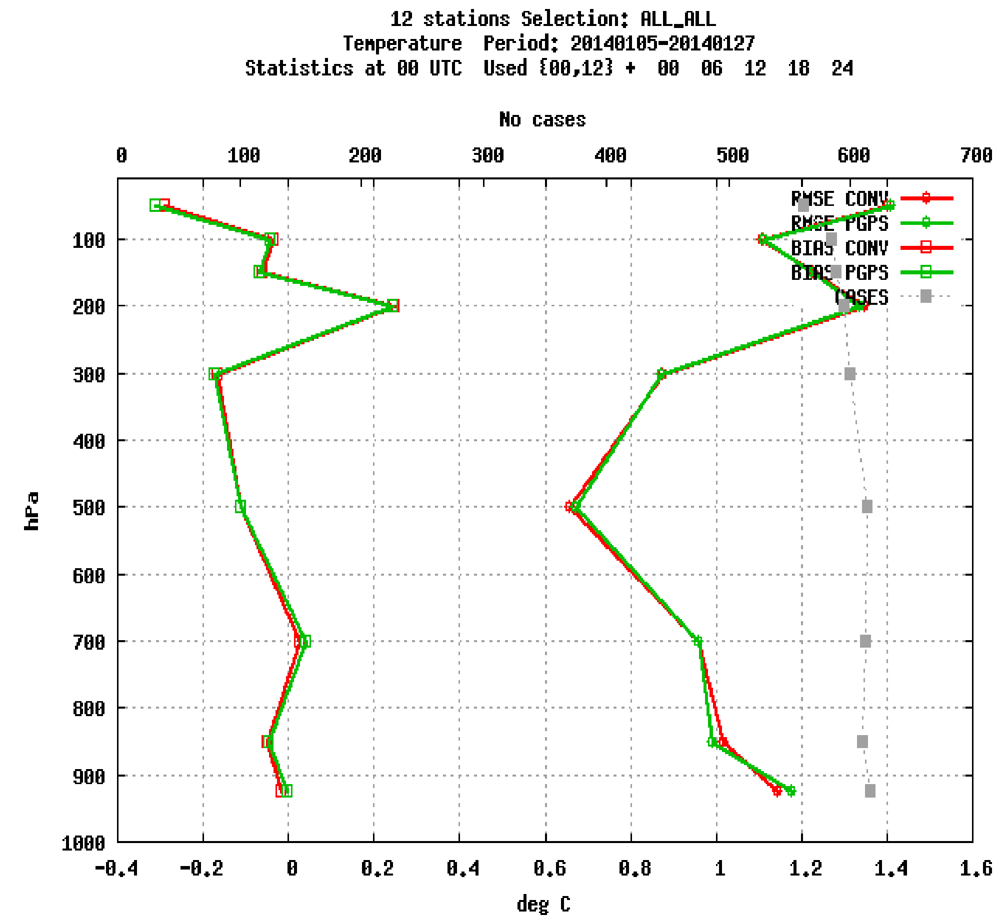

Use of observations
GNSS ZTD

- Verification results from **summer** period 10/07 – 31/07 2014
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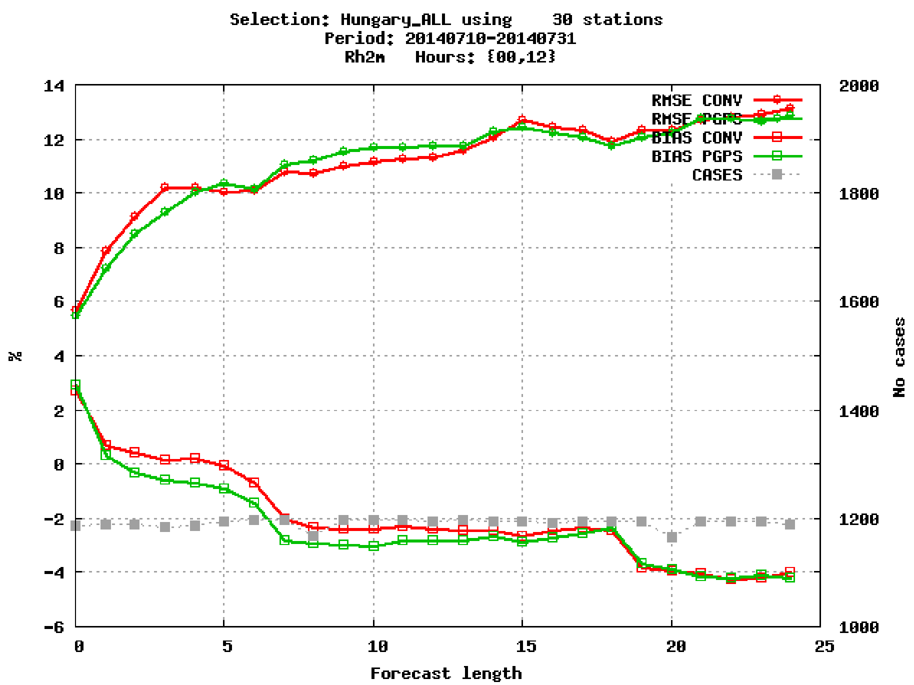

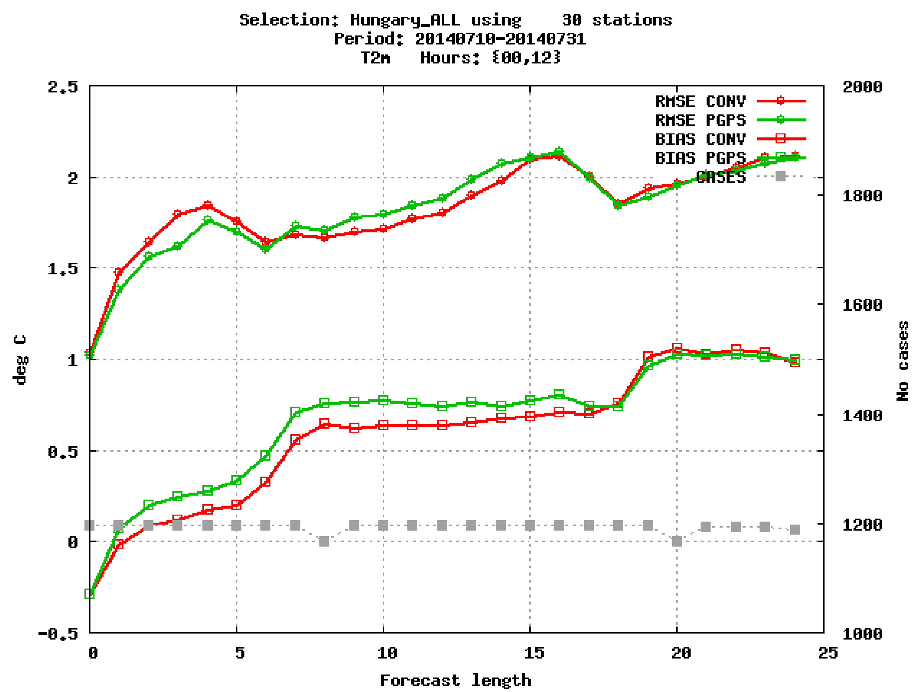

Use of observations

GNSS ZTD

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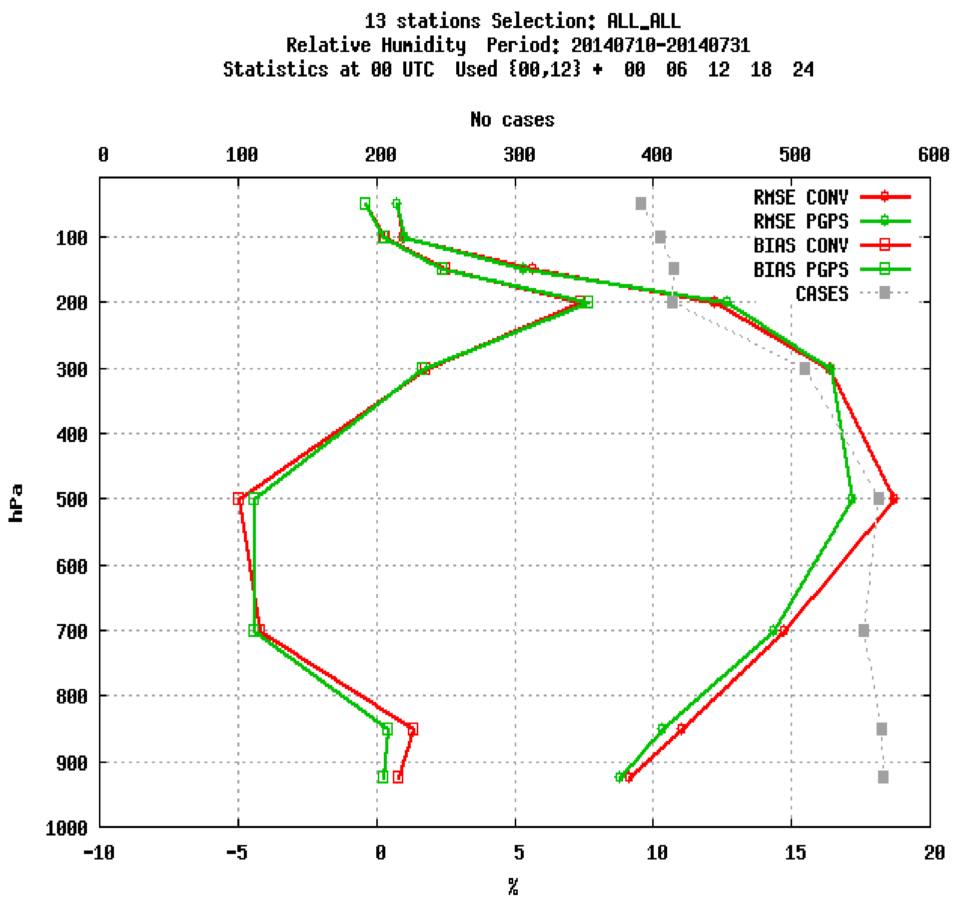
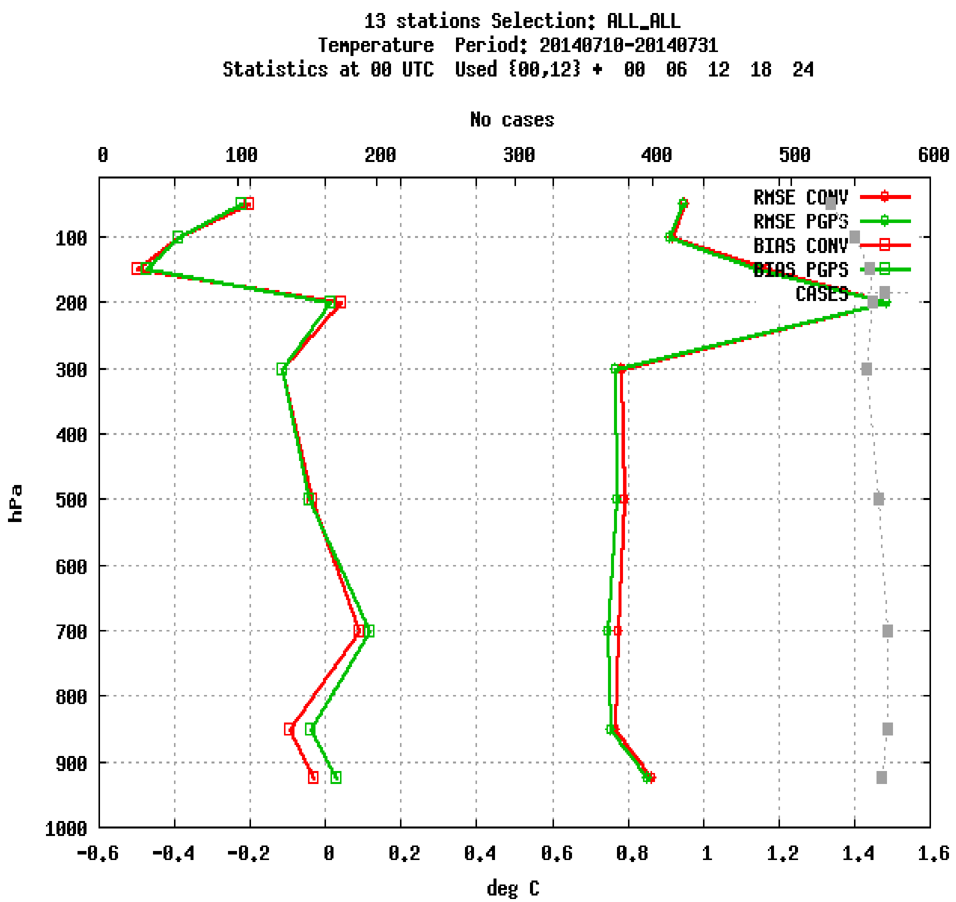




Use of observations

Mode-S MRAR

- After extensive validations and tests, assimilation of Mode-S (MRAR sensor) has been operationally implemented in Slovenian ALARO 3DVAR.
- The impact of Mode-S MRAR is clearly positive on the nowcasting scales and winter period. During summer the impact is more complex and indicates sensitivity on humidity analysis.
- Clear added value of Mode-S was observed in extreme freezing rain case of Slovenia. (See also Slovenian poster)

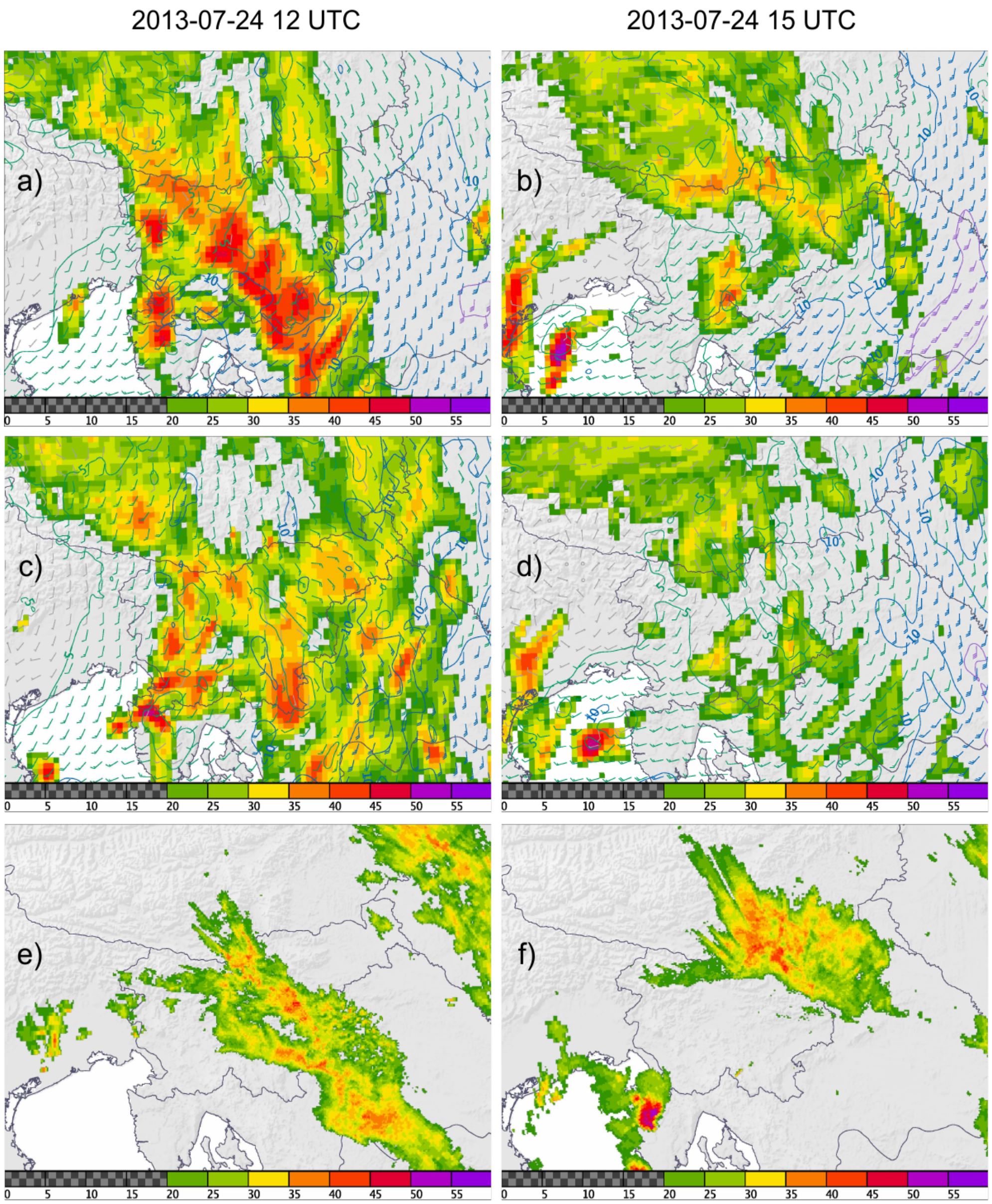
Use of observations

Mode-S MRAR

With Mode-S

Without Mode-S

Radar

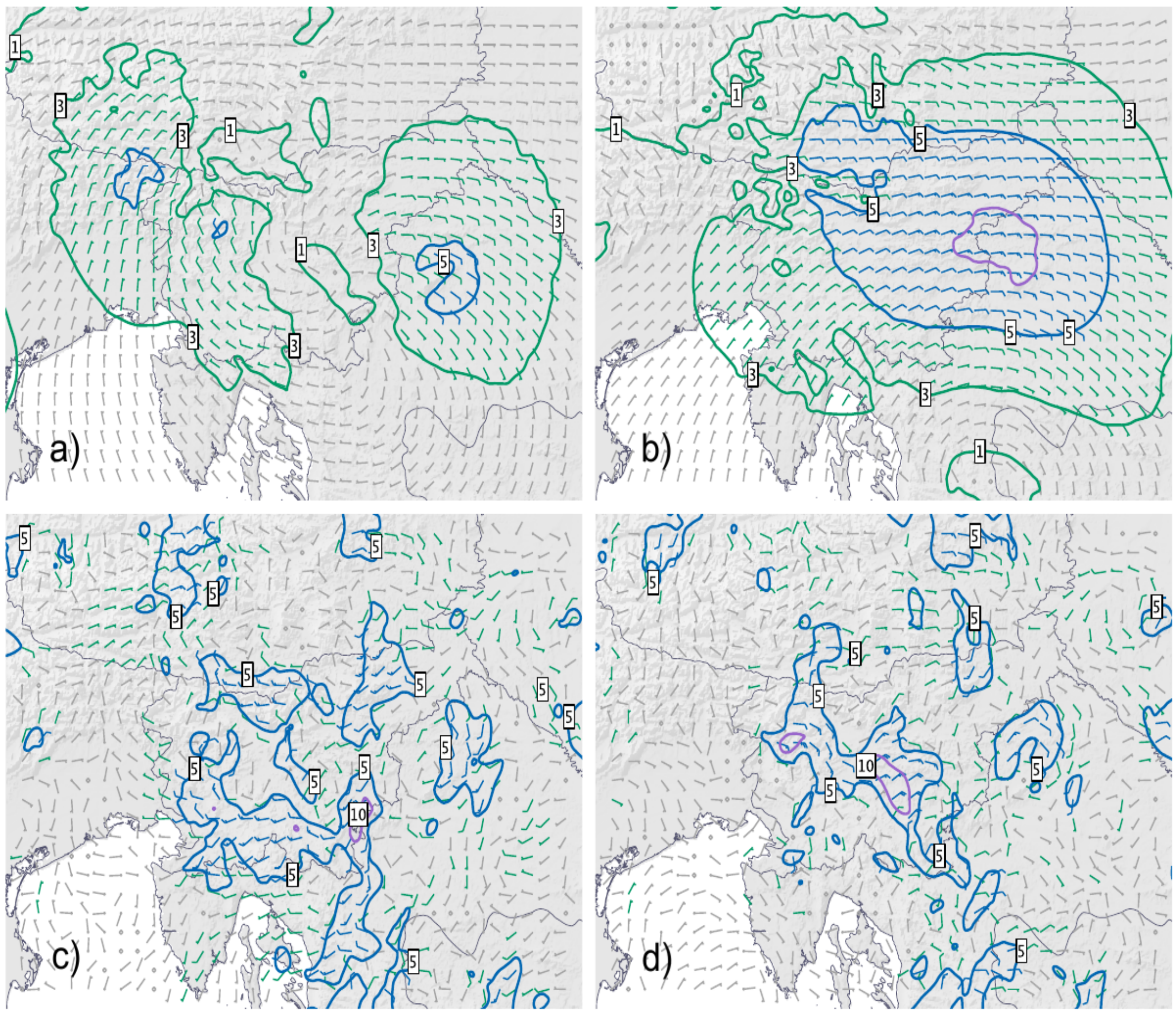


Use of observations

Mode-S MRAR

EXP Increment with Mode-S

REF Increment without Mode-S



Difference between analyses

Difference between first guesses

600 hPa wind

Thank You for your attention!
Questions?