The use of AMDAR humidity and Slovenian Mode-S data in AROME/Hungary

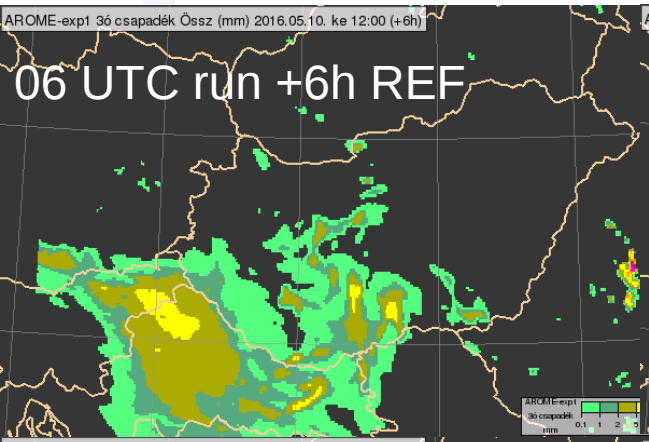
Viktória Homonnai

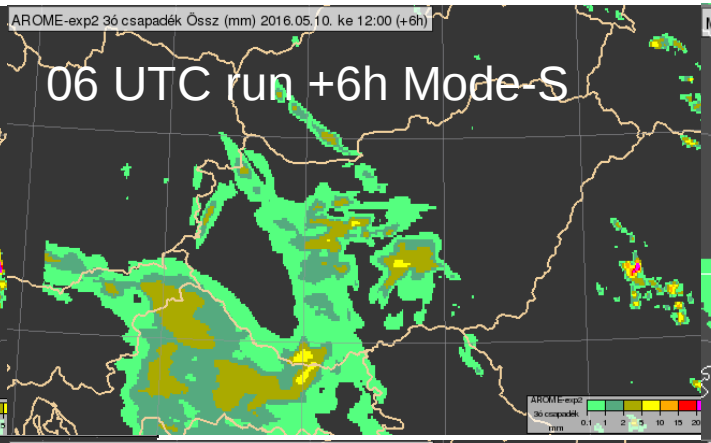
Outline

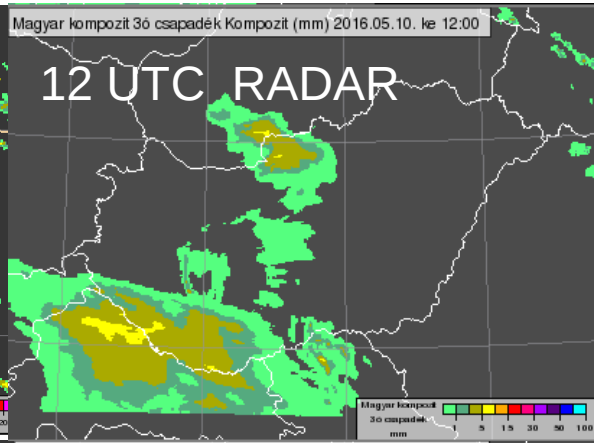
- The use of Mode-S MRAR data
  - Case study
  - Investigation of a winter period
- The use of AMDAR humidity data
  - Implementation of the DA system
  - Case studies (conditions: takeoff or landing from Budapest + interesting weather situation from this year)
  - Investigation of a summer period

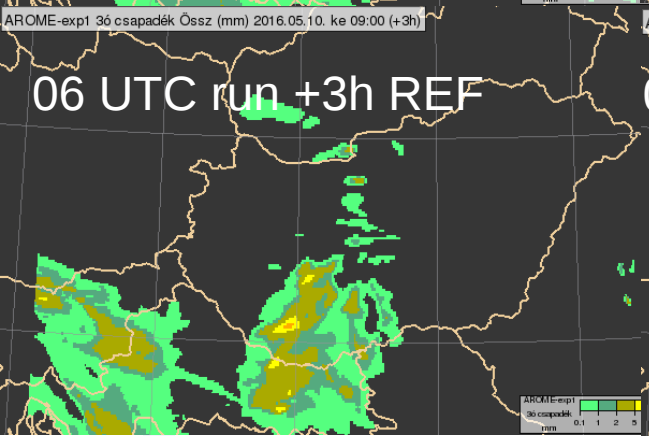
Assimilation of Slovenian Mode-S MRAR observations

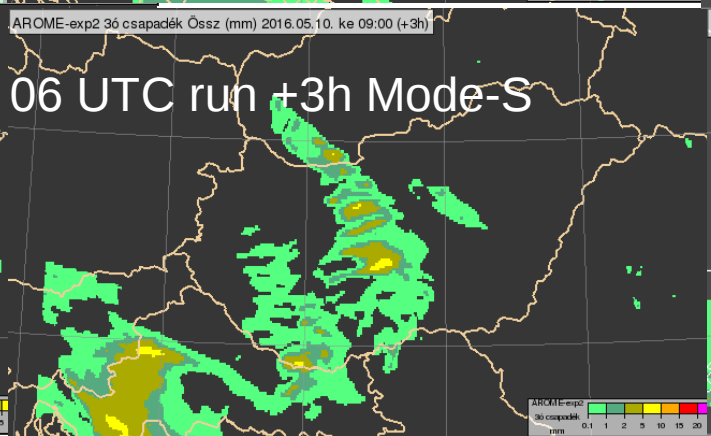
- Case study: 10th May 2016
- Cyclone from direction of Slovenia

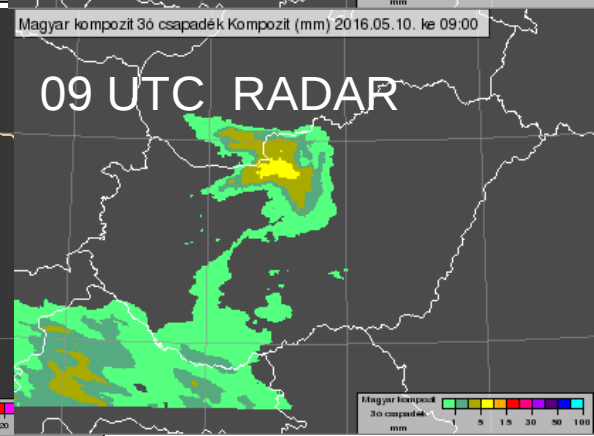






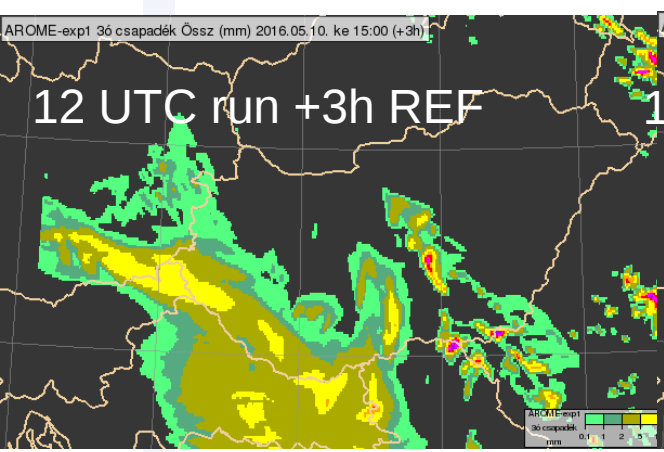


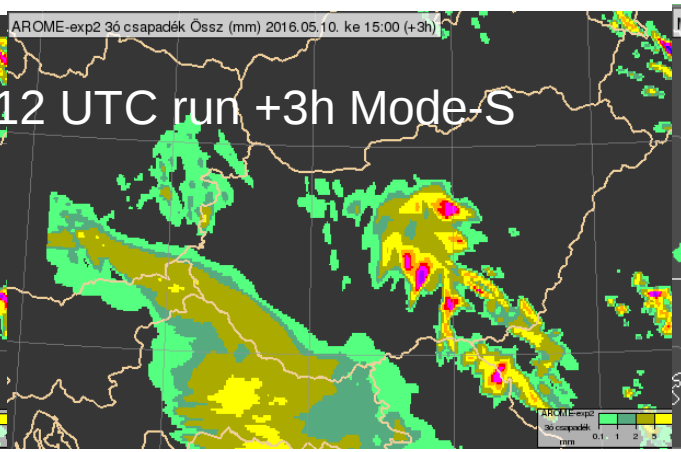


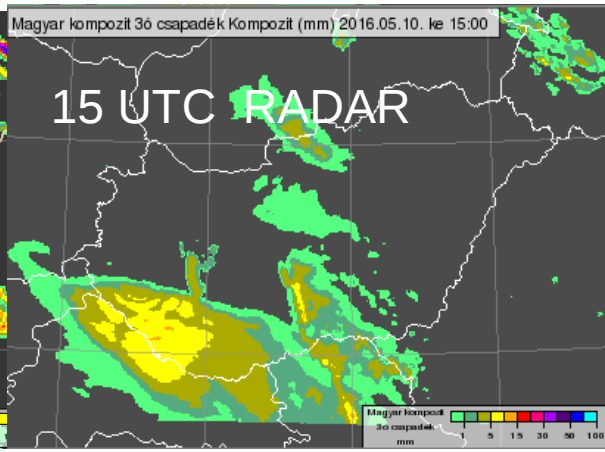


Assimilation of Slovenian Mode-S MRAR observations

- Case study: 10th May 2016
- Cyclone from direction of Slovenia







Assimilation of Slovenian Mode-S MRAR observations

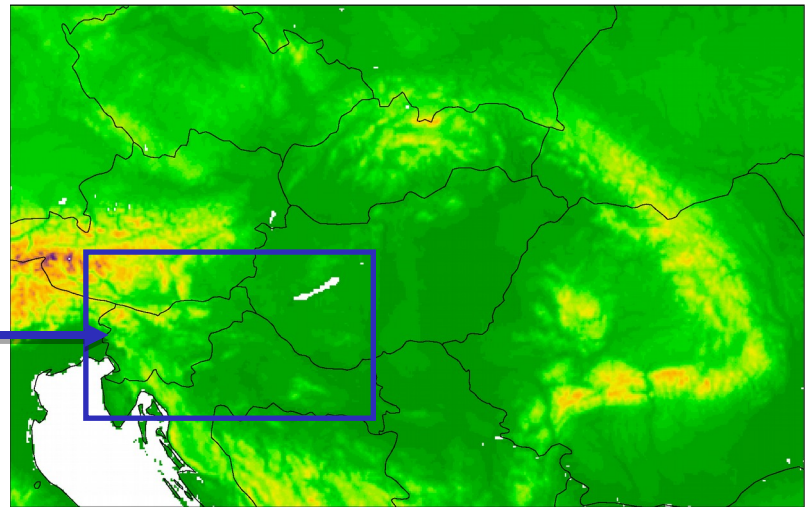
- Experimental run during longer period with Mode-S data from Slovenia → observations arrives from a small area compared to the AROME domain ➔ verification scores were calculated over a smaller domain (Slovenia + southwest Hungary)

Setup for the experiment:

- 3-hour assimilation cycle
- Period: 6 – 31 December 2015

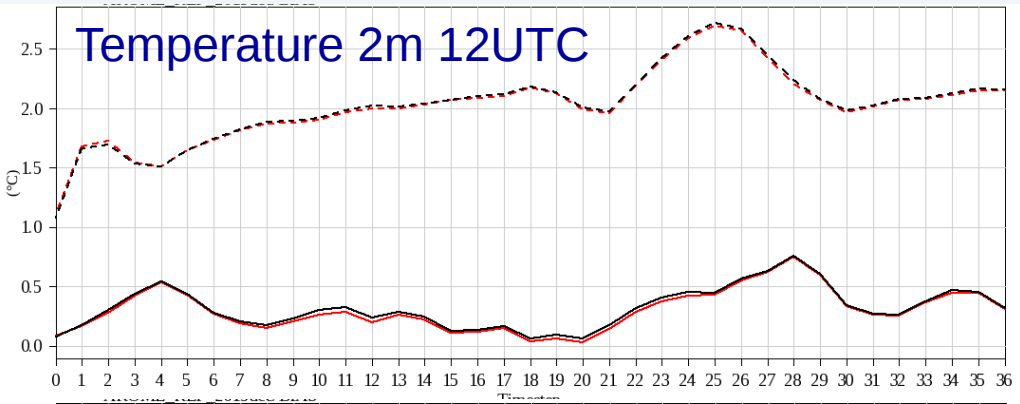
AROME domain

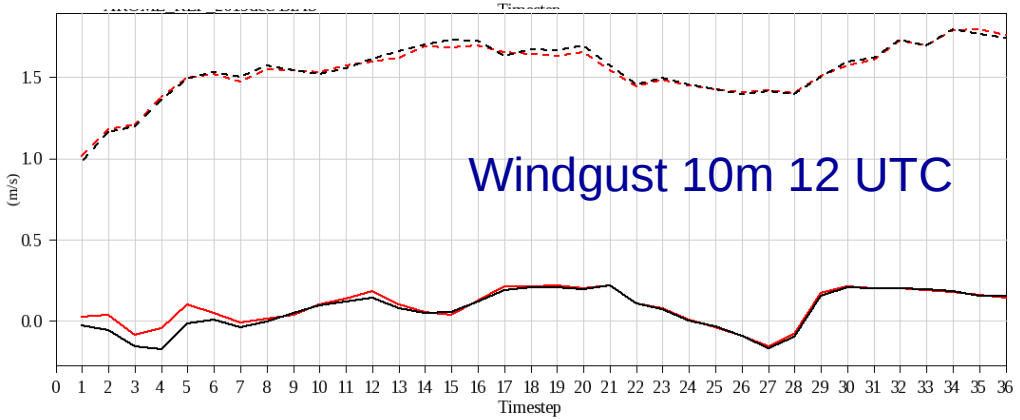
Domain used for verification

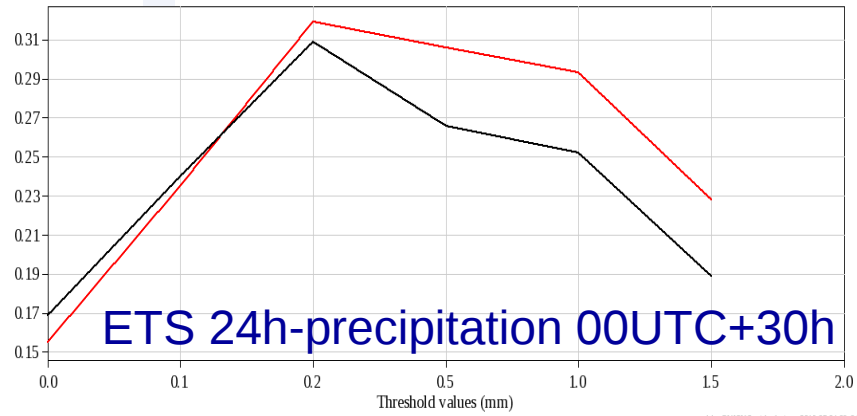


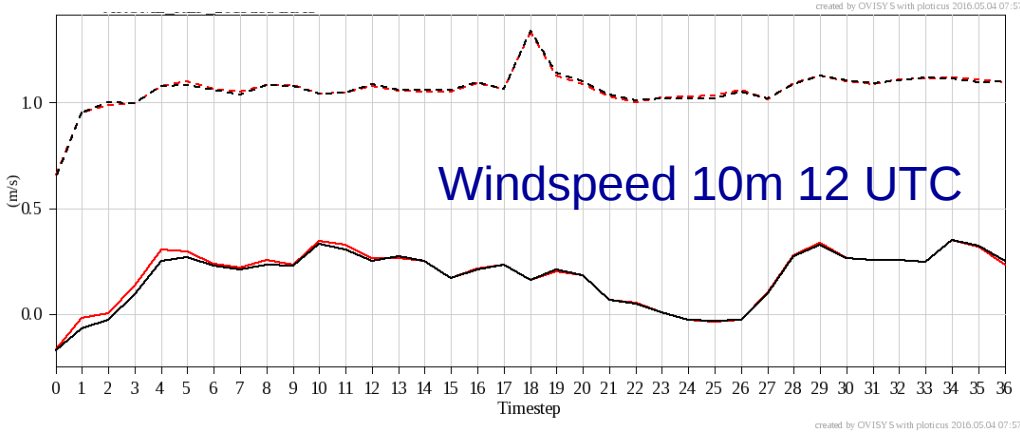
Assimilation of Slovenian Mode-S MRAR observations

- Mainly neutral impacts, small differences
- **REF** – reference: operational configuration was used (no Mode-S)
- **EXP** – additional Mode-S data









Assimilation of AMDAR humidity

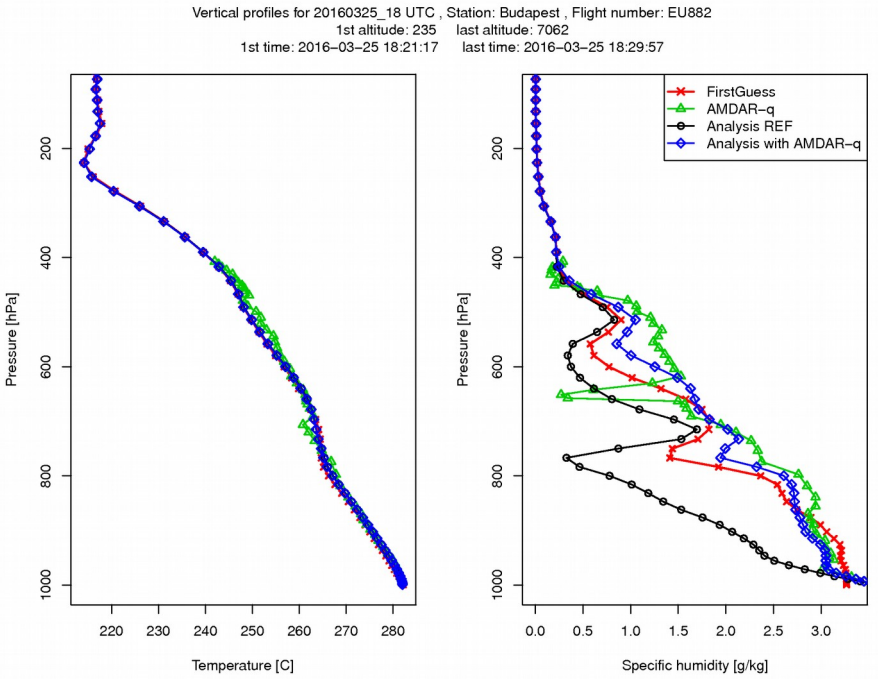
Implementation of this type of data in our DA system:

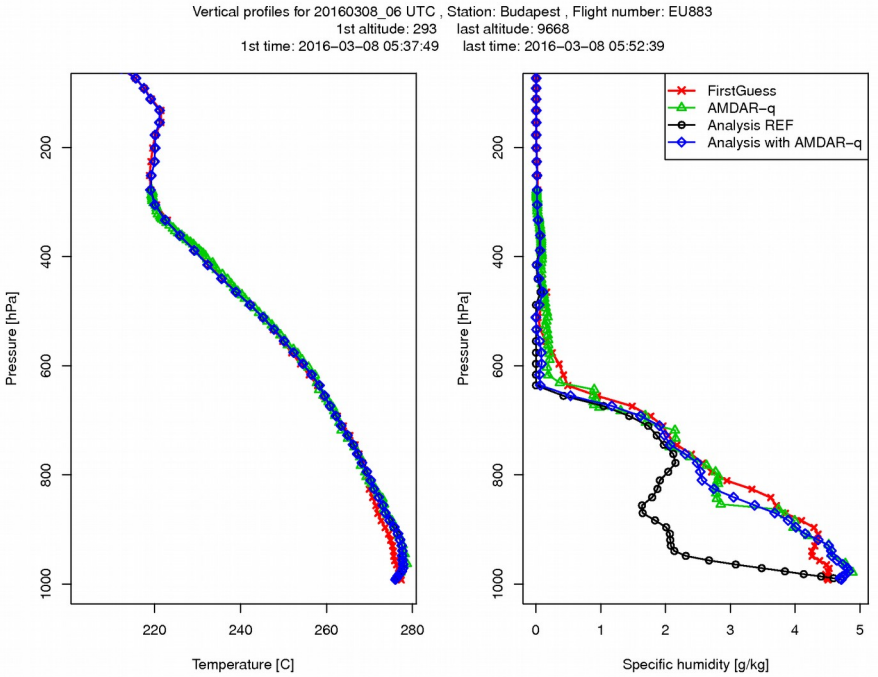
- earlier in **mf_blacklist.b** file only T,u,v data was allowed for use in case of AMDAR data – q was implemented in this section
- in &NAMJO section of **namel_minim** namelist file the proper number was set to 0
- data were read from OBSOUL file as other AMDAR data – in the first experiments they were added manually but now it is automatic ($б_o$ errors were computed similar to TEMP)

```
&NAMJO
  LTC=.FALSE.,
  NOTVAR(1,1)= 0, 0,-1,-1,-1, 0,-1, 0,-1,-1, 0,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,2)= 0, 0,-1,-1,-1,-1, 0,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1, 0,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,3)= 0, 0,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,4)=-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,5)=-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,6)= 0, 0,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,7)=-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1, 0,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,8)=-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,9)=-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  NOTVAR(1,10)=-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,-1,
  LQSCATT=.TRUE.,
/
```

Assimilation of AMDAR humidity

- useful information about the vertical structure of the troposphere beside radiosondes → more frequent observations and good agreement with TEMP profiles
- temperature and specific humidity profiles at 06 UTC and 18 UTC (on different days)
- all available conventional observations were assimilated (no TEMP at this time)
  AMDAR humidity included or not



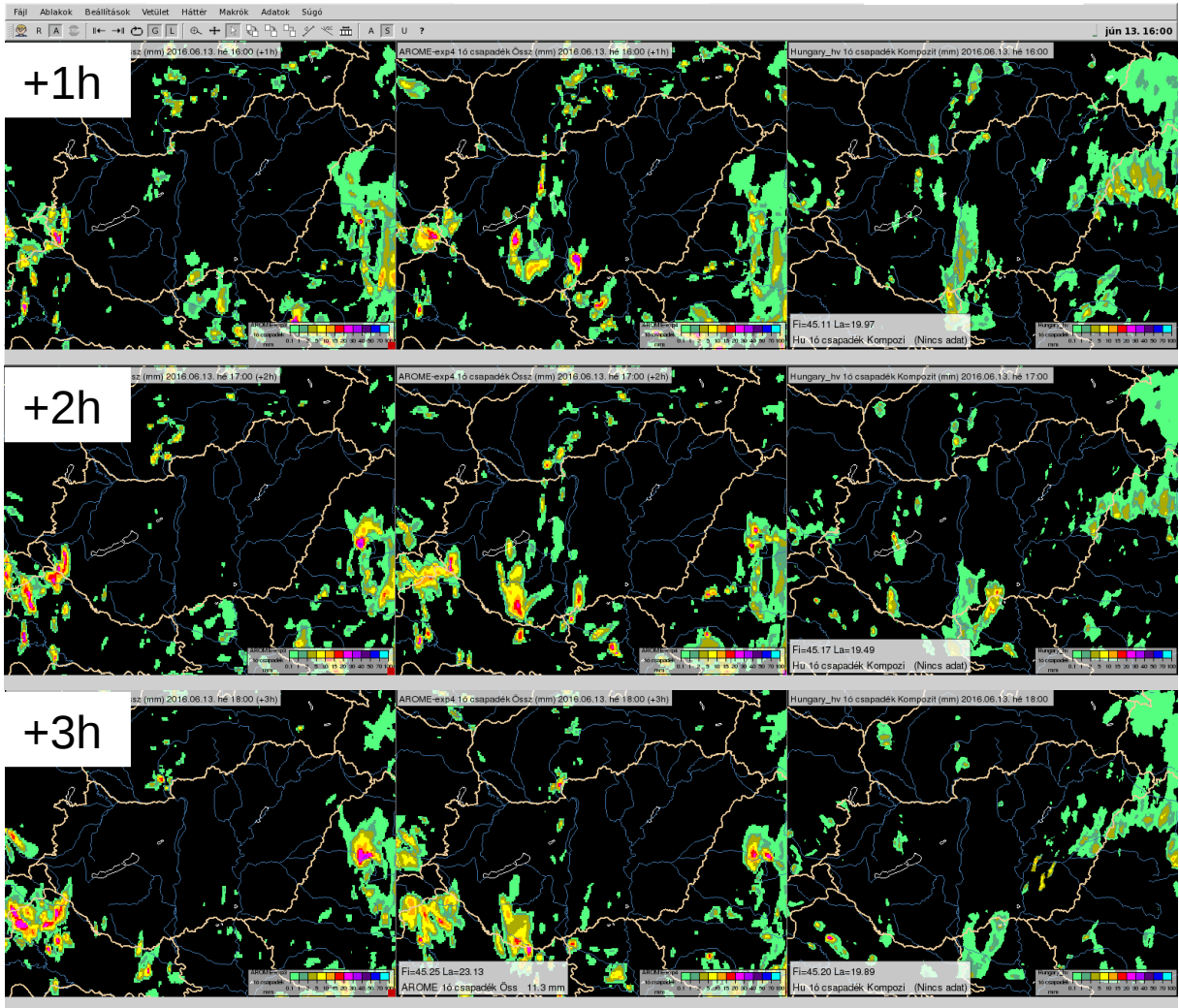


Assimilation of AMDAR humidity

- Case study:
  13th June 2016
  15UTC run
- Cyclone over Middle-Europe
  → heavy precipitation in Hungary

1h precipitation

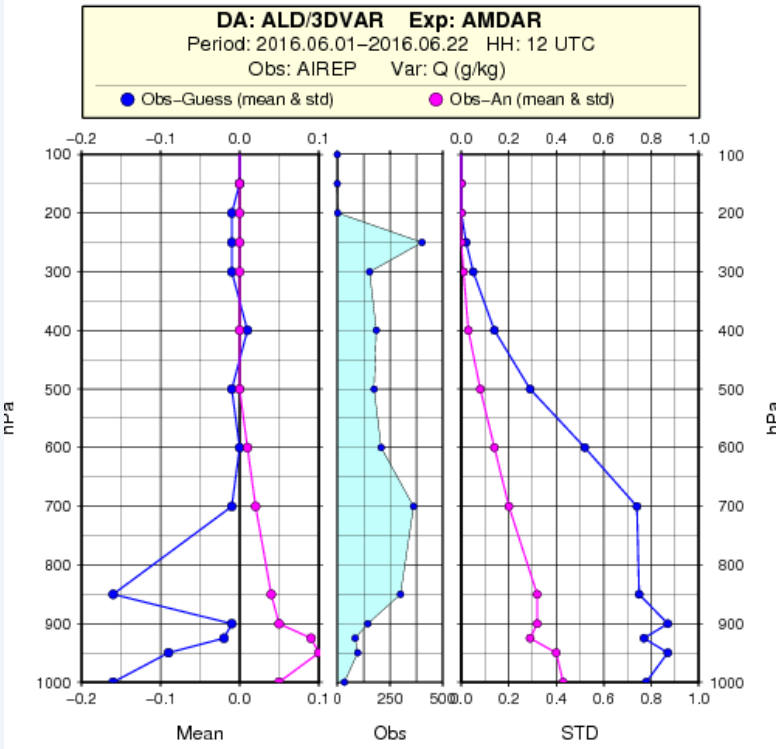
REF **AMDAR-q** **RADAR**

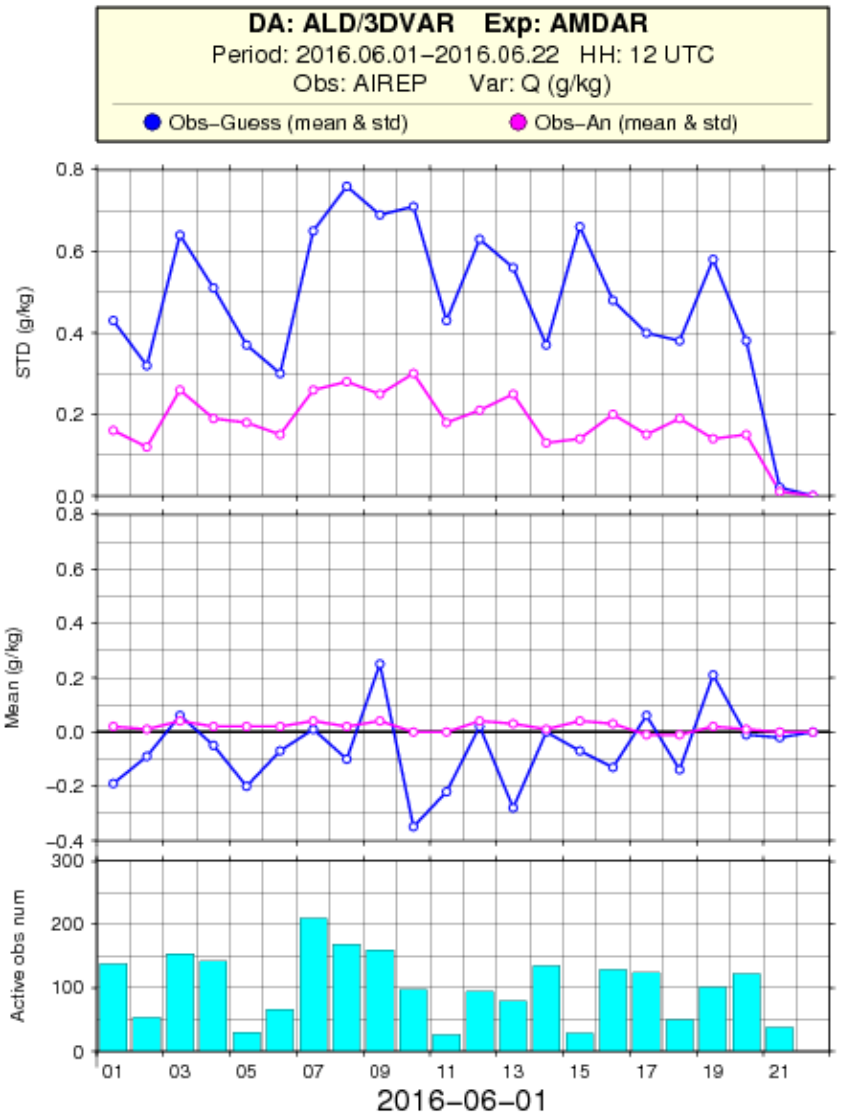


Assimilation of AMDAR humidity

Longer period:

- 01 – 22 June 2016
- +24h forecasts from 00 UTC, 09 UTC & 12 UTC



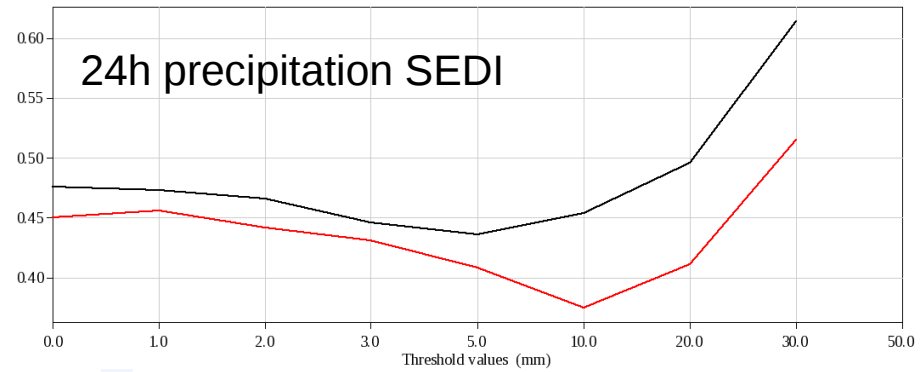


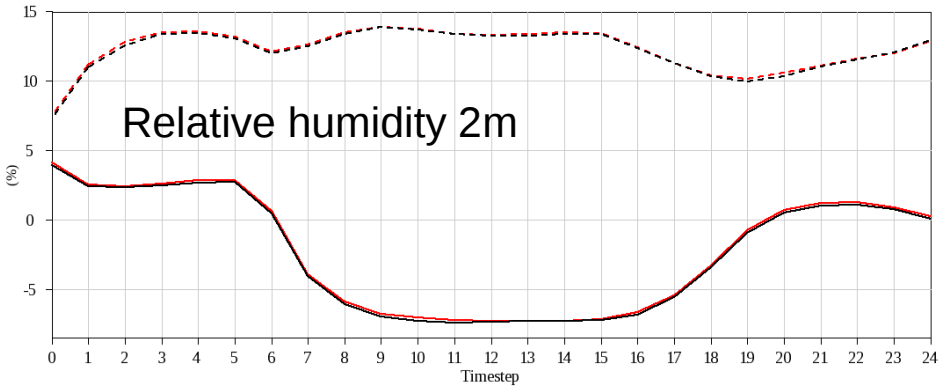
Assimilation of AMDAR humidity

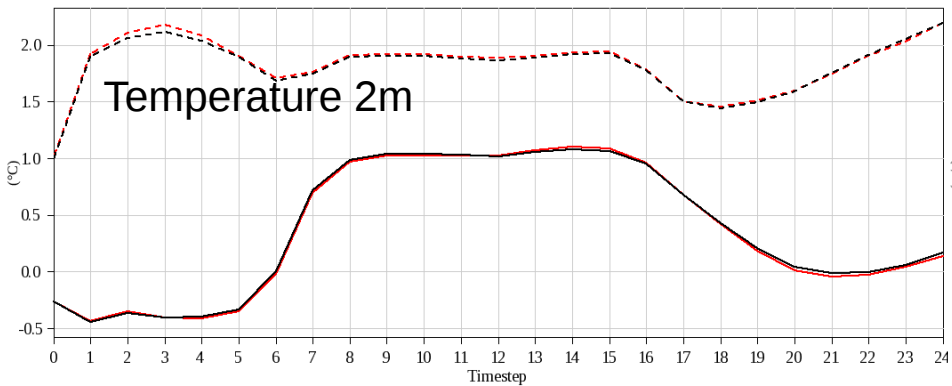
Longer period:

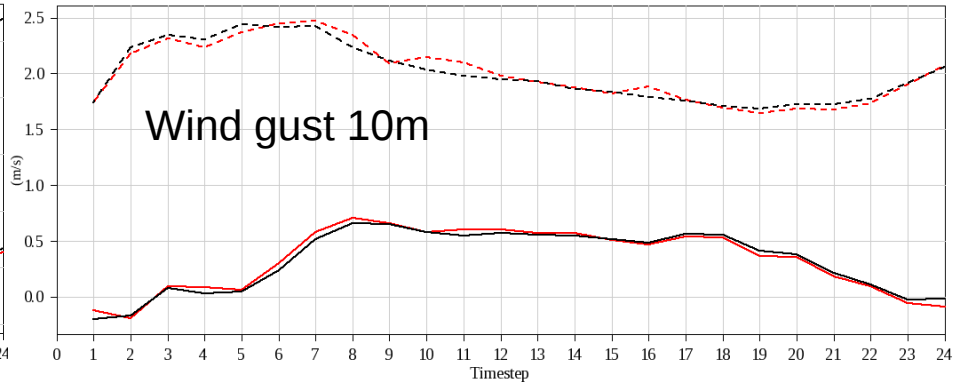
- 01 – 22 June2016
- +24h forecasts from 00 UTC, 09 UTC & 12 UTC
- **OPER** – operational run (no AMDAR-q)
- **EXP** – additional AMDAR-q data

12 UTC run







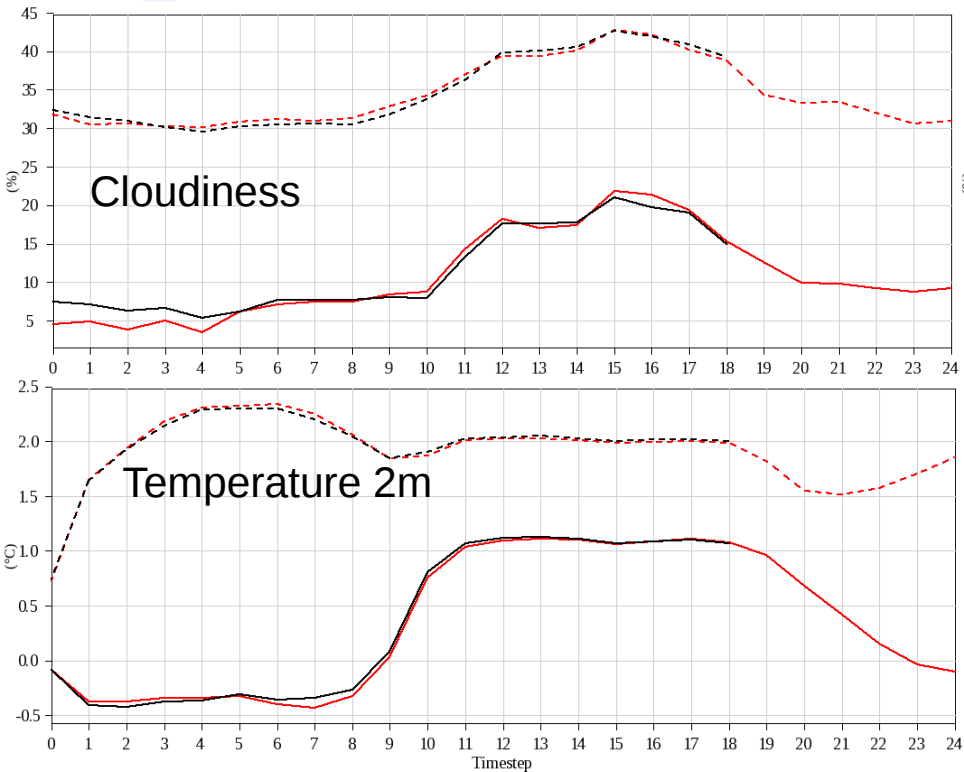


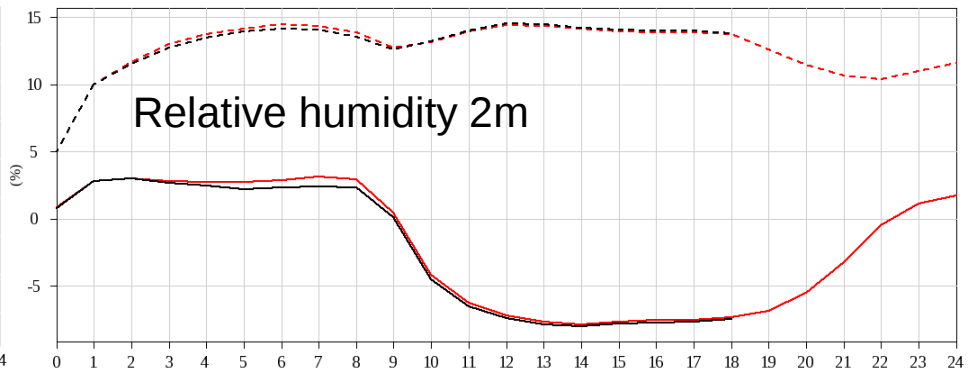
Assimilation of AMDAR humidity

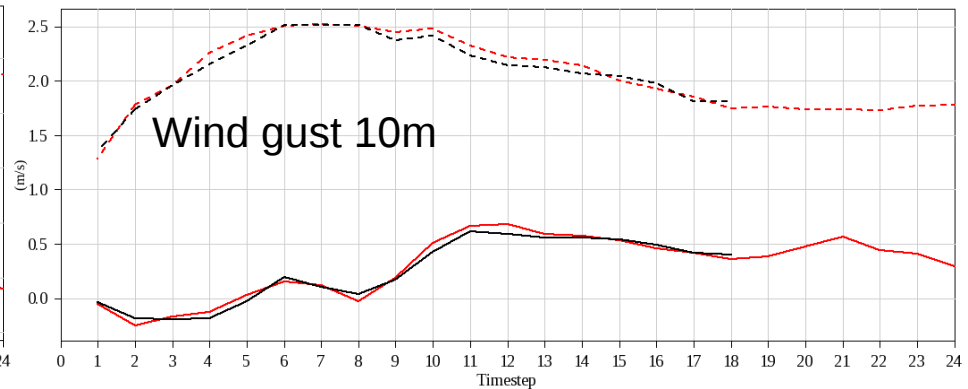
Longer period:

- 01 – 22 June2016
- +24h forecasts from 00 UTC, 09 UTC & 12 UTC
- **OPER** – operational run (no AMDAR-q; +18h forecast)
- **EXP** – additional AMDAR-q data

09 UTC run



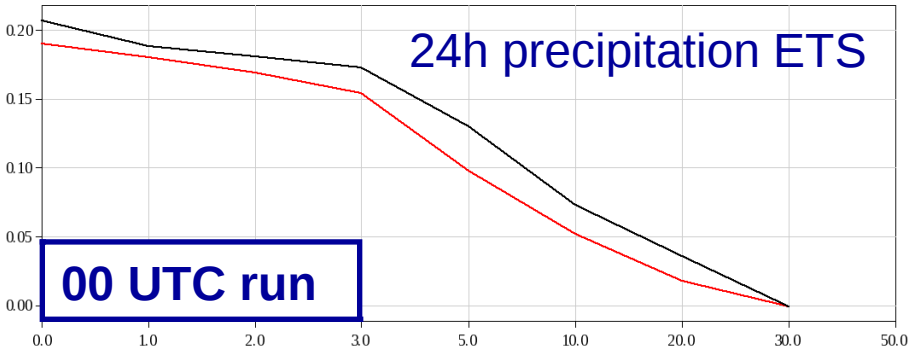


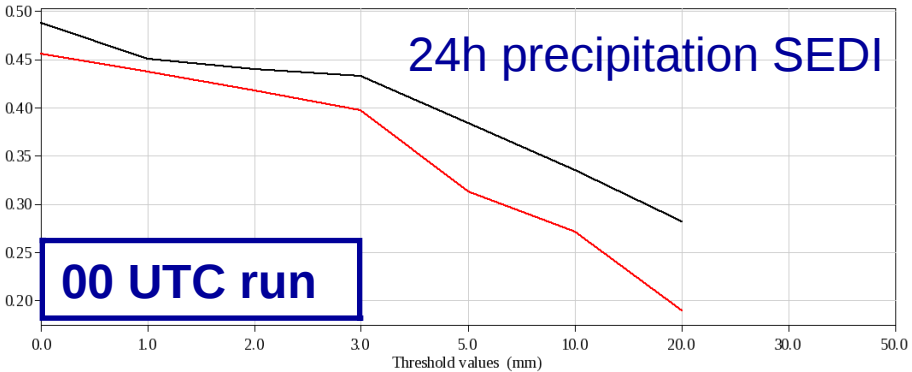


Assimilation of AMDAR humidity

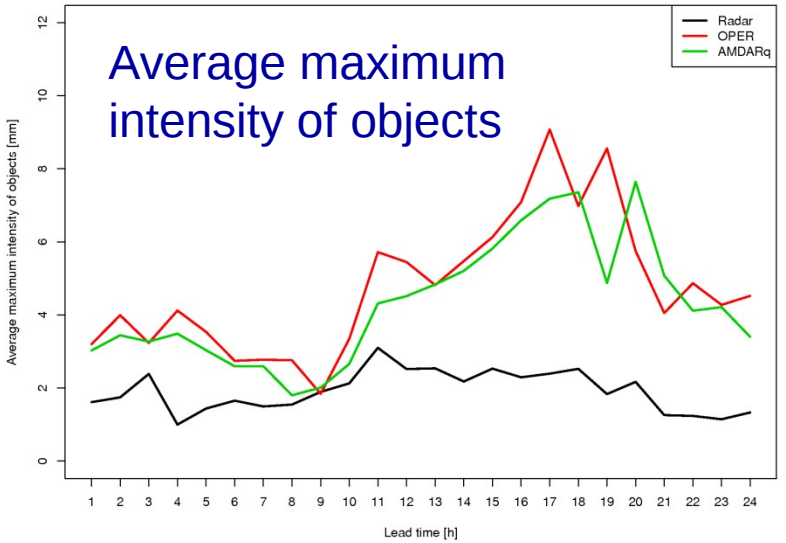
Result of SAL verification of precipitation:

- A little improvement in the 00UTC run
- Similar results at 12UTC

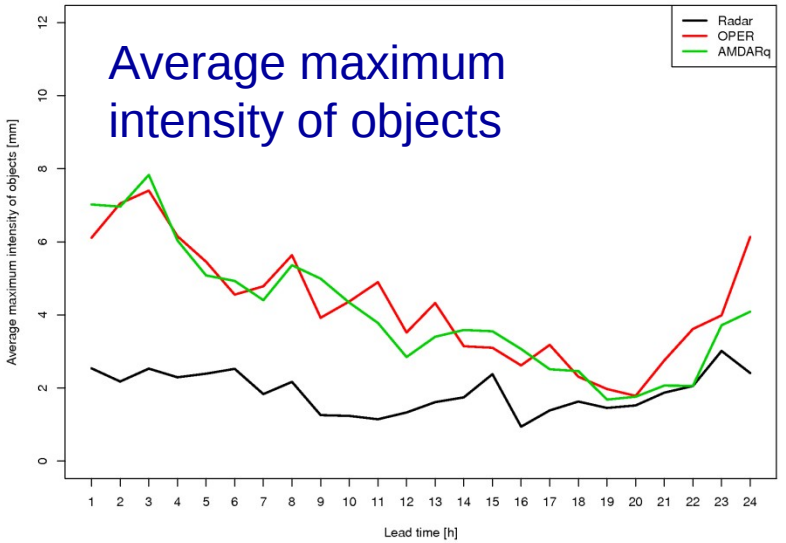




00 UTC run



12 UTC run



Conclusions

- The use of Mode-S data:
  - Mainly neutral impact over Hungary in winter

- The use of AMDAR humidity data:
  - Not too much data yet
  - At 00 and 12 UTC TEMP data are also available → we expected bigger impact at 09 UTC
  - Positive impact in cloudiness but negative impact in precipitation against SYNOP

Thank you for your attention!

Alapítva: 1870