Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Assimilation of OPERA reflectivity – preliminary study

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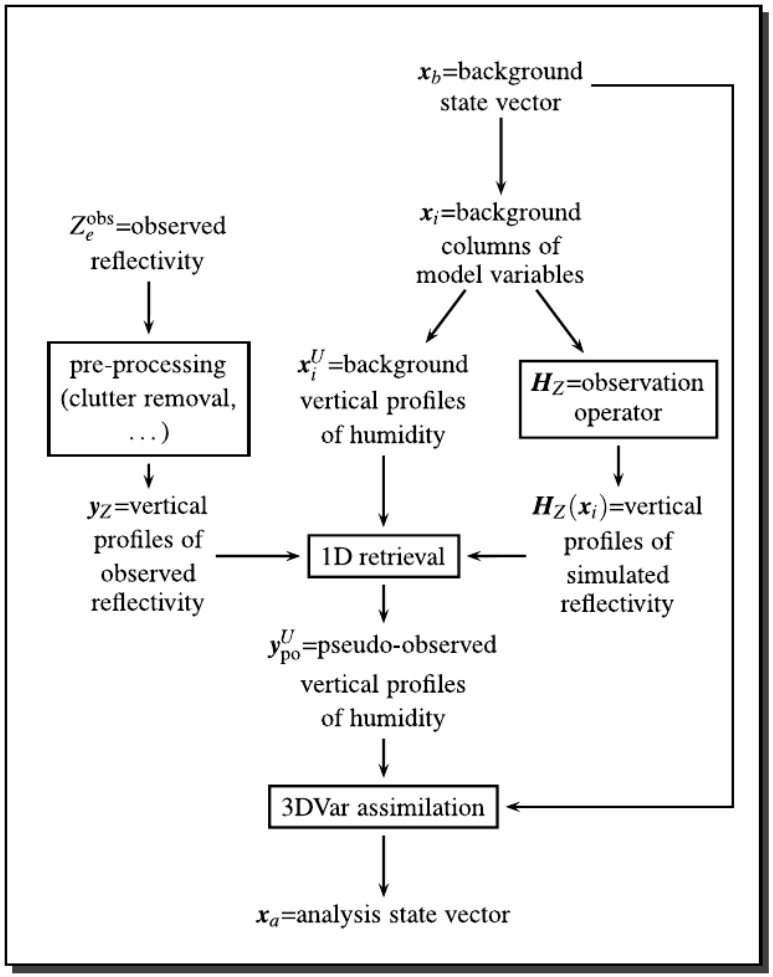
Outline

- Introduction: radar DA in ALADIN
- Code and preprocessing
- Passive evaluation of OPERA/OIFS data set (2 weeks)
- Active assimilation (2 weeks):
  - Case study
  - Scores
- Conclusions

Assimilation methodology

- 1D Bayesian inversion + 3D-Var [Watterelot et.al (2014), based on Caumont (2010, 2012)]
- Uses hydrometeor information without modifying them!
- No need for linearized *H* nor to extend the control vector
- Depends on realism of first guess (i.e., that relevant RH profiles are available).



Code and preprocessing

- Model version cy43bf10.
- **BATOR:**
  - Initial thinning of 10 km, to speed up reading
  - Used reflectivites up to 160 km distance from radar
  - Uses values where total quality index > 0.7 (the choice was set by MF after evaluation)
  - Gross errror check and clutter removal: reflectivity < 100 dBZ, and difference between TH and DBZH less then 3 dBZ.
- **SCREENING:**
  - RFIND = 15 km, RMIND = 10 km
- **MINIMIZATION:**
  - Small correction to routine gfl_subs_mod.F90 (L771-773) needed to avoid seg. faults in minimization

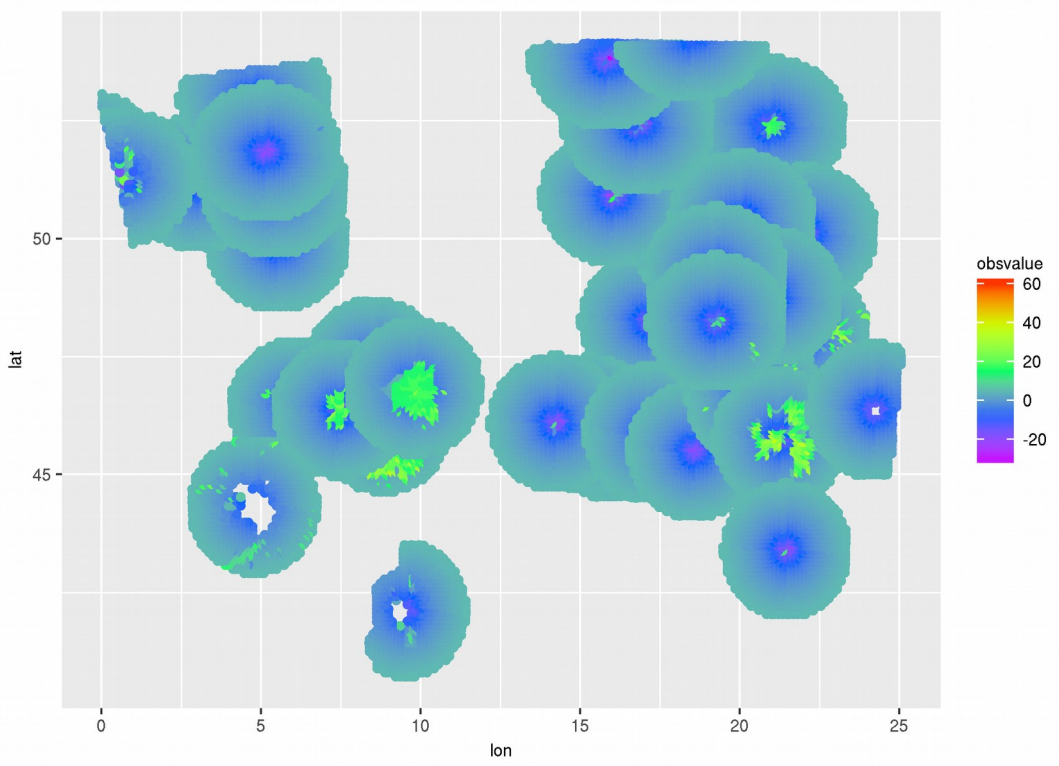
    ! CALL FALSIFY_GFL_COMP(YR)

    ! CALL FALSIFY_GFL_COMP(YS)

    ! CALL FALSIFY_GFL_COMP(YG)
  - NOTVAR: enable RH for obstype 13

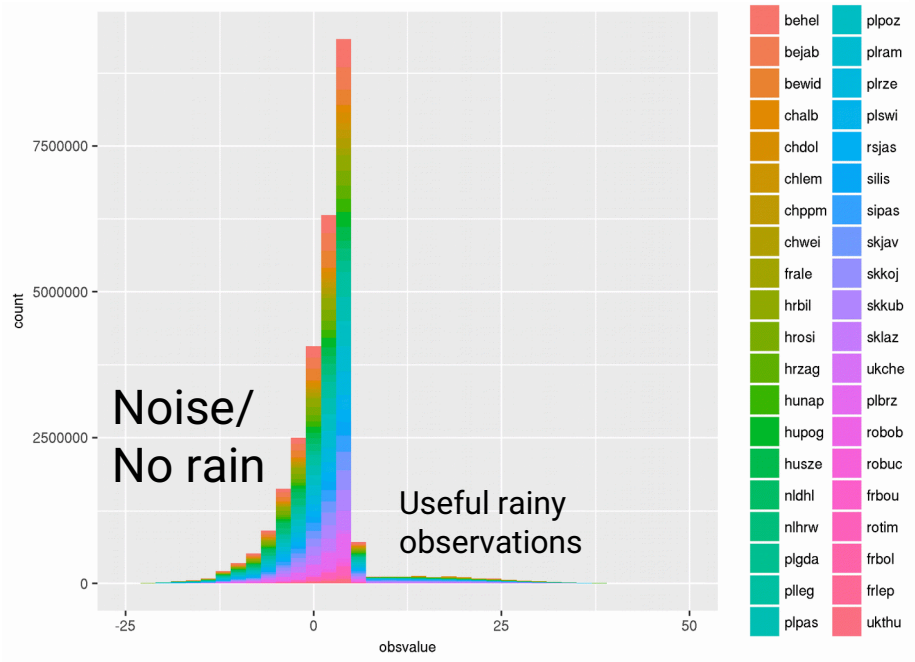
OPERA/OIFS dataset

- 15 days of data were considered (20 May – 5 Jun 2019). Used all data which passed default tests/reqirements in HOOF.
- German radars were rejected because some reflectivity scans do not have quality groups (this is to be reconsidered in HOOF!).

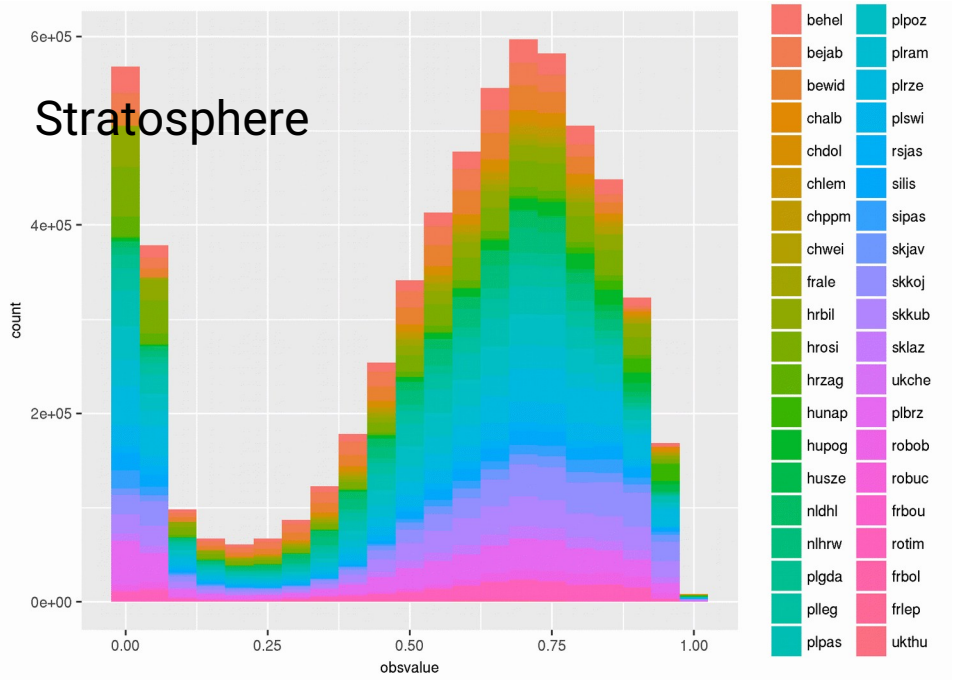


Passive evaluation: reflectivity/RH retrieval statistics

Reflectivity [DBZ]



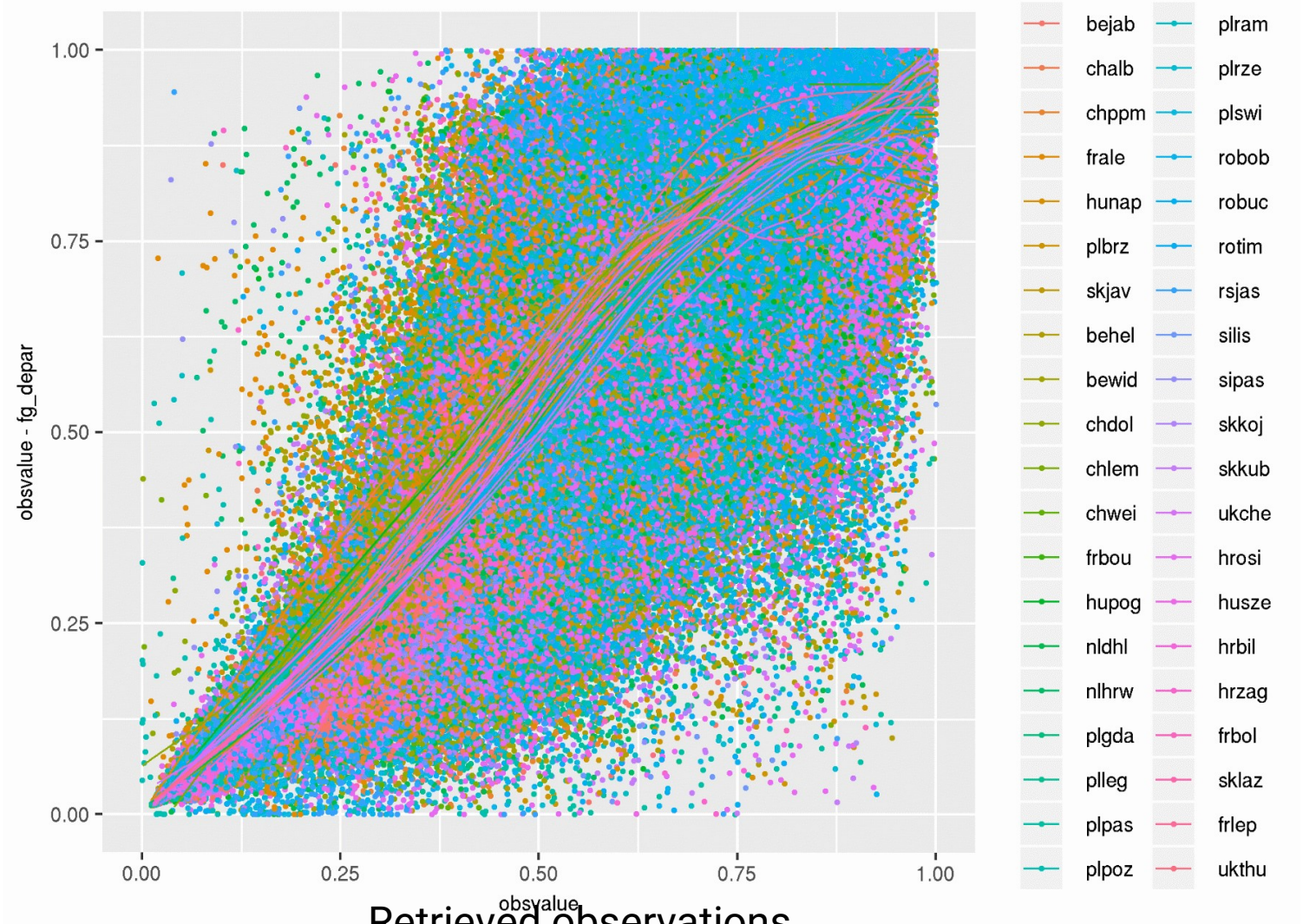
RH values from profiles [%]



Troposphere

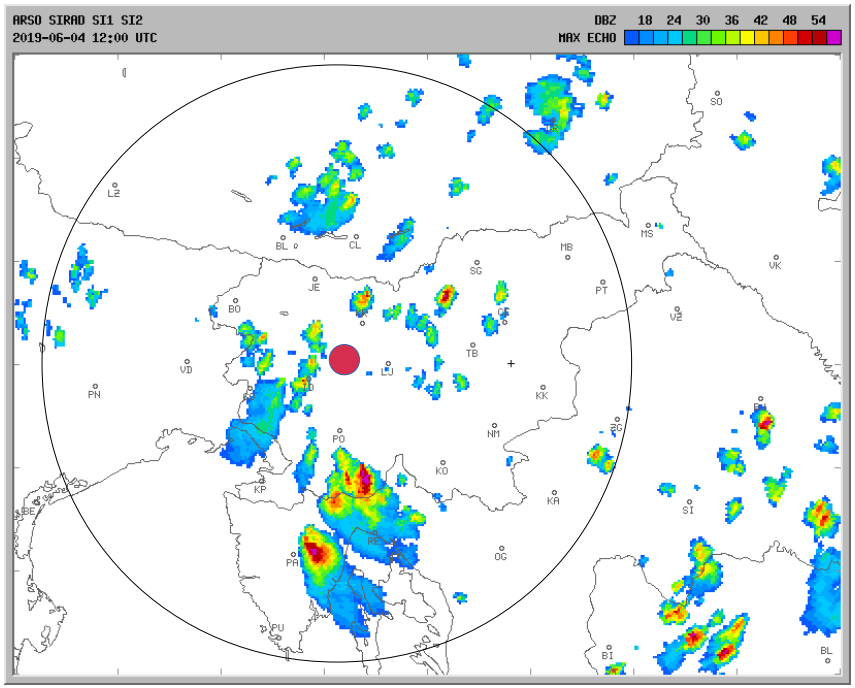
Passive evaluation: Obs-minus-guess departures

Model

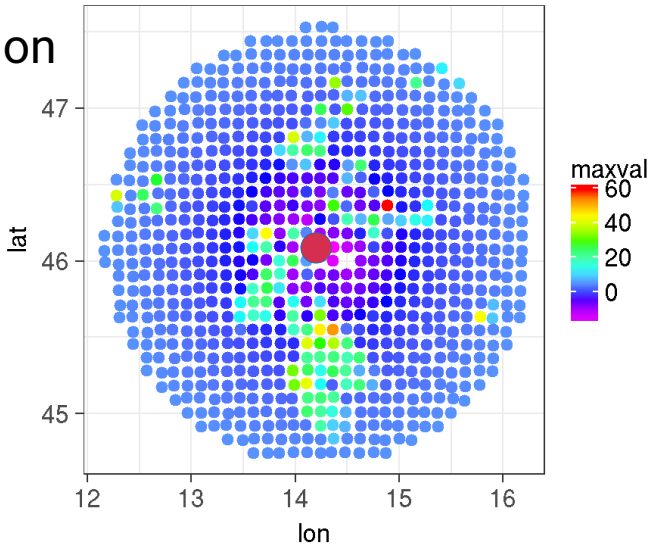


Retrieved observations

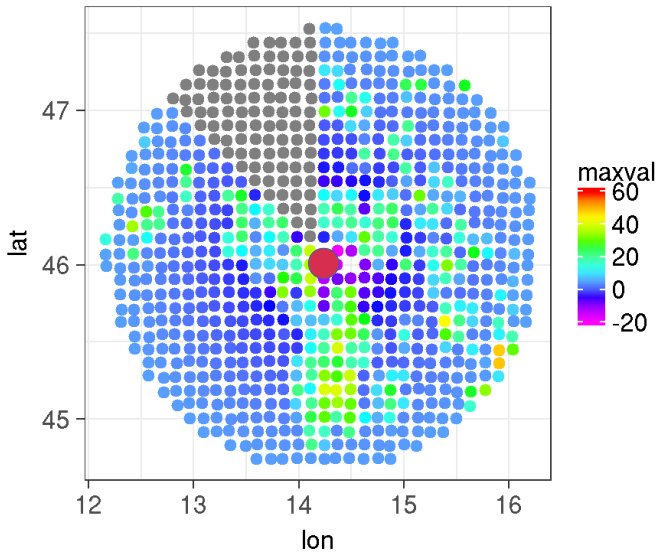
Case study: 2019-06-04 12 UTC, site sipas



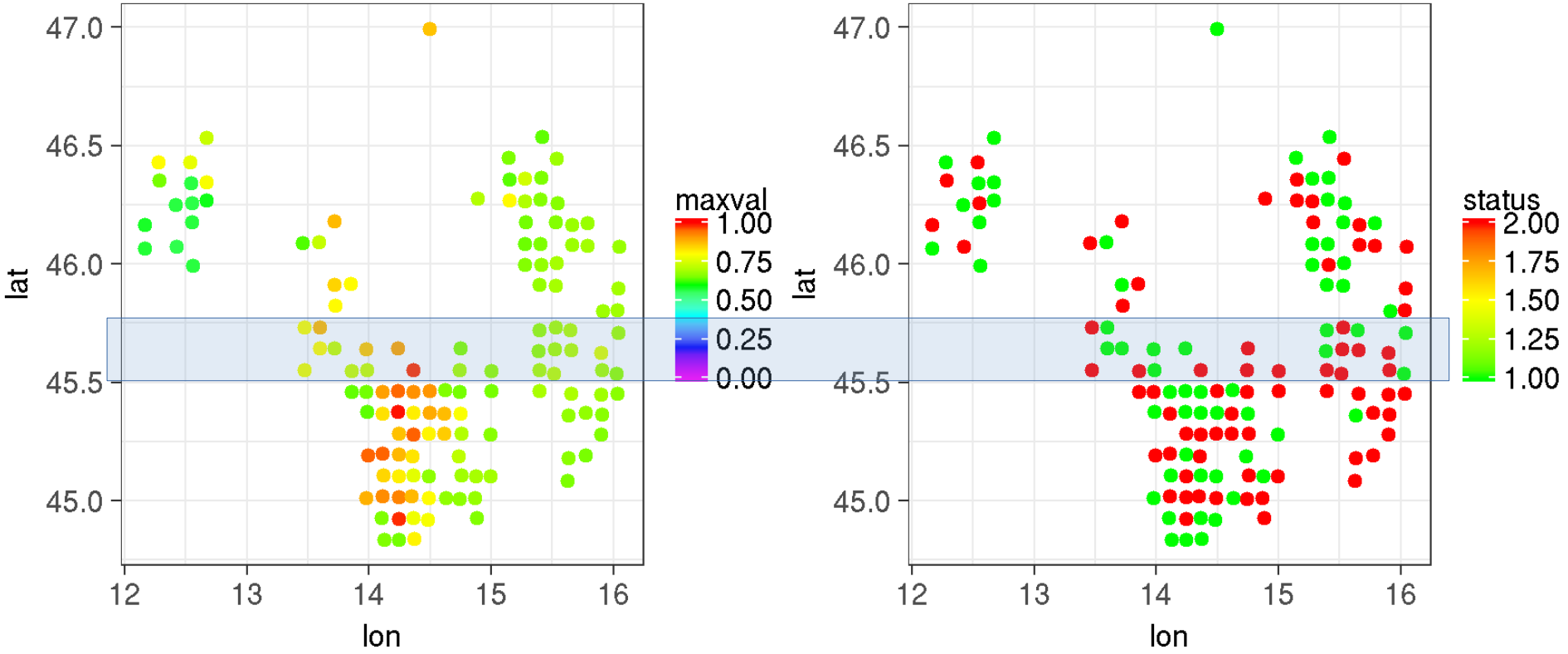
Observation



Guess at obs. points

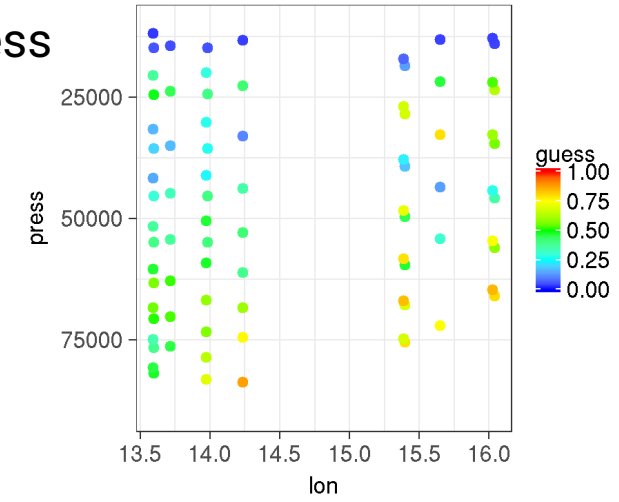


Pseudo-obs RH profiles and status in assimilation

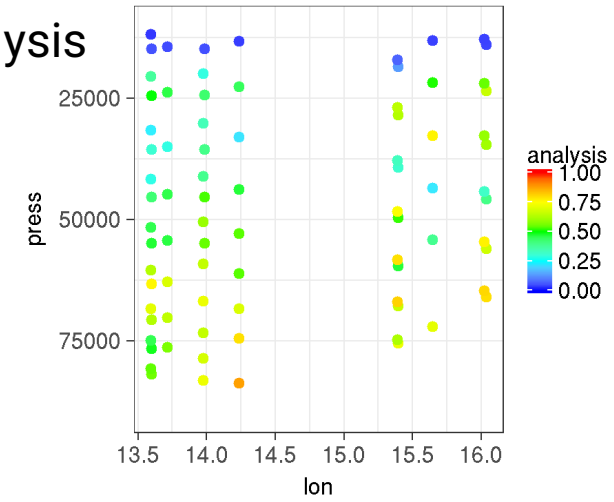


RH profile assimilation

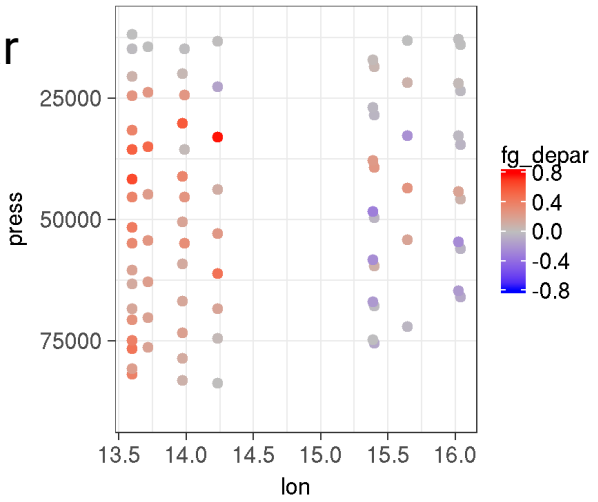
Guess



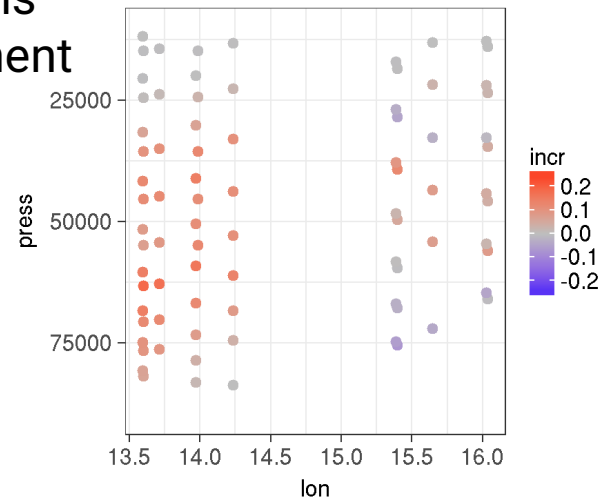
Analysis



FG depar

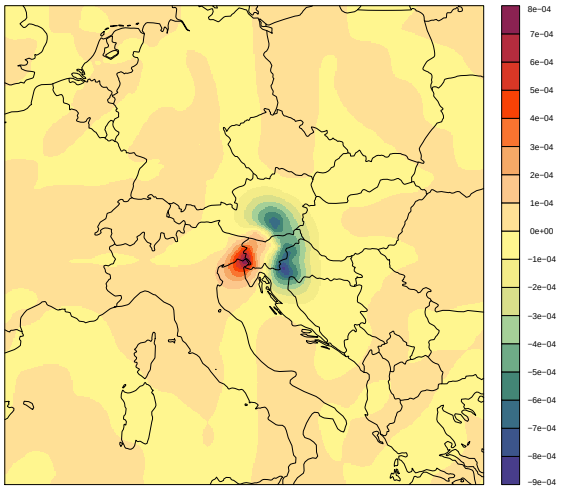


Analysis increment

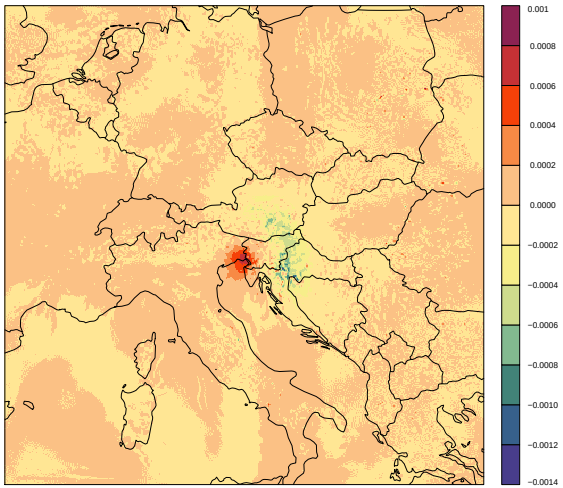


Evolution of humidity obs.increment

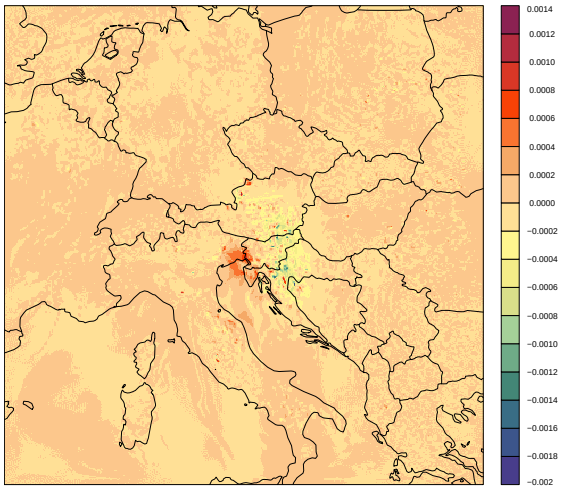
Analysis



1h forecast

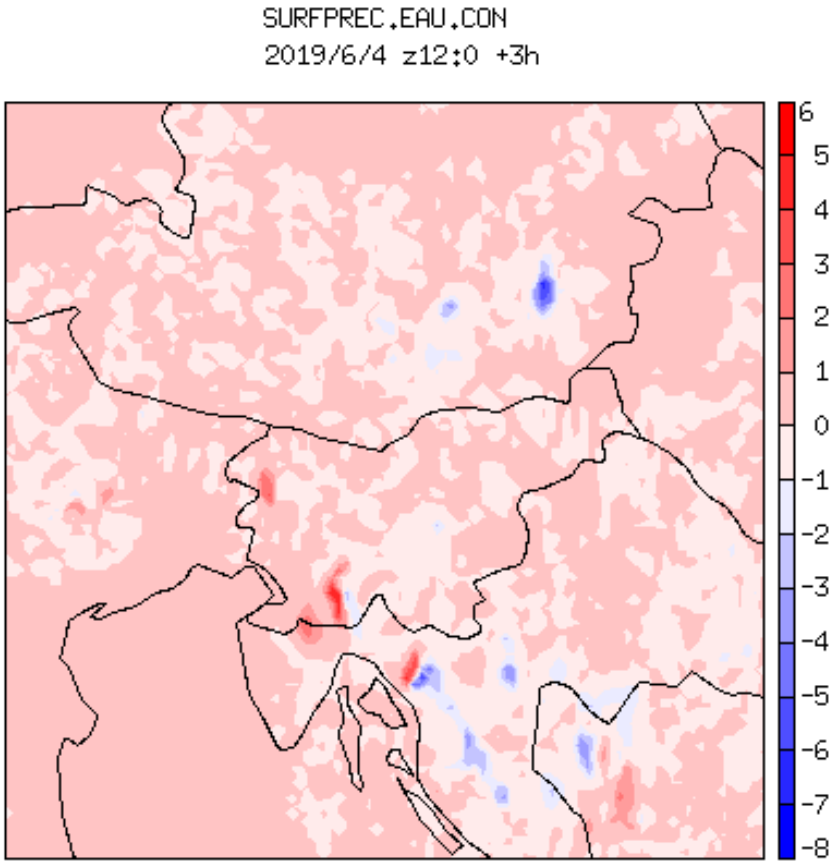


2h forecast



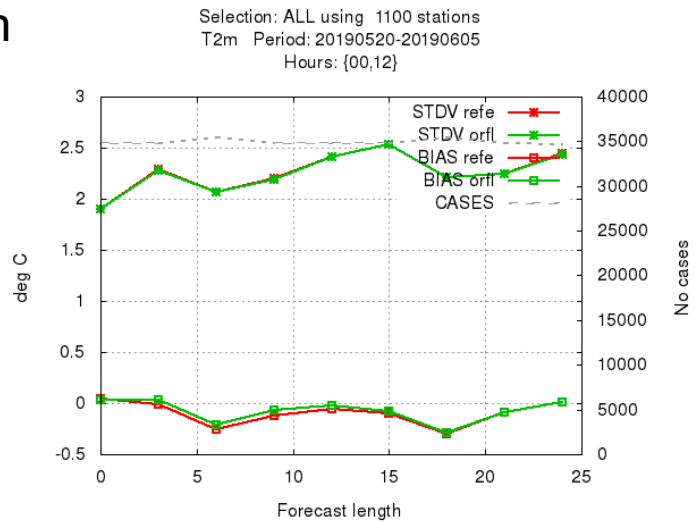
Impact on 3h precitiptation

Difference with/without SIPAS radar

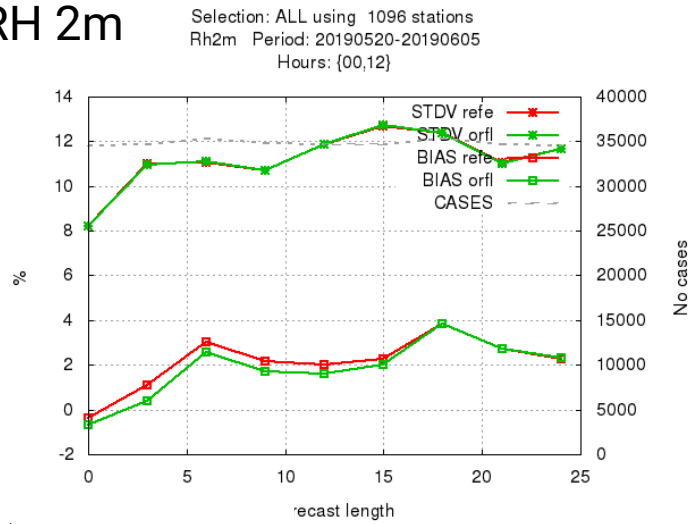


Impact on forecast scores - surface

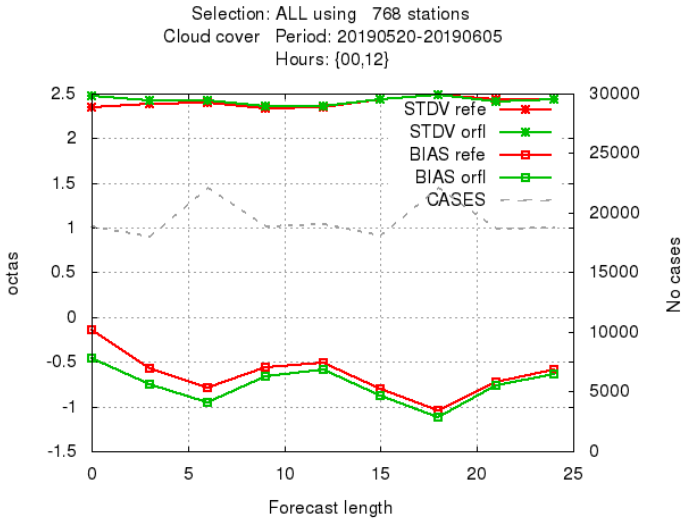
T 2m



RH 2m

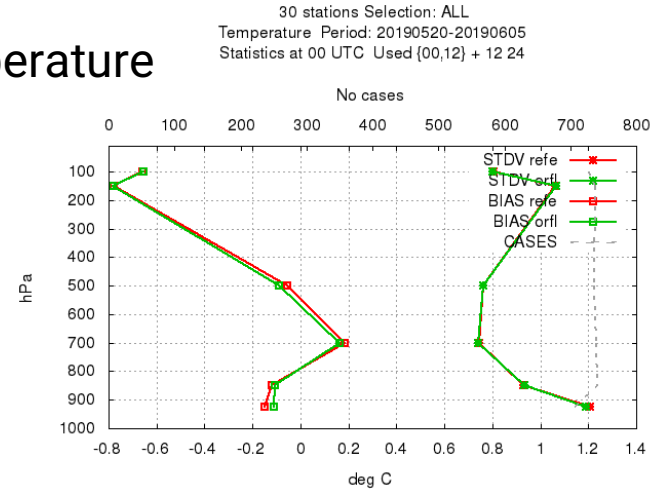


Cloud cover

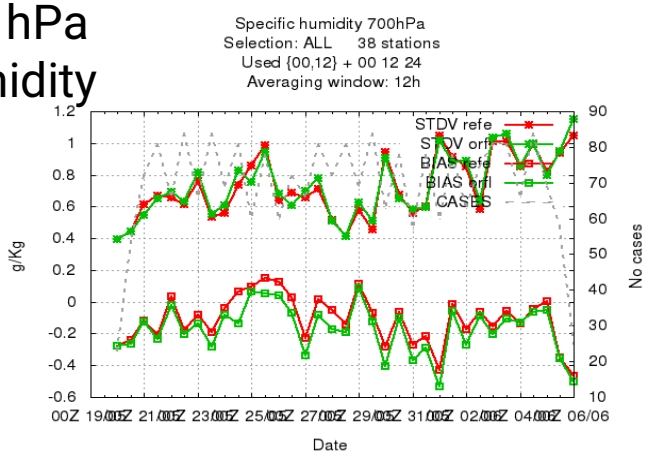


Impact on forecast scores – upper air

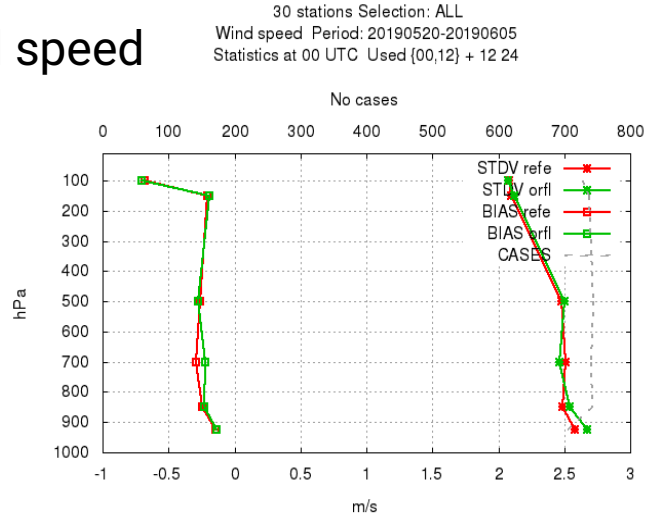
Temperature



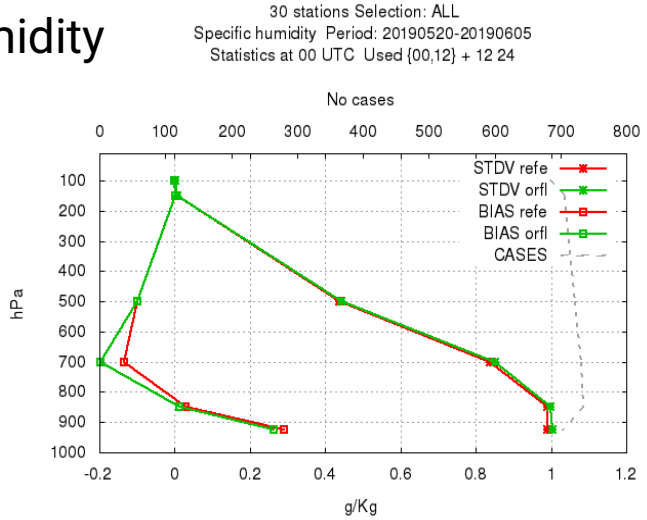
700 hPa humidity



Wind speed



Humidity



Conclusions

- Reflectivity assimilation works (with ALARO)
- Issues:
  - DE radars/might need to slightly modify HOOF
- Over the (short) test period, radar DA mostly contributed to drying the atmosphere:
  - Degraded upper-air humidity bias
  - Improved temperature bias
  - Slightly improved wind
  - Improved surface scores
- Further evaluation to be focussed on hourly verification of precipitation and repeated on future 1.3 km domain