Regional Cooperation for
Limited Area Modeling in Central Europe

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QC analysis of ”new” observations

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Motivation

- to extend use of existing observations
- currently assimilated observations within 6h BlendVar:
  - SYNOP (Ps), TEMP (t, q, u, v), AMV,
  - AMDAR (t, u, v), Mode-S MRAR CZ (t, u, v), Mode-S EHS from KNMI (t, u, v)
  - SEVIRI (channels: 2, 3)
- quality assessment of ”new” data - still ongoing
  - validation with respect to NWP model
  - 3 months period of 25 March - 25 June 2019
  - cross-check with comparable (reference) observations, if available

Data

- ”new” observations (from OPLACE, except for Czech MRAR):
  - aircraft: AMDAR, Mode-S EHS (KNMI), Slovenian MRAR & Czech MRAR
  - wind profiler, high-resolution AMV (HRWIND), scatterometer
  - national synoptic observations
- validation with respect to NWP data
  - operational ALARO/CZ 2.3km forecast of various length (6-11h)
  - observations assimilated with +/-30min assimilation window
  - pragmatical decision to get data samples every hour

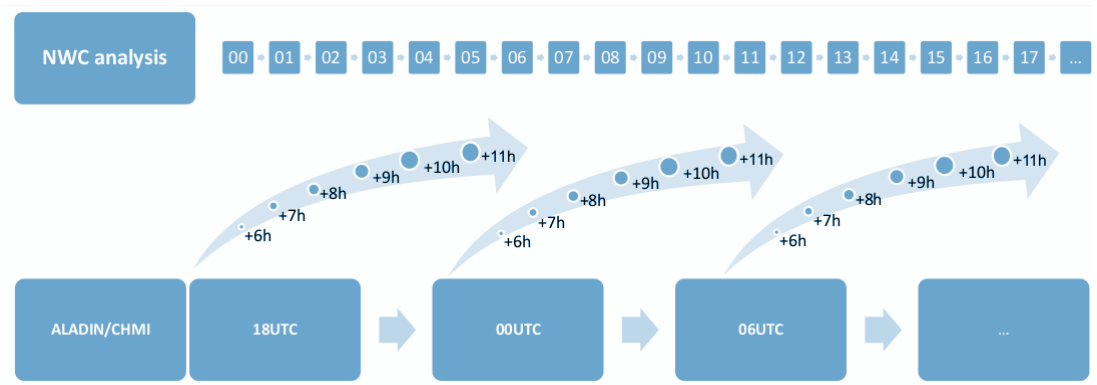


Figure 4: The scheme of the ALADIN/CHMI operational forecast used as the first guess for hourly analyses.

Czech MRAR observations

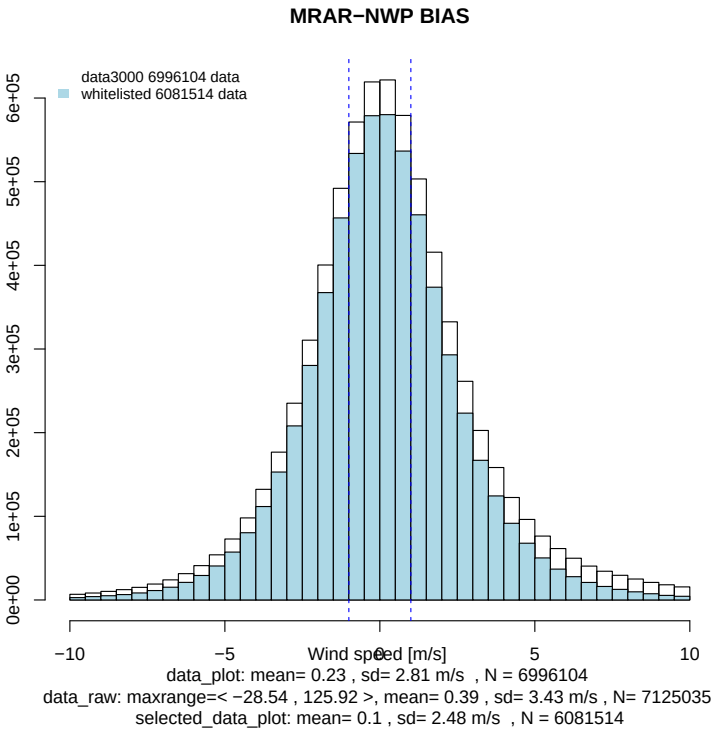
- **quality of Mode-S aircraft data from modern air surveillance system reassessed**
- **good measurements selected based on 3 months statistics (March-June 2019) w.r.t. ALARO/CZ NWP model separately for each aircraft (whitelist) following Strajnar (2012)**
- **aircraft without BIAS & with STD comparable with other observations selected**

var	number of obs	mean	std
temperature	3000	$<$1K	$<$2K
wind speed	3000	$<$1m/s	$<$5m/s
wind direction	3000	$<$10	$<$100

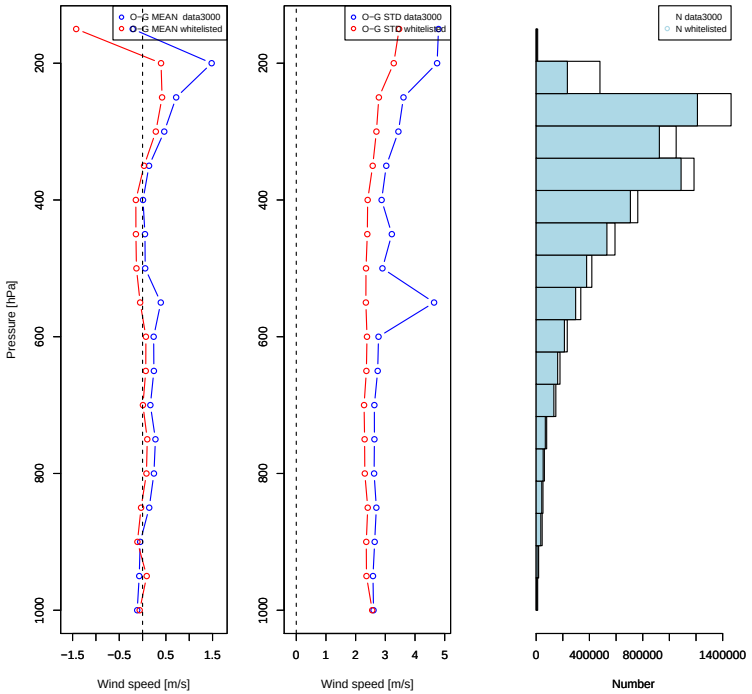
Table 1: Thresholds used to generate Czech MRAR whitelist of aircraft

Czech MRAR observations

CZ-MRAR wind speed

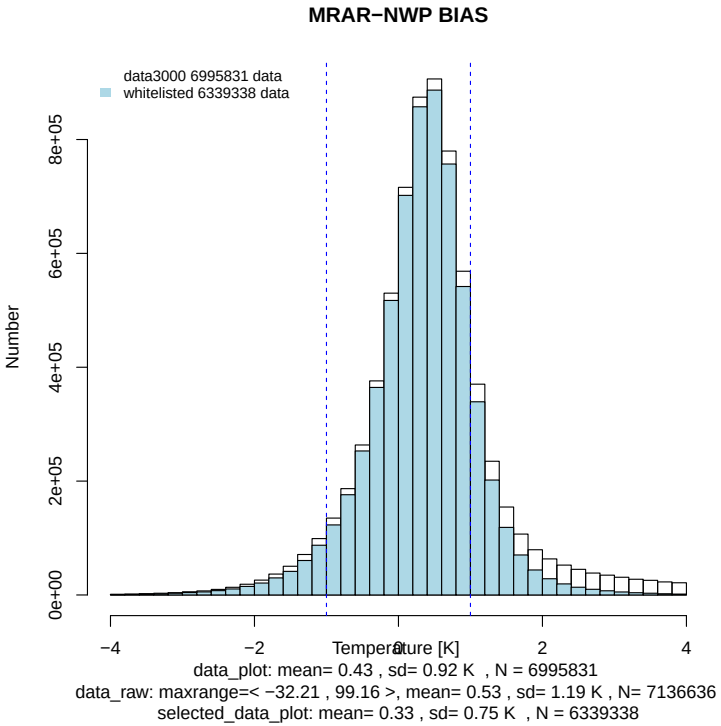


CZ-MRAR wind speed

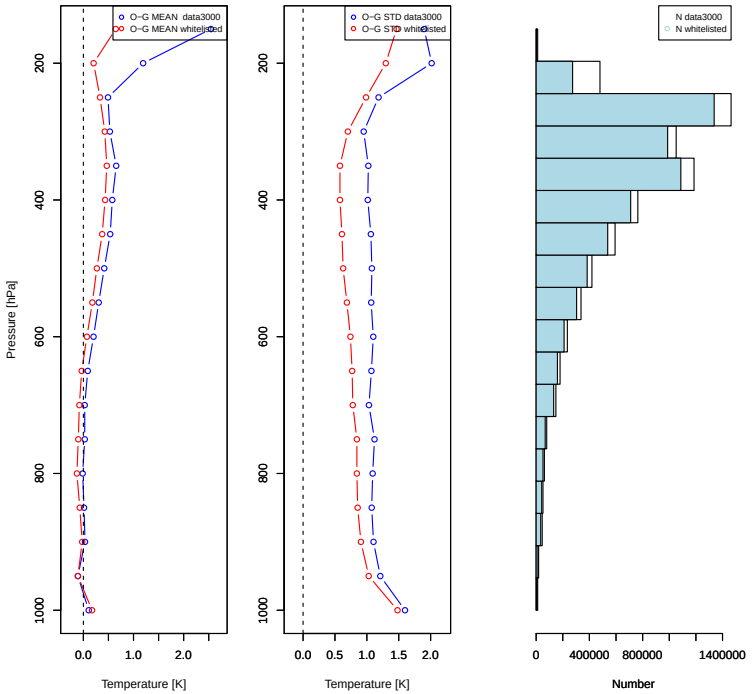


Czech MRAR observations

CZ-MRAR temperature



CZ-MRAR temperature



- **small BIAS above 500hPa**

Czech MRAR observations

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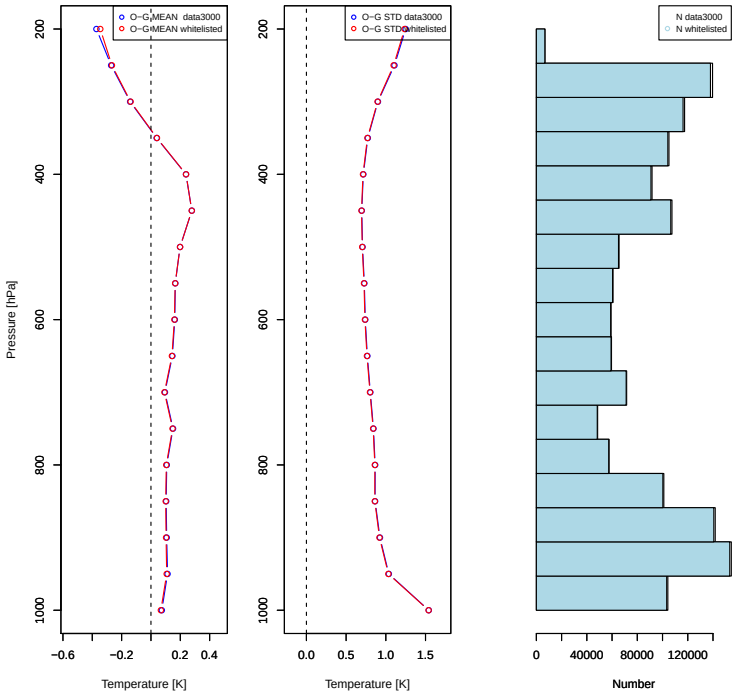
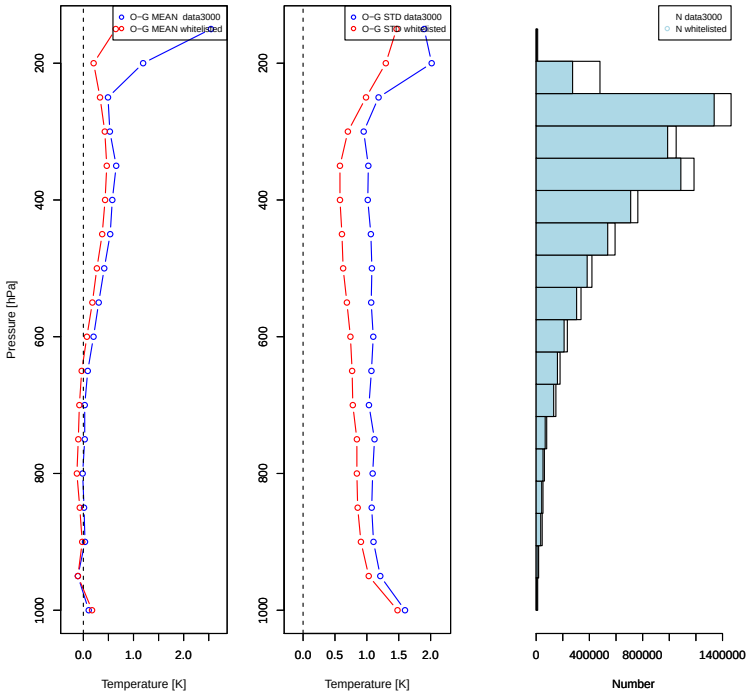
LACE-AMDAR temperature



CZ-MRAR temperature



- **not clean comparison - data samples covers different domains & AMDAR vs MRAR !**

Slovenian MRAR observations

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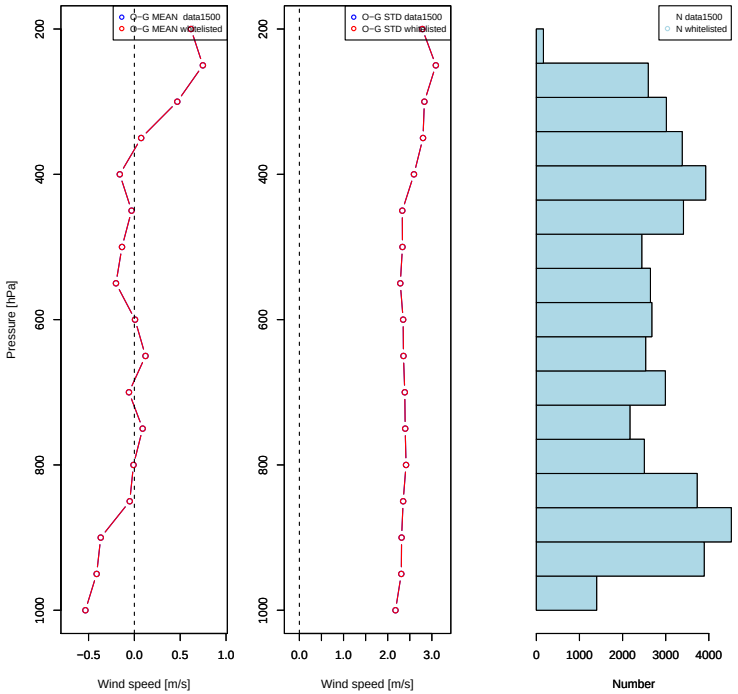
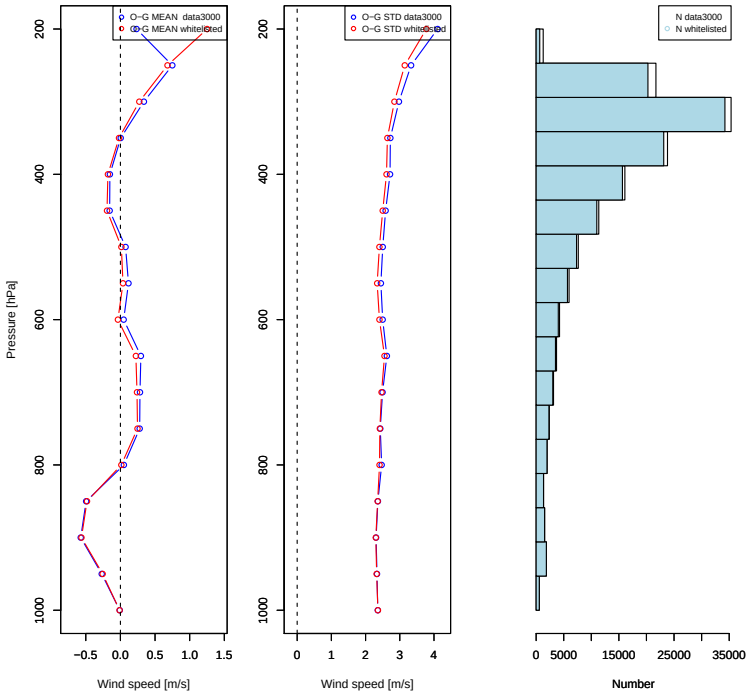
SI-AMDAR wind speed



SI-MRAR wind speed



- **not clean comparison - AMDAR vs MRAR (over Slovenian air-space)**

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Slovenian MRAR observations

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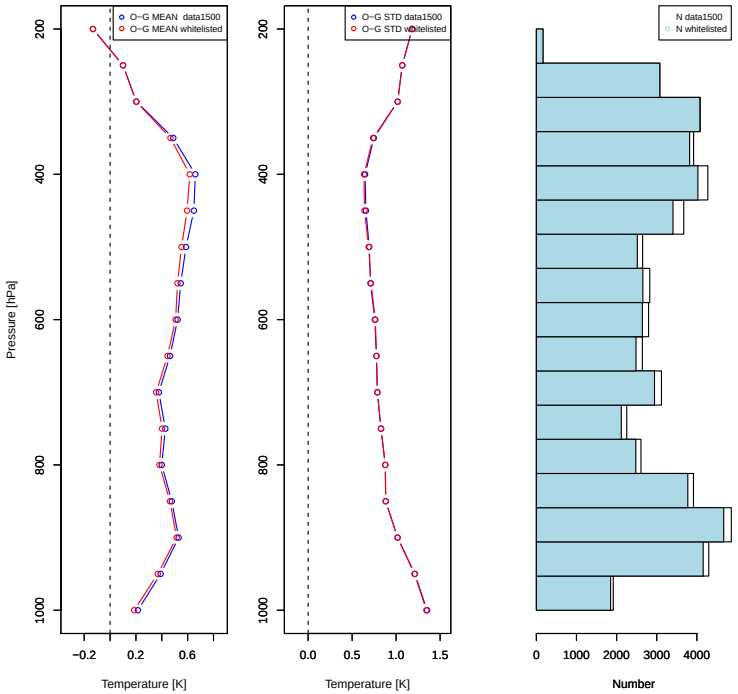
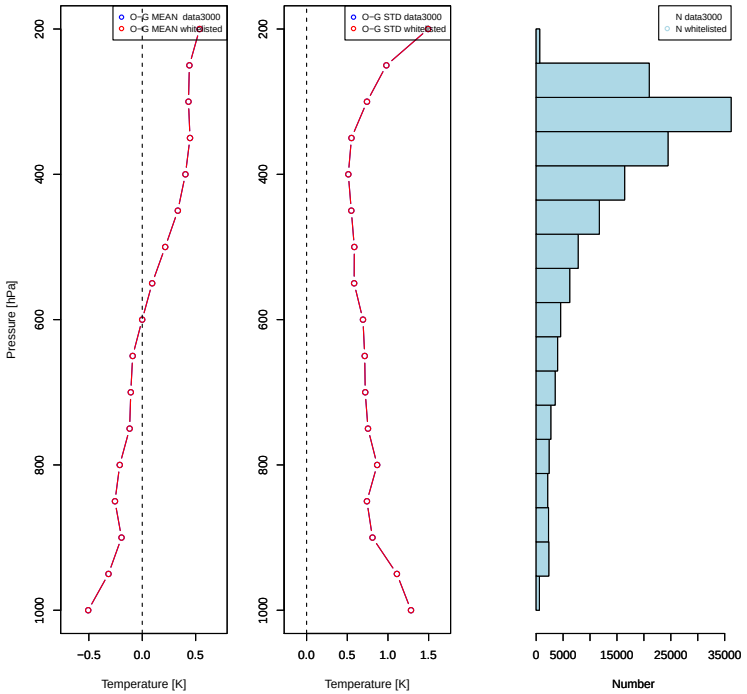
SI-AMDAR temperature



SI-MRAR temperature



- **not clean comparison - AMDAR vs MRAR (over Slovenian air-space)**

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MRAR observations

- quality assessment of Mode-S aircraft data - still ongoing
- temperature biases to be further investigated
  - might be caused by data sampling, e.g. domain, AMDAR vs MRAR, NWP model (6-11h forecast), phase of flight, aircraft type, ...
  - more strict criteria could be used ?
  - VarBC ?

Wind profiler observations

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- **quality of wind profiler (WP) data investigated**
- **based on 3 months statistics (March-June 2019) w.r.t. NWP model for each station**
- **aim to define thresholds (MEAN & STD) for the blacklisting**

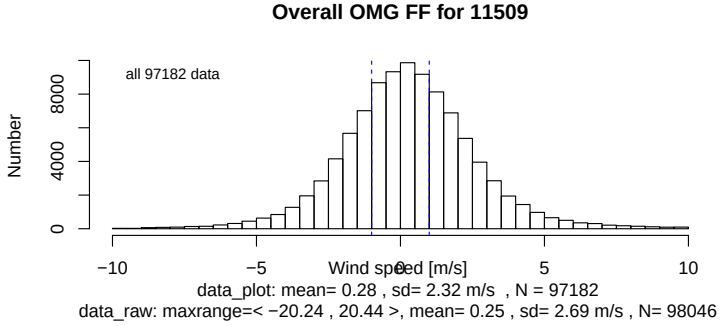
var	number of obs	mean	std
wind speed	?	<?m/s	<?m/s
wind direction	?	<?	<?

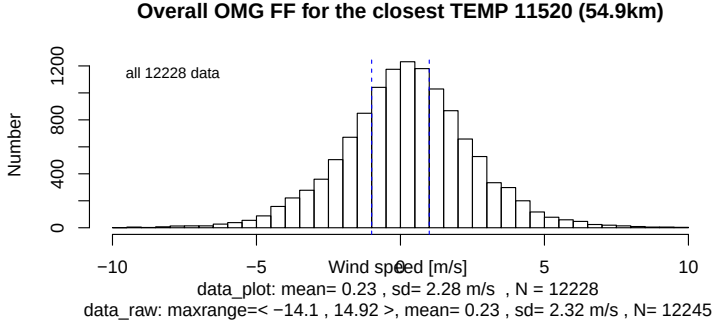
Table 2: Thresholds used to generate blacklist of wind profiler stations

Wind profiler observations

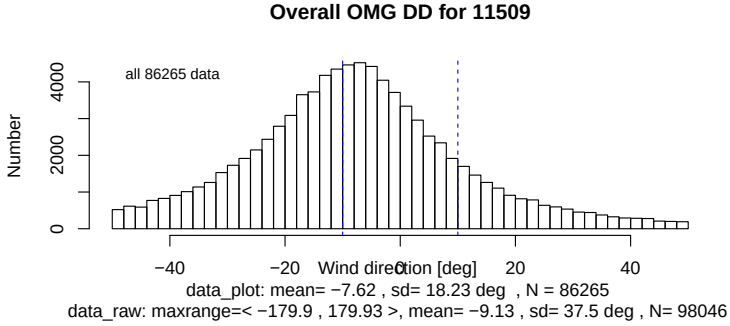
- **WP station 11509 Doksany (CZ) compared with the closest TEMP station**

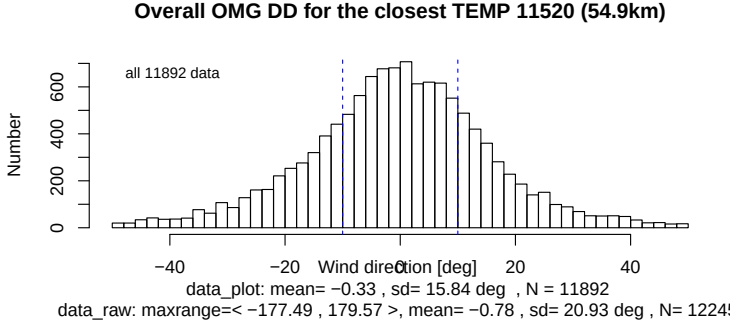
wind speed





wind direction





Wind profiler observations

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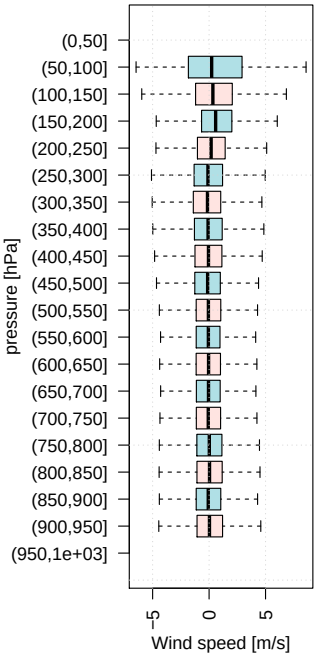
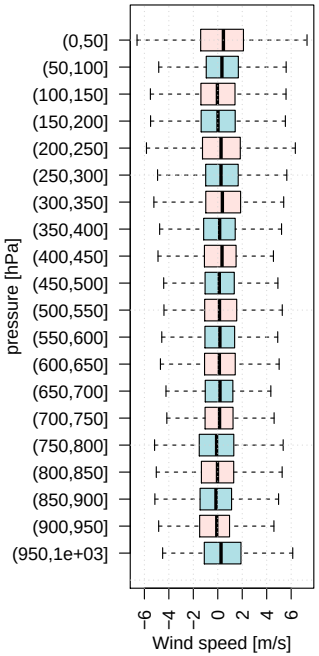
- **WP station 10394 Lindenberg (CZ) compared with the closest TEMP station**

wind speed

Overall OMG FF for WP 10394

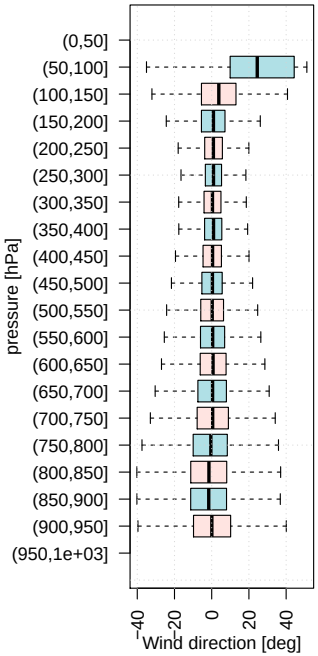


and for TEMP 10393 (1.2km)

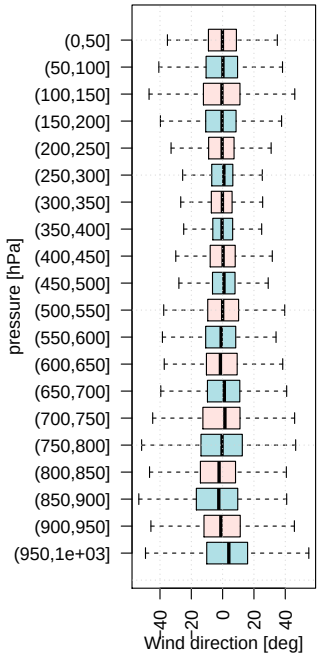


wind direction

Overall OMG DD for WP 10394



and for TEMP 10393 (1.2km)

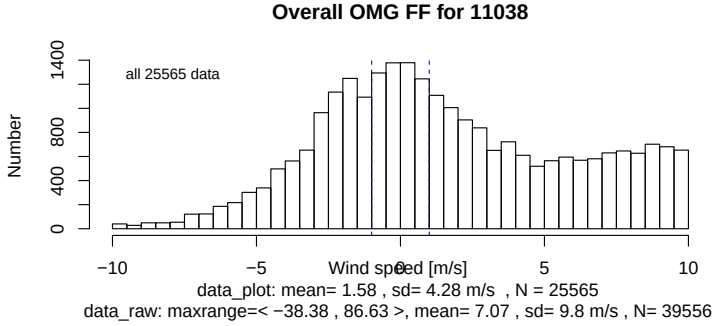


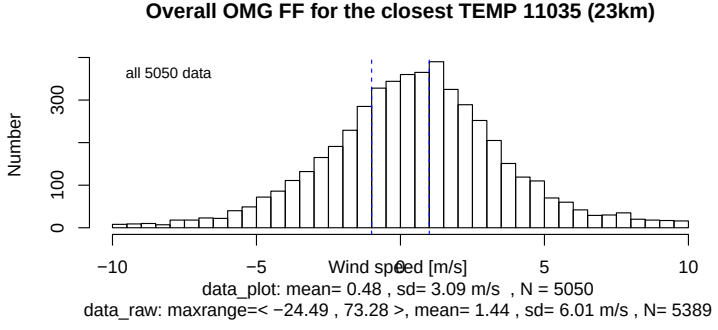
- **very good agreement**

Wind profiler observations

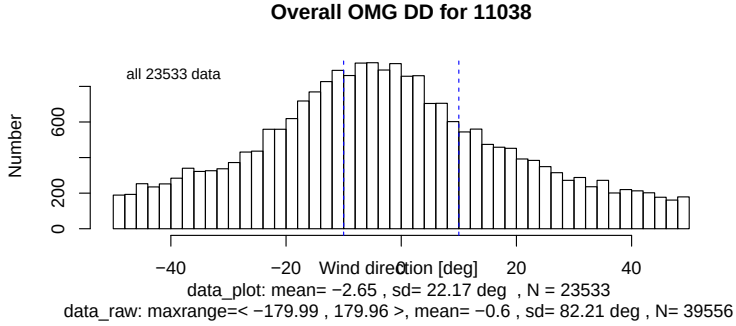
- **WP station 11038 Vienna (CZ) compared with the closest TEMP station**

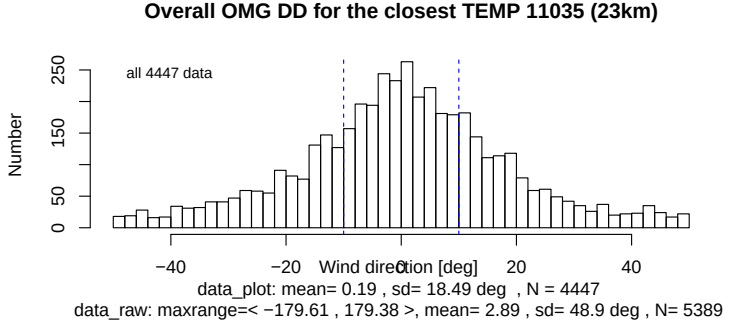
wind speed





wind direction



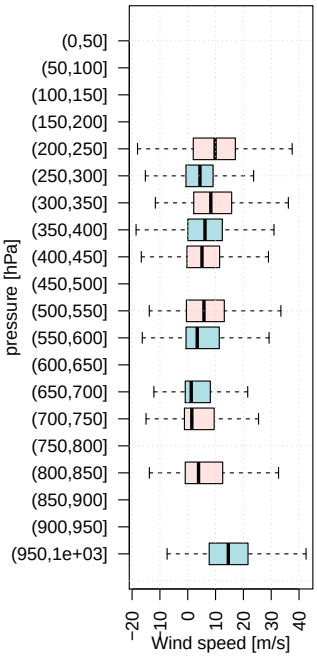


Wind profiler observations

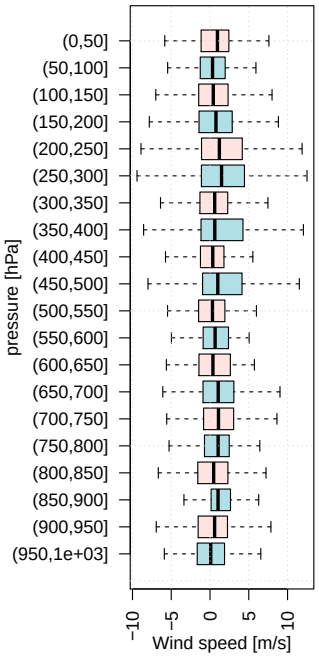
- **WP station 11038 Vienna (AT) compared with the closest TEMP station**

wind speed

Overall OMG FF for WP 11038

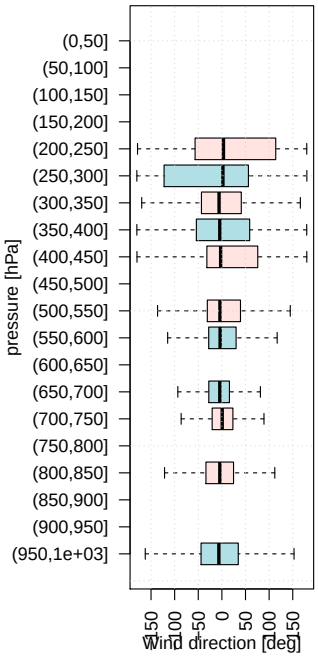


and for TEMP 11035 (23km)

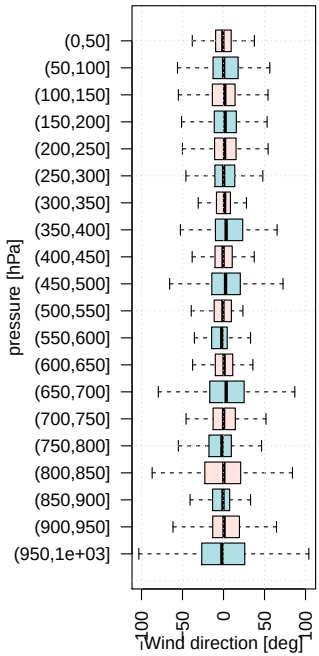


wind direction

Overall OMG DD for WP 11038



and for TEMP 11035 (23km)



- **a candidate for blacklisting**

Wind profiler observations

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- **quality assessment of WP data - still ongoing**
  - **thresholds (MEAN & STD) for the blacklisting to be defined**
  - **WP data (one BUFR file) contains several (up to 6 measurement within an hour)**
  - **data closest to analysis time to be checked**
  - **update mf_blacklist.b when appropriate:**

```
if (OBSTYP = pilot) then

    if (PRESS < MODTOP) then fail(CONSTANT); endif; # <=1. dans cln

    ...

    if VARIAB in (u, v) then
       if (CODTYP = eu_profiler) then
          if (PRESS < 250.) or (PRESS > 850.) then fail(CONSTANT); endif;
       endif;
    endif;

endif;
```

Future Plans

- Continue QC assessment & perform impact studies
- Investigate use of VarBC for aircraft temperature

End

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Thank you for your attention !

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References

Benedikt Strajnar. Validation of Mode-S Meteorological Routine Air Report aircraft observations. *Journal of Geophysical Research (Atmospheres)*, 117:23110–, 12 2012. doi: 10.1029/2012JD018315.

Operational Setup at CHMI

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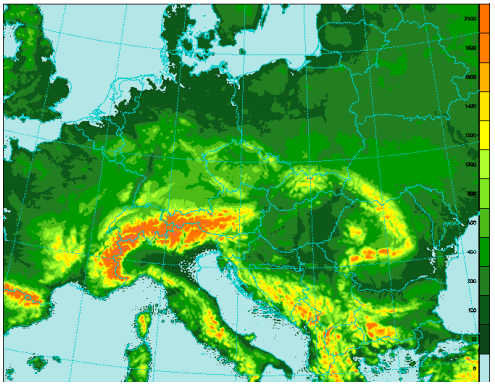

- ALARO NH-v1B cy43t2pt_op1:
  - domain: $\triangle$x 2.3km, 1069x853GP
  - 87 vertical levels, mean orography
  - time step 90s
  - 3h space consistency coupling ARPEGE synchronous
  - forecasts up to +72/+54h at 00, 06, 12 and 18 UTC
  - weak IDFI of short cut-off production analysis
- Upper air analysis – BlendVar scheme
  - BlendVar = DF Blending (filter. at trunc. E102x81) followed by 3D-Var
  - 6h assim cycle, no IDFI in the next +6h assim guess
  - REDNMC=0.5, spin-up ensemble B matrix based on AEARP
  - $\pm$1.5h assim window, VARBC 24h cycling
  - Assimilated observations - SYNOP (Ps), TEMP (t, q, u, v), AMDAR (t, u, v), AMV, SEVIRI (channels: 2, 3), Mode-S MRAR CZ (t, u, v), Mode-S EHS from KNMI (t, u, v)
  - SIGMAO_COEF=.67, SIGMAO_COEF(AMDAR)=2.8, SIGMAO_COEF(RADIANCE)=1.15
- Surface analysis – OI based on SYNOP (T2m, RH2m)
  - SST from ARPEGE