Some interesting facts out of KENDA monitoring

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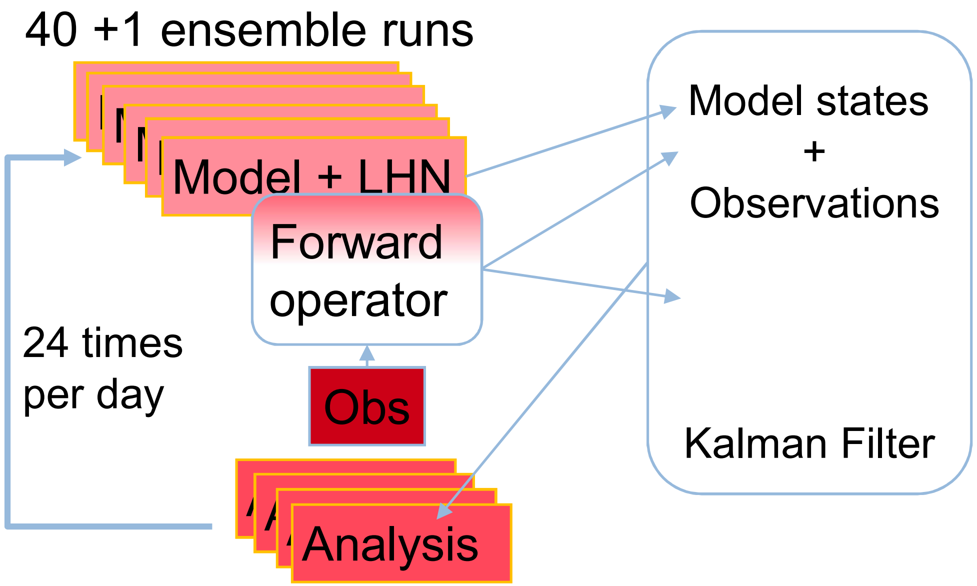


Monitoring can be done of several parts:
- Observations (i.e. OmB)
- Increments
- DACE (LETKF) monitoring
- LHN monitoring
- …

<u>Observations in KENDA</u>

SYNOP
- manual stations
- automatic stations

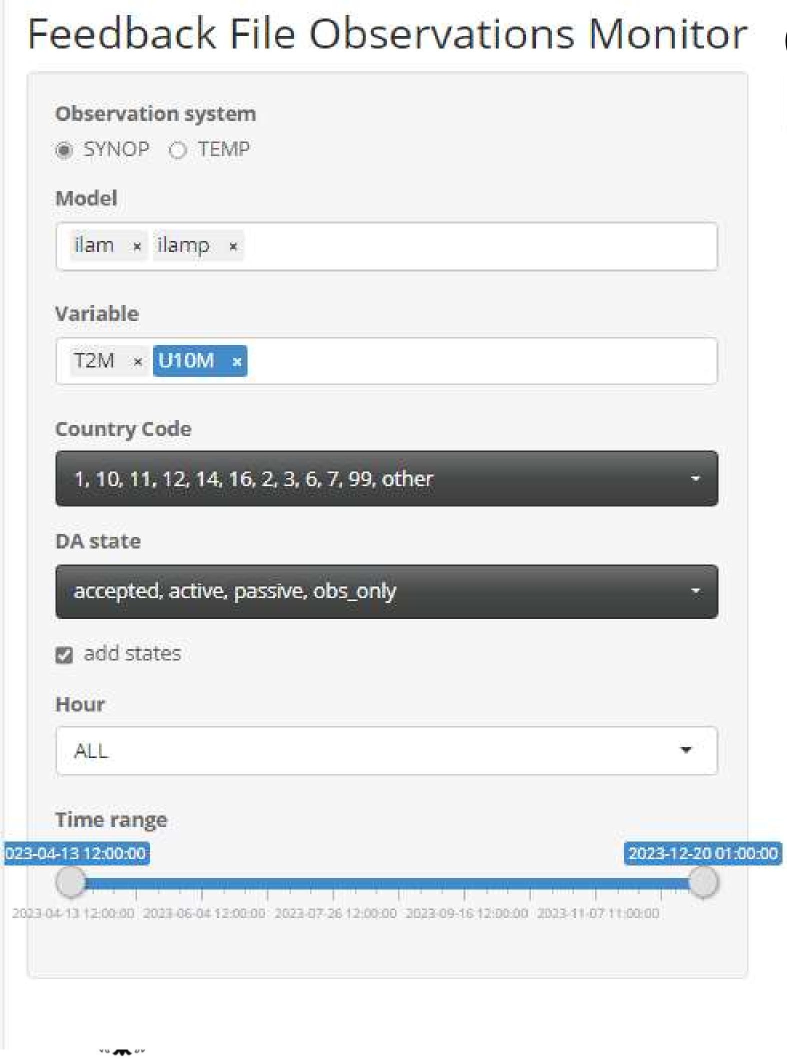
AIREP
- AMDAR
- MODE-S
- Some others

TEMP
- Acent and decent measurements

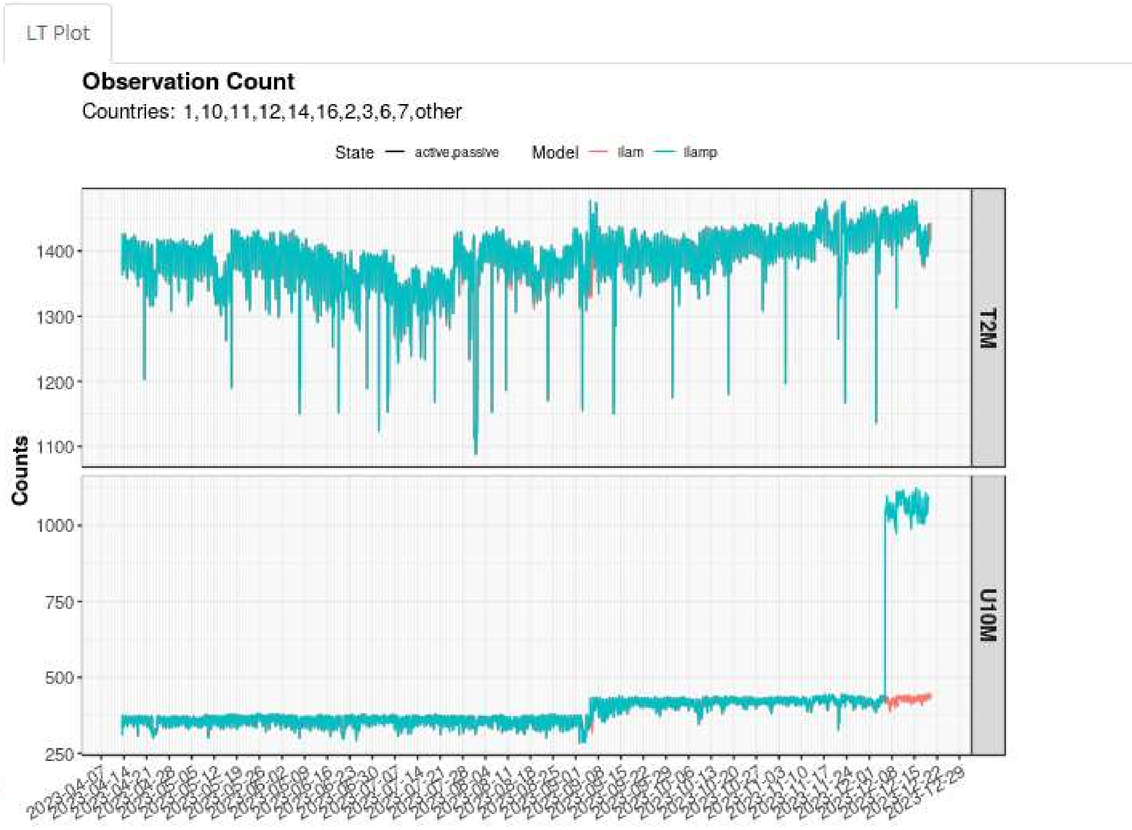
RADAR
PILOT
DRIBU
RAD (Seviri-VIS and Seviri IR)
….

Monitoring of Observations

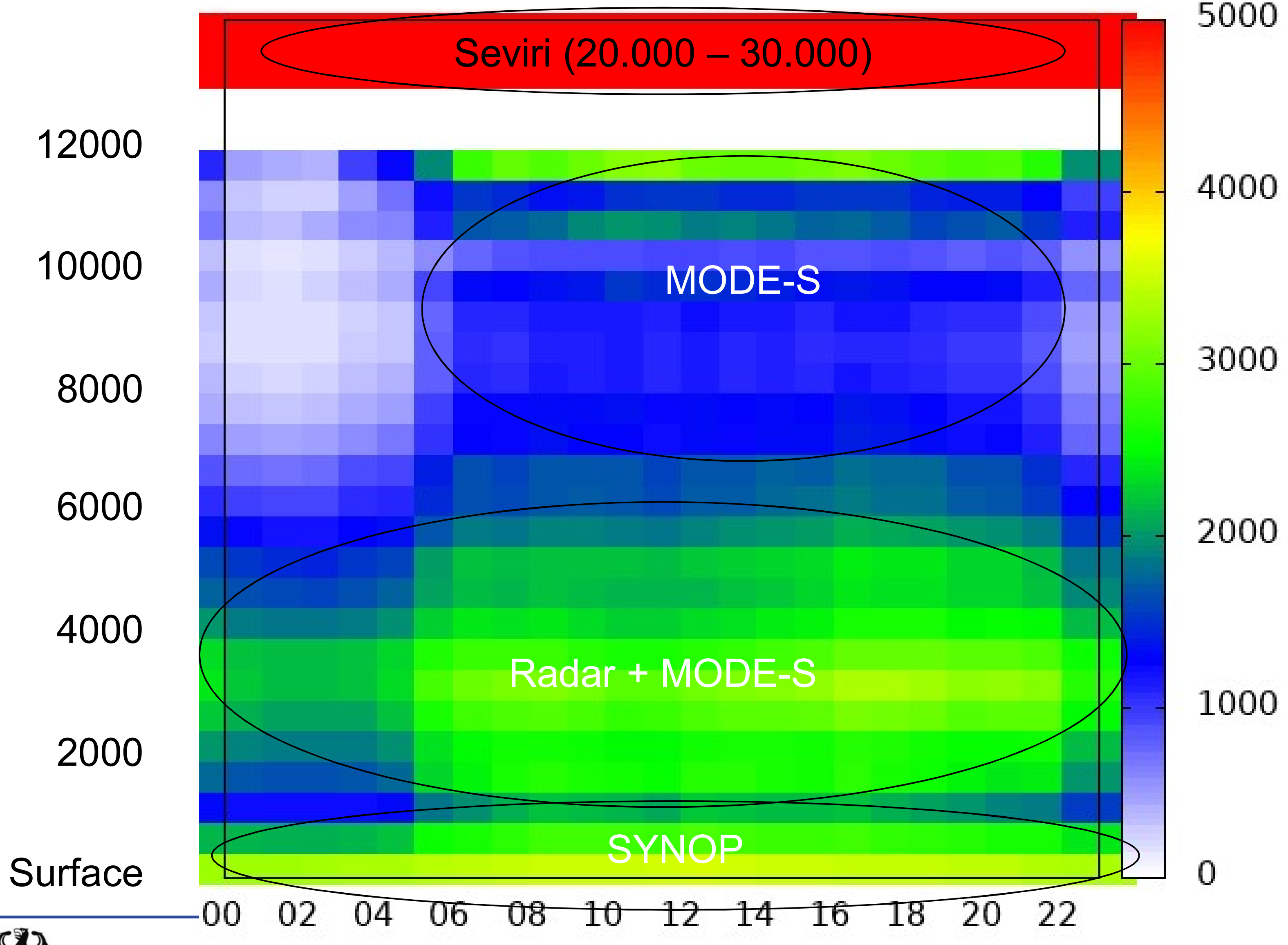
There are already lots of monitoring results available,



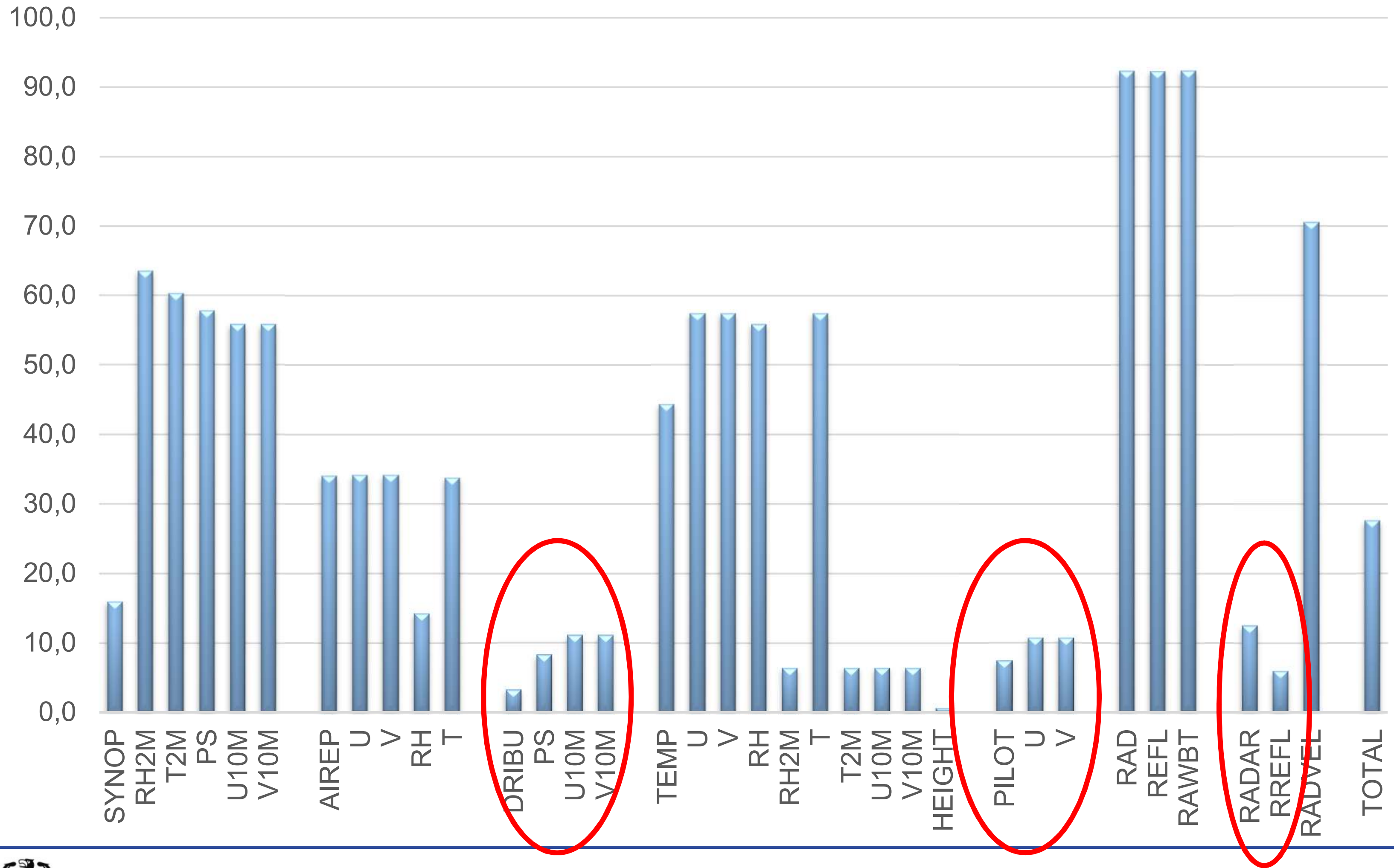
(available at DWD by Felix Fundel)



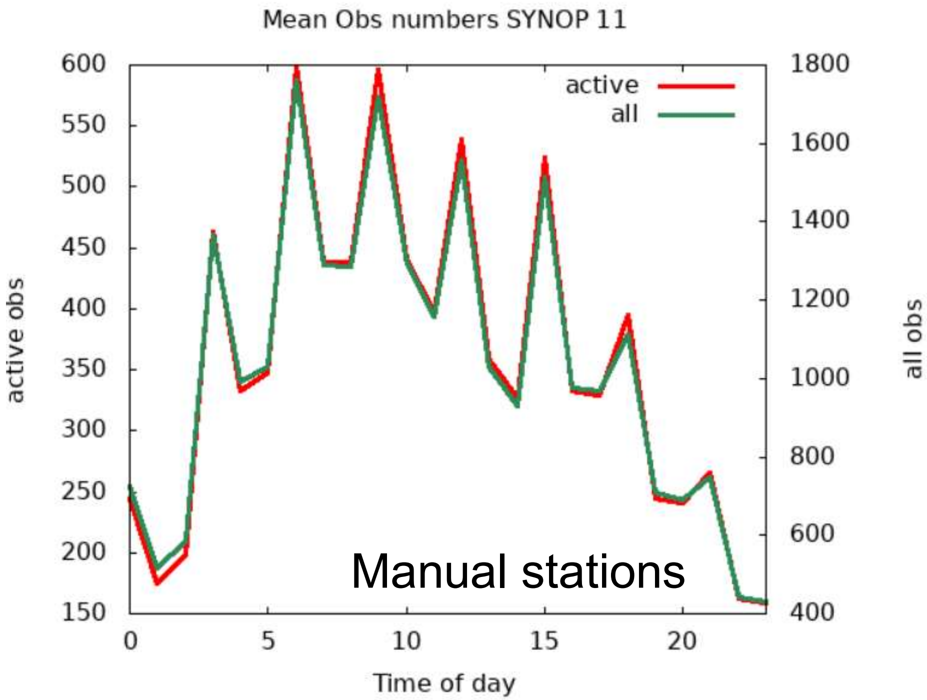
Actively used observations in KENDA of last month (averaged per cycle)

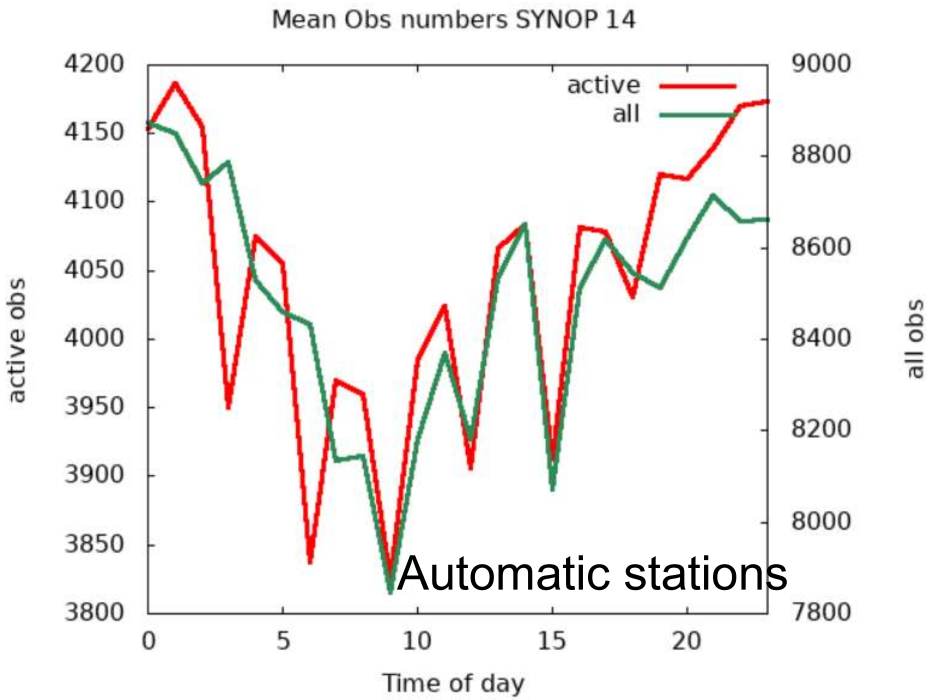


Percentage of actively used data (12 UTC DWD) against processed data in LETKF

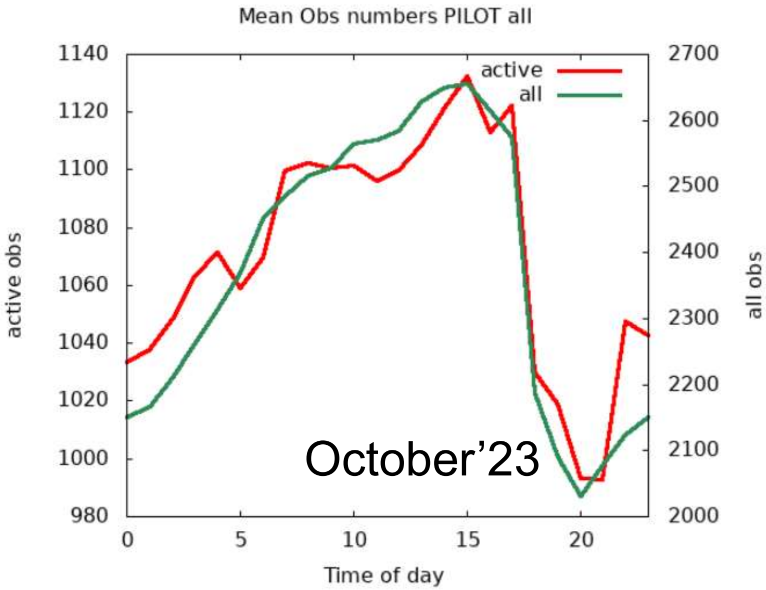


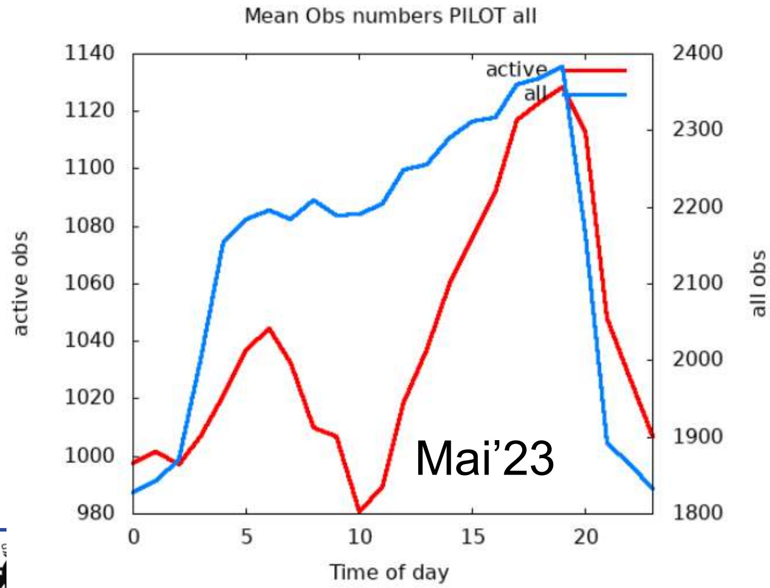
SYNOP


Mean Obs numbers SYNOP 11
active
all
active obs
all obs
Time of day
Manual stations

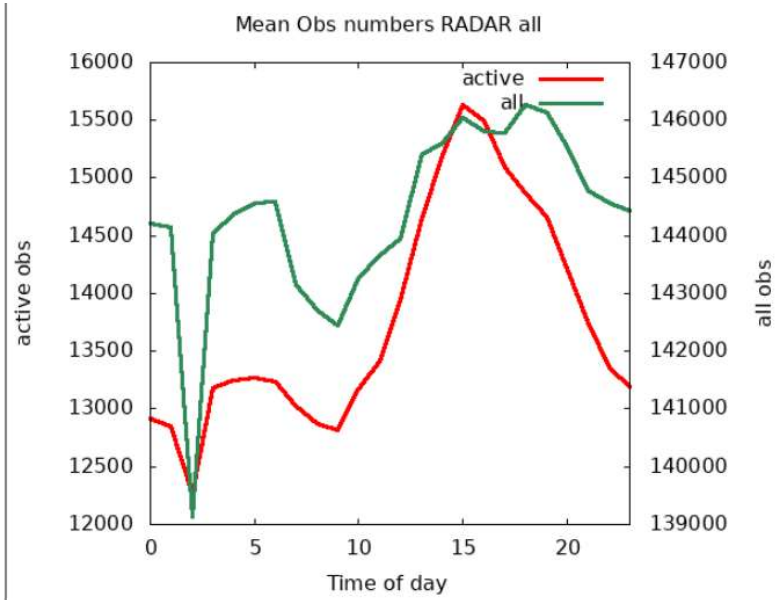

Mean Obs numbers SYNOP 14
active
all
active obs
all obs
Time of day
Automatic stations

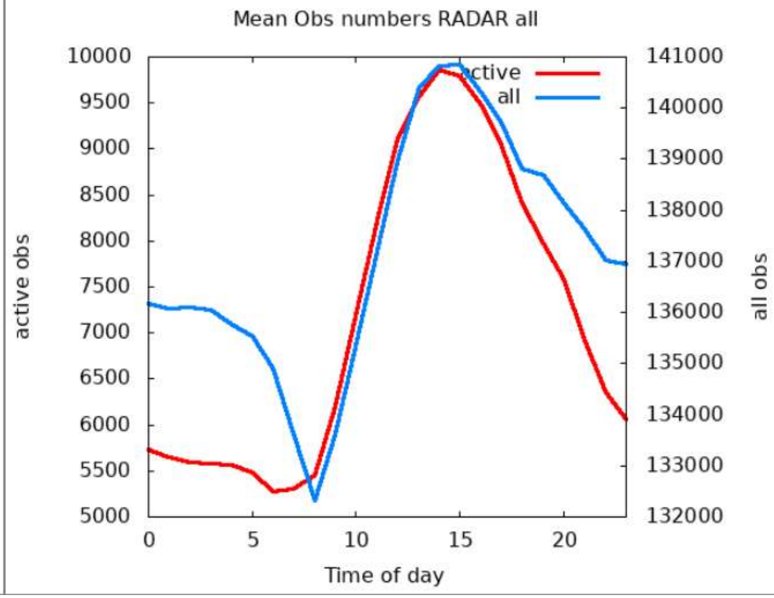
PILOT


Mean Obs numbers PILOT all
active
all
active obs
all obs
Time of day
October'23


Mean Obs numbers PILOT all
active
all
active obs
all obs
Time of day
Mai'23

RADAR


Mean Obs numbers RADAR all
active
all
active obs
all obs
Time of day


Mean Obs numbers RADAR all
active
all
active obs
all obs
Time of day

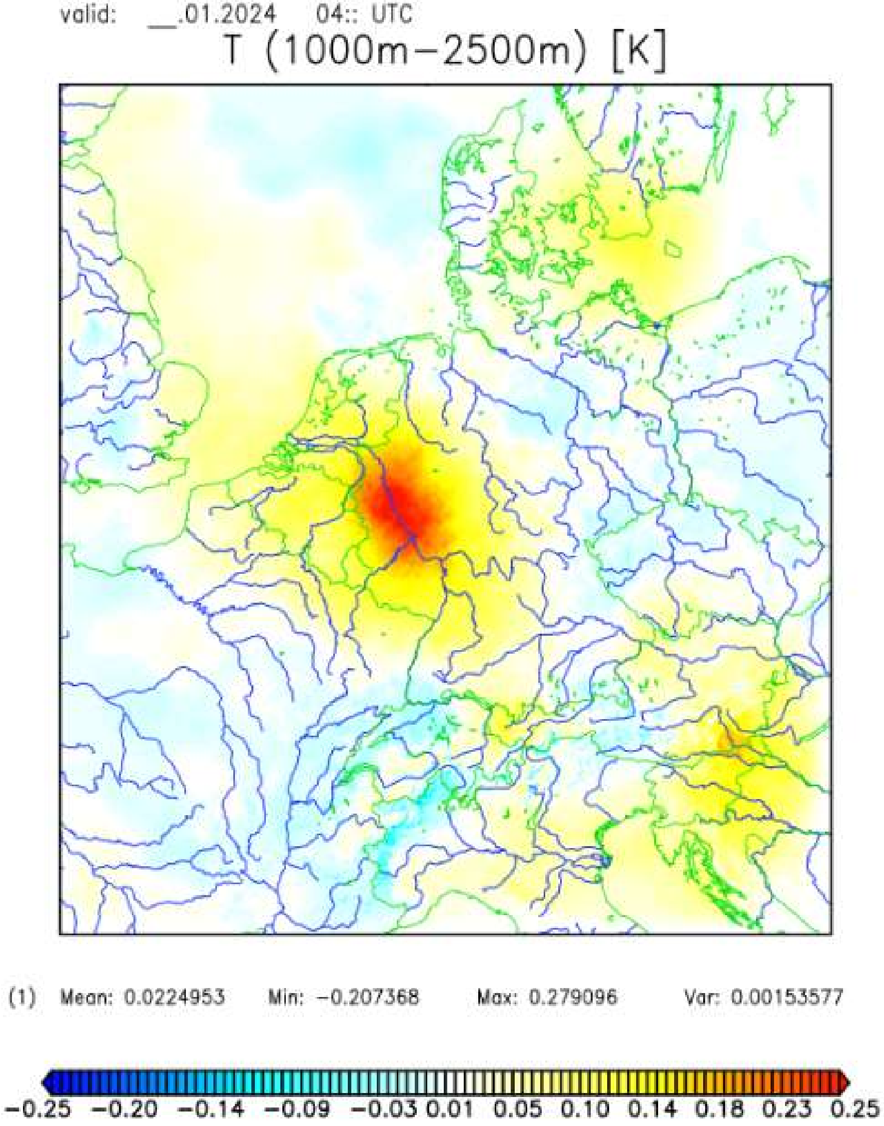
Monitoring of Analysis Increments

- ➔ As ICON-KENDA applies an IAU increments are calculated in each cycle (and stored in data base) for all elements within LETKF update vector
  - ➔ P, T, U, V, QV, QC, QI (operational ICON-D2)
- ➔ Calculation of monthly means can be done. I like to do so on hourly basis and to calculate a mean absolute increment as well.
  - ➔ Mean absolute increments may tell us a bit about observation localisation
  - ➔ Mean increments may tell us a bit about biases and artefacts
  - ➔ Be carefull in interpretation of increments in QC and QI (non-continuous variables)
- ➔ For the images I also do an average over certain height intervals.
- ➔ Evaluation is done for January 2024 (~ 2000 plots – be prepared)

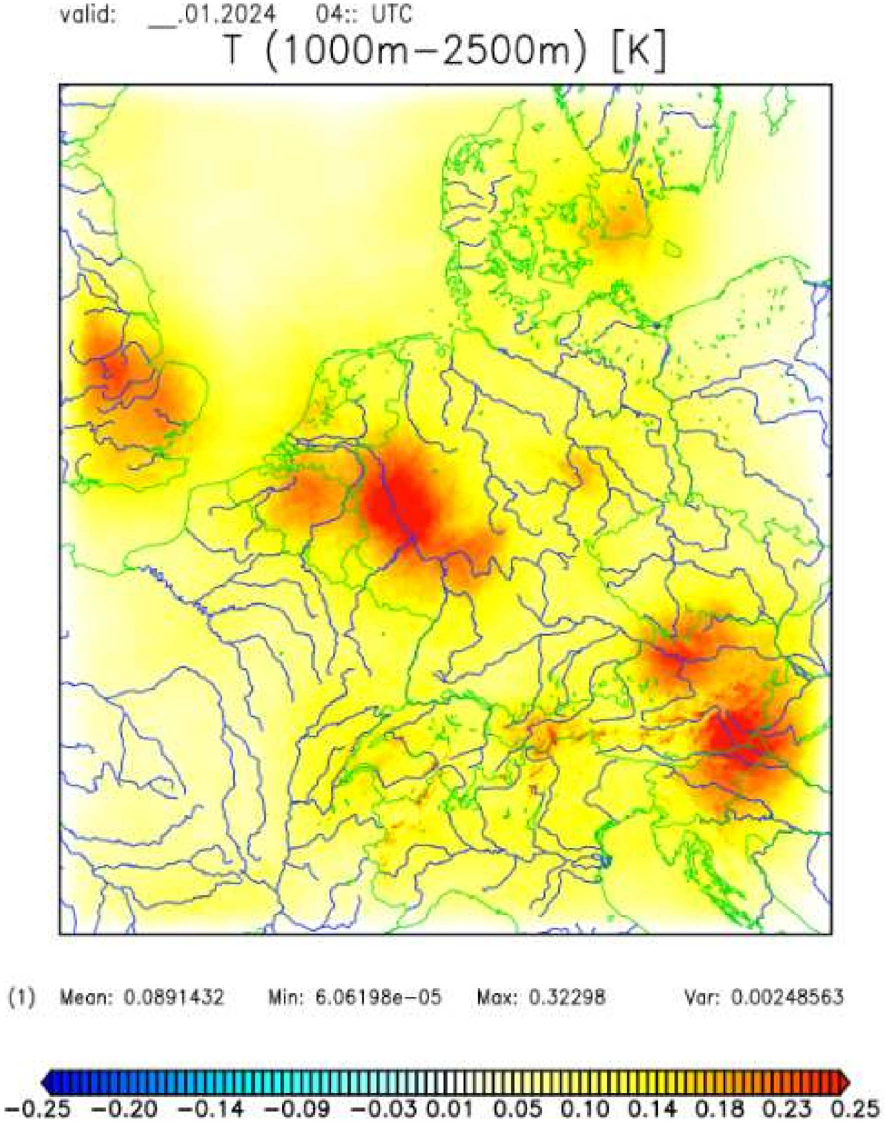
Example T in K at 4 UTC and 1000-2500m

Deutscher Wetterdienst

Mean increment in T

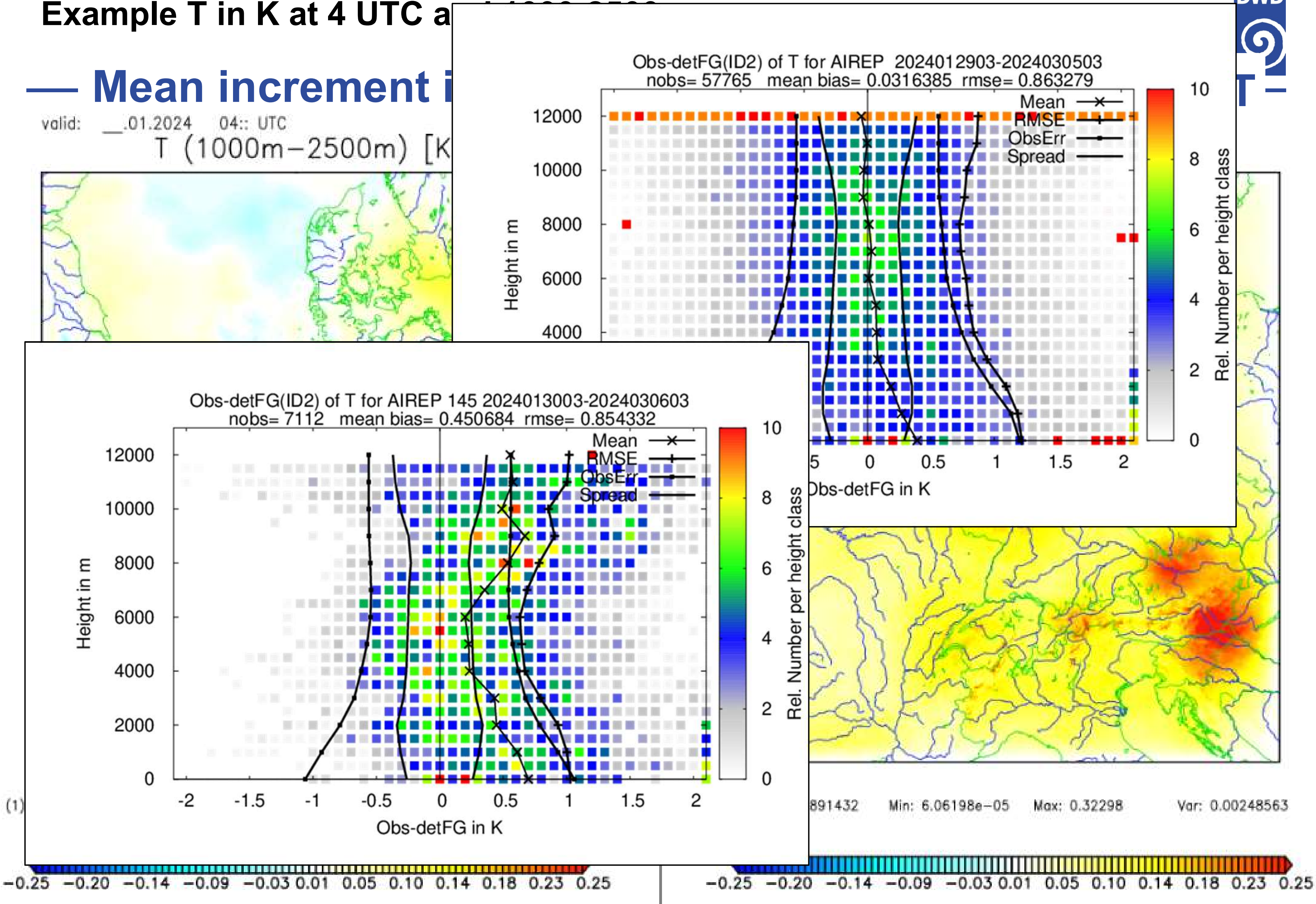


Mean abs.increment in T

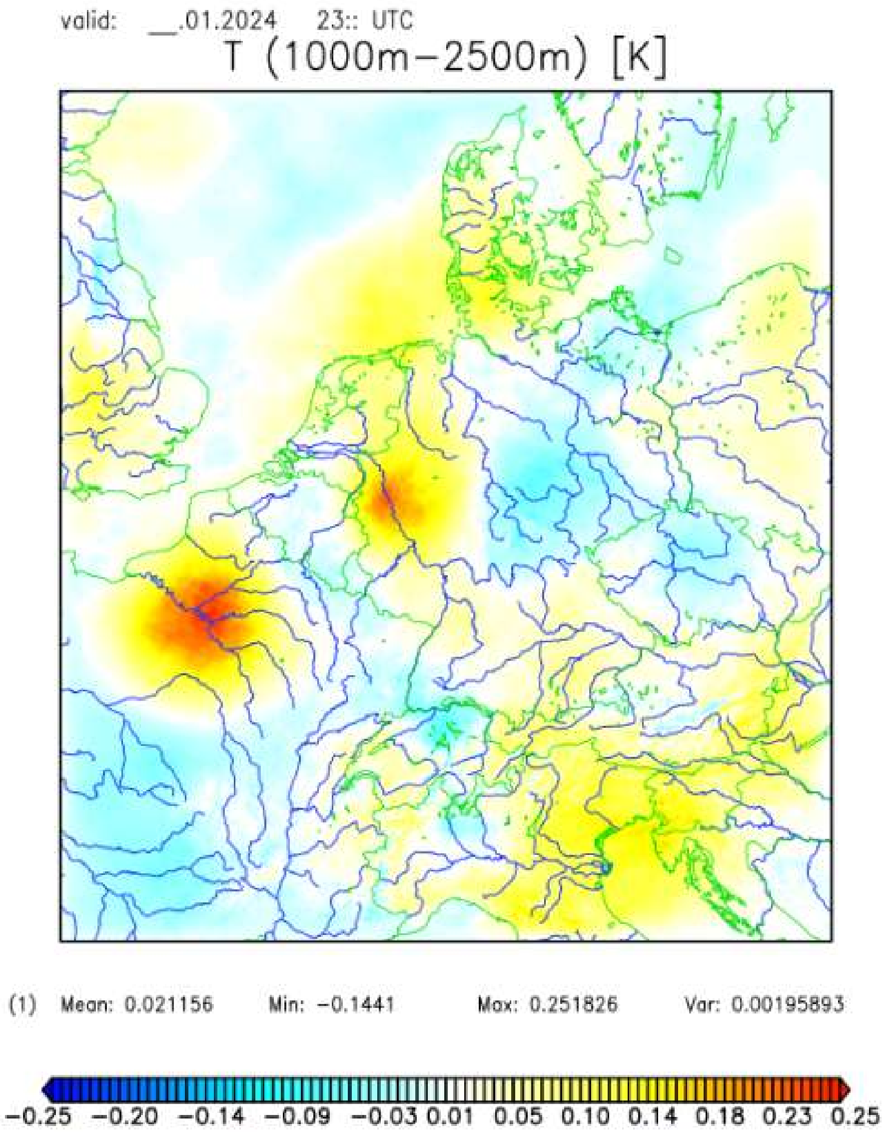


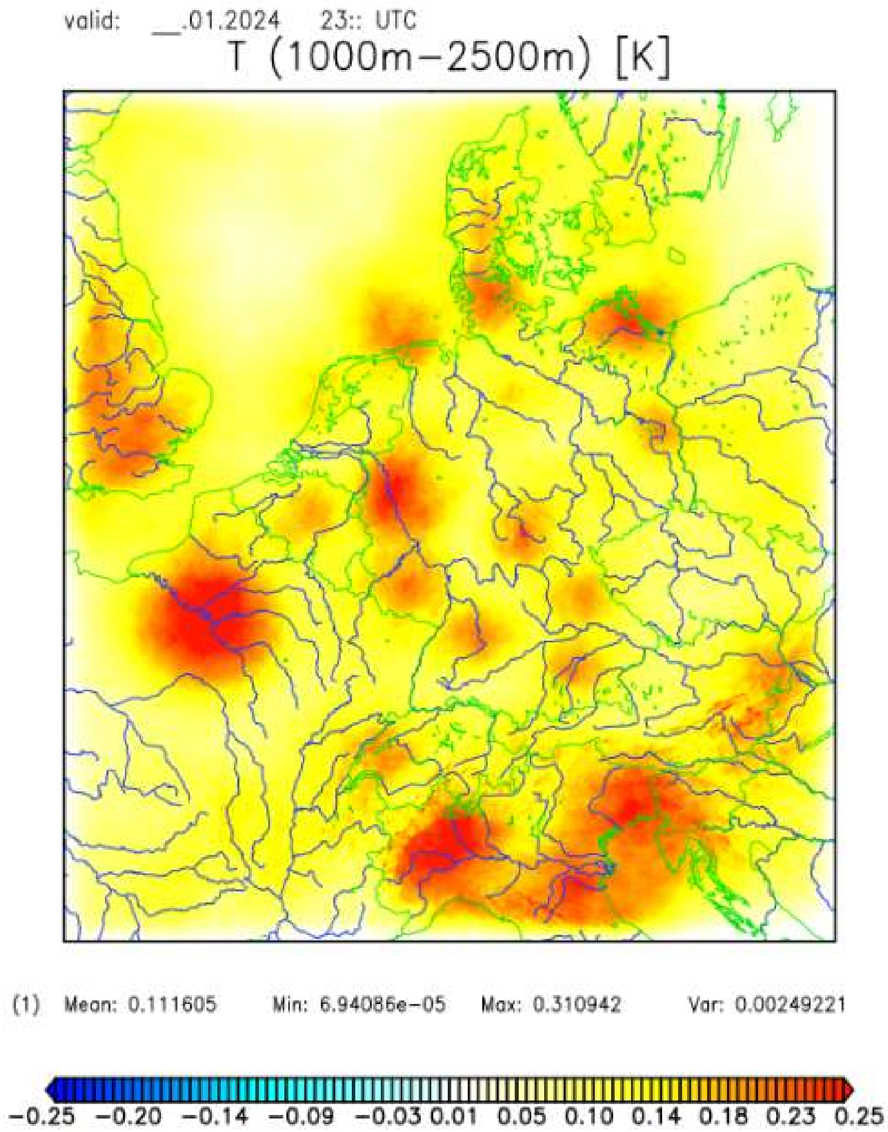
Example T in K at 4 UTC a

— Mean increment i

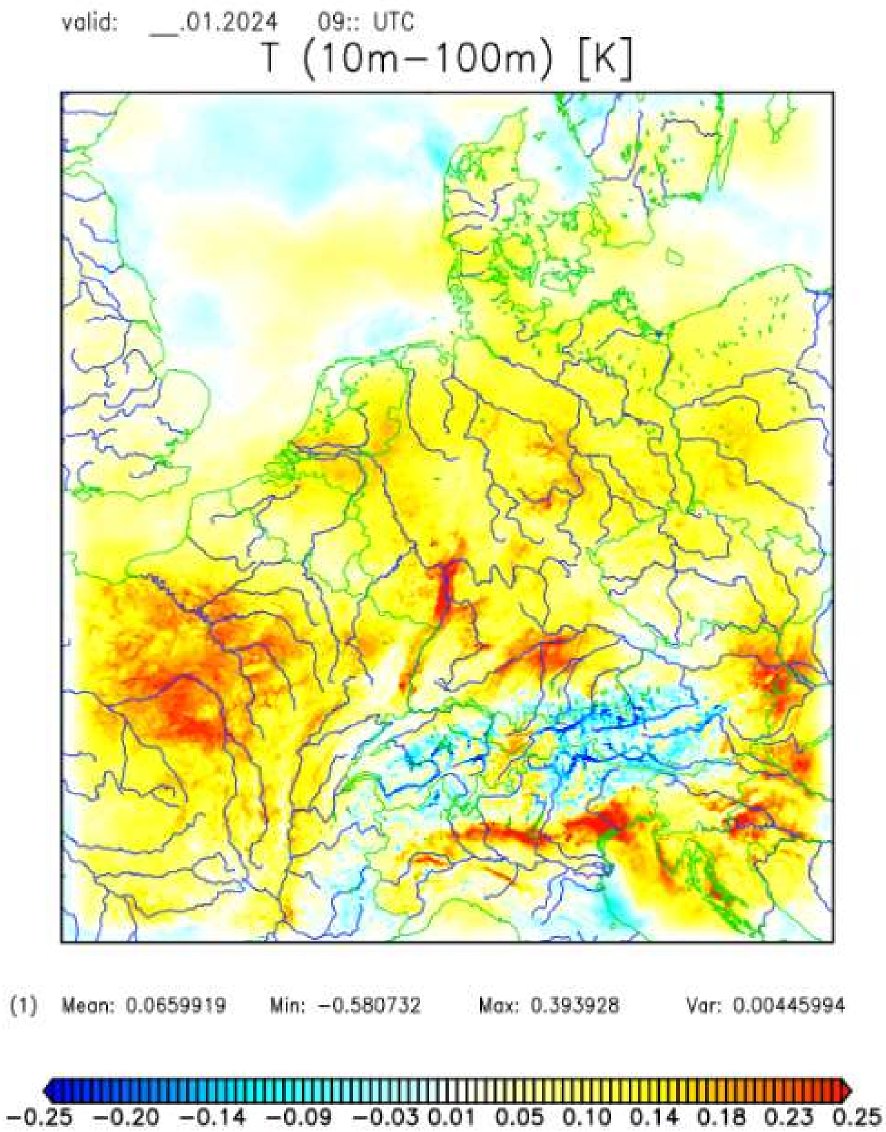


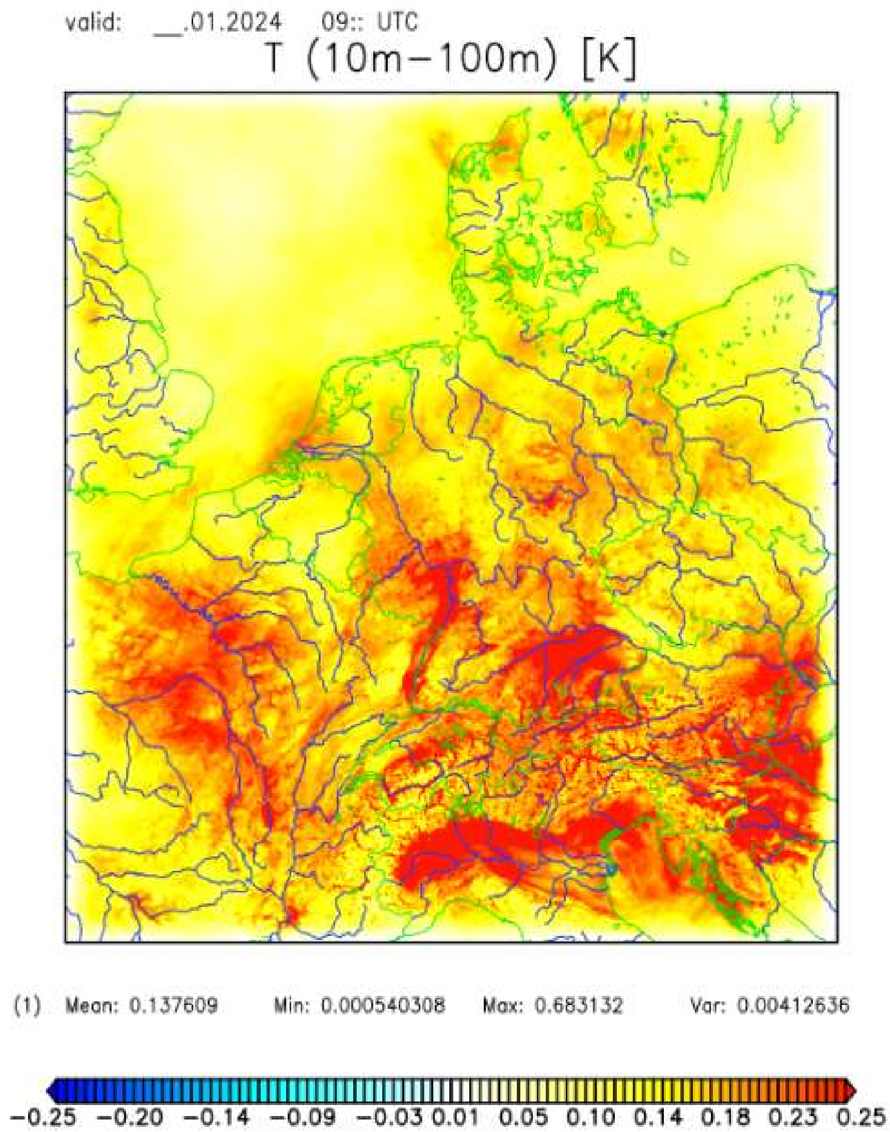
Example T in K at 23 UTC and 1000-2500m





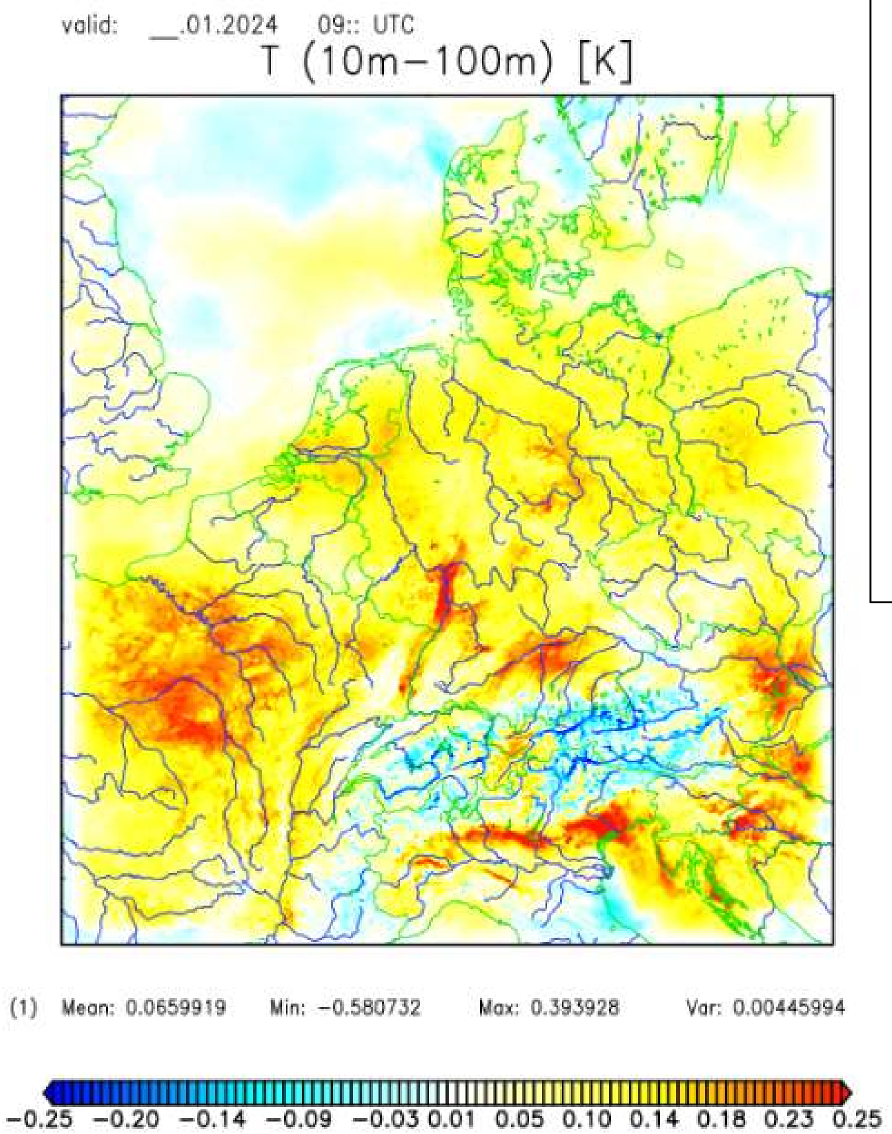
Example T in K at 9 UTC and 10-100m

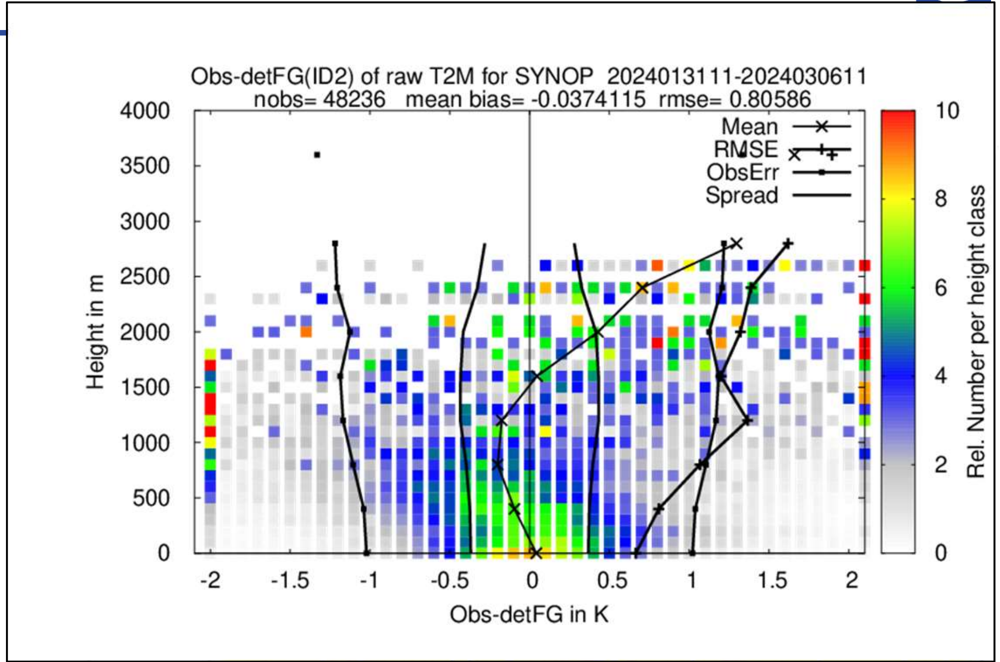


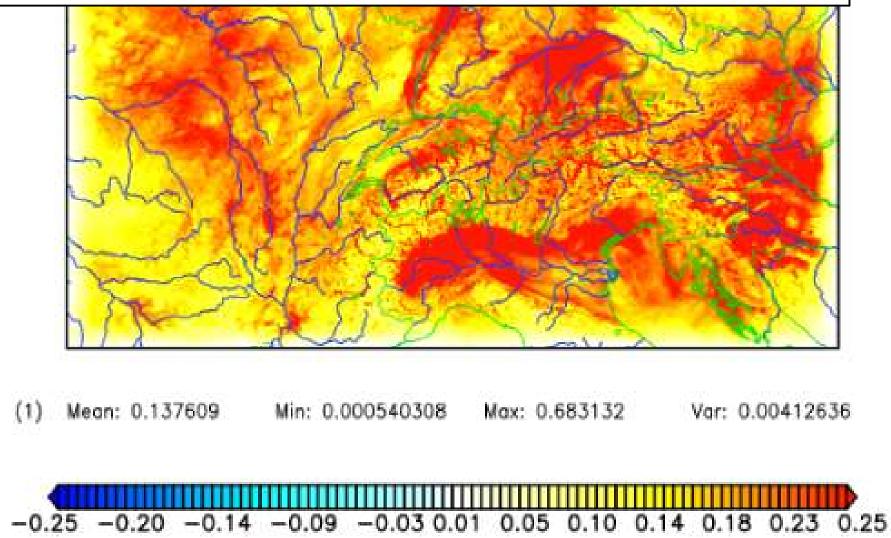


Example T in K at 9 UTC and 10-100m

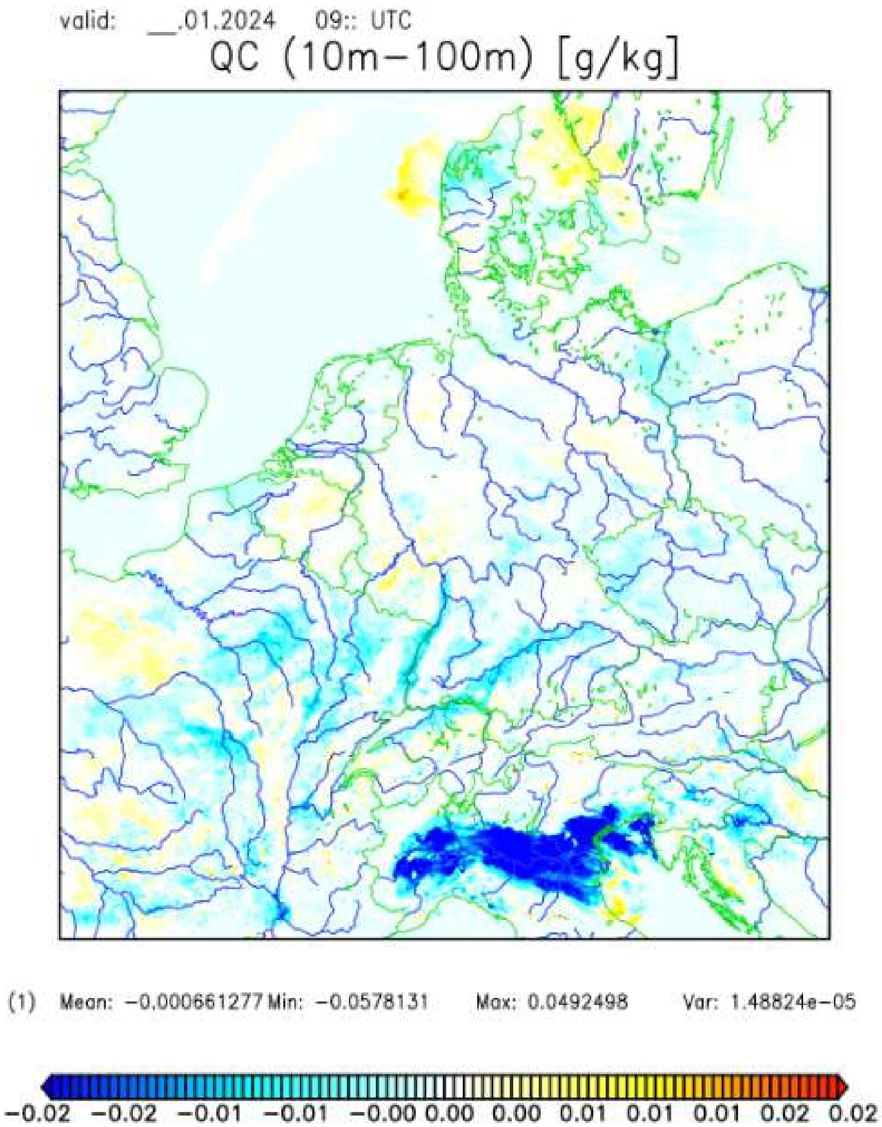
Deutscher Wetterdienst
Wetter und Klima aus einer Hand

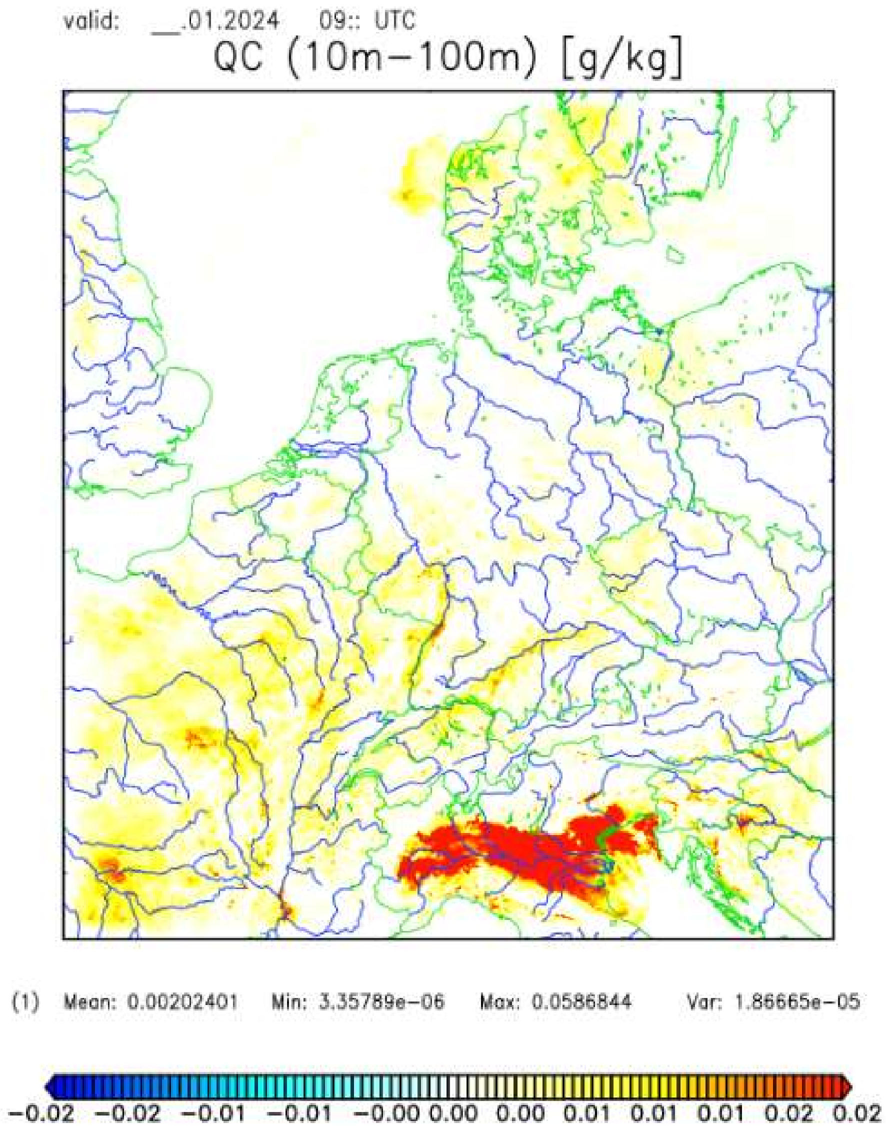






Example QC in g/kg at 9 UTC and 10-100m

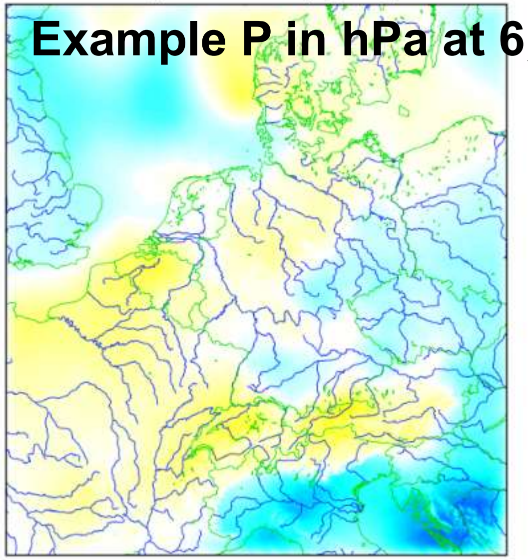




Example P in hPa at 6,7,8 UTC and 10-100m

valid: __.01.2024 06:: UTC

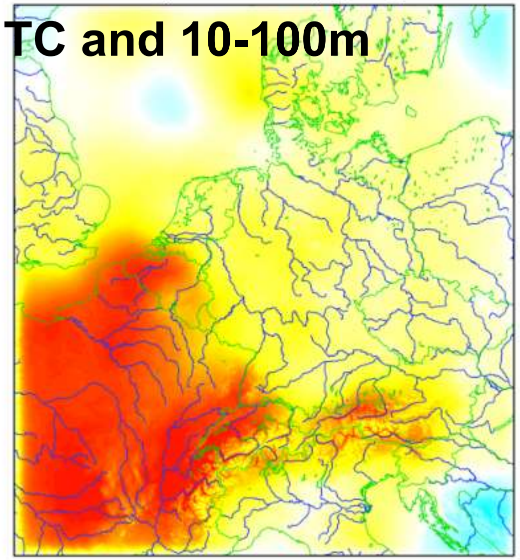
P (10m–100m) [hPa]



(1) Mean: –0.00425312 Min: –0.421577 Max: 0.334666 Var: 0.0100706

valid: __.01.2024 07:: UTC

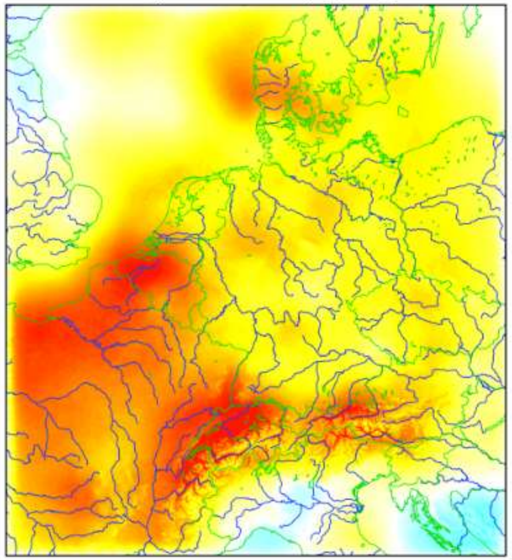
P (10m–100m) [hPa]



(1) Mean: 0.195787 Min: –0.254105 Max: 0.601343 Var: 0.024476

valid: __.01.2024 08:: UTC

P (10m–100m) [hPa]

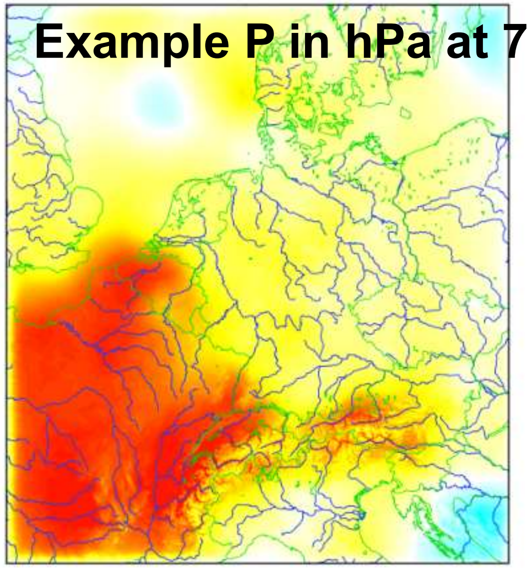


(1) Mean: 0.24134 Min: –0.171589 Max: 0.677975 Var: 0.017633

Example P in hPa at 7 UTC and 10-100, 100-1000, 1000-2500 m

valid: __.01.2024 07:: UTC

P (10m–100m) [hPa]

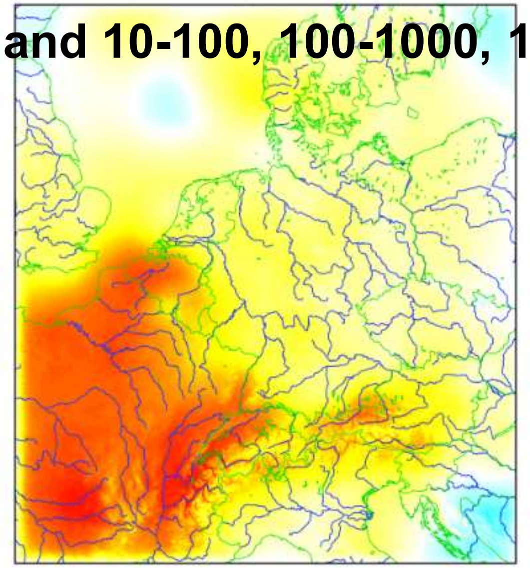


(1) Mean: 0.195787 Min: –0.254105 Max: 0.601343 Var: 0.024476

–0.50 –0.39 –0.28 –0.17 –0.06 0.02 0.11 0.20 0.28 0.37 0.45 0.50

valid: __.01.2024 07:: UTC

P (100m–1000m) [hPa]

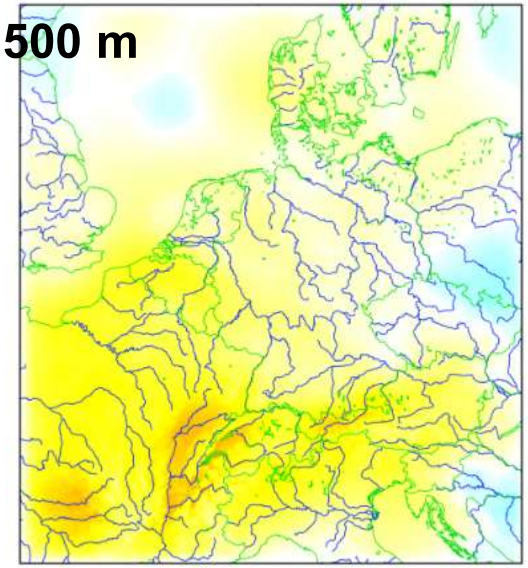


(1) Mean: 0.179346 Min: –0.201013 Max: 0.541841 Var: 0.0204091

–0.50 –0.39 –0.28 –0.17 –0.06 0.02 0.11 0.20 0.28 0.37 0.45 0.50

valid: __.01.2024 07:: UTC

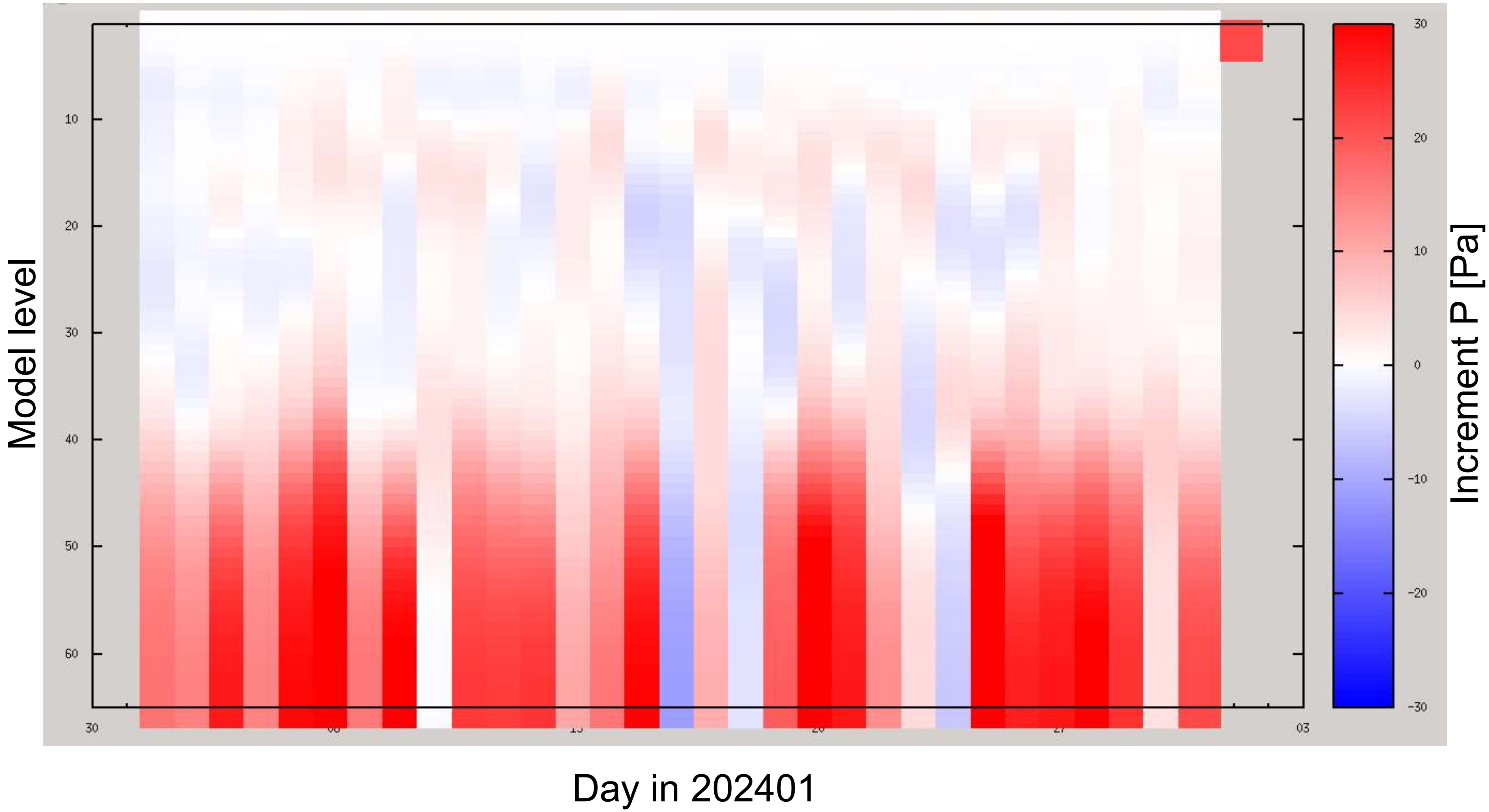
P (1000m–2500m) [hPa]



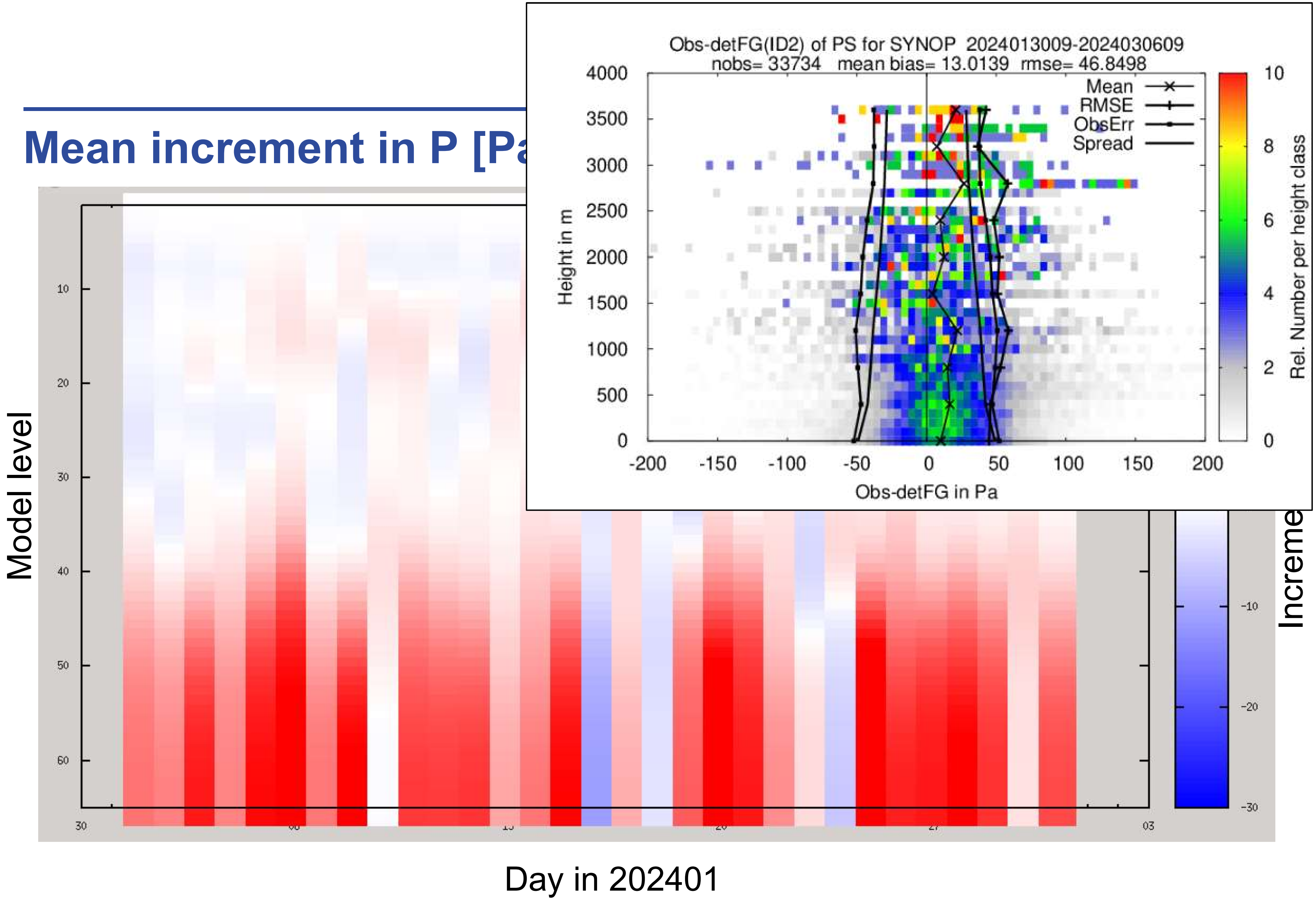
(1) Mean: 0.110181 Min: –0.101994 Max: 0.3573 Var: 0.00859478

–0.50 –0.39 –0.28 –0.17 –0.06 0.02 0.11 0.20 0.28 0.37 0.45 0.50

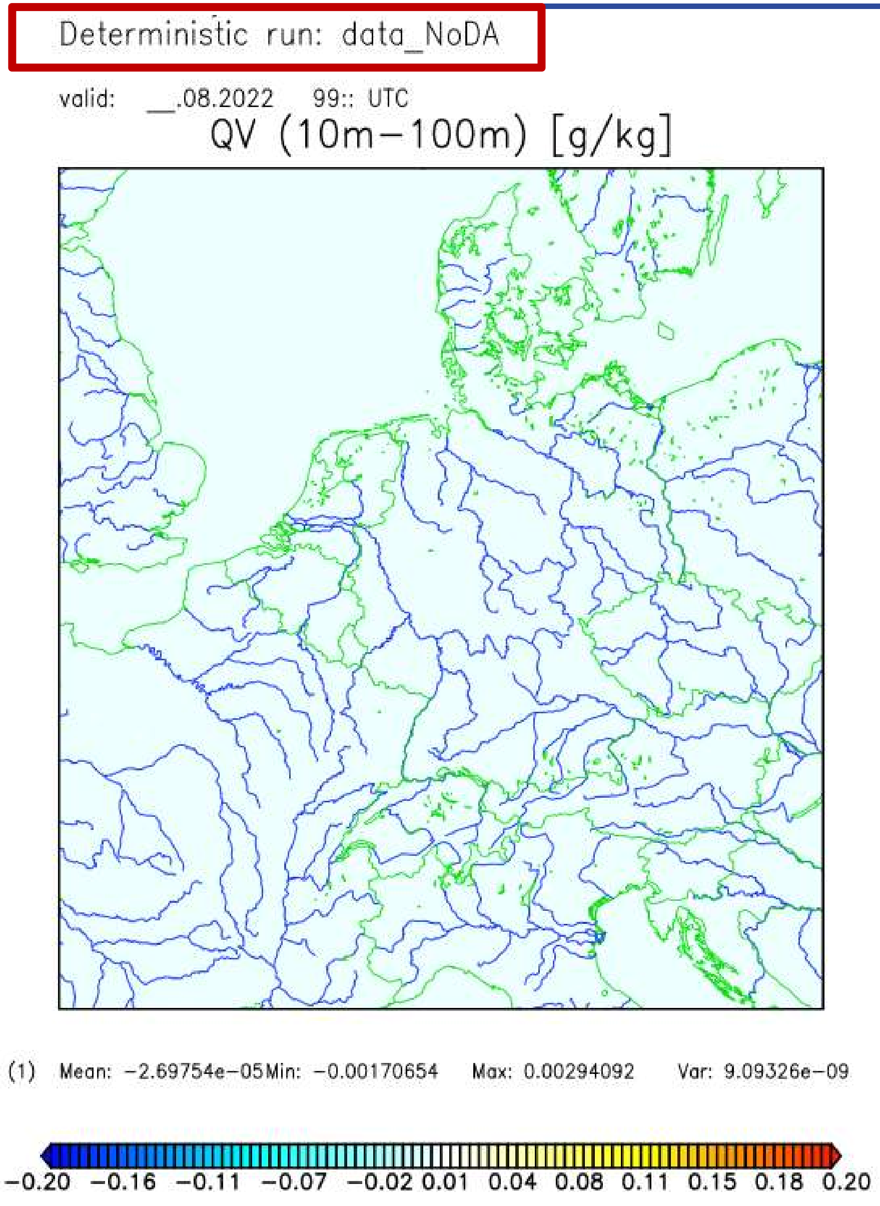
Mean increment in P [Pa] over entire domain valid at 7 UTC

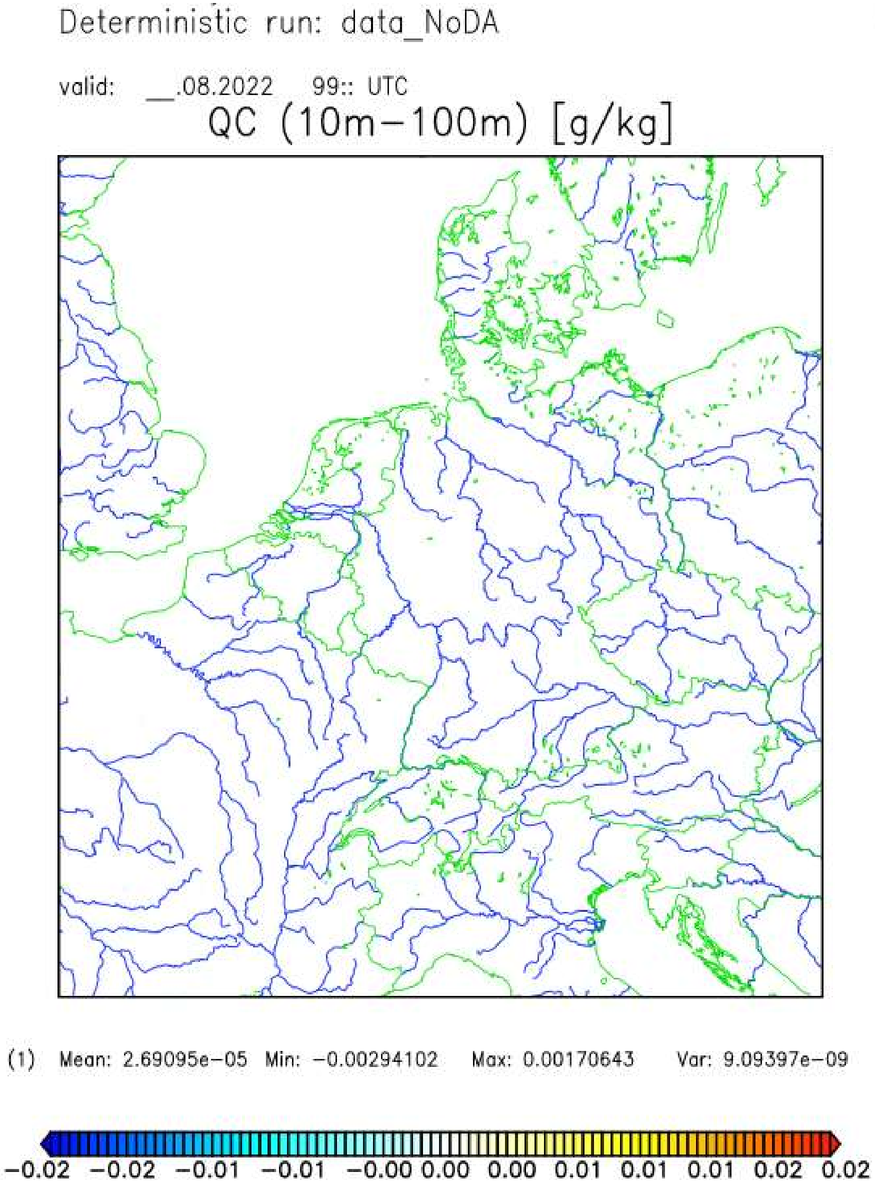


Mean increment in P [Pa



By the way


Deterministic run: data_NoDA
valid: __.08.2022 99:: UTC
QV (10m−100m) [g/kg]
(1) Mean: −2.69754e−05Min: −0.00170654 Max: 0.00294092 Var: 9.09326e−09
−0.20 −0.16 −0.11 −0.07 −0.02 0.01 0.04 0.08 0.11 0.15 0.18 0.20


Deterministic run: data_NoDA
valid: __.08.2022 99:: UTC
QC (10m−100m) [g/kg]
(1) Mean: 2.69095e−05 Min: −0.00294102 Max: 0.00170643 Var: 9.09397e−09
−0.02 −0.02 −0.01 −0.01 −0.00 0.00 0.00 0.01 0.01 0.01 0.02 0.02

What’s the take-home message?

➔ Our DA systems is rather complex! Sure, there will be artefacts.

➔ Monitoring can reveal such artefacts. However, we should not only monitor but also take some action to understand and remove artefacts.

➔ Anomalies in increments are very likely a hint of biases between model and observations. So, should we think about a more intense bias correction in KENDA?