Regional Cooperation for
Limited Area Modeling in Central Europe

LACE
nwp central europe

Data assimilation status at DHMZ

DAWD 18-20.09.2017.

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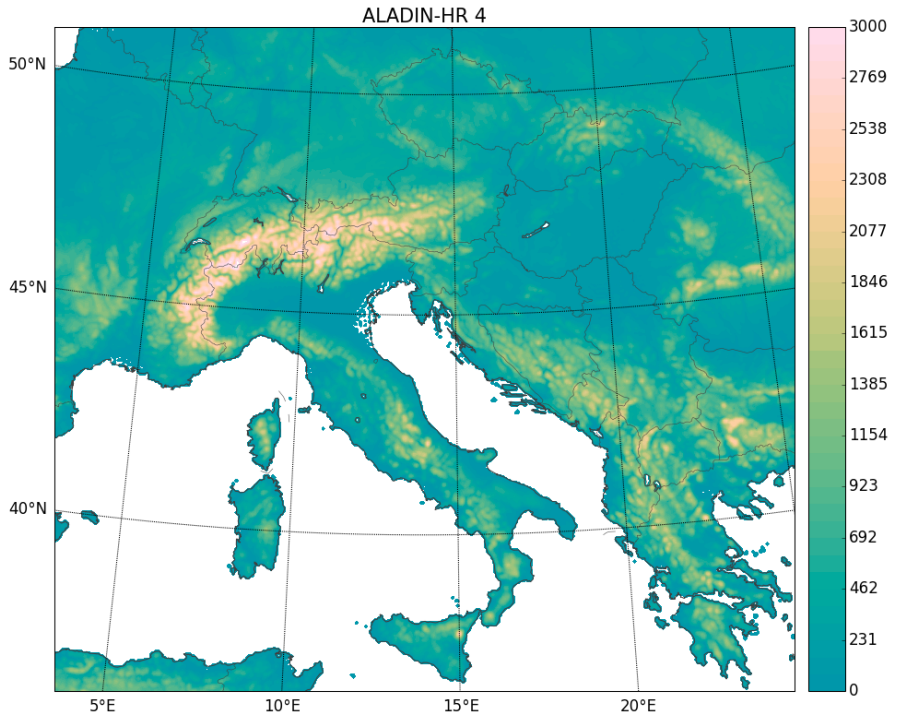
DHMZ SHMU ARSO METEO Slovenia OMSZ ZAMG ROMANIA ANM

New from last DAWD

- ALADIN-HR4 with data assimilation operational
- New B matrix computed – still under evaluation
- Work on radar data assimilation started

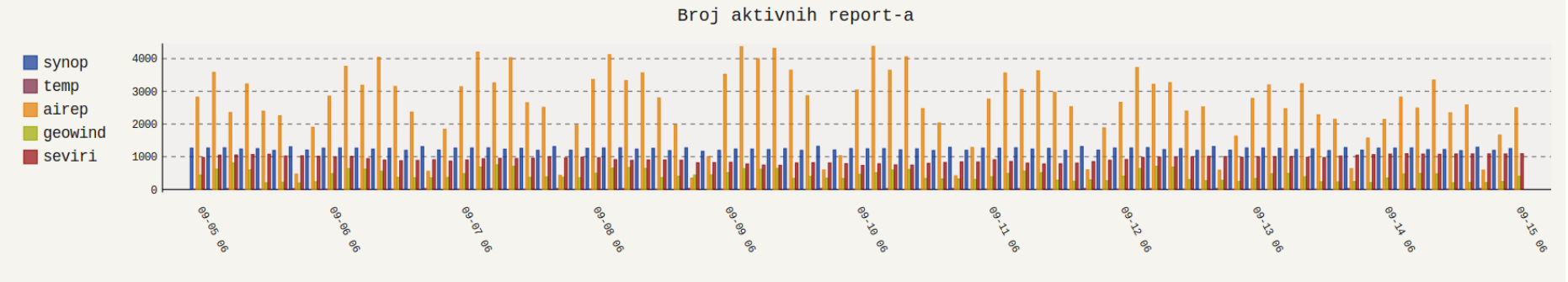
ALADIN-HR4 data assimilation setup

- 4km horizontal resolution
- 73 vertical levels
- Surface: CANARI OI (cy38t1)
- Upper air: 3DVar (cy38t1)
- 3h cycle (cy38t1)
- LBC from ECMWF

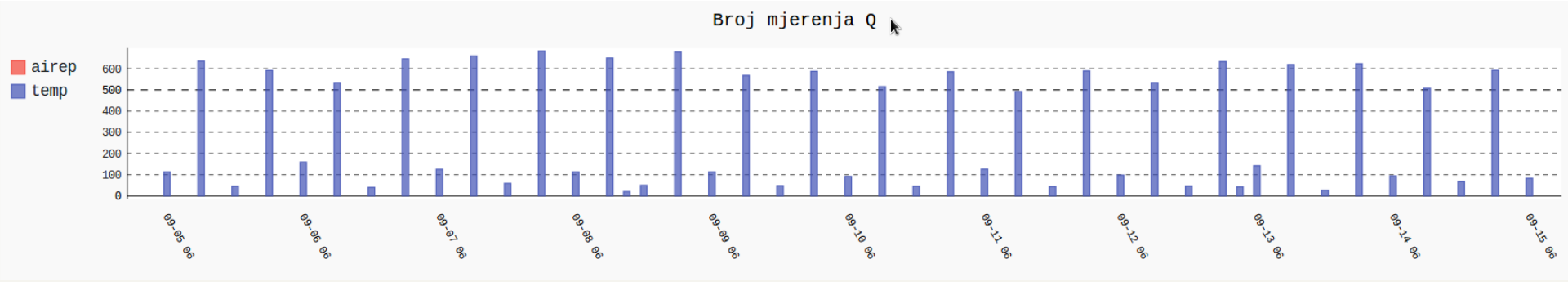


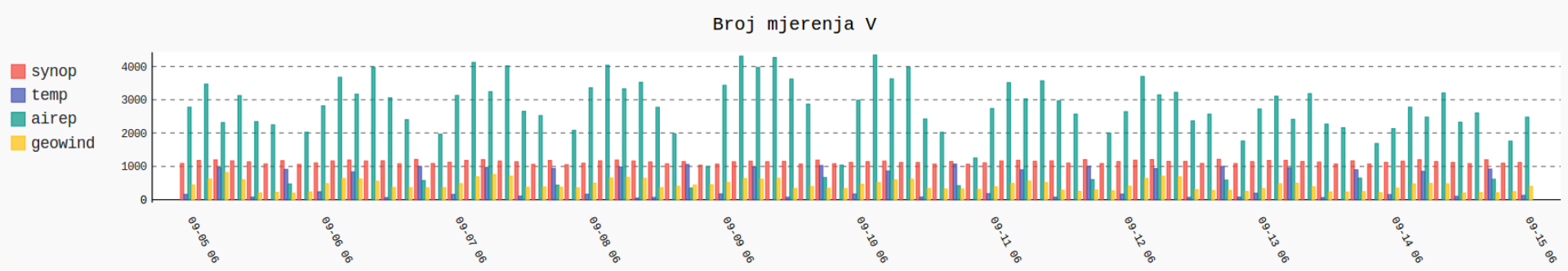
Data assimilated

- SYNOP
- TEMP
- GEOWIND
- AMDAR and MODE-S MRAR (Slovenia)
- SEVIRI (ch: 2,3,4,6)

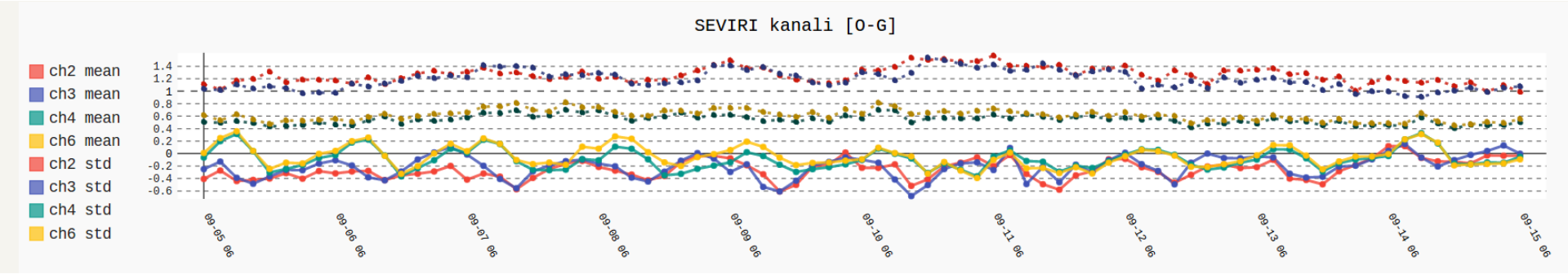


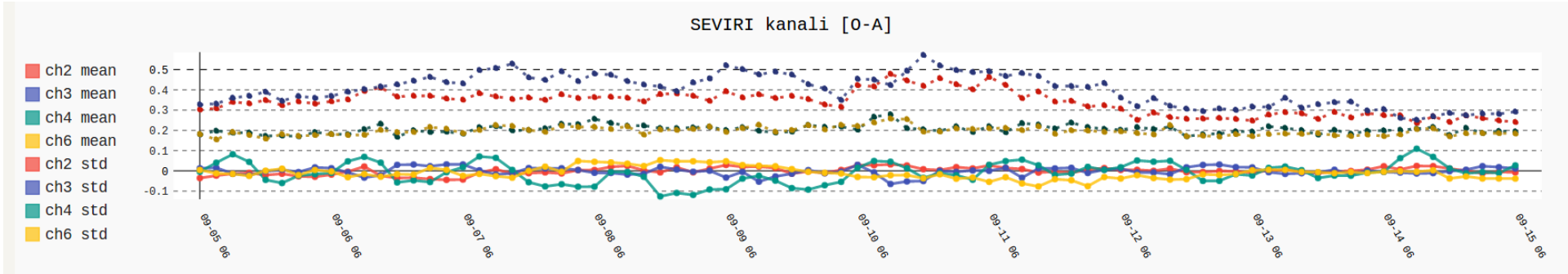
Data assimilated - monitoring (10 days)

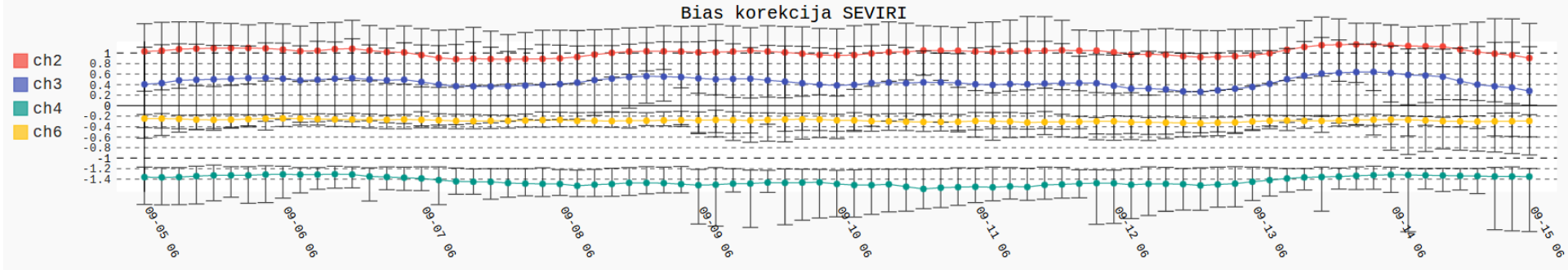




Data assimilated – monitoring SEVIRI







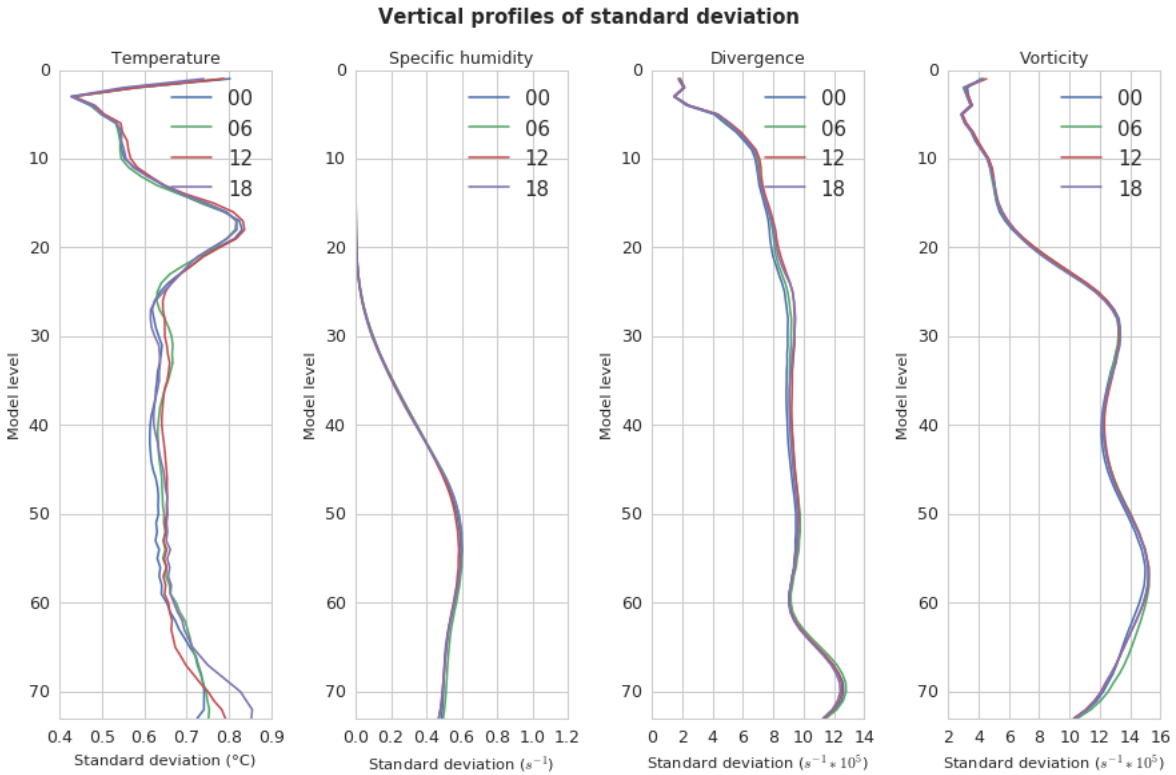
B matrix

- Comparison of B matrix obtained by different computation methods
  - NMC (standard, 12-36h fcst. differences, 4 runs per day) - NMC
  - Ensemble (local ALADIN-HR4 ensemble, 6 members, 6h cycle, upper air observation perturbation)
    - Operational ECMWF LBC same for all members - ENS
    - LBC from ECMWF global ensemble - ENS-LBC
- Time period: 20161210 – 20170228
- Number of differences:
  - NMC – 316
  - ENS/ENS-LBC – 972

Goal: compare NMC vs. ENS diagnostics, evaluate influence on forecast scores, evaluate impact of LBC error on ENS statistics

B matrix

- Bmatrix was estimated for 4 analysis times 00,06,12 and 18 UTC
- Differences exists but rather small

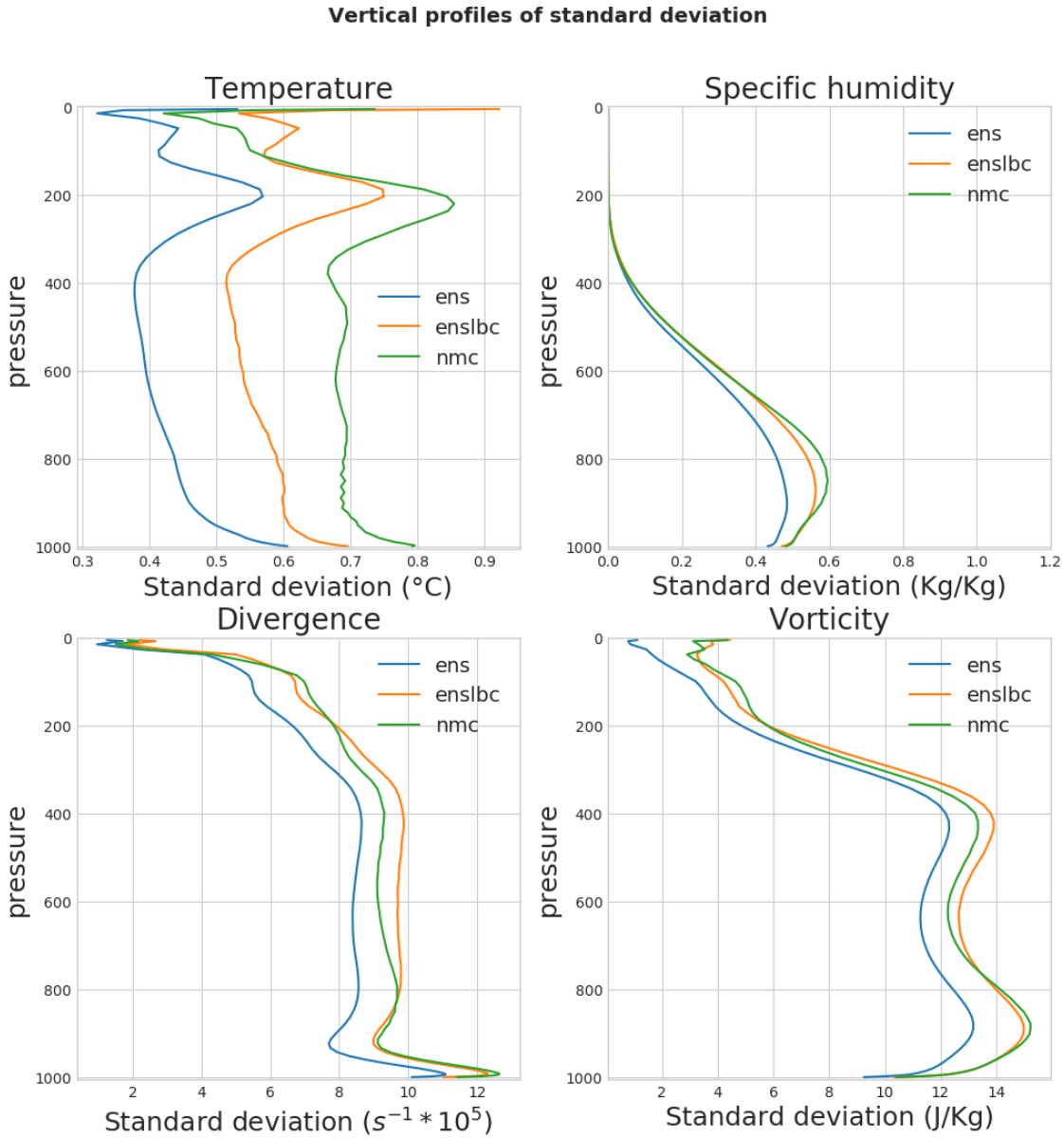


B matrix

- B matrices for comparison were estimated over all available sample of differences
- Diagnostic study still in progress
- Verification was performed for May and July 2017
  - Statistical scores using HARMONIE

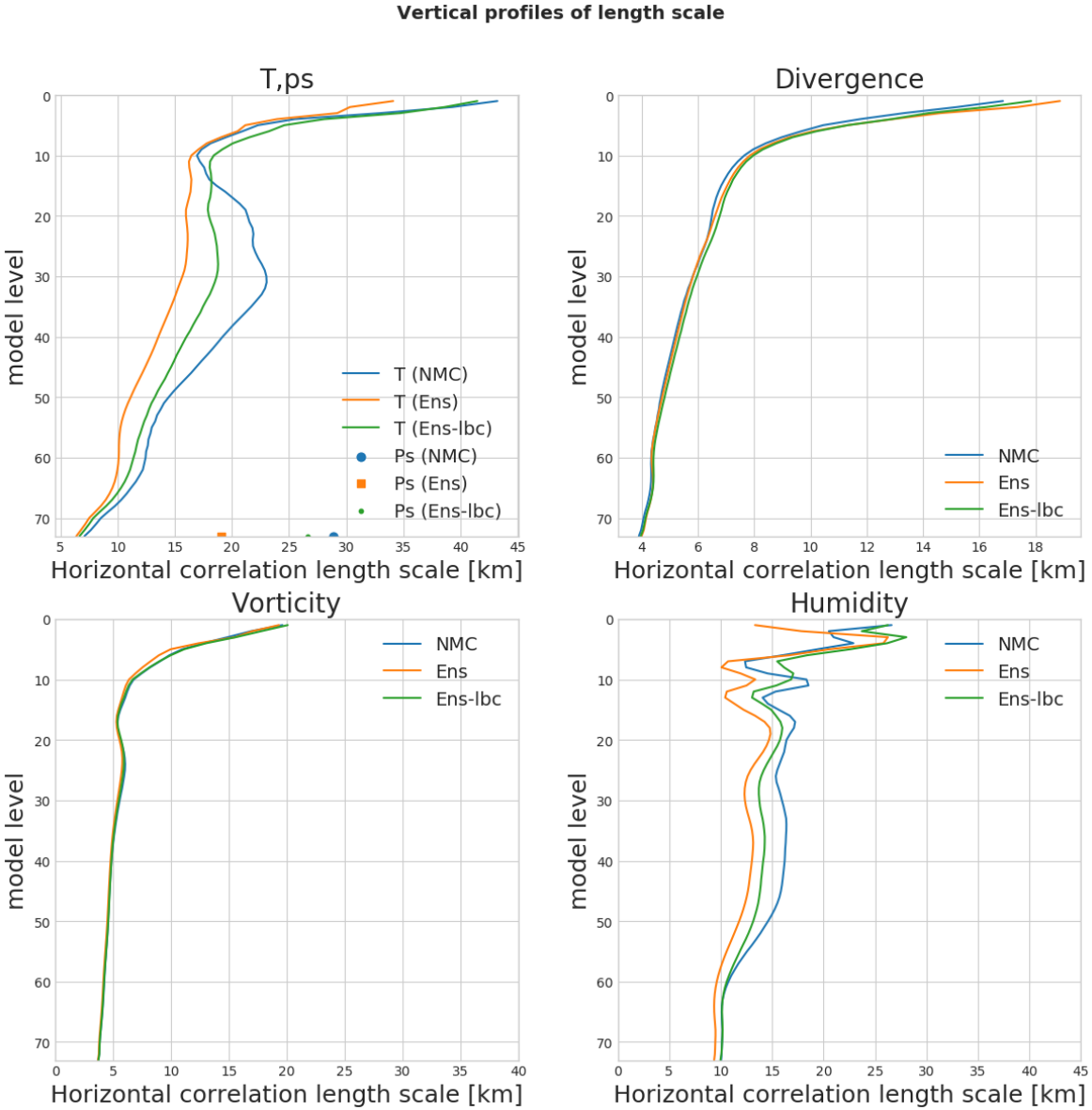
B matrix - diagnostics

- Largest std for NMC method, smalles for ENS
- Similar shape
- Except temperature, ENS-LBC and NMC very simmilar



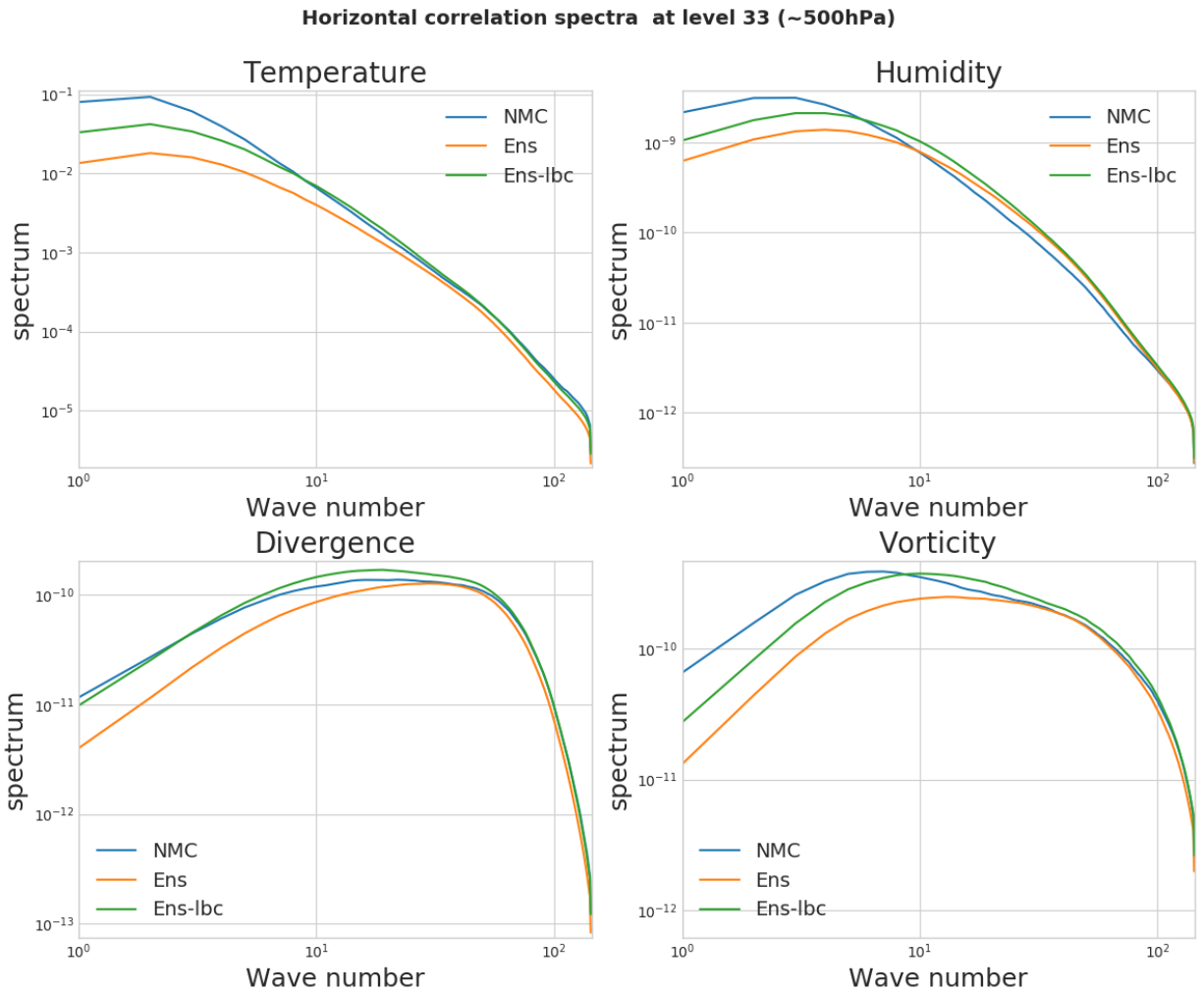
B matrix - diagnostics

- Shorter length scales for ensemble B matrix than NMC
- Shape simmilar for ENS and ENS-LBC



B matrix - diagnostics

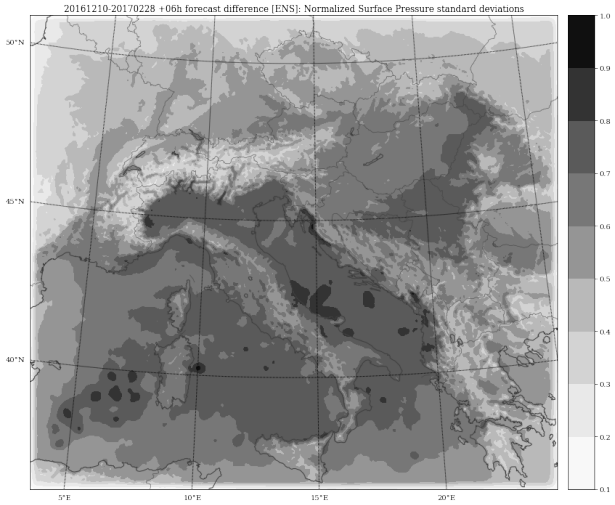
- Smallest energy for ENS on almost all scales especially on long scales (no LBC perturb.)
- A bit higher contribution of smaller scales for ENS-LBC method compared to NMC



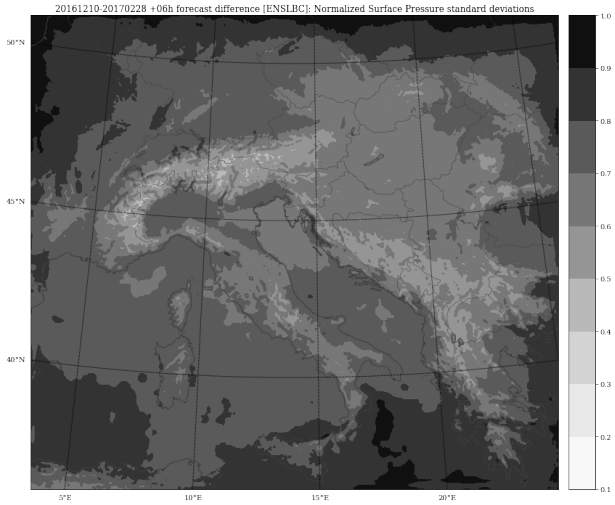
B matrix - diagnostics

Normalized Surface Pressure standard deviations

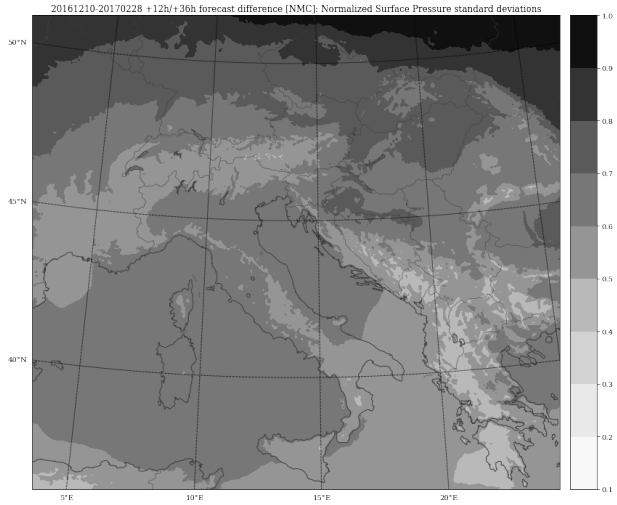
ENS



ENS-LBC



NMC

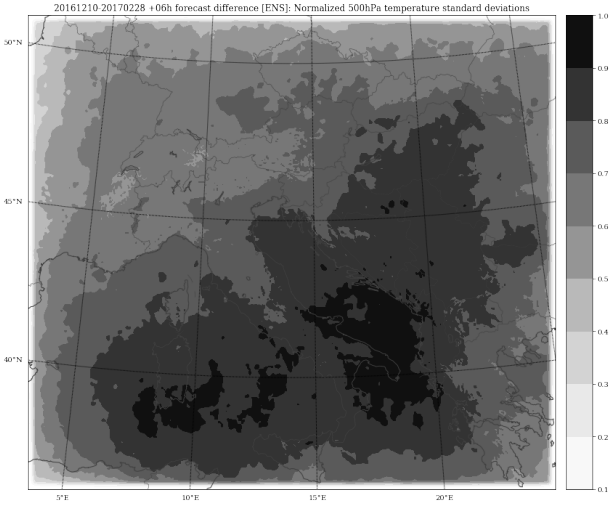


- Big influence of LBC on standard deviation

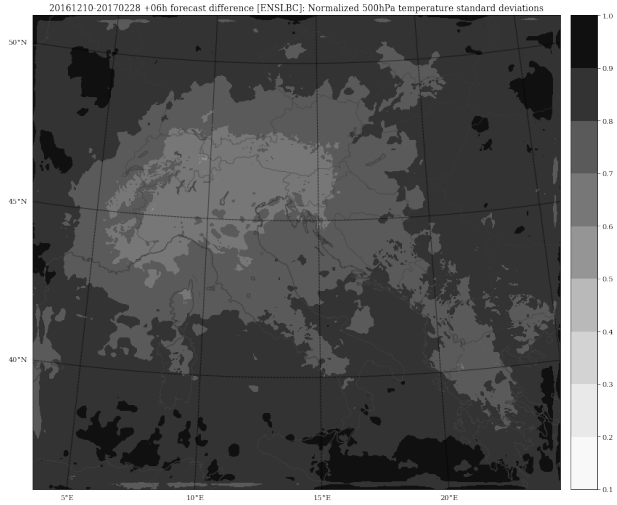
B matrix - diagnostics

Normalized temperature at lev 33 (~500hPa) standard deviations

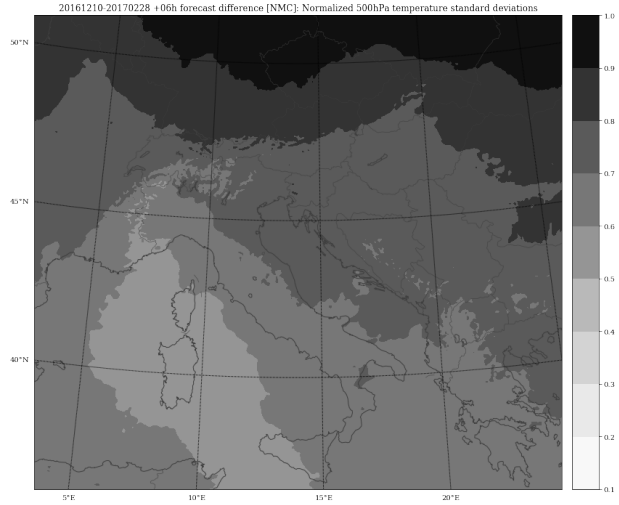
ENS



ENS-LBC



NMC



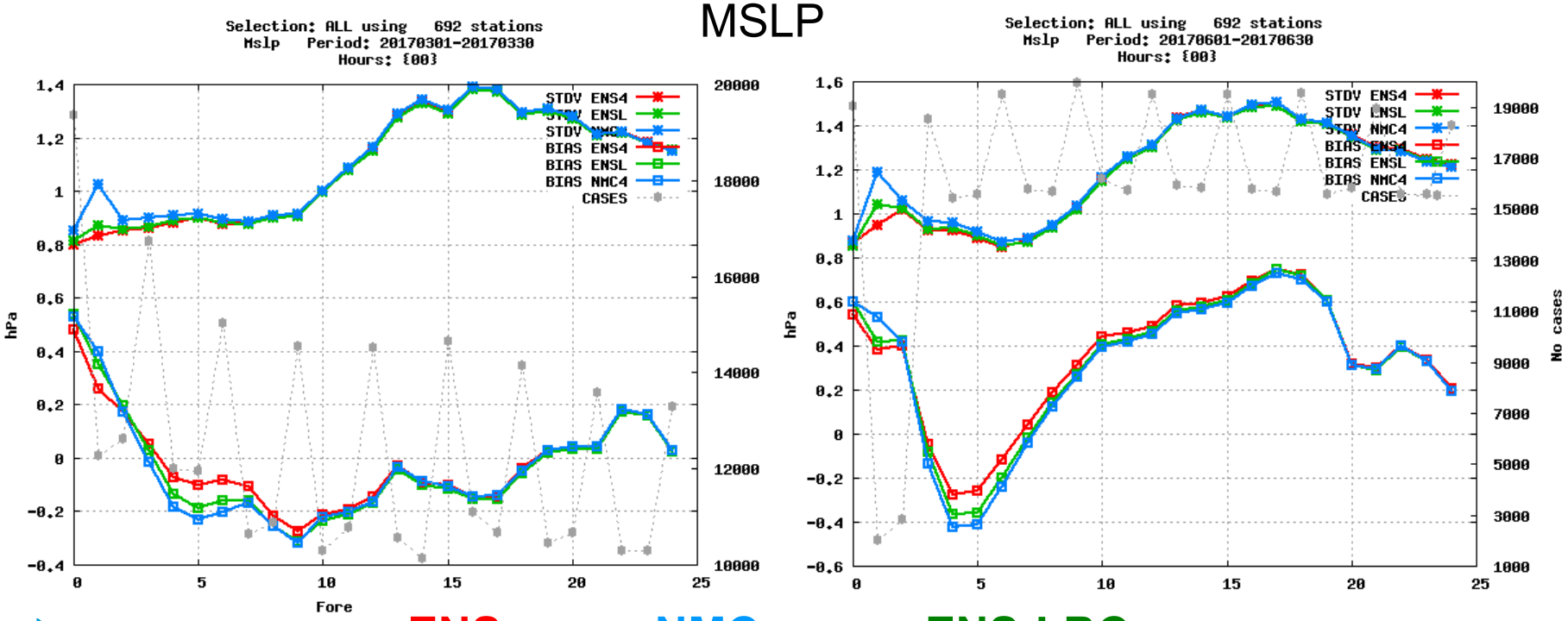
B matrix - verification

- Verification was done for May and June 2017; tuning of B matrix performed over one month period (Desrozier et al; REDNMC: NMC → **1.3**; ENS_LBC → **1.4**; ENS → **1.7**)
- Small differences in surface scores, mainly visible in first 24 hour
- Bigger differences for upper-air

May

MSLP

June

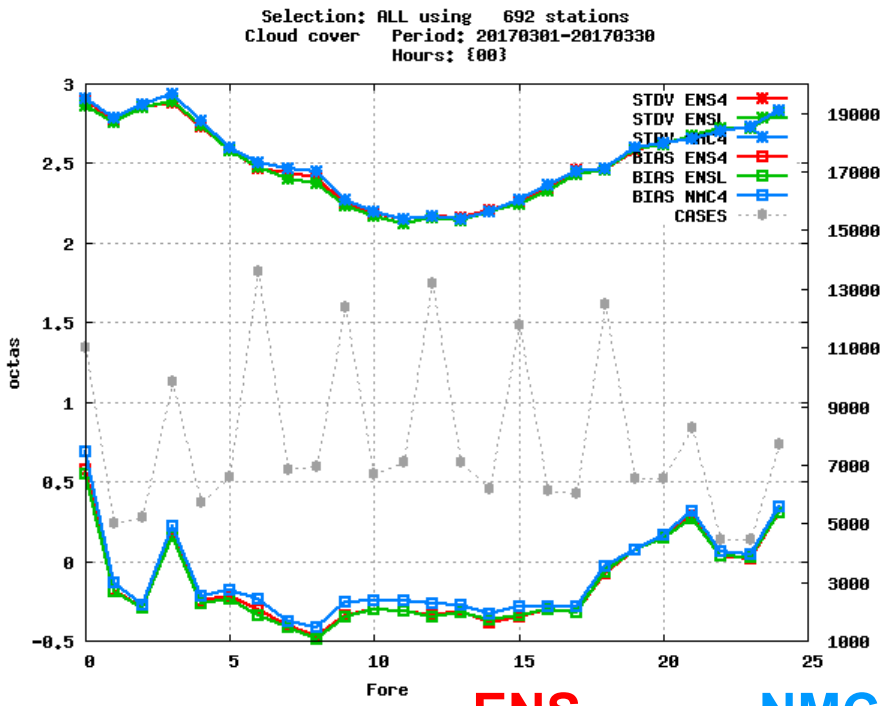


ENS **NMC** **ENS-LBC**

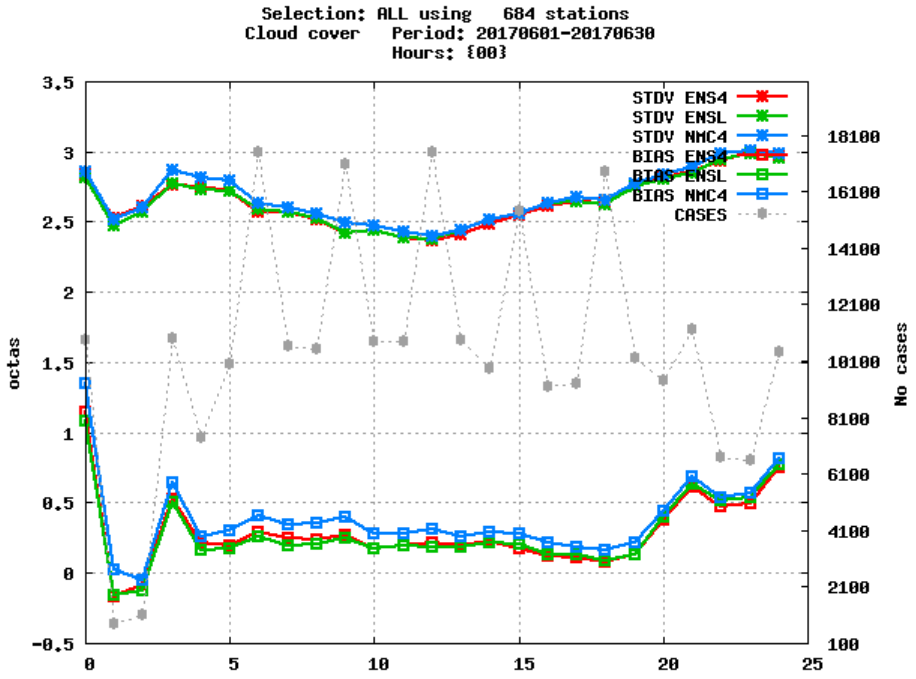
B matrix - verification

Cloud cover

May



June

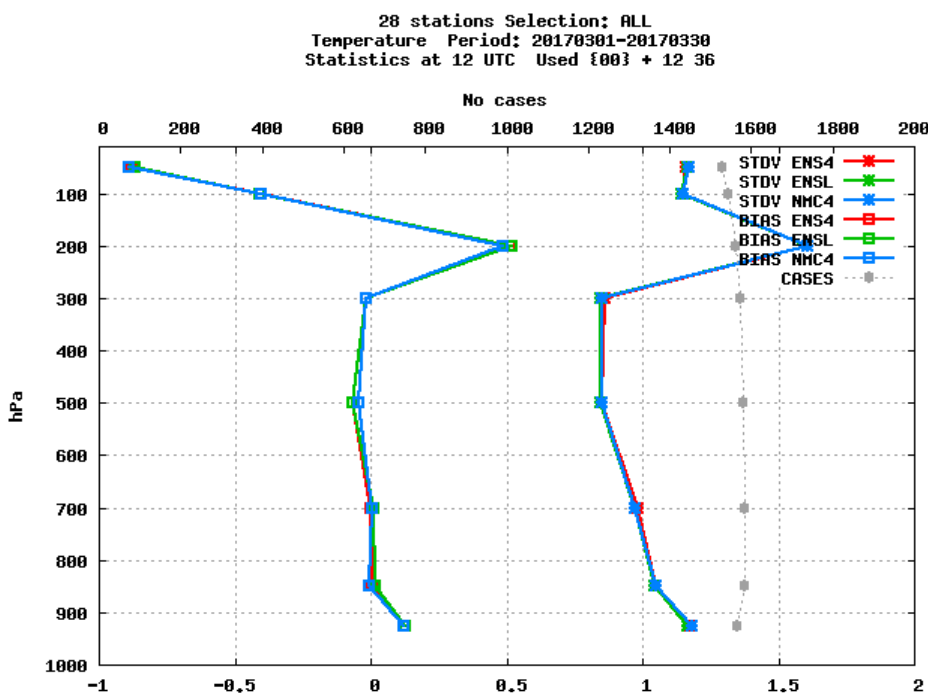


ENS **NMC** **ENS-LBC**

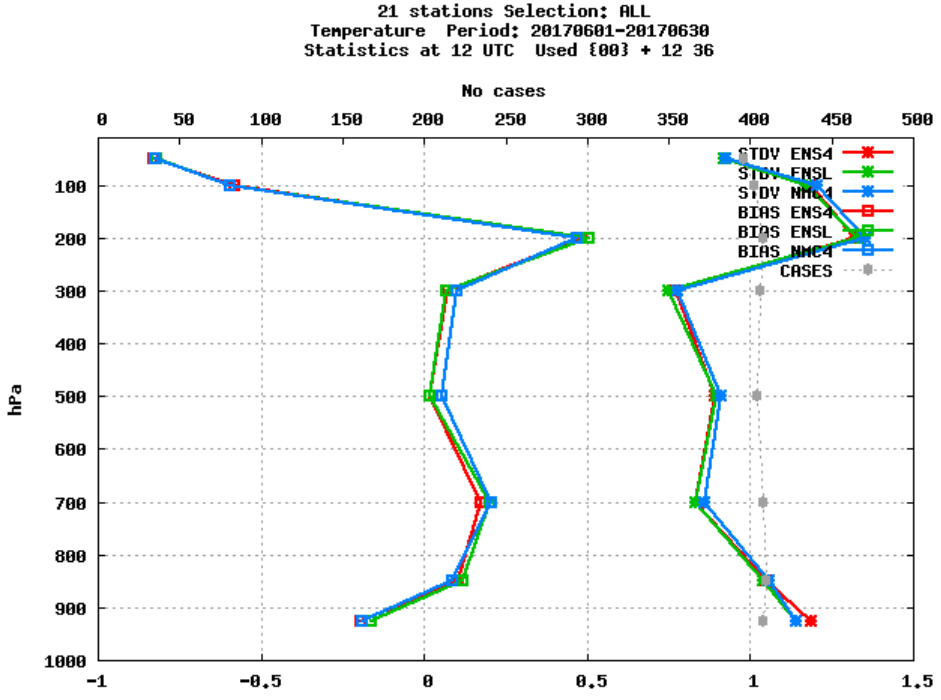
B matrix - verification

Temperature

May



June

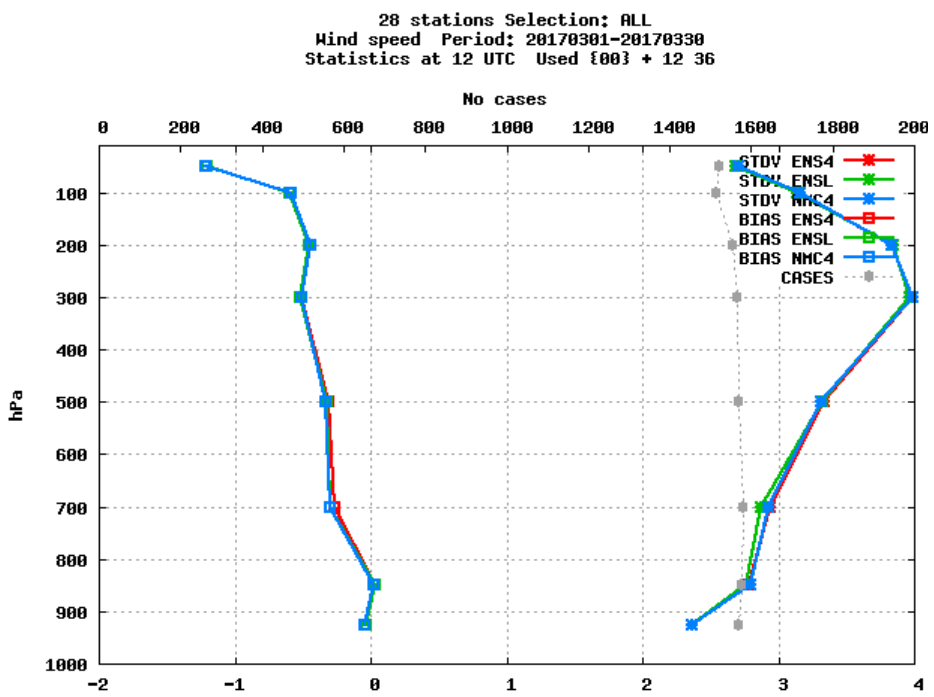


ENS **NMC** **ENS-LBC**

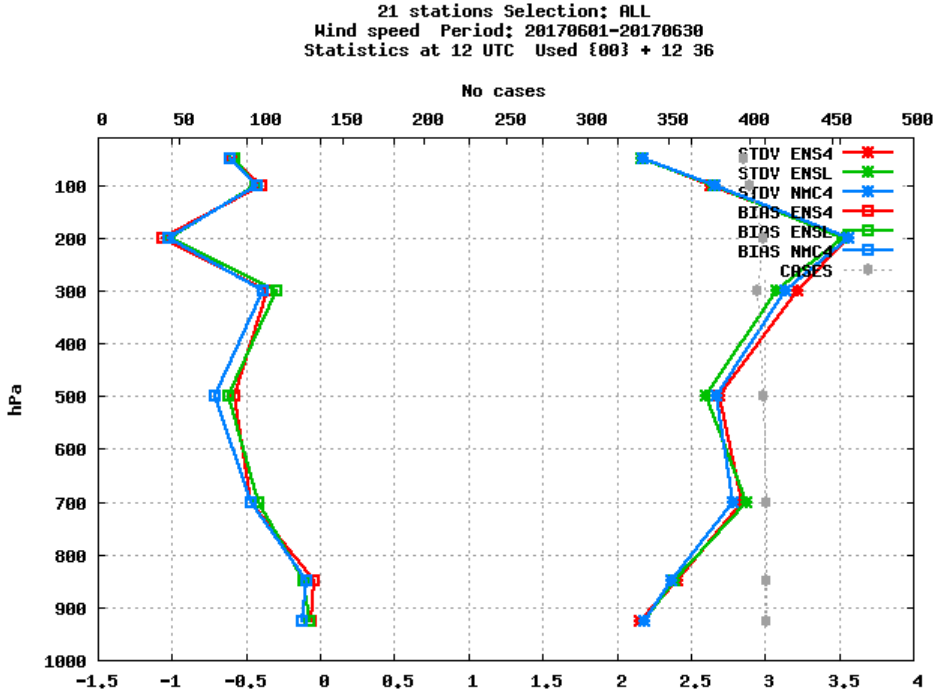
B matrix - verification

Wind speed

May



June

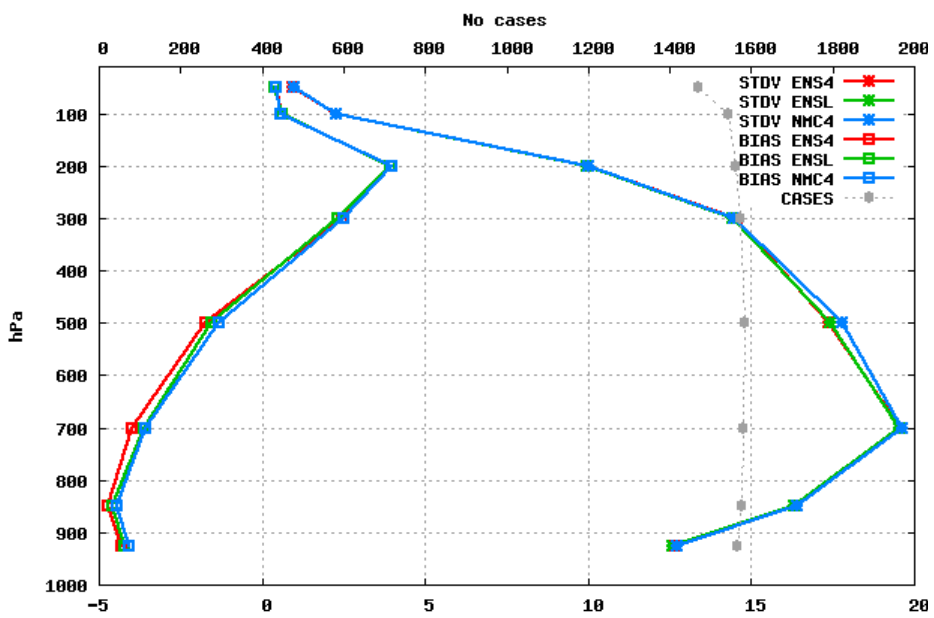


ENS **NMC** **ENS-LBC**

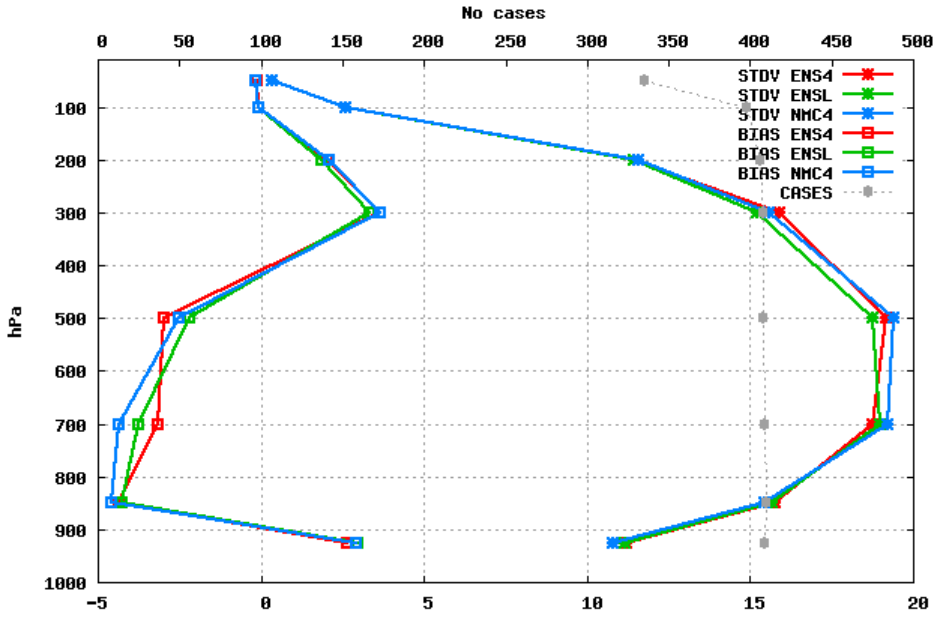
B matrix - verification

Relative humidity

May



June



ENS **NMC** **ENS-LBC**

B matrix

- New B matrix computed using ensemble method
  - ongoing diagnostics and verification
  - diagnostic results more or less as expected
  - Verification scores similar for ensemble methods but mainly better for ensemble B matrix

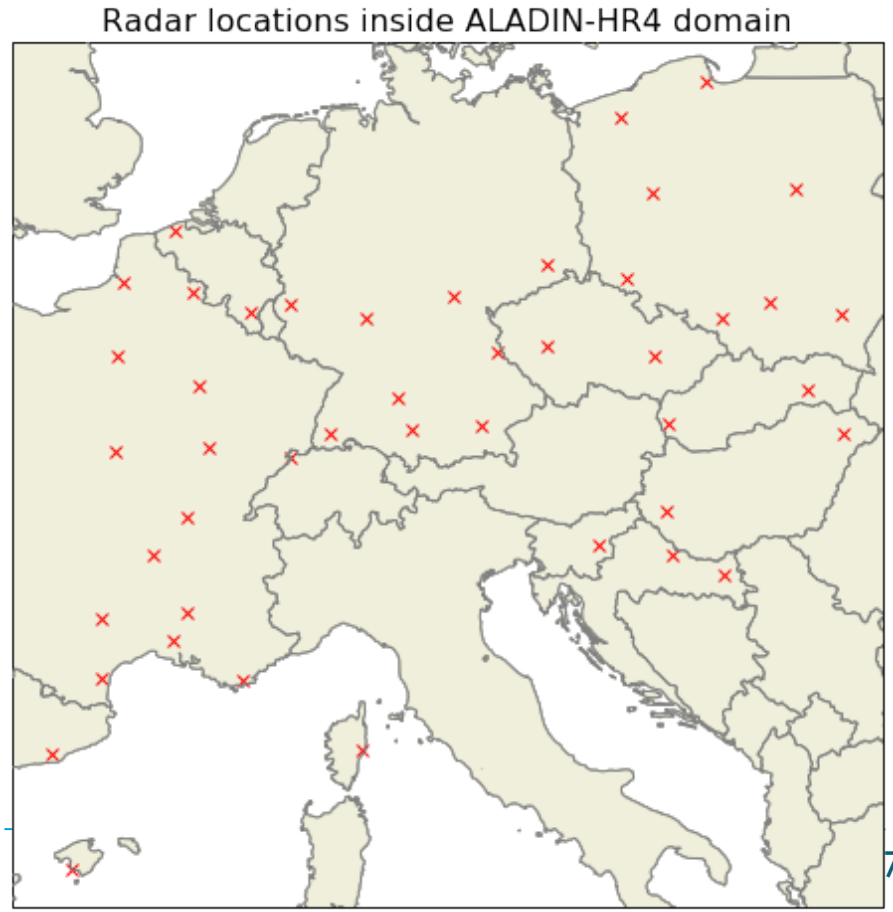
Radar data assimilation

Plan:

1	To try to get data from OIFS	Done
2	To do inspection of HDF5 files and to see what is common and what is different in files from different countries	Ongoing
3	To check data quality.	Not done
4	To check prepopera.py and to see if some modifications are needed	Ongoing
5	To see what changes are needed in BATOR.	Not done
6	To do assimilation with radar data.	Not done

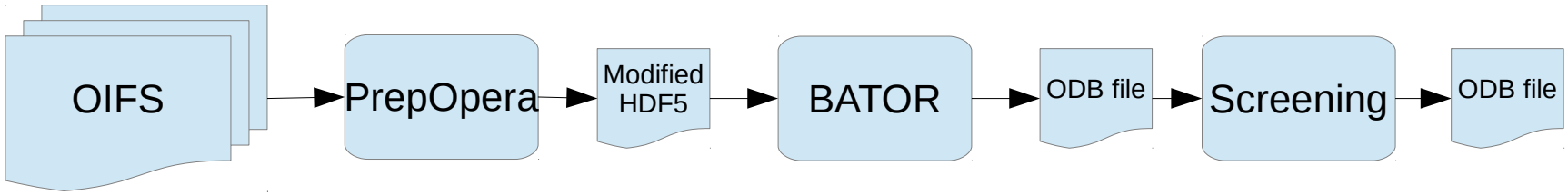
Radar data assimilation

- we have applied for OPENIFS account
- from beginning of July started to store OPERA volume scans from individual radars in our domain with hourly frequency



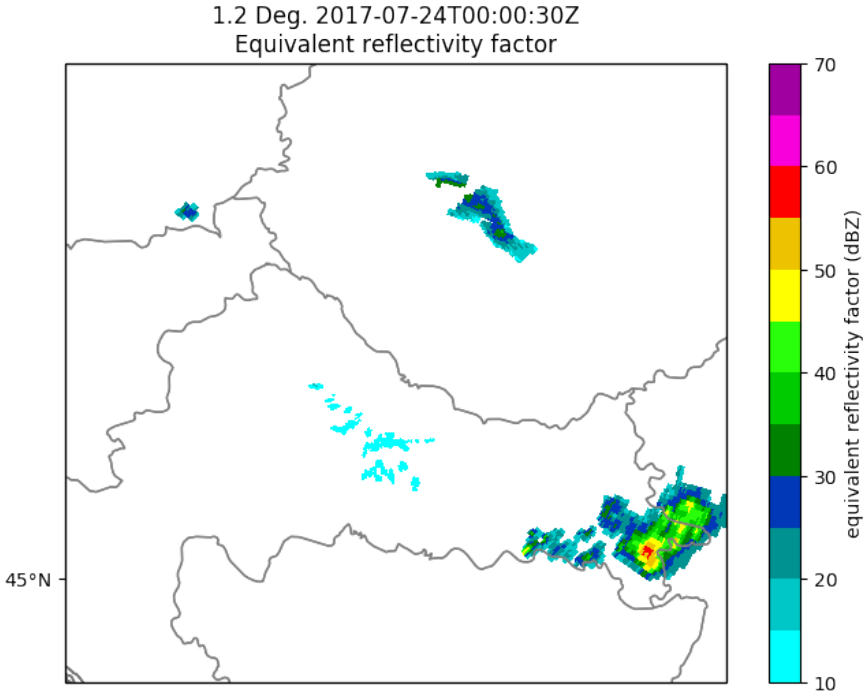
Radar data assimilation

- Radar data preprocesing is done by prepoper.py and BATOR
- BATOR with subroutines that allow usage of higher elevations, provided by Florian Meier was compiled
- Scripts for BATOR and prepopera.py were adjusted and technical reading of several radar files (preprocessed with prepopera.py) in ODB database was successful

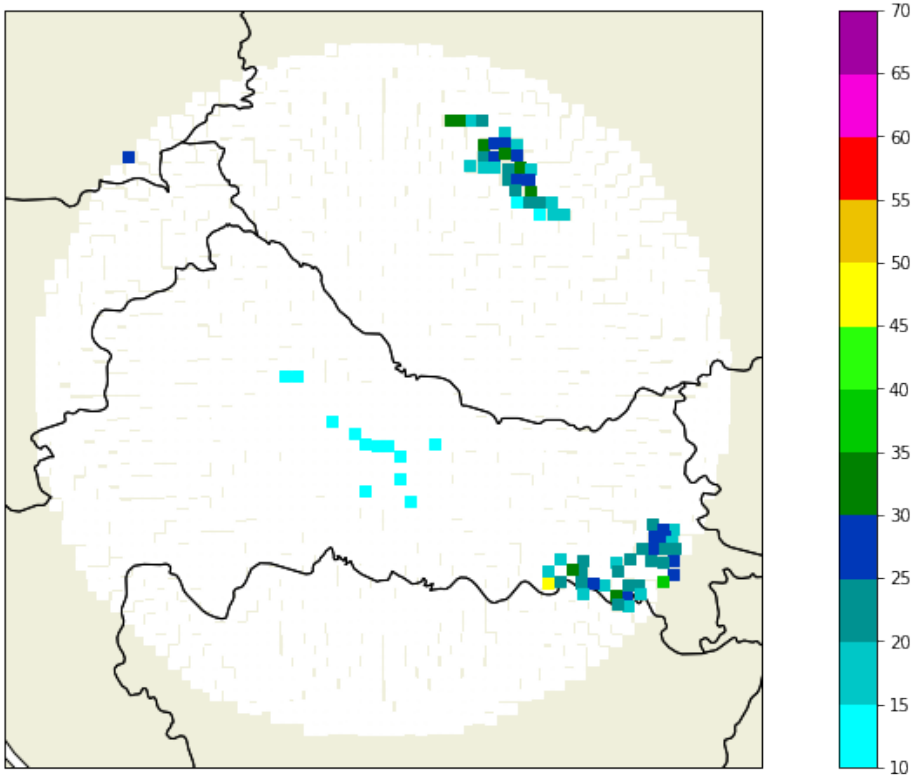


Radar data assimilation

HDF preprocessed by prepopera



Content of ODB



Some ideas about radar data assimilation

- Moving projection from BATOR to Prepopera.
  - To put projection from polar to Cartesian coordinates in Prepopera
  - Output file in Cartesian coordinates
  - To add a new dataset with heights of data points
  - Simpler BATOR; no calculation of horizontal positions and height
  - More open to modifications from radar experts.
- To remove representativeness errors
  - • For models with horizontal resolution of 4km and 2 or 1 km all details of radar image are not needed because processes that cause them are not resolved by model
  - Instead of thinning to use smoothing or filtering

Some ideas about radar data assimilation

- To keep scan with lowest elevation
  - Presently this scan is removed because there is to much clutter in it
  - More work with radar experts is needed to remove ground clutter and anomalous propagation.
  - To ask OPERA to add flags for suspicious data to the lowest elevation scans
- To consider radial component of vertical speed of falling precipitation

Plan

Plans:

- Implement GPS data (planned for this year) in data assimilation suite (start with test) ?
- Continue work on B matrix → ensemble B matrix will probably go to operational suite
- Set up data assimilation suite at ECMWF
- Continue work on radar data assimilation