



# NWP at Meteorological and Hydrological Service of Croatia in autumn 2017

Martina Tudor (tudor@cirus.dhz.hr), Stjepan Ivatek-Šahdan, Antonio Stanešić, Tomislav Kovačić, Mario Hrastinski, Suzana Panežić, Iris Odak Plenković, Alica Bajić, Kristian Horvath  
Meteorological and Hydrological Service of Croatia, Grič 3, HR10000 Zagreb, Croatia

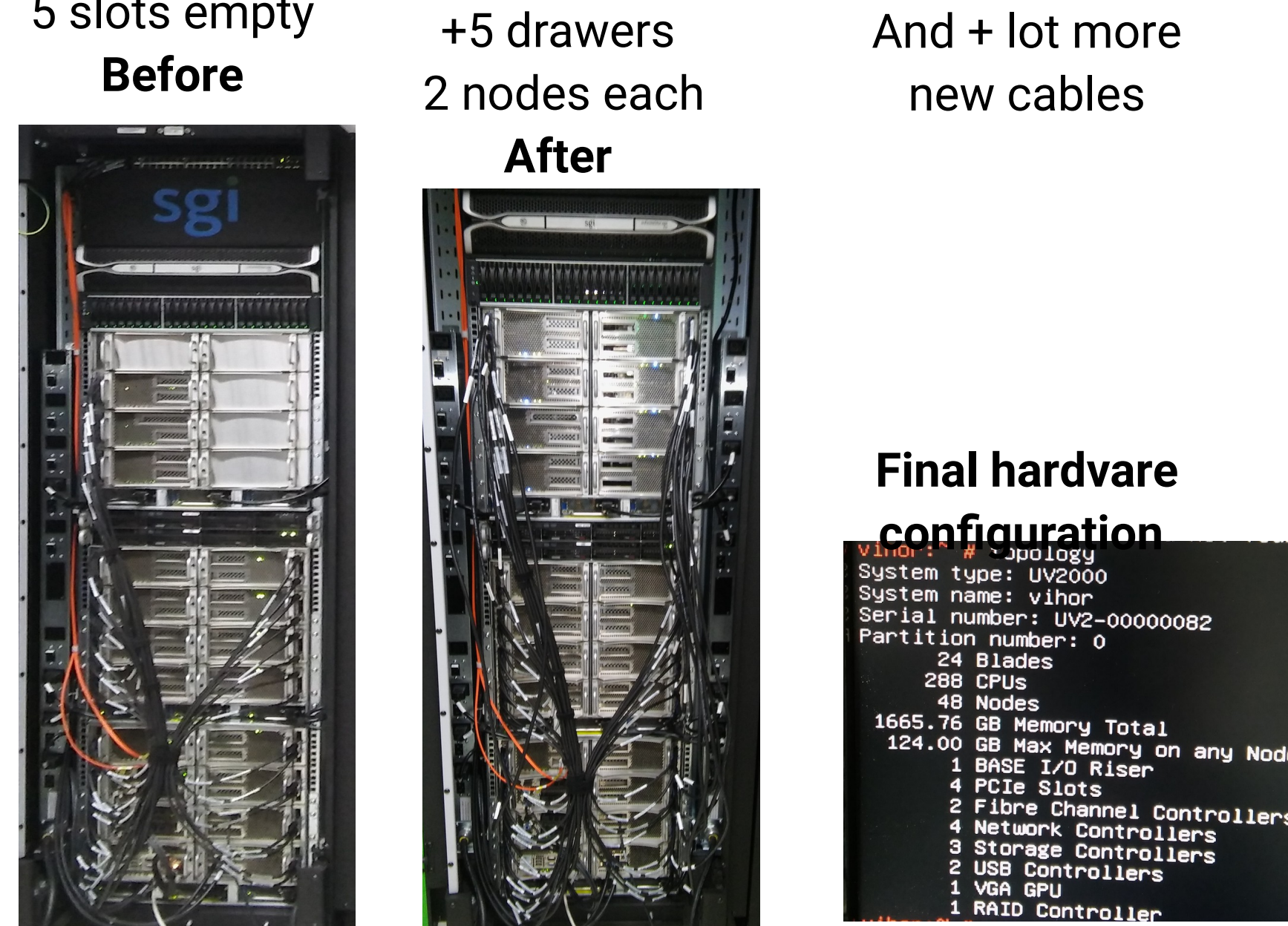
## INTRODUCTION

The operational model version used is AL38T1 with ALAR00 physics for 8, 4 and 2 km resolution forecasts. Operational forecasts run for:

- 8 km res, 360 sec, 4 times per day, 3D-Var and surface OI, 3h cycling, to 72 hours, LBCs: IFS, 37 levels.
- 4 km res, 180 sec, hydrostatic, 4 times per day, up to 72 hours, 3D-Var and surface OI, 3h cycling, LBCs: IFS, 73 levels.
- 2 km dynamical adaptation, 60 sec time-step, hourly, up to 72 hours,
- 2 km non-hydrostatic run, 60 sec time-step, using AL36T1 with available ALAR00 developments, from 06 UTC up to 24 hours.

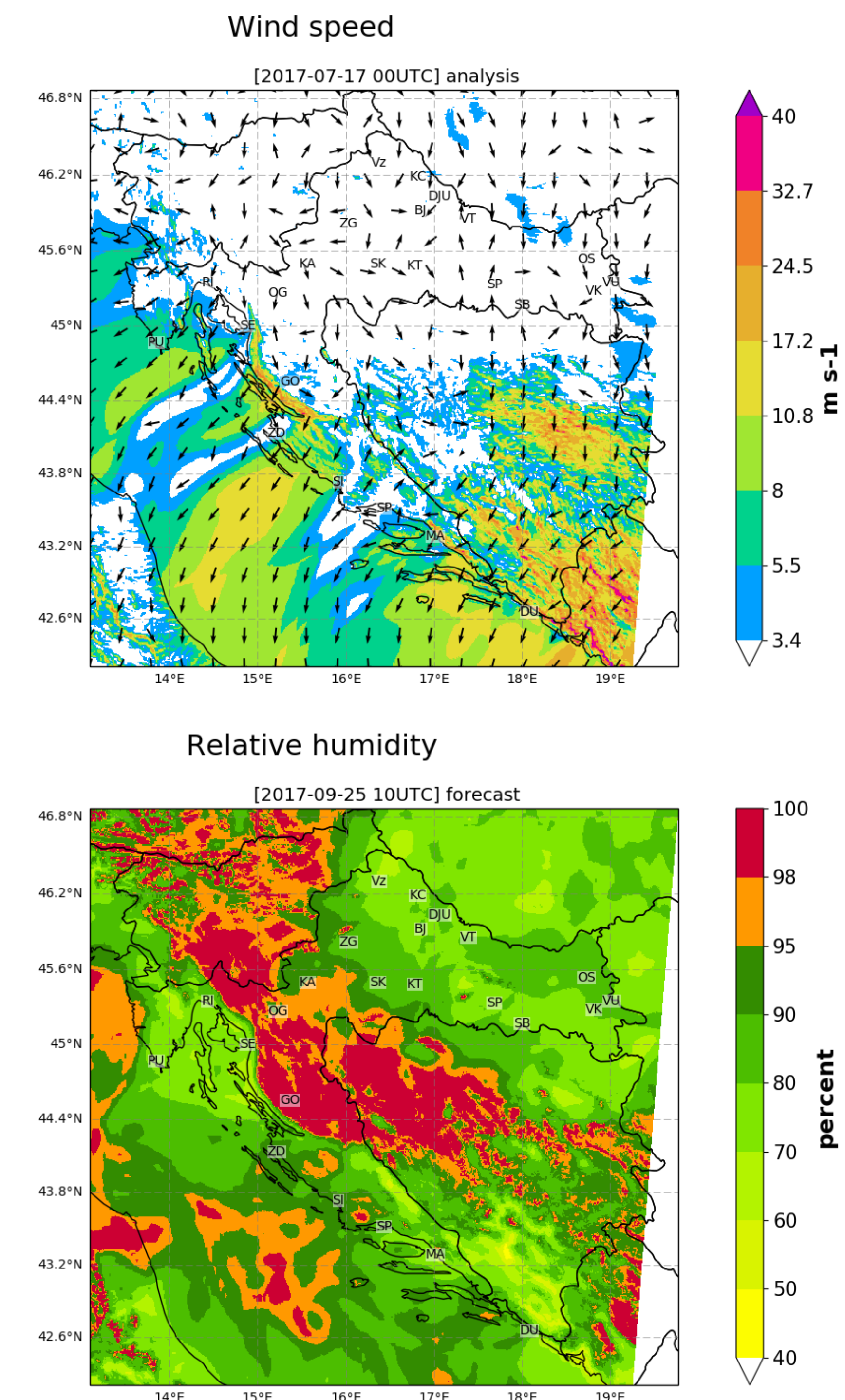
## Hardware upgrade

The mainframe computer was upgraded by 10 nodes (60 cores) reaching 48 nodes (288 cores).  
5 slots empty +5 drawers And + lot more new cables



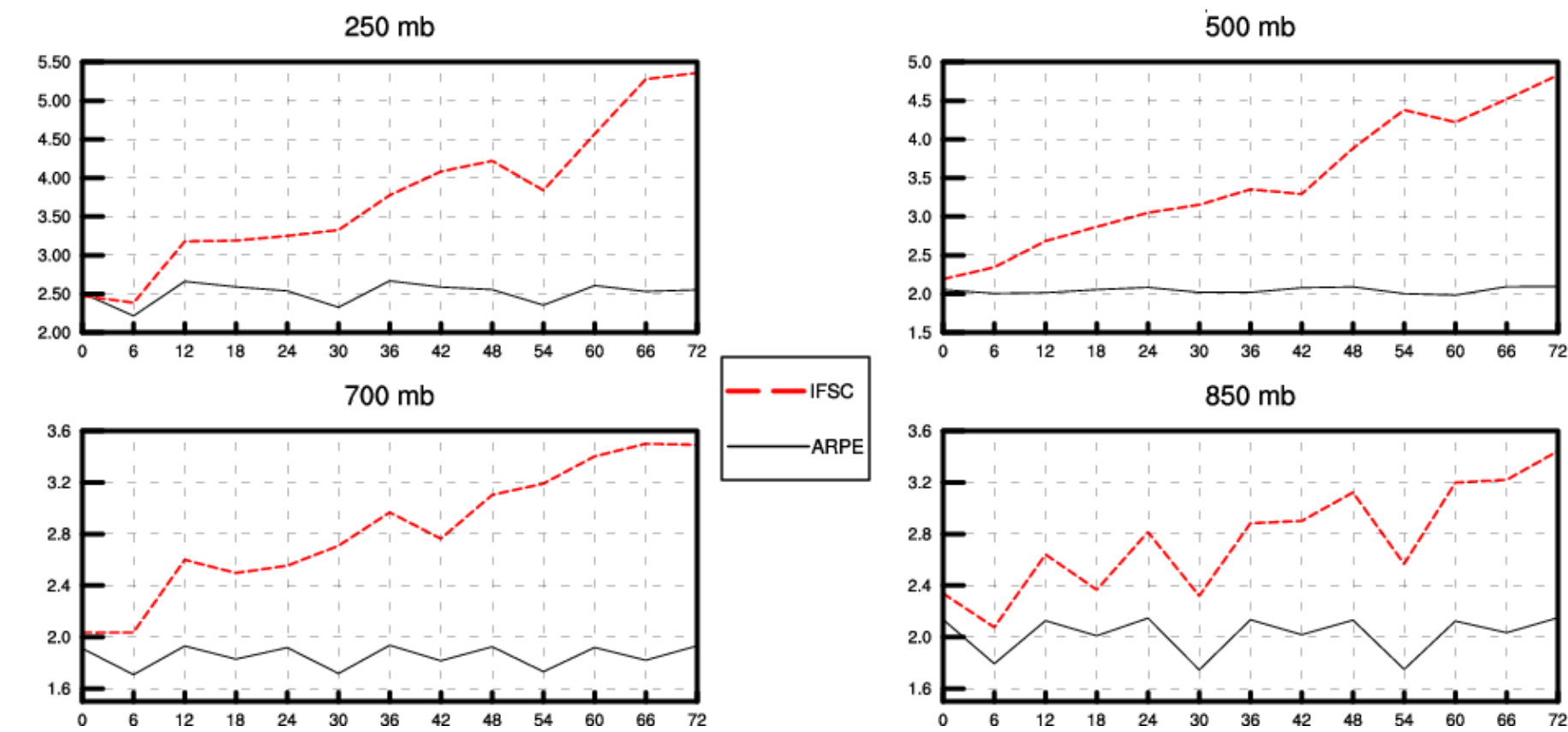
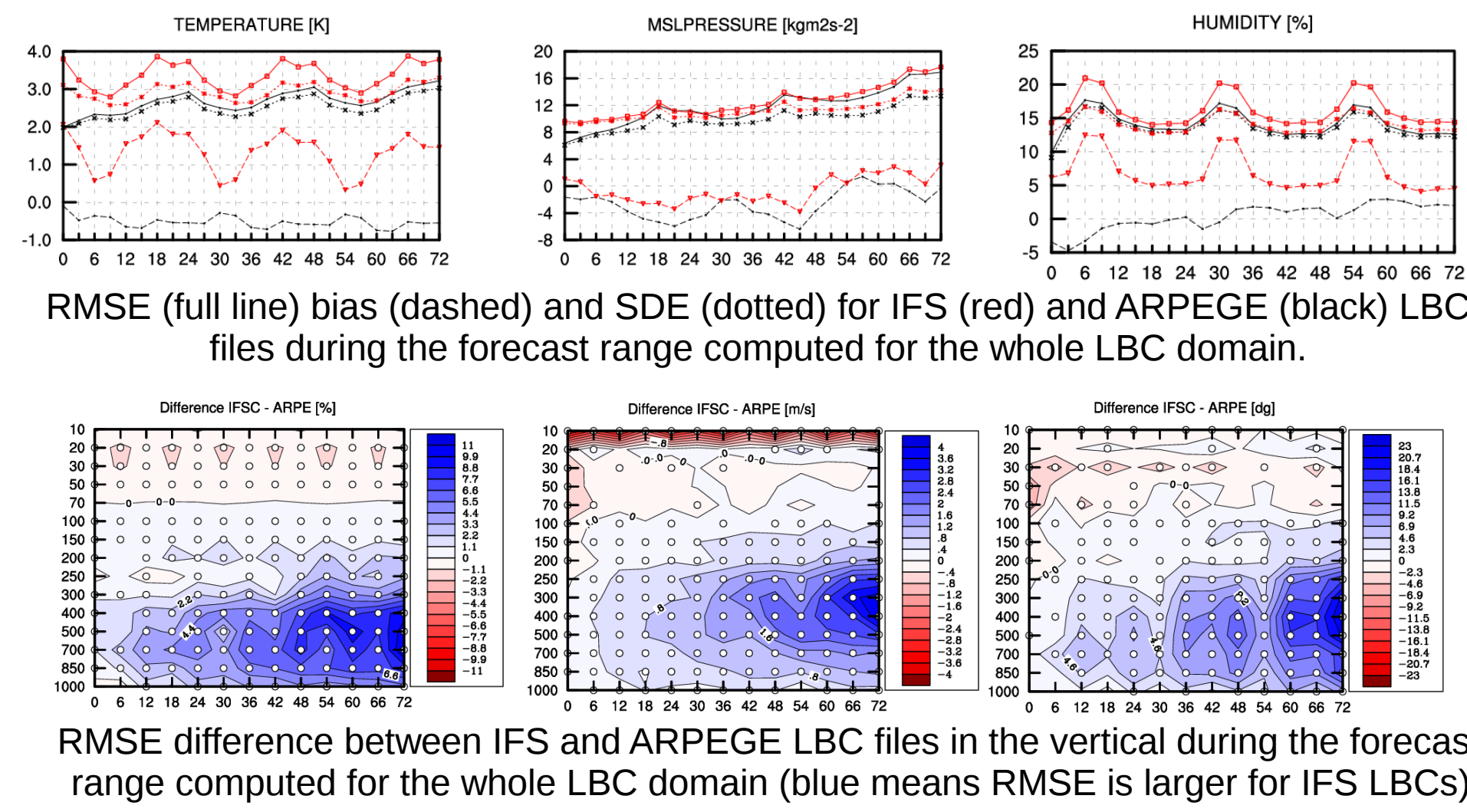
## Nowcasting using INCA in Croatia

Results of nowcasting 10 m wind and 2 m relative humidity using INCA with ALADIN-HR4 forecast as first guess.



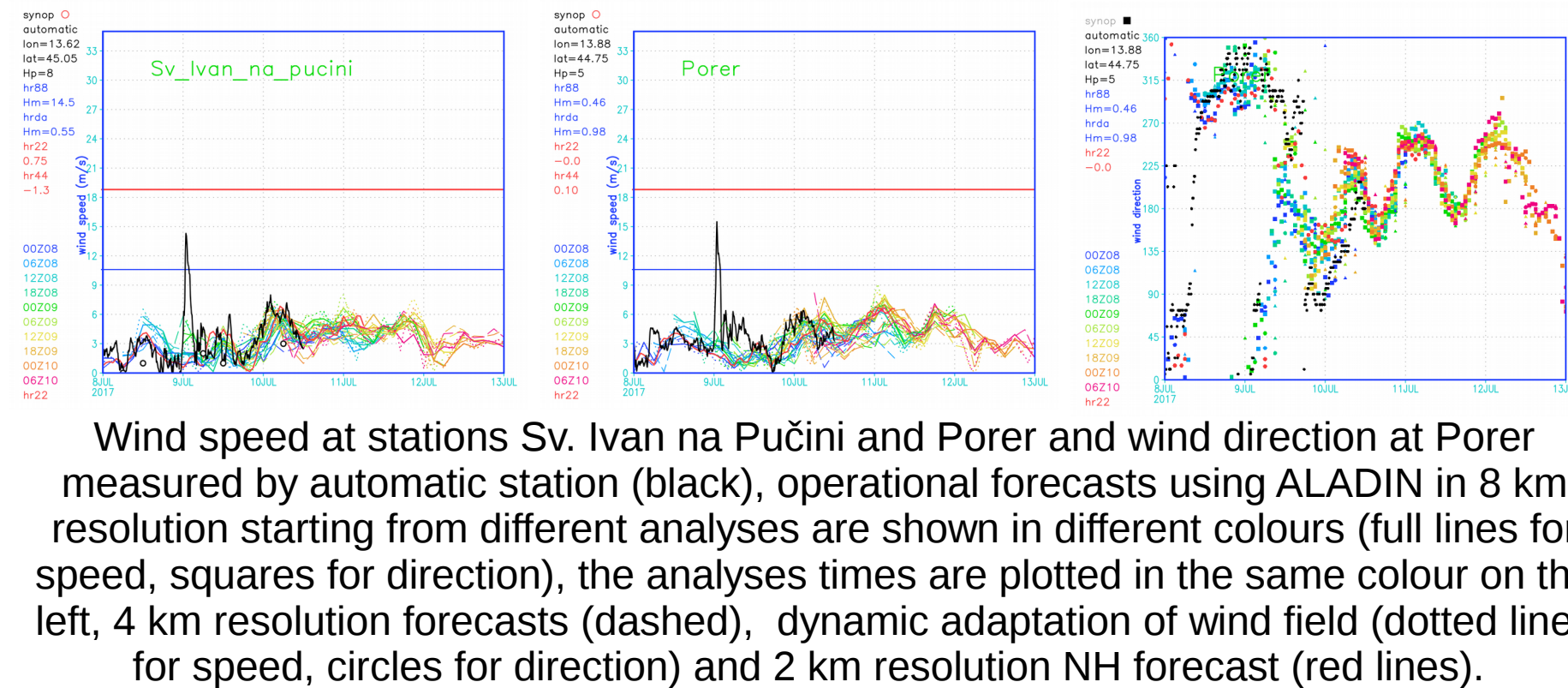
## Verification on LBC files

Standard verification scores (BIAS, RMSE) were computed for the LBC files. The results are intriguing: scores deteriorate with forecast range much faster for LBCs from IFS than for ARPEGE.



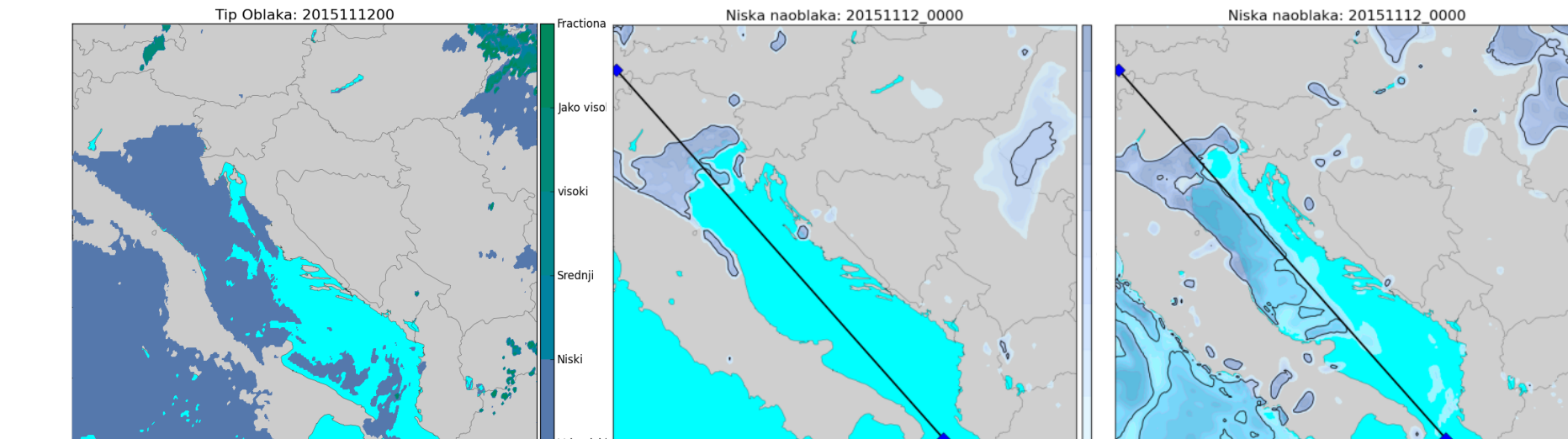
## Storm not forecast

Just after midnight on 9 July 2017, a storm developed over the western coast of Istria with a short episode of strong wind. It was not forecast by any operational configuration and there was no warning issued. Users were not happy.

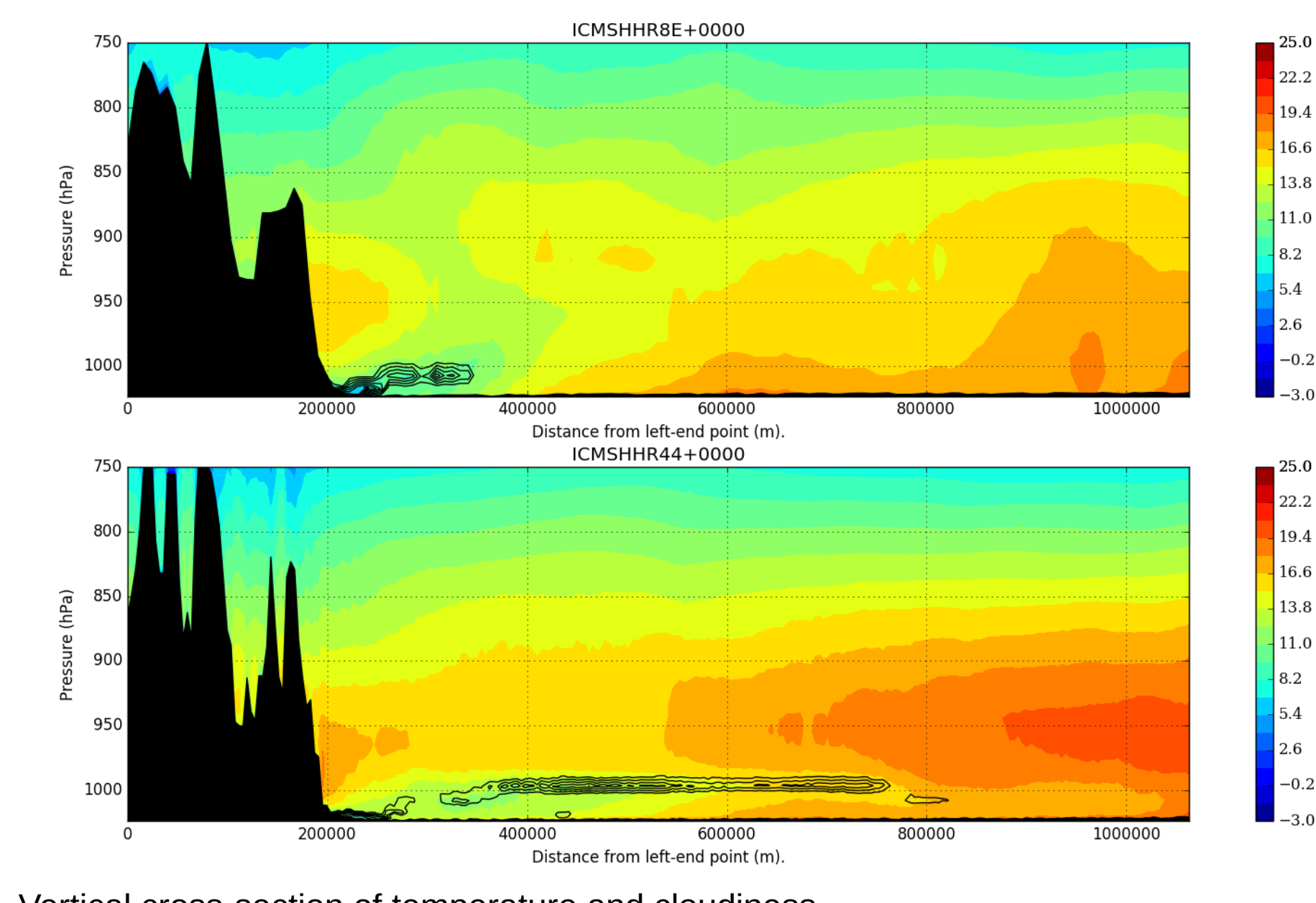


## Foggy issues

Forecast of low level clouds and fog could use improvement. Below is one forecast where there is cloud in the initial conditions, but it dissipates during the forecast.



Cloud type from NWC SAF, ALADIN System 8 km 37 levels and 4 km 73 levels for 00 UTC on 12.11.2015.



## Ensemble method for estimation of background error covariance matrix

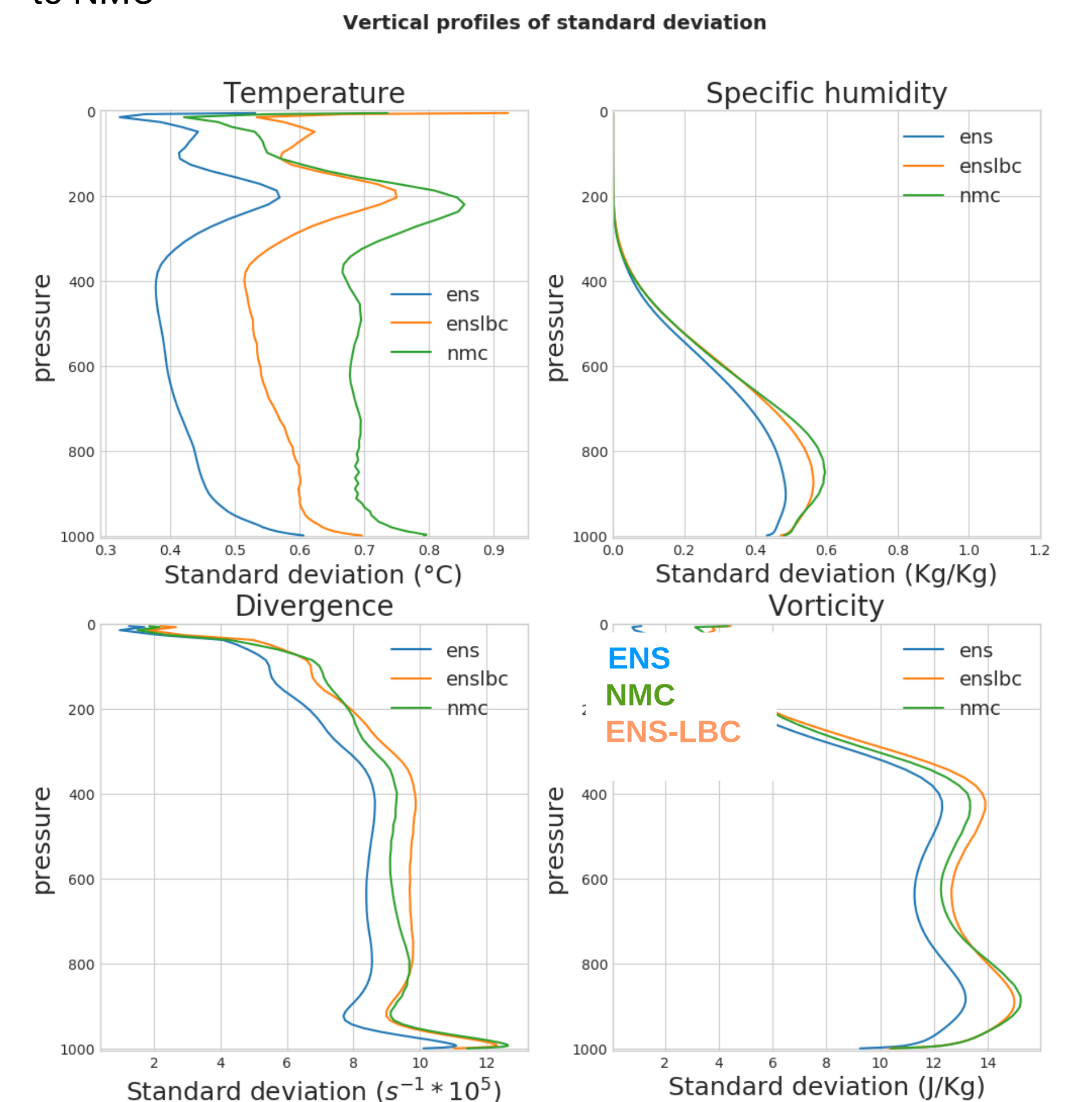
New B matrix was calculated and diagnostic comparison of B matrix properties was made. Three B matrices were computed with following methods/characteristics:

- 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

## Results

- Largest horizontally averaged standard deviation for NMC method, smaller for ENS; similar shape
- Shorter length scales for ensemble B matrix than NMC; Shape similar for ENS and ENS-LBC
- Smallest energy for ENS on almost all scales especially on long scales (no LBC perturbations)
- A bit higher contribution of smaller scales for ENS-LBC method compared to NMC
- Narrower vertical correlations for ENS and ENS-LBC compared to NMC



## 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 better visible for June

