

# Overview of ALADIN data assimilation activities at Slovenian Environment Agency (ARSO)

January – August 2016

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## Summary

In the first half of 2016, DA activities at ARSO were focused on:

- computation of new ensemble B-matrix for ALADIN ALARO1
- test of using global VarBC coefficients
- assimilation of local GPS observations
- two-way coupled ocean-atmosphere model in the assimilation cycle

Table 1: Summary of DA related activities at ARSO (Jan – Aug 2016) in person/months.

| Project/staff                                 | Jure Cedilnik (pm) | Benedikt Strajnar (pm) | Total (pm) |
|---|--------------------|------------------------|------------|
| New B matrix                                  | 2                  | 1                      | 3          |
| Diagnosis of Var-BC, exp. global coefficients | 0                  | 0.5                    | 0.5        |
| Local GPS evaluation                          | 0                  | 0.5                    | 0.5        |
| Two-way coupled ALADIN+POM in assim. cycle    | 0                  | 1                      | 1          |
| <b>Total</b>                                  | <b>2</b>           | <b>3</b>               | <b>5</b>   |

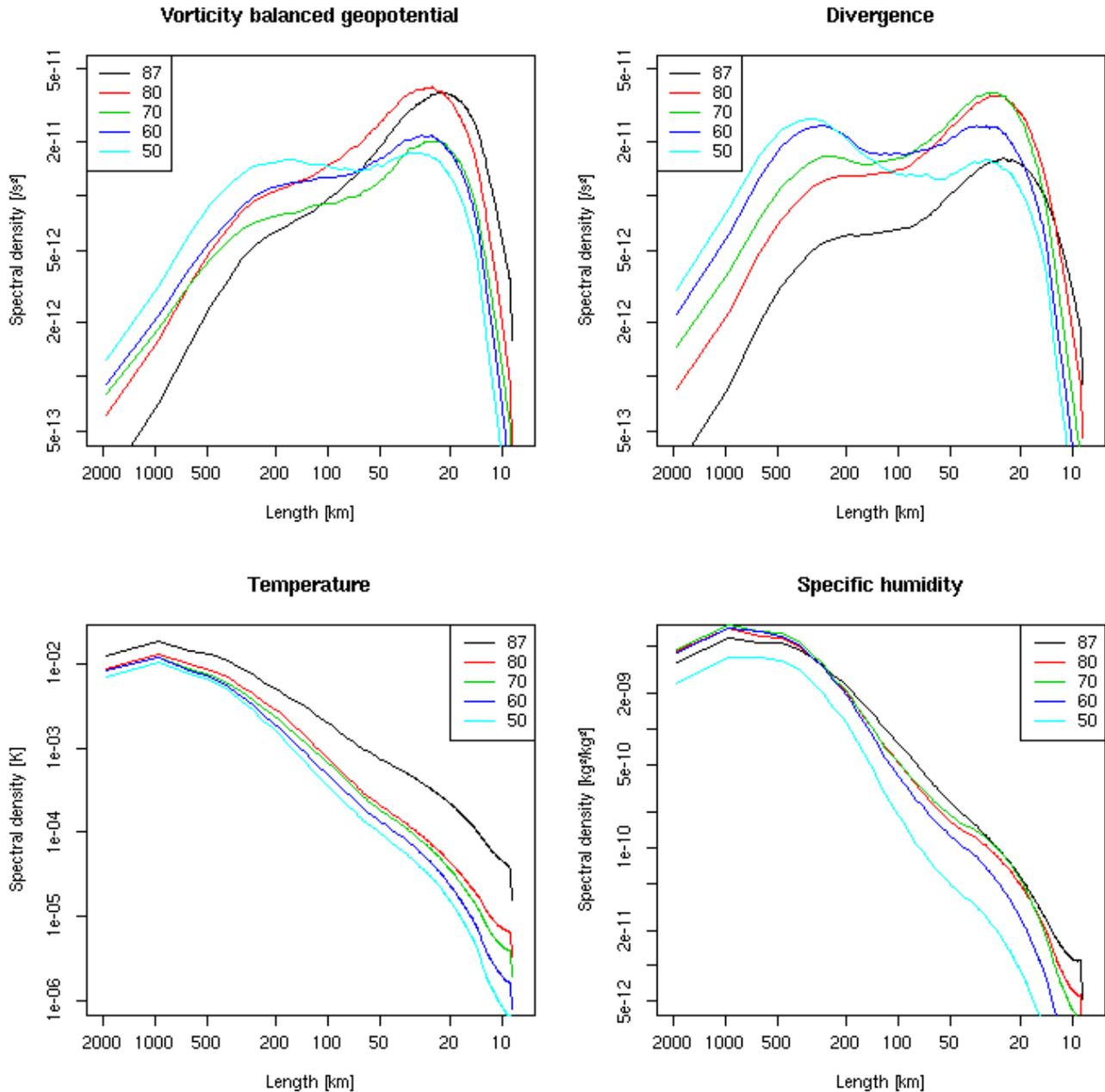
## Current operational assimilation suite HPC

The operational setup (from June 2014) includes:

- model cycle cy38t1 (ALARO-0 baseline)
- 432 x 432 grid points, 4.4 km resolution
- 87 vertical levels
- B-matrix based on ECMWF EDA
- 3-hourly assimilation cycle
- ECMWF LBC coupling
- space-consistent coupling (no DFI)
- observations: SYNOP, AMV, TEMP, AMSU&MHS (currently mostly blacklisted), SEVIRI, Mode-S MRAR

## Computation of a new B matrix for ALARO1

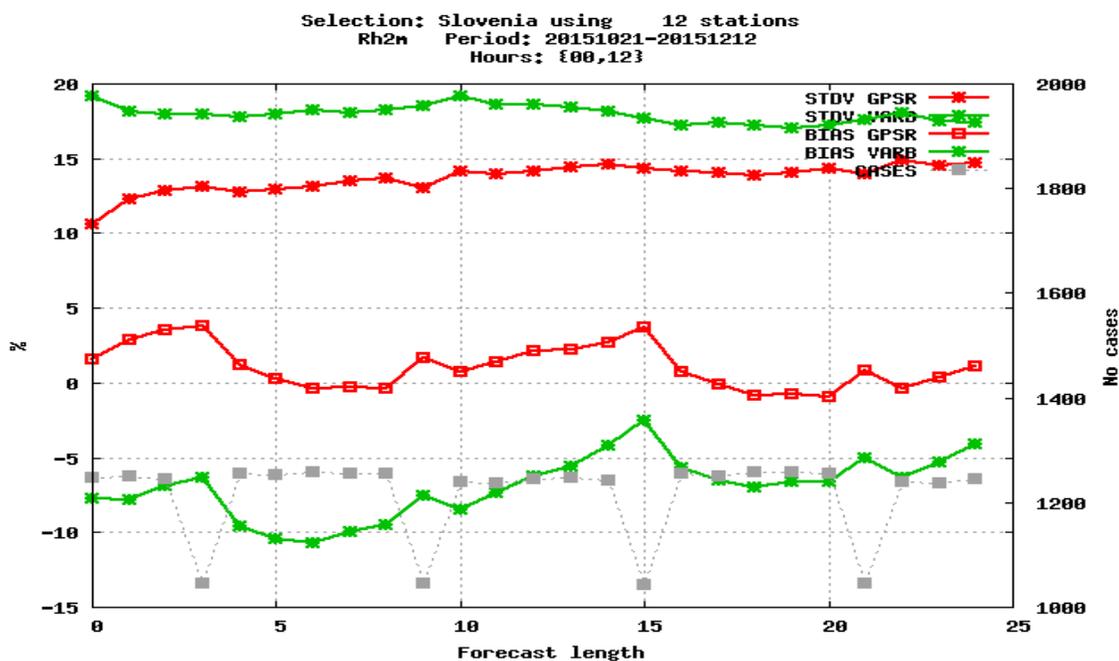
Along with the pre-operational tests of ALARO 1, a new background-error covariances were computed in order to correctly represent the covariance structures of the improved physics. The period of computation was spring 2016. The proxy for model errors were differences between downscaled members of ECMWF EDA, the total sample size was 712. The computation was performed on ECMWF infrastructure using Harmonie package.



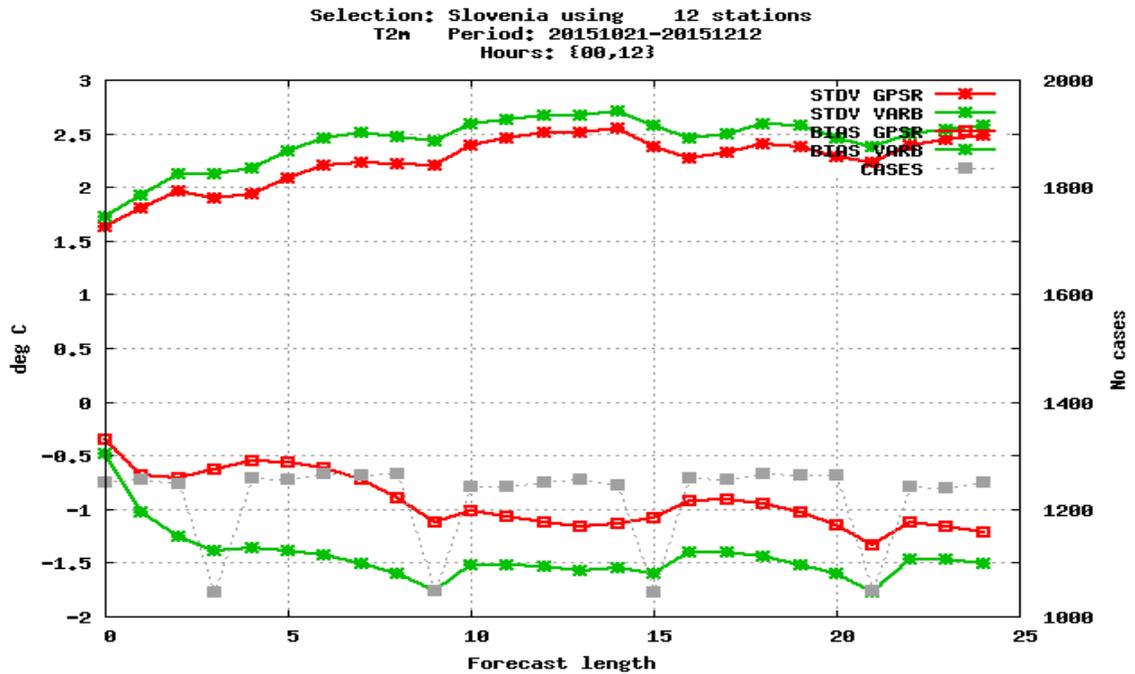
**Figure:** Spectral density of forecast errors of control variables at various model levels (the model has 87 levels) for ALARO1 B-matrix.

## Assimilation of local GPS observations

GPS developments included maintenance of data stream from Geodetic Institute of Slovenia to ARSO. The stay of Zied Sassy in Ljubljana was devoted to assessing the impact of data within a variational bias correction approach. The idea was to consider all the available stations and investigate the ability of the variational bias correction system to reduce bias, thus, no prior stations selection has been considered. The impact of the assimilated GPS data was shown very high taking the model towards observations. The relative humidity increments showed also high impact of the GPS data over the Slovenian domain. Despite a neutral impact over the LACE domain, we noticed a high deterioration of scores over the Slovenian domain, especially for relative humidity and surface temperature (see figures), with less negative impact on surface pressure. The latter parameter scores evolution shows an improvement of scores after a period of one month. It remains unclear why the adaptation of VarBC predictor was slow even if the inter comparison between stations show that certain biases exist. The results suggest that prior data selection can not be avoided even if the case of variational bias correction.



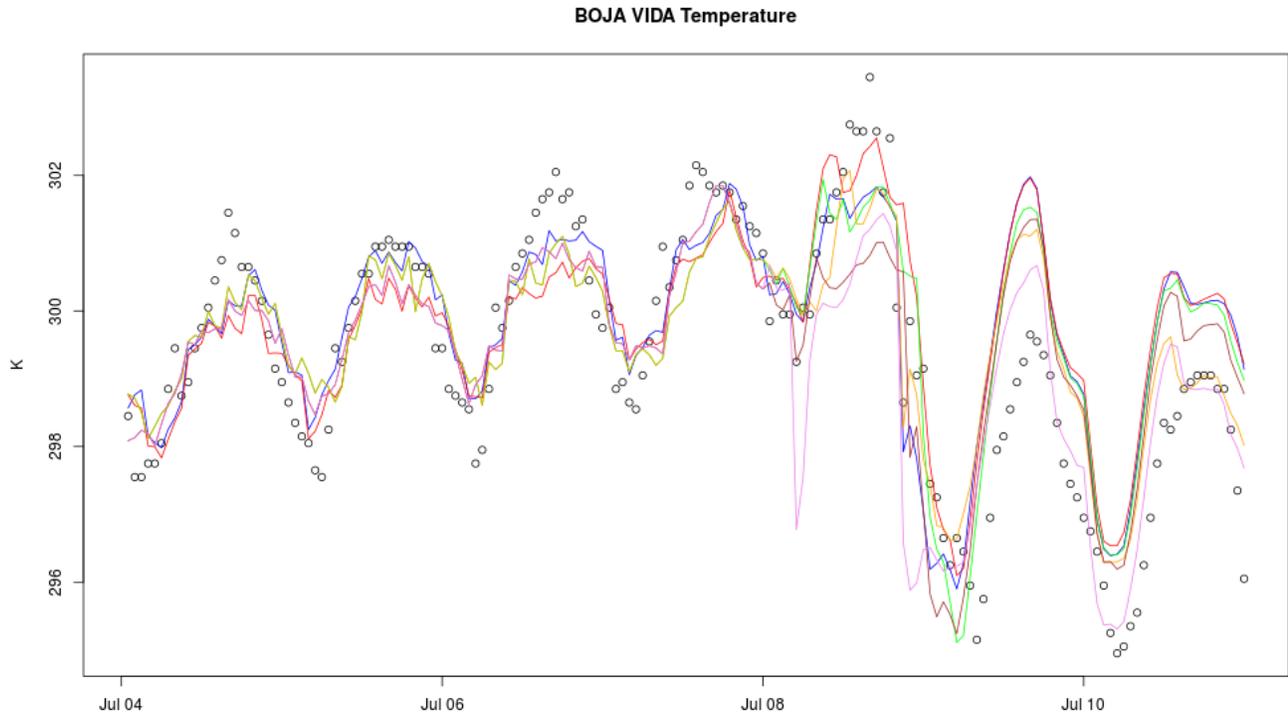
**Figure:** Bias and standard deviation of experiment against reference for 2m relative humidity (verified over Slovenia)



**Figure:** Bias and standard deviation of experiment against reference for 2m temperature (verified over Slovenia)

### Testing the two-way coupled ocean-atmosphere model in the assimilation cycle

The importance of two-way coupling between atmosphere and ocean in the assimilation cycle was studied on a set of 5 high-impact precipitation cases over Slovenia and Adriatic. Different levels of coupling for assimilation and production cycle were tested. The first preliminary conclusion was that fully coupled system had some beneficial impact on temperature and partly on precipitation fields especially close to the shore.



**Figure:** Forecast and observed (dots) air temperature at ocean buoy located in Gulf of Trieste of 4-11 July 2016. Assimilation cycle is run till 8 July 0 UTC, then a 72h forecast is computed. Different colors indicate different types of coupling. The magenta line is fully coupled assimilation and production, the red one fully decoupled.