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

January – August 2015

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14 September 2015

Summary

In the first half of 2015, DA activities at ARSO were focused on:

- monitoring observations in terms of incoming times/size
- visualization and diagnosis of satellite Var-BC performance
- developments of Mode-S MRAR observations, assimilation of data from the second radar in Slovenia, preparation of Czech Mode-S data
- assimilation of LandSAF snow cover
- collection and preparation of local GPS data

Table 1: Summary of DA related activities at ARSO (Jan – Aug 2015) in person/months.

Project/staff	Benedikt Strajnar (pm)	Jure Cedilnik (pm)	Neva Pristov (pm)	Total (pm)
Diagnosis of Var-BC	1	0	0	1
Mode-S MRAR	1.5	0	0	1.5
Monitoring of incoming data	0.5	0	1	1.5
GPS data preparation	0.5	0	0	0.5
LandSAF snow assimilation	0	1	0	1
Total	3.5	1	1	5.5

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, SEVIRI, Mode-S MRAR (see data structure example in Fig. 1)

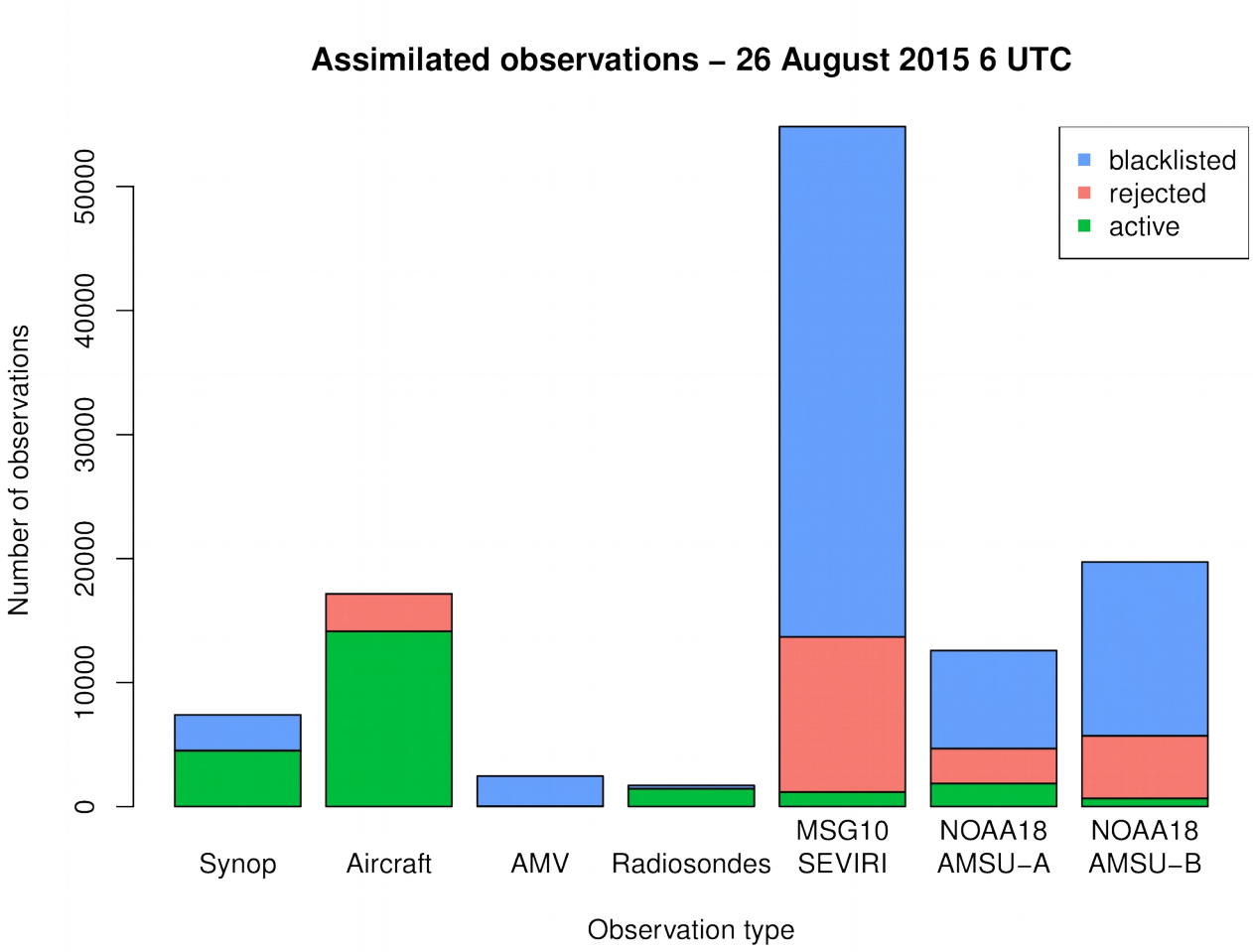

Figure 1: Structure of observations assimilated in ALADIN-SI on 26 August 2015 at 6 UTC.

Visualization and diagnosis of satellite Var-BC performance

Var-BC is used in cy38 as the default bias correction scheme. A web-based tool was developed to monitor the net effect of Var-BC, and analysis (OMA) and first guess (OMG) departures, separately for each analysis time and channel (Fig. 2-3). The main advantage is visualization in real time and zoomable maps.

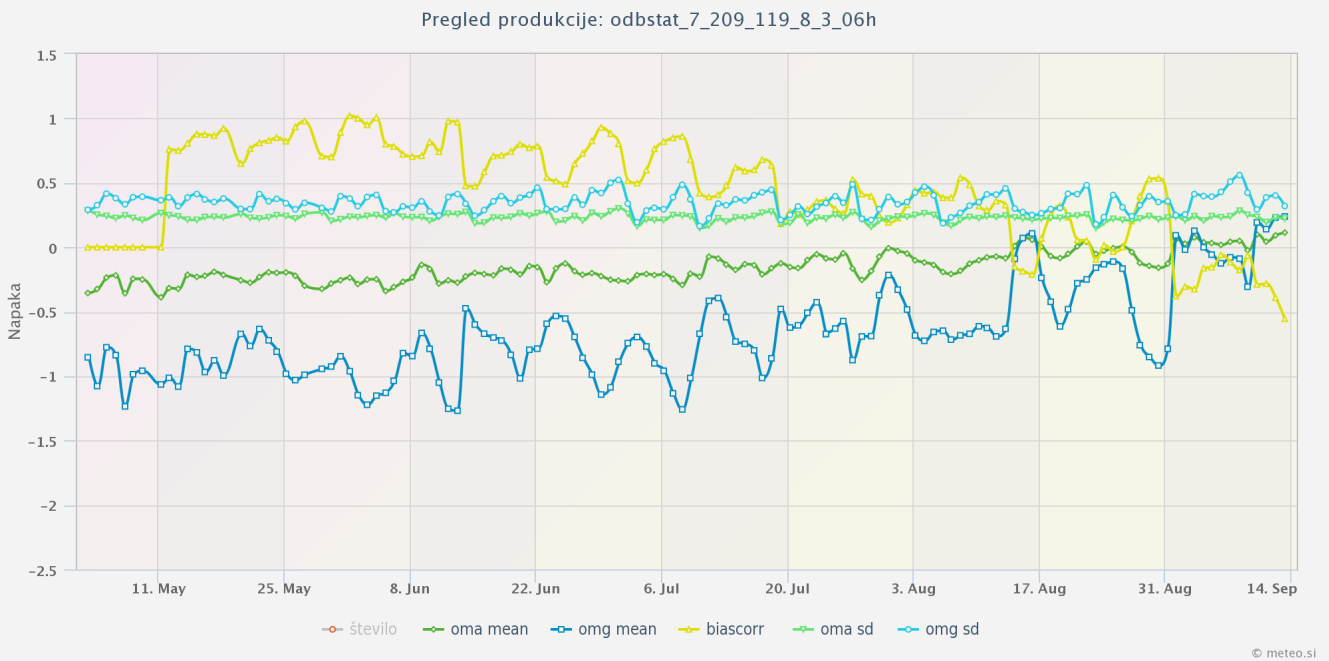

Figure 2: Time evolution of OMG and OMA mean and standard deviation, and correction as determined by Var-BC for SEVIRI ch.2 radiances at 3 UTC.

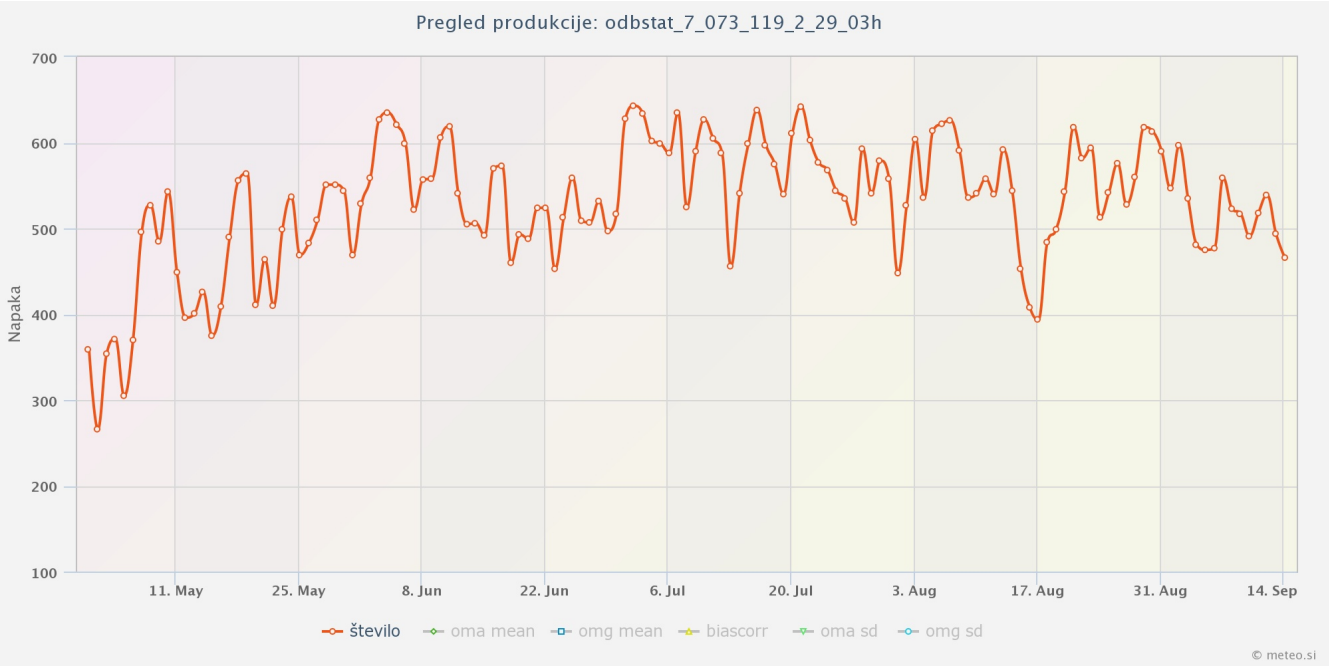

Figure 3: Time evolution of the number of assimilated SEVIRI ch.2 radiances at 3 UTC.

Development of Mode-S MRAR

The second Mode-S radar in Oljska Gora near Ljubljana was successfully implemented and is operationally assimilated in ALADIN-SI.

During a 3 week stay at CHMI in Prague, Chech Mode-S data preprocessing was started. See details in the report: http://www.rclace.eu/File/Data_Assimilation/reports/BS_Modes_report_2015.pdf

Monitoring observations in terms of incoming times/size

Due to rather short cutoff time of production run of ALADIN-SI with respect to the observation window, a web-base monitoring of the size of input observational files was developed (Fig. 4-5). Based on the results a cutoff time was optimized (delayed for 15 minutes) in order to assimilate more data. Recommendations for OPLACE processing were provided and a bug in OPLACE (observation files size decreasing with time) was fixed.

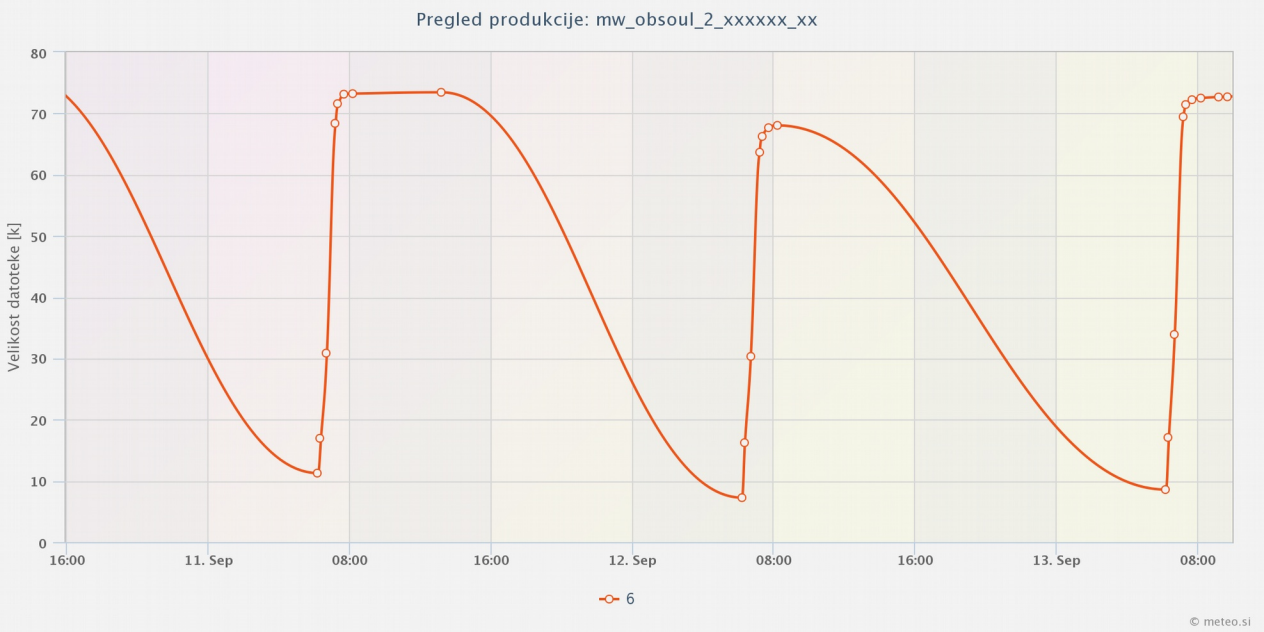

Figure 4: Time evolution of the size of incoming AMDAR obsoul files for 6 UTC.

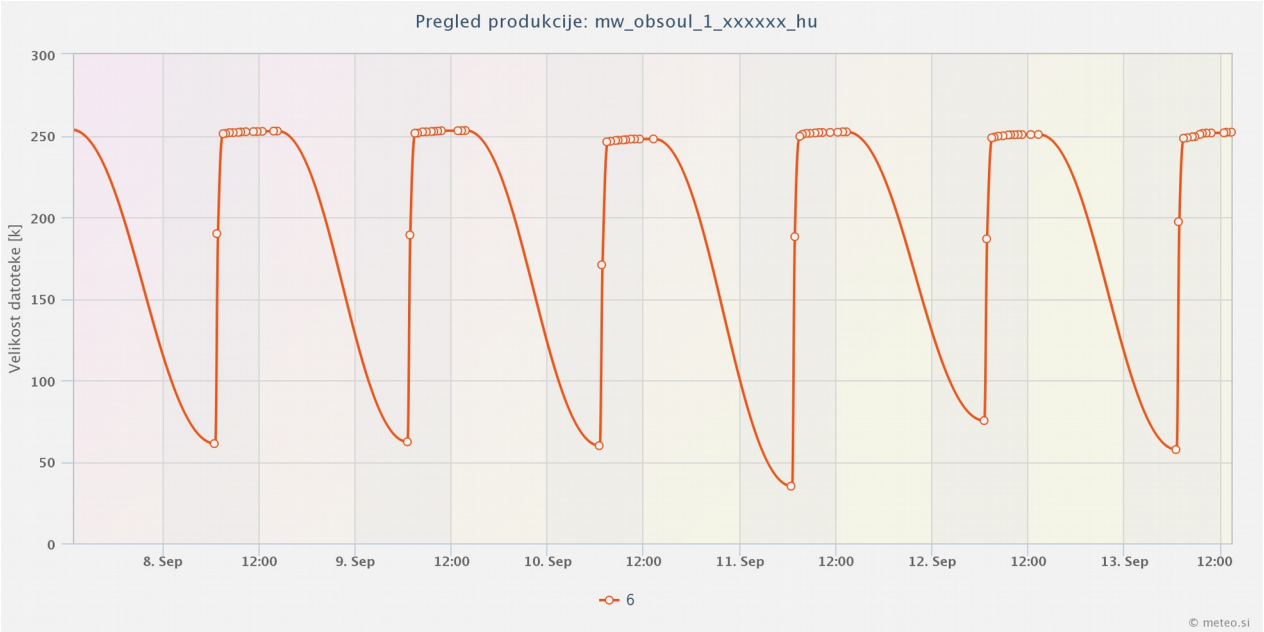

Figure 5: Time evolution of the size of incoming SYNOP obsoul file for 6 UTC.

GPS data preparation

In order to initiate the use of GPS data in Slovenia, contacts with geodesic institute of Slovenia were set up. An initial data sample for a period of about 2 months were provided. Observations were coded into obsoul format and successful read by the model. ARSO also gained access to test E-GVAP data set.

LandSAF snow cover assimilation

Snow cover product (15 minute intermediate product) from LandSAF were used to initialize the snow content in ALADIN analysis. Snow was either removed or added (10 cm) based on the satellite retrieval. Figures 6-7 show RMSE and bias of reference operational ALADIN-SI forecast and experimental run using LandSAF snow product for temperature at at 2 m over the period of 15 days in December 2010. It can be preliminary concluded that impact of LandSAF on forecast is positive..

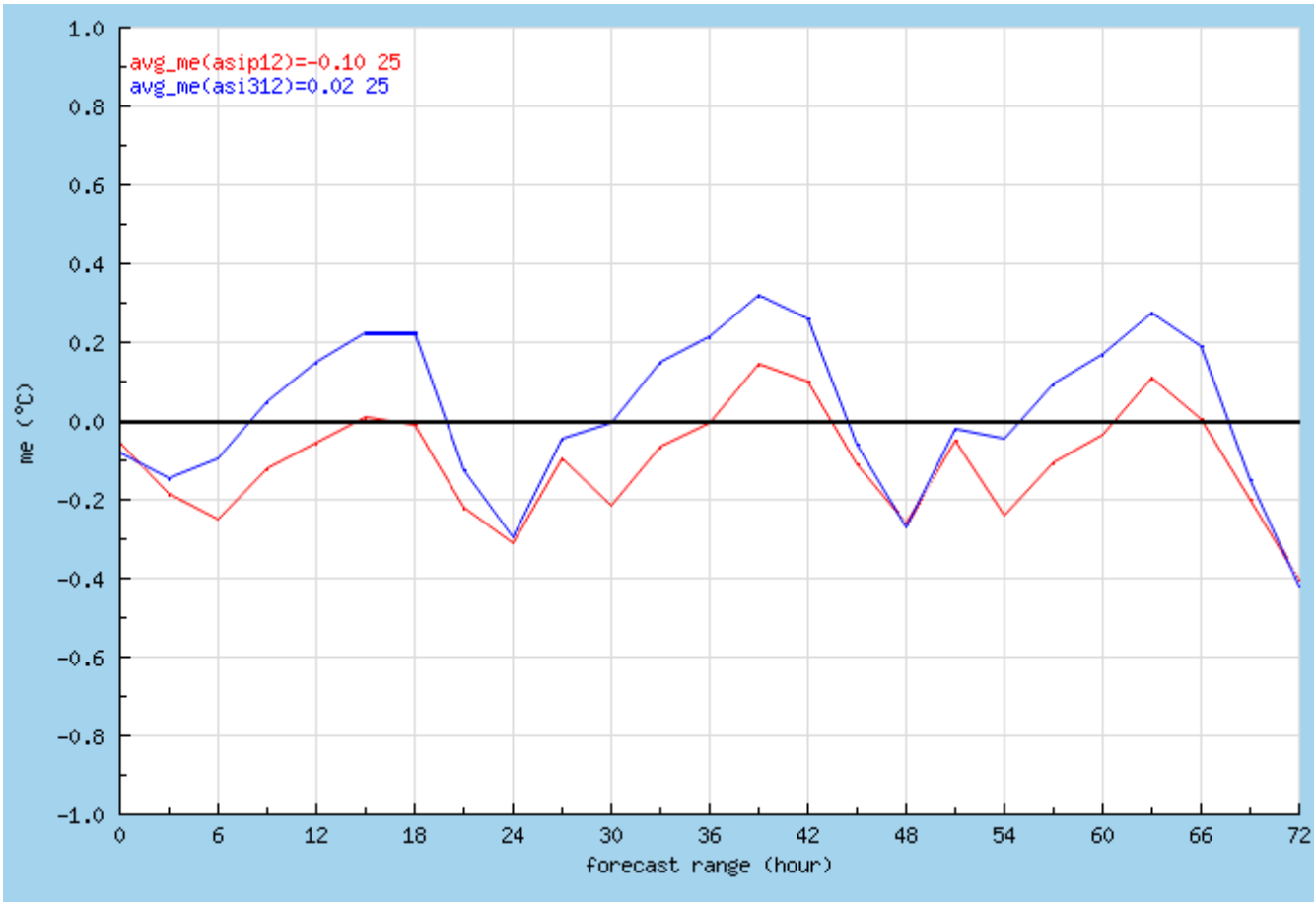

Figure 6: Bias of temperature at 2 m in operational reference (red) and LandSAF experiment (blue).

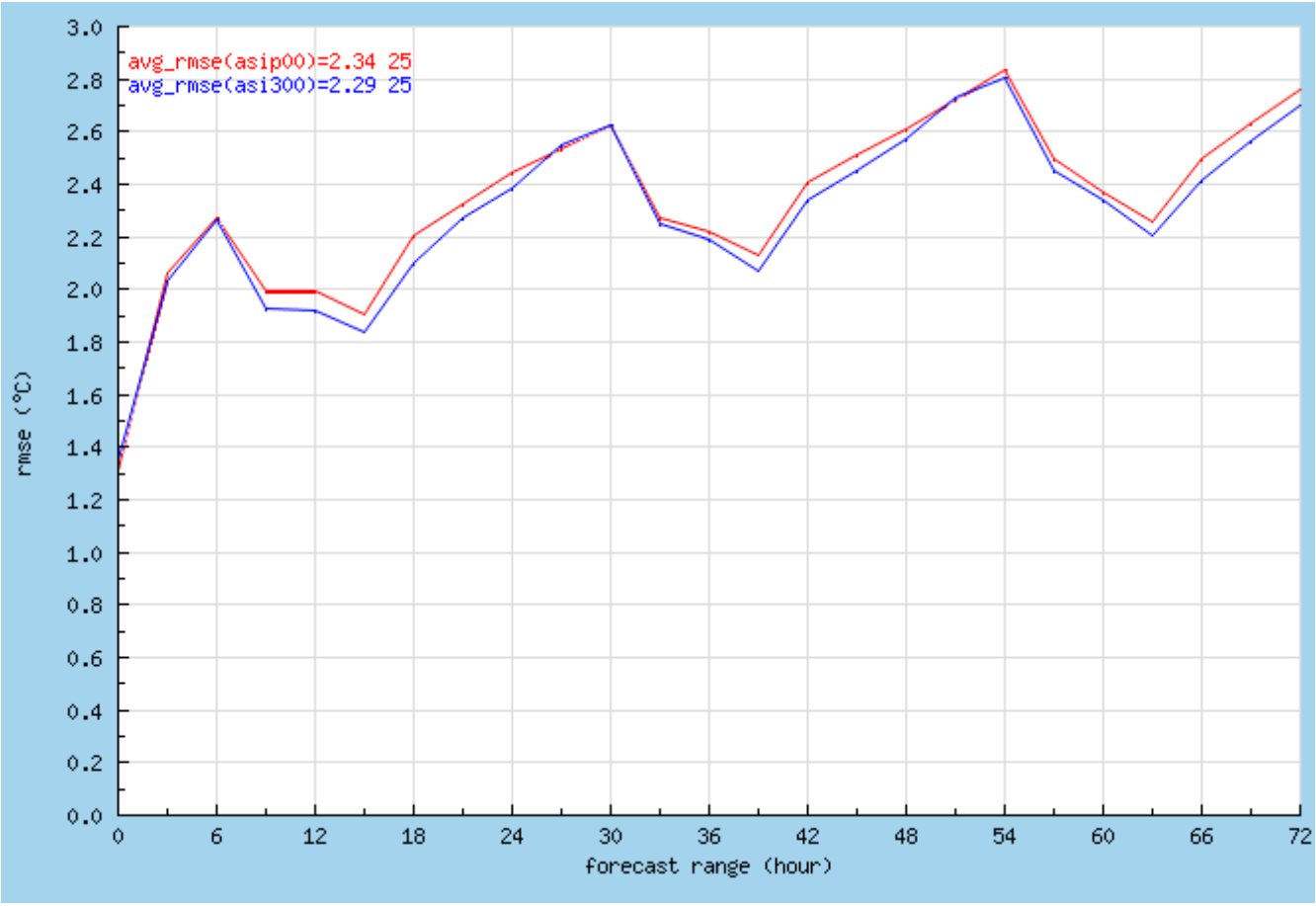

Figure 7: RMSE for temperature at 2 m in operational reference (red) and LandSAF experiment (blue).

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

September – December 2015

Benedikt Strajnar

17 February 2016

Summary

In the second half of 2015, DA activities at ARSO were focused on:

- resolving issues with Var-BC performance
- collection and assimilation of local and test E-GVAP GPS observations
- developments of Mode-S MRAR observations
- testing the two-way coupled ocean-atmosphere model in the assimilation cycle

Table 1: Summary of DA related activities at ARSO (Sep – Dec 2015) in person/months.

Project/staff	Benedikt Strajnar (pm)	Total (pm)
Diagnosis of Var-BC	0.5	0.5
GPS data preparation	1	1
Mode-S MRAR	0.25	0.25
Two-way coupled ALADIN+POM in assim. cycle	0.25	0.25
Total	2	2

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

Resolving issues with Var-BC performance

Recently more attention was given to Var-BC performance. In 2015 a web-based tool was developed to monitor the bias correction and severe divergence was detected for some satellites and channels.

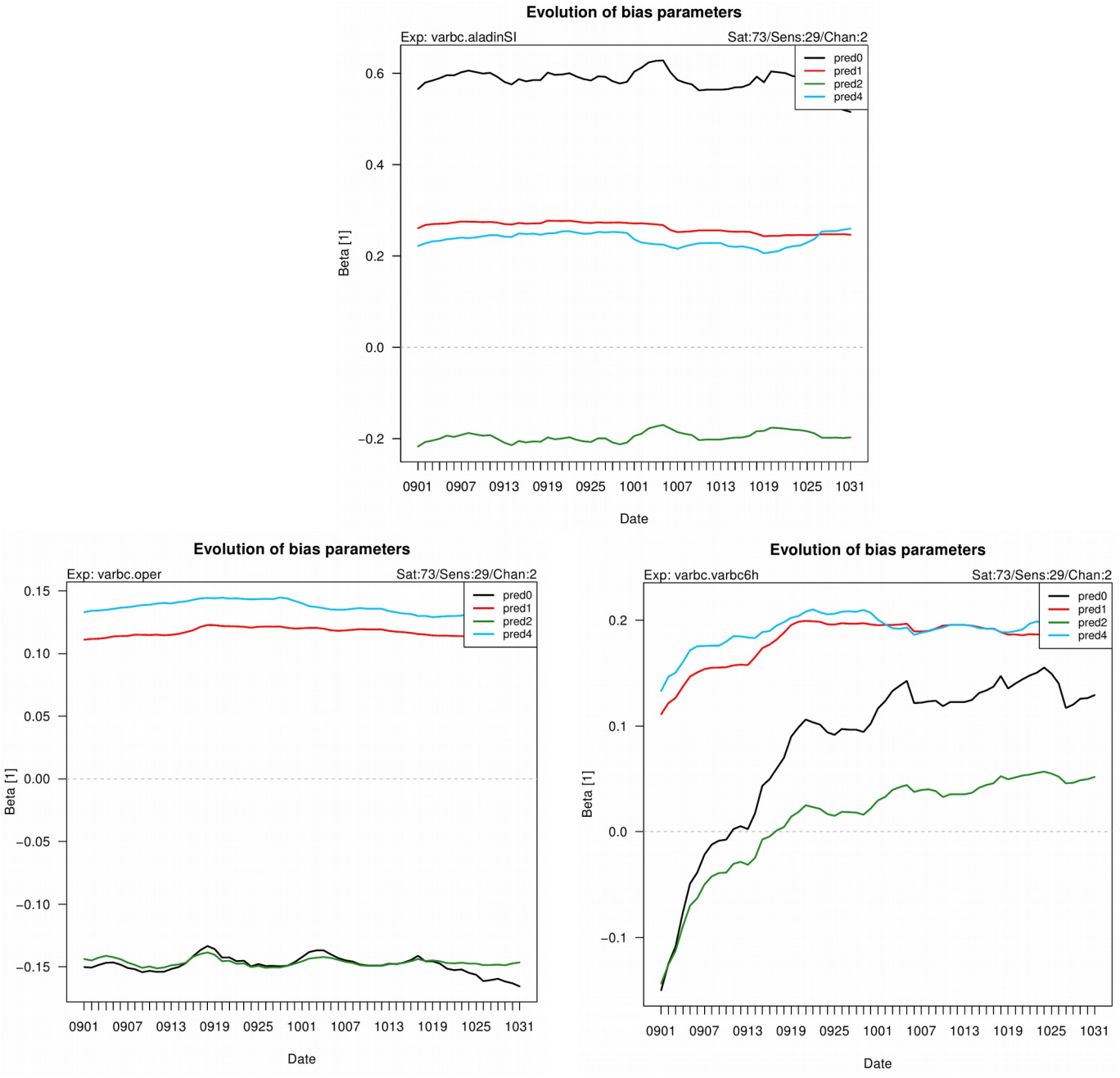

Figure 1: Evolution of VarBC coefficients for SEVIRI Ch.2 at 12 UTC in operational ALADIN/SI (top), ALADIN/CZ (bottom left) and experiment with 6-hour ALADIN/SI using only SEVIRI (bottom right).

The performance was tested for RC-LACE reference period of Sep-Oct 2015. Disagreements were found for SEVIRI channels with ALADIN/CZ, ARPEGE and AROME/FR (Fig.1). A separate experiment was run with hot start of VarBC coefficients from ALADIN/CZ and using 6-hour assimilation cycling. However, the coefficients quickly adapted to a different solution (see bottom right part of Fig.1) but they stayed rather unstable. This may indicate the effects of different model bias or different usage of SEVIRI channels (in ALADIN/CZ additional SEVRI channels are used together with NWC-SAF cloud type filtering). The investigation is ongoing.

Collection and assimilation of local and test E-GVAP GPS observations

GPS developments included the operationalization of data stream from Geodetic Institute of Slovenia to ARSO. Additionally, samples of test E-GVAP data were obtained. During the stay of Zied Sassy in Ljubljana and afterward both data types were used in assimilation experiments including static and variational bias correction. The conclusion is that GPS slightly improve bias of mean sea level pressure (Fig. 2), relative humidity and clouds and does not change other variables. Benefits can be observed for both observation networks. More details can be found in the stay report at RC-LACE web site.

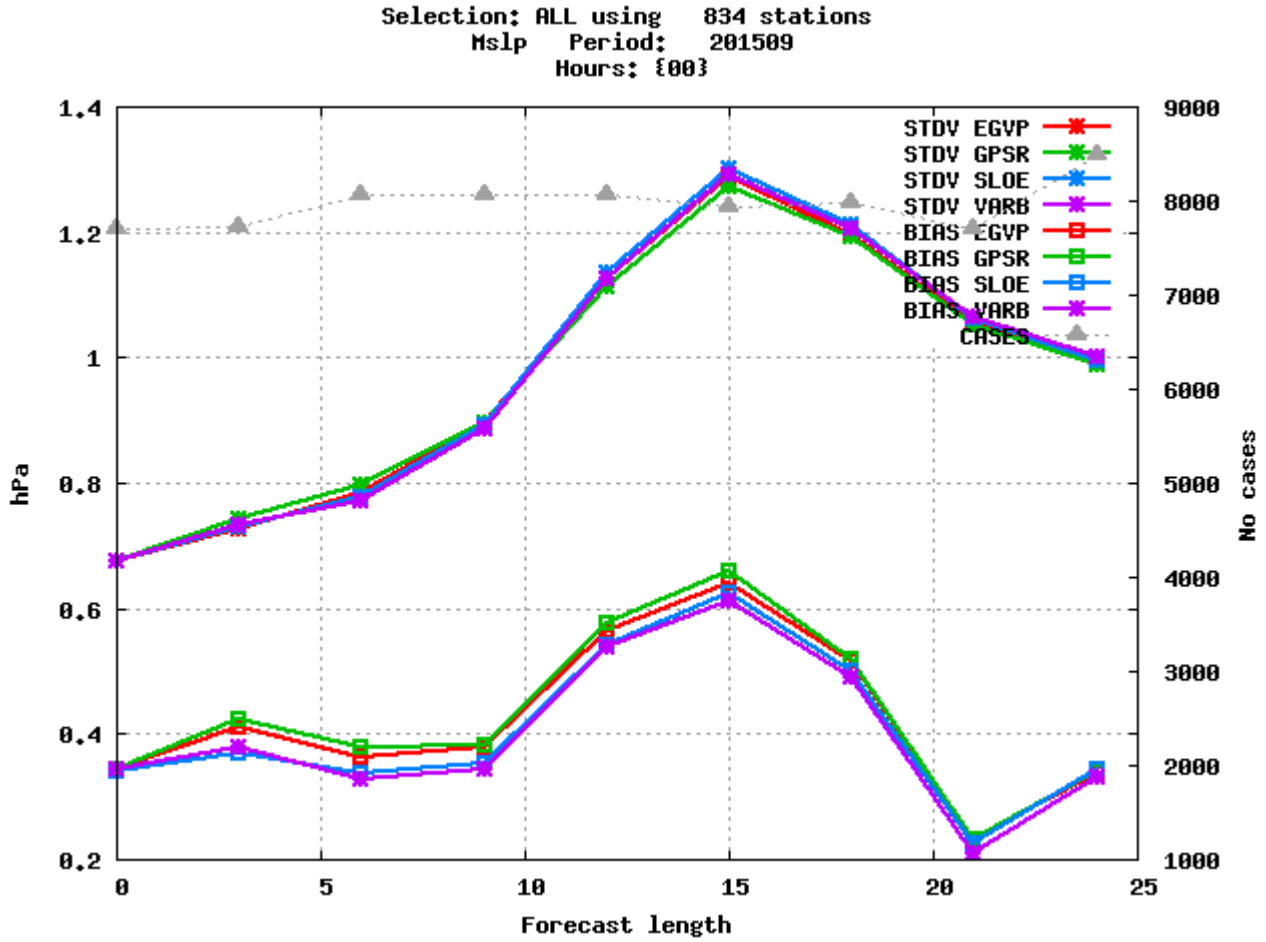

Figure 2: Verification of several GPS ZTD impact experiments against reference (green) for surface pressure over the operational domain for all network times

Developments of Mode-S MRAR observations

Small developments were applied to Mode-S MRAR preprocessing including the addition of new data from second Slovenian ATC radar to OPLACE.

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

The earlier results with two-way coupled Princeton Ocean Model (POM) for Adriatic Sea and ALADIN in production runs (Ličer et.al. 2016) suggested to run the full coupling in the assimilation cycle of ALADIN as well in order to get more impact on the atmospheric side. This required some changes in the assimilation step organization related to SST initialization (to use POM SST instead of the standard OSTIA/ECMWF). The first test for a case of Mediterranean convective storm of 19 January 2014 preliminary showed that:
- there is a large difference in SST of POM and OSTIA/ECMWF for this specific event, and thus that more precise knowledge of SST is important,
- two-way coupled runs in production had some beneficial impact on precipitation fields.
Such a setup will be further evaluated on precipitation cases in the Northern Adriatic.

Ličer, M., Smerkol, P., Fettich, A., Ravdas, M., Papapostolou, A., Mantziafou, A., Strajnar, B., Cedilnik, J., Jeromel, M., Jerman, J., Petan, S., Malačič, V., and Sofianos, S.: Modeling the ocean and atmosphere during an extreme bora event in northern Adriatic using one-way and two-way atmosphere–ocean coupling, Ocean Sci., 12, 71-86, doi:10.5194/os-12-71-2016, 2016.