

Report from LACE Data Assimilation Working Days (DAWD) 2018 (Joint working days with Data assimilation starters KIT)

Bucharest (Romania)
19/09/2018 – 21/09/2018

This year the DAWD was special. DAWD and Data assimilation starters KIT (DAsKIT) were partly joined this year to exchange knowledge and to support DAsKIT by LACE experts. The program started at 9am on Wednesday 19th with joint session DAWD+DAsKIT, where participants of both meetings were giving progress/status presentations. During the late Wednesday afternoon and Thursday both meeting had separate programs. On Friday morning there was short common discussion of both meetings, afterwards LACE planning was held in separate session. In this report only overview of LACE members talks will be given, the presentations of DAsKIT members from common status part are on RC LACE web page as well, see presentations of Algeria, Belgium, Bulgaria, Poland, Portugal, Morocco, Tunisia and Turkey (<http://www.rlace.eu/?page=11#workshops>). A separate report from DAsKIT meeting can be found on [ALADIN web](#).

List of DAWD participants

Antonín Bučánek (CHMI)
Alena Trojáčková (CHMI)
Patrik Benáček (CHMI)
Tomislav Kovacic (DHMZ)
Antonio Stanesic (DHMZ)
Suzana Panežić (DHMZ)
Endi Keresturi (DHMZ)
Martina Tudor (DHMZ)
Benedikt Strajnar (ARSO)

Alina Dumitru (MeteoRom)
Alexandra Craciun (MeteoRom)
Michal Nestiak (SHMU)
Martin Imrisek (SHMU)
Florian Meier (ZAMG)
Jasmin Vural (ZAMG)
Mihály Szűcs (OMSZ)
Roger Randriamampianina (MetNorway)

Overview of operational systems

State/model	Resolution	Cycle	LBC	DA Method surface	DA Method upper air	Cycling	B matrix	Special
Austria/ALARO-0	4.8L60	40t1	IFS 3h	OI	dynadapt	6h	-	Additional snow melting
Austria/AROME	2.5L90	40t1	IFS 1h	OI_main + Mescan	3DVAR	3h	Static Down-scaled LAEF 11km	Snowgrid+SAT snow init
Austria/AROME RUC	1.2L90	40t1	AROME 2.5 1h	taken from AROME 2.5	3DVAR + LHN +FDDA-nudging	1h (2x 2h cycling)	Static down-scaled AROME 2.5 EPS	IAU
Croatia/ALARO-0	4L73	38t1	IFS 3h SCC	OI + Mescan	3DVAR	3h	NMC	DFI in prod REDNMC=1.4
Czech/ALARO-1vB	4.7L87	43t2_bf8	ARP 3h SCC	OI, sst ARP	BlendVar	6h	Down-scaled AEARP	sigmao_coef =0.67 REDNMC=1.7 IDFI in prod
Hungary/ALARO	8L49	38t1_bf3	IFS 3h	OI	3DVAR	6h	ALARO EDA	
Hungary/AROME	2.5L60	40t1	IFS 1h	OI_main	3DVAR	3h	AROME EDA	GNSS ZTD

Slovakia/ALARO-0	9L37	36t1.10	ARP 3h SCC	OI	DF Blending	6h		
Slovakia/ALARO-1	4.5L63	40t1_bf6	ARP 3h SCC	OI	DF Blending	6h		
Slovenia/ALARO-1vB	4.4L87	40t1	IFS 3h SCC	OI, sst IFS	3DVAR	3h	Down-scaled AEARP	REDNMC=1.6 sigma_coef=0.9
Romania/ALARO-0	6.5L60	40t1_bf07	ARP 3h	OI, sst ARP	3DVAR	6h	Down-scaled AEARP	

Austria (Florian Meier)

The following topics have been mentioned in the Austrian status presentation:

- New HPC
- Harmonie obs monitoring system installed
A parallel AROME-ESUITE (radar reflectivity from At,De,Si stations and MODE-S winds from Slovenia, KNMI and Austrian ATC, AMDAR-q)
- AROME-RUC 1.2km
- SCADA wind turbine assimilation
- plan to focus on GNSS RO due to expectation that more and more observations will be available soon

More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DAstatus_Austria_2018.pdf

Hungary (Mihály Szűcs)

The following topics have been mentioned in the Hungarian status presentation:

- New HPC
- Issues with OI_main parallelization, so only 1 node is used on cy40t1
- GNSS-ZTD improvement in summer, in winter neutral impact
- RADAR pre-processing and processing in Bator

More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DAstatus_Hungary_2018.pdf

Croatia (Tomislav Kovačić)

The following topics have been mentioned in the Croatian status presentation:

- B matrix comparison (NMC vs EDA vs EDA const LBC)
- Radar – comparison of ODIM HDF5 file content (report on RCLACE)
- Radar – case study

More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DAstatus_Croatia_2018.pdf

The Czech Republic (Antonín Bučánek)

The following topics have been mentioned in the Czech status presentation:

- Mode-S EHS observations processed by KNMI added to operational suite
- VarBC for satellite radiances and GNSS-ZTD
- Migration from TAC2BUFR ongoing

(More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DAstatus_CzechRep_2018.pdf)

Slovakia (Michal Nestiak)

The following topics have been mentioned in the Slovak status presentation:

- Two high resolution domains for testing ALARO and AROME
- New spinup EDA B matrix for ALARO 4.5L63
- Urban stations testing
- SODA-EKF

More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DAstatus_Slovakia_2018.pdf

Romania (Simona Tascu)

The following topics have been mentioned in the Romanian status presentation:

- ALARO DA system pre-operational (cy40t1)
- case studies
- preparation for new domain – 5km

More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DAstatus_Romania_2018.pdf

Slovenia (Benedikt Strajnar)

The following topics have been mentioned in the Slovenian status presentation:

- Development of a Python tool for Homogenization of Opera OIFS Files (HOOF) dataset
- Monitoring of Automatic Weather Stations (AWS) data from Poland (OPLACE) and north Italy (bilateral exchange)
- 2-way coupling of ALADIN and ocean model POM over the Adriatic Sea

More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DAstatus_Slovenia_2018.pdf

Status of OPLACE system (Alena Trojakova)

The following topics have been mentioned in the OPLACE status presentation:

- new EUMETSAT prime spacecraft Meteosat-11 (MSG-4) since 20 February 2018
- new product coastal winds from ASCAT (since March 2018)
- redesign of the OPLACE scripts started
- corrections for TEMP data processing
- TAC2BUFR ongoing
- Exchange of high resolution aircraft data (Mode-S MRAR from Slovenia and EHS from KNMI) works well and data were assimilated successfully. LACE initiated a negotiation with KNMI about processing of Czech and Slovenian Mode-S EHS data. All Members were encouraged to further explore availability of Mode-S data.
- Discussion – on new satellites (NOAA20 was launched already in 2017 and Metop-C will come soon in November 2018) and sensors (ATOVS MHS will be replaced by ATMS on future satellite missions)

More details can be read in the uploaded pdf on the RC LACE webpage -

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/oplace_status2018.pdf

SURFEX activities at ZAMG (Jasmin Vural)

Surface assimilation activities have been highlighted, namely the soil moisture assimilation (SWI), T2m and LST assimilation, tests with local observation errors. The use of sEKF surface assimilation with SWI measurements of SCATSAR (combination of ASCAT and Sentinel-1 SSM products) in 6 layers of the diffusion scheme shows positive impact on T2m scores over flat land stations in Austria. The use of spatially varying observation error for SCATSAR-SWI shows very slight improvement but the calculation of errors will be further optimized. Test with assimilation of SCATSAR-SWI in high resolution (1.25km) are ongoing.

The assimilation of Land Surface Temperature (LST) from satellite Sentinel-3, MSG, MODIS with similar sEKF setup as in SWI assimilation was also presented. There are quite large differences between those 3 satellite products that need to be further inspected. More information can be seen in Jasmin's uploaded presentation on RCLACE webpage - http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/talk_SURFEX_ZAMG_JV.pdf

HIRLAM upper-air data assimilation (Roger Randriamampianina)

The following topics have been mentioned by Roger about HIRLAM upper-air data assimilation activities:

- Operational data assimilation configurations in HIRLAM countries
- Recent reported issues (crash in screening)
- Field Alignment (FA) Assimilation of Doppler Wind Radar Data in HARMONIE
- Development of time lagged EDA/EPS systems
- Nowcasting EPS test on 750m, 7memb, 3dvar every 10min on very small domain
- LAM 4D-Var development continues, it was found that CONGRAD minimizer use less iteration compared to M1QN3 on average in 4D-Var
- Development of upper air LETKF is almost done
- EnVar is coded but further testing and tuning is ongoing
- VarBC for aircraft observations developed with promising results.

More information can be seen in Roger's uploaded presentation on the RC LACE webpage - http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/HIRLAM_UA_DA_RR_2018_LACE.pdf

DA activities with focus on GNSS data (Martin Imrisek)

Martin was presenting validation of new whitelist of GNSS-ZTD stations. It was found that normal distribution of OPG cannot be expected for some stations (Tail are missing on one on other side). After the validation 6 more station were excluded from whitelist.

The GNSS-ZTD observations were tested in 3dvar to LAEF 4.8L60, the impact is on slight spread increase and slight RMSE decrease.

Slant total delays and gradients were computed (resolution 25kx25kx1km) and ready for use for assimilation experiments. See more details in Martin's presentation - http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/Imrisek_DA.pdf

Variational bias correction in LAM DA systems (Patrik Benacek)

At the beginning of the presentation, Patrik gives overview of Variational bias correction in 3D-Var and shows its properties on simplified model. Shows that Nbg parameter is important property of adaptivity of VarBC scheme. Nbg value can be set either static or dynamically

according Cameron and Bell (2016) or Patrik's proposal (submitted to QJRMS soon). Patrik propose to use one of dynamical approaches to set-up of Nbg parameter since these are able to work with small data samples (≥ 50 Obs). From discussion it seems that Patrik's proposal for Nbg set-up will not be added to common code since Patrik stays at CHMI only for 20% of his time.

AROME-Nowcasting, rapid update cycle (Florian Meier, Mirela Pietrisi)

At ZAMG they are filling the gap between classical nowcasting systems and short range NWP by AROME RUC 1.2km with forecast every hour up to 12h. Among assimilated observations are radar reflectivities, Doppler winds, MODE-S, national SYNOP, AMDAR-Q, national GNSS ZTD. Latent heat nudging, FDDA nudging, cloud analysis and IAU (first 10 min of FC) are applied during initialization. Two 2h separate assimilation cycles are used. Once per day (OUTC) a non-cycled run is performed using AROME 2.5km guesses to not allow for larger differences between cycles. This special 2h cycle strategy was chosen since 1h cycle had problems with spin-up and had larger bias. They had also issues with over-fitting observations by large values of REDNMC parameter; decrease of it improved the bias further.

Issue NaN values in cost function without crash! During minimization is called diagnostics for 2m temperature which is inconsistent with surfex t2m, MF knows about the problem and sets NFPLI =3 in 927 for old ISBA fields. In ZAMG they changed the old ISBA fields by surfex ones and the problem is avoided so far.

There is change of reflectivity assimilation on cy43t1, there is enlarged searching radius for reflectivity profiles (100 \rightarrow 200km). The reason is to overcome problem when nothing is simulated in model. But there is another proposal with saturated pseudo-profile insertion to model if radar observations exceed some threshold and there is nothing simulated in model.

The results regarding FDDA nudging, use of Mode-S observations from KNMI and extension of assimilation window are discussed in Florian's presentation:

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/DA_Austria_2018_RUC.pdf

Jk blending method in AROME 3D-Var (Endi Keresturi)

The presentation shows use of Jk method proposed by Guidard and Fischer (2008) in context of AROME 2.5km. First an overview of the method was given, and then specific tuning of setup was discussed. The cutoff truncation of V matrix was chosen according to shape of variance spectra, the point was chosen where the horizontal error variance spectra, between LAM and global model, started to diverge (wavelength 135km). The V matrix uses univariate formulation.

Verification shows positive impact on both upper-air and surface parameter, see more details in Endi's presentation:

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/JK_DAWD2018.pdf

OPERA radar data homogenization (Benedikt Strajnar)

HOOF - Homogenization of Opera OIFS Files new tool written in python was overviewed by Benedikt. The tool

- splits content of OIFS files to separate measurements,
- rearranges the content according to specification in namelist,
- encodes prescribed meta data separately for individual radars or for the whole data set.

For details about its usage please see Benedikt's presentation:

http://www.rclace.eu/File/Data_Assimilation/workshops/DAWD2018/lace_dawd_2018_radar.pdf

Discussion:

Florian mentioned that for wind de-aliasing it is important to have both wind and reflectivity on the same elevation/scan. Benedikt replied that it is not done yet, but can be added as an extra option.

Do we extend HOOF for superobing? Alena was proposing to put a superobing solution to BATOR but it seems that it would be easier to put in HOOF from preopera.

Vertical thinning? Florian replied that in BATOR overlapping rays are removed, Benedikt concluded that it is not common practise in LACE radar that rays overlap.

An issue of encoding of wind data was mentioned. Croatia and Slovenia have Nyquist frequency (NI) in the file and the values of wind are scaled with NI? Can it be fixed within the radar software they are using before uploading to OIFS.

TODO:

- 1) Add an optional filtering in HOOF to keep only elevations with both reflectivity & wind.
- 2) Explore possibilities to add superobing (from the preopera tool) to HOOF or BATOR.
- 3) Check encoding of wind data & relevant metadata (probably not a high priority at the moment)

Radar data processing in BATOR (stay report Michal Nestiak)

Michal showed reading of 4 LACE radars in BATOR but during the stay they realized that they were using bugged version so the exercise should be redone. Main findings are: bator can read correctly the HOOF processed files, can make spacial thinning and can apply a filters for wind observations. It is possible to read reflectivity alone without wind obs. Investigation showed that there are missing quality flags for some LACE radars, that there is an issue with reading files when no blanks are inserted to the names of parameter e.g. "TH "

TODO:

- 1) Check with MF, if name structure with blanks is necessary in bator_decodhdf5_mod.F90
- 2) Check if Bator is able to read QC indices

Radar data assimilation at KNMI (Wim Verkley, Jan Barkmeijer)

At KNMI they are testing radar reflectivities from French radars taken from OPERA (SMHI server) on top of operationally assimilated observations. Prior assimilation the data are averaged in the azimuthal direction (every 3 rays) and in the radial direction (binsize 6000 km).

They showed statistically significant positive impact of radar data on t2m, rh2m, q2m up to more than 12h of forecast. They plan to extend the dataset step-by-step by radar-data from other countries.

Discussion – What was the key for the success? One of the reason could be homogeneous set of radars, the other one is probably superobbing. In past we were using thinning but it was not working well.

LACE DA discussion and planning

- **B matrix/error stat** – Slovenian colleagues plan to create 20mem EDA for creation of flow-dependent statistics.
Todo: Ask MF about updates of sigma B maps computation and its availability in code
- **Radar reflectivity** – Florian mentioned that they use a climatological filter during pre-processing of reflectivity which they found important. Florian checked with their radar colleagues that:
 - 1) climatological flag is based on a time series of the radars themselves, so it can be calculated from a series of OPERA data without special local information needed
 - 2) unfortunately, the code cannot be shared
 - 3) New article about clim. filter will be published by the end of first quarter of 2019

Beni proposed to put superobing to HOOF tool.

Mihaly raised question: “Can we ask OPERA to provide better qc indexes, climatological indexes?”

TODO:

- 1) BATOR still some hard coded values are in we should find if it fits our radar and how to introduce our radar spec
 - 2) check the vertical profiles (slant)
 - 3) Alena prepares feedback for OPERA,
- **GNSS** – Patrik commented VarBC for ZTD:”global offset is ok, 3h cycling of VARBC, nbq param is constant 60”
 - **Radiance observations** – We should put it back to plan even no PM is allocated for 2019

We should focus on sensor ATMS which will replace AMSU-B/MHS on polar satellites, it has a higher pixel resolution but also a higher noise. Florian commented that NOAA20 is already available with ATMS and that Metop-C will be launched soon. Regarding priorities Patrik suggested to focus on microwave sensors (ATMS). The data could be assimilated in cloudy areas. Patrik also commented that it would be wise to put effort on infrared sensor IASI which is now available on polar satellites (Metop) because it will be soon available on geostationary satellites (MTG). It would be better to get familiar with a channel selection, inter-channel error correlations in R matrix are important (under development in MF).

Alena commented that cloud analysis could be investigated, following HARMONIE approach. They showed nice impact over winter period but with positive bias on precipitation. Florian summarized their experiences, e.g. difficulties to get necessary inputs – cloud height from surface observations and some satellites obs.

ASCAT coastal winds (12km product) from Metop-A/B were successfully assimilated in Slovenia and some LACE members expressed a wish to use more ocean wind observations.

TODO: Alena check availability of more scatterometer data (OPLACE)

TODO

Michal Nestiak

- 1) Check with MF, if name structure with blanks is necessary in bator_decodhdf5_mod.F90
- 2) Check if Bator is able to read QC indices

General radar colleagues

- 1) Check hard coded values in BATOR, they should fit our radar
- 2) Check how to introduce our radar specs
- 3) Check the vertical profiles (slant)
- 4) Check encoding of wind data & relevant metadata (probably not a high priority at the moment)

Alena Trojáková

- 1) Prepare feedback for OPERA
- 2) Check availability of more scatterometer data for OPLACE
- 3) Explore possibilities to add superobing (from the preopera tool) to HOOF or BATOR.

Antonin Bučánek

- 1) Check with MF updates related to sigma B maps computation and its availability in the code
- 2) Put back to plan Radiance observations

Benedikt Strajnar

- 1) Superobing in HOOF tool
- 2) Add an optional filtering in HOOF to keep only elevations with both reflectivity & wind.
- 3) Check with radar department the issue of normalizing the radial velocity with NI in Slovenia (and Croatia).