

Report from LACE DA Working Days 2013 in ZAMG Vienna

2013.09.18-09.20.

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Introduction:

The annually organized LACE DA Working Days (DAWD) is to share experiments and knowledge about DA systems and its development within LACE members. At the beginning of the meeting national status reports and/or operational systems are usually presented. At the second half of the DAWD, more presentations and discussions are organized on research and development issues. This event is a good opportunity also to solve problematic questions and plan the future activities.

National Status Reports:

Slovenian Report (Benedikt Strajnar)

Recent operational settings: ALARO cy35t1, 4.4km horizontal and 43L vertical resolution, 6 hourly data assimilation cycle, 3DVAR – CANARI – SST replacement, static B matrix

At last winter significant temperature bias was observed in Slovenian ALADIN model and found that large part of this observed bias was coming from the unrealistic snow amount of the model. To temporary solve this discrepancy CANARI snow analysis was done as a first action. Then the tune of REDNMC (REDNMC increased from 1.3 to 1.6) and switch on the relaxation to climatology (RCLIMCA=0.045) were set for further operational runs.

The assimilation of Mode-S aircraft observations was investigated in Slovenia as well. A carefully prepared pre-processing method was applied in order to smooth the data but still preserve the good data coverage. In conclusion the assimilation of Mode-S can clearly improve skill of the analyses and forecasts.

Croatian Report (Antonio Stanesic)

Recent operational settings: ALADIN HR 8km horizontal 37L vertical resolution, cycle 32t3, ALARO-0 3MT, DFI ; ALADIN HR22 2km horizontal 37L vertical resolution, NH core, ALARO-0

The coupling to ECMWF LBC was tested during the last year and compared with operational ARPEGE coupling. The LBC-s from ECMWF were tested in the 6 hours lagged mode to simulate its operational availability, but impact was mainly negative compare to ARPEGE. Using LBC-s at their valid time provided beneficial results, but the operational implementation of this option is not viable.

The first result of assimilation of RADAR observation was successfully done last year in Croatian. The full assimilation procedure of RADAR observations was carefully checked. First case study was also presented.

Romania Report (Mirela Pietrisi)

Recent operational settings: ALADIN 6.5 km horizontal 49L vertical resolution, IC and LBC from ARPEGE coupling 3 hours frequency, cy35t1

Encouraging results were shown about the previous version of Romanian DA system which clearly outperform the dynamical adaptation. Of course the improvements were bigger at the beginning of the forecast range, but still kept at longer ranges as well. Recently new cycle and new computer are under evaluation and some problems were found concerning the incorrect settings of new system.

Hungarian Report (Mate Mile)

Recent operational settings:

ALARO 8km horizontal 49L vertical resolution, CANARI+3DVAR DA, cy36t1

AROME 2.5 km horizontal 60L vertical resolution, 3DVAR DA, cy36t1

AROME 3DVAR operational DA system was introduced last year with conventional observations. AMV from Meteosat satellite was found beneficial in AROME 3DVAR system compared to operational 3DVAR. Also RADAR reflectivity and doppler wind were tested in AROME. New model cycle for ALARO full CANARI+3DVAR was also implemented this year.

Austrian Report (Florian Meier)

Recent operational settings:

ALARO, 4.8 km horizontal 60L vertical resolution, CANARI operational DA, cy36t1_export

Several case studies were examined with operational ALARO model which were found problematic during operational runs. In August 2013 strong heat wave occurred in Central Europe when ALARO T2m forecast had major bias caused by wrong soil moisture. With WP replacement from ARPEGE the bias in temperature was mainly removed.

AROME is running in pre-operational phase at ZAMG and the following developments were applied during last year:

- New observations: GPS, Windprofiler, lake temperature, RADAR, pseudo temp

- New domain and B-matrix

- cy37t1_op1 physics, small (60L) and big (90L) domain

- IDFI

To highlight some these issues, lake surface temperature was initialized with insitu measurement which method influenced slightly the surface temperature and humidity fields. The assimilation of RADAR reflectivity was successfully tested, but some problems were encountered with RADAR doppler wind. Assimilation of MODIS snow products was also investigated in AROME in the framework of SNOWGRID project.

Slovakian Report (Michal Nestiak)

Recent operational settings:

ALARO, 9 km horizontal, blending, CANARI operational DA, cy36t1

The full DA system was technically finished and further validation for it is ongoing. A test suite for AROME 2.5km and a higher resolution ALARO 3.3km were built as well. To get proper RADAR observations for DA purposes local usage of CONRAD tool and conversion to MF BUFR have been investigated also.

Czech Republic Report (Alena Trojakova)

Recent operational settings:

ALARO, 4,7 km horizontal, blending, cy36t1

The evaluation of experimental DA scheme was introduced in national report in the context of background error statistics and tuning of observation and background error diagnostics. Ensemble based statistics for 00, 06, 12, 18 UTC and all were examined. Different characteristics of the different B were observed and compared in the simplified framework of an experimental 3DVAR scheme. The B matrix based on all forecast runs was applied during further tests, but this decision was mainly ad hoc. The 3DVAR scheme have been tuned with Desroziers method as well to properly set the REDNMC and SIGMAO_COEF parameters. This study provided good potential to improve the analysis.

Special topics, presentations:

In LACE consortia the following DA topics are determining the main common activities recently: RADAR data assimilation, optimal usage of non-conventional mainly radiance observations and better representation of background error statistics. During the Working Days latest developments around these issues were introduced which presentations can be found on public LACE webpage as well.

RADAR data assimilation:

LACE RADAR data samples (Michal Nestiak)

Short overview on LACE RADAR data samples was given. Recently RADAR samples are available from 5 LACE members and still need to collect from Romania and Austria. The format of these data and conversion were also explained and the possible way to produce MF BUFR which is the necessary input format of RADAR data assimilation.

Short discussion was touched the projection of the raw RADAR observations and the results of the BATOR configuration.

RADAR data assimilation in Croatia (Tomislav Kovacic)

The application and development of CONRAD_RC tool was described in details and introduced mainly the relevant structure of the program. Due these developments the C++ classes were restructured and become easy to use. CONRAD_RC is a part of the official CONRAD software in HIRLAM repository which is open-source and ready to use. Raw RADAR data can be converted by CONRAD (through CONRAD_RC) into MF_BUFR format and then BATOR is able to read it and store in ODB.

The first RADAR DA case study was done in Croatia with ALARO for 5th June 2012. All the necessary steps in BATOR-002-131 were carefully checked during the study and found correctly handled.

AROME RADAR data assimilation (Mate Mile)

From Hungary the RADAR stations, measurements and the pre-processing of the observations were presented at the beginning of the talk. The reflectivity RADAR data is additionally filtered and observations are removed under 7dBz. Later on so called RaySmooth and Wifi-filter are also applied.

An assimilation impact study was investigated for a summer period when operational AROME CONV and AROME operational plus RADAR reflectivity, doppler wind were compared. The low elevation blacklisting was separately tested in a different experiment.

Relatively large impact of RADAR observations on analysis was shown regarding the DFS values which means it has good potential to improve the skill of mesoscale DA systems. The results of the impact study was presented after with point-based and object based verification. Due to results and case studies it was pointed out that the proper usage of RADAR observations is still ongoing in Hungary.

RADAR studies in Portugalia (Maria Monteiro remotely)

In Portugalia correct pre-processing of RADAR data was done in order to create MF BUFR, but some issues were found with Harmonie release 37h1.2 where all RADAR observation data was rejected after.

Other data related presentations:

Satellite BIAS correction for MSG (Patrik Benacek)

Satellite bias correction is based on observation minus model guess departures detection. Increasing model bias can lead to wrong satellite bias detection and using suboptimal weights of predictors (bias parameters) in the correction scheme VarBC. The main goals of the presentation were to detect increasing RH model bias in UT and investigate an impact of the model bias on the VarBC setting for high-peaking WV channels (6.2 and 7.3 μ onboard MSG). Improved bias parameters in VarBC scheme were found and new bias correction was tested on the WV channels in 3DVAR.

GPS ZTD data assimilation in AROME/3DVAR in Austria (Xin Yan)

The assimilation of GPS ZTD data was investigated in Austria with AROME 3DVAR. A period from 15th of May to 1st of July 2011 was selected and checked the AROME skill regarding the impact of GPS observations. Respect to the surface score the assimilation of GPS ZTD has positive or neutral impact. Also the lower level (700-850hPa) humidity BIAS scores were improved during the test period. The object-based verification method so called SAL was employed to estimate skill of AROME precipitation forecast with GPS assimilation. Overall the amplitude on short-ranges became better and the location for longer-ranges as well.

Soil moisture assimilation (Stefan Schneider)

ALADIN model with cy35t1 over Europe and ALARO model with cy36t1 over Eastern-Africa were applied to an impact study of EKF soil moisture assimilation. During these studies a Simplified EKF with SURFEX version 4.8 were running and assimilating ASCAT soil moisture product. This satellite product was pre-processed by Vienna Technical University and therefore Quality Control and BIAS correction based on CDF matching were calculated. The results of the investigation was mainly neutral regarding point-based and SAL verifications and one successful case study was presented.

Background error statistics section:

Dispersion spectra of 3DVAR with different setups (Antonin Bucanek)

LAM Aladin ensemble coupled to AEARP was used to diagnose background error dispersion. Then 3DVAR assimilation cycle with perturbed observations was set for each member of ensemble. Perturbations are constructed as random draws from normal distribution with zero mean and variance equal to expected observation error. 3DVAR analysis standard deviation (stde) is larger than in guess for temperature and specific humidity. There was no significant increase of stde for vorticity and divergence. The main increase of dispersion was observed in long waves (up to wave number 11). A conclusion was that 3DVAR corrects large scales more intensively than small scales in this framework. With more observations the previously observed picture wasn't changed significantly. The tuning of REDNMC parameter (increasing) and different representation of B matrix were also investigated, but still without effect on shorter waves which was wished to improve by LAM 3DVAR assimilation. Further study is needed to better understanding the system.

Spatially varying background error variances (Alena Trojakova)

The reopening of spatially varying background errors statistics was presented and several questions were posed to start discussion on the method and its application. The questions were taken around the available literature of the application of the method and the possible continuation. Also it was mentioned that Czech colleagues are going to testing this method in ALARO DA during the next year.

Grid-point sigma B maps in AROME 3DVAR (Florian Meier and Mate Mile)

In spring 2013 the method of grid-point sigma B maps by Strajnar 2008 was tried in AROME 3DVAR framework and compared with using climatological B matrix. The first outcome of this work was to determine the spatial variability of the AEARP sigma B maps over Central Europe i.e. our area of interest which was observed finally insufficient. The second thing what was found that AROME 3DVAR has incorrect application for the usage of the sigma B maps, because a single wind observation study produced zero increment for variable humidity and distorted increment with single temperature study.

General Discussion and Continuation of the Work

Highlights from discussions:

Concerning the *RADAR data exchange* many issues were discussed and the following main conclusions were made. The collection of data samples should be continued with an overview of the already received samples and feedback to the colleagues to address the existing deficiencies. In order to decide the QC issue and Quality flags two possible directions were mentioned. The first one is supporting the idea of pre-processed and controlled RADAR data at every LACE centers locally which seems to be less advantageous than organize a common action (QC and conversion) on the raw RADAR data.

In the section of *background error statistics* the question of flow-dependency and usage of sigma B maps were dominant. All colleagues agreed on the importance of flow-dependency aspects of DA and on the fact that application of sigma B maps provides the easiest way to reach this. However on mesoscale the recently available AEARP maps hasn't got enough spatial variability over our domains

and as a next step the computation of limited-area ensemble sigma B maps should be done. From the AROME model side another issue of the incorrect humidity increments were addressed and discussed as an urgent action towards the usage of the method.

After the presentations, discussions the following issues were addressed to be further studied and understand (so called TODO duties):

1. Verify again the missing SURFRESERV.EAU increments in CANARI and open LACE forum topic for common sharing the results. (All Colleagues)
2. Understand and solve technical issues in Romanian Assimilation System (Mirela Pietrisi, Mate Mile, backup Olda Spaniel)
3. Identify the BATOR RADAR data reading details concerning ECMWF library and MF library in Croatia (Antonio Stanesic, Tomislav Kovacic)
4. Information about HIRS radiances is needed. Create LACE forum topic for this and share information (Mate Mile)
5. Coordination of Satellite Channel Selection (All Colleagues)
6. Sharing Monitor software within LACE (Alena Trojakova)
7. Collect information about local RADAR data QC and QC flags which flags are used in the screening. (Tomislav Kovacic)
8. Availability of BUFR TEMP observations (Alena Trojakova)
9. RADAR data exchange (Mate Mile, Michal Nestiak)
10. Upload DFS and MTEN diagnostics into LACE forum and give short readme (Mate Mile)
11. Update the operational namelists on LACE website (All Colleagues)
12. Post AROME 3DVAR sigma B maps error in LACE forum
13. Post quick solution on LACE forum to fix snow in Slovenian ALARO (Alena Trojakova)

Summary of the next year Planning and Discussion on far future

What will LACE DA be in 2020?

The question was raised and a brief overview of European plans from the bigger consortias and centers was presented as a starter of a discussion. Weighing our opportunities up to the next year the following directions, statements were made or at least imagined:

1. LACE members should continue their own data collection strategies with special emphasis on dense and high quality observations in order to outperform bigger centers and commercial companies locally.
2. Rapid Update Cycling is good approach on longer term
3. For state-of-art methodology developments like 4D-EnVAR LACE hasn't got enough manpower, but the possible collaboration with HIRLAM and ALADIN countries should be possible..
4. It is important to participate in the OOPS project especially its LAM DA side and manpower support should be allocated for this. This is mainly true for shorter planning.
5. The optimal (!) usage of (mainly non-conventional) available observations is wished and more coordinated work is needed.

About the next year planning several directions and opportunities were taken into account. First of the refinement of the draft plan was made which is available on the LACE website in 'Plans' sections. Some of the discussed points, additional items of the this plan can be seen below briefly:

1. OPLACE maintenance
 1. BUFR TEMP needed
 2. AMV HRW will be ok for next year
 3. GPS have to clarify policy issues
 4. Mode-S is too early for next year
 5. ASCAT products (?)
2. Grid-point sigma B maps
 1. Check the possibility to create such maps from LAEF
 2. Try to solve AROME bug (simple tests with errgrib file)
3. RADAR assimilation
 1. Croatia and Hungary will focus on impact studies in 2014
 2. Common QC (hdf5 → QC → CONRAD → BATOR)
4. GPS assimilation
 1. EGVAP GPS data can be tested in Hungary to make impact study

Others

The next Working Days should be organized at the first week of September, before the LSC meeting which will be also feasible for every LACE colleagues.