

Working Area Predictability

Work Plan

Prepared by:	Martin Belluš
Period:	2018 (updated)
Date:	March 2018

Introduction and background

The regional ensemble forecasting system ALADIN-LAEF is one of the flagships of RC LACE cooperation. It provides the probabilistic forecasts for the LACE partners operationally on daily basis. One of our main tasks is the continual enhancement of such system. Its upgrade towards the higher resolution with many other modifications was already tested in pre-operational mode with very positive results. For 2018 the introduction of major upgrade to the IC perturbation - the ENS BlendVar - was planned, however in the light of new circumstances the operational implementation (even of its first phase) is at best questionable. The new ALADIN-LAEF on 5 km with 60 vertical levels (and new physics) becomes too expensive regarding the billing units despite its reduced computational domain, that it is not any more possible to have it operational under the austrian account at ECMWF HPCF. Its cost in comparison with the current system is about 12-times higher and we are talking about 130 Mio SBUs per year which would be needed. Therefore, we are facing several key questions. Who will provide the necessary billing units for the operations of new ALADIN-LAEF? Can it be collected within the LACE partners who are also ECMWF full members? What could be sacrificed in order to decrease its consumption in case there won't be enough resources?

Goals

Among several other tasks and smaller topics, there will be two major goals tackled during this year:

- A) The new method for handling IC perturbation of the upper-air fields (ENS BlendVar) has to be carefully tested within new ALADIN-LAEF. At the same time the quality and reliability of the observations entering the upper-air data assimilation (3DVar) must be checked regularly. The different possibilities for background error statistics computation need to be investigated, e.g. a flow dependent B-matrix creation is considered in the cooperation with DA group.
- B) More effort will be dedicated into the work on convection-permitting ensembles, especially into their operational implementation. At ZAMG they already started to develop their Convection permitting Limited Area Ensemble Forecasting system C-LAEF based on AROME 2.5 km. In the ideal situation a test suite will be prepared by the end of the year with the parameter and/or process-based stochastic physics perturbation incorporated.

Main R&D activities

1 Action/Subject: **Optimization of ALADIN-LAEF**

Description and objectives: Research and development concerning the regional ensemble forecasting system ALADIN-LAEF in order to sustainably improve its operational implementation.

- ❑ Perform detailed scientific validation and tuning of 3DVar within ALADIN-LAEF framework in order to be used in ENS BlendVar.
- ❑ Investigate the possibility to reduce the drying effect of stochastic physics by preserving relative humidity during the perturbation. This way the oversaturation can be hopefully avoided in case of decreased temperature with some impact on water vapour content. However, if the temperature perturbations are going to be symmetric, the neutral impact on global scales should be achieved.
- ❑ Investigate different approaches for the creation of background model error statistics in the EPS framework, e.g. flow-dependent B-matrix can be recomputed regularly every couple of weeks with very little costs. Test its impact on ALADIN-LAEF performance.
- ❑ Suggest the assimilation strategy which could be used in the context of newly implemented ENS BlendVar. Several possibilities to create an assimilation loop in ALADIN-LAEF have to be considered taking into account the operational environment limitations.
- ❑ Test the benefits of ensemble calibration and post processing of high resolution ALADIN-LAEF wind forecast.
- ❑ The operational implementation of ALADIN-LAEF 5 km (depending on the answers to the questions from the introduction).

Proposed contributors & Estimated efforts: Florian Weidle, Christoph Wittmann (both ZAMG), Martin Belluš, Martin Dian (both SHMU), Raluca Pomaga (NMA), Iris Odak Plenković (DHMZ) - 10 PM (including 4 PM LACE stays at ZAMG)

Planned time-frame and deliverable: Ongoing. State-of-the-art ensemble system capable to deliver operational probabilistic forecasts, the evaluation results, stay reports.

Planned stays:

1. Martin Belluš (4+4 weeks) - ENS BlendVar [spring, autumn]
2. Iris Odak Plenković (4 weeks) - wind forecast calibration [5 Feb - 2 March]
3. Raluca Pomaga (4 weeks) - 3DVar tuning [6 -31 Aug]

2 Action/Subject: ALADIN-LAEF maintenance

Description and objectives: Maintain and monitor the operational suite of ALADIN-LAEF running on Cray HPCF at ECMWF.

Necessary update of the operational data-flow and running scripts will be done with respect to the new ALADIN-LAEF implementation (phase I and II), if applicable.

Proposed contributors & Estimated efforts: Florian Weidle (ZAMG), Martin Belluš (SHMU) - 3 PM

Planned time-frame and deliverable: Ongoing. Stable ALADIN-LAEF operational suite and reliable delivery of the probabilistic forecast products (GRIB files, plots) to the LACE partners.

3 Action/Subject: Development of AROME-EPS

Description and objectives: Development of convection-permitting ensemble system based on non-hydrostatic AROME model. The aim would be to probabilistically forecast high-impact weather on local spatial scales and with short life-cycle. Activities are planned at ZAMG and OMSZ:

- Continue work on stochastic perturbation of physics tendencies as a tool to simulate the model uncertainty, with the usage of improved random number generator (SPG).
- Test and evaluate the different options of model perturbation, e.g. parameter and/or process based stochastic physics for AROME.
- Consider the implementation of 3D version of new SPG to have vertical structure for random patterns and also a non-Gaussian noise distribution option (for the meteorological fields which do not have normal statistical distribution).
- Pre-operational implementation and testing of a convection-permitting ensemble system C-LAEF.

Proposed contributors & Estimated efforts: Mihály Szűcs, Réka Suga (both OMSZ), Clemens Wastl, Christoph Wittmann (both ZAMG) - 11 PM (including 1.5 PM LACE stays at ZAMG)

Planned time-frame and deliverable: Ongoing. Reports on the experiments, exchange of the technical expertise.

Planned stays:

1. Mihály Szűcs (2 weeks) - 3D version of SPG [2-13 July]
2. Réka Suga (4 weeks) - model error representation [8 Oct - 2 Nov]

4 Action/Subject: Verification

Description and objectives: Further development of the verification tools for both ALADIN-LAEF and AROME-EPS forecasts.

Proposed contributors & Estimated efforts: Simona Taşcu (NMA) - 1 PM (including 1 PM LACE stay at ZAMG)

Planned time-frame and deliverable: Ongoing. Enhanced verification tools.

Planned stays:

1. Simona Taşcu (4 weeks) - LAEF Verification package [9 July - 3 Aug]

5 Action/Subject: Contributions to international projects, collaboration

Description and objectives: Activities merging different areas, collaboration with other consortia, applications, projects.

- Organization of LACE working days in the area of EPS. (There was an idea initiated by Mihaly after his positive experience from last year's HIRLAM working week on EPS and Predictability in Helsinki.)
- Closer collaboration with HIRLAM group and the exchange of know-how related to their HarmonEPS and our ALADIN-LAEF systems.
- Contributions to the other workshops and meetings.

Proposed contributors & Estimated efforts: Florian Weidle, Yong Wang (both ZAMG), Mihály Szűcs (OMSZ), Martin Belluš (SHMU) - 2 PM

Planned time-frame and deliverable: Ongoing. Presentations at the workshops, reports.

6 Action/Subject: Publications

Description and objectives: The scientific achievements of the LACE EPS R&D activities are being presented at the international workshops and published in the scientific journals.

Proposed contributors & Estimated efforts: Florian Weidle, Yong Wang, Christoph Wittmann, Clemens Wastl (all ZAMG), Martin Belluš (SHMU), Simona Taşcu (NMA), Mihály Szűcs (OMSZ) - 6 PM

Planned time-frame and deliverable: Ongoing. Reviewed papers and the workshop contributions.

Summary of resources [PM]

Subject	Manpower	LACE	ALADIN	Other
S1: Optimization of LAEF	10	4		
S2: LAEF maintenance	3			
S3: AROME-EPS	11	1.5		
S4: EPS - Verification	1	1		
S5: Collaboration	2			
S6: Publications	6			
Total:	33	6.5	0	0

Meetings and events (2018)

- 30th LSC Meeting, 15-16 March, Plitvicka jezera, Croatia
- Joint 28th ALADIN Workshop & HIRLAM All Staff Meeting 2018, 16-19 April 2018, Météo-France Toulouse, France
- 31th LSC Meeting
- 40th EWGLAM and 25th SRNWP joined meetings, 1-4 October 2018, Austria
- International EPS related conferences or workshops (e.g. SRNWP-EPS II)