

Working Area Predictability

Work Plan

Prepared by:	Area Leader Martin Belluš
Period:	2020
Date:	March 2020

Introduction and background

It is clear that the future of the operational NWP is in a probabilistic approach. That is one of the reasons why a lot of effort and man power was recently put into the preparation of new operational ensembles at member states. (The other reasons being the availability of supercomputers together with strong pushes from higher management.)

The situation in RC LACE is currently a bit complicated, since there are three independent systems developed in parallel, however they are very much different in their focus. There is the common RC LACE EPS with 4.8 km horizontal resolution based on ALARO-1 physics running on a big European domain (A-LAEF), Austrian convection-permitting EPS with 2.5 km horizontal resolution utilizing nonhydrostatic AROME model on a middle European domain (C-LAEF) and similar convection-permitting EPS configuration in Hungary (AROME-EPS), although with fewer ensemble members and running only once per day on their local HPC.

All three systems got the operational status by the end of 2019 or at the beginning of 2020. We have to believe, that the huge energy invested into the doubled (or even tripled) work is going to be transformed into the closer cooperation and faster progress in the future.

Goals

The main goal for 2020 is clearly the commencing of the operational utilization of all three mentioned ensemble systems, with the higher emphasis on common A-LAEF production (since it covers reasonably big integration domain while having still interesting spatial resolution and 3-days forecast range). Except that, there are other new or postponed topics to be investigated.

Main R&D activities

1 Action/Subject: Optimization of A-LAEF

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

- Implementation of new random number generator (SPG) suitable for LAM EPS environment in A-LAEF 5 km.
- Investigate the possibilities of stochastic perturbation of fluxes instead of tendencies. This should be beneficial with respect to the energy balance preservation in perturbed model.
- Preparation of flow-dependent B-matrix using the A-LAEF 5 km operational outputs.

- ❑ Creation of new A-LAEF probabilistic products to meet the different users requirements.
- ❑ Implementation of A-LAEF 5 km Phase II configuration involving ENS BlendVar to improve the simulation of upper-air ICs uncertainty.
- ❑ Continuation work on analog-based post-processing method to improve the point forecast of high-resolution wind field. Investigation of the possibility to use such method for the ensemble of other surface parameters like T2m or RH2m and also on the full grid.
- ❑ Calibration of precipitation. Methodology for post-processing over the river catchments according to the needs of hydrological models.

Proposed contributors & Estimated efforts: Martin Belluš, Martin Imrišek (both SHMU), Martina Tudor, Iris Odak Plenković (both DHMZ), Neva Pristov (ARSO) - 11 PM (including 3 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 Imrišek (4 weeks) - new SPG (postponed from 2019)
2. Iris Odak Plenković (4 weeks) - analog-based post-processing method
3. Martin Belluš (4 weeks) - A-LAEF (postponed from 2019)

2 Action/Subject: A-LAEF maintenance

Description and objectives: Maintain and monitor the operational A-LAEF suite running on ECMWF's HPCF.

For the operations of new A-LAEF system at ECMWF it was agreed to collect 130 mio SBUs per year (HR 20, SI 40, AT 5 and TR 65). The system will be monitored and maintained in order to guarantee the real-time dissemination of probabilistic forecasts to the LACE partners. Upgrades and improvements of the A-LAEF scripting system will be done as necessary. The upgrade of the upper-air IC uncertainty simulation by ENS BlendVar will be implemented operationally as a Phase II.

Proposed contributors & Estimated efforts: Martin Belluš (SHMU), ??? - 4 PM (including 1 PM LACE stay)

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

Planned stays:

1. Martin Belluš (4 weeks) - operational implementation of A-LAEF Phase II

3 Action/Subject: **Development of AROME-EPS**

Description and objectives: Development of convection-permitting ensemble system based on nonhydrostatic AROME model in order to probabilistically forecast high-impact weather on local spatial scales, with short life-cycles. Activities are planned at ZAMG and OMSZ partners:

- ❑ Optimize settings of new random number generator (SPG) for convection-permitting ensemble at OMSZ. Work on tapering function.
- ❑ Testing and optimization of supersaturation check for convection-permitting ensemble at OMSZ.
- ❑ Optimization of different approaches in stochastic physics (e.g. implementation of SPG pattern generator, tests for flow dependent pattern generator), testing of new observations in C-LAEF (ModeS, GNSS).
- ❑ Perform the “cheap” parallel experiments with lagged convection-permitting ensemble system formed by several deterministic AROME runs (RUC).
- ❑ Optimization and tuning of the operational C-LAEF at ECMWF HPCF.
- ❑ Optimization and tuning of convection-permitting ensemble system on new HPC at OMSZ.

Proposed contributors & Estimated efforts: Réka Suga, Mihály Szűcs, Viktória Homonnai, Katalin Jávoréné-Radnóczy (all OMSZ), Christoph Wittmann, Clemens Wastl (both ZAMG), Endi Keresturi (DHMZ) - 20 PM (including 1 PM LACE stay at ZAMG)

Planned time-frame and deliverable: Ongoing. Reports on the experiments, exchange of expertise. Improvements of the operational implementations of convection-permitting ensembles.

Planned stays:

1. Endi Keresturi (4 weeks) - convection-permitting EPS development

4 Action/Subject: **Verification**

Description and objectives: Revision, consolidation and further development of the verification tools for probabilistic forecasts.

Proposed contributors & Estimated efforts: Réka Suga (OMSZ), Martin Belluš (SHMU) - 1.5 PM (including 1 PM LACE stay at SHMU)

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

Planned stays:

1. Réka Suga (4 weeks) - April-May 2020, understanding and implementing the LAEF verification package at OMSZ (postponed from 2019)

5 Action/Subject: Contributions to international projects, collaboration

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

- ECMWF special project for LAM EPS R&D experiments at HPCF.
- Collaboration with DA on ensemble assimilation methods (flow dependent B-matrix, etc.).
- Collaboration with HIRLAM EPS group and the exchange of know-how.
- Contributions to the other workshops and meetings.

Proposed contributors & Estimated efforts: Martina Tudor (DHMZ), 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, Florian Meier, Yong Wang, Christoph Wittmann, Clemens Wastl (all ZAMG), Martin Belluš, Martin Imrišek (both SHMU), Simona Taşcu (NMA), Mihály Szűcs (OMSZ), Martina Tudor, Iris Odak Plenković, Endi Keresturi (all DHMZ) - 6 PM

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

Summary of resources [PM]

Subject	Manpower	LACE	ALADIN	Other
S1: Optimization of A-LAEF	11	1+2*		
S2: A-LAEF maintenance	4	1*		
S3: AROME-EPS	20	1		
S4: EPS - Verification	1.5	1*		
S5: Collaboration	2			
S6: Publications	6			
Total:	44.5	2+4*	0	0

(*) RC LACE stays postponed from 2018, 2019

Meetings and events (2020)

- 34th LSC Meeting, March 2020
- Joint 30th ALADIN Workshop & HIRLAM All Staff Meeting 2020, 30 March - 4 April 2020, Ljubljana, Slovenia
- 35th LSC Meeting, September 2020
- 42nd EWGLAM and 27th SRNWP joined meetings, October 2020, Belgium
- Other international EPS related conferences or workshops