Working Area Predictability

Work Plan

Prepared by:	Area Leader Martin Belluš/Clemens Wastl
Period:	2021
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Introduction and background

The situation in EPS area of RC LACE is rather complicated due to the development of different LAM EPS systems. Currently, we operate three independent ensemble systems - A-LAEF (common operational ensemble system of RC LACE), C-LAEF (Austrian convection-permitting ensemble system) and AROME-EPS (Hungarian convection-permitting ensemble system). For the time being their development and maintenance is carried out separately at SHMU, ZAMG and OMSZ, respectively.

Although these systems are very much different in their focus and content (hence the above statement is partly understandable), we have to find at least a minimal cross-section of interest for our cooperation. One of such topics would be a common action in the preparation of boundary conditions, although we clearly see a big challenge regarding the merging of various needs of the systems. ECMWF is currently setting up new tasks for ensemble boundary condition production with 903 which can be used for C-LAEF and AROME-EPS systems. It would be nice in the future to unify the processing of global ENS data into the couplings for all three systems, the spared SBUs from a Special BC Project shall be possibly used to support the common operations of A-LAEF.

It should be probably stressed that the operations' cost of the common system A-LAEF is currently being covered only by **national resources of** Croatia and Slovenia, **with the great help of Turkey (43% of all SBUs)**, while the other two systems (the first one with comparable costs) are being operated individually by ZAMG and OMZS (but they are also the only users of those systems).

End of ALADIN-LAEF system on May 11, 2020!!!

Goals

The main goals for 2021 are very similar to those of previous years. Our systems are already running operationally, but we need to invest time into their further improvements and maintenance, and we also have to ensure that their outputs are being accordingly utilized in order to maximize their potential. A big issue for 2021/22 is of course the transfer of the operational suites A-LAEF and C-LAEF to the new HPCF at ECMWF. It is expected to get some additional SBUs – possible expansions (members, domain, resolution, etc.) should be envisaged.
For the future it will be very important to have a long-term vision in which direction we want to go within RC LACE to meet the fast development in EPS area.

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.

The main topics are:

- ❏ Implementation and testing of new random number generator (SPG) suitable for LAM EPS environment in A-LAEF.
- ❏ Stochastic perturbation of fluxes instead of tendencies in order to preserve the energy balance in perturbed model.
- ❏ Utilization of A-LAEF operational forecasts for flow-dependent B-matrix computation to be used in local assimilation cycles of RC LACE members.
- ❏ Continuation work on methods for analog-based post-processing of probabilistic fields on a regular grid.

Proposed contributors & Estimated efforts: Martin Belluš, Martin Imrišek, Mária Derková (all SHMU), Martina Tudor, Iris Odak Plenković (both DHMZ), Neva Pristov (ARSO) - 10 PM (including 3 PM LACE stays)

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
2. Iris Odak Plenković (4 weeks) - analog-based post-processing methods
3. Martin Belluš (4 weeks) - flow-dependent B-matrix

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 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 (and Turkey). 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 considered taking into account available resources.

The main topics are:

- ❏ Migration of A-LAEF system to the new ECMWF's computer in Bologna and its upgrade to cy43 or cy46 (if available).
- ❏ Upgrade of the upper-air IC uncertainty simulation by ENS BlendVar (if feasible with respect to the available resources).
- ❏ Unification of A-LAEF grib coding and inclusion of new fullpos fields according to users' requirements.
- ❏ Technical support for Turkey with the utilization of A-LAEF operational data.
- ❏ A-LAEF coupling for the local convection-permitting EPS applications

Proposed contributors & Estimated efforts: Martin Belluš, Mária Derková (both SHMU) - 5 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 RC LACE partners.

Planned stays:
1. Martin Belluš (4 weeks) - A-LAEF migration and upgrade

3 Action/Subject: Development of AROME-EPS

Description and objectives: Development of convection-permitting ensemble systems based on non-hydrostatic AROME model in order to probabilistically forecast high-impact weather on small spatial scales, with short life-cycles. These activities are planned for ZAMG and OMSZ partners.

The main topics are:

- ❏ Optimization and tuning of convection-permitting ensemble system on HPCF at OMSZ
- ❏ Continuation of EDA experiments with AROME-EPS at OMSZ
- ❏ OMSZ: Test of ECMWF ENS LBC upgrade (to 137 model levels) in the first half of 2021; increase the number of operational EPS runs from 1 to 4 until the end of 2021
- ❏ Development of decision-making criteria based on EPS for various users (e.g. hydrology, renewable energy, road safety)
- ❏ Improvement of uncertainty representation of surface processes in convection permitting C-LAEF system at ZAMG (e.g. new perturbations, new methods)
- ❏ Improvement of stochastic parameter perturbations (SPP) with special focus on convective hazards (e.g. processes in micro-physics) in C-LAEF at ZAMG
- ❏ Optimization and tuning of C-LAEF system on cy43t2; migration to new ECMWF HPCF
- ❏ Tests on expansion of C-LAEF (higher resolution, more members, larger domain) with the expectation of more SBUs at the new HPCF at the ECMWF
- ❏ Adaptation of C-LAEF for other domains (interest of Turkey)

Proposed contributors & Estimated efforts: Viktória Homonnai, Katalin Jávorné-Radnóczi, Gabriella Tóth (all OMSZ), Christoph Wittmann, Clemens Wastl, Florian Weidle (all ZAMG) - 20 PM

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) in Vienna - model error representation in C-LAEF
2. ACCORD stay for Turkish colleague in Vienna - set-up C-LAEF for Turkish domain.

4 Action/Subject: Verification – This topic might be shifted to new area Applications and Verification

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

The main topics are:

- ❏ Implementation and utilization of LAEF verification package.
- ❏ Implementation and utilization of HARP verification package.

Proposed contributors & Estimated efforts: Marcin Kolonko (IMGW), Martin Petráš (SHMU), Florian Weidle, Christoph Zingerle (both ZAMG) - 4 PM (including 1 PM LACE stay)

Planned time-frame and deliverable: Restarted. Probabilistic verification tools.

Planned stays:

5 Action/Subject: Contributions to international projects, collaboration

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

The main topic are:

- ECMWF special project for A-LAEF R&D experiments at HPCF.
- Collaboration with DA group on ensemble assimilation methods (flow dependent B-matrix, etc.).
- Contributions to the other workshops and meetings.
- Collaboration with ACCORD predictability area

Proposed contributors & Estimated efforts: Martina Tudor (DHMZ), Martin Belluš (SHMU), Clemens Wastl (ZAMG) - 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; Mária Derková (all SHMU), Simona Taşcu (NMA), 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	ACCORD	Other
S1: Optimization of A-LAEF	**10**	**3**		
S2: A-LAEF maintenance	**5**	**1**		
S3: AROME-EPS	**20**	**1**	**1**	
S4: EPS - Verification	**4**			
S5: Collaboration	**2**			
S6: Publications	**6**			
Total:	**47**	**5**	**1**	**0**

Meetings and events (2021)

- ❏ 36th LSC Meeting, 13-24 March 2021 (online)
- ❏ 1st ACCORD All Staff Meeting 2021, 12-16 April 2021 (online)
- ❏ 37th LSC Meeting, September 2021
- ❏ 43rd EWGLAM and 28th SRNWP joined meetings, October 2021
- ❏ Other international EPS related conferences or workshops