

# Working Area Predictability

## **Work Plan**

<b>Prepared by:</b>	Area Leader: Clemens Wastl
<b>Period:</b>	2022
<b>Date:</b>	September 2021

## Introduction and background

Currently three different EPSs are operated within RC-LACE: A-LAEF the common EPS of RC-LACE and the two convection-permitting EPSs C-LAEF (Austria) and AROME-EPS (Hungary). 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 it would be much more effective and efficient to merge some work or at least to increase the scientific exchange in research topics. One good example for such a merged topic is the common action in the preparation of boundary conditions for C-LAEF and AROME-EPS by ECMWF with 903 which has finally been implemented in 2021. It would be very nice for the future to find much more such symbiosis within the three EPSs in RC-LACE so that we can meet the fast development in the EPS area worldwide (first EPSs are going to 1km resolution already). Just some ideas: the output of the common A-LAEF system could for example be used in the future for coupling highly resolved EPSs; our local EPSs could be applied to other domains (Turkey is already implementing C-LAE for their domain); etc.

An increase of cooperation and collaboration between member states is also one of the key issues in the RWP of the newly formed ACCORD consortium. The new ACCORD area leader for EPS (Henrik Fedderson) has initiated stronger cooperation between the area leaders of the different consortia (Inger-Lise Frogner, Laure Raynaud, Clemens Wastl), resulting in several online meetings about RWP and common EPS topics. As a result of this stronger cooperation the ACCORD RWP has been completely reorganized from consortia based actions to thematic actions. Due to this fact it is also reasonable to reorganize the RC-LACE work plan accordingly. Hence, the present work plan for 2022 is organized in thematic subjects starting with S1 (Preparation, evolution and migration) where all operational activities are put together. The following subjects S2-S5 are dedicated to the uncertainty representation in the different areas of EPS (initial conditions, model error, surface, LBCs). S6 is a new topic in the work plan of RC-LACE and meets the increasing effort spent on statistical post-processing and the development of user-oriented approaches and products. S7 finally is dedicated to collaboration between EPS researches in RC-LACE and ACCORD and to the publication of scientific research. With this reorganization of the work plan the reporting and planning will be much easier in the future for all of us.

In the near future (starting with autumn 2021) regular thematic workshops (mostly online, but if Corona situation allows also physical) in the EPS area (e.g. model error representation, surface perturbations, etc.) are planned within ACCORD where also interested RC-LACE colleagues should participate.

## Goals

The main goals for 2022 are in most points very similar to those of the 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. Because of this I have added a new subject S6 which deals with statistical post-processing and the development of user-oriented approaches and products.

A big issue for 2022 is of course the transfer of the operational suites A-LAEF and C-LAEF to the new HPCF at ECMWF in Bologna which should be fully available in Q2/2022 (initially it was planned for 2021 but was postponed several times due to Brexit and Corona). It is expected to get some additional SBUs on this new machine, so possible expansions of the EPSs (members, domain, resolution, etc.) should be envisaged.

In the next years we have definitely think about going towards 1km resolution (at least for the local EPSs; ZAMG is planning to develop 1km C-LAEF in the next 3 years) and therefore it will be very important to strengthen the cooperation within RC-LACE on this topic.

However, not only the resolution, also the quality of the EPSs should be continuously improved. New methods (e.g. flow dependent perturbations for IC and model error; integration of AI technologies; etc.) are very much welcome and should be developed to meet the fast development in the EPS area worldwide.

## 1 Subject: Preparation, evolution and migration

**Description and objectives:** Maintain and monitor the operational suites of A-LAEF and C-LAEF running on ECMWF's HPCF and the AROME-EPS running at the HPCF at OMSZ. Migration and implementations to new HPCFs, operational upgrades, new cycles, optimizations and tunings.

The main topics for 2022 are:

- A-LAEF and C-LAEF: Migration to the new ECMWF's computer in Bologna and upgrades to cy43.
- A-LAEF: Upgrade of the upper-air IC uncertainty simulation by ENS BlendVar
- C-LAEF: Possible expansion of C-LAEF (higher resolution, more members, larger domain) with the expectation of more SBUs at the new HPCF at the ECMWF
- C-LAEF: Adaptation to other domains (e.g. Turkey)
- AROME-EPS: Optimization and tuning of convection-permitting ensemble system on HPCF at OMSZ
- AROME-EPS: Introduction of EDA in AROME-EPS

**Proposed contributors & Estimated efforts:** Martin Belluš, Mária Derková (SHMU), Katalin Jávorné-Radnóczy, Gabriella Tóth (OMSZ), Christoph Wittmann, Clemens Wastl, Florian Weidle (ZAMG), Yelis Cengiz (Turkey) - 17 PM

**Planned time-frame and deliverable:** Permanent. Stable and state-of-the-art operational suites of all three EPSs in RC-LACE.

### Planned stays:

1. Martin Bellus (4 weeks at ZAMG) – A-LAEF migration and upgrade
2. ACCORD stay for Turkish colleague at ZAMG - set-up of C-LAEF for Turkish domain

## 2 Action/Subject: **Model perturbations**

**Description and objectives:** Research and development concerning model perturbations in the three EPSs within RC-LACE. Study ways to represent uncertainty in the atmospheric models itself and how to best incorporate this into the models.

The main topics for 2022 are:

- A-LAEF: Stochastic perturbation of fluxes instead of tendencies in order to preserve the energy balance in perturbed model.
- C-LAEF: Improvement of stochastic parameter perturbations (SPP) with special focus on convective hazards (e.g. processes in microphysics)
- C-LAEF: Development of flow-dependent model perturbations

**Proposed contributors & Estimated efforts:** Martin Belluš, Mária Derková, Martin Imrišek (SHMU), Christoph Wittmann, Clemens Wastl, Florian Weidle (ZAMG), Endi Keresturi (DHMZ) - 10 PM

**Planned time-frame and deliverable:** Ongoing. Reports on the experiments; exchange of expertise; improvements of the operational implementations of convection-permitting ensembles; scientific publications and presentations

### **Planned stays:**

1. Endi Keresturi (4 weeks at ZAMG) – stochastic perturbations in C-LAEF

### 3 Action/Subject: **Initial condition perturbations**

**Description and objectives:** Research and development concerning initial condition perturbations in the three EPSs within RC-LACE.

The main topics for 2022 are:

- A-LAEF: Utilization of A-LAEF operational forecasts for flow-dependent B-matrix computation to be used in local assimilation cycles of RC-LACE members.
- C-LAEF: Development of EnVar system

**Proposed contributors & Estimated efforts:** Martin Belluš (SHMU), Florian Meier (ZAMG) - 4 PM

**Planned time-frame and deliverable:** Ongoing. Reports on the experiments; exchange of expertise; improvements of the operational implementations of convection-permitting ensembles; scientific publications and presentations

#### **Planned stays:**

1. Martin Belluš (4 weeks at ZAMG) - flow-dependent B-matrix

#### **4 Action/Subject: Surface perturbations**

**Description and objectives:** Research and development concerning surface perturbations in the three EPSs within RC-LACE.

The main topics for 2022 are:

- C-LAEF: Improve uncertainty representation of surface processes

**Proposed contributors & Estimated efforts:** Clemens Wastl (ZAMG) - 1 PM

**Planned time-frame and deliverable:** Ongoing. Reports on the experiments; exchange of expertise; improvements of the operational implementations of convection-permitting ensembles; scientific publications and presentations

**Planned stays:**

**5 Action/Subject: Lateral boundary condition perturbations**

**Description and objectives:** Research and development concerning lateral boundary condition perturbations in the three EPSs within RC-LACE.

The main topics for 2022 are:

- A-LAEF: Coupling for the local convection-permitting EPS applications

**Proposed contributors & Estimated efforts:** Martin Bellus (SHMU) – 1 PM

**Planned time-frame and deliverable:** Ongoing. Reports on the experiments; exchange of expertise; improvements of the operational implementations of convection-permitting ensembles; scientific publications and presentations

**Planned stays:**



## 6 Action/Subject: **Statistical EPS and user-oriented approaches**

**Description and objectives:** Research and development concerning statistical calibration of EPS data to reduce systematic errors; research and development of new products; user-oriented approaches to increase the reputation of EPS

The main topics for 2022 are:

- A-LAEF: Continuation work on methods for analog-based post-processing of probabilistic fields on a regular grid
- C-LAEF: Work on statistical post-processing of EPS data
- C-LAEF: Early warnings of severe rainfall and severe wind (EFI, SOT)
- C-LAEF: Detection of precipitation objects in ensembles, neighbouring
- ALL: Development of new probabilistic products
- ALL: Development of decision-making criteria based on EPS for various users (e.g. hydrology, renewable energy, road safety)
- ALL: New EPS products on the RC-LACE webpage

**Proposed contributors & Estimated efforts:** Iris Odak Plenković, Endi Keresturi (DHMZ), Aitor Atencia, Markus Dabernig, Irene Schicker, Christoph Wittmann, Florian Weidle, Christoph Zingerle (ZAMG), Martin Bellus (SHMU), Simona Tascu (METRO) – 6 PM

**Planned time-frame and deliverable:** Ongoing. Reports on the experiments and on new products; exchange of expertise; scientific publications and presentations

### **Planned stays:**

1. Iris Odak Plenković (4 weeks at ZAMG) - analog-based post-processing methods

**7 Action/Subject: Collaboration and Publication**

**Description and objectives:** Activities merging different areas, collaboration with other consortia, applications, projects. Publication and presentation of relevant scientific output at international workshops and in scientific journals.

The main topics for 2022 are:

- A-LAEF: Collaboration with DA group on ensemble assimilation methods (flow dependent B-matrix, etc.).
- ALL: Contributions to workshops and meetings.
- ALL: Collaboration with ACCORD predictability area
- ALL: Publications in scientific journals

**Proposed contributors & Estimated efforts:** Martina Tudor (DHMZ), Martin Belluš (SHMU), Clemens Wastl (ZAMG) - 3 PM

**Planned time-frame and deliverable:** Ongoing. Presentations at the workshops; reports; publications.

## Summary of resources [PM]

Subject	Manpower	LACE	ACCORD	Other
<b>S1: Preparation, evolution and migration</b>	16	15	1	
<b>S2: Model perturbations</b>	10	10		
<b>S3: IC perturbations</b>	4	4		
<b>S4: Surface perturbations</b>	1	1		
<b>S5: LBC perturbations</b>	1	1		
<b>S6: Statistical EPS and user-oriented approaches</b>	6	6		
<b>S7: Collaboration and publication</b>	3	3		
<b>Total:</b>	<b>41</b>	<b>40</b>	<b>1</b>	<b>0</b>

## Meetings and events (2022)

- 38<sup>th</sup> LSC Meeting, March 2022
- 2<sup>nd</sup> ACCORD All Staff Meeting, April 2022
- 39<sup>th</sup> LSC Meeting, September 2022
- 44<sup>rd</sup> EWGLAM and 29<sup>th</sup> SRNWP joined meetings, October 2022
- Other international EPS related conferences and workshops