LACE
nwp central europe

Working Area Predictability

Work Plan

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1   Introduction and background

RC LACE's limited area model ensemble system ALADIN-LAEF has been run operationally at the ECMWF computer facility since 2011. A revised version on enlarged computational domain with enhanced resolution (both horizontal and vertical), optimized multi-physics and ensemble data assimilation for the surface fields has become operational in July 2013. Verification tests proved that the new ALADIN-LAEF system outperforms the old version. In September 2014 ALADIN-LAEF has been migrated to the new CRAY XC30 system at ECMWF after the old IBM Power7 cluster had been switched off from the operations. In parallel, a positive experience has been made with the stochastic perturbation of physics tendencies for soil and surface fields. The idea to simulate the uncertainty of soil/surface processes and their interaction with the lower atmosphere together with the stochastic perturbation of physics tendencies for the prognostic variables on model levels and initial time perturbations via ensemble of data assimilations will be investigated in the near future.

Next to the ALADIN-LAEF development a second main topic would be the continuation of the work on convection-permitting EPS. Several good results have been already achieved with AROME-EPS at OMSZ and ZAMG institutes in the past two years. The experiments involved studies using different driving models for obtaining the initial-time and lateral boundary conditions, studies proving the benefits of convection-permitting EPS in comparison with the "grey-zone" LAM ensemble system. Investigated was also the impact of EDA with perturbed observations, atmospheric motion vectors and stochastic perturbation of physics tendencies for the upper-air model fields.

2   Goals

The research in 2015 shall continue especially on the topic of stochastic physics and its interaction with other ensemble techniques used in our systems. For ALADIN-LAEF, several further optimizations of the system are planned including improvement of the multi-physics settings, SPPT for the soil/surface and upper-air fields, EDA also for the vertical model levels. An ambitious plan is to enhance the horizontal resolution of ALADIN-LAEF to 5km, which shall demand retuning of spectral blending and obviously also new settings for the physical parameterizations in used multi-physics. Its reliability and feasibility regarding the CPU consumption increase and gained precision will be investigated. All above mentioned upgrades will require also the inclusion of verification tool improvements for the different applications of ALADIN-LAEF.

Locally at OMSZ, ongoing work on convection-permitting EPS and use of stochastic physics shall be a major topic for 2015. Various set ups will be tested in sensitivity studies and case studies, especially a longer test period with combined EDA and SPPT in ALARO-EPS will be carried out. For better understanding the penetration of stochastic perturbation signal from the upper levels towards the surface, the 1D tests are planned. This shall enable new fundamental knowledge about the role of SPPT in the ensemble. Also the AROME-EPS tests focusing on model error representation shall be further continued.

3   Main R&D activities

1 Action/Subject: Optimization of ALADIN-LAEF (ZAMG)

Description and objectives: ALADIN-LAEF upgrades and related R&D

- Set-up of a 5km version of ALADIN-LAEF. This will require retuning of upper-air spectral blending and obviously also some revision of multi-physics settings. Its price versus performance ratio must be investigated regarding the possibility of the operational implementation. (LACE stay of Martin Belluš, Florian Weidle)

- Further optimization of ALADIN-LAEF multi-physics. The multi-physics will be reduced to a few configurations with comparable performance combined with a SPPT scheme. (LACE stay of Simona Tașcu)

- Stochastic soil and surface physics shall be tested and enhanced, based on earlier experience with perturbed tendencies in the SURFEX / ISBA scheme. To be continued by Martin Belluš during LACE stay.

- Research on the use of stochastic physics for the estimation of ideal physics closure parameters.

- Tests with ensemble-3DVAR in ALADIN-LAEF with perturbed observations.

- Assessment of the initial condition perturbations based on the uncertainty of the analysis.

Proposed contributors & Estimated efforts: 10 person months (5 months LACE stay); Florian Weidle, Yong Wang, Christoph Wittmann, Clemens Wastl (ZAMG), Martin Belluš (SHMU), Simona Tașcu (NMA), Chinese guest scientist(s) at ZAMG

Planned time-frame and deliverable: New evaluation results, improvement of current system, reports, time-frame: whole year 2015

3 Action/Subject: Development of AROME-EPS (ZAMG, OMSZ)

Description and objectives: Study on convective scale predictability in AROME. Activities planned at ZAMG and OMSZ:

- Continue tests with different coupling models like PEARP, ECMWF (high and low resolution) and ALARO-EPS. Evaluate the benefit of convection-permitting EPS compared to the existing EPS systems.

- Continue work on SPPT:

  - Sensitivity tests with 1D model + diagnostic tools

  - Implementation of promising set-ups for test cases

- Answer some fundamental questions of the use of SPPT:

  - Modify the full set of prognostic variables' tendencies or only specified parameterization's tendencies?
  - Modify all variable's tendencies in the same way or treat every variable in a different way?
  - Use the same vertical structure of the perturbations for all variables (e.g. let it tend to 0 near surface) or not? In other words, is it necessary for stability reasons to keep the zero perturbations for all variables at surface?

Proposed contributors & Estimated efforts: (6 OMSZ+1 LACE stay at ZAMG) person months; Mihály Szűcs (OMSZ), Clemens Wastl (ZAMG)

Planned time-frame and deliverable: Reports on the experiments

5 Action/Subject: Contributions to international projects, collaborations

Description and objectives:

- Contributions to PHASES 1/2 of the SRNWP-EPS activities (preparation/submission of proposals for 3-year EPS demonstration project)

- Contributions to the workshops concerning the merge of EPS, DA and PHY activities

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

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

6 Action/Subject: Publications

Description and objectives: Publication of the scientific results achieved within the project. The scientific achievements of the project will be presented at international workshops and published in scientific journals.

Proposed contributors & Estimated efforts: 6 person months; Florian Weidle, Florian Meier, Yong Wang, Christoph Wittmann, Clemens Wastl (ZAMG), Martin Belluš (SHMU), Simona Tascu (NMA), Mihály Szűcs (OMSZ)

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

4   Summary of resources

Subject	Manpower	LACE	ALADIN	Other
S1: Optimization of LAEF	10	5	1	
S2: LAEF maintenance				
S3: AROME-EPS	7	1		
S4: EPS - Verification				
S5: Collaborations	2			
S6: Publications	6			
Total:	**25**	**6**	**1**	**0**

5   Meetings and events

- 25th ALADIN Workshop & HIRLAM All Staff Meeting 2015, 13-17 April 2015, Copenhagen, Denmark

- 37th EWGLAM/22st SRNWP joined meetings, 5-8 October 2015, Serbia

- 1-2 international EPS related conferences or workshops (e.g. SRNWP EPS-DA /EPS –PHY workshop,): Florian Weidle (ZAMG), Mihály Szűcs (OMSZ)