REQUEST FOR A SPECIAL PROJECT 2015–2017

MEMBER STATE: Belgium

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Project Title:

Multiphysics and stochastic perturbations for high-resolution LAMEPS

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** _____
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2015

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2015-2017: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2017.)	**2015**	**2016**	**2017**
High Performance Computing Facility (units)	130000	130000	130000
Data storage capacity (total archive volume) (gigabytes)	800	800	800

*An electronic copy of this form **must be sent** via e-mail to:* *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date):

27/06/2014

Continue overleaf

Principal Investigator: Piet Termonia

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Extended abstract

It is expected that Special Projects requesting large amounts of computing resources (500,000 SBU or more) should provide a more detailed abstract/project description (3-5 pages) including a scientific plan, a justification of the computer resources requested and the technical characteristics of the code to be used. The Scientific Advisory Committee and the Technical Advisory Committee review the scientific and technical aspects of each Special Project application. The review process takes into account the resources available, the quality of the scientific and technical proposals, the use of ECMWF software and data infrastructure, and their relevance to ECMWF's objectives. - Descriptions of all accepted projects will be published on the ECMWF website.

Relying on ECMWF data provided within the context of a previous ECMWF Special Project SPFRCOUP (2006-2014), the ALADIN/ALARO/AROME models developed within in the ALADIN consortium (Algeria, Austria, Belgium, Bulgaria, Croatia, Czech Republic, France, Hungary, Morocco, Poland, Portugal, Romania, Slovakia, Slovenia, Tunisia and Turkey in 2014) can now be coupled to global IFS boundary data. This project has been instrumental in developing and validating capabilities to couple these models to data from ECMWF. A basic framework for this coupling is now in place and frequently used by a number of ALADIN countries. Some of the developments from SPFRCOUP haven given rise to operational applications. Notable results are, besides the coupling of deterministic forecast models, the downscaling of ERA-40 for regional climate studies. Two EPS systems have been developed relying on the context provided by this project; the LAEF system and the GLAMEPS system. Both of them use EPS members of ECMWF EPS data as boundary conditions.

Several countries in this consortium are now building prototypes of convection-permitting EPS systems running at resolutions a few kilometres. Some known perturbation methods such as SPPT have been tested, but without clearly convincing results so far. During the last ALADIN workshop in April this year, it became clear that there is a need to investigate alternative perturbation methods. It is well know that convective processes are very sensitive to the details of the parameterization schemes of turbulence, the surface scheme and the parameterizations of convection themselves. Within the ALADIN consortium several physics schemes have been developed that can be run within the model, for instance the 3MT deep-convection scheme, the TOUCANS turbulence scheme, and the meso-NH physics package. Several options can be taken leading to different model configurations. This allows to construct EPS systems where (groups of) members could use different configurations of the model physics. All of the schemes have underlying scientific hypotheses and a given choice for a deterministic application can only represent one option. Therefore building an EPS where members are chosen from different configurations may generate an ensemble spread that is representative of the range of the scientific underlying hypotheses.

The concrete steps to be carried out are:

1. In a first stage, we will study two existing setups, the so-called LAEF system and the GLAMEPS mesoscale systems. It has been demonstrated (Smet et al. 2012), that combining these schemes with the ECMWF EPS can generate extra economic value on top of the ECMWF output. These two systems will be considered as a reference in this project.

2. Extra computational resources will be available in the partner countries of the ALADIN consortium. Some versions of the convection-permitting EPS system will be installed. A close interaction will be organized with the physics developers and the EPS experts to make

proposals of combinations of the physics parameterization schemes that are consistent among themselves (i.e. do not contain contradicting scientific choices).

3. These systems will be forced with boundary data coming from the ECMWF EPS, relying on the code and tools that have been developed in the SPFRCOUP project.

4. Different combinations of multi-physics choices will be considered.

Specific activities planned in this project are:

1. Maintenance of a set of scripts and data for IC/LBC creation from ECMWF data (stored in MARS) to AAA. These will build upon results of SPFRCOUP, but will be extended with e.g. SMS scripts.
2. Study of the sensitivities of the convection permitting system to various aspects::
    - surface error and perturbations
    - LBC perturbations
    - the SPPT method (which has been tested for instance in the LAEF system)
    - the use of different physics configurations (e.g. with or without a parameterization of deep convection, third order moments or not, etc …)

While the research will be carried out mostly using the computing resources of the participating ALADIN countries, this project is necessary to generate the necessary boundary conditions and to transfer the data to the machines in the participating countries.

Ref:
Smet, G., P. Termonia and A. Deckmyn, 2012: Added economic value of limited area multi-EPS weather forecasting applications Tellus , A , 64 , 18901