# REQUEST FOR A SPECIAL PROJECT 2012–2014


**MEMBER STATE:** Italy……..…

**Principal Investigator[1]:** Lucio Torrisi, Francesca Marcucci…….……

**Affiliation:** CNMCA, ITALIAN METEOROLOGICAL SERVICE

**Address:** Aeroporto De Bernardi, Via di Pratica di Mare – 00040 Pomezia – Roma (ITALY)

**E-mail:** torrisi@meteoam.it,marcucci@meteoam.it

**Other researchers:**

Massimo Bonavita (massimo.bonavita@ecmwf.int)


**Project Title:** Data Assimilation and Short-Range Forecast with a Limited Area Ensemble Kalman Filter

| | | |
|---|---|---|
| If this is a continuation of an existing project, please state the computer project account assigned previously. | **SP** _____ | |
| Starting year:<br>(Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.) | 2012 | |
| Would you accept support for 1 year only, if necessary? | YES ☒ | NO ☐ |

| **Computer resources required for 2012-2014:**<br>(The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2014.) | **2012** | **2013** | **2014** |
|---|---|---|---|
| High Performance Computing Facility (units) | 3000000 | 3500000 | 4000000 |
| Data storage capacity (total archive volume) (gigabytes) | 1000 | 1000 | 1000 |

*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): 02-05-11

*Continue overleaf*

[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.

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# Extended abstract

The goal of this project is to investigate methodologies to improve analysis and forecast skill in the field of operational limited area NWP models through the use of a variation of the Ensemble Kalman Filter (EnKF) approach. This is an important current research topic in meteorology and many competing approaches are currently under study and experimentation.
The CNMCA has recently implemented and tested the ensemble data assimilation algorithm based on the LETKF approach (Hunt et al., 2007). The LETKF ensemble mean analysis and forecast has proved to be of superior quality with respect to the CNMCA operational 3DVar. The LETKF algorithm is of rather straightforward implementation but, as with many other ensemble based systems, it requires careful tuning of a number of parameters (notably horizontal and vertical localization lengths, covariance inflation parameters, ensemble size) to obtain a calibrated system. This activity is obviously CPU intensive in that it requires repeated trials of the assimilation and prediction systems in various configurations over an optimization period which cannot be too short for the results to have statistical significance.

The workplan now is :

1. perform a more thorough exploration of the filter's parameter space, finding the “optimal” values for our operational setup;
2. improve the model error representation in the filter; so far an adaptive multiplicative and a climatological additive inflation parametrization of model error has been implemented, but other promising options need to be explored (evolved additive perturbation, stochastic kinetic energy backscatter, stochastic physics, etc);
3. continue investigating the use of nonlocal observations (I.e., radiances and precipitation) which is not computationally straightforward to implement in a local algorithm such as LETKF
4. improve the balancing of the analysis ensemble

Another goal will be to use the LETKF analysis perturbations as the basis for extended forecast model runs. This approach to local area ensemble prediction has not been fully explored though it is clearly theoretically advantageous over current downscaling or indirect (Singular Vectors, Breeding) methods.