LATE REQUEST FOR A SPECIAL PROJECT 2024–2026

MEMBER STATE: Italy

Principal Investigator[1]: Massimo Milelli (mcy)

Affiliation: CIMA Research Foundation

Address: Via Magliotto 2, 17100, Savona

Other researchers:

Project Title: Continuation of the intensive test of ICON-LAM Model with urban parameterization scheme TERRA_URB

To make changes to an existing project please submit an amended version of the original form.)

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP**ITMIL2	
Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.)	2025	
Would you accept support for 1 year only, if necessary?	YES X	NO ☐

Computer resources required for project year:		**2024**	**2025**	**2026**
High Performance Computing Facility	[SBU]		500000	
Accumulated data storage (total archive volume)[2]	[GB]		500	

EWC resources required for project year:		**2024**	**2025**	**2026**
Number of vCPUs	[#]		-	
Total memory	[GB]		-	
Storage	[GB]		-	
Number of vGPUs[3]	[#]		-	

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 annual progress reports of the project's activities, etc.

[2] These figures refer to data archived in ECFS and MARS. If e.g. you archive x GB in year one and y GB in year two and don't delete anything you need to request x + y GB for the second project year etc.

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Extended abstract

All Special Project requests should provide an abstract/project description including a scientific plan, a justification of the computer resources requested and the technical characteristics of the code to be used. The completed form should be submitted/uploaded at https://www.ecmwf.int/en/research/special-projects/special-project-application/special-project-request-submission.

Following submission by the relevant Member State the Special Project requests will be published on the ECMWF website and evaluated by ECMWF and its Scientific Advisory Committee. The requests are evaluated based on their scientific and technical quality, and the justification of the resources requested. Previous Special Project reports and the use of ECMWF software and data infrastructure will also be considered in the evaluation process.

Requests exceeding 10,000,000 SBU should be more detailed (3-5 pages).

Motivation and work plan

During 2024, the ICON-LAM+TERRA_URB package has been finalized, at least as the parametrization itself is concerned. Some results of the previous testing have been shown during the periodic meetings of the working group of the COSMO Consortium:

https://www.cosmo-model.org/content/consortium/generalMeetings/general2024/parallel/wg3ab/Milelli_CITTA_GM2024.pdf

What is missing is the inclusion of more detailed external parameters. In particular ECOCLIMAP SG is already included in EXTPAR, a pre-processor for ICON. The missing part is to make ICON able to read the new data and this should be included in 2025. For this reason, more testing will be needed.

The plan would be to run short test cases over north-west Italy (Turin area Fig. 1), with horizontal resolution of about 1.2 km or even half (600 m), testing the CTRL runs (TERRA_URB scheme off) vs URB runs (TERRA_URB scheme on) in hindcast mode. To be decided whether tests in forecast mode are needed or not, according also to manpower availability.

With this workplan I will use about 500000 SBU (roughly).

The verification will focus on screen level parameters and vertical profiles where available.

Fig.1: domain of the simulations (inner shaded area).

Technical characteristics of the numerical codes

In the framework of this special project, the F90 ICON code (open-source) will be used. ICON Model, which combines the non-hydrostatic dynamical core, with the parametrisation package originating from the ECHAM6 atmosphere model. The physics is adapted for the vertical coordinate system and time stepping scheme of the ICON dynamical core. ICON has an icosahedral grid which provides a nearly homogeneous coverage of the globe. This avoids the so-called pole problem related to the convergence of meridians in lat-lon grids, which poses severe challenges to a computationally efficient implementation. In the current operational version, the global ICON grid has 2,949,120 triangles, corresponding to an average area of 173 km² and thus to an effective mesh size of about 13 km. All scalar prognostic model variables (e.g. temperature, density, moisture quantities) are located in the circumcentre of the triangles, whereas the edge-normal wind components are located in the edge midpoints.

Computer resources

This work will consider deterministic runs only (no use of the EPS is foreseen). The simulations will be performed at very high horizontal resolution (around 1200-600 m), over a limited domain (North-West of Italy, Fig. 1). Therefore an overall cost of about 500000 SBU is envisaged. Depending on the results, the set-up of the system could be partly modified and it might be possible to have other simulations. The memory resources (hourly output) should be around 500 GB maximum.

References

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