LATE REQUEST FOR A EMI R&D PROJECT 2026–2028

Country/ Organisation: ……Italy……

Principal Investigator[1]: ……Federico Serva……

Affiliation: ……National Research Council……

Address: ……Via Fosso del Cavaliere 100, 00133, Rome, Italy…

Other researchers: ……

Project Title: ……Investigating the origin of stratospheric model biases: configuration and boundary conditions……

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** ITSERV	
Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.)	2027	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Late EMI R&D Projects are normally approved for 1 year, but exceptionally can be approved for 3 years.

Computer resources required for project year:		**2026**	**2027**	**2028**
High Performance Computing Facility	[SBU]	/	8 M	/
Graphics Processing Unit Cluster-A	[GBU]	/	/	/
Graphics Processing Unit Cluster-B	[GBU]	/	/	/
Accumulated data storage (total archive volume)[2]	[GB]	/	10 K	/

[1] The Principal Investigator will act as contact person for this EMI R&D 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.

[3]The number of vGPU is referred to the equivalent number of virtualized vGPUs with 8GB memory.

EWC resources required for project year:		**2026**	**2027**	**2028**
Number of vCPUs	[#]	/	/	/
Total memory	[GB]	/	/	/
Storage	[GB]	/	/	/
Number of vGPUs[3]	[#]	/	/	/

Continue overleaf.

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Extended abstract

All EMI R&D 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 EMI R&D 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 EMI R&D 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).

This late request is a continuation of a 1-year Special Project started in 2026 (SPITSERV, with the same title), aimed at the investigation of stratospheric processes in high vertical resolution configurations of the IFS model, with timescales of interest from multi-annual to decadal.

Unfortunately, lack of manpower and uncertainty regarding the best model version to use for the experiments slowed down progress and only a few tests have been made. Accordingly, the allocation of the previous project has been reduced to make best use of resources, thanks to the Special Project support team.

At this point in time, it is clear that the EC-Earth4 climate model (https://ec-earth.org/ec-earth/ec-earth4/) will be based on OpenIFS 48r1, which, unlike previous versions, is openly available online (https://github.com/ecmwf-ifs/openifs). Therefore, this Special Project will make use of this version of OpenIFS and take advantage of recently published results (e.g., Andrews et al., 2026) to evaluate the model response to different configurations, as well as to nudging.

To illustrate why vertical resolution matters, Fig. 1 shows the variability of upper-atmospheric tropical winds in versions 2 and 3 of the EC-Earth model (Serva et al., 2024). The emergence of a realistic variability (compared to reanalyses) can be ascribed to increased vertical resolution and more realistic physical parameterization.

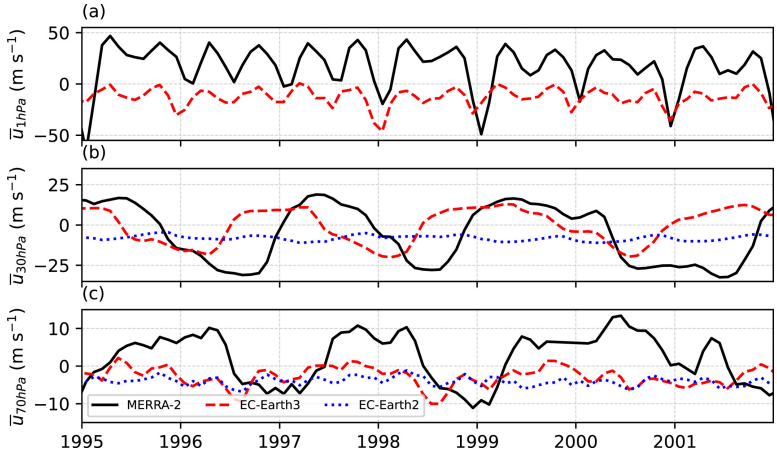

Figure 1: Time series of the equatorial zonal mean zonal wind at pressure levels (a) 1, (b) 30 and (c) 70 hPa. Reproduced from Serva et al. (2024).

Simulations will be carried out also accounting for developments related to the seventh phase of the Coupled Model Intercomparison Project, especially regarding the model boundary conditions (where supported).

As for the previous Special Project, resource allocation is meant to support atmosphere-only runs (exploring the possible range of OpenIFS), with storage of post-processed data only on ECFS. To ensure realistic nudging, the period of interest will mostly be the satellite era.

References

Andrews, M., and coauthors (including Serva, F.): Extratropical teleconnections in a multi-model ensemble nudged towards the observed QBO, Weather Clim. Dynam., 7, 1797–1820, https://doi.org/10.5194/wcd-7-1797-2026, 2026.

Serva, F., and coauthors, , Changes in Stratospheric Dynamics Simulated by the EC-Earth Model From CMIP5 to CMIP6, J. Adv. Model. Earth Sys., https://doi.org/10.1029/2023MS003756, 2024.