

# REQUEST FOR ADDITIONAL RESOURCES IN THE CURRENT YEAR FOR AN EXISTING EMI R&D PROJECT

Please submit the completed form via <https://www.ecmwf.int/en/support> (choose *Software and Computing*, then *Gain access to computing resources (create ticket)*) or send to [special\\_projects@ecmwf.int](mailto:special_projects@ecmwf.int)

**Country/Organisation:** Switzerland

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**Project title:** Improving Cloud Droplet Activation in OpenIFS–HAMM7 through  
Physically Based and Deep-Learning-Derived Vertical-Velocity  
Variability.....

**Project account:** SPchirfa\_ \_ \_ \_ \_

| Additional computing resources requested for year |       | 2026       |
|---------------------------------------------------|-------|------------|
| High Performance Computing Facility               | [SBU] | 25,000,000 |
| Graphics Processing Unit Cluster - A              | [GBU] |            |
| Graphics Processing Unit Cluster - B              | [GBU] |            |
| Total DHS Data storage capacity                   | [GB]  | 100,000    |
| <b>EWC resources</b>                              |       |            |
| Number of vCPUs                                   | [#]   |            |
| Total memory                                      | [GB]  |            |
| Storage                                           | [GB]  |            |
| Number of vGPUs <sup>3</sup>                      | [#]   |            |

<sup>1</sup> The Principal Investigator is the contact person for this EMI R&D Project

*Continue overleaf*

## **Technical reasons and scientific justifications why additional resources are needed**

The Special Project "Improving Cloud Droplet Activation in OpenIFS–HAMM7 through Physically-Based and Deep-Learning-Derived Vertical-Velocity Variability" investigates the impact of alternative representations of subgrid-scale vertical velocity variability ( $\sigma_w$ ) on aerosol activation, cloud droplet number concentration (CDNC), and aerosol–cloud interactions in OpenIFS–HAMM7. The approved scientific plan consists of six global two-year simulations (12 model-years in total), including experiments using prescribed, TKE-derived, and machine-learning-derived  $\sigma_w$  parameterizations.

The project was initially allocated 20 million SBU. During model development and implementation, additional computational requirements became apparent. The integration and testing of the Morales & Nenes (2014) activation scheme, the TKE-based  $\sigma_w$  diagnostic, and the Wnet machine-learning parameterization required a larger number of development, debugging, restart, and sensitivity simulations than originally anticipated. These activities are essential to ensure numerical stability, verify scientific correctness, and assess parameterization behaviour across different atmospheric regimes before conducting the final production simulations.

Furthermore, the online evaluation of multiple activation and  $\sigma_w$  formulations requires repeated global simulations and diagnostic experiments to quantify uncertainties and assess the robustness of machine-learning-based parameterizations under both in-distribution and out-of-distribution conditions. The project specifically evaluates performance in physically extreme environments, including stable Arctic boundary layers and strongly forced Mediterranean orographic regimes.

Based on current resource consumption and updated benchmarking, the initially allocated 20 million SBU is insufficient to complete the full experimental matrix and associated sensitivity analyses. An additional allocation of 25 million SBU is therefore requested to complete the planned simulations, perform the required validation experiments, and generate the diagnostics necessary to meet the scientific objectives of the project. The additional resources will ensure successful delivery of the objectives of the approved Special Project and support ongoing activities within the Horizon Europe CleanCloud project.