

REQUEST FOR ADDITIONAL RESOURCES IN THE CURRENT YEAR FOR AN EXISTING SPECIAL PROJECT

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MEMBER STATE: ITALY

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Ambientale per lo sviluppo sostenibile

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Project title: A High-Resolution Hindcast for the Sahel Region Based on ERA5
data and the MOLOCH model

Project account: SPITCAPE

Additional computing resources requested for year		
High Performance Computing Facility	[SBU]	4.5 M
Total DHS Data storage capacity	[GB]	See the request for ECFS data storage capacity below
EWC resources		
Number of vCPUs	[#]	
Total memory	[GB]	
Storage	[GB]	
Number of vGPUs ³	[#]	

Continue overleaf

¹ The Principal Investigator is the contact person for this Special Project

Technical reasons and scientific justifications why additional resources are needed

Since the initial submission of the SPITCAPE Special Project, a revision of the experimental setup has led to a significant increase in the estimated computational cost. The original SBU request was based on a more conservative configuration, which has now evolved to better meet the scientific objectives of the project.

In particular, the following major updates have been introduced:

- **Domain extension:** the simulation domain has been substantially enlarged to include the entire *Great Green Wall* region (see Figure 1). This choice was made to enhance the scientific impact of the project, enabling broader investigations on land–atmosphere interactions and supporting potential future studies. Moreover, this extended domain is expected to foster new collaborations with African and international partners working in the region.
- **Increase in vertical resolution:** the number of vertical levels has been increased to 70. This improvement is crucial to better resolve atmospheric processes, particularly within the boundary layer and in deep convection regimes typical of the Sahel region. However, it also significantly increases computational costs.
- **More advanced microphysics scheme:** the model configuration now adopts a two-moment microphysics scheme, replacing the simpler scheme used in the initial estimate. While this choice improves the physical realism of cloud and precipitation processes, it is considerably more computationally expensive.

As a consequence of these changes, the computational demand is substantially higher than originally setup. The initial SBU estimate is therefore no longer sufficient to complete the planned simulations.

We kindly request an increase in the allocated SBUs to ensure the feasibility of the revised experimental design and to fully achieve the scientific objectives of the project.

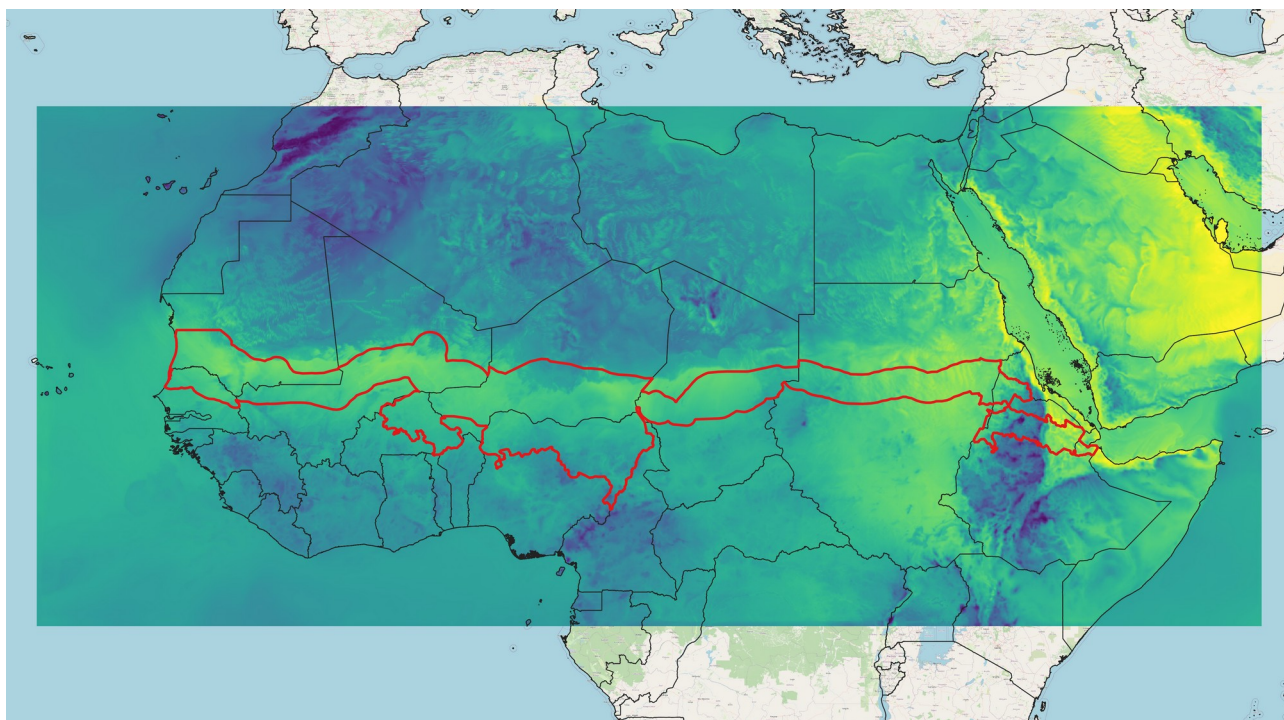


Figure 1: sample data of the MOLOCH hindcast. The red line indicates the Great Green Wall, <https://www.unccd.int/our-work/ggwi>

Revised SBU request

Based on the tests performed with the updated model configuration (including ERA5 download and preprocessing, model preprocessing, model integration, post-processing, and archiving), the estimated computational cost is approximately 7000 SBUs per simulated day.

Considering the updated computational cost, a full-year hindcast would exceed the originally requested resources. However, in order to remain within the initially allocated budget of 4.5 million SBUs, we revised the experimental design.

In particular, simulations will be limited to the core monsoon season (May–October), which is the most relevant period for precipitation and hydrological applications in the Sahel region.

This corresponds to approximately 6 months per year (~180 days), leading to an estimated cost of:

- ~1.25 million SBUs per simulated year
- ~12.5 million SBUs for a 10-year hindcast period

Given the project constraints, and the initial request made (4.5 million SBU) we will therefore reduce the temporal coverage rather than the model complexity, in order to preserve the scientific quality of the simulations (larger domain, 70 vertical levels, and two-moment microphysics).

This strategy allows us to keep the total SBU consumption within the originally requested allocation, while still achieving the main scientific objectives of the project.

Estimated data storage requirements (ECFS)

The estimated data volume produced by the MOLOCH simulations is approximately 80 GB per simulated month, including model output (~55 GB) and soil backup data (~25 GB) needed for restart.

Since simulations are limited to the May–October period (6 months per year), the expected data volume is:

- ~480 GB per simulated year
- ~4.8 TB for a 10-year hindcast period

Including a conservative overhead of ~10–15% (e.g. additional diagnostics, metadata, and re-runs), the total estimated archive volume is:

- ~5.3–5.5 TB (ECFS)