

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

Country/Organisation: SPAIN

Principal Investigator¹: MARÍA LUISA MARTÍN

Affiliation: ESCUELA DE INGENIERÍA INFORMÁTICA. UNIVERSIDAD DE VALLADOLID

Address: PLAZA DE LA UNIVERSIDAD, 1; 40005 SEGOVIA, SPAIN

Project title: Dynamical and risk assessment analysis under future climate conditions of tropical cyclones impacting the eastern North Atlantic

Project account: SPESMART

Additional computing resources requested for year		2026
High Performance Computing Facility	[SBU]	9000000
Graphics Processing Unit Cluster - A	[GBU]	
Graphics Processing Unit Cluster - B	[GBU]	
Total DHS Data storage capacity	[GB]	
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 EMI R&D Project

Technical reasons and scientific justifications why additional resources are needed

The main purpose of the current proposal consists of evaluating the genesis and evolution of anomalous African East Waves (AEWs) and tropical transitions (TTs) that may pose a threat to southwestern Europe, and how Anthropogenic Climate Change (ACC) could contribute to amplify this risk. This response will be studied via the Pseudo Global Warming (PGW) approach for high-resolution mesoscale atmospheric simulations. To the knowledge of this research team, this proposal is the first application of this kind of methodology to AEWs and TTs over the eastern North Atlantic (eNATL) basin. WRF, HARMONIE-AROME and MPAS mesoscale atmospheric models will be considered for this purpose. These models will be evaluated in very-high resolution mode (500 m - 3 km) for a better adaptation to future weather forecasts.

First, to study cyclones developed from anomalous AEWs, trajectories in the Atlantic Ocean have been analysed using the HURTAD2 database between the years 1979-2022. A pool of cyclones from AEWs with anomalous trajectories have been selected. Right now, this database has been recently extended from 1940 to 2024 using ERA5. Moreover, the objectives related to comprehensively characterize the environmental conditions that promote the development of AEWs and TTs over the eNATL under present climate and future climate conditions are already achieved. Additionally, monthly climatologies of relevant variables for AEW/TT genesis and evolution in CMIP6 simulations are done.

Until April 2026, different testing experiments have been needed to set up WRF and HARMONIE-AROME models. To do this, several systems (Ophelia, Delta, Leslie) have been simulated using both models. The very high-resolution WRF and HARMONIE-AROME modules consume more computational resources than the high resolution (> 1 km) because it's necessary to add more routines and parallelize them to achieve higher efficiency and reduce running time. All this results on a strong increase in the number of the used SBUs. Right now, we continue to simulate several systems using different configurations to establish the influence of ACC (via the PGW methodology) in developing TTs and cyclones from anomalous AEWs.

Each atmospheric simulation consumes 93000 units approximately using WRF and, around 600000 units have cost using the very-high horizontal resolution in HARMONIE, all in a huge domain. As we also mentioned, some additional experiments have been required to run WRF and HARMONIE that finally have cost more than we expected, using much more SBUs than we have.

Considering all, the system setup, domain, two models and high-resolution, we are sorry but finally we have utilized more resources than we originally and secondly expected. To sum up, we would need additional SBUs to continue simulating these cyclones from TTs and AEWs at very high-resolution, because these experiments require additional resources that in the original request, we did not expect to need.