REQUEST FOR A SPECIAL PROJECT 2026–2028

MEMBER STATE: Sweden……

Principal Investigator[1]: Wilhelm May……

Affiliation: Centre of Environmental and Climate Science, Lund University……

Address: Kontaktvägen 10, 223 62 Lund, Sweden……

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Other researchers:

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Project Title: Analysing climate variability and change based on various types of climate simulations……

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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** SEMAY……..	
Starting year: (A project can have a duration of up to 3 years, agreed at the beginning of the project.)	2026	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for project year:		**2026**	**2027**	**2028**
High Performance Computing Facility	[SBU]	200000	800000	500000
Accumulated data storage (total archive volume)[2]	[GB]	100000	120000	140000

EWC resources required for project year:		**2026**	**2027**	**2028**
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.
[3]The number of vGPU is referred to the equivalent number of virtualized vGPUs with 8GB memory.

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Extended abstract

Need for computer resources

All the project activities described below are heavily dependant on the data storage as they utilize large data sets from observations as well as from various types of climate simulations. Advanced analysis methods may require the use of HPC resources, while running configurations of the EC-Earth earth system model (ESM) rely on the HPC resources. The SBUs are based on experiences of running EC-Earth on the old system, cca.

Purpose and aims

The purpose of the special project is to facilitate different research activities, partly related to international research projects in the Horizon programmes by the EU. These are, for instance, to analyse the impacts of the projected climate changes in East Africa on agricultural practices in the region (as part of the UPSCALE project) as well as to evaluate the post-CMIP6 versions of different ESMs run at high resolution and to analyse the regional climate changes associated with certain levels of global warming (both as part of the OptimESM project). Another aspect is to continue my work with EC-Earth on the role of the land-surface atmosphere coupling in the ESM.

Project activities

The special project is meant to facilitate a range of my research activities. These activities mainly consist of the analysis of various aspects of climate variability and change but also include some modelling work with the new version of the EC-Earth ESM.

Climate change in East Africa

Agriculture in East Africa is rainfed and, thus, closely linked to the occurrence of rainfall during the rainy seasons. This makes agriculture in this region extremely vulnerable to variations and changes in the characteristics of rainfall, e.g., the timing of the rainy seasons, the total amount of rainfall, the intraseasonal variability of rainfall, the frequency and intensity of heavy precipitation as well as the frequency and intensity of drought conditions, and changes in the hottest temperatures.

As a contribution to the UPSCALE project, I assess the projected future changes in the weather and climate conditions in East Africa relevant for agriculture from a set of climate scenarios for Africa. These scenarios originate from simulations with different regional climate models (RCMs) driven by different global climate models. At the same time, I evaluate the RCM's ability to simulate the relevant aspects of weather and climate, particularly the seasonal variation of rainfall in East Africa, realistically. This evaluation gives an idea on the validity of the projected future changes in climate simulated by the RCMs.

The projected future changes in the weather and climate conditions in East Africa are used in the UPSCALE project to assess their effects on agriculture in the region and to explore the value of ecological intensification to attenuate the potentially adverse effects of these changes on agriculture.

High-resolution climate simulations

In the OptimESM project, a set of high-resolution global climate simulations are performed with several post-CMIP6 ESMs to explore the additional value of the increased resolution for the representation of various aspects of the climate system. I evaluate the effects of the high resolution

on the statistics of daily precipitation, on surface energy fluxes and on the land-surface atmosphere coupling in the tropics in these ESMs. The post-CMIP6 version of EC-Earth is one of the ESMs providing a simulation.

Regional climate change

As another contribution to the OptimESM project, I assess the regional changes in climate associated with certain levels of global warming. I analyse the role of the processes governing the interactions between the land surface and the atmosphere for the projected changes in mean climate as well as in climate variability and in the characteristics of extreme weather and climate events. The focus is on Europe and the polar regions. The post-CMIP6 version of EC-Earth is one of the ESMs providing simulations.

Land-surface atmosphere coupling in EC-Earth4

Following up on my work on the CMIP6 version (3) of the EC-Earth ESM (e.g., May 2025), I evaluate the representation of the land surface in version (4) of EC-Earth, which is being developed for CMP7. OpenIFS has been included as the atmospheric component of the ESM and several aspects of the LPJ-GUESS dynamical vegetation model have been updated.

I also assess the role of the interactions between the land-surface and the atmosphere for the simulation of certain aspects of climate in EC-Earth4. To this end, I also perform simulations with the offline version of the land-surface component of the ESM and with the atmospheric component of EC-Earth4.

Benefits from the project

In addition to the scientific value for the two international research projects, the work with the EC-Earth4 ESM will contribute to better understanding the process governing the interactions between the land surface and the atmosphere in the new version of EC-Earth which includes ECMWFs OpenIFS system as the atmospheric component, which, in turn, incorporates the HTESSEL land-surface model.

Reference

May, W., 2025: The role of the land surface for surface climate: results from a stepwise land-atmosphere coupling experiment. Climate Dynamics, 63, 123

Links

Optimal High Resolution Earth System Models for Exploring Future Climate Change (OptimESM) https://optimesm-he.eu/

Upscaling the Benefits of Push-Pull Technology for Sustainable Agricultural Intensification in East Africa (UPSCALE) https://upscale-h2020.eu/