SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year	2023
Project Title:	AddRessing iMpact of lArGe- and small-scale biases of North Atlantic SSTs on the mid-latitude Circulation (ARMAGNAC)
Computer Project Account:	spitdav2
Principal Investigator(s):	Paolo Davini
Affiliation:	Istituto di Scienza dell'Atmosfera e del Clima, Consiglio Nazionale delle Ricerche (CNR-ISAC)
Name of ECMWF scientist(s) collaborating to the project (if applicable)	
Start date of the project:	01/01/2022
Expected end date:	31/12/2024

Computer resources allocated/used for the current year and the previous one

(if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)	26 millions	3.5 millions	32 millions	0
Data storage capacity	(Gbytes)	20,000	0	42,000	0

Summary of project objectives (10 lines max)

Within ARMAGNAC we aim at exploring the impact that different patterns and biases of North Atlantic sea surface temperatures (SSTs) - at different spatial and temporal scales - have on the mid-latitude circulation, using the newly developed version 4 of the EC-Earth Global Climate Model (GCM). Making use of a set of atmosphere-only integrations at three different horizontal resolutions (~100 km, ~50 km and ~25 km) we will 1) explore the effect of the most common large-scale SST bias featured by GCMs, such as the ones participating to the CMIP6 effort, 2) assess to what extent spatial and temporal resolution of the SST boundary forcing are relevant for a high resolution atmosphere, and 3) explore what are the impacts of different topologies of the Gulf Stream front, comparing *elongated* (non-meandering) vs. *convoluted* (meandering) Gulf Stream configurations on the local and downstream atmospheric circulation. Overall, ARMAGNAC aims at providing a deeper understanding of the influence that North Atlantic SST biases exert on the mid-latitude circulation dynamics, providing insightful indications for future pathways of bias reduction and model development.

Summary of problems encountered (10 lines max)

The project has been significantly slowed down in the last year due to three main issues 1) Delays in the development of EC-Earth4, which resulted – among others - in a version of the model that to this day does not include the CMIP6 forcing, nor the solar cycle: however, we decided not to fall back for the older EC-Earth3 configuration since that model configuration can be considered as obsolete and the quality of results will be questionable 2) Difficulties in hiring the staff that was expected to work on the ARMAGNAC project: this caused the most important delays. 3) Some additional difficulties raised by numerical instabilities in the model that limited the testing at high resolution.

Summary of plans for the continuation of the project (10 lines max)

As soon as the new staff dedicated to the project will be hired in July, we will start immediately with the runs: as planned we will start with the CTRL integrations, i.e. the AMIP like integrations at the 3 different horizontal resolution: given the lack of CMIP6 forcing available within EC-Earth4, we will probably go for simulations with fixed GHG for the entire project. It is likely that given the accumulated delays the RESOLUTION integrations will be dropped from the list of the planned simulations.

List of publications/reports from the project with complete references

None – The experiments will be starting in next months.

Summary of results

The last version of the code has been updated to the most recent version of EC-Earth on the Atos HPC facility and the diagnostic and postprocessing tools were set up. Last autumn we tested the new eORCA1 grids and used the obtained runs to develop a new tool which can be used to assess the quality of EC-Earth4 simulations, namely ECmean4.
Although we realize we are significantly lagging behind schedule, we are confident that in the coming months we will be able to recover the original plan thanks to the new hiring: in case this will not be possible, we will ask ECMWF to reduce the amount of available core hours for the project in order to free computing time for other projects.