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

Please email the completed form to special_projects@ecmwf.int.

MEMBER STATE: ITALY……………….………………………………………...…

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Other researchers: Susanna Corti (CNR-ISAC), Irina Sandu (ECMWF)

Project title: Resolved orography impact on the mid-latitude flow with EC-Earth (REFOrgE)

Project account: **SPITDAV2**

Additional computer resources requested for	2020
High Performance Computing Facility (units)	10.000.000
Data storage capacity (total) (Gbytes)	

Continue overleaf

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

Technical reasons and scientific justifications
why additional resources are needed

The REFOrgE project planned to explore the role of orography resolution in climate runs, running the CMIP6 version of EC-Earth3 at three different resolutions, TL255, TL511 and TL799.

I ran TL255, TL511 and TL799, all with orographic parametrizations active (rfrg-ctrl-param) and all without (rfrg-ctrl-noparam). Then, as planned I ran high resolution with TL255 orography (rfrg-orog255-noparam). Results seemed promising, showing the expected dependency to parametrizations and resolved orography. So far, I have been using about 20millions SBUs of the 30millions available for this year.

Unfortunately, after the most of the simulations have been run, at the beginning of the summer we found a tremendous bug in EC-Earth: the program which handles the SST/SIC forcing had a bug that show up only when the simulations are run using a fixed year (as this sensitivity experiments with runs with constant forcing from year 2000) and when the IFS restart frequency is shorter than one year (which is occurring only when IFS resolution is > TL255). In this configuration - which is quite uncommon for EC-Earth3 - the model does not read the SST/SIC fields from the 15th of December to the 31st of December, setting them to 0 (Celsius): this is happening every year, creating a surface temperature drop of about 10K at the end of each December, compromising all the simulations performed. Considering that I was looking at mid-tropospheric climate variability, this issue did not show up when I initially analyzed the runs.
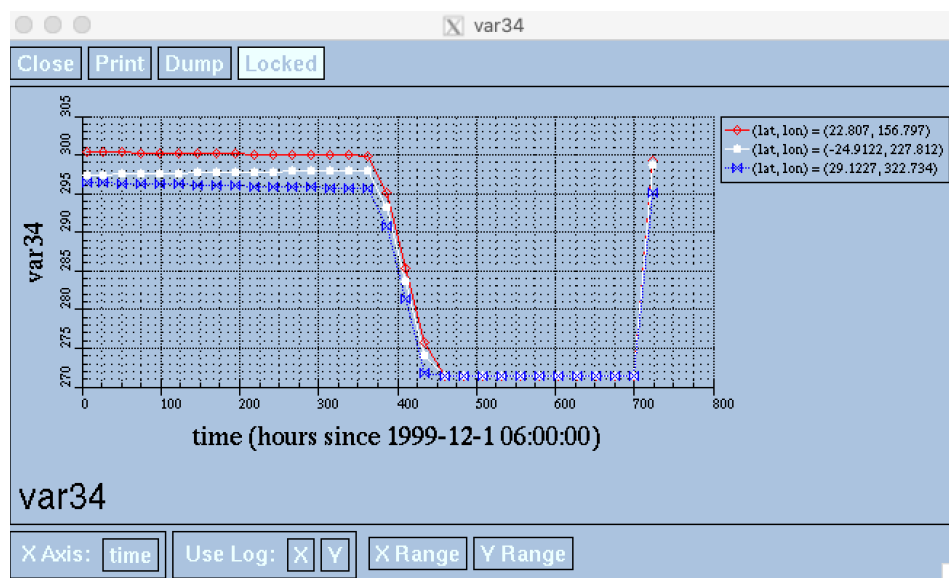

Fig 1. SST evolution in December caused be the bug described in the text for three different ocean grid points.

I developed a bug fix, which has been committed to the EC-Earth repo and included in the trunk during the summer.

Then, I re-run the TL511 resolution experiments which have a limited cost, using an extremely conservative setup. This however costed about 9 million SBUs. Therefore, I am now in the situation for which I cannot re-run the high resolution TL799 run with the current available core hours.

Each simulated year at TL799 cost between 290.000 (more conservative, implying larger walltime) and 380.000 SBUs (implying shorter walltime), as a function of the setup I use.

A few years of the TL799 simulations are however still usable, since the very first years have been run with a restart frequency of 1 year, so that they do not show the bug. We have in total 17 years that are "good".

Considering this, I have done some estimates which range from 12 million SBUs (using a conservative setup and running only 3x20 years) up to 27 million SBUs (using a faster setup and running 3x30 years of simulation as for the TL511 and TL255). I still have about 20 million SBUs available between this and the next year, but they should be used for different kinds of sensitivity experiments of the REFORGE project. However, I could redirect some of these hours to the but only if some extra hours, ideally 10 million SBUs, could be granted.