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

MEMBER STATE: Sweden

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Project title: EC-EARTH: developing a European Earth System model based on ECMWF modelling systems

Project account: **SPNLTUNE**

Additional computer resources requested for	05/06/17
High Performance Computing Facility (units)	10,000,000
Data storage capacity (total) (Gbytes)	60,000

Continue overleaf

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

Technical reasons and scientific justifications why additional resources are needed

Significant work has been performed since the beginning of this special project for developing EC-Earth v3 (based on IFS cy36r4 and NEMO 3.6), with aim to reach a well-tuned Earth-System-Model, suitable for performing CMIP6 simulations and addressing a wide range of scientific questions. Almost 200 issues have been opened and addressed on the EC-Earth development portal, accompanied by the necessary numerical experiments, since the beginning of this SP in 2015. A tight schedule of model releases has been followed in the past months including EC-Earth 3.2.1 in December 2016 (used for AMIP tuning) and EC-Earth 3.2.2 in March 2015 (used to test and tune the coupled model) Resources provided by this SP have been essential to achieve this goal, with a final, greatly improved, release of EC-Earth v3 suitable for CMIP6 and other projects planned for this summer.

In particular owing to the need to keep to this deadline, in the past few months it has been necessary to perform a large set of AMIP and coupled numerical simulations with the model using the project resources. The simulations which have been performed include long coupled model runs both at standard (T255L91/ORCA1) and at high (T511L91/ORCA025) resolutions, over decades and hundreds of model years respectively. In particularly AMIP tuning of the standard and high-resolution versions of the model and long coupled runs at standard resolution (needed to investigate and fix energy conservation issues between the atmosphere and the ocean) had a consistent impact on the use of resources. Still, the use of the resources of this SP has allowed to reach solutions for all these issues.

This simulation set will need to be significantly extended in the next months of 2017, in particular to address three main issues which are still open:

1) Too low AMOC in coupled model runs, particularly at standard resolution:
   While significant progress is being made in tackling this issue, testing the different options will require further long coupled model runs both at standard and high resolution.

2) Final tuning of the coupled version of the model:
   Some important changes are still being implemented in the model (such as solving the insufficient AMOC issue mentioned above), together with the implementation of a very few climate forcings (in particular stratospheric aerosols and land-use and vegetation changes). This will require a final tuning of the model, with suitably long runs (decades to hundreds of years) at all resolutions.

3) Testing and tuning Earth-System-Model versions of EC-Earth:
   After the release of the CMIP6-ready physical model release this summer, intense work will be shifted already this year to test and tune and the ESM configurations of the model. Long coupled runs of the ESM-coupled model will be needed to this end.

We estimate that the maximum possible extension of (10M SBU) will be fully needed to achieve these goals. In particular, we estimate that we will need to perform at least another 500 model years of coupled simulations at standard resolution T255L91/ORCA1 (cost estimate on cca: 5,000,000 SBU) and another 50 years of high-resolution coupled simulations (cost estimate on cca: 5,000,000 SBU).