

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 2020

Project Title: DECK Simulations with an alternative EC-Earth v4 prototype based on OpenIFS-43r3 coupled to FESOM2

Computer Project Account: de1a

Principal Investigator(s): Streffing, Jan

Affiliation: AWI

Name of ECMWF scientist(s) collaborating to the project (if applicable)

Start date of the project: 1st of January 2020

Expected end date: 31. of December 2020

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) | | | 35000 | 956.5 |
| Data storage capacity | (Gbytes) | | | 5.500 | 0 |

Summary of project objectives (10 lines max)

The project aims to provide a first benchmark for a new coupled system based on latest cycle of OpenIFS cy43 and the AWI developed unstructured grid finite volume ocean model FESOM2. Performing CMIP6 DECK simulations will enable further tuning and development of a comprehensive Earth System Model. The Project also serves as a testbed during the development of the first prototypes of EC-Earth4, since the coupled model tested here is one of the possible AOGCM configurations of EC-Earth4.

Summary of problems encountered (10 lines max)

The FESOM2 model had not previously been compiled and run on with a CRAY compiler environment. With its stricter adherence to the FORTRAN90 standard, the CRAY compiler required a number of small improvements in the code. The surrounding framework, that is used to download, compile run and post-process the coupled model, the ESM-tools, were not set up for use with PBS and aprun. While the PBS integration proved simple aprun lead to continued problems. In order to run OpenIFS efficiently at high SYPD requires MPI/OMP hybrid parallelization. FESOM2 on the other hand scales to about one order of magnitude higher numbers of MPI threads and OpenIFS, and does not contain any OMP pragmas. The custom slurm heterogeneous job solution that was developed to allow one model to run hybrid-parallelized, and the other MPI-only-parallelized was not portable to aprun. This would have resulted either in low SYPD or high SBU/simulated year.

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

The project shall not be continued at ECMWF, and the simulations will be carried out on the ESM-partition of the juwels@fz-juelich.de hpc facility. This system is more familiar to the project members, resembles more closely the system on model was developed, and will allow for results to be obtained within the current year.

The previously reserved ECMWF resources were relinquished in May 2020 to allow for alternative usage.

List of publications/reports from the project with complete references

Simulations are still ongoing. The model description and evaluation paper is in early preparation.

Summary of results

The work carried out at ECMWF resulted in several minor improvement of the coupled system and will enable an easier transition to other hpcs down the road.