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	2021
Project Title:	Impact of Greenland melt water on EC-Earth high resolution simulations
Computer Project Account:	spnldrij
Principal Investigator(s):	Dr. S.S. Drijfhout
Affiliation:	Royal Netherlands Meteorological Institute
Name of ECMWF scientist(s) collaborating to the project (if applicable)	André Jüling, Philippe Le Sager, Rein Haarsma (all at KNMI)
Start date of the project:	2020
Expected end date:	2022

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)	10,000,000	10,000,000	10,000,000	10,000,000
Data storage capacity	(Gbytes)	120,000	120,000	240,000	240,000

Summary of project objectives (10 lines max)

The project aims to ascertain the impacts of freshwater fluxes from the melting Greenland ice sheet in an eddy-permitting version of the EC-Earth3 under a high emission scenario up to 2100. We focus on changes to the North Atlantic ocean circulation, in particular the Atlantic Meridional Overturning Circulation, and their impacts on dynamic sea level as well as regional and global climate. A freshwater forcing protocol is developed to mitigate the lack of an active ice sheet component in the model. This protocol uses both the simulated temperatures above Greenland from the standard, no-freshwater-forcing simulations to drive a more realistic future Greenland surface mass balance and dynamic ice loss results from the recent ice sheet model intercomparison project for freshwater flux estimates.

Summary of problems encountered (10 lines max)

None so far.

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

As we want to compare circulation changes with and without the input of additional freshwater, we first continue EC-Earth3P-HR simulations which were performed until 2050 in the European H2020 PRIMAVERA project for the CMIP6 HighResMIP exercise. Two members are now available until 2100 and the third will be performed at ECMWF once initial conditions are recomputed at KNMI (resources for this are available at the end of July 2021). Once all three members are available (expected this autumn), we use their temperature results with a surface mass balance parametrization to calculate freshwater fluxes from Greenland and Southern Ocean subsurface temperature to calculate Antarctic mass loss. We then perform a three-member ensemble EC-Earth3P-HR freshwater-forced experiment from either 1980 or 2005 to 2100 and will analyse them early 2022.

List of publications/reports from the project with complete references

None yet.

Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

Two SSP585 simulation have been continued until 2100 and a third ensemble member will be started shortly when initial conditions are recomputed. The freshwater forcing protocol is currently being developed by a postdoc who started in May 2021 and will be implemented once all three members of the EC-Earth3P-HR SSP585 simulations are available. This is expected to be in the fall of 2021 so that the freshwater forcing simulations can be started in the end of 2021.