

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: Greenland climate modelling: assessing and developing HCLIM
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Computer Project Account: spdkmott.....

Principal Investigator(s): Ruth Mottram, Rasmus Anker Pedersen
.....

Affiliation: Danish Meteorological Institute.....

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

Start date of the project: February 2020.....

Expected end date: December 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)			9,5 million	61272.29
Data storage capacity	(Gbytes)			8000	

Summary of project objectives (10 lines max)

This project aims to set-up the HARMONIE climate model (Belusic et al., 2020) for Greenland with the aim of downscaling climate projections and ERA-5 reanalysis. The ultimate aim is to run high-resolution, kilometre-scale climate simulations that can serve as a reference for climate and ice sheet surface mass balance studies and provide future projections. The project focuses on Greenland ice sheet surface mass budget, a key variable in assessing the ice sheet's contribution to sea level rise. Key objectives include:

- Assess the performance of the model at different resolutions (12km, 5km, 2.5km) and using different physical schemes against observational data and CARRA reanalysis
- Testing output to ensure it can be used offline to run the SMB model (see polarportal.dk) for providing a near real-time monitoring of the ice sheet a
- Implement an SMB scheme internally within the model to account for snowpack processes
- Downscale a 10 year period of ERA-5 and GCM output for projections.

Summary of problems encountered (10 lines max)

An initial delay in starting the project was caused by the failure of the PI to receive notification of the special project award from the ECMWF! This seems to have been a result of email problems, most likely at DMI and was an unfortunate mishap. Further delays have been introduced by the Corona shutdown necessitating working from home and associated issues with bandwidth. However, this is largely now over and the first HCLIM test month over Greenland has been completed. We have identified some odd features in the output which may be the result of numerical instability in the code and these are being investigated with the help of NWP colleagues at DMI and within the HCLIM user group. A number of test simulations are planned over the summer to catch up with the project. It is not envisaged there will be serious delays within the project otherwise.

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

Although there has been a late start to this project we plan to continue along the lines laid out in our initial application, the first test year for the whole Greenland domain at 5km will be run over the next few weeks. In August we plan to start a higher resolution run for a limited domain covering south west Greenland where collaborators at Asiaq (the Greenland Survey organisation) and GEUS (The Geological Survey of Denmark and Greenland), operate observation stations that can be used to evaluate model output. While this is running we will prepare and use the SMB model for offline forcing with HCLIM output and use this also to compare output from the Copernicus Arctic Reanalysis (CARRA), which will also be used to calculate SMB. The remainder of 2020 will be spent implementing the SMB model directly into HCLIM and preparing for climate projections to be run in the future years of this project.

List of publications/reports from the project with complete references

None so far, but a study is in progress comparing SMB forced with CARRA output to that from the HIRHAM regional climate model. It is envisaged that output from these experiments will be added to in order to disseminate results quickly.

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.

Results so far have been limited due to delays in starting the project, however we have restarted the project post-Corona shutdown and expect to have a full simulation test-year complete at 5km resolution within the next few weeks. We do expect to use our full allotted quota over the remainder of the year, however, as the higher resolution simulations we have planned will be computationally

intensive. We therefore request that the resources allocated in this project over the next years (see below) are maintained in order to complete our objectives.

Computer resources required for 2020-2022:

(To make changes to an existing project please submit an amended version of the original form.)

		2020	2021	2022
High Performance Computing Facility	(SBU)	9,5 million	9,5 million	9,5 million
Accumulated data storage (total archive volume) ²	(TB)	8	12	16

References:

Belušić, D. et al., 2020, HCLIM38: A flexible regional climate model applicable for different climate zones from coarse to convection permitting scales, Geosci. Model Dev., 13, 1311–1333