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: Netherlands

Principal Investigator[1]: Dr. Willem Jan van de Berg

Affiliation: Utrecht University, Institute for Marine and Atmospheric Research Utrecht (IMAU)

Address: Princetonplein 5

3584 CC, Utrecht

The Netherlands

Other researchers: Brice Noël, Stan Jakobs, Melchior van Wessem, Leo van Kampenhout, Christiaan van Dalum, Peter Kuipers Munneke, Carleen Tijm-Reijmer and Michiel van den Broeke (UU/IMAU)

Project title: Present-day and future climate of Antarctica and Greenland modelled with RACMO2 and HCLIM

Project account: **SPNLBERG**

Additional computer resources requested for		**2019**
High Performance Computing Facility	(units)	10.000.000
Data storage capacity (total)	(Gbytes)	

Continue overleaf

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

Technical reasons and scientific justifications why additional resources are needed

The SPNLBERG project supports the calculation requirements of the polar regional climate modelling group at Utrecht University. As a research group we aim to provide the most accurate historical, contemporary and future surface mass balance (SMB) estimates of the Greenland (GrIS), and Antarctic ice sheets (AIS), and key other glaciated regions on Earth. To that end, we use the polar adapted regional climate model RACMO2.

The initially requested budget for 2019 was spent on:

- Two CESM2-driven RACMO2 runs for Greenland and Antarctica. These results are presented in the 2019 progress report. The results for the GrIS have been submitted to The Cryosphere.
- Sensitivity tests of snow melt production in Antarctica using an updated glaciated surface tile model embedded in RACMO2. The amount of snow melt on the ice shelves of Antarctica proved highly sensitive to parameterization choices. Multiple sensitivity experiments were therefore required to nail down the best working approach, which has been found now.
- Final 1979-2018 GrIS SMB simulations with RACMO2 using a novel narrowband snow albedo scheme.
- Shorter runs to update our operational SMB and climate data sets for the GrIS and AIS.

In the remainder of 2019, we need to complete the following simulations:

1. Two final 1979-2018 simulations to quantify the effect of the snow melt albedo feedback on the surface melt of the Antarctic ice shelves. Estimated costs are 3.5 MSBU.
2. Completion of the 1979-2018 GrIS SMB simulation using the novel narrowband snow albedo scheme. An extra 15 year simulation is also required to analyse the effect of the implementation of internal heating of the snow pack due to radiation penetration. Estimated costs are 2 MSBU.
3. A 2014-2100 GrIS SMB simulation, driven by CESM2 under the RCP8.5 scenario, to provide detailed physical estimates of possible future GrIS mass loss in a low-mitigation scenario. Estimated costs are about 6.5 MSBU.

The first two simulations were not conducted earlier as they were depending on model development and detailed model output analysis. These simulations are crucial for the completion of two PhD projects and should be finalised by the end of the year; postponing these would threaten the chances of two PhDs to obtain their degree.
The scenario simulation has been postponed for a long time due to technical issues – which are now solved – and apparent low priority. However, its completion is now urgent because all CMIP6 models, particularly CESM2, show a much higher climate sensitivity than previous CMIP5 models, affecting projections of global mean sea level rise. First GrIS SMB estimates using CESM2 under RCP8.5 scenario show surface mass loss reaching 500 to 2000 Gt yr^{-1} by 2100, which is equivalent to 1.4 to 5.6 mm global mean sea level rise per year. Given the societal impact of this drastically changed figure, a complementary RACMO2-based SMB estimate is essential to confirm this single future GrIS mass loss estimate in the IPCC AR6. To meet the IPCC deadline, the scenario run must be completed and analysed by December 2019.

The listed additional simulations exceed the requested budget of 10 MSBU. For the excess, we contacted KNMI. Finally, besides the three urgent simulations listed here, we have also postponed relevant but less time critical simulations to 2020, e.g. new ERA5 driven reference simulations for Greenland and Antarctica, which will replace our current operational ERA-Interim simulations, and future climate simulations for Antactica.