REQUEST FOR A SPECIAL PROJECT 2012–2014

MEMBER STATE: Netherlands

Principal Investigator[1]: Dr. E. van Meijgaard

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Project Title: Contribution of the great ice sheets to sea level rise: assessments with a polar regional climate model

If this is a continuation of an existing project, please state the computer project account assigned previously.	**SP** _____	
Starting year: (Each project will have a well defined duration, up to a maximum of 3 years, agreed at the beginning of the project.)	2012	
Would you accept support for 1 year only, if necessary?	YES ☒	NO ☐

Computer resources required for 2012-2014: (The maximum project duration is 3 years, therefore a continuation project cannot request resources for 2014.)	**2012**	**2013**	**2014**
High Performance Computing Facility (units)	499000	499000	499000
Data storage capacity (total archive volume) (gigabytes)	5000	5000	5000

*An electronic copy of this form **must be sent** via e-mail to:* *special_projects@ecmwf.int*

Electronic copy of the form sent on (please specify date): 26 April 2011

Continue overleaf

[1] The Principal Investigator will act as contact person for this Special Project and, in particular, will be asked to register the project, provide an annual progress report of the project's activities, etc.

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Extended abstract

The Greenland ice sheet (GrIS) and the Antarctic ice sheet (AIS) represent the largest freshwater sources on Earth. Their role in ongoing and future sea level change is very significant. The climate of Greenland is relatively mild, being influenced by the sea-ice free North Atlantic Drift throughout the year. As a result, the GrIS has a well-defined ablation zone with extensive summer melting and subsequent runoff, in stark contrast to the Antarctic ice sheet where no well-defined ablation zone exists. Since the mid 1990's, both melting and iceberg discharge from the GrIS have increased dramatically, while it is expected that snowfall on the AIS will increase in a warmer climate, offsetting part of the ongoing mass loss through enhanced iceberg calving in the Amundsen and Bellingshausen Sea coasts in West Antarctica.

Owing to considerable research efforts, notably the improved performance of regional atmospheric climate models, the absolute contribution to global sea level rise and the partitioning of mass fluxes from the GrIS and AIS are now better known than 10 years ago. The uncertainties that remain are mainly caused by our incomplete knowledge of the spatial and temporal variability of the surface mass balance (SMB), the sum of accumulation by snowfall and ablation by meltwater runoff and (snowdrift) sublimation. This proposal aims to quantify the SMB of the AIS and GrIS for the current and future climate (until 2100) by further improving and testing the regional atmospheric climate model RACMO2 (with an improved albedo scheme and advanced snowdrift physics) and by performing dedicated model evaluation of present-day climat eruns. The planned work will include model runs into the future (2100), following IPCC AR5 scenario's, and first tests in which the regional atmospheric model is one-way coupled to an ocean model (FESOM) which an unstructured mesh that resolves Antarctic ice shelf cavities.

The timing of this proposal will allow its main results to be available for the IPCC fifth assessment report, planned for 2014.

Some references pertaining to the proposed work:

Ettema, J., M.R. van den Broeke, E. van Meijgaard, W.J. van de Berg, J.L. Bamber, J.E. Box and R.C. Bales, 2009: Higher surface mass balance of the Greenland ice sheet revealed by high-resolution climate modeling Geophys. Res. Lett., 36, doi:10.1029/2009GL038110.

Fettweis, X., G. Mabille, M. Erpicum, S. Nicolay and M. R. van den Broeke, 2010: The 1958–2009 Greenland ice sheet surface melt and the mid-tropospheric atmospheric circulation, Climate Dynamics, doi: 10.1007/s00382-010-0772-8.

Meijgaard, E. van, L.H. van Ulft, W.J. van de Berg, F.C. Bosveld, B.J.J.M. van den Hurk, G. Lenderink, A.P. Siebesma, 2008: The regional atmospheric climate model RACMO, version 2.1, KNMI-Technical report-302, pp. 43 (2008)

Rignot, E., J. L. Bamber, M. R. van den Broeke, C. Davis, Y. Li, W. J. van de Berg, E. van Meijgaard, 2008: Recent Antarctic mass loss from radar interferometry and regional climate modeling, Nature Geoscience 2, 106-110.

Rignot, E., I. Velicogna, M. R. van den Broeke, A. Monaghan, and J. Lenaerts, 2011: Acceleration of the contribution of the Greenland and Antarctic ice sheets to sea level rise, Geophysical Research Letters 38, L05503, doi:10.1029/ 2011GL046583..

Van de Berg, W. J., M. R. van den Broeke and E. van Meijgaard, 2006: Reassessment of the Antarctic surface mass balance using calibrated output of a regional atmospheric climate model, *Journal of Geophysical Research* 111, D11104, doi:10.1029/2005JD006495.

Van den Broeke, M. R., W. J. van de Berg and E. van Meijgaard, 2006: Snowfall in coastal West Antarctica much greater than previously assumed, Geophysical Research Letters 33, L02505, doi:10.1029/2005GL025239

Van den Broeke, M. R.,, J. Bamber, J. Ettema, E. Rignot, E. Schrama, W.J. van den Berg, E. van Meijgaard, I. Velicogna and B. Wouters, 2009: Partitioning Recent Greenland Mass Loss Science, 326, 5955, 984-986, doi:10.1126/science.1178176.