SPECIAL PROJECT FINAL REPORT

All the following mandatory information needs to be provided.

Project Title:	Impact of Greenland melt water on EC-Earth high resolution simulations
Computer Project Account:	spnldrij
Start Year - End Year:	2020 - 2024
Principal Investigator(s)	Sybren Drijfhout
Affiliation/Address:	Royal Netherlands Meteorological Institute (KNMI) Utrechtseweg 297 3731 GA De Bilt The Netherlands
Other Researchers (Name/Affiliation):	Andre Juling, Rein Haarsma, and Philippe Le Sager (KNMI)

The following should cover the entire project duration.

Summary of project objectives

(10 lines max)

To Develop a protocol for meltwater release from the Antarctic and Greenland ice caps.
Implement these in the high-resolution Primavera version of EC-Earth3P
Assess the impact of extra meltwater release from ice caps no longer in equilibrium on the ocean circulation.

Summary of problems encountered

(If you encountered any problems of a more technical nature, please describe them here.)

We were no longer able to compile and run EC-Earth3P due to library and compiler changes and computer re-allocation to Bologna and the model version not being updated at KNMI and switched to EC-Earth3 for which no high-resolution version existed, but could successfully test and extend the Meltwater Release Protocol there making it part of new versions of EC -Earth3 including EC-Earth4

Experience with the Special Project framework

(Please let us know about your experience with administrative aspects like the application procedure, progress reporting etc.)

No particularities.

Summary of results

(This section should comprise up to 10 pages, reflecting the complexity and duration of the project, and can be replaced by a short summary plus an existing scientific report on the project.)

Despite the inability to rerun EC-Earth3P and the necessity to change the original plan we managed in this special project to realize crucial progress in the treatment of ocean/ atmosphere interaction with the Antarctic Ice Sheet and Greenland Ice Sheet. The protocols developed here already have been partly used in the post-CMIP6 version of EC-Earth3 used in the EU-funded program OptimESM and will become (are now becoming) part of EC-Earth4 and CMIP7.

List of publications/reports from the project with complete references

1. Chen, J.-J., et al. (2023). Reduced deep convection and bottom water formation due to Antarctic meltwater in a multi-model ensemble. *Geophysical Research Letters*, **50**, e2023GL106492. **https://doi.org/10.1029/2023gl106492**
2. Lambert, E., Jüling, A., van de Wal, R. S. W., and Holland, P. R.: Modelling Antarctic ice shelf basal melt patterns using the one-layer Antarctic model for dynamical downscaling of ice–ocean exchanges (LADDIE v1.0), The Cryosphere, 17, 3203–3228, https://doi.org/10.5194/tc-17-3203-2023, 2023.
3. Lambert, E., Le Bars, D., van der Linden, E., Jüling, A., and Drijfhout, S.: Quantifying the feedback between Antarctic meltwater release and subsurface Southern Ocean warming, EGUsphere, https://doi.org/10.5194/egusphere-2024-2257, 2024.
4. Swart, N. C., et al.: The Southern Ocean Freshwater Input from Antarctica (SOFIA) Initiative: scientific objectives and experimental design, Geosci. Model Dev., 16, 7289–7309, https://doi.org/10.5194/gmd-16-7289-2023, 2023.
5. van der Linden, E. C., Le Bars, D., Lambert, E., and Drijfhout, S.: Antarctic contribution to future sea level from ice shelf basal melt as constrained by ice discharge observations, The Cryosphere, 17, 79–103, https://doi.org/10.5194/tc-17-79-2023, 2023

Future plans

(Please let us know of any imminent plans regarding a continuation of this research activity, in particular if they are linked to another/new Special Project.)

The PI is with pension now.