

EGU2020-19348

<https://doi.org/10.5194/egusphere-egu2020-19348>

EGU General Assembly 2020

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Modelling the Antarctic Ice Sheet in the warm Mid-Pliocene

James O'Neill¹, Tamsin Edwards¹, Lauren Gregoire², Niall Gandy², Aisling Dolan², Andreas Wernecke³, Stephen Cornford⁴, Bas de Boer⁵, Ilan Kelman⁶, and Tina van de Flierdt⁷

¹Kings College London, Department of Geography, London, United Kingdom of Great Britain and Northern Ireland (james.f.o'neill@kcl.ac.uk)

²School of Earth and Environment, University of Leeds, Leeds, United Kingdom of Great Britain and Northern Ireland

³School of Environment Earth and Ecosystem Sciences, Faculty of Science, Technology, Engineering and Mathematics, Open University, Milton Keynes, United Kingdom of Great Britain and Northern Ireland

⁴Department of Geography, Swansea University, Swansea, United Kingdom of Great Britain and Northern Ireland

⁵Earth and Climate Cluster, Faculty of Science, Vrije Universiteit Amsterdam, Amsterdam, the Netherlands

⁶Institute for Risk and Disaster Reduction, University College London, London, United Kingdom of Great Britain and Northern Ireland

⁷Department of Earth Science and Engineering, Imperial College London, UK

The Antarctic ice sheet is a deeply uncertain component of future sea level under anthropogenic climate change. To shed light on the ice sheets response to warmer climates in the past and its' response to future warming, periods in Earth's geological record can serve as instructive modelling targets. The mid-Pliocene warm period (3.3 – 3.0 Ma) is characterised by global mean surface temperatures ~2.7-4°C above pre-industrial, atmospheric CO₂ concentrations of ~400ppm and eustatic sea level rise on the order of ~10-30m above modern. The mid-Pliocene sea level record is subject to large uncertainties. The upper end of this record implies a significant contribution from Antarctica and possible collapse of regions of the ice sheet, driven by marine ice sheet instabilities.

We present a suite of BISICLES ice sheet model simulations, forced with a subset of Pliocene Modelling Intercomparison Project (PlioMIP phase 1) coupled atmosphere-ocean climate models, that represent the Pliocene Antarctic ice sheet. This ensemble captures a range of possible ice sheet model responses to a warm Pliocene-like climate under different parameter choices, sampled in a Latin hypercube design. Modelled Antarctic sea level contribution is compared to reconstructions of Pliocene sea level, to explore the extent to which available data with large uncertainties can constrain the model parameter values.

Our aim with this work is to provide insights on Antarctic contribution to sea level in the warm mid-Pliocene. We seek to characterise the role of ice-ocean, ice-atmosphere and ice-bedrock parameter uncertainty in BISICLES on the ice sheet sea level contribution range, and whether cliff instability processes are necessary in reproduce high Pliocene sea levels in this ice sheet model.