PROJECT TITLE: Meltwater, the stability of ice shelves and the contribution of Antarctica to future sea level rise

DTP Research Theme(s): Changing Planet

Lead Institution: University of Bristol

Lead Supervisor: Prof. Antony Payne, School of Geographical Sciences, University of Bristol

Co-Supervisor: Dr. Sammie Buzzard, School of Earth and Environmental Sciences, Cardiff University

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Project keywords: Antarctic ice sheet, meltwater, modelling, sea level rise

Project Background

The need to predict the impact of the changing Antarctic ice sheet on global sea levels has led to the coupling of models of the ice sheets into global climate models. An important set of processes are however yet to be considered within these models, which is the impact of atmospheric warming generating large amounts of melt water on floating ice shelves leading to their fracture-based collapse. Loss of these ice shelves is thought to be a key trigger in the dynamics of ice grounded on bedrock and could potentially lead to the unstable collapse of the ice sheet creating very high rates of sea level rise over the coming centuries.

These processes were observed in the 2002 collapse of the Larsen B and other similar ice shelves along the with associated acceleration and mass loss from neighbouring glaciers. While the mass of ice in the Antarctic Peninsula is not sufficient to lead to major sea level rise, similar collapse of the larger ice shelves fringing the main Antarctic ice sheet further South, as air temperatures continue to rise, has very much more serious implications for sea level.

Project Aims and Methods

This project represents a collaboration between the Bristol and Swansea glaciology groups, and brings together their expertise in modelling ice sheet dynamics using the BISICLES ice-sheet model and meltwater and firn modelling, respectively. The aim is to work with the Met Office Hadley Centre to incorporate these processes into the UK’s new Earth System Model, UKESM. The project will comprise three main elements, although there is some scope to adapt these elements to match the interests of the student.

(a) Incorporation of an advanced model of snow melt and firn water storage processes to predict the future occurrence of meltponds on Antarctica’s ice shelves.

(b) Development of models linking these meltponds to the fracture of ice shelves and their eventual collapse.

(c) Projections of the future dynamics of the Antarctic ice sheet using BISICLES coupled to UKESM with these key processes incorporated.
**Candidate requirements**
The project would suit students with a strong quantitative background (such as a degree in Environmental or Earth Sciences, Oceanography or Physics). Students should have coding experience in languages such as C, python and/or matlab, and an appreciation of the application of large-scale numerical models of environmental processes. We welcome and encourage student applications from under-represented groups. We value a diverse research environment.

**Project partners**
The project will be supervised jointly between the Universities of Bristol and Cardiff and the Met Office.

**Training**
Training will be provided in the development and application of scientific software (using languages such as python, fortran90 and matlab) and in the use of high-performance computing. Training will also be provided in writing for scientific publication and presenting your results in the form of talks and posters. There will also be opportunities to attend international conferences and workshops to present your work.

**Background reading and references**


**Useful links**
http://www.bristol.ac.uk/geography/courses/postgraduate/

Bristol NERC GW4+ DTP Prospectus:
http://www.bristol.ac.uk/study/postgraduate/2023/doctoral/phd-great-western-four-dtp/

How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

Please note: If you wish to apply for more than one project please contact the Bristol NERC GW4+ DTP Administrator to find out the process for doing this.

The application deadline is Monday 9 January 2023 at 2359 GMT.
Interviews will take place during the period 22 February – 8 March 2023.

NERC GW4+ DTP Website:
For more information about the NERC GW4+ Doctoral Training Partnership please visit
https://www.nercgw4plus.ac.uk.

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