ONE Planet
Doctoral Training Partnership

Natural Environment Research Council

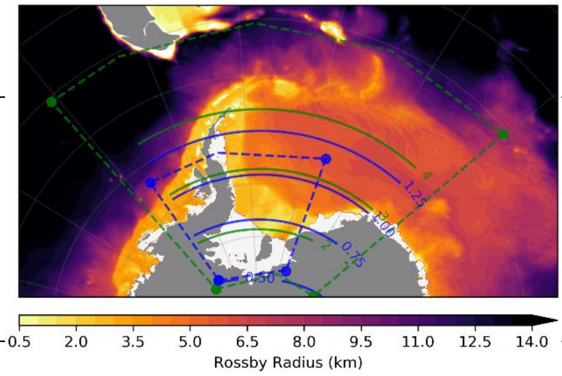
Project title: Revealing the role of eddies and buoyancy fluxes in projected regime shifts in the ocean circulation under Antarctica's ice shelves

(Ref: OP2152)

Keywords: numerical ocean modelling, big data, ice shelves

One Planet Research Theme:
Climate & Climate Change ☒ | Earth System Processes ☒ | Anthropocene ☐ | Environmental Informatics ☐

Lead Supervisor: Christopher Bull



Key Research Gaps and Questions:
What is the role of fine scale ocean processes and tides in fluxing heat across Antarctica's shelf?
What role will these processes play with increased greenhouse gases in the atmosphere in the future?

Project Description:
Global sea-level rise is one of the most severe impacts of climate change which threatens large coastal cities and related ecosystems. Sea-level rise is caused by several sources, including melting of glaciers and ice sheets. Around the Antarctic ice sheet's edges, there are thinner areas of ice that float on the ocean, called 'ice shelves'. These ice shelves are melted underneath by the ocean, and slow the melting of the ice sheet into the ocean. Climate models used for melt-rate projections are currently limited in that they cannot simulate critically important fine scale ocean processes such as mesoscale eddies. Eddies have been shown to be important for realistic heat fluxes across the Antarctic margins and physically appropriate ocean circulation responses to changes in wind forcing. This project will improve our understanding of how these small scale features regulate the heat crossing the Antarctic shelf and into the ice-shelf cavities. This project will develop and evaluate the first eddy-resolving (1/36° NEMO as indicated by blue lines in figure) ocean simulation of the Filchner Ice Shelf System with realistic shelf geometry, thermodynamically-interactive ice shelves, and tidal forcing. As necessary, simplified, idealised models will enable a process based understanding of the same system, with the ultimate goal of improving climate model representations of fine scale processes. This project has a potential partnership with the British Antarctic Survey and/or coupling to the Úa ice-sheet model, dependent on the student's interest. The student will join a growing, vibrant modelling group at Northumbria University who are interested in improving our physical understanding of the ocean, ice-shelf and ice-sheet climate system. The student will gain real-world experience in solving geophysical equations using complex numerical codes on modern compute clusters. Quantative, industry-sought big data skills will be developed and fascinating geophysical phenomena studied.

Prerequisites: A physical science or quantitative background (first degree in maths/physics or similar) is essential. Previous experience with the manipulation and analysis of large datasets and some knowledge of computer programming (e.g. Python/Matlab/Fortran) would be desirable. For more information, please contact Christopher Bull (christopher.bull@northumbria.ac.uk).

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