PROJECT TITLE: **Future Antarctic ice sheet climate and mass balance**

DTP Research Theme(s):	**Changing planet**
Lead Institution:	**British Antarctic Survey**
Main Supervisor:	**Dr Andrew Orr (BAS Atmosphere, Ice and Climate team)**
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Project Background

The Antarctic Ice Sheet (AIS) is the largest mass of ice on Earth, which would raise sea levels by 58 meters if melted. The AIS is highly sensitive to recent climate change, which may be a harbinger of more rapid changes in the coming century, resulting in a possibly catastrophic rise of sea level. For example, parts of Antarctica are amongst the fastest warming regions on Earth, resulting in the collapse of several ice shelves. While many outlet glaciers in West Antarctica have also accelerated, thinned, and retreated, and are now contributing approximately 10% to global sea level rise. However, a warming atmosphere should also result in significantly increased snowfall over the AIS, which could potentially compensate for any ice loss. Thus, more accurate predictions of future climate change are crucially required to understand the evolution of the AIS, and associated changes in sea level rise.

Project Aims and Methods

The project will use regional modelling of the atmosphere to deliver projections of the climate of the AIS, including associated changes in surface mass balance and meltwater availability, which will be used as forcing for an ice-sheet model to explore the effects of climate change on the AIS evolution. For the atmosphere, we will use the state-of-the-art UK Met Office Unified Model (MetUM) in its regional configuration to derive a variety of high-resolution projections for the whole of Antarctica, which are able to resolve the narrow and steep coastal margins of the AIS. These simulations will include a realistic representation of the necessary snow, firn and ice processes, by making improvements to the multi-layer snow scheme used by the MetUM. For the ice-sheet, we will use the BISICLES adaptive-mesh model applied to the whole of the AIS with sub-kilometre resolution for grounding lines and ice streams. These tools will be used to explore projections of the Antarctic climate and ice sheet to various scenarios of twenty-first century climate change. The simulations will form part of the Polar-CORDEX (Coordinated Regional Downscaling Experiment) initiative, as well contributing to the Intergovernmental Panel on Climate Change (IPCC) assessment reports.

Candidate

We seek an enthusiastic, self-reliant, and self-motivated candidate with good numerical and computational skills. The student should have a strong interest in climate science, and an interest in helping people be more aware of its impacts.

Training

The student will receive excellent supervision and training in climate and ice-sheet modelling, as well as meteorology and atmospheric and snow physics. The training will be through short courses and Summer Schools. In addition, a wide range of generic and personal transferable skills training will be available. The student will also have the opportunity to interact with other Polar CORDEX scientists, and in the process learn from them.

References / Background reading list

Cornford and others, Century-scale simulations of the response of the West Antarctic Ice Sheet to a warming climate, *The Cryosphere*, **9**, 1579-1600, doi: 10.5194/tc-9-1579-2015, 2015.

Trusel and others, Divergent trajectories of Antarctic surface melt under two twenty-first-century climate scenarios, *Nature Geoscience*, **8**, 927-932, doi: 10.1038/ngeo2563, 2015.

Fettweis and others, Estimating the Greenland ice sheet surface mass balance contribution to future sea level rise using the regional atmospheric model MAR, *The Cryosphere*, **7**, 469-489, doi: 10.5194/tc-7-469-2013, 2013.

Gregory and Huybrechts, Ice-sheet contributions to future sea-level change, *Philosophical Transactions of the Royal Society*, **364**, 1709-1731, doi: 10.1098/rsta.2006.1796, 2006.