

PROJECT TITLE: What happened to all the Antarctic sea ice?

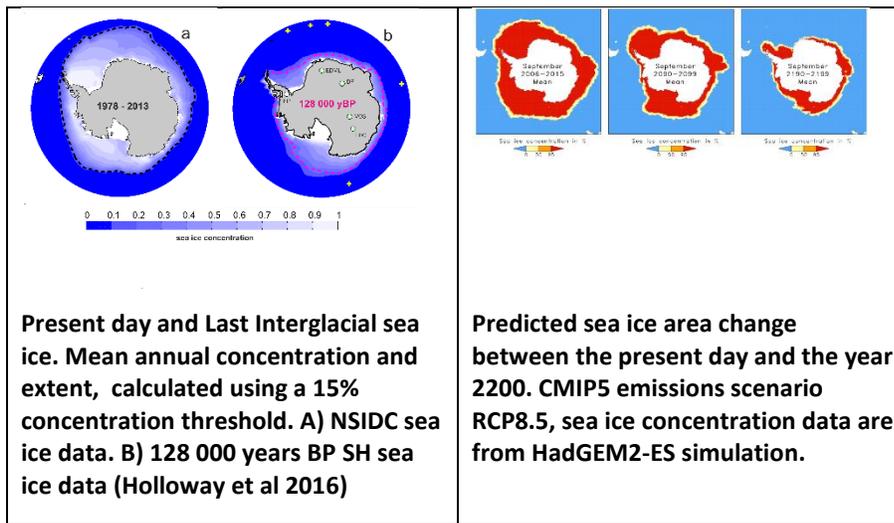
Lead Institution: British Antarctic Survey

Main Supervisor: Dr Louise Sime, Ice Dynamics and Paleoclimate, Cambridge

Co-Supervisor: Prof. Paul Valdes, Earth Sciences, The University of Bristol

Co-Supervisor: Dr Alistair Sellar, UKESM1 Team, The MetOffice, Exeter

Project Enquiries & Applications Dr Louise Sime - lsim@bas.ac.uk



Project Background

Every year sea ice in the Southern Hemisphere extends 18 mill. km² over the Southern Ocean creating an ephemeral surface roughly twice the size of Europe. The sea ice has profound consequences that resonate across multiple scales, from weather to local ecosystems and other polar resources. Accurate forecasts of Southern Hemisphere sea ice over the coming decades to centuries are crucial to understanding these consequences, yet are currently lacking. While sea ice is predicted to retreat this century in both the Southern and Northern Hemispheres, there is only low confidence is associated with the Southern Hemisphere prediction. The uncertainty surrounding sea ice in the SH is considered one of the greatest challenges in contemporary climate.

Project Aims & Methods

To address this knowledge gap, the student will model SH ice retreat a period during the Last Interglacial, or LIG, between 130 000 and 116 000 years Before Present (BP) when there was a substantial loss of SH sea ice (Fig 1). This period provides an excellent analogue to test models that predict a decrease of up to 58% in SH sea ice at the end of the 21st century (Fig 2). Additionally, the student will explore the less well known Early Holocene 11 000 yBP SH sea ice retreat.

Aim 1 - Carry out the first model and data-driven investigation of whether our models can accurately simulate a major SH sea ice retreat;

Aim 2 – Investigate the impact of Antarctic ice sheet changes, both past and future, on the production and destruction of sea ice.

Aim 3 – Feed findings into a re-assessment of the level of confidence that can be attributed to SH sea ice predictions of retreat for the 6th and 7th Intergovernmental Panel on Climate Change (IPCC) Reports.

Method – Set up and analysis, with the Met Office, a range of HadCM3 and UKESM1 simulations.

Candidate Requirements

We seek a candidate with a numerate scientific background and an interest in Meteorology, Oceanography, or Climate Modelling. This project would suite a candidate with a first – or evidence of a strong aptitude in modelling - in Oceanography, Meteorology, Physics, Applied Maths, or Statistics.

CASE or Collaborative Partner

Collaboration with **the MetOffice**, BAS, and the exceptional University of Bristol modelling group will provide the student with the best possible environment to establish themselves in this field. The student will sit within Dr Sime's research group (current group size six), within the larger Ice Dynamics and Paleoclimate Team (current size of twenty) which Sime co-leads.

Training

The student would be encouraged to attend: the Unified Model (UM) training course, held at the University of Reading; an advanced UM user training course held at the Met Office; Fortran courses in Cambridge, and the NCAS Climate Modelling Summer School, held at the Oxford University during September. Wider paleoclimate training can be obtained through the July Italian Urbino Summer School in Paleoclimatology. There will be opportunities to attend, and present results at, international workshops and conferences, such as at Paleoclimate Modelling Intercomparison Project meetings and international conferences, e.g. the American Geophysical Union conference in San Francisco, USA.

References / Background reading list

Holloway, Max D., Sime, Louise C., Allen, Claire S., Hillenbrand, Claus-Dieter, Bunch, Pete, Wolff, Eric, Valdes, Paul J.. (2017) The spatial structure of the 128 ka Antarctic sea ice minimum. *Geophysical Research Letters*, 44. 11129-11139. 10.1002/2017GL074594

Holloway, Max D., Sime, Louise C., Singarayer, Joy S., Tindall, Julia C., Bunch, Pete, Valdes, Paul J.. (2016) Antarctic last interglacial isotope peak in response to sea ice retreat not ice-sheet collapse. *Nature Communications*, 7. 9 pp. doi:10.1038/ncomms12293

Turner, John, Comiso, Josefino. (2017) Solve Antarctica's sea-ice puzzle. *Nature*, 547. 275-277. 10.1038/547275a

Useful links

<https://www.bas.ac.uk/>

<https://www.bas.ac.uk/science/science-and-students/nerc-doctoral-training-opportunities/>

Interested in a project? Contact the lead project supervisor for more information.

To apply, please send the following documents directly to the project supervisor:

- A full CV
- Copies of transcripts and degree certificates
- A statement of interest (no more than 2 sides A4)
- Name/email address of two professional referees

For general enquiries: Contact Ali Teague alag@bas.ac.uk in the BAS Student Office

The application deadline is 1600 hours GMT Monday 7 January 2019 and interviews will take place between 4 and 15 February 2019. For more information about the NERC GW4+ DTP, please visit <https://nercgw4plus.ac.uk>.