Two fully funded PhD positions to investigate the last interglacial warm period in Antarctica

We are offering two PhD scholarships to explore ice core data-constrained modelling efforts to improve our understanding of Antarctica's contribution to sea level rise during the last interglacial warm period.

Science Focus

In a rapidly warming world, the potentially catastrophic deglaciation of the West Antarctic Ice Sheet (WAIS) remains a primary cause of uncertainty in Intergovernmental Panel on Climate Change (IPCC) sea level rise projections[1]. Updated global mean sea level rise projections suggest that atmospheric warming exceeding the Paris Agreement target, will commit WAIS and perhaps East Antarctica's marine based ice sheets (ice grounded below sea level) to irreversible retreat causing global sea level to rise[2]. Urgently needed adaption strategies are hampered by large inter-model variability and poorly quantified uncertainties in future projections[3]. Applying the IPCC high emission scenario (RCP 8.5), sea level projections to 2100 range from 0.7 to 1.7 m[2,4,5] by 2100. The large range of inter-model variability of future projections suggests that key physical processes and their effects are not yet adequately captured or understood, leading to important uncertainties[6,7].

Reconstructions of relevant past time slices provide valuable constraints for improving model performance, and offer key insights into feedbacks, thresholds, and climate sensitivities[2,4-6,8]. A particularly useful example is the Last Interglacial period (LIG, 130-115 thousand years [ka] ago), also referred to as Marine Isotope Stage 5e (MIS 5e), when CO_2 concentration was 30% lower, global temperature 1-1.5°C warmer, and global sea level 6-9 m higher than today[9]. During this period, Greenland's sea level contribution has been constrained to ≤2 m[10]. With an additional ~1 m derived from the thermal expansion of the ocean, this implies a contribution from the marine-based WAIS of up to 3.3 m sea level equivalent, with marine-based sectors of the East Antarctic Ice Sheets (EAIS) potentially contributing the remainder (0-2.7 m)[9].

Thus, WAIS and perhaps the marine-based regions of East Antarctica and their buttressing ice shelves appear to be highly sensitive to oceanic and atmospheric feedbacks[9] within the relatively small temperature increases that are relevant to the goals of the Paris Agreement. Six existing East Antarctic ice cores contain MIS 5e records[11,12] but they do not hold information on the WAIS[12,13]. This project takes advantage of the Roosevelt Island Climate Evolution (RICE) ice core, the first West Antarctic MIS 5e record, to answer the question: Did the WAIS collapse when global temperatures were 1-2°C higher than today?

PhD Scholarships:

We are offering two fully funded PhD positions. One based in New Zealand and one first based in the UK and then in New Zealand.

Assessing Antarctic environmental change and ocean-ice-atmosphere interactions during the last Interglacial using data-constrained Earth system models (Supervisors: Liz Keller and Nancy Bertler)

This fully funded PhD position is available at the Antarctic Research Centre (ARC), Victoria University of Wellington, in collaboration with GNS Science to develop an environmental reconstruction of the Ross Sea region during MIS 5e using data-constrained intermediate complexity Earth system models. The successful candidate will be hosted by the ARC and collaborate with international scientists and graduate students from the ARC and GNS Science. The candidate will be part of the new National Modelling Hub and will have access to excellent technical support, high-performance computing, statistical modelling, climate models, and mentorship from senior researchers.

Location: New Zealand / Victoria University and GNS Science
Scholarship: NZ$27,500 pa + full fees for 3 years
Supervisors: Liz Keller (L.Keller@gns.cri.nz) and Nancy Bertler (Nancy.Bertler@vuw.ac.nz)
Eligibility: The ideal candidate will hold an MSc degree. An excellent grade / GPA is required.
Criteria: The candidate has a background in one or more of the following fields

- Earth System Modelling
- Paleoclimate reconstructions/Earth Sciences
- Ice core proxy development and reconstruction
- Physics
- Computer Science
- Oceanography
- Meteorology or atmospheric science
- Some basic programming skills are required (e.g. Python, R, , C/C++, Fortran, command line scripting)

Reduced Antarctic ice volume and sea ice during the last interglacial: The RICE ice core and climate modelling with isotopes (Supervisors: Louise Sime and Nancy Bertler)

A fully funded PhD position is available at the Antarctic Research Centre (ARC) in collaboration with British Antarctic Survey and GNS Science to develop last interglacial (during MIS 5e) environmental reconstructions in the Ross Sea region of Antarctica using new isotope measurements from the RICE ice core alongside a suite of isotope-enabled climate models. Initially it was planned for the student to travel between NZ and the UK to develop their thesis work. With Covid-19 travel restrictions, the successful candidate will now be hosted for the first 12-18months by the British Antarctic Survey and will then move to New Zealand to be hosted by the ARC and GNS Science. Being part of the new and new National Modelling Hub, the candidate has access to excellent technical support, high-performance computing, statistical modelling, climate modelling, and, and mentorship from senior researchers.

Location: United Kingdom / British Antarctic Survey AND New Zealand Victoria University and GNS Science. It is anticipated that this PhD project will be hosted for the first 12-18 months by the British Antarctic Survey in Cambridge, UK, and the remaining time at Victoria University of Wellington and GNS Science in Wellington, New Zealand.
Scholarship: NZ$27,500 pa + full fees for 3 years
Supervisors: Louise Sime (lsim@bas.ac.uk) and Nancy Bertler (Nancy.Bertler@vuw.ac.nz)
Eligibility: The ideal candidate will hold an MSc degree. An excellent grade / GPA is required.

Criteria: The candidate has a background in one or more of the following fields

- Earth System Modelling
- Paleoclimate reconstructions/Earth Sciences
- Ice core proxy development and reconstruction
- Physics
- Computer Science
- Oceanography
- Meteorology or atmospheric science
- Some basic programming skills are required (e.g. Python, R, , C/C++, Fortran, command line scripting)

Dr Louise Sime would also like to draw your attention to the related EU-DEEPICE Climate-Ocean modeller PhD studentship https://www.bas.ac.uk/jobs/vacancy/climate-ocean-modeller-deepice-2/ (short deadline 31th March)

More Details:

For further information please contact the supervisor:
Liz Keller (L.Keller@gns.cri.nz)
Louise Sime (lsim@bas.ac.uk)
Nancy Bertler (Nancy.Bertler@vuw.ac.nz)

Application Process

To apply for the PhD position, please send the relevant supervisors by **30 April 2021**:

- A cover letter (please include the PhD position you apply for)
- Your CV
- 2 Referees

References

[1] PCC Climate Change 2013. The Physical Basis. Contribution to Working Group 1 of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker, T.F., D. Qin, G.-K. Platner, M. Tignor, S.K. Allen, J. Boshung, A. Nauels, Y. Xia, V.Bex and P.M. Midgley (eds)]. 1535 pp (Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 2013).
[2] Golledge, N. R. et al. The multi-millennial Antarctic commitment to future sea-level rise. Nature 526, 421-425, doi:10.1038/nature15706
[3] Bamber, J. L., Oppenheimer, M., Kopp, R. E., Aspinall, W. P. & Cooke, R. M. Ice sheet contributions to future sea-level rise from structured expert judgment. Proceedings of the National Academy of Sciences 116, 11195-11200, doi:10.1073/pnas.1817205116 (2019).
[4] DeConto, R. M. & Pollard, D. Contribution of Antarctica to past and future sea-level rise. Nature 531, 591-597 (2016).
[5] Mengel, M. et al. Future sea level rise constrained by observations and long-term commitment. Proceedings of the National Academy of Sciences 113, 2597-2602, doi:10.1073/pnas.1500515113 (2016).
[6] Levermann, A. et al. The multimillennial sea-level commitment of global warming. Proceedings of the National Academy of Sciences 110, 13745-13750 (2013).
[7] Golledge, N. R. et al. Global environmental consequences of twenty-first-century ice-sheet melt. Nature 566, 65-72, doi:10.1038/s41586-019-0889-9 (2019).
[8] Bertler, N. A. N., Levy, R. & Turnbull, J. in WMO Greenhouse Gas Bulletin - The State of the Greenhouse Gas in the Atmosphere based on Global Observations through 2016 Vol. 13 (ed WMO Greenhouse Gas Expert Group) 4-5 (WMO, 2017).
[9] Dutton, A. et al. Sea-level rise due to polar ice-sheet mass loss during past warm periods. Sci 349 (2015).
[10] NEEM community members. Eemian interglacial reconstructed from a Greenland folded ice core. Nature 493, 489-494, (2013).
[11] Masson-Delmotte, V. et al. A comparison of the present and last interglacial periods in six Antarctic ice cores. CliPa 7, 397-423 (2011).
[12] Past Interglacials Working Group of PAGES. Interglacials of the last 800,000 years. RvGeo 54, 162-219, (2016).
[13] Holloway, M. D. et al. Antarctic last interglacial isotope peak in response to sea ice retreat not ice-sheet collapse. Nature Communications 7, 12293
[14] Bertler, N. A. N. et al. The Ross Sea Dipole - Temperature, Snow Accumulation and Sea Ice Variability in the Ross Sea Region, Antarctica, over the Past 2,700 Years. CliPa 14, 193-214, doi:10.5194/cp-14-193-2018 (2018)