THE UNIVERSITY of EDINBURGH

Job Description

Internship Title: Influence of glacier inventories on area coverage, ice thickness and volume estimates in Antarctic Peripheral Glaciers and Ice caps

Department/ School	School of Geosciences, University of Edinburgh, Kings Buildings Campus
Reports To	Beatriz Recinos Rivas, NERC Independent Research Fellow, beatriz.recinos@ed.ac.uk School of GeoSciences Qi Ou, Lecturer in Radar Remote Sensing, qi.ou@ed.ac.uk , School of GeoSciences Clara Nyqvist, c.j.nyqvist@ed.ac.uk , PhD mentor, University of Edinburgh

Job Purpose

This project focuses on Peripheral Glaciers and ice caps on Antarctic islands and includes two main components: (1) running the Open Global Glacier Model (OGGM) in its standard configuration with two different glacier inventories to assess how estimates of glacier area, ice thickness, and volume vary with inventory choice and (2) gathering Sentinel-1 data to support future automatic mapping of glacier outlines in Antarctica.

Main Responsibilities

- To integrate alternative glacier inventories into the OGGM framework following its standard configuration and the model tutorials. (Week 1 and 2)
- To compare ice volume and thickness estimates derived from different inventories at both the individual glacier and regional levels. (Week 3 to 5)
- To assess how these new estimates compare with existing published results, these previously published data sets are already integrated in the OGGM shop. (Week 6)
- Gather Sentinel-1A and Sentinel-1B imagery for glaciers not covered in the Huber and Cook inventories, to support future mapping efforts of these glaciers and ice caps by giving suggestions (remaining time).

Knowledge Skills and Experience (required for the role)

Attribute	Essential	Desirable
Education, Qualifications & Training	- Undergraduate or Integrated Master student in a relevant field (e.g., Geosciences,	- Coursework or training in one or more disciplines including computer

	Environmental Science, Geography, Physics, Maths or related discipline)	sciences, statistics, glaciology, remote sensing, or climate science.
Knowledge & - Experience	- Basic understanding of climate change; - experience working with scientific datasets	- Familiar with the use of GIS tools or programming in Python.

Person Specification

Planning and Organising
Good time management and ability to follow structured programming tutorials and workflows

Problem Solving
Able to troubleshoot issues with data, models, or code using available resources and documentation

Decision Making
Demonstrates initiative in identifying and exploring solutions beyond the methods given for the project.

Key Contacts:
Beatriz Recinos Rivas, NERC Independent Research Fellow, University of Edinburgh
Qi Ou, Lecturer in Radar Remote Sensing, University of Edinburgh
Clara Nyqvist, c.j.nyqvist@ed.ac.uk , PhD mentor, University of Edinburgh

The student will be embedded in the Cryosphere Research Group, with the opportunity to attend regular seminars and group meetings, gaining insight into current developments in polar and glaciological research.
- The student will have access to the OGGM Hub; a cloud-based platform for running the Open Global Glacier Model enabling them to conduct experiments efficiently and collaborate with others.
- The student will be integrated into the OGGM community, an active international network of researchers working on global glacier modelling. Through participation in community meetings and discussions, the student will engage with leading scientists in the field, gain valuable feedback, and develop connections that will support their academic and professional development in cryospheric science.

Dimensions
Closing date for applications: Wednesday 14th May 2025 (Midnight)
Start date: Between 16th June and 20th August – 7 to 8 weeks
Hours per week and preferred pattern/ restrictions (if applicable) – 35 hours per week

Additional Information

Project Outline

Antarctic Peripheral Glaciers and Ice Caps (APGs), located on islands surrounding the Antarctic continent, represent the largest glacierised area outside the Greenland and Antarctic ice sheets (~132,867 km²). Due to their exposure to strong spatial variations in atmospheric and oceanic conditions, APGs are highly sensitive to short-term (decadal) changes in the climate system. Understanding how much ice these glaciers store is crucial for assessing their potential contribution to meltwater input, which could influence regional ocean circulation, ecosystems, and contribute to global sea-level rise.
Despite their importance, there are few reliable estimates of ice volume and thickness for many of these glaciers. This is primarily due to a lack of accurate and consistent glacier inventories. Most global estimates, including those by Hock et al. (2023), Farinotti et al. (2019), and Millan et al. (2022), rely on the Randolph Glacier Inventory (RGI), which in this region is largely based on glacierised area outlines compiled by Bliss et al. (2017).

However, two more detailed inventories exist: Cook et al. (2014) and Huber et al. (2017), which provide more accurate and higher-resolution outlines of some of the glaciers in the islands next to the Antarctic Peninsula but have not yet been used in conjunction with glacier modelling frameworks to estimate ice thickness or volume.
A recent study by Li et al. (2023) using the Open Global Glacier Model (OGGM) demonstrated that the choice of glacier inventory has a significant influence on modelled ice volume, and thus on estimates of glacier contribution to sea-level rise, using the Himalayas as a case study. This project aims to replicate a similar approach for the Antarctic Peripheral Glaciers.
The proposed research will integrate the glacier outlines from Cook et al. (2014) and Huber et al. (2017) into the OGGM workflow and compare the resulting ice thickness and volume estimates to those obtained using the standard RGIv7.0 inventory (Bliss et al. 2017). This will allow us to assess the sensitivity of modelled glacier volume to the choice of inventory in this understudied region.

The main objectives are:
Week 1 – 5:

- To integrate alternative glacier inventories into the OGGM framework following its standard configuration and the model tutorials.
- To compare ice volume and thickness estimates derived from different inventories at both the individual glacier and regional levels.
- To assess how these new estimates compare with existing published results, these previously published data sets are already integrated in the OGGM shop.

Week 6 – 8:

- The student will also gather Sentinel-1A and Sentinel-1B imagery for glaciers not covered in the Huber and Cook inventories, to support future mapping efforts of these glaciers and ice caps. The student will be able to propose future ways of mapping glacier outlines.

The student will follow the OGGM tutorial on using custom glacier inventories, available at: https://tutorials.oggm.org/stable/notebooks/tutorials/use_your_own_inventory.html They will also use the OGGM-Shop tools to access and download previous model outputs for direct comparison. The project will involve working with geospatial datasets, basic Python coding (supported by the main supervisor B Recinos, glacier modeller and previous contributor to the OGGM code), and will provide hands-on experience in glaciological modelling. OGGM can also be run in cloud-based services thus the student doesn't have to install the software to start the project.

Overall, this placement will help improve our understanding of the uncertainties in glacier modelling driven by boundary conditions and the input data ingested into models. This work will contribute to a better estimation of Antarctic glacier ice volume and its potential contribution to sea-level rise.

References

- Hock, R., Maussion, F., Marzeion, B. & Nowicki, S. What is the global glacier ice volume outside the ice sheets? Journal of Glaciology 69, 204–210 (2023).
- Maussion, F., Hock, R., Paul, F., Raup, B., Rastner, P., Zemp, M, Andreassen, L., Barr, I., Bolch, T., Kochtitzky, W., McNabb, R. and Tielidze, L: The Randolph Glacier Inventory version 7.0 User guide v1.0, 2023. doi:10.5281/zenodo.8362857. Online access: https://doi.org/10.5281/zenodo.8362857.
- Maussion, F., Butenko, A., Champollion, N., Dusch, M., Eis, J., Fourteau, K., Gregor, P., Jarosch, A. H., Landmann, J., Oesterle, F., Recinos, B., Rothenpieler, T., Vlug, A., Wild, C. T., and Marzeion, B.: The Open Global Glacier Model (OGGM) v1.1, Geosci. Model Dev., 12, 909–931, https://doi.org/10.5194/gmd-12-909-2019, 2019.
- Millan, R., Mouginot, J., Rabatel, A. *et al.* Ice velocity and thickness of the world's glaciers. *Nat. Geosci.* **15**, 124–129 (2022). https://doi.org/10.1038/s41561-021-00885-z
- Farinotti, D. et al. A consensus estimates for the ice thickness distribution of all glaciers on Earth. Nat. Geosci. 12, 168–173 (2019).
- Li, F., Maussion, F., Wu, G., Chen, W., Yu, Z., Li, Y. and Liu, G.: Influence of glacier inventories on ice thickness estimates and future glacier change projections in the Tian Shan range, Central Asia, Journal of Glaciology, doi:10.1017/jog.2022.60, 2023.
- Huber, J., Cook, A. J., Paul, F., and Zemp, M.: A complete glacier inventory of the Antarctic Peninsula based on Landsat 7 images from 2000 to 2002 and other preexisting data sets, Earth Syst. Sci. Data, 9, 115–131, https://doi.org/10.5194/essd-9-115-2017, 2017.
- Bliss A, Hock R, Graham Cogley J. A new inventory of mountain glaciers and ice caps for the Antarctic periphery. Annals of Glaciology. 2013;54(63):191-199. doi:10.3189/2013AoG63A377

Budget

A maximum of £500 towards project costs is available.

Location

School of Geosciences, Kings Buildings, University of Edinburgh

Health & Safety Requirements for the role

None

Key Job hazard information specific to the role

None

Programme Information

The Research Experience Programme (REPs), funded by NERC, offers paid research opportunities for undergraduate students. The programme is designed to address both demographic and diversity challenges in the environmental sciences, as well as thematic skills gaps, such as quantitative skills.
This is a valuable opportunity to gain hands on research experience, boost your employability, and explore potential pathways into further study or careers in environmental science.

For full details on how to apply and the selection process, please visit our REP webpage

Application Support

The University's Careers service provides a wide range of resources to support your application, including guidance on CVs, cover letters, and interview preparation.
Students undertaking a REP placement will also have the opportunity participate in the Edinburgh Award - a structured programme that helps you reflect on and gain recognition from the University for the skills and attributes developed during your internship.
For more information, you can book an appointment with a Careers Consultant via MyCareerHub.

Eligibility Criteria

To be eligible for a REP placement, applicants must meet **all** of the following criteria:

• Be currently studying towards their first undergraduate degree studies (including integrated Master's degrees) in a UK Higher Education institution, in any science discipline
Note: *Final year students are eligible if they still hold student status at the* ***start of the placement,*** *even if the student graduates during the course of the placement.*

- Be eligible for subsequent NERC PhD funding as defined here:
- A UK citizen who has been living in the UK for at least the past 3 years OR
- An EU citizen with pre-settled or settled status under the EU Settlement Scheme OR
- A non-EU citizen who has obtained the right to remain in the UK - known as 'indefinite leave to remain' (ILR) OR
- An International/EU student currently studying in the UK under a Tier 4 or Student Route Visa with validity until at least September 2025.

REPs **do not** meet the requirements for visa sponsorship. As such, students who are not currently residing in the UK or who do not hold a valid UK visa are not eligible to apply.

You cannot take part if you are a visiting student, or have previously taken part in REP programme.

Privacy Statement

In addition to the University's HR Privacy Information Notice, please read the Student and Graduate Privacy Statement: Internships and work experience programmes to understand how your personal information will be collected, used, and stored as part of the application process. .

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