

Student research experience, Department of Earth Sciences

Reconstructing Historical CO₂ Dynamics in Arctic Rivers Using Water Chemistry and Geochemical Modelling

Hourly rate of pay: £14.20

Casual work for up to 6 weeks (starting on the week commencing the 18th of August).

This is an exciting opportunity to gain research experience for a student with interests in biogeochemistry, quantitative data analysis, GIS, and Arctic systems undergoing climate change. The project will use historical river data, remote sensing and geochemical modelling software (CO₂SYS) to analyse geochemical changes that have occurred in Arctic rivers over the last 3 decades in the context of climate change.

The Arctic is warming nearly four times faster than the global average, with profound impacts on hydrology, permafrost, and biogeochemical cycles. One consequence is the acceleration of chemical weathering processes, including carbonate and sulfide oxidation, which can generate dissolved inorganic carbon (DIC) and contribute to CO₂ outgassing from rivers. Understanding how these processes have varied over space and time is critical for evaluating the role of Arctic rivers in the carbon cycle. By reconstructing past carbonate system dynamics, we can assess how climate-driven changes in water chemistry have influenced CO₂ emissions and what this might mean for the future.

This project will investigate how climate-driven spatiotemporal variations in water chemistry influence the carbonate system and greenhouse gas evasion in Arctic rivers. Using historical datasets, the student will reconstruct past carbonate system parameters using the CO₂SYS software and explore the role of weathering and hydrological drivers on CO₂ production. Results will be visualized in a spatial context using GIS tools, with optional comparison to existing gas transfer velocity (*k*) values to further assess spatial trends and differences among certain catchments in the study area.

Aims and Objectives:

- Compile and process historical water chemistry data from Arctic rivers.
- Use CO₂SYS to estimate carbonate system parameters (e.g., pCO₂, HCO₃⁻, saturation indices).
- Explore spatial and temporal trends using GIS.
- Use remote sensing tools to explore river change.

About you

You must be:

- Comfortable handling large environmental datasets.
- Have experience in analysing data and working independently.

- Interested in geochemical modelling (using carbonate chemistry tools - CO2SYS)
- Keen to use remote sensing / GIS and spatial analysis tools.
- Comfortable with your understanding of the basics of the carbonate system.

Upon completion of the project, you will have experience in geochemical modelling, managing and organising your own work and presenting your findings and progress on a regular basis. You will also develop your critical thinking and scientific writing, and acquire additional skills in remote sensing and using multiple tools and resources for geochemical problem-solving.

In case of interest please send a CV and a cover letter (maximum two pages long, explaining your interest in the project, specific skills that might be relevant and the period of time you are available for) directly to the HR Team, personnel@earth.ox.ac.uk.

The deadline for applications is the **30th of June 2025**.