How will climate change affect organic matter exported from peat?

Supervisors: Dr. C. Moody, Prof. P. Chapman

Contact email: c.s.moody@leeds.ac.uk

Project summary

Peatlands cover only 2.8% of the Earth but store 50% of the global soil carbon pool and 10% of the world's freshwater[1]. Peatland rivers are significant sources of fluvial carbon (as dissolved organic carbon (DOC), a component of organic matter) and concentrations in the northern hemisphere have doubled in the last 20 years[2]. Climate change has been cited as one of the possible reasons for the observed increase, and prolonged drought is known to increase DOC production from peat, but the effect of climate change on organic matter composition is unknown[3]. Temperature increase is likely to affect the rate of the processing of organic matter in water, and therefore the greenhouse gas (GHG) emissions, further contributing to climate change. In-stream emissions from water bodies are under-represented in the Intergovernmental Panel on Climate Change (IPCC) reports. It is important to understand the relationship between climate and organic matter composition and processing to allow models of future climate change to include the potential for positive feedback as GHG emissions from water increase.

There are also implications of this increase in DOC concentration for water companies, as the water draining peatlands has high DOC and therefore dissolved organic matter (DOM) concentrations, resulting in highly coloured water.[3] When water colour peaks become too severe water companies have to invest tens of millions of pounds in capital for every new treatment plant, plus the additional expense of running those plants. For the IPCC, water companies, policy makers and society there is an urgent need to understand how climate change will affect the composition, processing and treatability of DOM, and the outcomes of this project will help to optimise water treatment performance to deal with threats posed by changes in DOM composition as a result of climate change.

This project will explore an interdisciplinary approach to quantify the effect of climate and land-use change on DOM composition and processing, and therefore potential GHG emissions.

Aims and Objectives

This project will investigate the composition changes in organic matter under future climate change scenarios through lab and field experiments and analysis. Fieldwork will be conducted in the UK uplands, and the findings will be of international relevance.

The aim is to discover the impact of climate change and increased atmospheric CO_2 concentrations on organic matter composition and processing, and the potential for positive climate feedbacks.

Impact

This work has the potential to impact the IPCC reports and budgets, especially regarding emissions from peatlands and water bodies that are not well quantified, and therefore affect policy makers and budgets of GHGs. The findings of this research will quantify the impact of climate change and land use on DOM composition and processing, allowing climate change models to include GHG emissions from these environments in predictions and budgets of future ecosystem C cycling.

Geography at Leeds

This project is within the River Basin Processes and Management research cluster in in the School of Geography at the University of Leeds. The School hosts one of the largest groups of peatland scientists in the world, including world-renowned scientists.

Student profile

Applicants should have a strong background in physical geography and an interest in environmental geochemistry. Strong field and lab work skills are desirable but not essential, as full training will be provided during the PhD.

References

1. Xu et al. 2018 PEATMAP: Refining estimates of global peatland distribution based on meta-analysis. Catena 160, 134-140

2. Evans et al. 2006 Alternative explanations for rising dissolved organic carbon export from organic soils. Global Change Biology 12, 2044-2053

3. Ritson et al. 2017 The effect of drought on dissolved organic carbon (DOC) release from peatland soil and vegetation sources. Biogeosciences 14, 2891-2902