PROJECT TITLE: AI-accelerated global greenhouse gas emissions evaluation

Project Science Theme: Science for Environmental Solutions
Project keywords: Machine learning, methane, carbon dioxide

Lead Institution: University Bristol
Lead Supervisor: Professor Matt Rigby, Bristol, School of Chemistry
Co-Supervisor: Raul Santos Rodriguez, University of Bristol, School of Engineering Mathematics
Co-Supervisor: Anita Ganesan, University of Bristol, School of Geographical Sciences
Co-supervisor: Rachel Tunnicliffe, University of Bristol, School of Geographical Sciences
Co-supervisor: Alistair Manning, Met Office

Project Enquiries: matt.rigby@bristol.ac.uk

Webpage: https://mattrigby.blogs.bris.ac.uk

Project description:

Every country reports its greenhouse gas emissions, but only a handful test those reports against atmospheric measurements. A new generation of satellites now makes near-real-time global verification conceivable, transforming our ability to evaluate compliance with agreements such as the Global Methane Pledge. The obstacle is computational: interpreting these data requires atmospheric simulations too costly to run at scale.

Our team pioneered machine learning emulation of atmospheric dispersion, and our latest model runs thousands of times faster than the 3D simulators it replaces (https://doi.org/10.5194/gmd-19-1893-2026). You will develop it into an operational global inference system: designing surrogate architectures, quantifying uncertainty, coupling it to Bayesian inversion methods, and testing it against satellite methane and carbon dioxide data on Isambard-AI, one of the UK's largest AI supercomputers.

This is an environmental PhD in which you will spend most of your time building and using AI models. You will be trained on the job in machine learning (Santos-Rodriguez), Bayesian inference and atmospheric chemistry (Rigby, Ganesan), and science-to-policy translation (Manning, Met Office). You will leave with HPC, research software engineering and open science skills valued in academia and industry. We expect results publishable at machine learning venues as well as in the environmental literature.

As our CASE partner, the Met Office will meet with you weekly and host your internship, where you will work alongside the team that leads the UK's emissions verification programme. Few PhDs offer so direct a route into national and international reporting.

You will shape the research direction, deciding which algorithms to pursue, and which applications and extensions to open up. We will build your independence through regular mentoring.

We welcome applicants from physical sciences, computing or mathematics. No previous atmospheric science or machine learning experience is required. There is no laboratory or fieldwork, and the project is available full- or part-time.

CASE partner:

The Met Office will provide supervision and hosting an internship. They will provide £1K per year, travel and subsistence while working at the Met Office.

Useful recruitment links:

For information relating to the research project please contact the lead Supervisor via: matt.rigby@bristol.ac.uk

Bristol NERC GW4+ DTP Prospectus:
https://www.bristol.ac.uk/study/postgraduate/research/great-western-four-doctoral-training-partnership-nerc/

How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

The application deadline is Thursday 7 January 2027 at 2359 GMT