**PROJECT TITLE:** Estimating greenhouse gas emissions using the next generation of satellite observations  
DTP Research Theme(s): Changing Planet  
Lead Institution: University of Bristol  
Lead Supervisor: Dr. Anita Ganesan, University of Bristol, School of Geographical Sciences  
Co-Supervisor: Prof. Alistair Manning, Met Office, Hadley Centre  
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Project keywords: greenhouse gas, climate change, carbon dioxide, methane

**Simulation of methane concentration in the upper atmosphere using the MOZART model**

**Project Background**
Through the work in Bristol’s School of Geographical Sciences, Atmospheric Chemistry Research Group (ACRG) and the Met Office, the UK is world-leading in the estimation of greenhouse gas (GHG) emissions using atmospheric data. The next frontier in this field is the use of satellite data to learn new insights about the global carbon cycle and atmospheric methane budget. The recent launch of space-based instruments such as TROPOMI on ESA’s Sentinel 5-Precursor, or NASA’s Orbiting Carbon Observatory (OCO-2) are providing global carbon dioxide and methane data at a resolution orders of magnitude higher than previous systems. However, our current tools, which have been developed primarily for national in situ monitoring infrastructure (such as that in the ‘Detection and Attribution of Regional GHG emissions in the UK’ project), are ill-suited for estimating GHG fluxes from such enormous datasets. In this studentship, you will develop novel approaches for the estimation of GHG flux at urban through global scales to help us tackle some of the most pressing questions regarding the changing concentration of atmospheric GHGs.

**Project Aims and Methods**
Our team has shown that GHG emissions can be inferred at national scales from the previous generation of satellite observations, based on simulations of atmospheric gas transport using the Met Office NAME model and Bayesian methods (e.g. Ganesan, et al., 2017). However, the extension of current approaches to the new generation of satellite data are challenging due to the size of datasets involved. Here, we propose to use novel data science approaches to explore how to infer GHG fluxes from large atmospheric concentration datasets and use this information to tackle a range of pressing challenges, such as: a) what is driving the current rapid growth in atmospheric methane? b) how is the terrestrial carbon sink changing with time? c) are national GHG emissions reports reliable?

We have a wide range of ongoing GHG science projects using atmospheric data that span urban to global scales. The student will have flexibility to align their research with any of these projects, if desired.
Candidate Requirements
You should have a degree in physical sciences, mathematics or computer science and a strong desire to apply cutting edge computational and mathematical principles to environmental science. Experience in chemistry is not required, but a good foundation in mathematics is essential.

CASE or Collaborative Partner
This project is a CASE award with the Met Office Hadley Centre. The CASE partner will provide training on the use of the NAME model and demonstrate how observations and models are used in the UK’s National Inventory Report (making the UK one of only four countries to carry out such emissions evaluation). The student will have the opportunity to work with Met Office scientists for up to three months per year.

Training
In collaboration with the Met Office, you will be trained in atmospheric GHG measurements and modelling and Bayesian methods. Our team of post-docs and postgraduate students will train you in computational methods and you will co-develop novel machine learning approaches with them. There will be the opportunity to work with international collaborators, for example, at MIT, with whom exchange visits can be arranged, if desired. You will have the opportunity to participate in measurement site visits. You will be trained in cloud computing techniques that have been developed through the ACRG-led HUGS project. You will have the opportunity to participate in meetings with GHG scientists and policy makers at national and international conferences and meetings of projects such as DARE-UK or the UK DECC network.

References / Background reading list

Links:
http://www.bristol.ac.uk/chemistry/courses/postgraduate/
http://matrigby.blogs.bris.ac.uk
https://dareuk.blogs.bristol.ac.uk
http://www.hugs-cloud.com

NERC GW4+ DTP Website:
For more information about the NERC GW4+ DTP, please visit http://nercgw4plus.ac.uk/

Bristol NERC GW4+ DTP Prospectus:
http://www.bristol.ac.uk/study/postgraduate/2019/doctoral/phd-great-western-four-dtp/

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

The application deadline is 1600 hours GMT Monday 6 January 2020 and interviews will take place between 10 and 21 February 2020

General Enquiries:
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