PROJECT TITLE: Atmospheric measurements and modelling to support the Montreal Protocol and international climate agreements

DTP Research Theme(s): Changing Planet

Lead Institution: University of Bristol

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Project keywords: greenhouse gas, climate change, ozone depletion, CFCs

Figure 1. Met Office NAME model simulations of atmospheric transport.

Figure 2. Data from measurement sites in Korea (“Gosan”) and Japan (“Hateruma”) were used to identify new emissions of CFC-11 after 2013 (Rigby, et al., 2019).

Project Background

In papers published in Nature in 2018 and 2019 \([1,2]\), our team used atmospheric data to present evidence of a major violation of the Montreal Protocol, the universally ratified treaty designed to protect the stratospheric ozone layer; emissions of the potent ozone depleting substance, CFC-11, had increased since 2012, despite the global ban in 2010. Intense media coverage followed, and enforcement activities were initiated in China, where a substantial fraction of the new emissions were found to originate. Ultimately, it is hoped that these findings will prevent further delay to the recovery of the ozone layer, and the avoidance of greenhouse gas emissions equivalent to those of the whole of London. Here, we will develop global and regional atmospheric modelling tools to provide an “early warning system” for the detection of similar anomalous trends in the emissions of a wide range of greenhouse gases and ozone depleting substances covered by the Montreal Protocol and other international climate treaties.

Project Aims and Methods

The Atmospheric Chemistry Research Group (ACRG) is a key member of the international Advanced Global Atmospheric Gases Experiment (AGAGE). AGAGE measures over 50 greenhouse gases and ozone depleting substances covered by the Montreal and Kyoto Protocols. To infer emissions from the AGAGE data, models of atmospheric chemistry and transport are required (e.g., Figure 1). These inferred emissions are reported to the UK government, and are vital to international decision making on climate.

In this project, you will:

a) create new computationally efficient open-source modelling tools to infer global greenhouse gas emissions using observations from remote monitoring sites from AGAGE and other international networks, allowing us to understand how global emissions are changing

b) devise an operational regional emissions estimation framework using the Met Office NAME model and Bayesian methods to “pinpoint” major sources near measurement stations (e.g. Figure 2)

c) develop a cloud-based system for the efficient and open sharing of data, model output and code, thus ensuring transparent and rapid access to results by interested parties
Candidate Requirements
This project is an excellent opportunity to use your scientific, mathematical or computational skills to provide policy makers, scientists and the public with vital information on the emissions of greenhouse gases and ozone depleting substances. You should have a degree in physical sciences, mathematics or computer science. Experience in chemistry is not required. A good foundation in mathematics is essential. Experience in scientific computing is desirable.

Collaborative Partner
This project has been co-developed with the Met Office Hadley Centre. The Met Office supervisor will provide training on the NAME model and ensure close links to policy makers through the UK DECC network.

Training and international collaboration
In collaboration with the Met Office and our team of post-docs and postgrads, you will be trained in atmospheric measurements and modelling, Bayesian methods and high-performance computing. There will be the opportunity to work extensively with international AGAGE collaborators (e.g. MIT, Scripps Institution of Oceanography, CSIRO), with whom exchange visits can be arranged. You will have the opportunity to participate in AGAGE meetings and measurement site visits (e.g. to Mace Head, Ireland or Ragged Point, Barbados). With the Advanced Computing Research Centre, 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 scientists and policy makers at national and international conferences and meetings of ACRG-led projects such as DARE-UK or the UK DECC network.

References

Links:
http://www.bristol.ac.uk/chemistry/courses/postgraduate/
http://www.bristol.ac.uk/chemistry/research/acrg/
http://matttrigby.blogs.bris.ac.uk
https://agage.mit.edu
http://www.hugs-cloud.com
https://dareuk.blogs.bristol.ac.uk

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/2020/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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