80% by 2050: Using big data to monitor the UK's greenhouse gas emissions reduction programme

Supervisors

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Project description

In the Climate Change Act (2008), the UK government set out targets to cut greenhouse gas (GHG) emissions by 80% by 2050 (compared to 1990 levels). The way that this progress will be measured is through various "bottom-up" accounting measures (number of cars, emissions per car, etc.). However, these methods are known lead to significant uncertainties when aggregated to the national scale, and could even be subject to foul play (see, for example, the recent scandal involving Volkswagen's emissions testing).

To provide an independent test that a country is meeting its emissions reduction goals, we can now measure the concentrations of GHG in the atmosphere, and "work backwards" to infer sources. The UK is leading the way, with data from a variety of monitoring sites, planes, ships and satellites. To infer emissions from these data streams, we use computer models that can determine how GHG flow though the atmosphere after being emitted.

One major problem that we are now facing is that the volume of data available for this work is growing very rapidly, particularly with space-based instruments. The Orbiting Carbon Observatory-2 generates millions of carbon dioxide data points per year, and the ESA TROPOMI instrument is due to provide a similar leap in data availability for atmospheric methane when it launches in 2016.

To make full use of these instruments, we need to re-think our approach to modelling the atmosphere and analysing large datasets. There are numerous "big-data" methods and advanced computing architectures that could be exploited for this purpose, but have not yet been applied to this field. Specific areas where progress can be made are in massive parallelisation (e.g. using graphical processing), data reduction methods, and the development of efficient statistical techniques to quantify uncertainties. With its wealth of in situ data to complement the satellite datasets, the UK is an ideal place to develop these methods. However, advances made in this project will allow us to use space-based data to examine emissions from other areas, which don't yet have in situ monitoring programmes.

You will be working across disciplines with researchers in the atmospheric chemistry and computer science departments at the University of Bristol and the Met Office. No prior knowledge of either field is necessary,

although some experience with computer programming is essential.

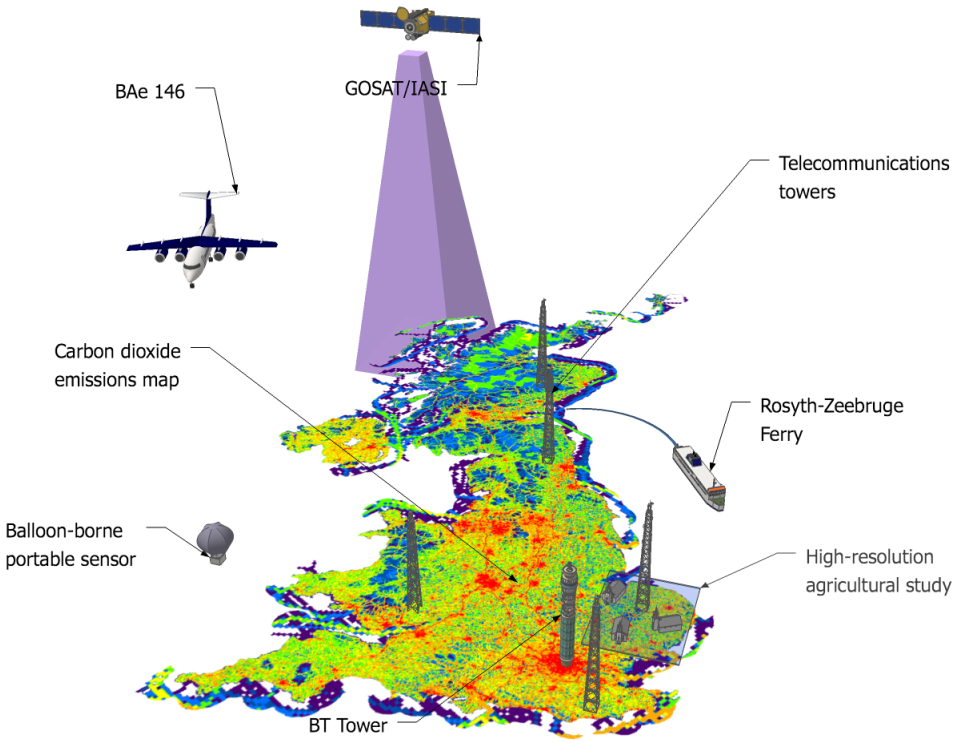

Figure: UK GHG monitoring platforms.