



Evaluating the contribution of regional emissions to atmospheric concentrations over the UK

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CO₂ is the largest contributor to the anthropogenic greenhouse warming of the Earth's surface. Climate treaties will need verification tools for CO₂ emission estimates - primarily those from fossil fuel emissions. Hence, the UK Natural Environment Research Council initiated the "gAs Uk and Global Emissions" (GAUGE) project, aimed at estimating and monitoring the UK's greenhouse gas emissions. GAUGE includes a comprehensive observational programme and a suite of forward and inverse atmospheric modelling tools. Observations include continuous records measured at 6 tall tower sites, regular north-south transects along the east coast of the UK using analysers mounted on ferries and dedicated flights using a BAe-146 aircraft.

One of our approaches to estimate CO₂ fluxes is based on an analysis of large CO₂ deviations from a background baseline using the continuous tower records and the background record from Mace Head, with the deviations being interpreted as signals caused by the UK sources and sinks. First, we will here analyse to what extent the towers record similar / different signals. We will then use tagged tracer simulations with the TOMCAT atmospheric chemistry and transport model to analyse to what extent and under which synoptic the deviations from a background baseline can indeed be attributed to sources and sinks located in the UK. Based on our results we will evaluate this flux estimation approach and make suggestions under which conditions the approach is feasible. Depending on the results of the study we will also propose a simple column budgeting technique to estimate GHG fluxes for the UK using the continuous tower records.