



## First data from GEMINI-UK, the UK national network of ground-based greenhouse gas observing spectrometers

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Over the past year, the National Centre for Earth Observation have been working to establish the Greenhouse gas Emissions Monitoring network to Inform Net-zero Initiatives for the UK (GEMINI-UK), a key part of the UK Greenhouse gas Emissions Measurement Modelling Advancement (GEMMA) programme. The GEMINI-UK network comprises ten Bruker EM27/SUN shortwave infrared spectrometers, and has been designed to help quantify regional net greenhouse gas (GHG) emissions across the UK, complementary to *in situ* air sampling measurements collected by the existing tall tower network. Taken together with inverse modelling efforts, these data will form the backbone of a pre-operational GHG emissions monitoring framework for the UK.

The GEMINI-UK instruments observe column concentrations of carbon dioxide, methane, and carbon monoxide in cloud-free conditions, which we use in to constrain regional flux estimates of these gases by way of Bayesian inverse methods. Using a dataset of simulated measurements based on the GEOS-Chem atmospheric chemistry and transport model, we have designed the measurement network to deliver the biggest error reductions in carbon dioxide flux estimates. We are also working closely with the GEMINI-UK host partners, including UK universities, schools, and NERC facilities, with the goal of promoting the open access and transparency of the collected data. Continuous and autonomous operation of the EM27/SUNs is made possible at each site by using an automated weatherproof enclosure, based on a design developed by University of Edinburgh researchers, which previously enabled year-round measurements to be collected during the UK DARE-UK experiment in central London. In this presentation we describe the first data, current status, and longer-term goals of GEMINI-UK, including an ongoing evaluation of the GEMINI-UK EM27/SUN that operates alongside a higher specification TCCON spectrometer at the Rutherford Appleton Laboratory in Harwell, Oxfordshire.