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Greenhouse gas fluxes for the UK and Ireland using aircraft sampling during the GAUGE project

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As part of the GAUGE campaign (Greenhouse gAs UK and Global Emissions) the UK's FAAM (Facility for Airborne Atmospheric Measurement) aircraft was deployed to measure atmospheric composition around the UK and Ireland. Overall 15 flights were flown during the summers of 2014 and 2015; here we focus on a case study from two of these flights conducted upwind and downwind of the UK mainland on a single day in May 2015. During these two flights the prevailing meteorology brought maritime air from the Atlantic Ocean across the region, providing an upwind background conducive to the calculation of bulk regional greenhouse gas fluxes.
We employ the NAME (Numerical Atmospheric dispersion Modelling Environment) dispersion model to generate air history maps for discrete sampling segments of the flight tracks. These are convolved with spatially disaggregated fluxes from bottom-up emission inventories to produce a modelled time series of concentration enhancements along the sampling path of the aircraft. By comparing modelled concentration enhancements to the measured time series it is possible to assess the overall inventory performance, and by looking at the scale factor between measured and modelled enhancements we can estimate the weighted greenhouse gas fluxes over the sample footprint. We also assess the sampling strategy used during these flights, and provide recommendations for future studies using this technique.