

## **Assessing the British Isles CH<sub>4</sub> flux using aircraft and ground-based sampling: a case study on 12 May 2015**

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Aircraft and ground-based sampling of atmospheric greenhouse gas composition over the British Isles was conducted between 2014 and 2016 as part of the Greenhouse gAs UK and Global Emissions (GAUGE) project. We report a case study focussing on two research aircraft flights conducted on 12 May 2015 to sample inflow and outflow across the British Isles. We have employed the NAME Lagrangian dispersion model to simulate CH<sub>4</sub> mole fraction enhancements corresponding to aircraft and ground-based sample times and locations, using CH<sub>4</sub> surface fluxes derived from a composite flux inventory, which included both anthropogenic and natural sources. For each sampling location, variations in the baseline CH<sub>4</sub> mole fraction were derived using the MOZART global chemical transport model, and added to the NAME enhancements to produce a dataset of modelled CH<sub>4</sub> mole fractions which can be compared to the measurements.

Using a multiple variable regression technique, we derive CH<sub>4</sub> fluxes for the British Isles region from both aircraft and ground-based datasets. We discuss the applicability of our approach for both datasets, and conclude that in this case the assumptions inherent in our method are much better satisfied for the aircraft data than for the ground-based data. Using the aircraft data we derive a possible range of scale factors for the prior inventory flux of 0.53 – 0.97, with a central estimate of 0.82 based on our assessment of the most likely apportionment of model uncertainty. This leads to a posterior estimate of the British Isles CH<sub>4</sub> flux of 67 kg s<sup>-1</sup> – 121 kg s<sup>-1</sup>, with a central value of 103 kg s<sup>-1</sup>.