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High-resolution methane emission estimates using surface measurements and the InTEM inversion system.

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High quality GHG emission estimates will be required to successfully tackle climate change. There is a growing need for comparisons between emission estimates produced using bottom-up and top-down techniques at high spatial resolution. Here, a top-down inversion approach combining multi-year atmospheric measurements and an inversion model, InTEM, was used to estimate methane emissions for a region in the South East of the UK ($\sim$100 x 150 km). We present results covering a 2-year period (July 2012 - July 2014) in which atmospheric methane concentrations were recorded at 1 - 2 minute time-steps at four locations within the region of interest. Precise measurements were obtained using gas chromatography with flame ionisation detection (GC-FID) for all sites except one, which used a PICARRO Cavity Ring-Down Spectrometer (CRDS). These observations, along with the UK Met Office's Lagrangian particle dispersion model, NAME, were used within InTEM to produce the methane emission fields. We present results from both Bayesian and non-prior based inversion analysis at varying spatial resolutions, for annual, seasonal and monthly time frames. These results are compared with the UK National Atmospheric Emissions Inventory (NAEI) which is compiled using bottom-up methods and available at 1x1 km resolution. A thorough assessment of uncertainty is incorporated into this technique which is represented in the results. This project is part of the UK GAUGE campaign which aims to produce robust estimates of the UK GHG budget using new and existing measurement networks (e.g. the UK DECC GHG network) and modelling activities at a range of scales.