



Mobile mapping of methane emissions and isoscapes

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Methane (CH_4) is a potent greenhouse gas emitted from a variety of natural and anthropogenic sources. It is crucial to accurately and efficiently detect CH_4 emissions and identify their sources to improve our understanding of changing emission patterns as well as to identify ways to curtail their release into the atmosphere. However, using established methods this can be challenging as well as time and resource intensive due to the temporal and spatial heterogeneity of many sources. To address this problem, we have developed a vehicle mounted mobile system that combines high precision CH_4 measurements with isotopic mapping and dual isotope source characterisation. We here present details of the development and testing of a unique system for the detection and isotopic analysis of CH_4 plumes built around a Picarro isotopic ($^{13}\text{C}/^{12}\text{C}$) gas analyser and a high precision Los Gatos greenhouse gas analyser. Combined with micrometeorological measurements and a mechanism for collecting discrete samples for high precision dual isotope ($^{13}\text{C}/^{12}\text{C}$, $^2\text{H}/^1\text{H}$) analysis the system enables mapping of concentrations as well as directional and isotope based source verification.

We then present findings from our mobile methane surveys around the North West of England. This area includes a variety of natural and anthropogenic methane sources within a relatively small geographical area, including live-stock farming, urban and industrial gas infrastructure, landfills and waste water treatment facilities, and wetlands. We show that the system was successfully able to locate leaks from natural gas infrastructure and emissions from agricultural activities and to distinguish isotope signatures from these sources.