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Mapping Methane and Carbon Dioxide Concentrations and $\delta^{13}C$ Values in the Atmosphere of Two Australian Coal Seam Gas Fields

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Abstract

Fugitive greenhouse gas emissions from unconventional gas extraction processes (e.g. shale gas, tight gas and coal bed methane/coal seam gas) are poorly understood due in part to the extensive area over which these emissions may occur. We apply a rapid qualitative approach for source assessment at the scale of a large gas field. A mobile cavity ring down spectrometer (Picarro G2201-*i*) was used to provide real-time, high-precision methane and carbon dioxide concentration and carbon isotope ratios ($\delta^{13}C$), allowing for "on the fly" decision making and therefore an efficient and dynamic surveying approach. The system was used to map the atmosphere of a production coal seam gas (CSG) field (Tara region, Australia), an area containing pre-production "exploration" CSG wells (Casino, Australia), and various other potential CO_2 and CH_4 sources (i.e. wetlands, sewage treatment plants, landfills, urban areas and bushfires). Results showed a widespread enrichment of both CH_4 (up to 6.89 ppm) and CO_2 (up to 541 ppm) within the production gas field, compared to outside. The CH_4 and CO_2 $\delta^{13}C$ source values showed distinct differences within and outside the production field, indicating a CH_4 source within the production field that has a $\delta^{13}C$ signature comparable to the regional CSG. While this study demonstrates how the method can be used to qualitatively assess the location and source of emissions, integration with atmospheric models may allow for quantitative assessment of emissions. The distinct patterns observed within the CSG field demonstrates the need to fully quantify the atmospheric flux of natural and anthropogenic, point and diffuse sources of greenhouse gases from individual Australian gas fields before and after production commences.

Keywords

Methane Carbon dioxide Cavity ring down spectroscopy Natural gas Coal seam gas Greenhouse gas Fugitive emissions

Notes

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