Geophysical Research Abstracts
Vol. 21, EGU2019-14892, 2019
EGU General Assembly 2019

Characterising methane emissions from North Sea gas production using δ13C in CH4 and C2H6:CH4 ratios

Max Coleman, Rebecca Fisher, Dave Lowry, James France, Mathias Lanoiselle, and Julianne Fernandez
Royal Holloway University of London, Earth Sciences, United Kingdom (max.coleman.2015@live.rhul.ac.uk)

Natural gas is regarded as a cleaner alternative to other fossil fuels with respect to pollution and carbon dioxide (CO_2) emissions when burned as fuel. Methane (CH4) is a potent greenhouse gas however and can escape during natural gas production and transmission. It is therefore vital to quantify fugitive CH4 emissions from natural gas production and transmission when assessing its contribution to climate change. Identifying and distinguishing emission sources is an important step in quantifying emissions, with δ13C in CH4, ethane:methane (C2H6:CH4) and CH4:CO_2 ratios being well used as signatures for this. Principally, these signatures enable fugitive natural gas emissions to be distinguished from other CH4 sources in aircraft and ground sampling. Studying these signatures also has potential utility in identifying specific emission processes (e.g. flaring vs leaking gas) and further characterising specific sources (e.g. maturity or depth of gas source).

As part of the United Nations Climate and Clean Air Coalition (UN CCAC) international methane studies, a five-day aircraft campaign was conducted over gas rigs in the southern North Sea in April 2018, with a further four-day campaign scheduled for April/May 2019. Flights are conducted using the British Antarctic Survey (BAS) Twin Otter aircraft. C2H6, CH4 and CO_2 mole fractions are measured continuously during flights using cavity enhanced spectroscopy. Whole air samples are collected in flasks and bags when flying through emission plumes at low altitude and analysed in the laboratory for δ13C in CH4 using high precision CF-GC-IRMS. Emissions from a few rigs have been identified from the April 2018 campaign, with enriched δ13C in CH4 signatures or elevated C2H6 measured from the CH4 plumes, indicating the rigs as sources. Targeted sampling in the April/May 2019 flight campaign should enable testing of the temporal consistency of the emissions and their δ13C in CH4 and C2H6:CH4 signatures, and aid investigation of the relationship between these signatures, and infrastructure and gas source characteristics.

Two ground surveys have also been conducted around each of three gas terminals on the UK's east coast. Surveys were conducted by car and on foot, again using cavity enhanced spectroscopy for continuous in situ C2H6, CH4 and CO_2 mole fraction measurement, and whole air sample collection in bags for laboratory analysis of δ13C in CH4. Differences in excess CH4 from terminals have been detected. δ13C in CH4 and C2H6:CH4 signatures of gas terminal emissions have been compared with those for gas rigs sampled during the aircraft campaigns, and additionally, with signatures from UK gas distribution network leaks.