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Assessing the fugitive emission of CH4 via migration along fault zones – comparing shale basins to non-shale basins

Ian Boothroyd (1), Sam Almond (2), Fred Worrall (1), and Richard Davies (2)

(1) Durham University, Eath Sciences, Earth Sciences, Durham, United Kingdom (i.m.boothroyd@durham.ac.uk), (2) (2) Newcastle University, School of Civil Engineering & Geosciences, Newcastle, United Kingdom

Fault zones and fracture networks have the potential to act as conduits for fluid flow and gas migration to groundwater aquifers and the surface, where fugitive emissions of greenhouse gases to the atmosphere can take place. It is important to understand the extent to which fault zones enhance fluid flow from hydrocarbon basins to the surface when considering the possible impacts of hydraulic fracturing in shale gas basins on the environment.
This study compares methane (CH4) concentrations across five fault systems in the UK using real-time mobile monitoring techniques. A Picarro Surveyor cavity-ring-down spectrometer was used to measure concentrations of CH4 and δ13C-CH4 to allow identification of thermogenic and biogenic CH4 sources. The study was conducted along faulted and non-faulted control routes in two shale gas basins, two coal basins and a non-hydrocarbon control basin.
Analysis of variance indicated that fault routes had higher concentrations of CH4 than non-faulted control routes, while differences between basins explained the most variation in CH4 concentration. Binary logistic regression highlighted the impact of elevated concentrations of CH4 from landfill sites and agricultural areas, but was not sensitive enough to detect differences between fault and control routes. The average flux of faults over and above that expected from the background was 0.27 $\pm$ 0.14 kgCH4/km of fault/day or 0.1 $\pm$ 0.05 tonnes CH4/km of fault/yr), however, this flux is concentrated onto certain locations on certain faults and it is not known what length of faults across the UK we should consider.