Geochemical and Isotopic Analysis of Escaped Natural Gases in Hydraulically Fractured and non-Fractured sites in Cumberland Forest, Tennessee

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Methane (CH_4) in the atmosphere accounts for 18% of the climate warming attributed to greenhouse gases. The rapid growth in high volume hydraulic fracturing (HVHF) technologies to procure natural gas raises concern for possible fugitive methane leaks. We measure the flux and carbon isotope composition of methane emitted from the soil into the atmosphere at two geologically similar sites in eastern Tennessee (Morgan Co.), one with HVHF ongoing and the other currently undeveloped. Our objective is to quantify potential non-point source emissions of microbial and thermogenic methane, which are principally distinguished by their $\delta^{13}C$ signatures.

Using cavity ring down spectroscopy (Picarro G2201-i) we collect rapid (~1 Hz) real-time measurements of methane emissions. The Picarro can measure fluxes of CH_4 and CO_2 at discrete locations by measuring their concentrations within a static and closed chamber that allows the gases to accumulate over time. Additionally, the mobility of the Picarro instrument permits the continuous collection of data, enabling broad spatial coverage. Applying geostatistical techniques to these data can highlight heterogeneities in the emissions of methane. Trends of where, how much, and what type of methane is escaping from the soil in environments with and without HVHF activities illustrate how to compare and contrast points as well as areas to assess the impact of this extensively implemented method of fossil fuel development.