Characterizing and Comparing Anthropogenic CH_4 Sources in the DJ Basin using Mobile Surveys

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Vehicle-based atmospheric surveys must be able to distinguish between source types in complex multi-use landscapes, and must also be sensitive to spatiotemporal changes in the ambient concentrations of naturally occurring gases. We performed 3,700 km of vehicle-based surveys with a Picarro Surveyor CRDS in the Denver-Julesburg (DJ) Basin during the summer of 2014 to compare emissions from different methane sources. During these surveys, we collected more than 500,000 geo-located multi-gas (carbon dioxide [CO_2], methane [CH_4], water vapor [H_2O], delta 13-methane [$\delta^{13}CH_4$]) measurements. We used super-ambient ratios of CO_2:CH_4 to detect CH_4 plumes and geospatial analysis to attribute the emissions to potential known sources. Based on wind direction and a threshold distance of 300 m, a total of 784 known infrastructure units were sampled on more than one occasion. Of the 2,524 CH_4-rich plumes (eCO_2:eCH_4 < 100), 954 (38%) were attributed to known local sources within 300 m of roadside. Though composting facilities and gas processing plants had the highest emission frequencies (25% and 20%, respectively), concentrated animal feeding operations and oil and gas wells accounted for 95% of emission sources (2% and 93%, respectively). These data are used to characterize the geochemical signature associated with each source type, as well as to compare emission rates to existing inventories. These data can ideally be used to inform policy and practice aimed at curbing greenhouse gas emissions and improving local air quality.

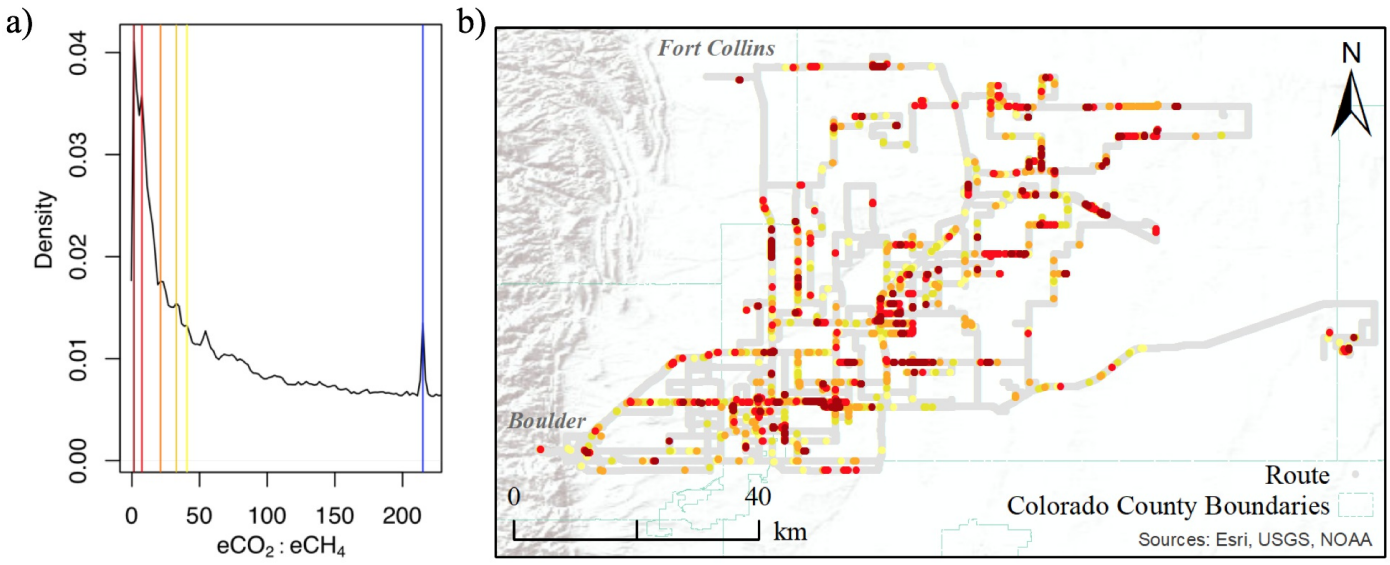

Figure 1. a) A density plot of the ratio of excess CO_2 to excess CH_4 reveals the most common CH_4-rich geochemical signatures observed during the survey campaign. The ambient ratio of excess CO_2 to excess CH_4 is marked by the minor isolated peak and blue line at 215. **b)** Locations of the CH_4-rich geochemical ratios marked on the previous plot are layered to form a heat map of CH_4 emissions.