Methane Source Attribution in the DJ Basin using Mobile Surveys and Computational Analytics

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Initiatives aimed at curbing the impacts of climate change by reducing CH_4 emissions require detection and attribution techniques capable of distinguishing between various types of sources, particularly in atmospherically complex multi-use landscapes such as the Denver-Julesburg (DJ) Basin in Colorado. This research applies Emissions Attribution using Computational Techniques (ExACT), proven successful in Canadian oil and gas settings, to Picarro Surveyor high-precision gas data collected in the DJ Basin through the summer of 2014. Throughout the mobile surveys, more than 350,000 geo-located multi-gas (CH_4, CO_2) measurements were recorded at 1 Hz frequency. ExACT uses super-ambient ratios of CO_2:CH_4 and geospatial analysis to distinguish point-source emissions from naturally variable background CH_4 concentrations, and attributes these emissions to potential known sources. Based on wind direction and a cut-off distance of 300 m from potential emission sources, 943 wellpads, 34 gas processing facilities, and 23 Concentrated Animal Feeding Operations (CAFOs) were sampled along the survey routes. Wellpads and gas processing facilities related to oil and gas operations had emission frequencies of 31% and 44%, respectively. CAFOs were associated with emissions 48% of the times they were sampled. Based on the high density of oil and gas infrastructure in the area, and relative similarities in CH_4 concentration distributions among the three main sources, oil and gas infrastructure emerged as the primary source of anthropogenic CH_4 emissions in the roughly 40-by-40 mi^2 study area. Emissions frequency varied significantly by operator, suggesting differences in the effectiveness of emissions mitigation practices. Knowledge of trends among emission sources can ideally be used to inform policy or regulation aimed at curbing GHG emissions and improving local air quality.

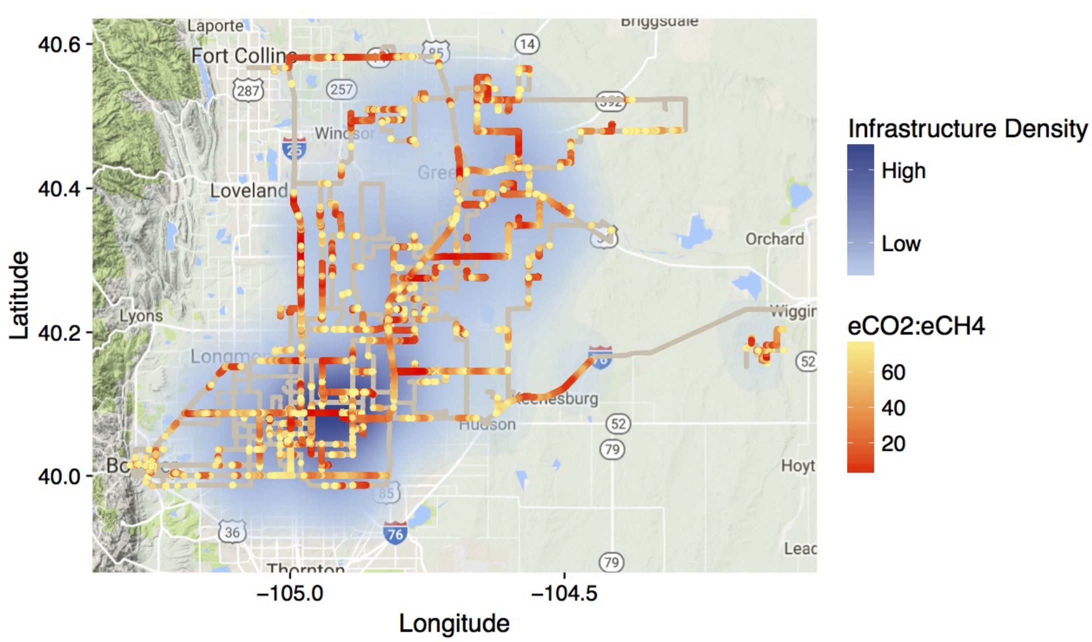

Figure 1. Location of CH_4-rich plumes defined by values of super-ambient CO_2:CH_4. Lower values correspond to more CH_4-rich signatures (red). Infrastructure density (blue) represents the locations of sampled oil and gas wellpads and facilities, and CAFOs.