

Separation of Methane Emissions from Biogenic Sources and Natural Gas Based on CH_4 , C_2H_6 and NH_3 Column Observations in the Colorado Front Range

N. Kille¹, R. Chiu¹, M. Frey², F. Hase², M. Sha², T. Blumenstock² and R. Volkamer³

¹Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309; 303-735-2235, E-mail: natalie.kille@colorado.edu

²Institute for Meteorology and Climate Research, Karlsruhe Institute of Technology, Campus Alpin, Karlsruhe, Germany

³University of Colorado, Department of Chemistry and Biochemistry, Boulder, CO 80309

Methane (CH_4) in the Northern Colorado Front Range is emitted from biogenic sources such as concentrated animal feeding operations (CAFOs) and natural gas production and storage. In March 2015 we deployed a network of five Fourier Transform Spectrometers (FTS) to characterize the regional-scale CH_4 dome in the Colorado Front Range based on vertical column measurements. Three EM27sun FTS measured CH_4 , oxygen (O_2) and water vapor columns at Eaton, CO, inside the dome and at two boundary sites; University of Colorado mobile Solar Occultation Flux measured ethane (C_2H_6), ammonia (NH_3), and H_2O at Eaton, CO, and a NCAR high-resolution FTS measured all gases at Boulder, CO. The column averaged dry air mole fractions $X\text{CH}_4$, $X\text{C}_2\text{H}_6$, and $X\text{NH}_3$ were determined using O_2 columns for air mass factor normalization, and background column was subtracted to derive column enhancements over background, $dX\text{CH}_4$, $dX\text{C}_2\text{H}_6$, $dX\text{NH}_3$ at Eaton, CO. Eaton is located both near CAFOs and at the northern edge of oil and natural gas production wells of the Denver-Julesburg Basin. Our approach for source apportioning methane employs a linear regression analysis that explains $dX\text{CH}_4$ in terms of $dX\text{C}_2\text{H}_6$ as tracer for natural gas sources, and $dX\text{NH}_3$ as tracer for CAFO emissions.

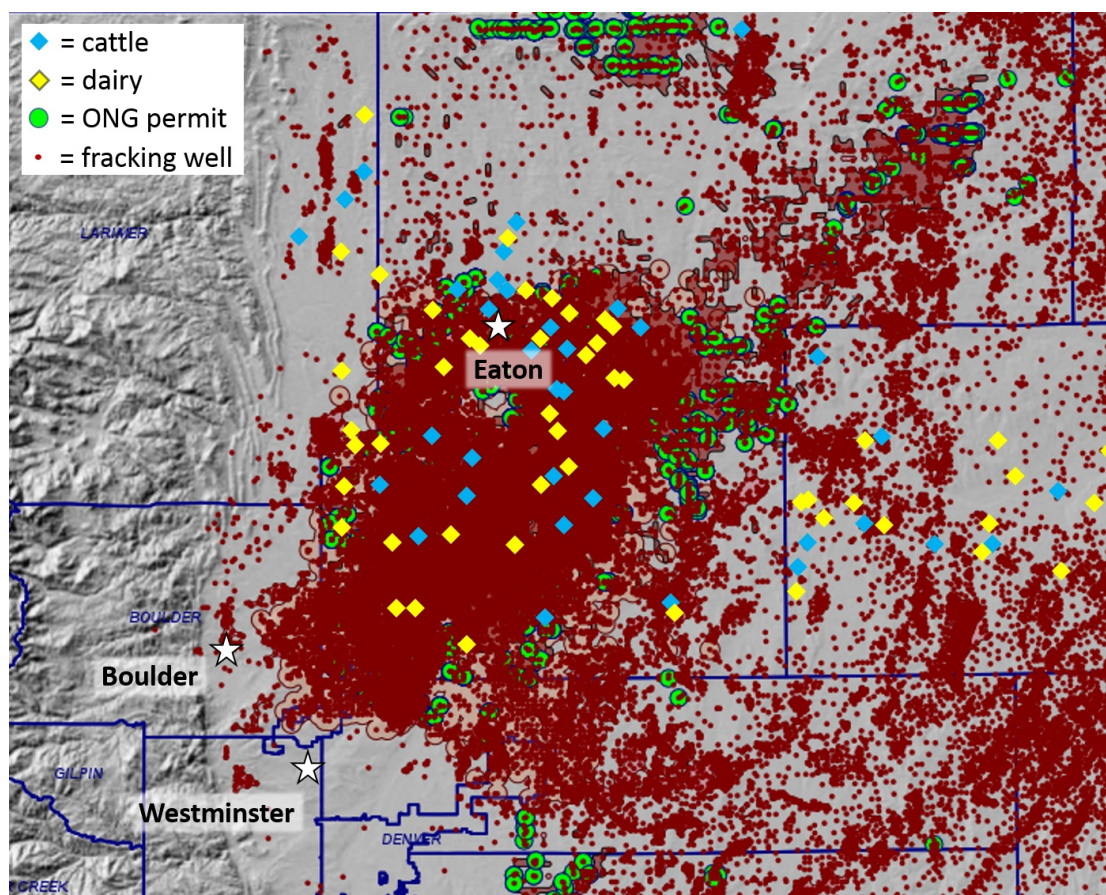


Figure 1. Map showing the measurement sites Eaton, Boulder, and Westminster, as well as CAFO and fracking locations.