EEMDL
Energy Emissions Modeling and Data Lab

ACS Fall Meeting 2024
Sci-Mix

COLORADO SCHOOL OF MINES

Title: Estimating methane emission durations using continuous monitoring systems

ABSTRACT

Updates to the EPA's Greenhouse Gas Reporting Program Subpart W will come into effect in January 2025, which include a requirement to report all "maintenance or abnormal emission events" greater than 100 kg/hr. Estimating the duration of these emissions is critical for accurate reporting, as the total emitted mass of methane is highly influenced by the length of the emissions. Infrequent sampling campaigns can roughly bound emission duration, but the fidelity of the duration estimates are limited by the sampling frequency. Continuous monitoring systems (CMS), on the other hand, measure methane concentrations in near-real time and hence provide a promising avenue for more robust, measurement-informed emission duration estimates. Here we present a method for creating duration estimates using CMS data. Our proposed method uses a gradient-based spike detection algorithm to cluster enhancements in the concentration time series into events and quantifies uncertainty by assessing the information content of the underlying concentration data as a function of wind direction.

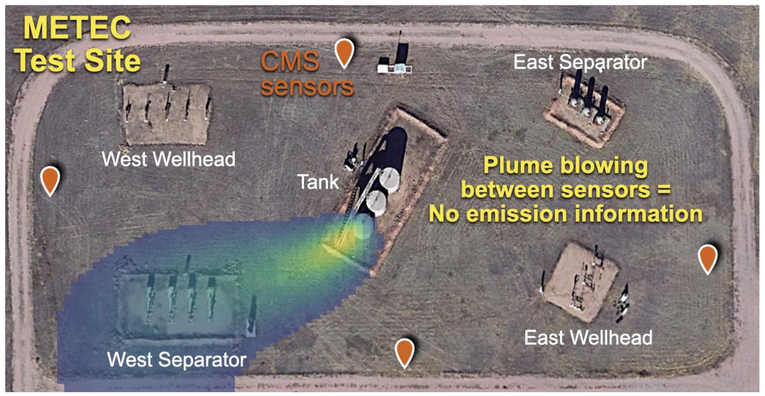
William Daniels
Applied Mathematics and Statistics
Colorado School of Mines
wdaniels@mines.edu

Dr. Dorit Hammerling
Associate Professor
Applied Mathematics and Statistics
Colorado School of Mines

1. Motivation

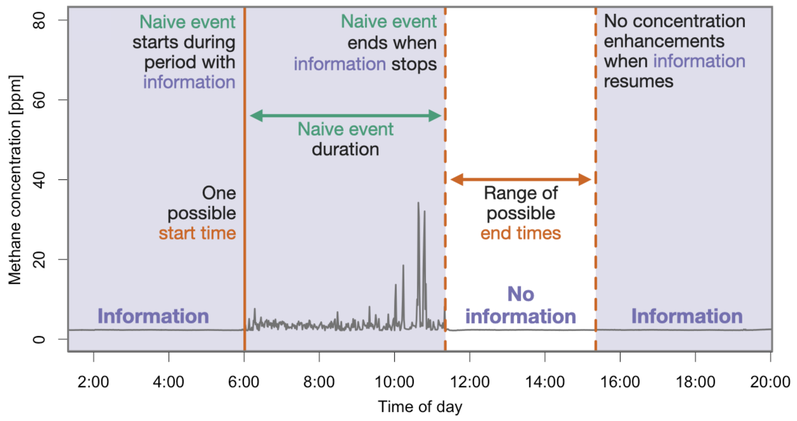
- Updates to the EPA's GHGRP Subpart W come into effect in January 2025, including a requirement to report all detected emission events > 100 kg/hr.
- Estimating the duration of these events is critical, as the total emitted mass of methane is highly influenced by the length of the emission.
- Infrequent sampling campaigns can roughly bound duration, but the fidelity of the duration estimate is limited by the sampling frequency.

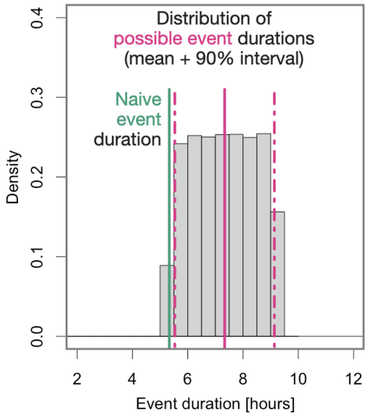
2. Background



- Continuous monitoring systems (CMS) measure methane concentrations in near real time and can complement snapshot measurements.
- However, gaps in information can make it appear that emissions start late or end early.

3. Methods





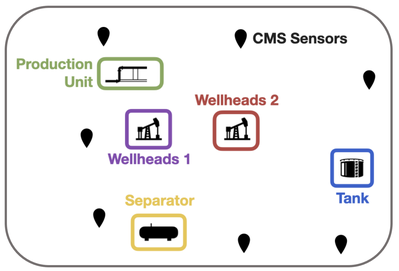
- Use atmospheric dispersion model to identify periods of information and no information.
- Account for gaps in information when sampling emission start and end times.
- Assign a probability of combining events that are separated by periods of no information.

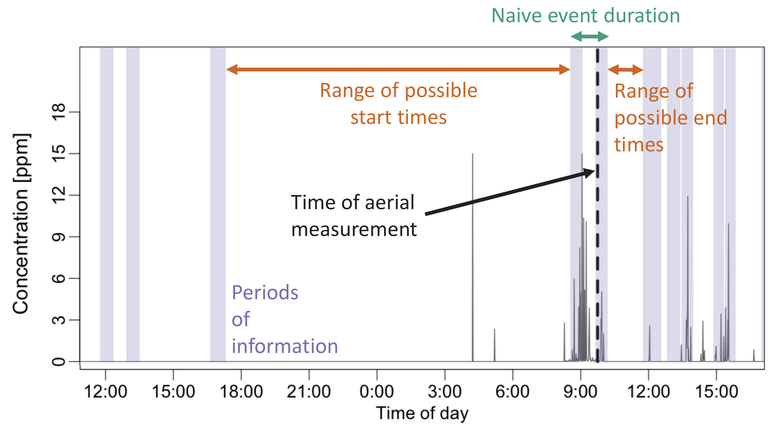
5. Conclusions

1. CMS can complement snapshot measurement techniques by bounding emission durations.
2. Accurate duration estimates from CMS require a method for addressing non-detect times.

4. Results

- Duration model evaluated on controlled releases. Slight tendency to underestimate (bias of -5%), with 87% of estimates within a factor of 2x error.
- Case study: Snapshot measurement of 9.6 kg/hr from the tanks. Can we use CMS data to bound the duration of this measurement?





9.6 kg/hr	X	naive duration: 1.78 hours mean of possible durations: 10.2 hours max of possible durations: 18.8 hours	=	17.1 kg 97.9 kg 180.5 kg
9.6 kg/hr	X	time since previous aerial survey: 3 months	=	21,024 kg
Detected emission rate		Potential duration estimates		Total emitted methane

Colorado State University

The University of Texas at Austin
Cockrell School of Engineering