

Ethan Rimelman

M.S. Student in the Department of Systems Engineering at Colorado State University

Current Project Summary: Colorado Ongoing Basins Emissions Study (COBE)

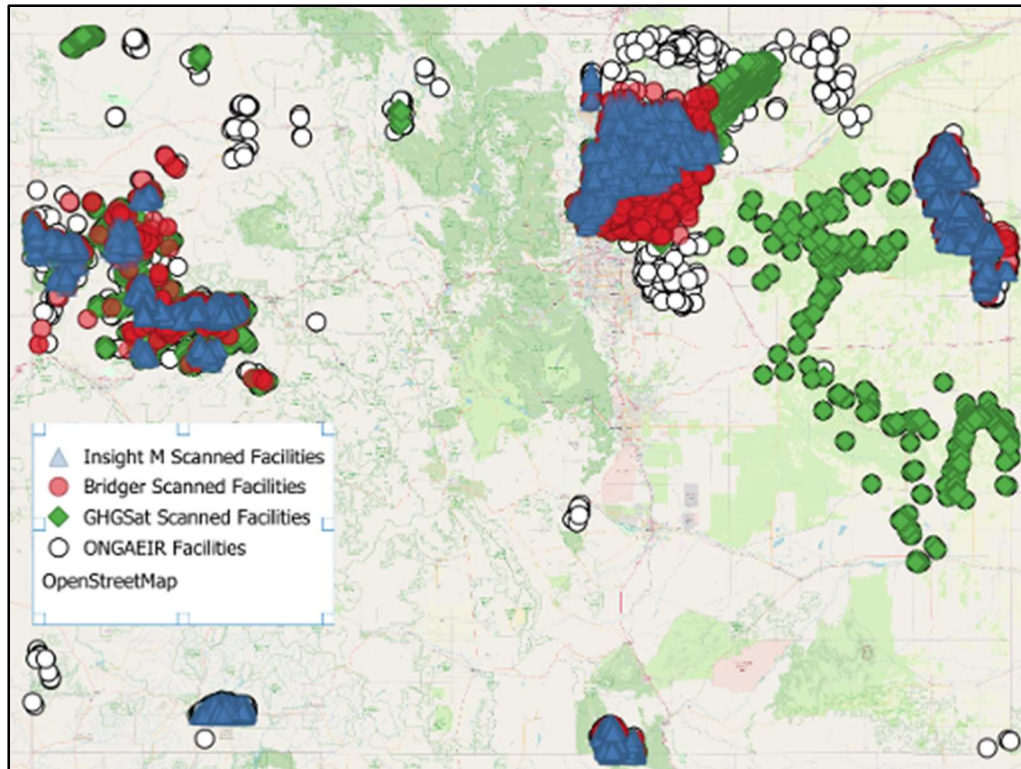


Figure 1: Aerial campaigns from three instrument companies (Insight M- blue, Bridger Photonics - red, GHGSat- green) cover a subset of the roughly 11,000 oil/gas development sites in the Colorado ONGAEIR (Oil and Natural Gas Annual Emission Inventory Reporting) database.

Uncertainty of methane emission estimates from oil and gas developments pose a significant challenge to air quality monitoring and control efforts within Colorado oil and gas basins. Operators of upstream and midstream facilities currently report greenhouse gas emissions, including methane, to the Oil and Natural Gas Annual Emission Inventory Reporting (ONGAEIR) program, as overseen by the Colorado Department of Public Health and Environment (CDPHE). Greenhouse gas emissions are organized in a database that represents an inventory, or bottom up estimate of emissions throughout Colorado.

In 2023, the Colorado Air Quality Control Commission adopted its Greenhouse Gas (GHG) Intensity Verification Rule, which defines intensity as the ratio of facility GHG emissions to oil and gas production volume^[1]. The Colorado Ongoing Basin Emissions (COBE) study aids in the development of intensity factor calculation by reconciling emissions reported to ONGAIER to emissions detected through basin-wide aerial measurement campaigns. What is described here is a measurement informed inventory (MII), a model that combines bottom-up estimation with overlapping instrument recorded data. By partnering with CDPHE and participating aerial instrument companies that detect methane at the equipment to facility scale, CSU's role is to anonymize and process a series of measurement campaigns done across a subset of production facilities in Colorado and then incorporate findings into our existing MII, the Mechanistic Air Emissions Simulator (MAES)^[2]. This manifests as a continuously (annual resurvey) updated profile of emissions from upstream oil and gas activity in Colorado.

Research Progress

Aircraft measurement surveys have concluded and data from each campaign is currently being incorporated in the model. This involves checking data quality and then categorizing emission sources as reported or unreported. CSU is currently working to prepare and run equipment-level simulations that combine the ONGAIER operator-reported inventory with the aerial plume detections, which can then be compared to the ONGAIER inventory alone.

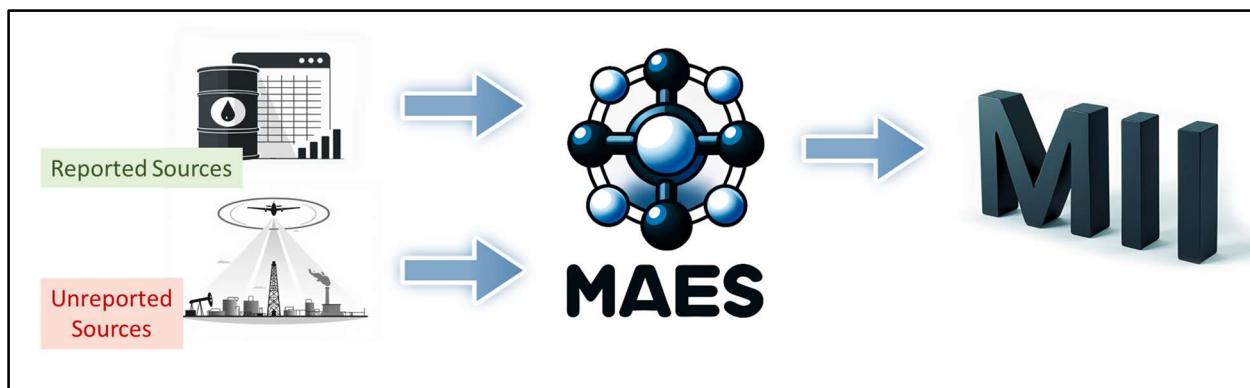


Figure 2: Simplified COBE data pipeline. MAES: Mechanistic Air Emissions Simulator, a discrete event simulator tool that predicts emissions. Specific simulations are run and compared to aerial campaign data to identify model improvements.

To accurately construct an inventory, an ‘activity basis’ must be established for all emitters that are modelled. This is done with respect to what quantitative emission data is available and presents a complex problem of deciding which equipment types are within modelling scope. The activity basis consists of frequency and number of emitting instances, which relies on operator equipment reporting. One way in which aerial measurements can benefit the MII is by correcting inconsistencies in site equipment counts, if the aerial measurement includes data on identified equipment counts. Using data from aerial overflights that report on equipment counts and a GIS tool designed to identify equipment layouts, instances of clear misreporting/implausible are amended from the inventory. Developing a workflow for cleaning, combining, and preparing data from each of these sources is an ongoing part of this project. This serves to build a more representative MII, as well as providing recommendations to CDPHE for updating the upstream reporting system.

More information about the COBE project is available at:

<https://metec.colostate.edu/colorado-ongoing-basin-emissions-cobe/>

References

[1]: *Colorado adopts first-of-its-kind measures to verify greenhouse gas emissions from certain oil and gas sites*. Colorado Department of Public Health and Environment.

<https://cdphe.colorado.gov/press-release/colorado-adopts-first-of-its-kind-measures-to-verify-greenhouse-gas-emissions-from>

[2]: Zimmerle, D., Duggan, G., Vaughn, T., Bell, C., Lute, C., Bennett, K., Kimura, Y., Cardoso-Saldaña, F. J., & Allen, D. T. (2022). Modeling air emissions from complex facilities at detailed temporal and spatial resolution: The Methane Emission Estimation Tool (meet). *Science of The Total Environment*, 824, 153653. <https://doi.org/10.1016/j.scitotenv.2022.153653>