New approach improves identification of natural-gas emitters

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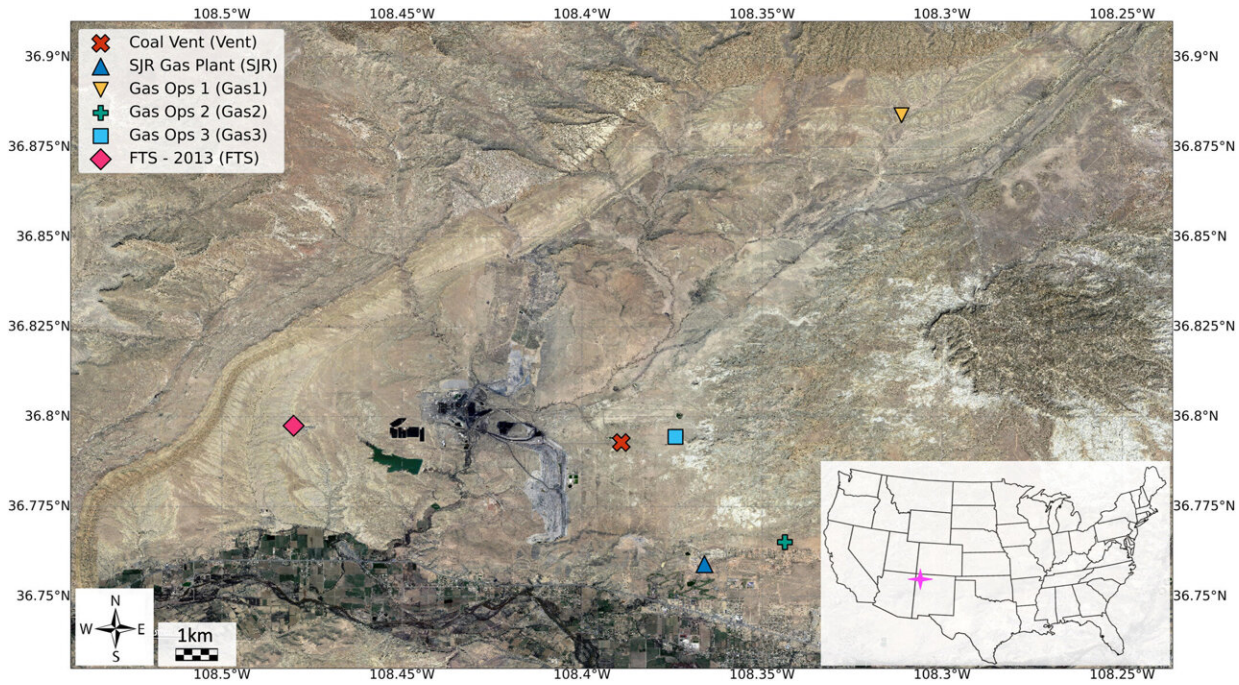

Map showing the San Juan, NM region containing a large coal mine. Known methane emission sources sampled during 2020/2021 mobile surveys and the location of the fourier transform spectrometer instrument are identified. *Journal of Geophysical Research: Atmospheres* (2022). DOI: 10.1029/2022JD037092

A new study in New Mexico's San Juan Basin will boost efforts to identify and reduce methane emissions, a key element of the Global Methane Pledge. The research team found that using multiple methods

to measure the ratio of ethane to methane in the ambient air around fossil energy development regions can be used to attribute emissions to specific polluters.

"We were able to show that individual sources of methane from coal, oil and gas, and fossil fuel infrastructure in New Mexico's San Juan Basin have different ethane-to-methane ratios that can be detected at various scales, allowing us to differentiate among them," said Aaron Meyer, a graduate student researcher at Los Alamos National Laboratory and lead author of a paper on the research published in the *Journal of Geophysical Research: Atmospheres*.

Meyer said the results bring an important new capability for attributing natural gas leaks with greater fidelity, which can help nations meet the Global Methane Pledge, signed by the United States, the European Union and about 100 nations at the COP26 climate conference. The pledge aims to reduce methane emissions globally by 30% by 2030, compared to 2020 levels.

The results in the San Juan Basin provide a basis for source identification and apportionment using a variety of measurement techniques that can be extended to other oil and gas basins.

While oil, gas and coal production is widely known to emit methane, a potent greenhouse gas, the industry's geographically vast and variable infrastructure from extraction sites to processing facilities makes attributing these emissions to specific sources challenging.

"Natural gas is primarily methane but includes other hydrocarbons, including ethane," said Manvendra Dubey, co-corresponding author of the paper and leader of the project at Los Alamos. "The composition of the gas varies with the source. We were able to discriminate among these using unique instruments that span many scales that were deployed by

Los Alamos in the Four Corners. Our findings enable emitter accountability to reduce methane emissions, which are 84 times more potent as a warming agent than carbon dioxide, in this decade."

Focusing on a methane hot spot discovered several years ago above the Four Corners, the study for the first time analyzed observations made at time scales from seconds to hours and length scales from meters to tens of kilometers. The research team took measurements with a mobile ground-based sensing system and studied older data from aircraft campaigns and remote sensing platforms.

The analysis determined that the vent shaft of the San Juan coal mine consistently emitted a stable ratio of ethane to methane over eight years of measurements. The ratio held up under a variety of measurement techniques and over a range of distances from the source.

That ethane-to-methane ratio serves as a distinct signature identifying the coal vent and differentiating it from other sources, many of which showed drastically different ratios, Meyer said.

"Despite a diverse and changing emissions environment, we successfully used ethane-to-methane ratios to identify and apportion several sources across scales in space and time," Meyer said. "Using different measurement techniques can leverage the advantages of each to build a systems-level approach to monitoring across an entire basin."

"Without the ability to identify, locate and quantify methane emissions, any reduction attempts are thwarted," Meyer noted.

More information: Aaron G. Meyer et al, Using Multiscale Ethane/Methane Observations to Attribute Coal Mine Vent Emissions in the San Juan Basin From 2013 to 2021, *Journal of Geophysical Research: Atmospheres* (2022). DOI: 10.1029/2022JD037092

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