

MEASURING MUD VOLCANO METHANE EMISSIONS IN AZERBAIJAN

The first comprehensive study using airborne measurements to quantify and characterize methane emissions from mud volcanoes in Azerbaijan.



DONOR:
Oil and Gas Climate Initiative (OGCI)



BENEFITTING COUNTRIES OR REGIONS:
Azerbaijan



SECTOR:
Natural Sources



Subsector, if applicable:
Geological

STATUS:
Project initiation

TIMELINE:
Measurements collected 2025



IMEO SCIENCE OBJECTIVE:

→ **Initiate scientific studies in support of data assurance and to characterize regions/sources with high uncertainty or discrepancies in the integrated data.**



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KEY FINDINGS

This study will determine the magnitude and variability of methane emissions from the most active mud volcanoes on Earth. Results will also provide chemical characterization of mud volcano methane, to distinguish from oil and gas sector emissions in Azerbaijan.

RATIONALE

To reduce uncertainties in the global methane budget, it is crucial to provide a more accurate quantification of natural emissions. Natural emissions include wetlands, freshwaters, wild animals, termites, gas hydrates and geological formations such as mud volcanoes. With nearly 400 active sites, Azerbaijan hosts the highest density of mud volcanoes on Earth. The study aims to quantify methane emissions from mud volcanoes using atmospheric measurements. The campaign will also characterize mud volcano-emitted gas. Since methane from mud volcanoes and exploited oil and gas reservoirs have a similar chemical fingerprint, the study will help better apportion global total methane emissions into natural sources such as mud volcanoes versus anthropogenic sources such as oil and gas.



RELATED PUBLICATIONS

In progress

SIGNIFICANCE FOR DECISIONMAKERS

Uncertainties in the global methane budget remain, slowing down mitigation strategies. The gap between emissions derived from inventory and atmospheric measurements is the largest for natural sources. More measurements can help bridge this gap and improve our global understanding of methane emissions. This study focuses on the contribution from mud volcano eruptions in Azerbaijan, which is also a major oil and gas producer. Distinguishing between anthropogenic and natural sources of methane from below Earth's surface will be required to guide mitigation strategies. Measurement methods and local partnerships developed through this campaign could pave the way for future missions in a region where measurement data is generally lacking.



STUDY APPROACH/ACTIVITIES

A methane-measuring instrument aboard a fixed-wing drone will collect measurements around individual mud volcanoes. The flight patterns follow circles at different altitudes and at a fixed radius around the volcano crater. Data analysis will consist of a mass-balance approach to convert methane enhancements downwind of the crater to an emission flux. Azerbaijan has a dense cluster of mud volcanoes that emit methane daily, which allows for repetitive visits at several sites to see how emissions rates vary. Samples will be taken from the surface, close to visible emission sources, both natural (e.g., gas bubbling, fumes) and anthropogenic (e.g., oil and gas extraction or processing facilities). Samples will be analyzed in the laboratory for gas composition and stable isotopic ratios.



CATALYZING ACTION

The German Aerospace Center (DLR) works with collaboration and support from drone-operating company Olimp. A team of unmanned aerial vehicle pilots has been trained to perform survey flights with remote support. The methodology can be applied subsequently and by local partners to other emission sources in the country.

OTHER SUPPORTERS/STAKEHOLDERS

Principal Investigator:

German Aerospace Center (DLR), Germany
Environmental Defense Fund, US

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The UN Environment Programme's International Methane Emissions Observatory (IMEO) exists to provide open, reliable, and actionable data to the individuals with the agency to reduce methane emissions. IMEO does this by integrating and reconciling data across sources, including its global methane science studies. IMEO supports measurement and research studies around the world to close the knowledge gap on methane emissions and provide policy-relevant insights to decisionmakers.