CHARACTERIZING REGIONAL METHANE EMISSIONS WITH TROPOMI

Quantifying emissions from high-producing oil and gas regions and other emission "hotspots".

DONOR:
Oil and Gas Climate Initiative (OGCI)

BENEFITTING COUNTRIES OR REGIONS:
Algeria, Venezuela

SECTOR:
Oil & Gas

Subsector, if applicable:
-

STATUS: **Published**

TIMELINE: **Measurements 2019 and 2020; latest publication 2024**

IMEO SCIENCE OBJECTIVE:

→ **Validation of measurement-based approaches**

KEY FINDINGS

The Algeria study evaluates how point sources contribute to total emissions. Top-down analysis indicates that a larger fraction of Algeria's methane emissions come from oil production (~75 per cent) than the latest national reporting suggests (5 per cent). Although diffuse methane sources dominate in the two Algerian basins that were studied, Hassi R'Mel and Hassi Messaoud, super-emitters still contribute substantially to regional emissions (24 per cent and 49 per cent, respectively).

The Venezuela study uses two different inversion models to estimate methane emissions in the country. A clear hot spot is observed around the eastern shore of Lake Maracaibo, with estimated emissions of 1.2 million metric tons in 2019 in the lake area alone. Emissions are predominantly from oil production. Production has significantly decreased in recent years, but the study finds a non-significant trend in emissions between 2018 and 2020 around the lake, suggesting that there could be large emissions from abandoned infrastructure. Finally, the study finds the increase in the methane emission intensity (11 to 23 per cent) is much higher than previous studies have found for other oil and gas production regions around the globe.

RATIONALE

There is significant uncertainty regarding methane emissions from several high-producing oil and gas regions. These studies utilize TROPOMI measurements to quantify regional emissions in Algeria and Venezuela, as well as a global list of precise methane hotspots based on prior methane plumes detected by TROPOMI.

RELATED PUBLICATIONS

Algeria (Naus et al., 2023)
Venezuela (Nathan et al., 2024)

SIGNIFICANCE FOR DECISIONMAKERS

By providing detailed, satellite-based quantification of emissions, the study highlights areas with high methane leakage and provides critical insights into the scale and sources of methane leaks, such as from deteriorating infrastructure in oil-rich areas like Lake Maracaibo, where analysis indicates that mitigation efforts should address both high-emitting point sources and smaller area sources. The results help policymakers and industry leaders target specific sources for mitigation. By identifying these emission hotspots, the study enables more effective climate policies and helps countries align with global methane reduction goals.

STUDY APPROACH/ACTIVITIES

The study in Algeria uses methane data from high-resolution Sentinel-2 instruments to identify and estimate emission time series for 11 super-emitters. This information was integrated in a transport model inversion that uses methane data from the coarser but higher-precision TROPOMI instrument to estimate emissions from both the 11 super-emitters and the remaining diffuse sources.

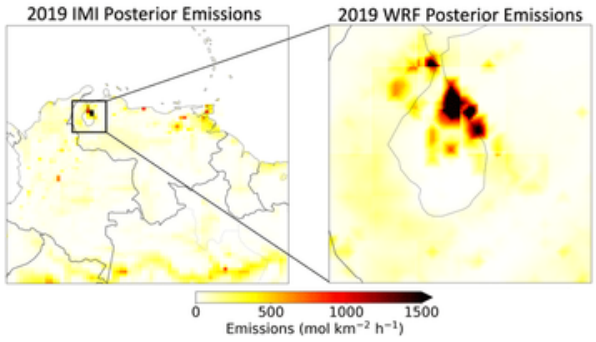
The study in Venezuela uses 2018–2020 TROPOMI methane data combined with two atmospheric transport models to estimate national and local Venezuelan methane emissions. It uses the Integrated Methane Inversion (IMI) framework to evaluate 2019 emissions for the entire country and uses WRF-Chem (Weather Research and Forecasting model with chemistry) to zoom in on the Lake Maracaibo hotspot and estimate annual emissions for 2018, 2019 and 2020.

CATALYZING ACTION

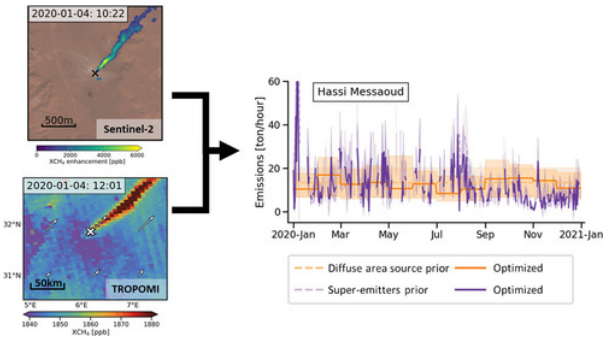
Results of the research in Algeria have been shared through IMEO's broader methane engagement with stakeholders from the Algerian government and national oil company. The study was also shared with a Venezuelan stakeholder, and IMEO continues outreach to the country.

OTHER SUPPORTERS/STAKEHOLDERS

Principal Investigator: **Netherlands Institute for Space Research, Netherlands**



Assessing methane emissions from collapsing Venezuelan oil production using TROPOMI



Assessing the Relative Importance of Satellite-Detected Methane Superemitters in Quantifying Total Emissions for Oil and Gas Production Areas in Algeria

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.