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**Just
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CLIMATE ACTIONS AND JUST TRANSITION: SECOND INTERNATIONAL CONFERENCE

MethaneSAT and MethaneAIR: Tracking and disaggregating regional methane emissions

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Associazione
GIShub

15 December 2025

www.unburnable.org

MethaneSAT



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*The 2nd International Conference on Climate
Action and Just Transition | 15 December, 2025*

MethaneSAT (March 2024 - June 2025)

Quantify methane emissions from global oil and gas production, catalyzing effective methane reductions. Additional areas of interest include agriculture.

Mission Lead Organization



Partners and Collaborators



CENTER FOR
ASTROPHYSICS
HARVARD & SMITHSONIAN

BAE SYSTEMS
INSPIRED WORK



MethaneSAT Data Transparency

MethaneSAT data publicly available to help industry and governments track emissions over time.



Source: BAE Systems

A complementary ecosystem of methane-detecting satellites

Global mapping

*7,000 m x 5,500 m pixels
across 2,600 km swath

- ✓ Global & large-scale regions
- ✓ Large point sources

Area mapping

*100 m x 400 m pixels
across 220 km swath

- ✓ Regional/Area sources
- ✓ Point sources (>500 kg/hr)
- ✓ Sector-wide quantification

Location mapping

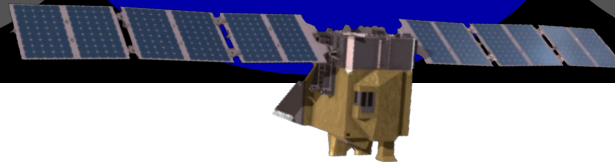
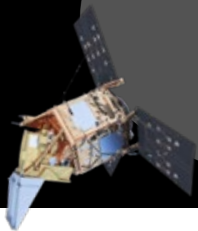
*30 m x 30 m pixels
across 12-20 km swath

- ✓ Point sources
- ✓ Facility-level attribution

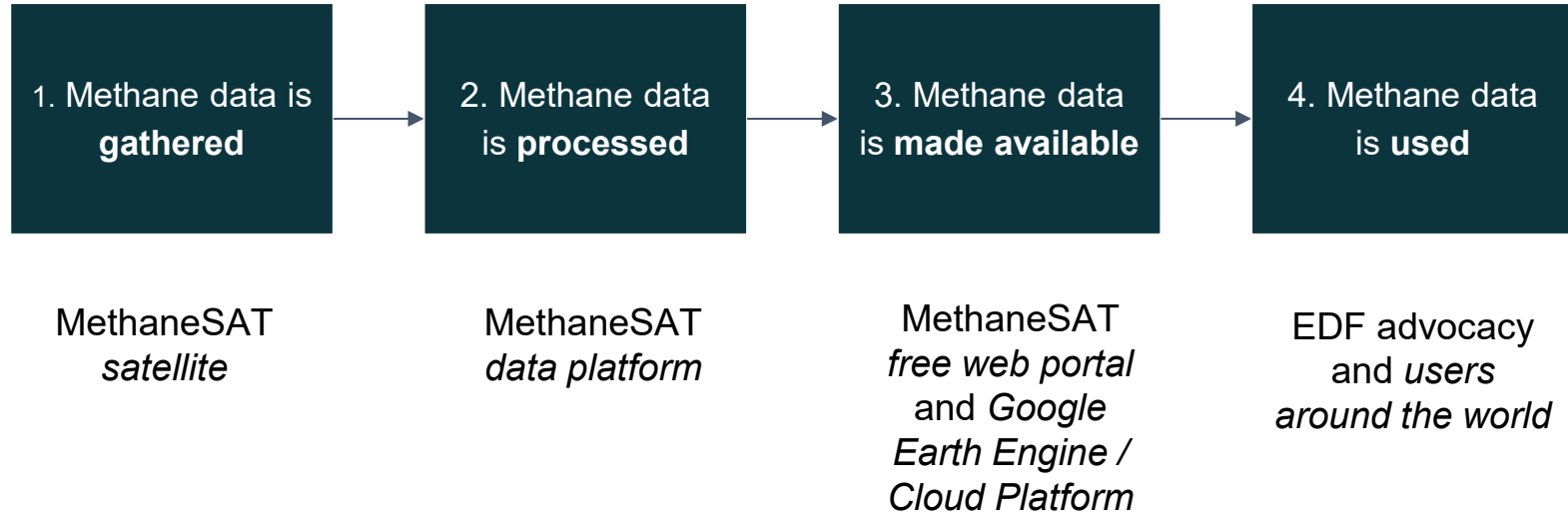
TROPOMI*
SCIAMACHY
GOSAT-1/2
Sentinel-5 (2025/26-)
GOSAT-GW (2025/26-)
CO2M (2027/28-)

MethaneSAT*
GOSAT-GW (2025/26-)
CO2M (2027/28-)

GHGSat*
PRISMA
EnMAP
EMIT
CarbonMapper (2024-)



MethaneSAT addresses the methane problem in four steps



MethaneSAT's unique capabilities meant it could see all emissions and produce accurate, policy relevant data

The satellite

The data platform

Wide view path & geographic scale



- ✓ 220 km view path (at nadir)
- ✓ Orbits in 95 minutes

High resolution & precision



- ✓ Native pixel resolution of 130m x 400m
- ✓ Concentration measurement sensitivity of 2-3 parts per billion, aggregated at 2 km x 2 km grids

Automation of emission rates



- ✓ Determines emission rates, or how fast methane is escaping
- ✓ Automates calculations that currently take scientists many weeks to months, providing users with data in just a few weeks

Ease of access & transparency

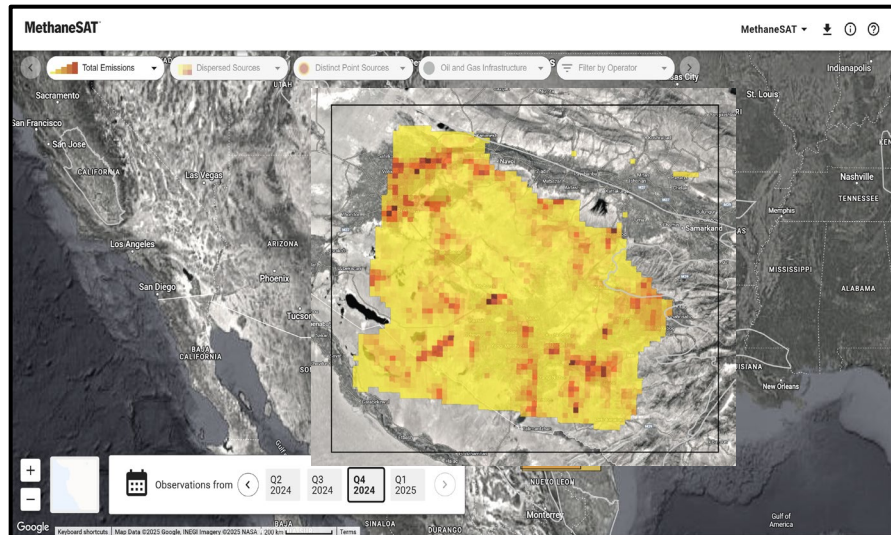


Emissions data are:

- ✓ Visualized online
- ✓ Overlaid with O&G assets
- ✓ **Free** to access for methane mitigation purposes
- ✓ And underlying datasets available on **Google Earth Engine and Cloud Marketplace**

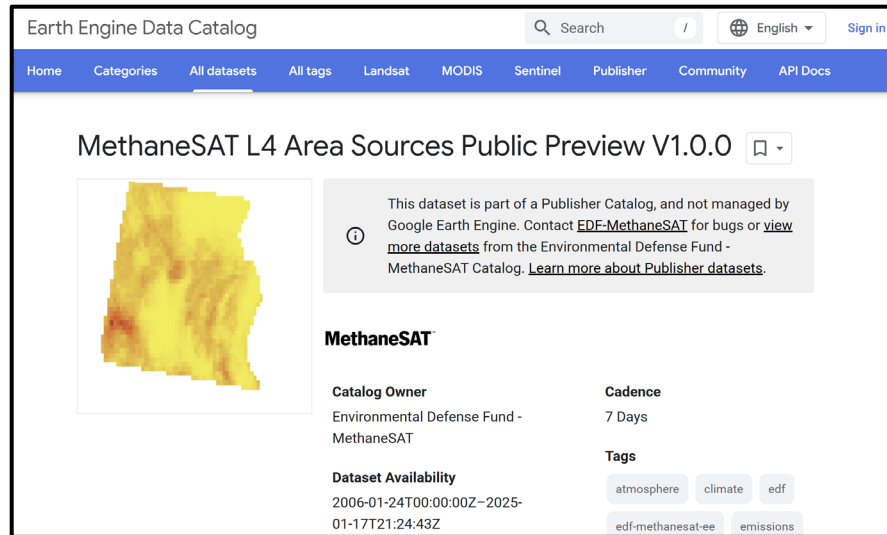
MethaneSAT Data Availability

MethaneSAT Portal



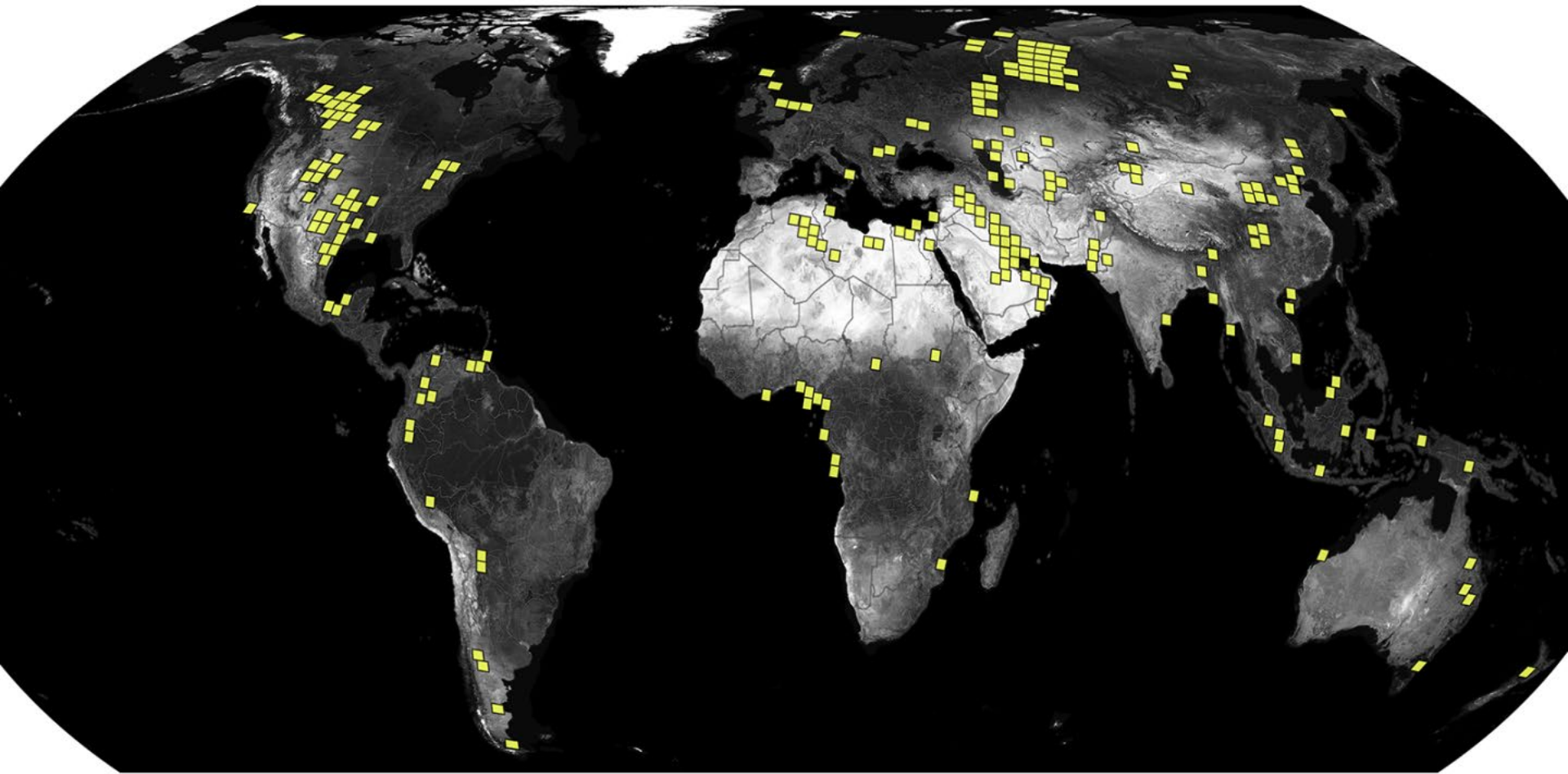
<https://portal.methanesat.org>

Google Earth Engine

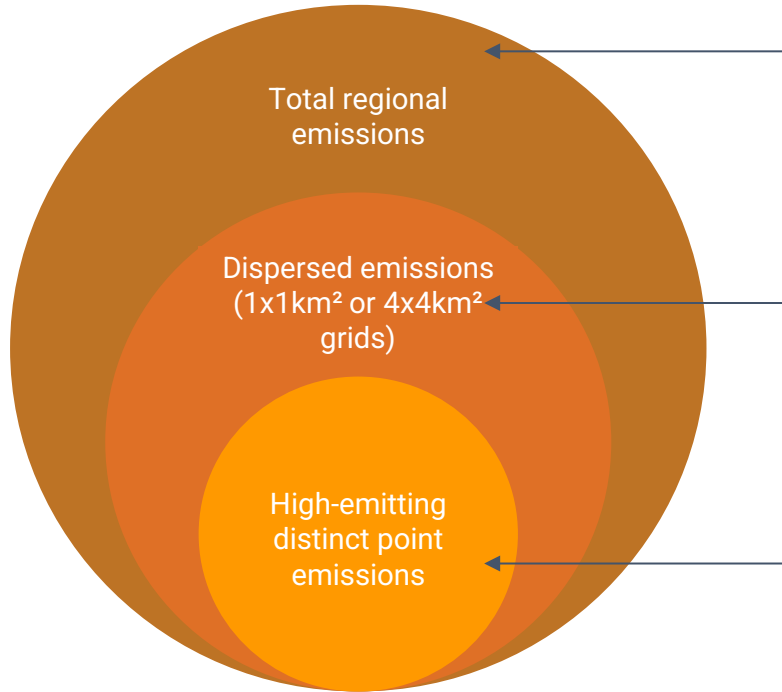


<https://developers.google.com/earth-engine/datasets/publisher/edf-methanesat-ee>

MethaneSAT targets representing majority of global onshore oil and gas production. Each target is ~220 km x 200 km.



Three types of data insights from MethaneAIR and MethaneSAT:



- Quantify & track **total regional emissions** from individual O&G basins and subbasins, providing sector-wide emission quantification for the vast majority of global O&G production
- Quantify & track **dispersed emissions** (*emissions from numerous sources over an area which cannot be attributed to a single point on the ground*) and visualize via high-resolution heatmaps
- Quantify and trace **high-emitting distinct point emissions** (*emissions detected at high levels that stand out from dispersed emissions*) back to their geographical origin.

MethaneSAT L3 Data

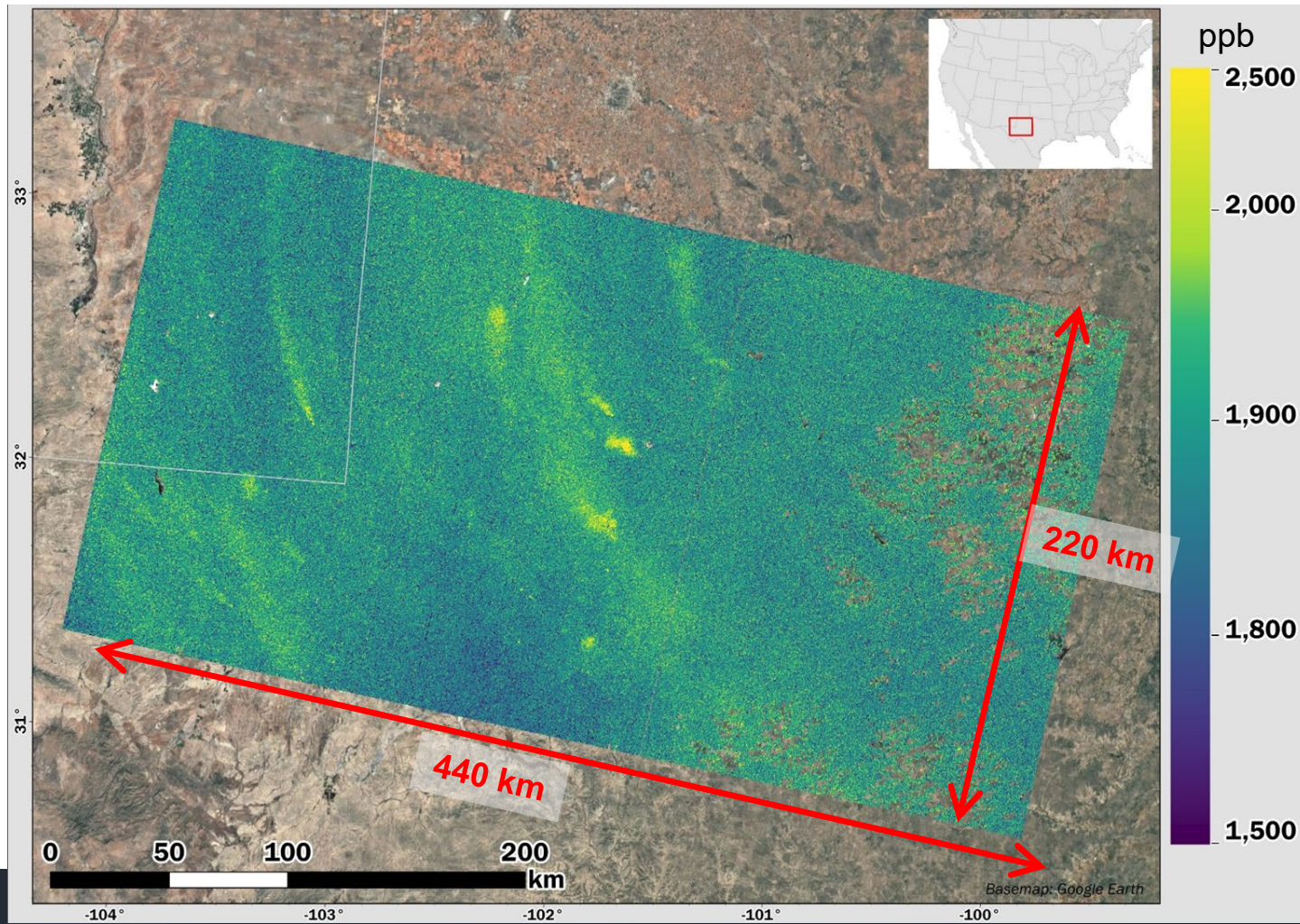
MethaneSAT combines

- Wide regional mapping
- High precision measurements
- High resolution

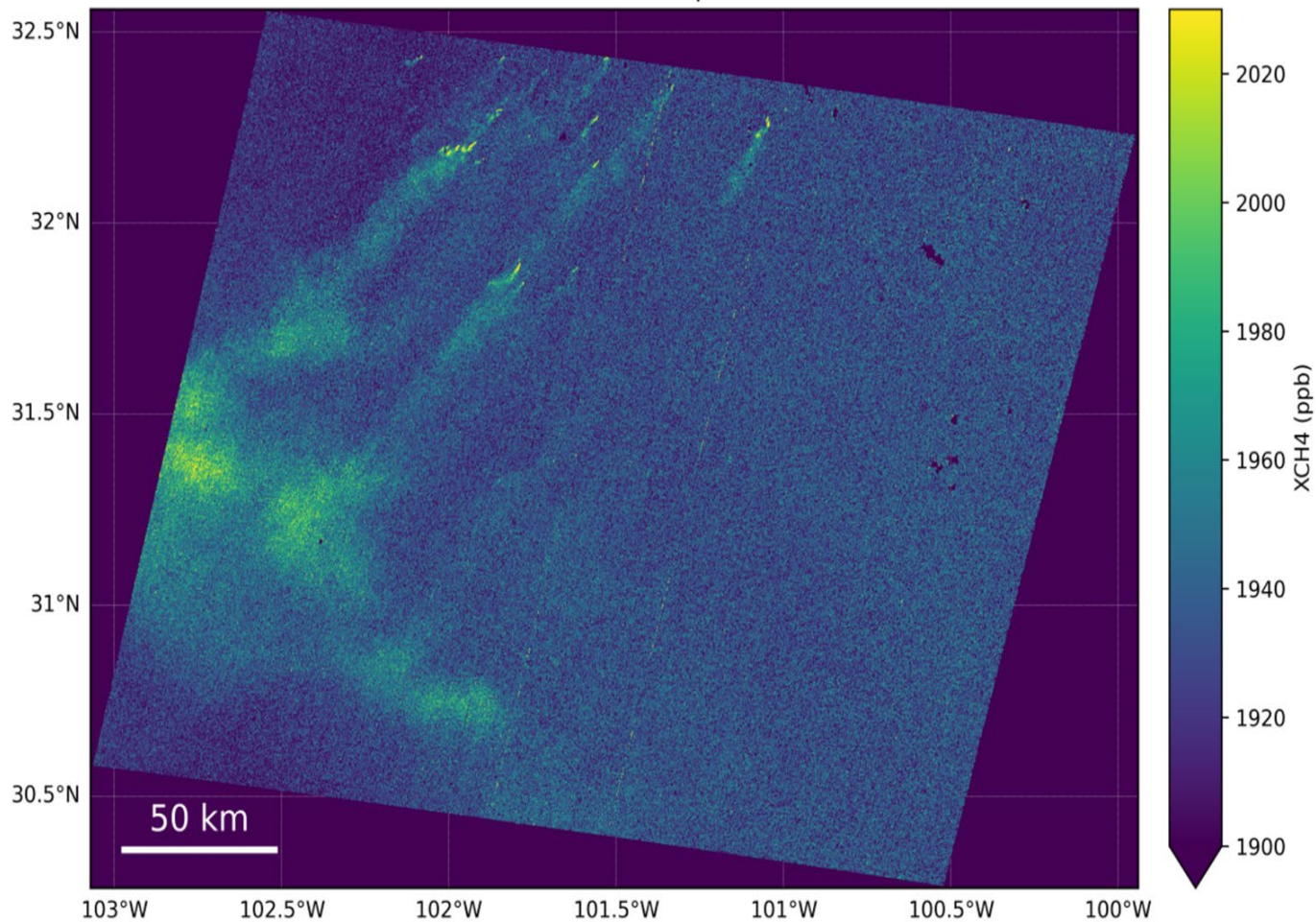
in order to quantify
TOTAL emissions and
resolve emissions at
high spatial resolution.

MethaneSAT image from
Permian Basin (Texas/New
Mexico)

11 Sep 2024

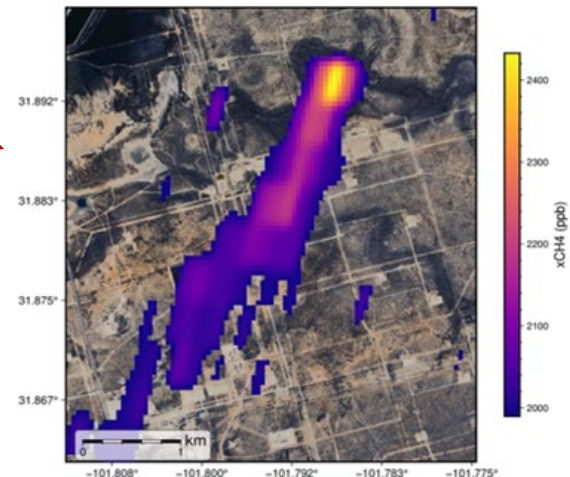
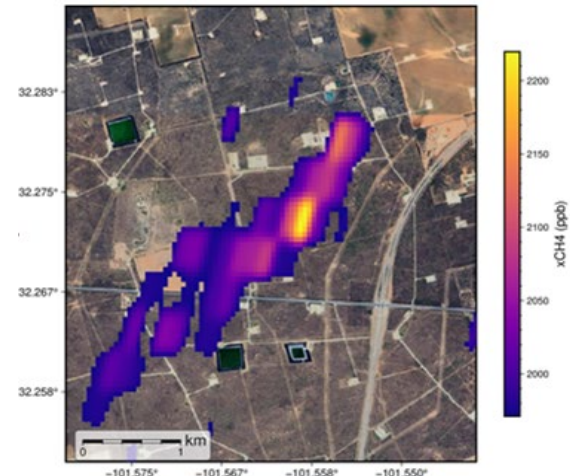
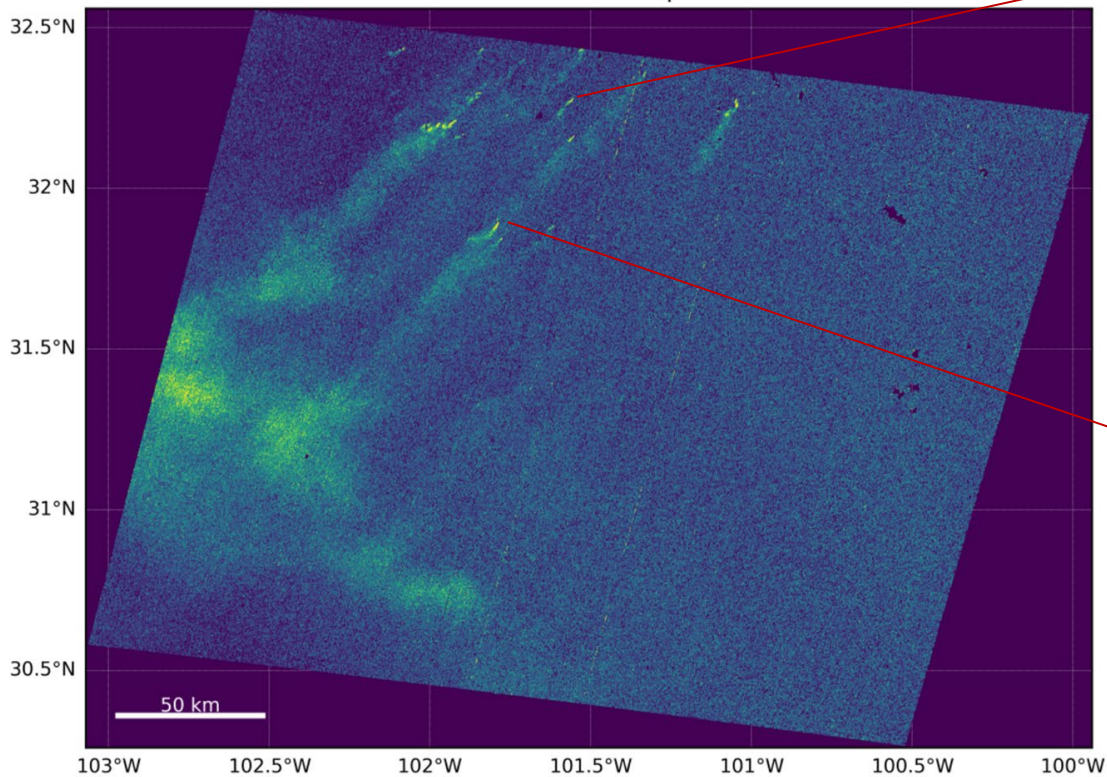


Permian Basin

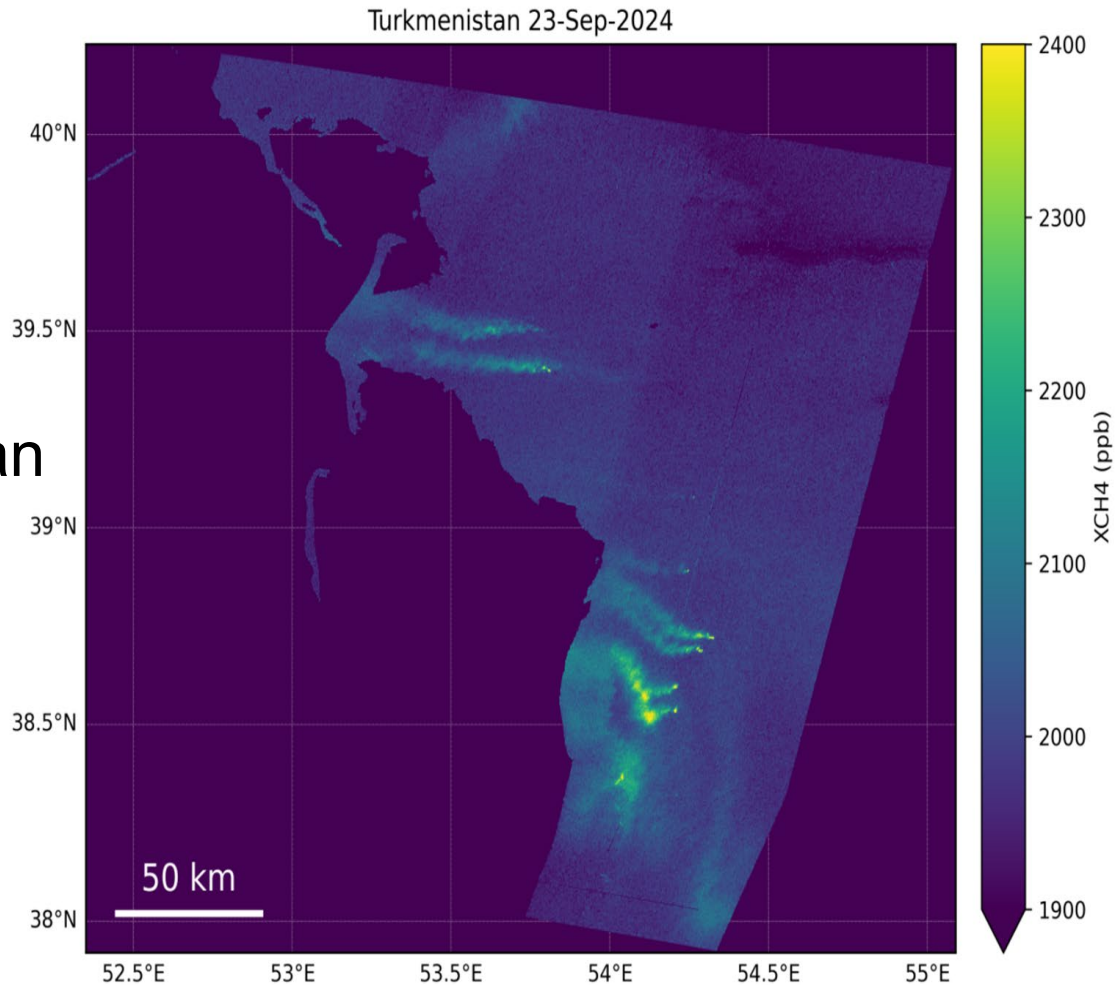


Permian Basin (USA)

Permian Basin 28-Sep-2024

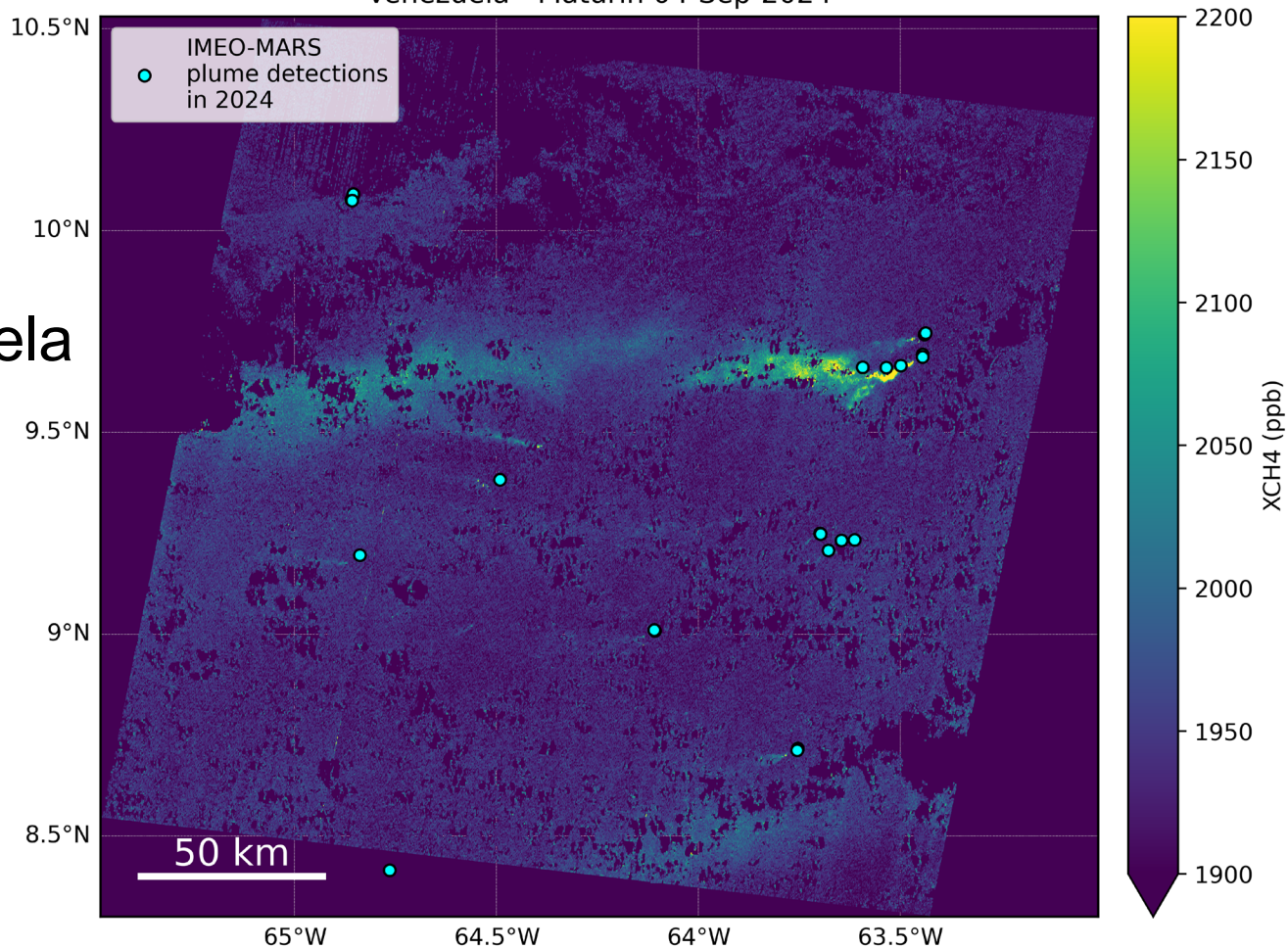


South Caspian, Turkmenistan



Venezuela - Maturin 04-Sep-2024

Venezuela



Appalachian

5 September 2024

MethaneSAT & TROPOMI

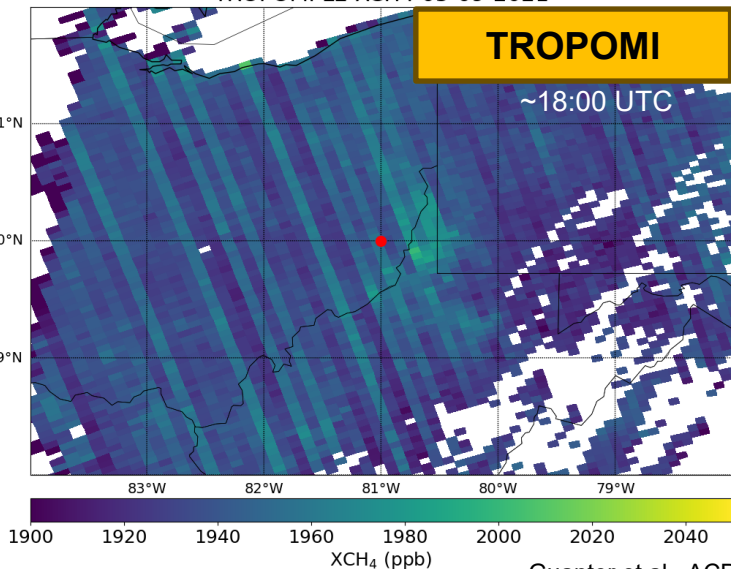
Enhancement included in the IMEO database as one single source detected with TROPOMI (~7 km /pixel)



TROPOMI L2 XCH4 05-09-2021

TROPOMI

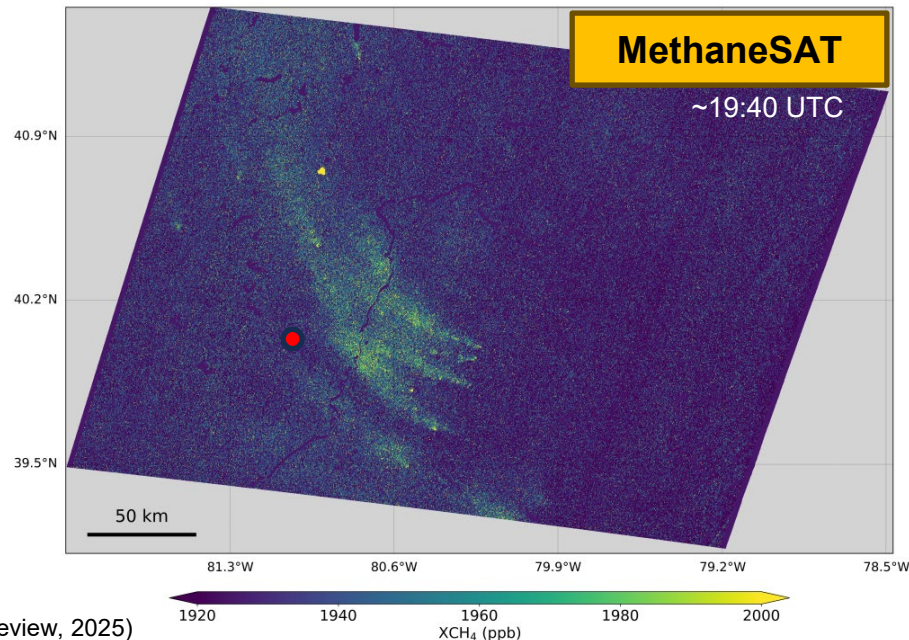
~18:00 UTC



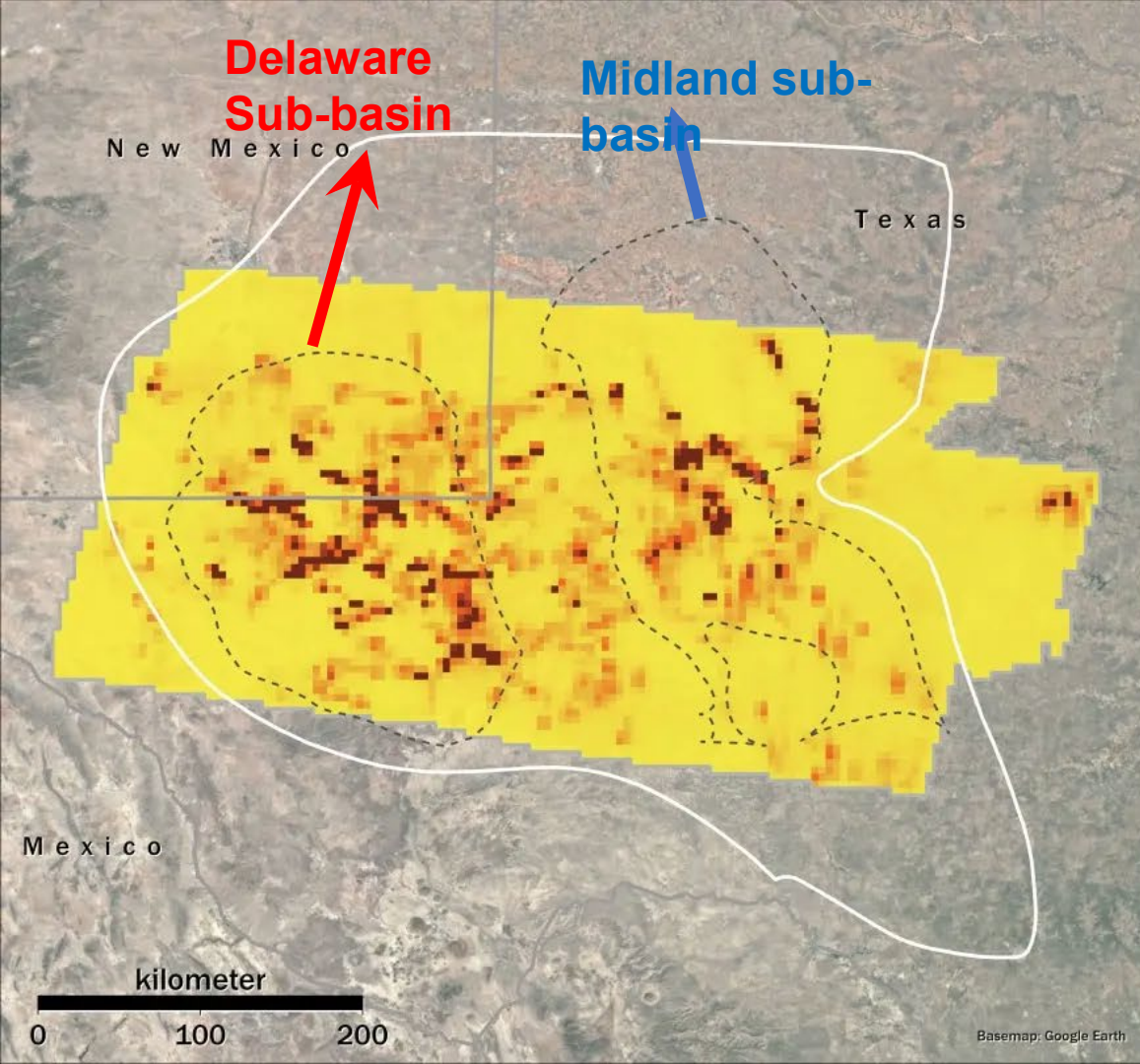
Guanter et al., ACP (under review, 2025)

MethaneSAT

~19:40 UTC



MethaneSAT L4 Data, Analyses, and Insights



Permian

Oil dominant region

Tonnes of total methane emitted per hour
490

Tonnes of oil and gas methane emitted per hour
440

Methane intensity

- 2.8% marketed gas production normalized
(0.17 kg CH₄/GJ of oil and gas production)

Dispersed area emissions (kg/hr/km²)

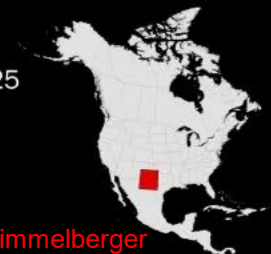


☐ Permian Basin

Dates of observation

Aggregated data for nine
scenes collected between
May 2024 and March 2025

Observation location



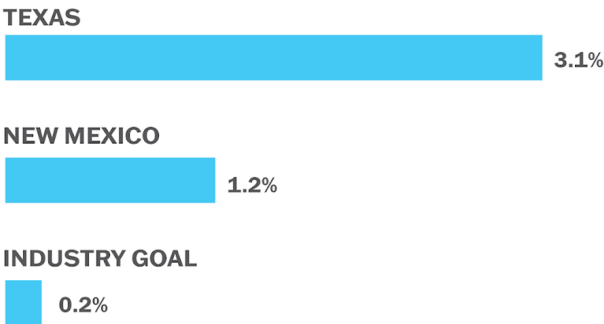
Visualization by Anthony Himmelberger

**Initial data. Methane intensity specific to basin domain.*

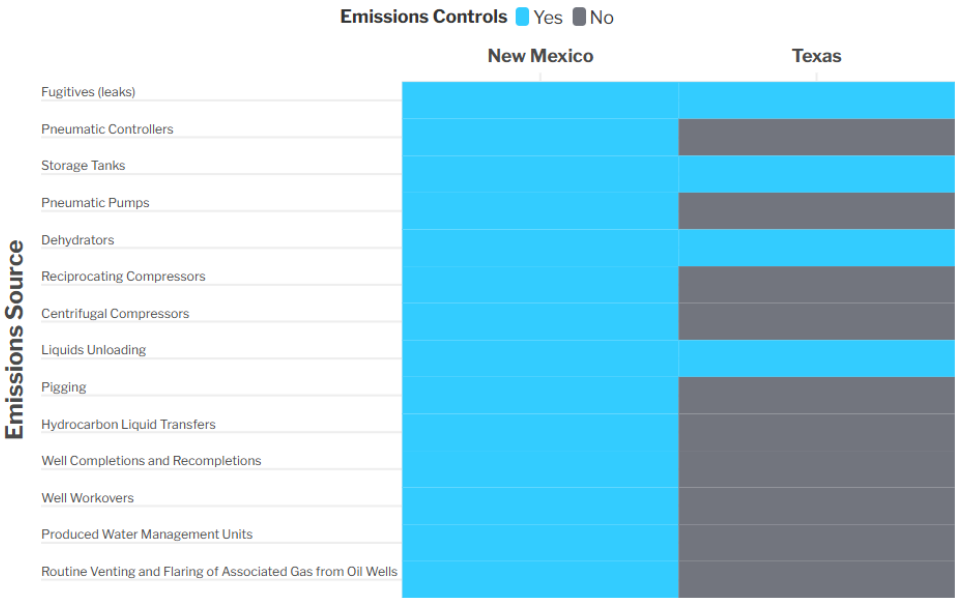
New Mexico portion of Delaware sub-basin associated with lower Methane Intensity than Texas, as revealed by an aggregation of multiple MethaneSAT observations during 2024-2025 – coinciding with stronger emission controls in New Mexico

Oil and Gas Methane Intensity in the Delaware Sub-Basin

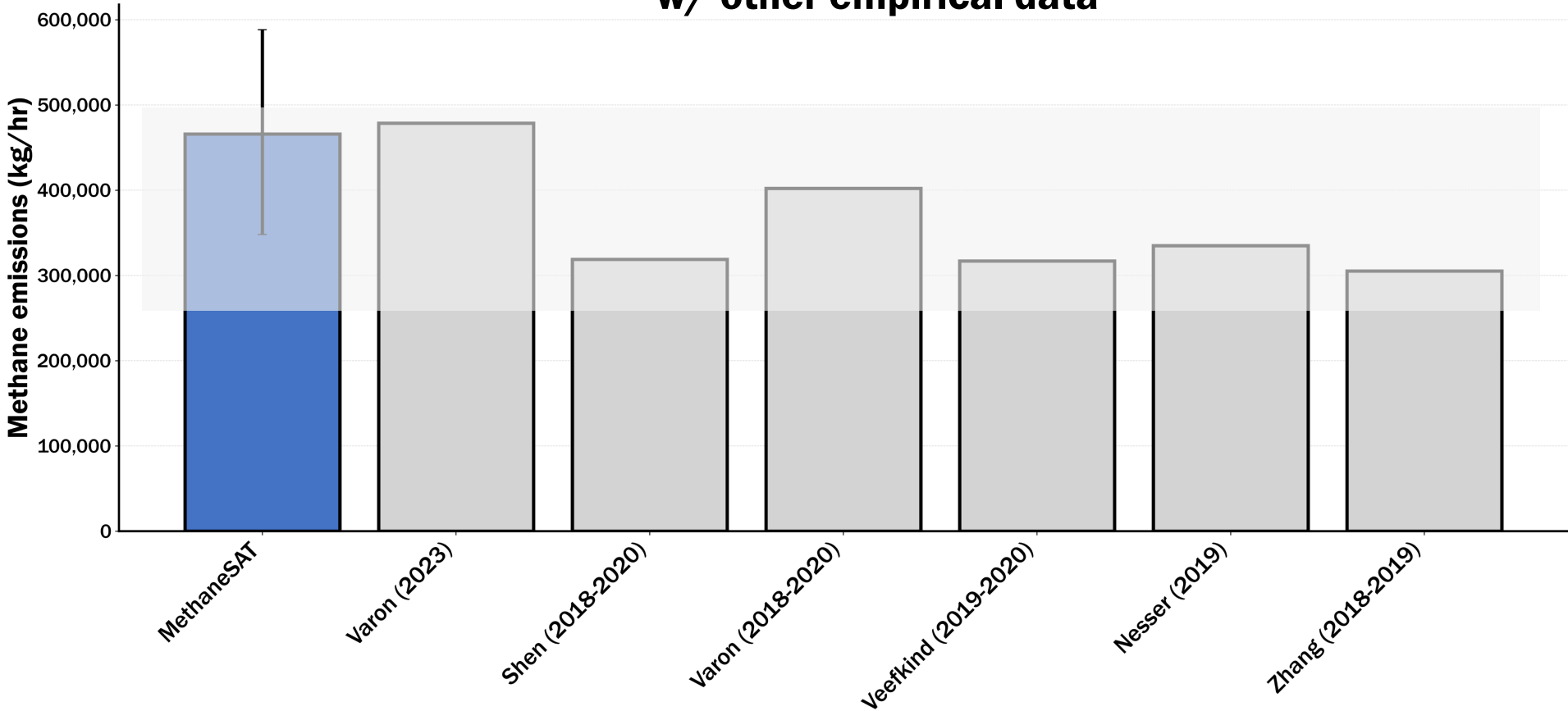
Intensity is methane emitted as a percentage of the marketed gas produced.

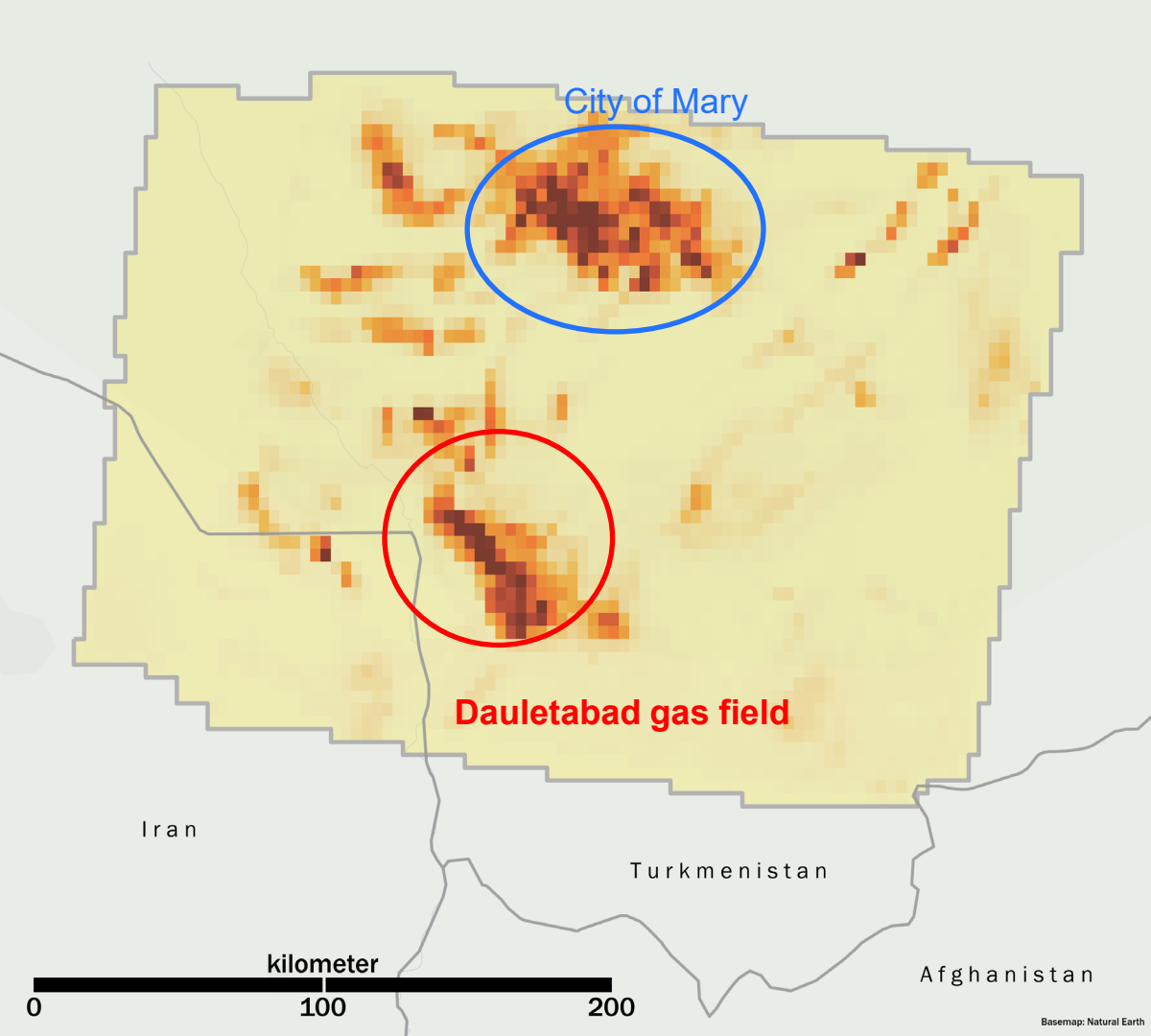


Comparing Methane Emissions Protections in Texas and New Mexico



Independent assessment/comparison of MethaneSAT emissions w/ other empirical data





Amu Darya

Gas dominant region

Tonnes of total methane emitted per hour

190

Tonnes of oil and gas methane emitted per hour

140

Methane intensity

- 3.3% marketed gas production normalized (0.58 kg CH₄/GJ of oil and gas production)

Dispersed area emissions (kg/hr/km²)



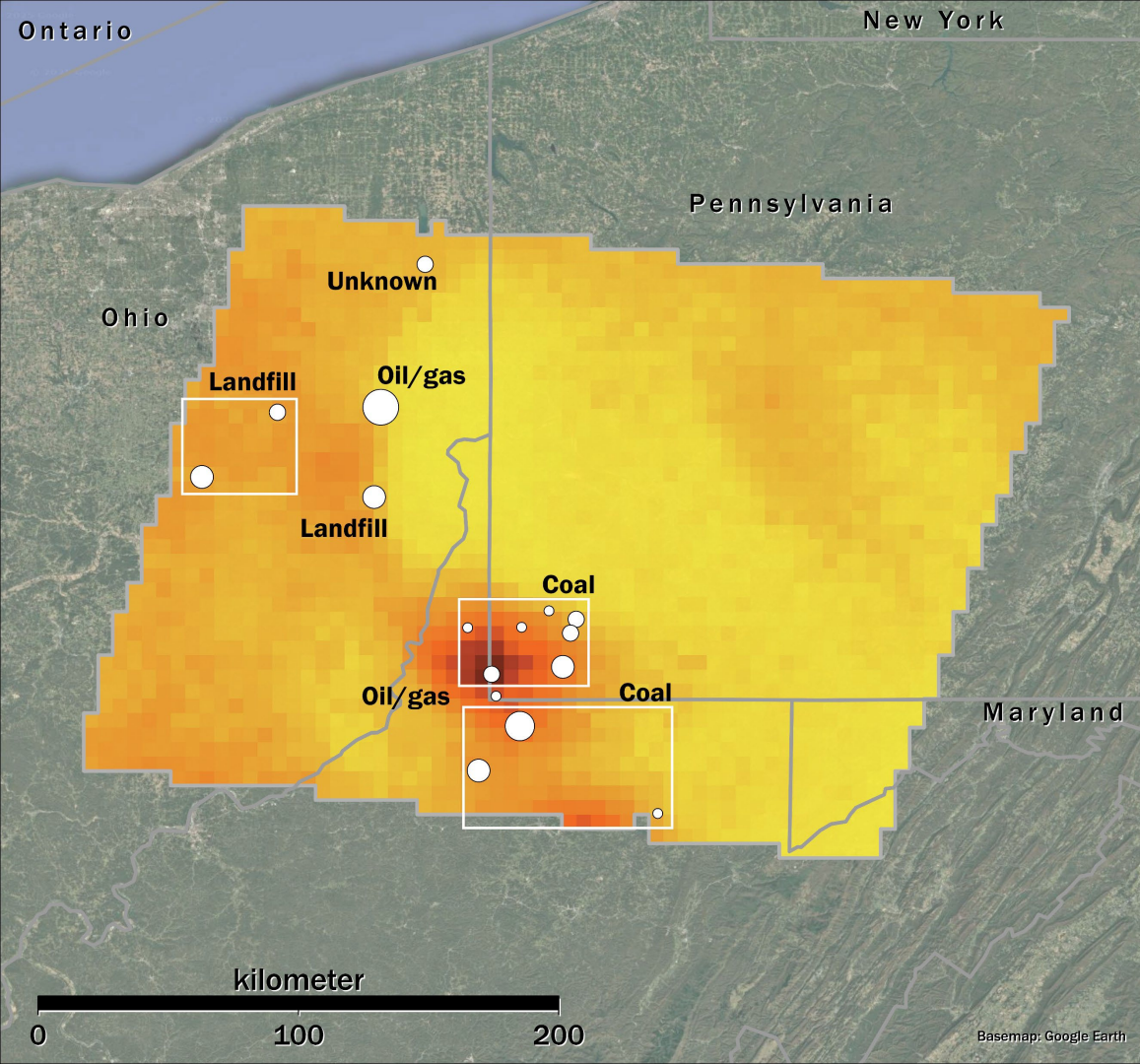
Dates of observation

Aggregated data for six scenes collected between Jul 2024 and Jun 2025

Observation location



Visualization by Anthony Himmelberger



Appalachian

Gas dominant region

Tonnes of total methane emitted per hour
226

Tonnes of oil/gas methane emitted per hour
129

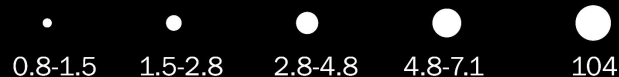
Methane intensity

- 0.9% (gross gas production normalized)
- 0.14 kg CH₄/GJ of oil and gas production

Dispersed area emissions (kg/hr/km²)



Distinct point source emissions (tonnes/hr)
(> 0.5 tonnes/hr)



Date of observation
5 September 2024

Observation location



Visualization by Anthony Himmelberger

**Initial data. Methane intensity specific to basin domain.*

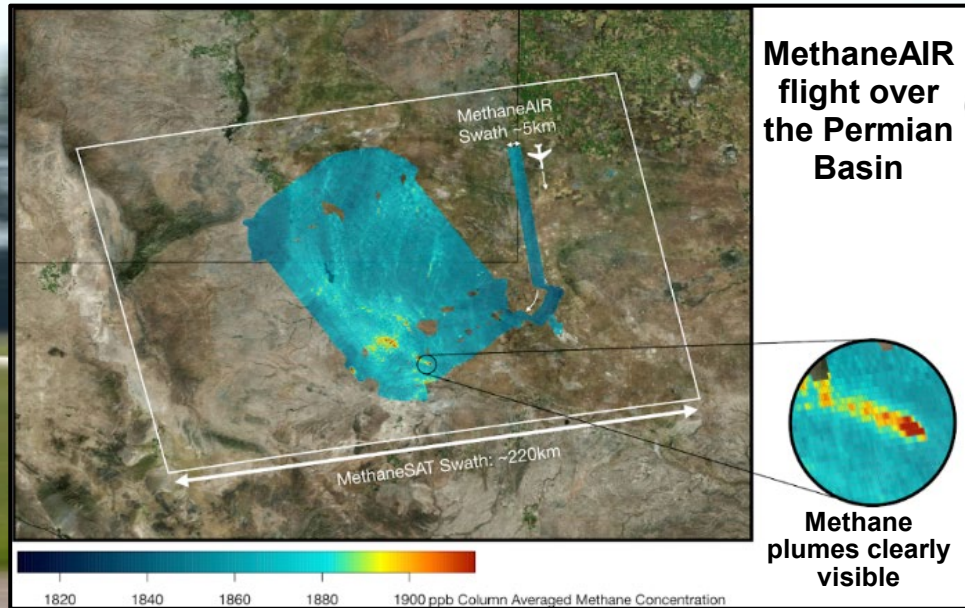
MethaneAIR – an airborne version of MethaneSAT



MethaneSAT

MethaneAIR: an airborne version of MethaneSAT

- MethaneAIR and MethaneSAT consist of two passive infrared imaging spectrometers designed to quantify methane emissions over large areas with high precision and accuracy
- MethaneAIR has been flying since 2021, MethaneSAT operated between March 2024 and June 2025.



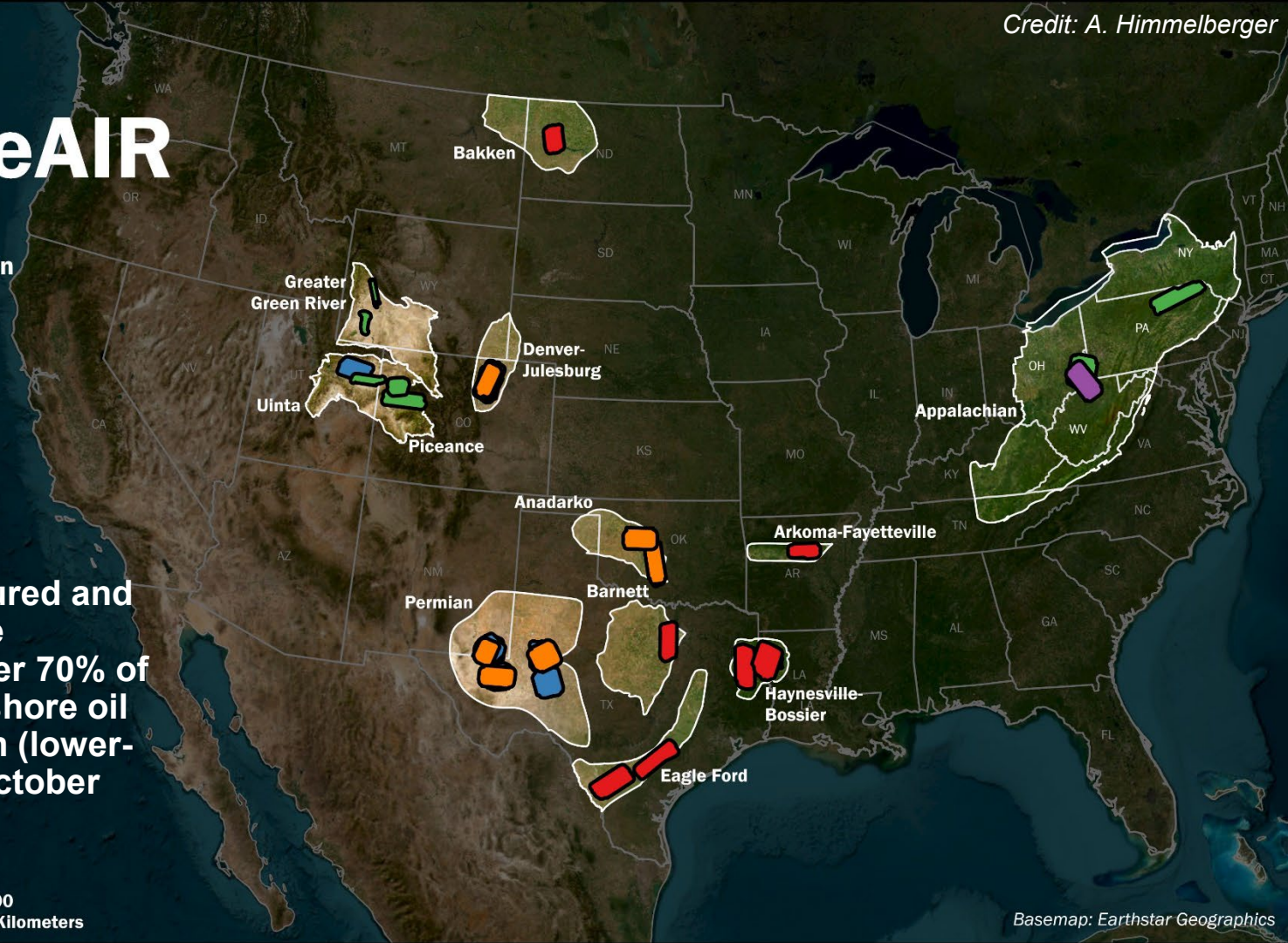
In 2023, MethaneAIR was flown on a modified Lear 35 jet to comprehensively map methane emissions from major oil and gas producing regions in the United States

MethaneAIR

MethaneAIR-X Flights Flown (2023)

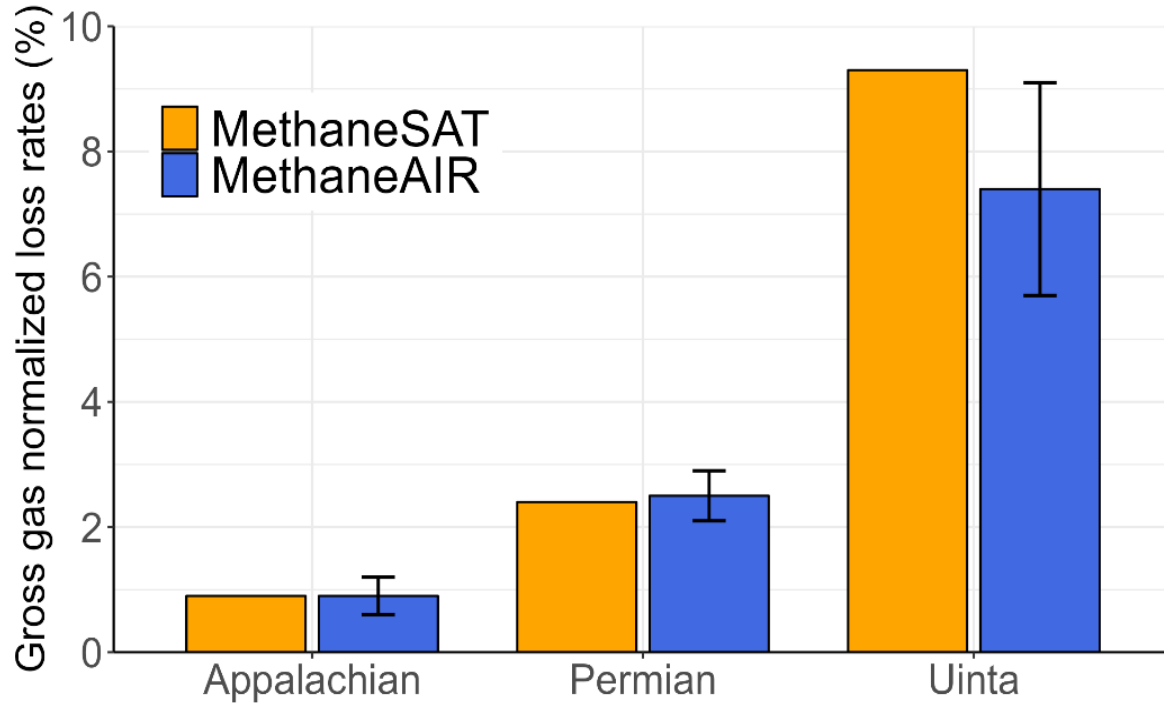
- June
- July
- August
- September
- October

MethaneAIR measured and quantified methane emissions from over 70% of contiguous US onshore oil and gas production (lower-48) from June to October 2023



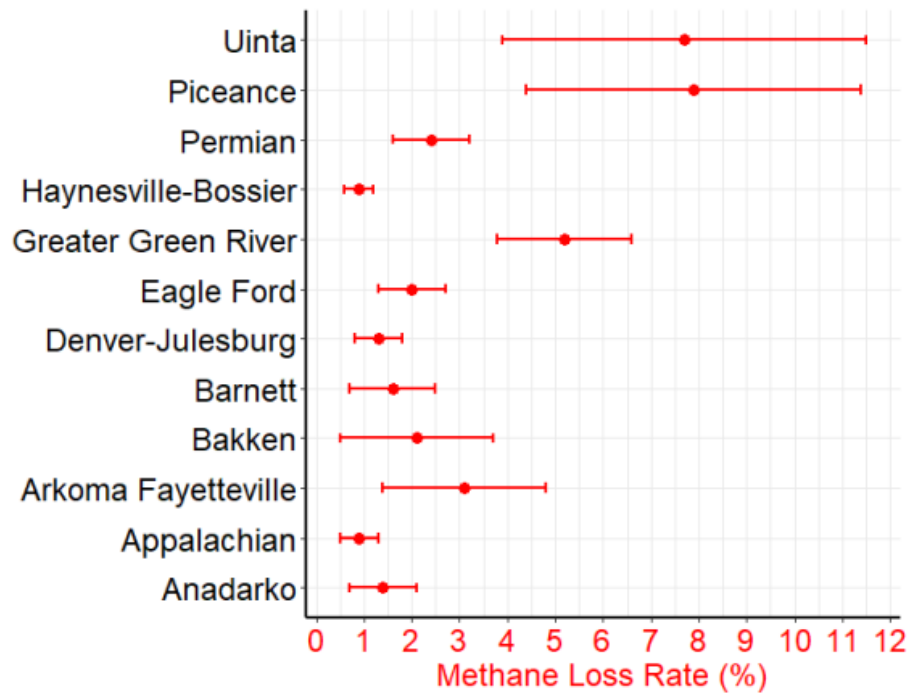
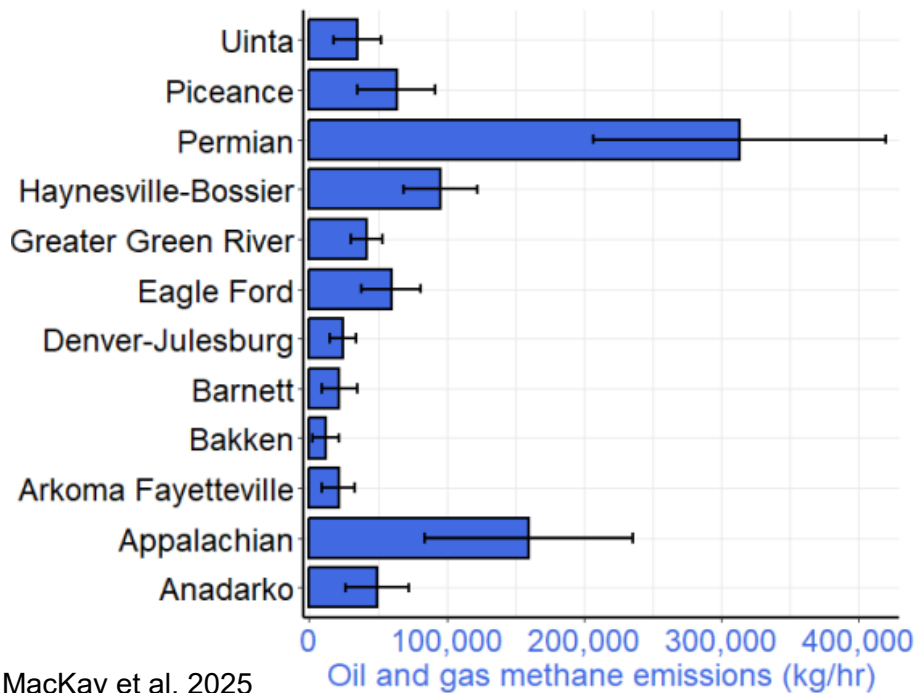
0 250 500 1,000
Kilometers

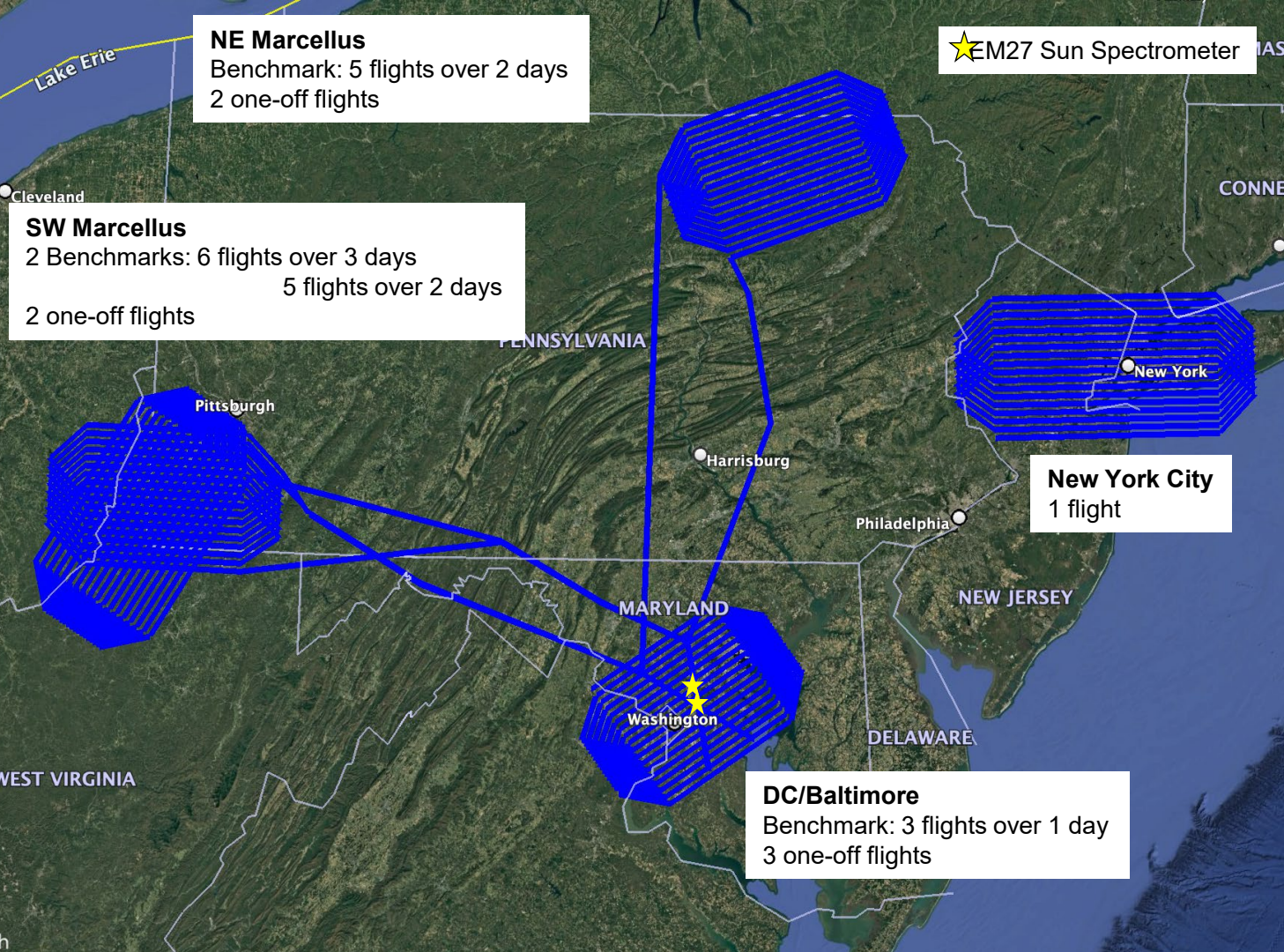
MethaneSAT- and MethaneAIR-derived methane loss rates



MethaneAIR 2023 campaigns

Methane emissions and intensity from 70% of contiguous US onshore oil and gas production mapped by MethaneAIR





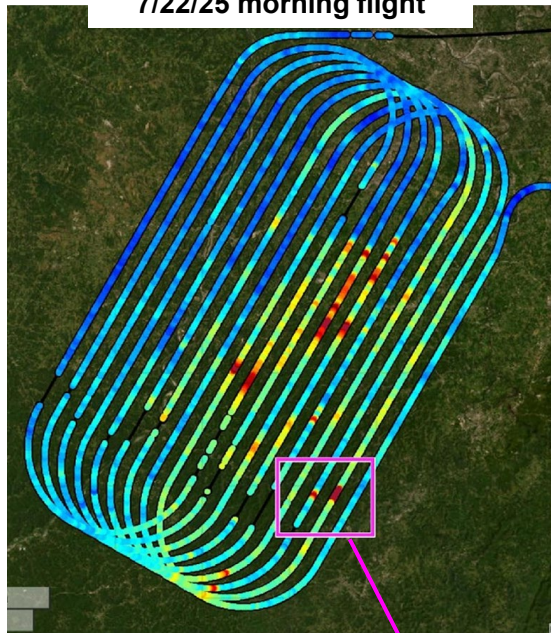
MethaneAIR 2025

Goal: Benchmark area methane emissions

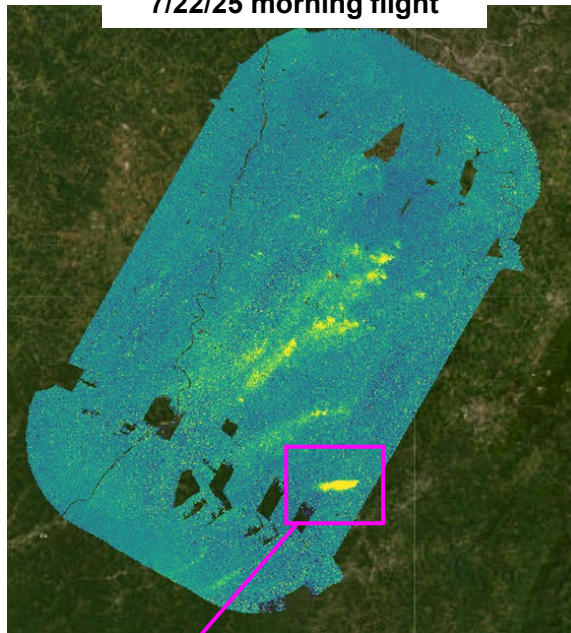
- 7/11 - 8/11/25
- 26 Flights
- 132 Flight hours
- MethaneAIR + NASA/HALO: 21 flights
- HALO: 5 night flights

Maryann Sargent

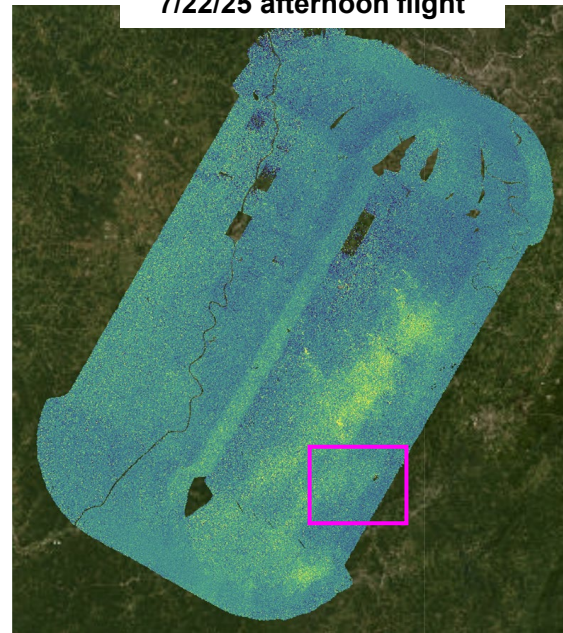
HALO lidar
7/22/25 morning flight



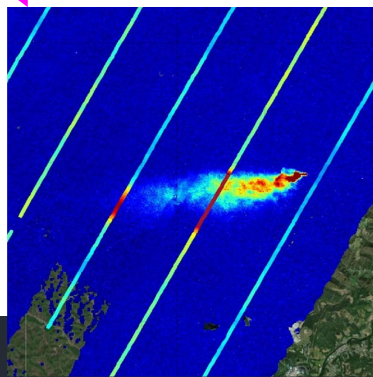
MethaneAIR
7/22/25 morning flight



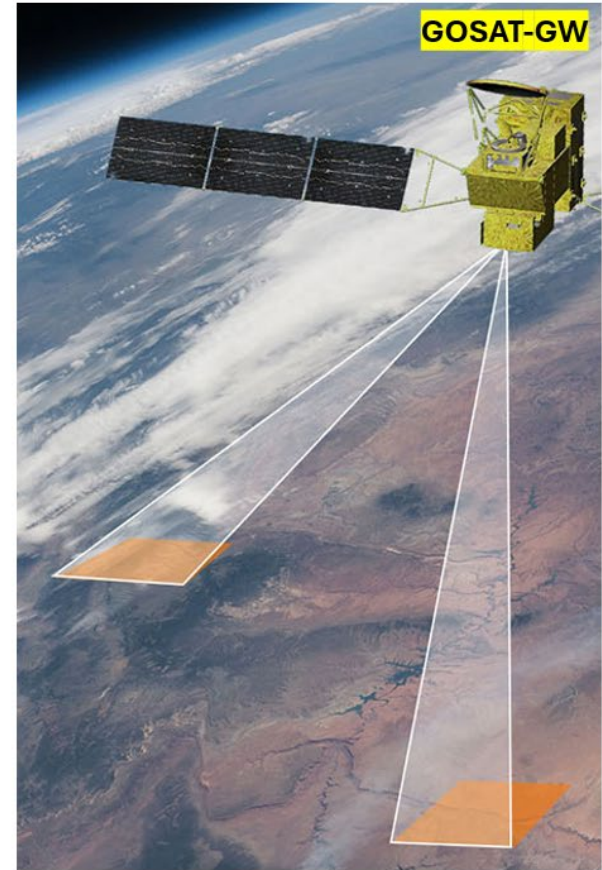
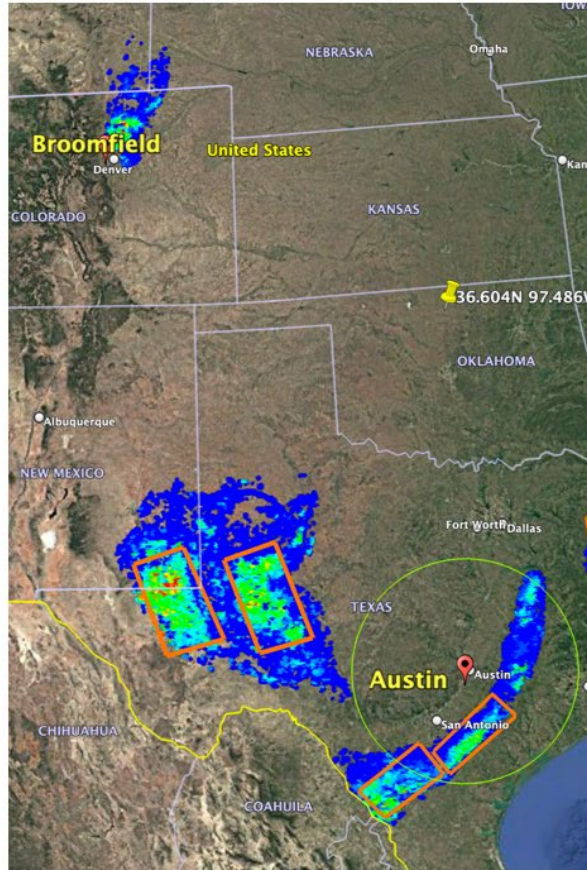
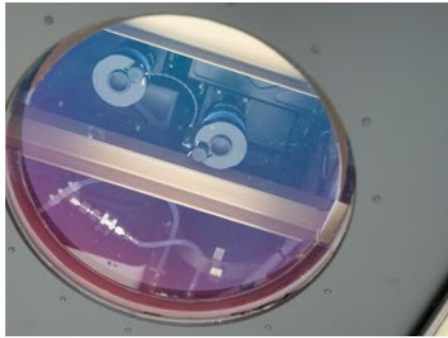
MethaneAIR
7/22/25 afternoon flight



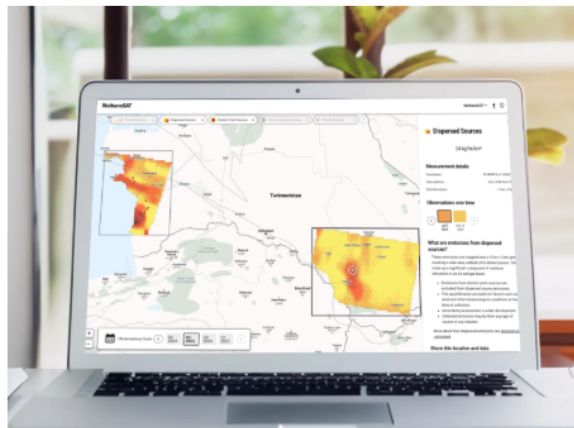
Maryann Sargent



Coordination between MethaneAIR flights and satellite ecosystem (GOSAT-GW, GOSAT-2, Carbon Mapper, EnMAP, PRISMA)



www.methanesat.org



ANALYZE, COMPARE AND ACT

Compare emissions across different areas, monitor how emissions change and deploy solutions that achieve maximum reductions.

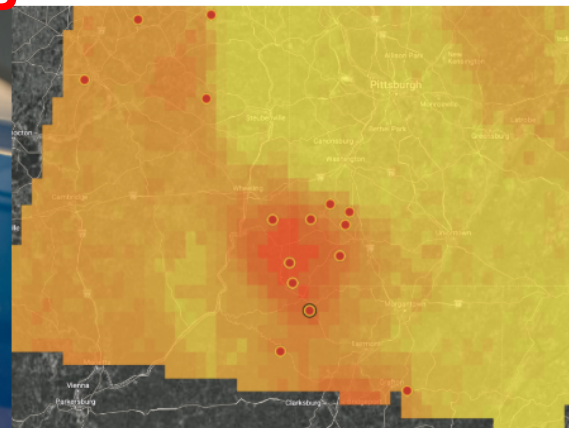
Our mission



UNMATCHED ACCURACY AND PRECISION

Advanced sensing technology detects methane emissions across the globe with unprecedented resolution and precision.

How we're different



FAST, FREE TRANSPARENT DATA

Automated MethaneSAT data will be online for free, ushering in a new era of climate transparency and accountability.

Explore the data