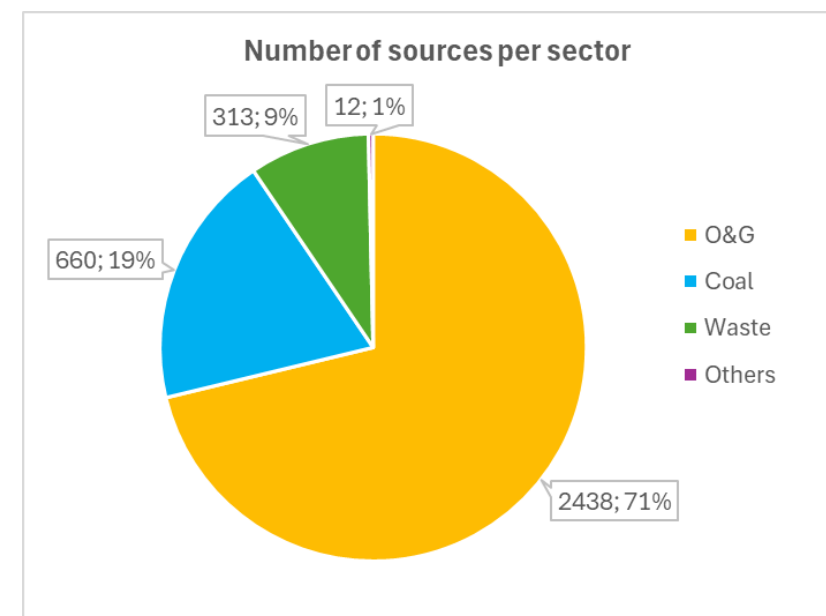
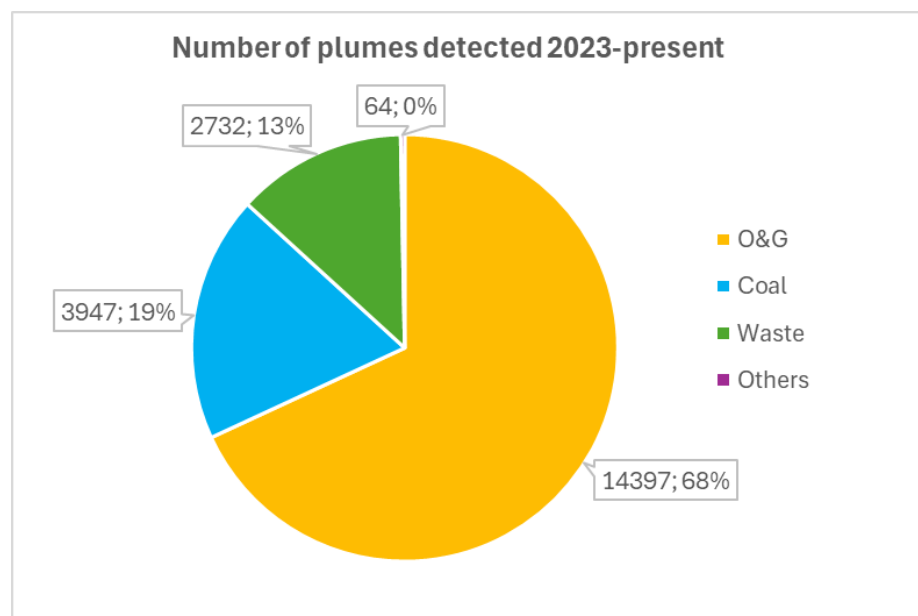


WGClimate-24 & GHG-TT-6

UNEP's IMEO engagement

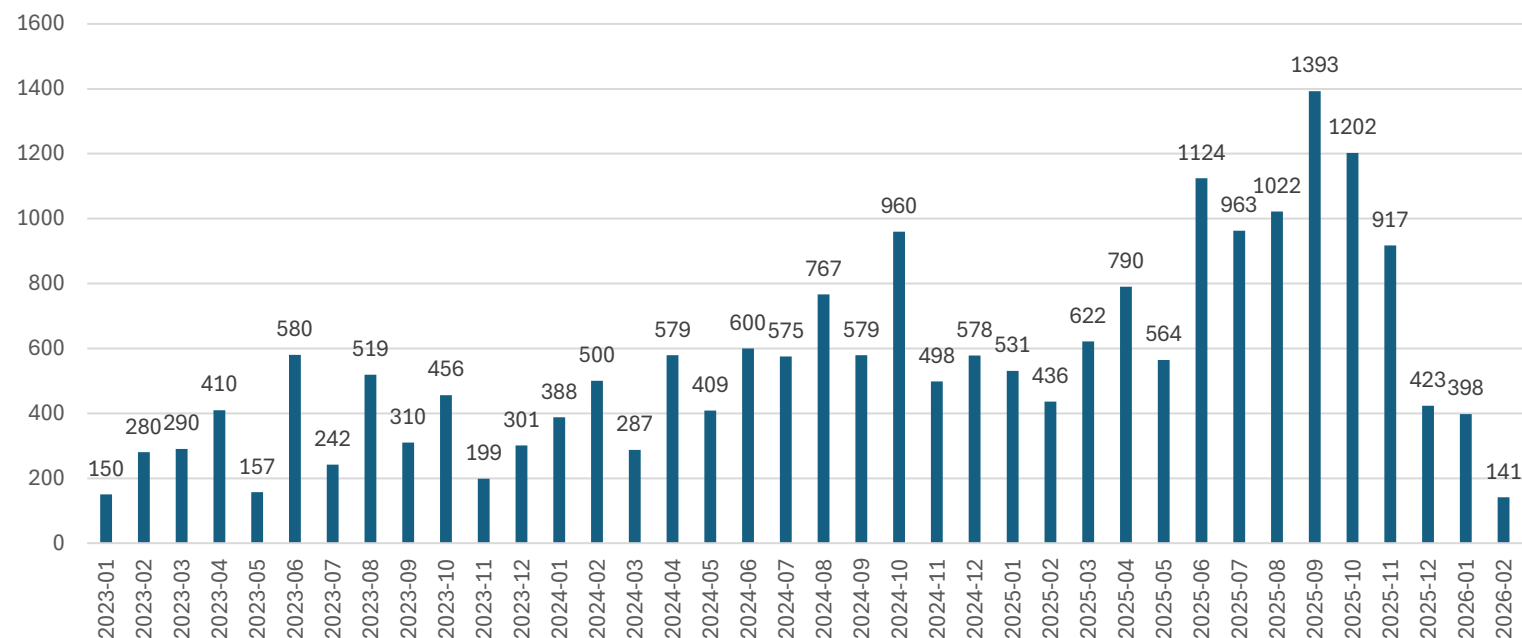
IMEO's MARS in numbers

❖ **21.140 plumes** detected by MARS between 2023 and the present, from **3.423 individual point sources**

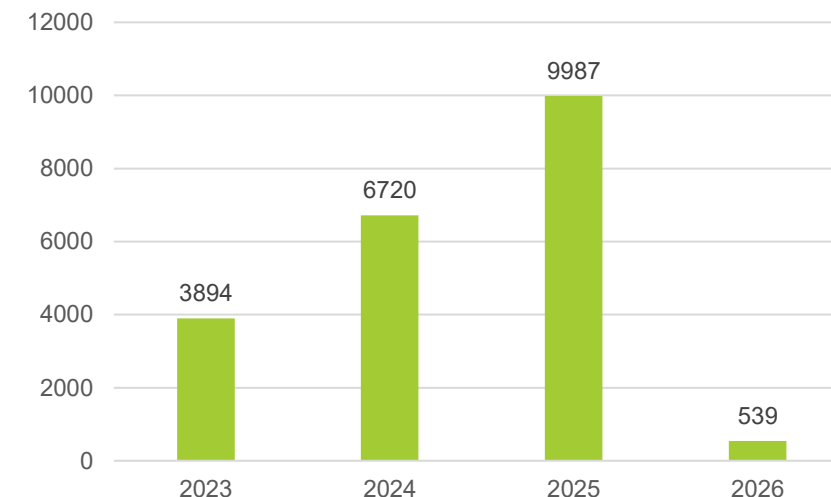


IMEO's MARS in numbers

Plumes detected per month

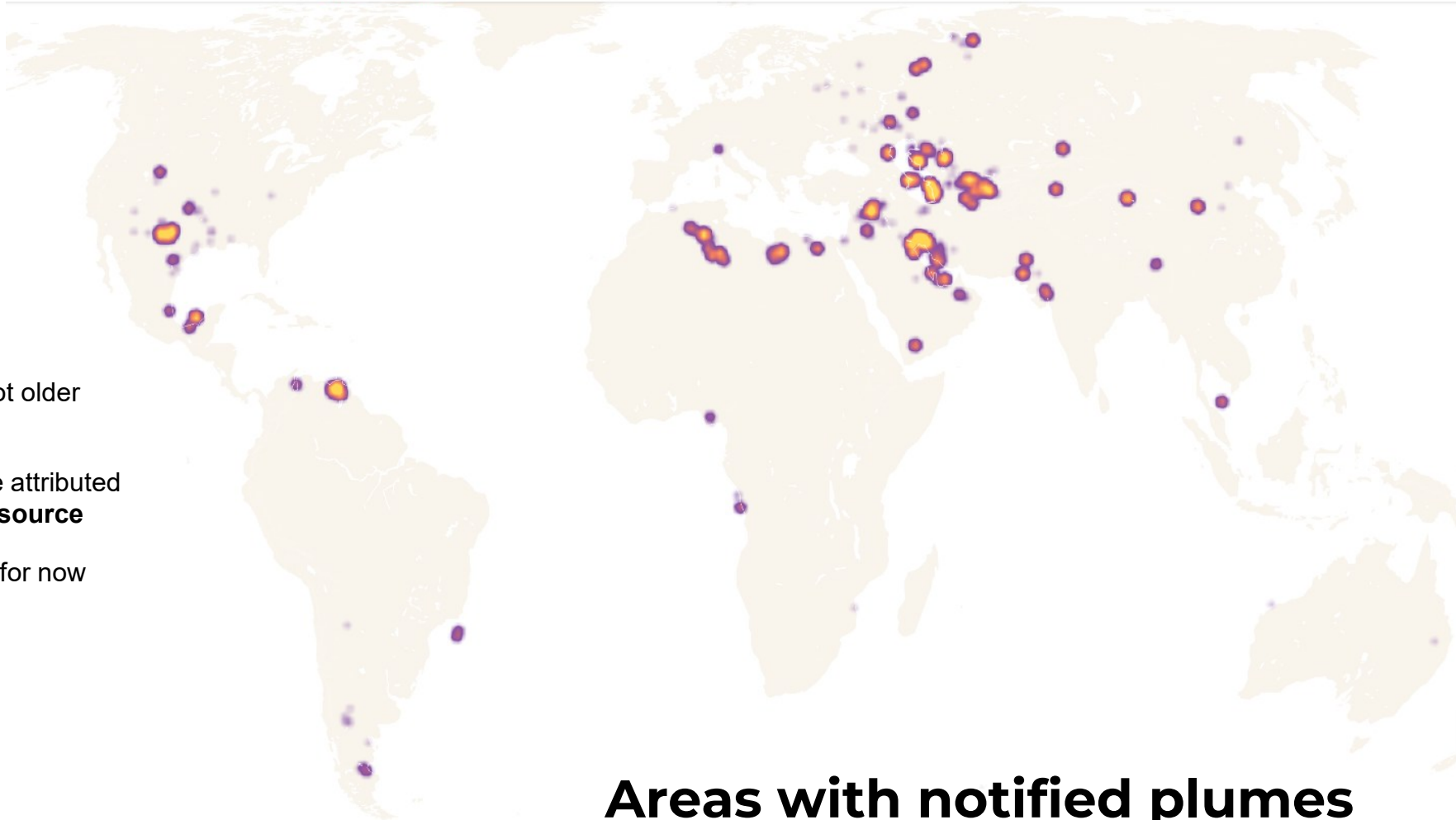


Detected plumes per year



- ❖ 6164 plumes notified and >30 sources effectively mitigated in more than 10 countries
- ❖ Response rate increasing. Several countries with a 100% response rate (inc. Argentina, Yemen, Mexico, Oman, or Brazil)
- ❖ 26 countries with nominated MARS focal point and 156 OGMP companies engaged

IMEO's MARS in numbers

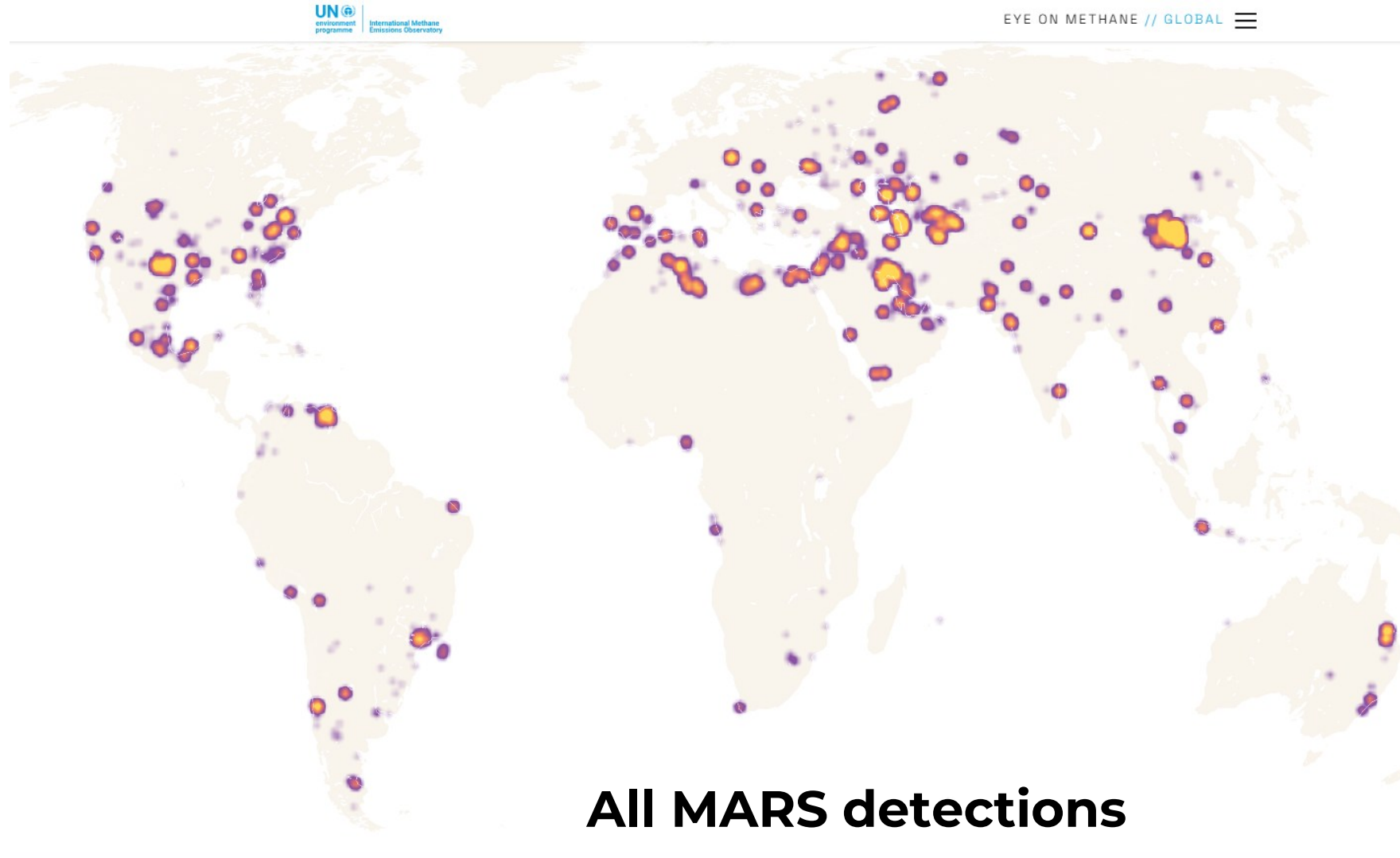


Notifiable plumes:

- **Recent** plumes. Not older than 15 days
- Plumes that can be attributed to a specific **point source**
- Only **O&G** plumes for now

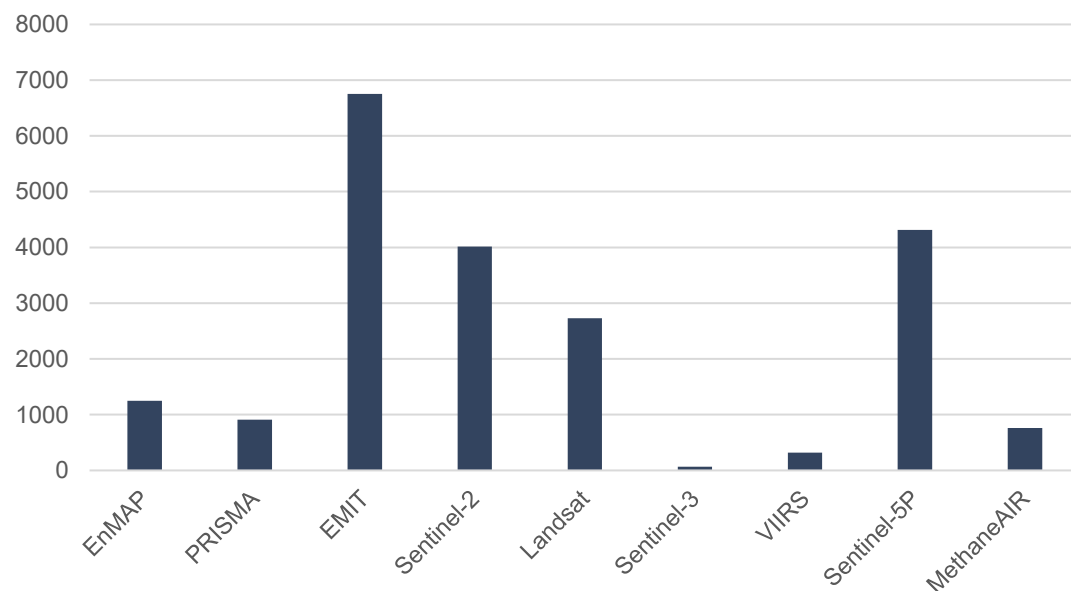
Areas with notified plumes

IMEO's MARS in numbers

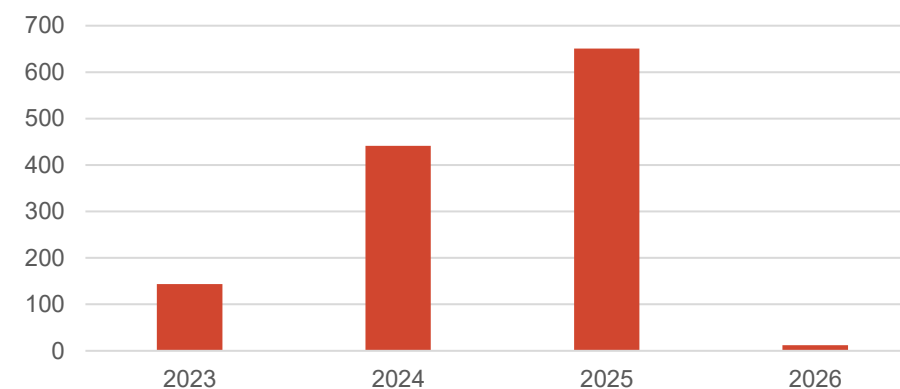


IMEO's MARS in numbers

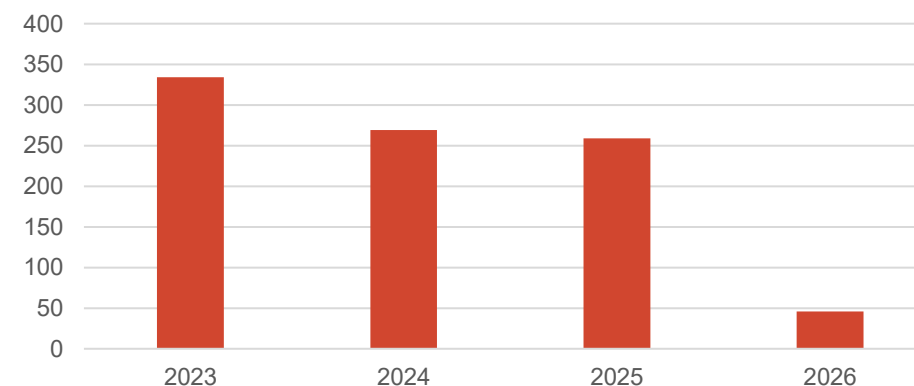
Plumes detected per satellite (2023-present)



EnMAP plumes (emission date)

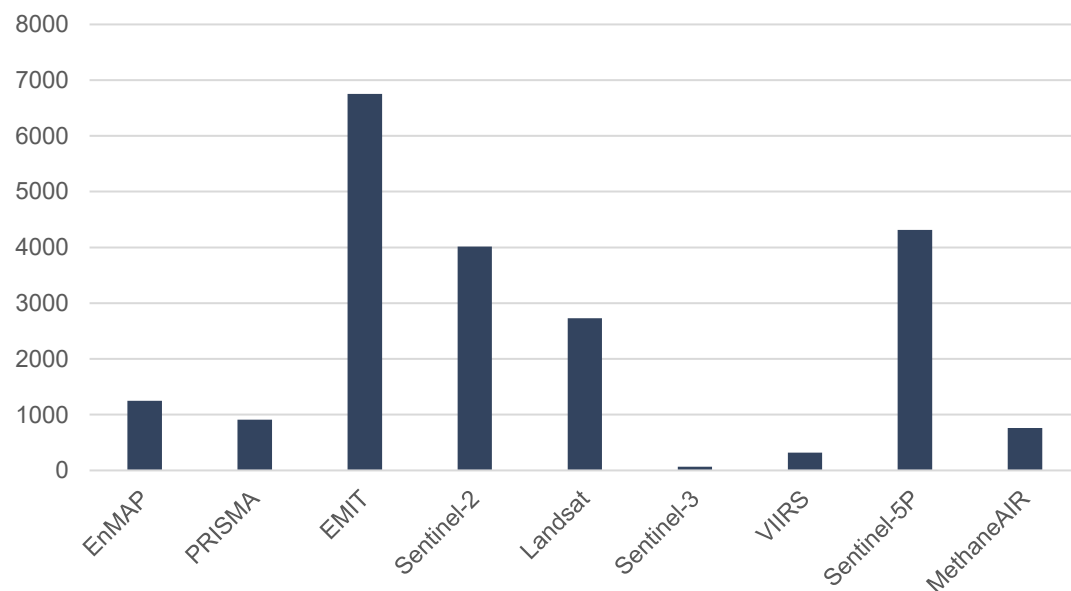


PRISMA plumes (emission date)



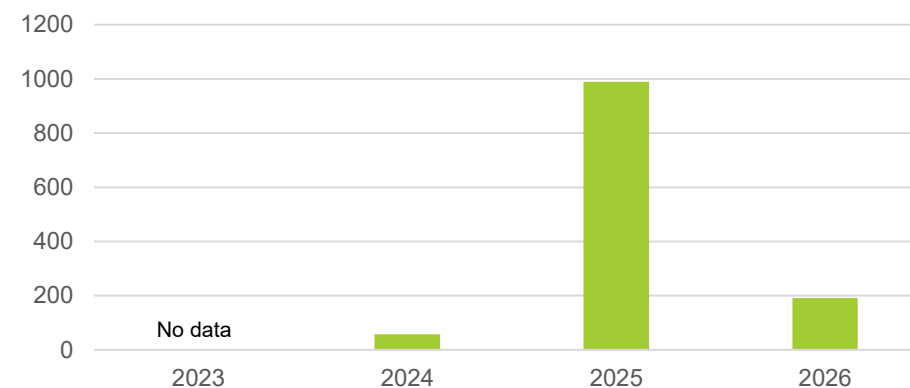
IMEO's MARS in numbers

Plumes detected per satellite (2023-present)

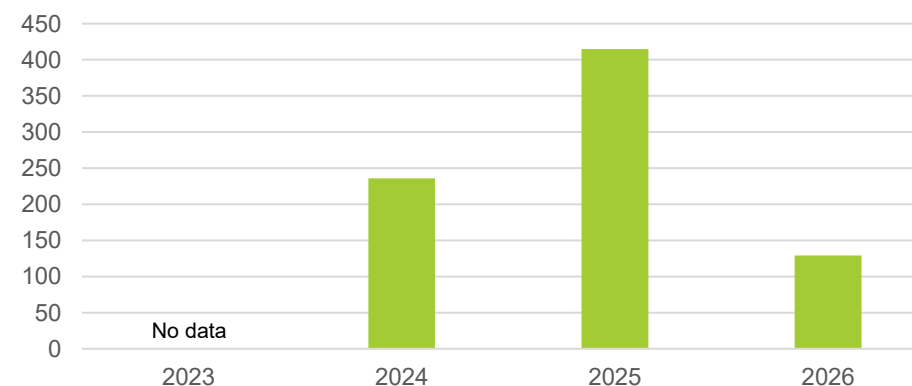


- ❖ EnMAP and PRISMA essential for complex areas, coal and waste sector, and emission cessation verification when we receive feedback
- ❖ GHGSat provided by UKSA key for mitigation verification

EnMAP plumes (validation date)

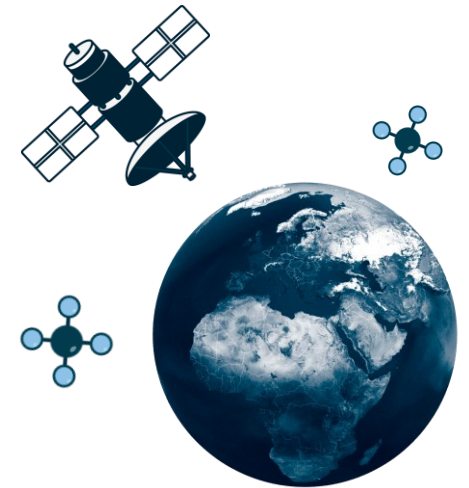


PRISMA plumes (Validation date)



New missions coming to MARS

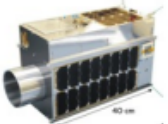
- ❖ MethaneSAT and MethaneAIR archive data
- ❖ Carbon Mapper – Tanager-1
- ❖ Collaboration with Chinese institutions:
 - NSFC – GaoFen-5 and ZY-1 data for IMEO's science studies and MARS notifications
 - HKUST – MUSICO sensor in the CSS



MUSICO instrument

- **Fabry-Perot resonant cavity spectrometer** characterized by light weight, compact size, low power consumption, and comprehensive functionality.
- **Synergic measurements of CO₂ and CH₄** with **a spatial resolution of 100 m** and **a spectral resolution of 0.1 nm**.
- Unique design of **steerable gimbal motion compensation** to achieve required signal-to-noise ratio (SNR) for high spatial resolution.
- **Wide swath of 50 km** that captures more pixels in a single pass.

Aerosol channels:
440 ± 10nm,
685 ± 10nm,
865nm ± 10nm

Instrument Specification	MUSICO 	OCO-2 	GHGSat-D 
Spectroscopy	F-P	Grating	F-P
Spectral Bands	1595-1620nm; 1630-1655nm; 755-775nm	768nm±10nm; 1610nm±25nm; 2060nm±30nm	1652.5nm±22.5nm
Spectral Res.	0.1nm	0.044nm; 0.08nm; 0.1nm	0.1nm
Swath	50km	20km	12km
Spatial Res.	100m	1km×2km, 2km×2km	24m
SNR	>200	>300	>200
Dimension	600mm×600mm×500mm	1200mm×1000mm×600mm	120mm × 120mm × 250mm
Mass	≤70kg	<110kg	15kg

Source and contact: Hui Su, cehsu@ust.hk

MUSICO instrument

	Concentration Precision at 100 m scale	Detectable Minimum Emission at 100 m scale
CO ₂	~0.5% (2 ppm)	32.5 t/h
CH ₄	~1% (20 ppb)	110 kg/h

- Based on model simulation analysis, the precision of CO₂ and CH₄ detection at a 100-m scale will be better than 2 ppm for CO₂ and 20 ppb for CH₄, respectively, allowing for the monitoring of large and medium-sized emission sources.

Source and contact: Hui Su, cehsu@ust.hk

MUSICO instrument

Pre-Phase A: Concept Study (11/2023-4/2024)

Project Approval: 1 April 2024

Phase A: Concept Formulation & Technology Development
(4/2024-8/2024)

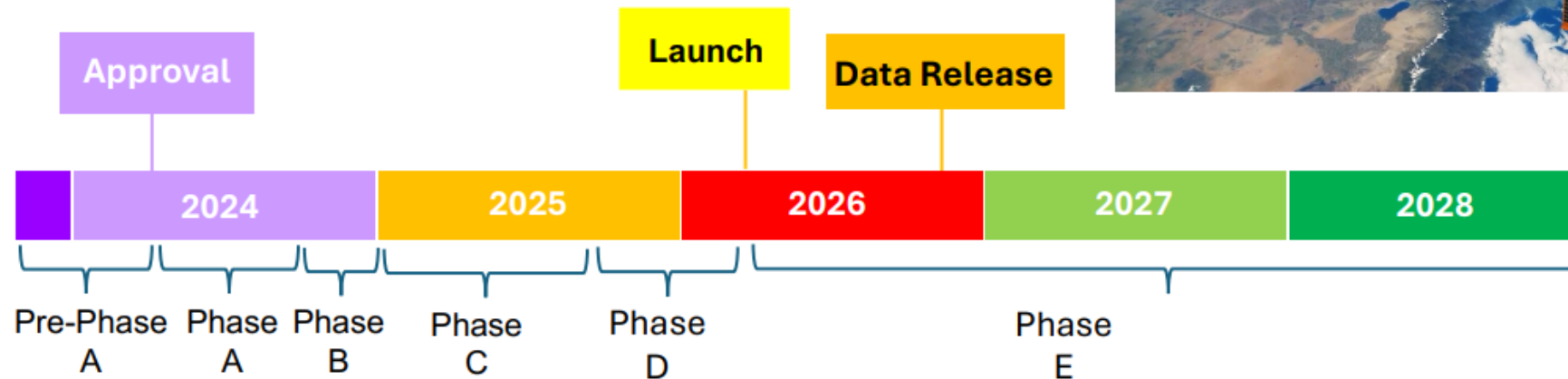
Phase B: Preliminary Design and Technology Completion
(8/24-12/2024)

Phase C: Final Design and Fabrication (1/2025-8/2025)

Phase D: System Assembly, Integration and Test
(9/2025-3/2026)

Launch: May 2026

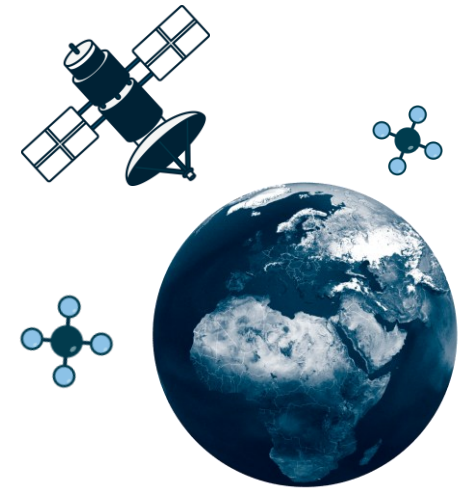
Phase E: Operations and Sustainment (5/2026-12/2028)



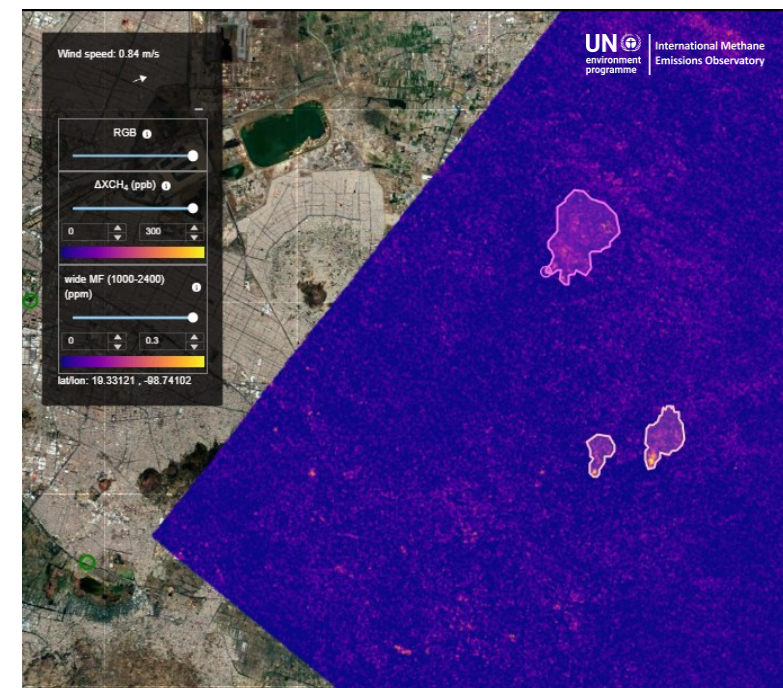
Source and contact: Hui Su, cehsu@ust.hk

New missions coming to MARS

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- ❖ Carbon Mapper – Tanager-1
- ❖ Collaboration with Chinese institutions:
 - NSFC – GaoFen-5 and ZY-1 data for IMEO's science studies and MARS notifications
 - HKUST – MUSICO sensor in the CSS
- ❖ GOSAT-GW data
- ❖ Sentinel-5
- ❖ GEO satellites



- ❖ AI-driven monitoring allowed MARS analysts to process nearly 300,000 satellite images in 2025 only
- ❖ AI models to detect potential methane plumes in 11 high-resolution missions (PRISMA, EnMAP, EMIT, Sentinel-2, Landsat 4-9, MSAT, and MAIR)
 - All AI alerts are analyzed by Remote Sensing analysts before notifying and publishing them in the data platform
- ❖ Plans to continue improving the existing models and build new ones if needed



Potential plumes detected by the AI model on an EMIT image on January 21, 2026, coming from landfills in Mexico City.

Data-derived metrics

The team is working to make the data collected more actionable and useful for policymakers based on their feedback and needs.

❖ **PoD estimation** per satellite, location, and observation conditions.

- Preliminary estimates ready and working to improve them.

❖ **Emission persistence metric:**

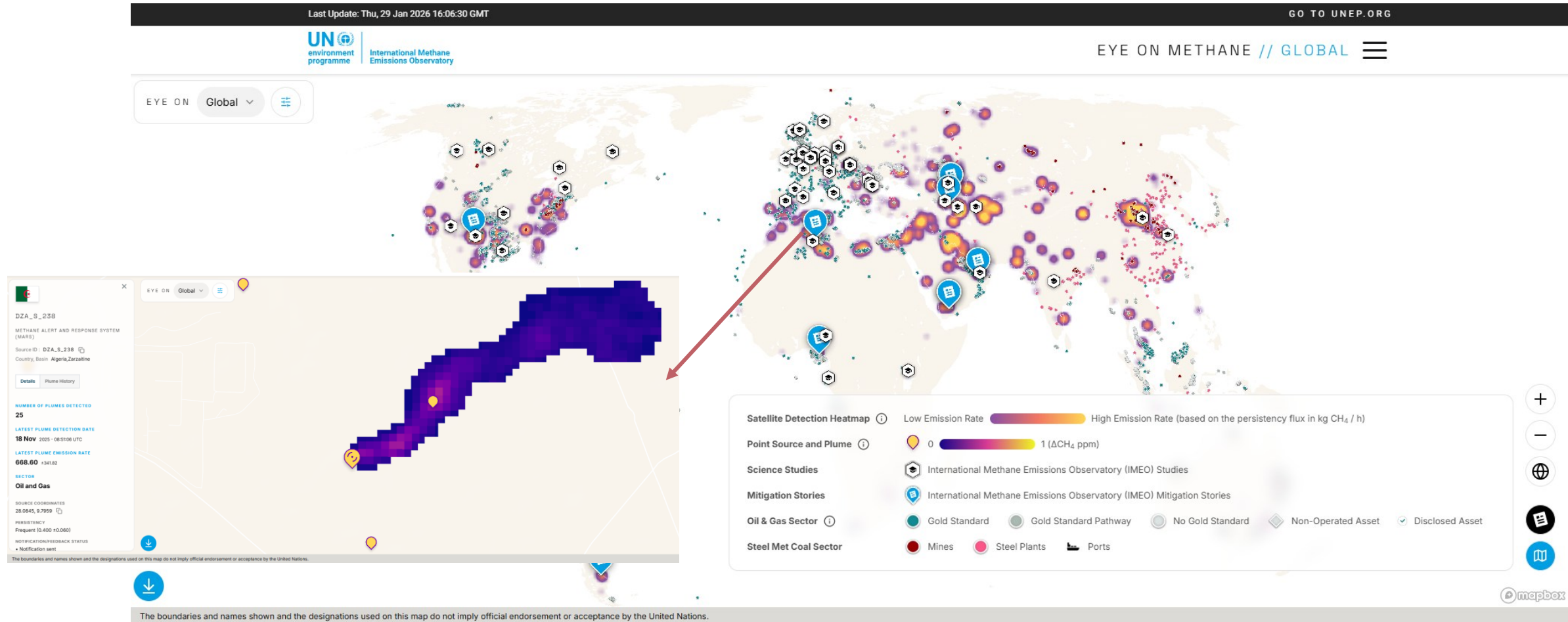
- It takes into account the **different PoDs of satellites** in the time series of observations.
- Right now, the persistence provided is based on data from the **last 6 months** to represent its status “at this moment.”
- We will incorporate **annual emission persistence** in the coming months.
- Persistence is provided per source **numerically**, with its uncertainty, and classified into **categories** (persistent, frequent, sporadic, undetermined)

❖ **Emission status** (coming soon):

- Automatic estimation of emission status per source based on observation time series: ongoing, under review, undetermined, potentially ceased, mitigated
- Sources classified as “mitigated” will require complete operator feedback with a detailed description of effective and sustainable mitigation actions over time

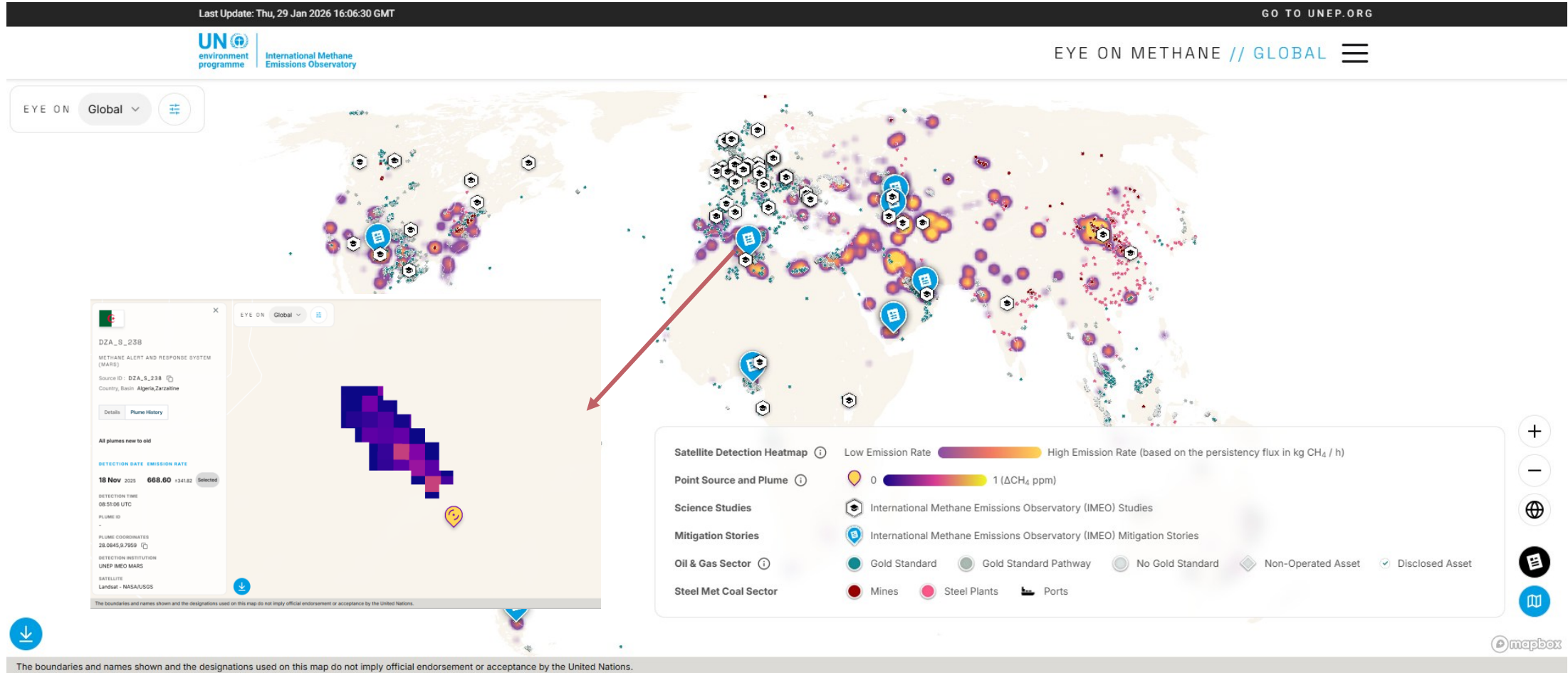
❖ **Top emitters list** (coming soon): List of the largest methane emitters, including all sectors, calculated based on emission persistence and average emission flux rates.

Eye on Methane data portal



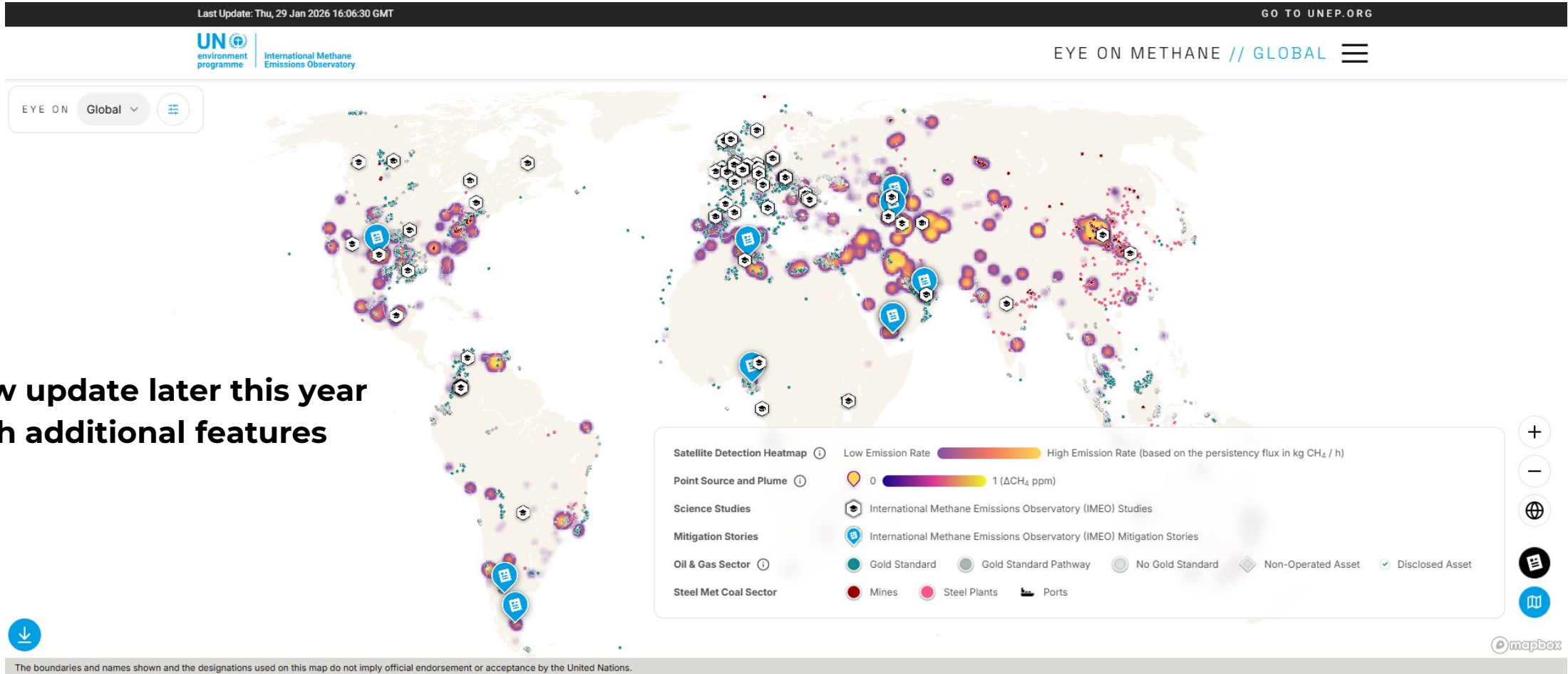
[Eye on Methane data platform | IMEO](#)

Eye on Methane data portal



[Eye on Methane data platform | IMEO](#)

Eye on Methane data portal



We encourage you to provide feedback through: unep-methanedata@un.org

Thank you!

Itziar Irakulis Loitxate (itziar.irakulisloitxate@un.org)

UNEP's IMEO Remote Sensing Lead

