UNEP's IMEO Methane Alert and Response System:

Current status and new requirements to enhance the system

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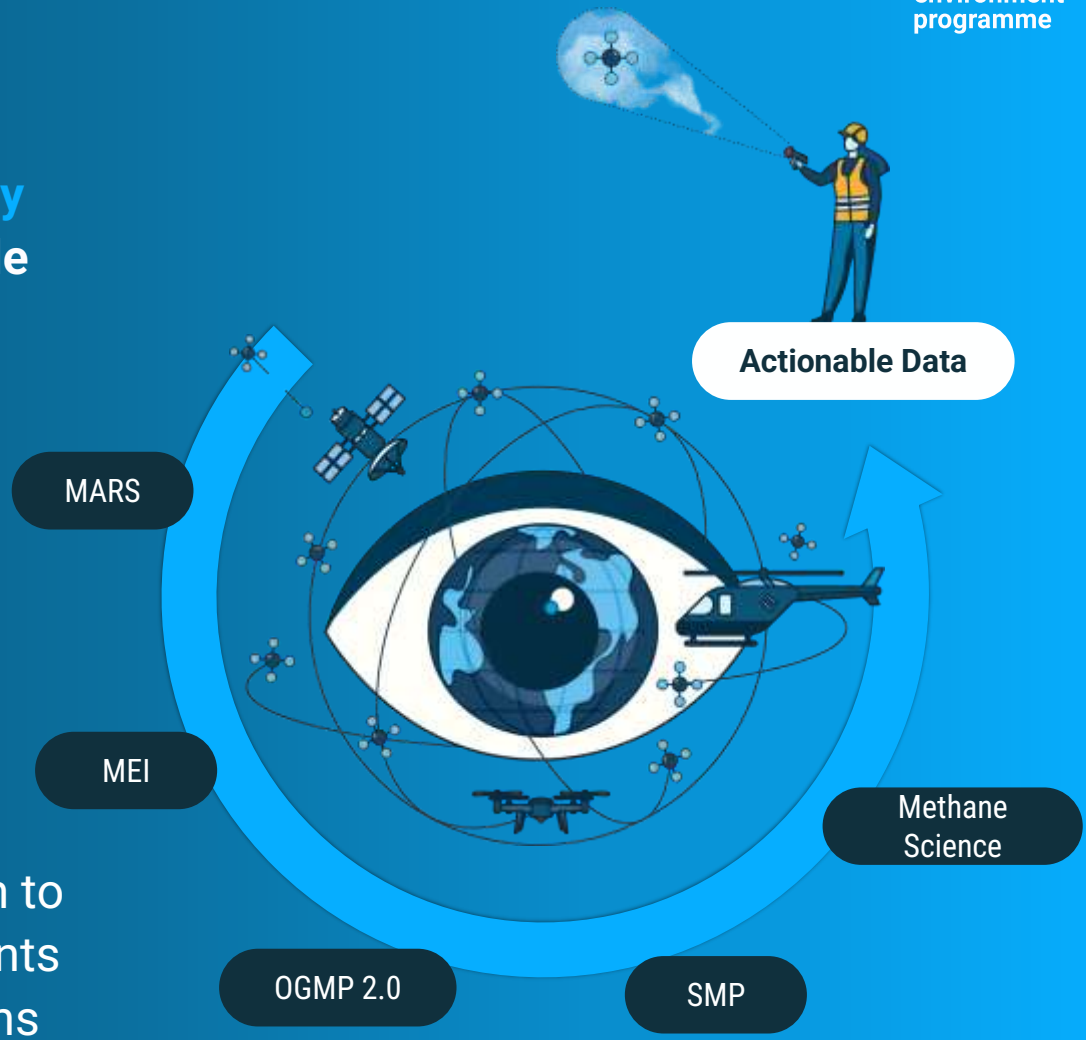
UNEP's IMEO

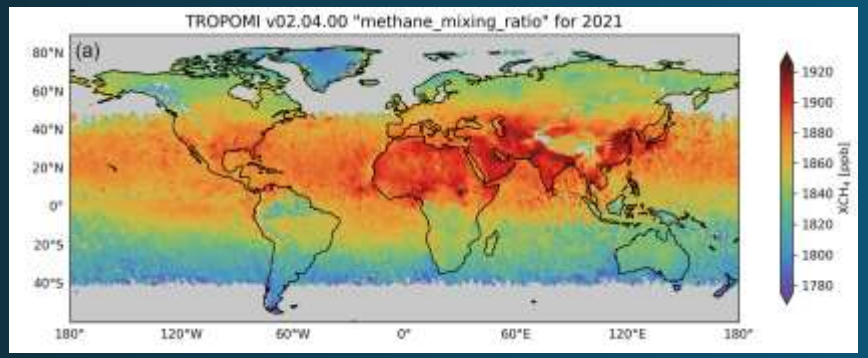
- **UNEP's International Methane Emissions Observatory (IMEO) exists to provide open, reliable, and actionable data to the individuals with the agency to reduce methane emissions.**

- We have the mandate to achieve drastic reductions in methane emissions by 2030 to meet the Paris Agreement.

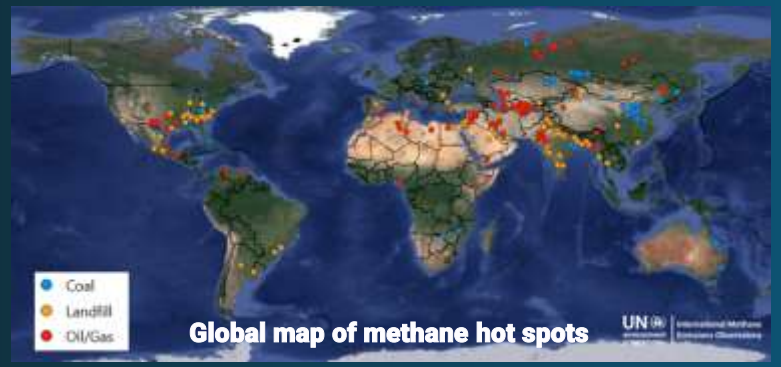
- IMEO consists of several projects

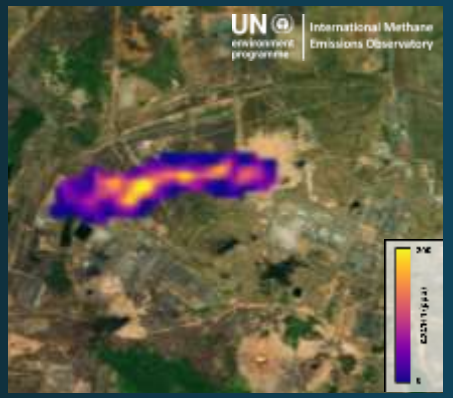
→ **Methane Alert and Response System (MARS):** A system to detect and notify large methane emissions to governments and companies worldwide based on satellite observations





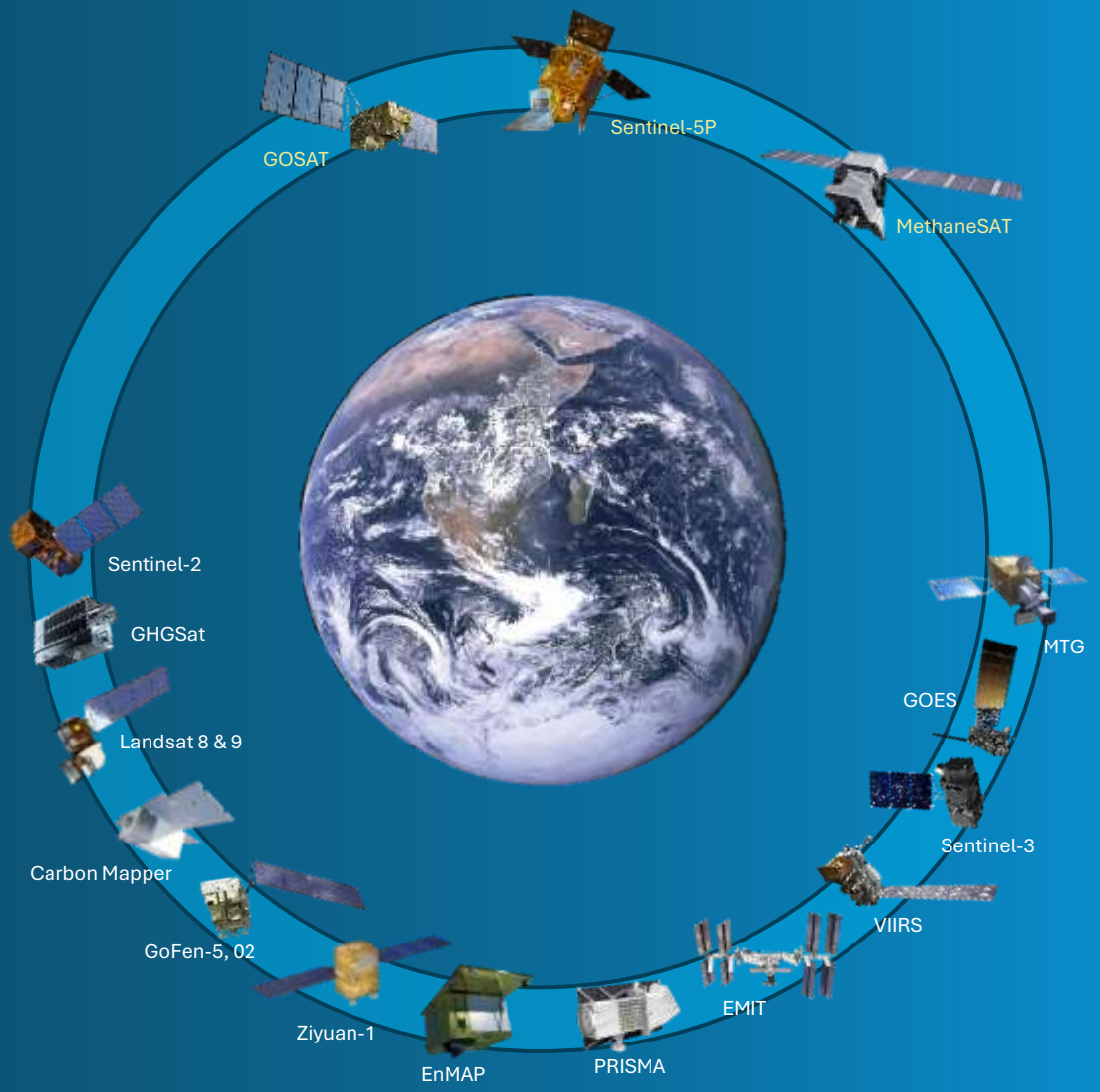
TROPOMI+GOSAT blended product. Balasus et al. 2023, AMT





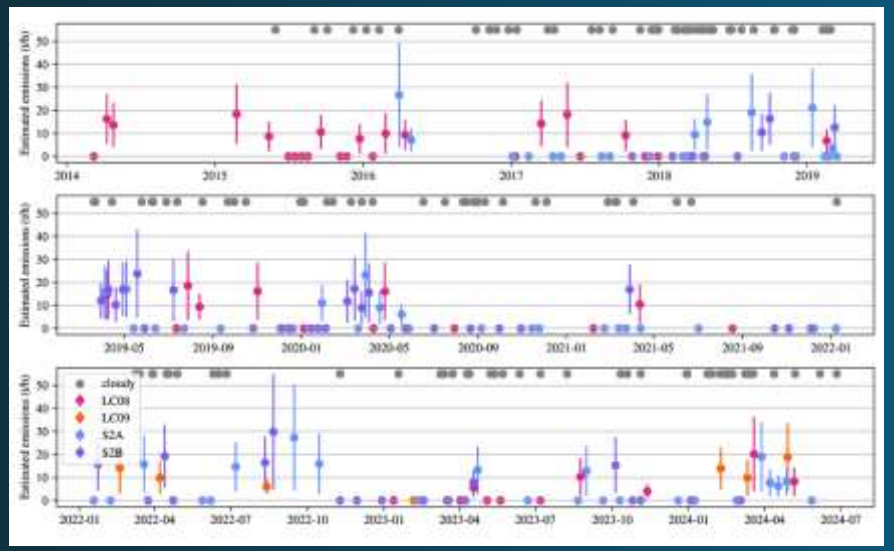
EnMAP detection at an O&G site, Punta de Mata, Venezuela. 9 Mar. 2025
Plume detection through the MARS Plume Viewer

AREA FLUX MAPPERS



POINT SOURCE IMAGERS

Emission time series



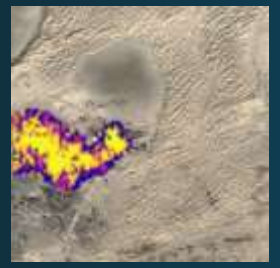
Vaughan et al., 2024 (in preprint)

Landsat 9 2024-09-03

Sentinel-2 2019-04-29

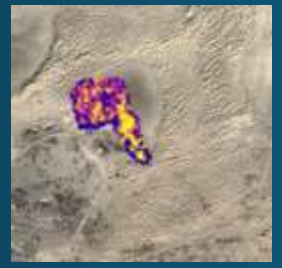
Landsat 8 2013-04-03

Landsat 5 2001-07-22

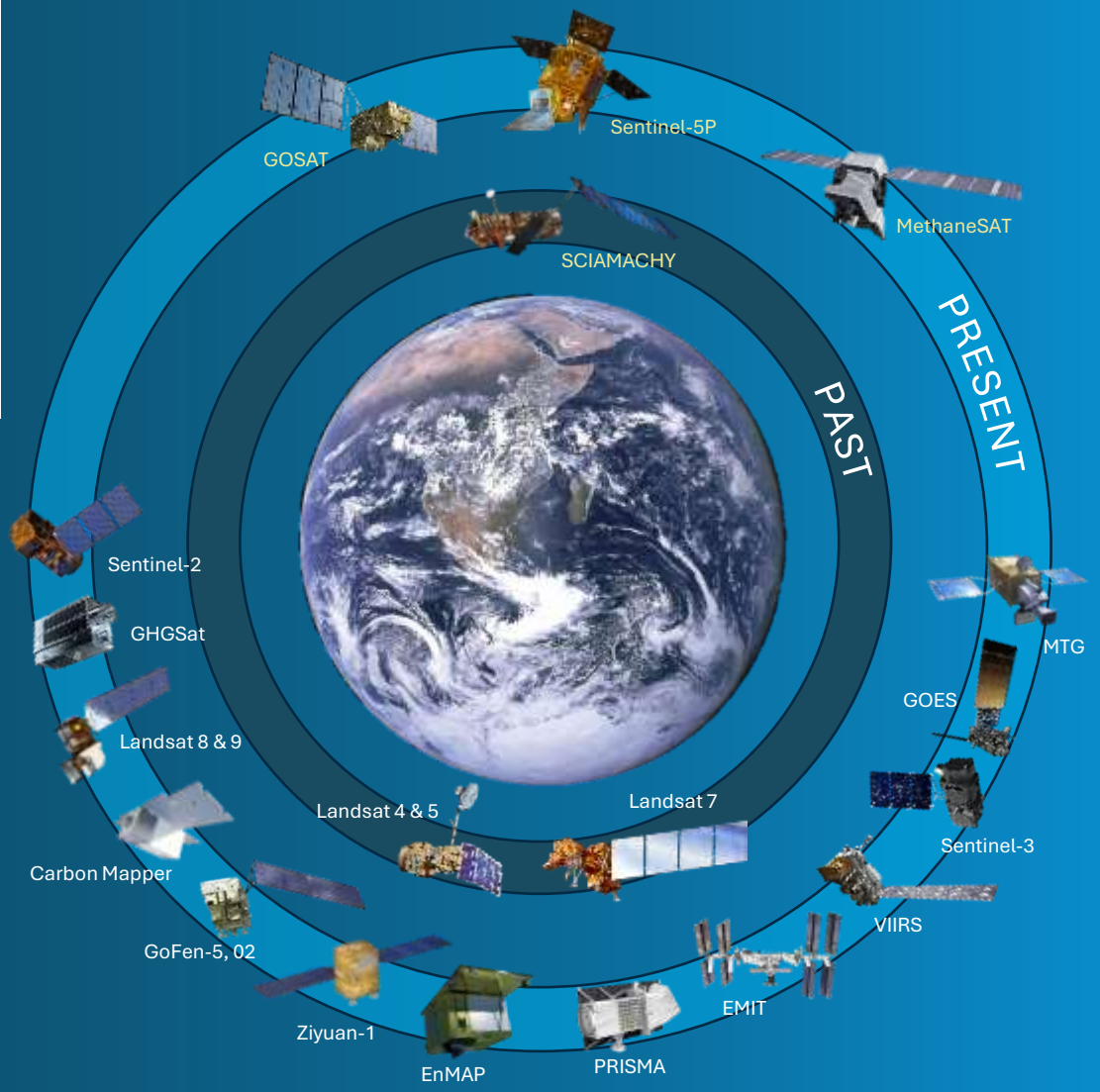


Landsat 5 1992-02-20

Landsat 5 1987-09-09



Plume detections through the MARS Plume Viewer



AREA FLUX MAPPERS

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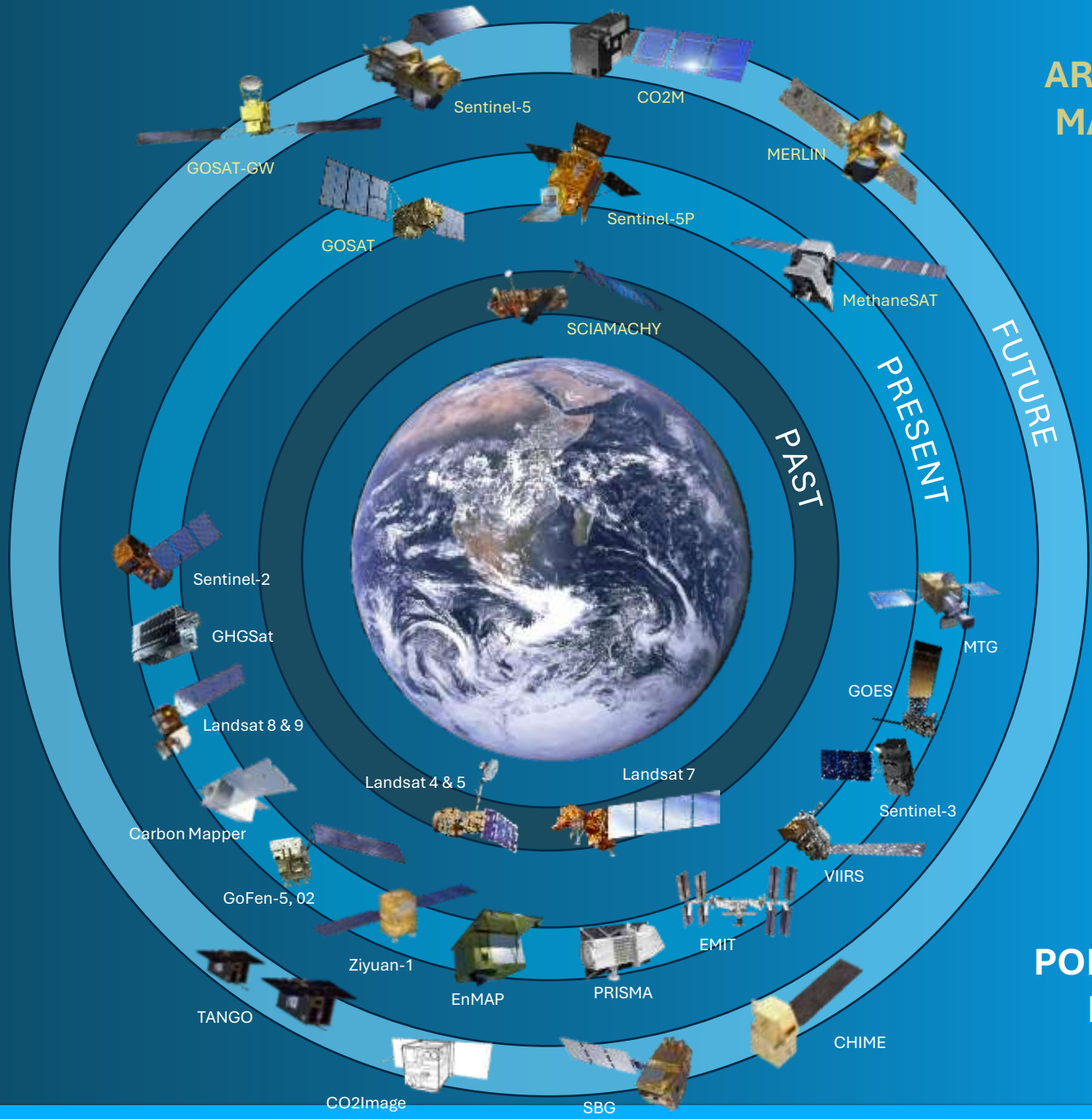
AREA FLUX MAPPERS
UN environment programme
Sentinel-5
CO2M
GOSAT-GW
MERLIN
GOSAT
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MethaneSAT
SCIAMACHY
PAST
PRESENT
FUTURE
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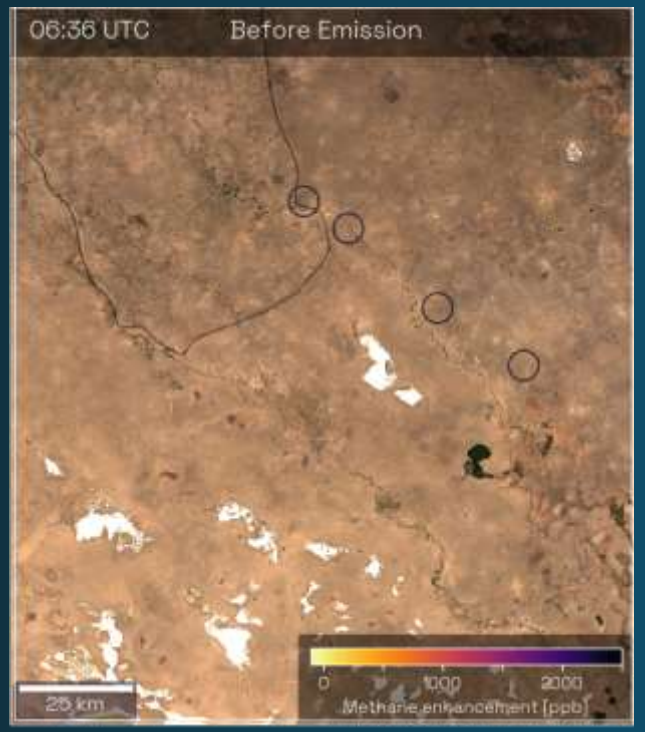
GHGSat
MTG
GOES
Landsat 8 & 9
Landsat 4 & 5
Landsat 7
Sentinel-3
Carbon Mapper
VIIRS
GoFen-5, 02
EMIT
Ziyuan-1
EnMAP
PRISMA
TANGO
CHIME
CO2Image
SBG
POINT SOURCE IMAGERS



Related publication de Jong et al., 2025 GRL

AREA FLUX MAPPERS

UN environment programme

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SBG

Newly added to MARS system

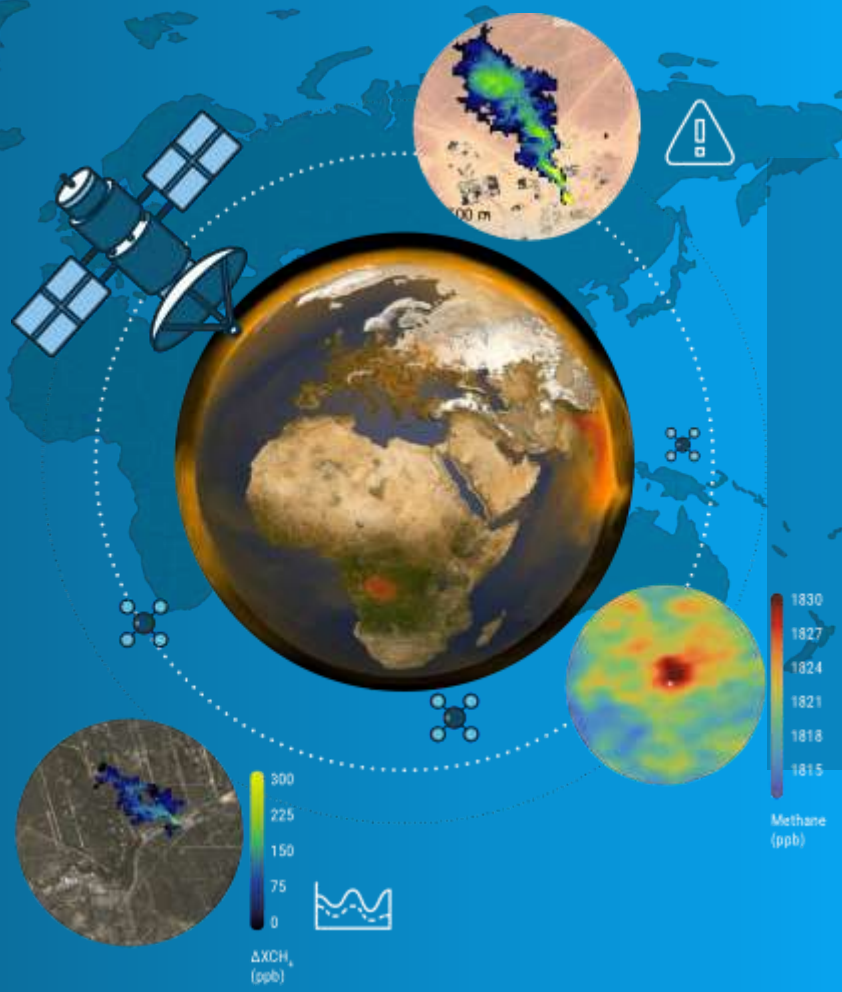
POINT SOURCE IMAGERS

IMEO's Methane Alert and Response System (MARS):

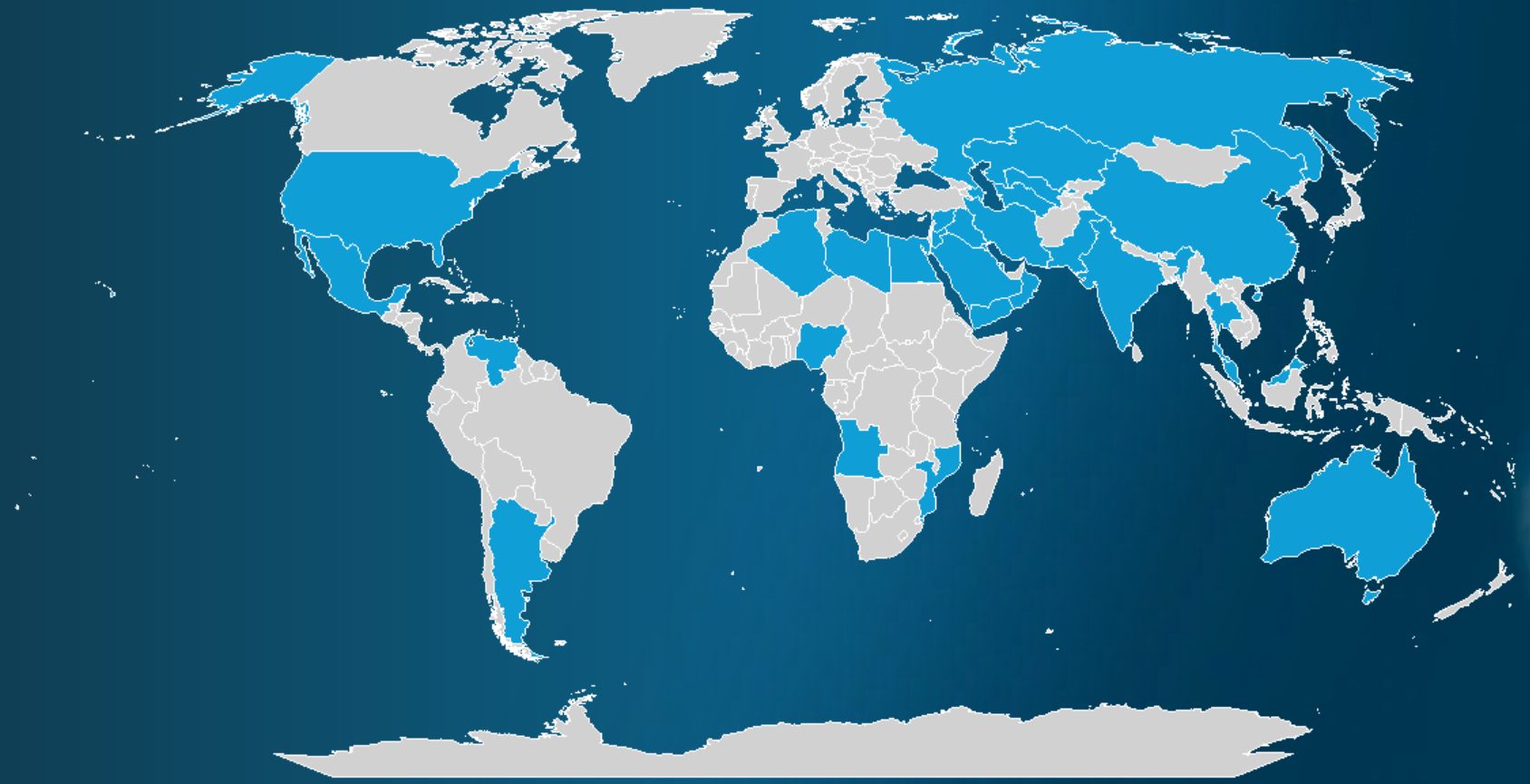
UN environment programme

MARS integrates data from a large ecosystem of methane-sensitive satellites to detect, monitor and attribute emissions to specific facilities and notify governments and companies across the globe.

- We work with AI models adapted to each satellite to improve the efficiency of the image analysis process.
- MARS notifications:
  - O&G sector + met coal pilot (different approach)
  - High-resolution plumes or confidently attributable to specific sources
  - Recent plumes (no older than 15 days)
- Feedback is requested from governments and companies on every notification.



Countries notified by MARS



From the oil and gas sector

- **Over 8,200** high-resolution detections
- **More than 2,500** plumes notified coming from **814 different sources** in **32 countries**

Across all sectors

- **Over 14,000** plume detections
- **More than 11,700** high-resolution detections in 63 countries

IMEO Eye of Methane Data Platform

- All MARS detections available in the data portal 30 days post-detection with their associated information
- The platform also provides information on IMEO's science studies and OGMP 2.0 data
- Data accessible to download through Excel, GeoJson, and API.

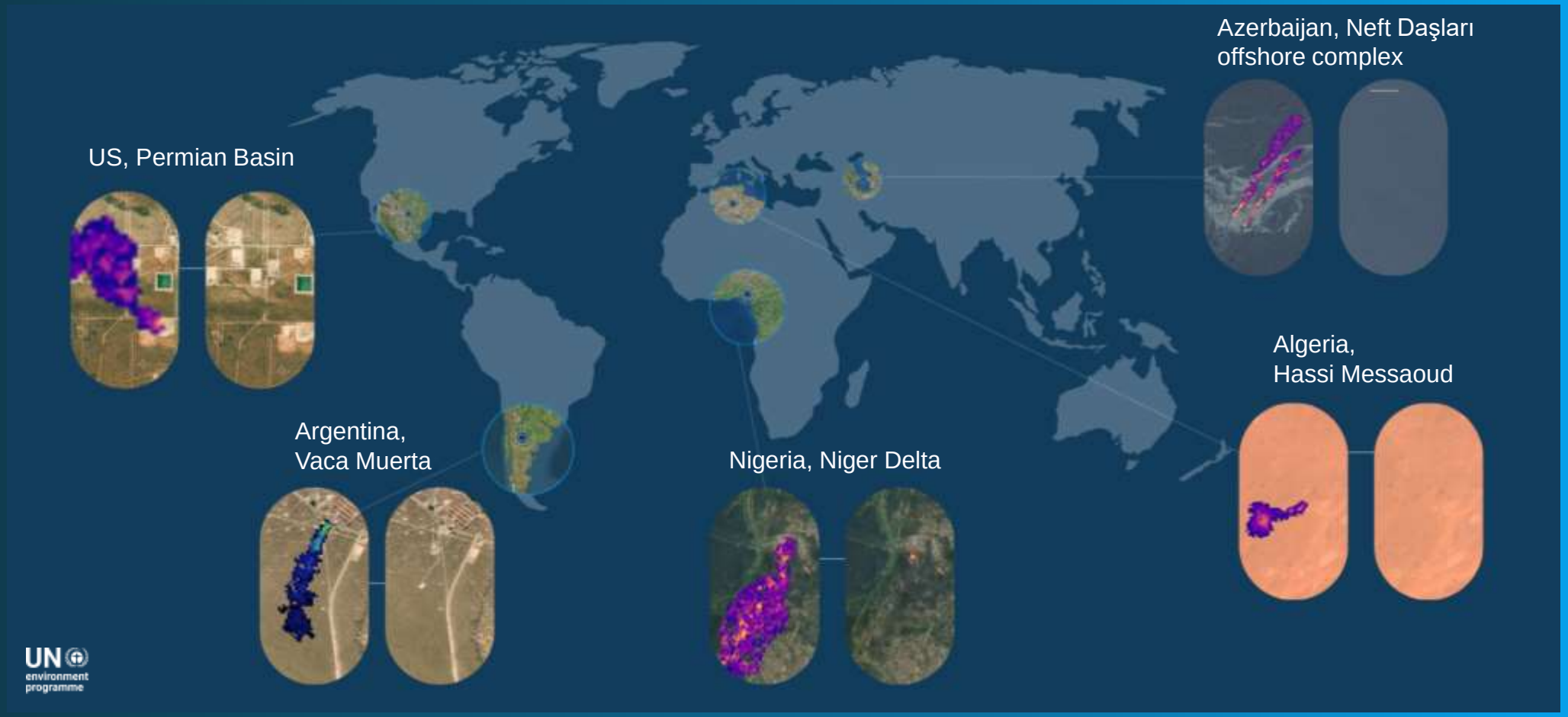
* Mayor update of the platform latter this year (2025) with new features and functionalities

Access to the data portal:

https://methanedata.unep.org/

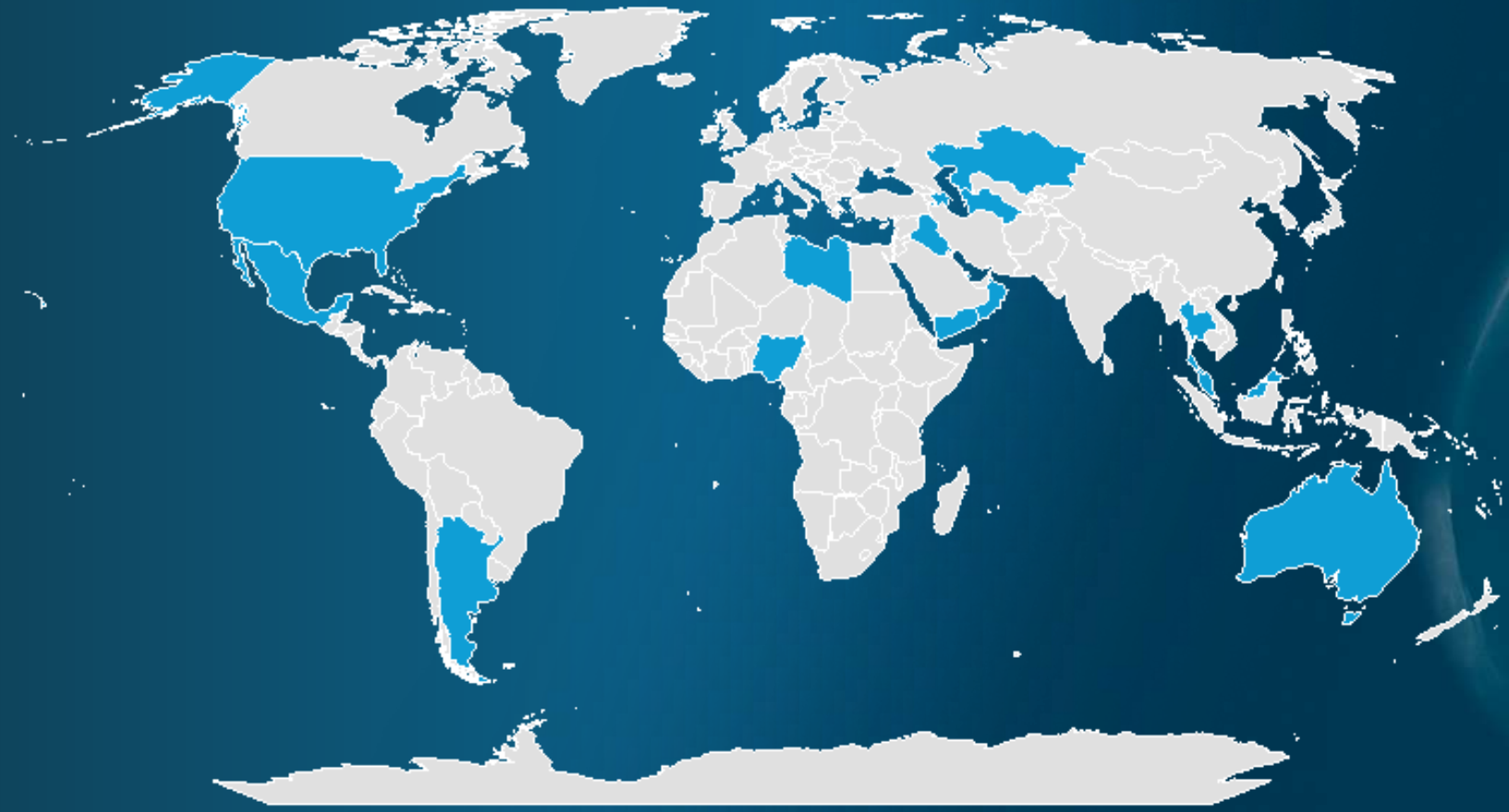
or scanning the QR code

→ MARS mitigation cases by 2024



https://www.unep.org/resources/eye-methane-2024

Countries providing feedback and taking action



- 10x increase in response rate
- Over 150 feedbacks received related to more than 80 sources from 15 countries
- ~45% permitted short duration events; ~35% mitigation actions taken or underway; ~20% no concrete actions taken yet

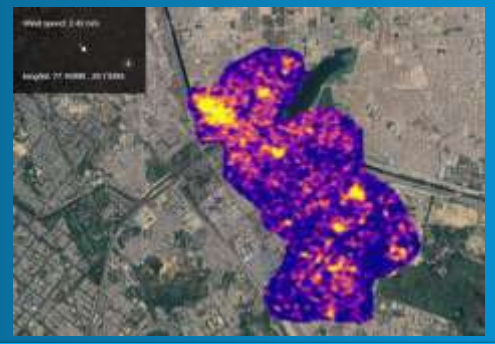
Needs for further improvements

- MARS data is expanding to other sectors. As we find more cases, we identify new limitations.
  - Better wind data
  - More accurate wind calibrations (*Ueff*) under different scenarios
    - Particularly concerning the quantification of landfills, open pit mines and, in general, diffuse emissions

O&G point source emissions

vs.

Landfill diffuse emissions



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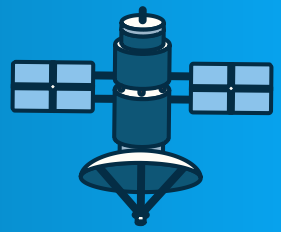

- Test our methods under different scenarios
  - IMEO, together with CEOS is putting together a controlled release experiment calendar for past, ongoing, and future release experiments.
  - If you do or know about new controlled release experiments, please share it with the community!
- For quick action, quick access to data
  - Hyperspectral/high methane sensitivity open-source satellite data especially welcome to have better coverage in difficult areas (e.g., high latitudes, vegetated areas, offshore, etc.).

Thank you !

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