

2024 Global Methane Forum

Mobilizing Methane Action

18-21 March 2024, Geneva, Switzerland

The Role of Technologies in Improving Measurements & Enhancing Inventories to Enable Faster Action

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Kayrros

New technologies are unlocking large-scale abatement opportunities

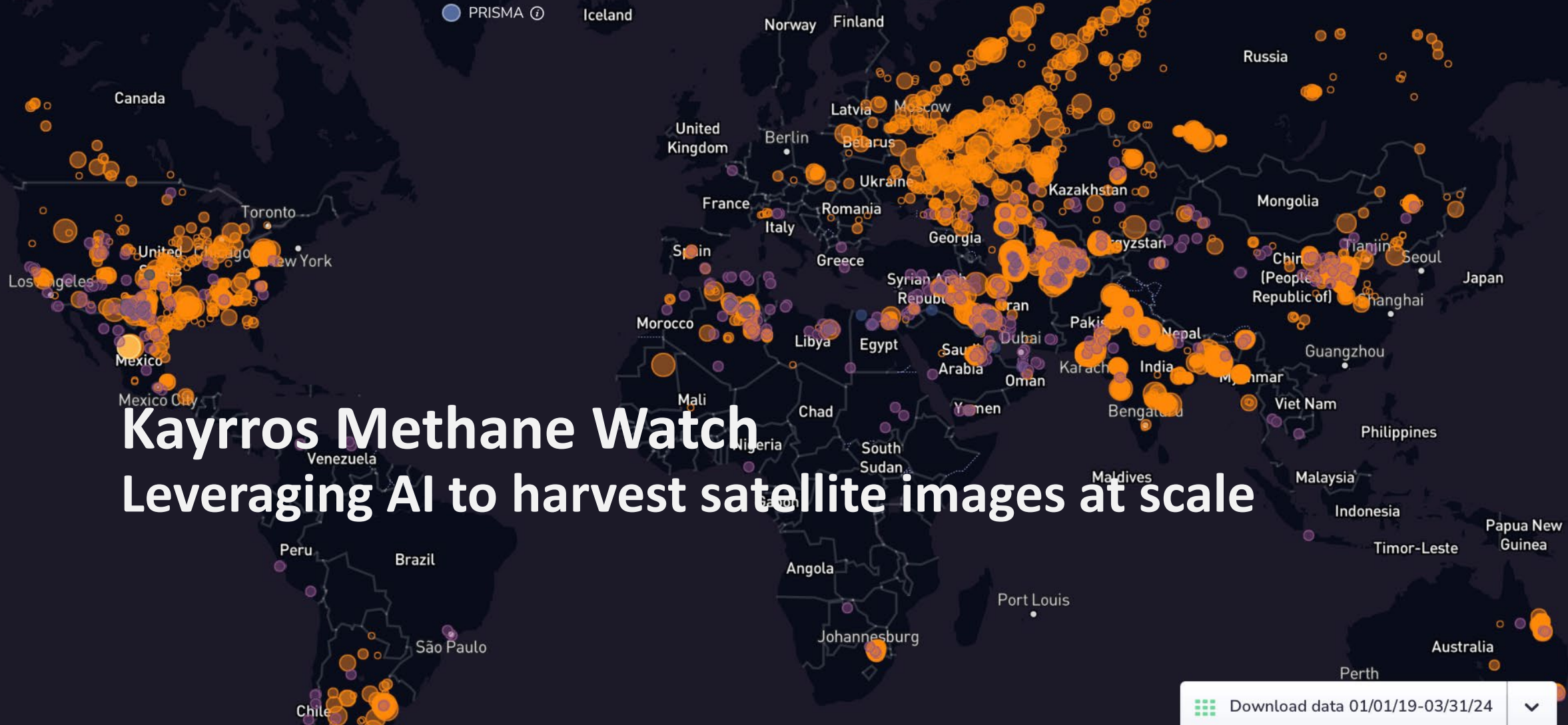
- “You can’t manage what you can’t measure.” For a long time, you just couldn’t measure methane
- Emission factors are useless to estimate methane emissions
 - Unlike carbon, methane is not a by-product of fossil fuel consumption
- Colorless, odorless, intermittent & sporadic
- MIA at COP21
- Multispectral sensors were long hard to deploy at scale
- AI + earth observation: a game changer
- Use cases: Super-emitters & inventories



- Low-resolution
- Sentinel-5P
 - Sentinel-3
 - GOES-R
- High-resolution
- Sentinel-2
 - EMIT
 - EnMAP
 - PRISMA

- Oil & Gas
- Coal
- Other Human Activity
- O&G fields
- Pipelines

2000 km



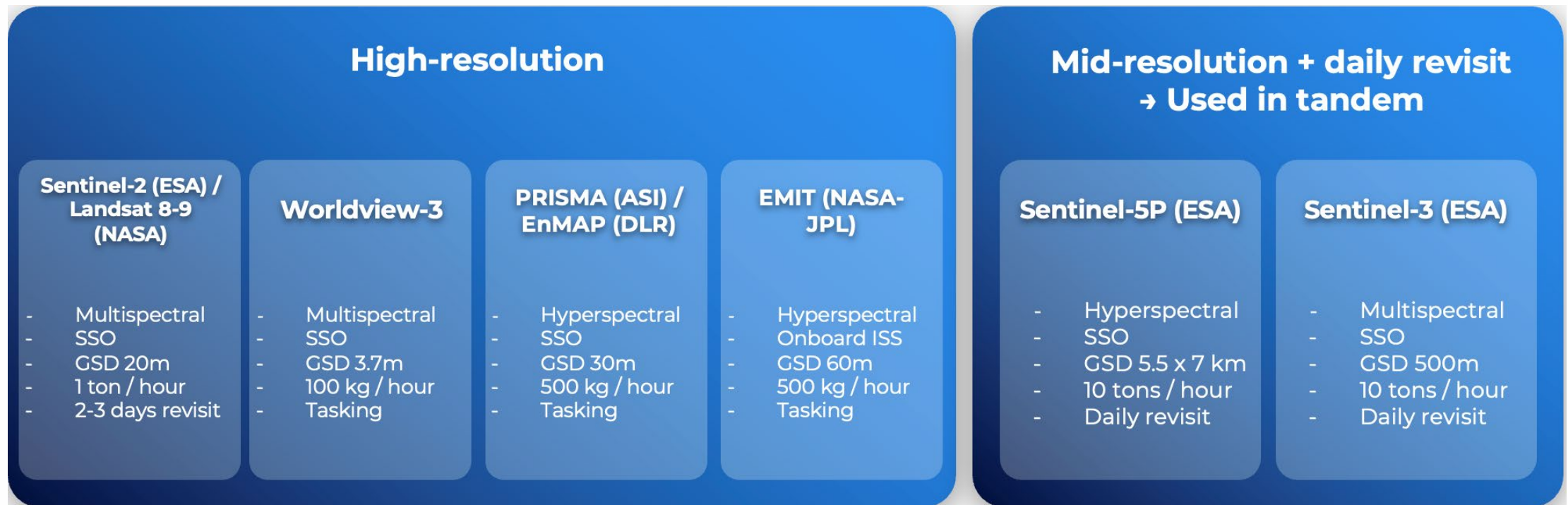
Kayrros Methane Watch

Leveraging AI to harvest satellite images at scale

Download data 01/01/19-03/31/24

Overcoming trade-offs

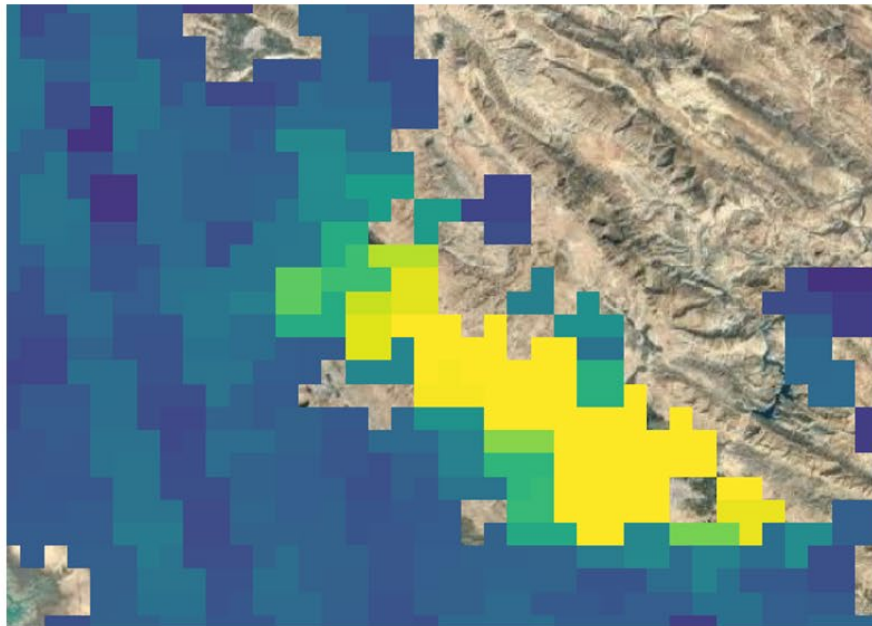
Data fusion helps transcend the limitations of individual instruments to create an ideal synthetic methane monitoring system



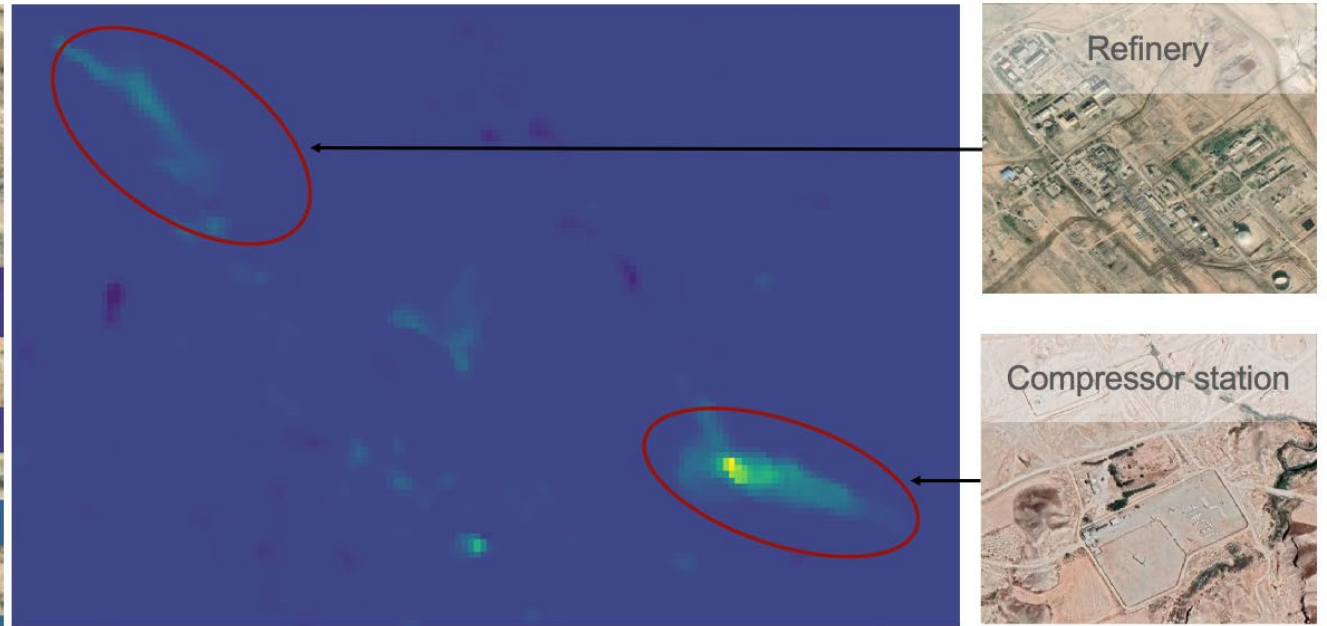
“Tip and cue”

Fusing data from multiple satellites to zoom in on the point sources of large releases

| Sentinel-5P



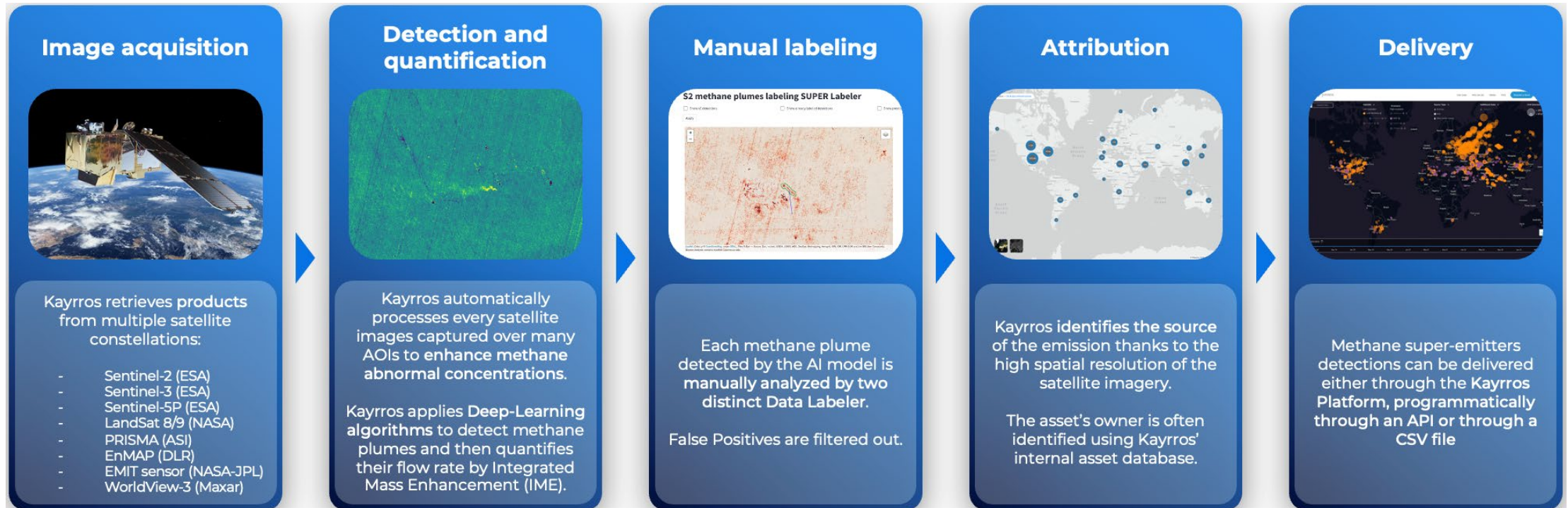
| Sentinel-3



Super-emitters: the proverbial low-hanging fruits

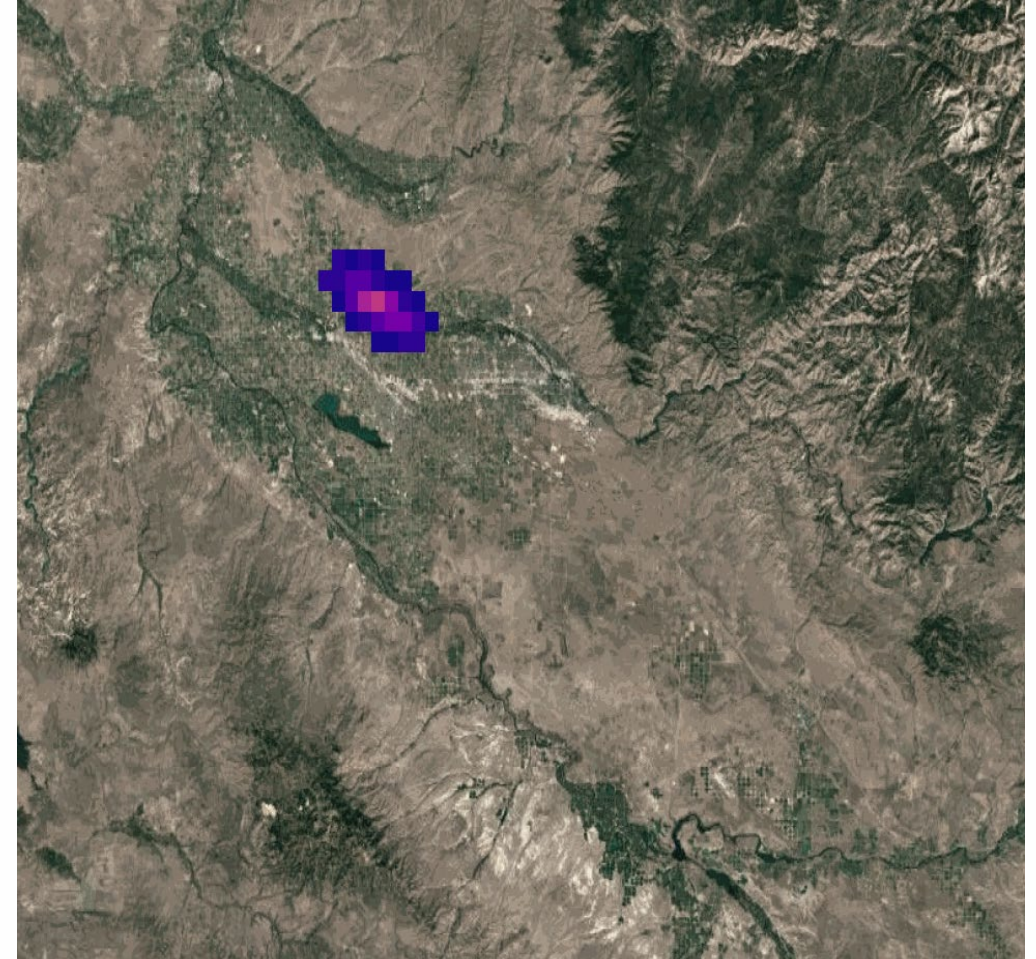
Scale and speed of monitoring are of the essence:

- *2,500+ super-emitters detected by Kayros in 2023*
- *Rapid response: 2-3 days between capture and delivery*



Sizing up a release with geostationary imagery

- A pipeline blast that displaced 10,000 people in Ohio on Oct. 12, 2023 at 10:39am caused a large, unreported methane release
- Kayrros started observing the emission at 10:46am
- **Based on GOES-16 images, Kayrros estimated the release at 840 tons**, equivalent to the annual emissions of ~15 000 U.S cars
- Large methane cloud drifted 120 kms southeast and remained visible for five hours

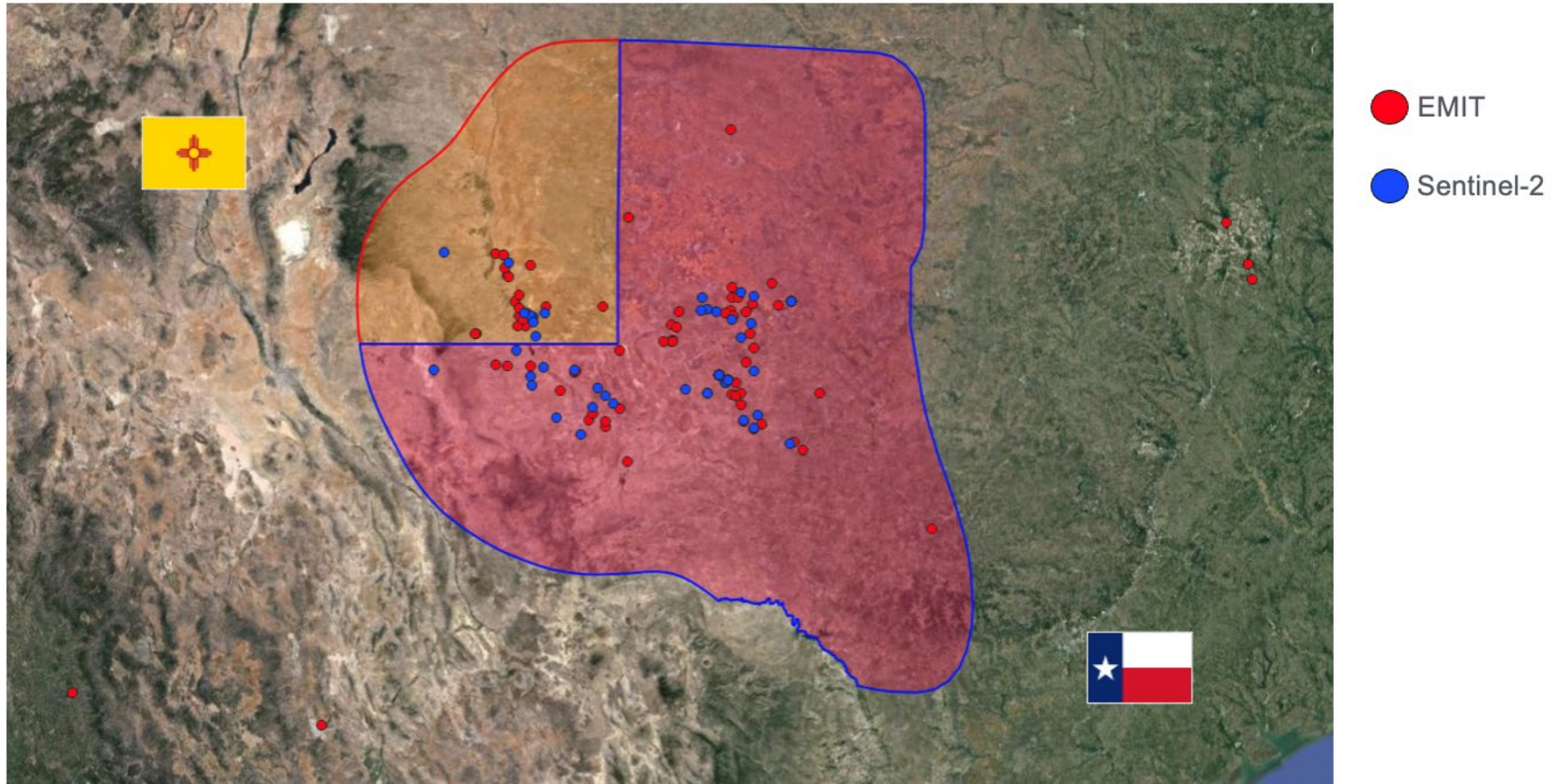


Source: Kayrros SAS, processed L1B images from NASA/NOAA GOES-16 satellite



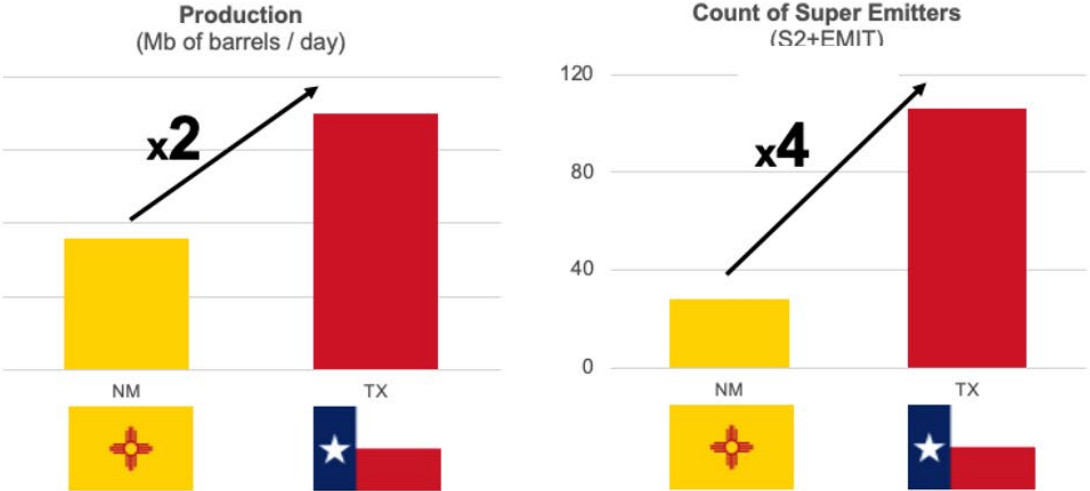
Assessing the impact of regulations

Two sides of the Permian basin

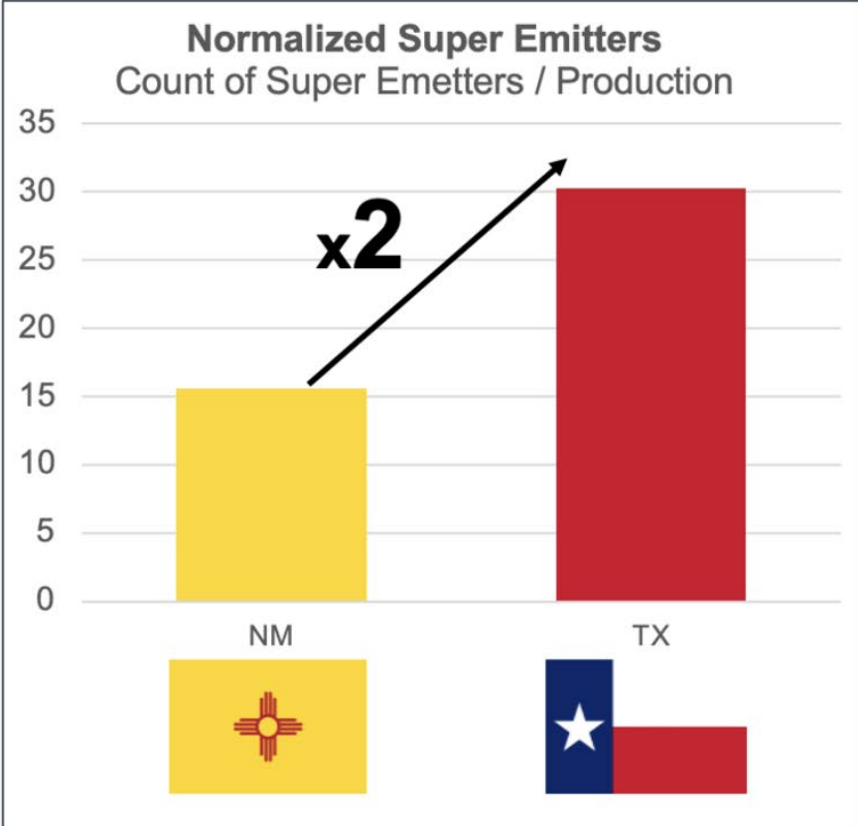


Fewer super-emitters on one side of the Permian than on the other

Number of Super Emitters (Sentinel-2)
normalized for production level, Q1 2023



Source: Kayrros



Scientific validation

Article | [Open access](#) | Published: 07 March 2023

Single-blind validation of space-based point-source detection and quantification of onshore methane emissions

[Evan D. Sherwin](#) ✉, [Jeffrey S. Rutherford](#), [Yuanlei Chen](#), [Sam Aminfard](#), [Eric A. Kort](#), [Robert B. Jackson](#) & [Adam R. Brandt](#)

Scientific Reports **13**, Article number: 3836 (2023) | [Cite this article](#)

Single-blind test of nine methane-sensing satellite systems from three continents

[Evan D. Sherwin](#)^{1,a}, [Sahar H. El Abbadi](#)^{1,a}, [Philippine M. Burdeau](#)¹, [Zhan Zhang](#)¹, [Zhenlin Chen](#)¹, [Jeffrey S. Rutherford](#)^{1,b}, [Yuanlei Chen](#)¹, and [Adam R. Brandt](#)¹

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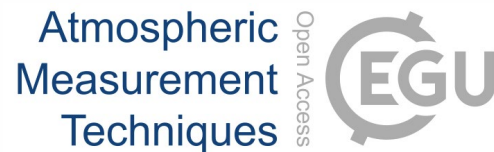
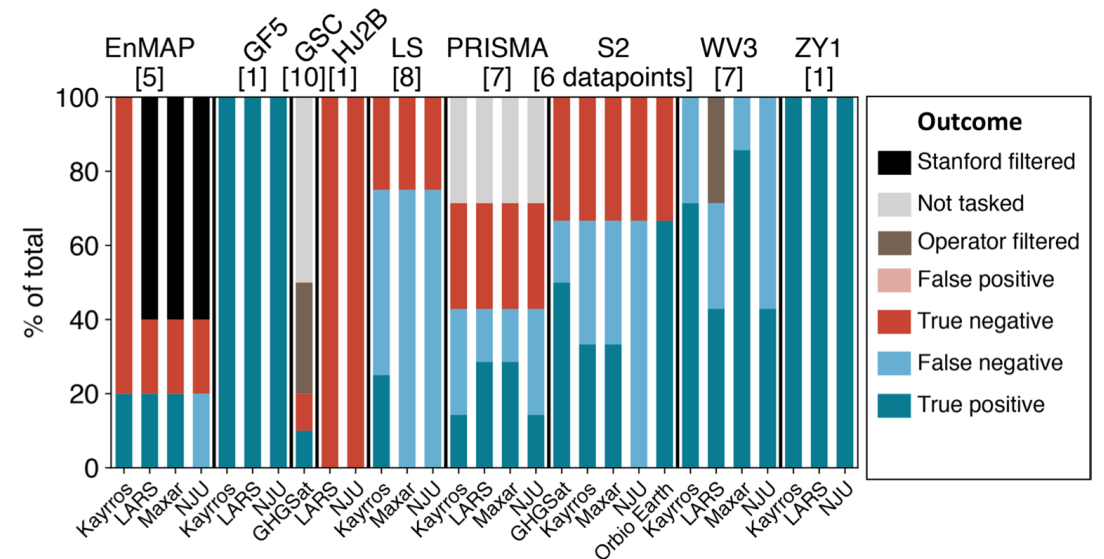
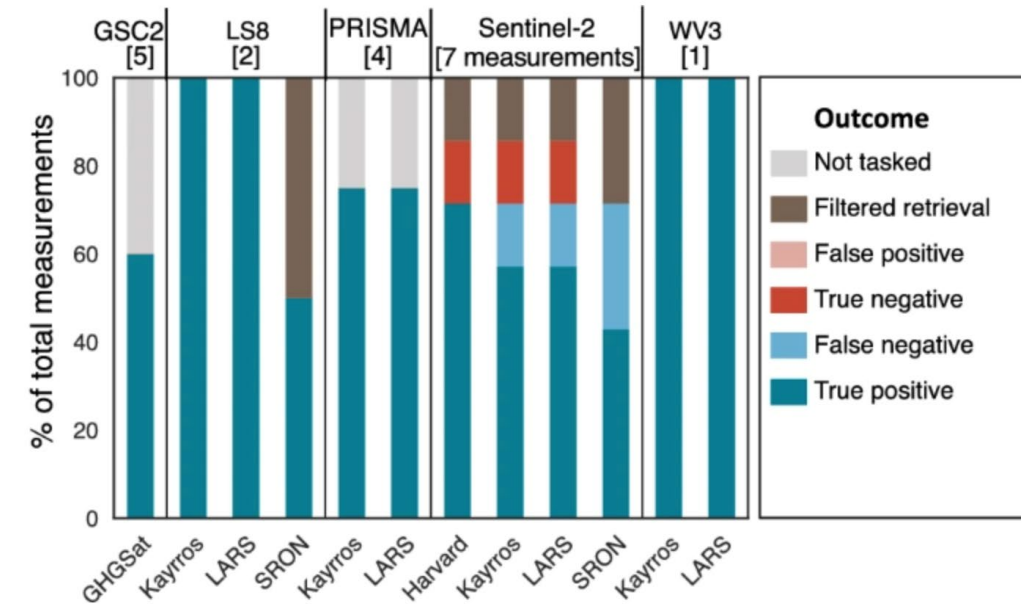


Figure 1



Regional inversions for inventories

iScience

CellPress
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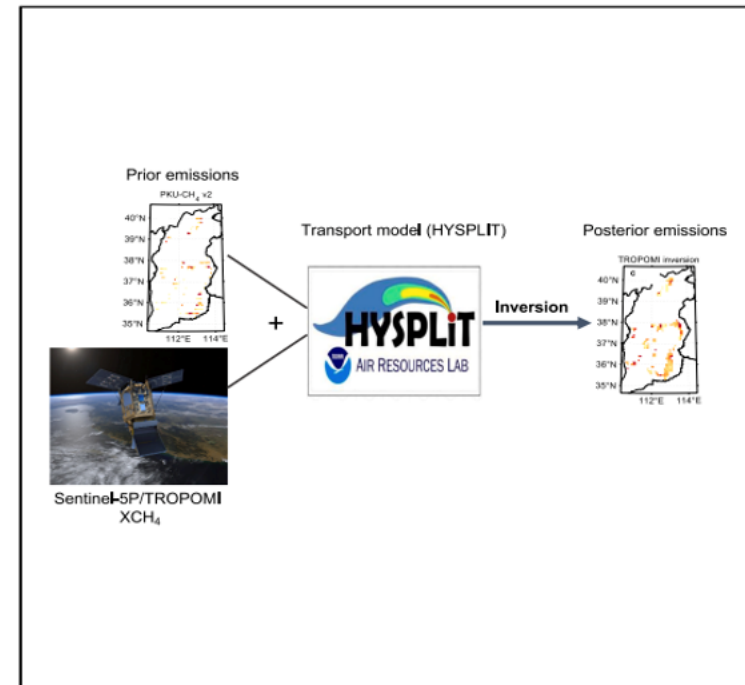
Article

High-resolution assessment of coal mining methane emissions by satellite in Shanxi, China

Inversion based on TROPOMI

- Penalized optimization framework (no bayesian regularization)
- Product used: Methane mixing ratio bias corrected
- Prior for locations only: Combination of EDGAR, public and private asset databases
- Lagrangian particle model HYSPLIT
- Monthly estimation*

* depending on number of observations



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Highlights

We assimilated TROPOMI images to inverse regional coal mining methane emissions

The inversed CH₄ emissions are close to upper bound of current bottom-up estimates

The CH₄ emission factors increase with coal mining depth at prefecture levels

We highlight potential of monitoring CH₄ leakages and emissions from satellites

Technologies as enablers & accelerators

- **Satellite+AI detection of super-emitters: the “speed radar” of methane abatement**
 - Scale
 - Coverage
 - Cost-efficiency
 - Independence
 - Accuracy
- **The case for banning super-emitters**
 - Super-emission events are scientifically indisputable
 - Super-emission events are morally unjustifiable
 - Super-emission events are technologically addressable
- **AI+EO also foundational for basin inversions (inventories)**
 - For progress reports and policy assessments
 - For rough methane intensity estimates
- **Current technologies are fit for purpose. Rapid adoption can score the first win in the race against global warming**



Thank you

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