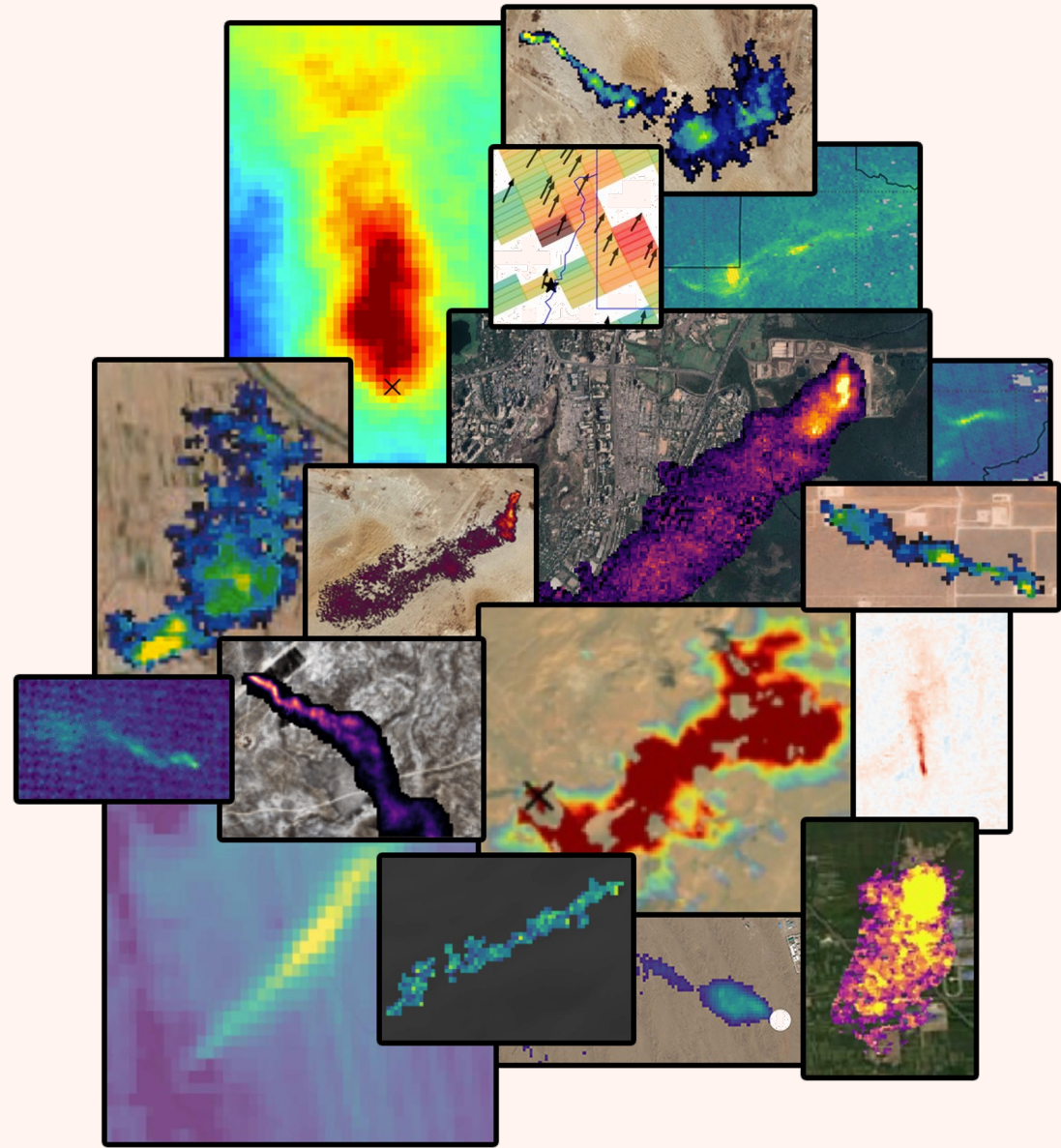


Methane Emissions Detection Using Satellites Assessment

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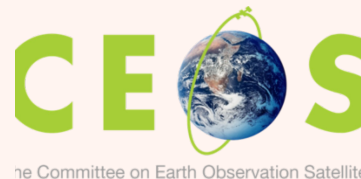


MEDUSA

Three-year project, started in 2024.

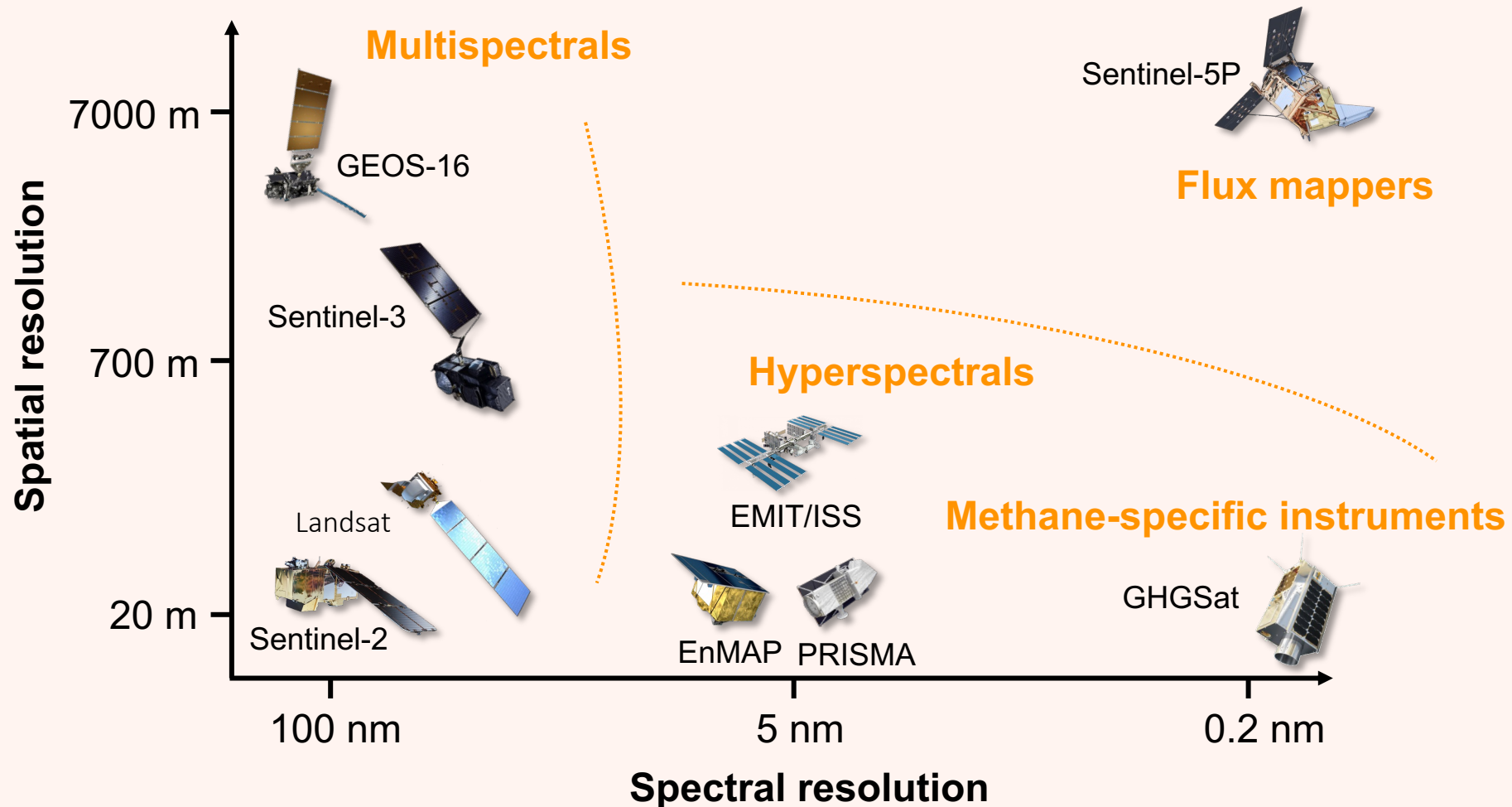
Goal: 'To develop the techniques and a pre-operational system to harmonize and integrate global information on subnational (urban, hot spot) to facility scale anthropogenic methane emissions derived using diverse satellite instruments and algorithms.'

Connected to policy through the user & advisory groups:



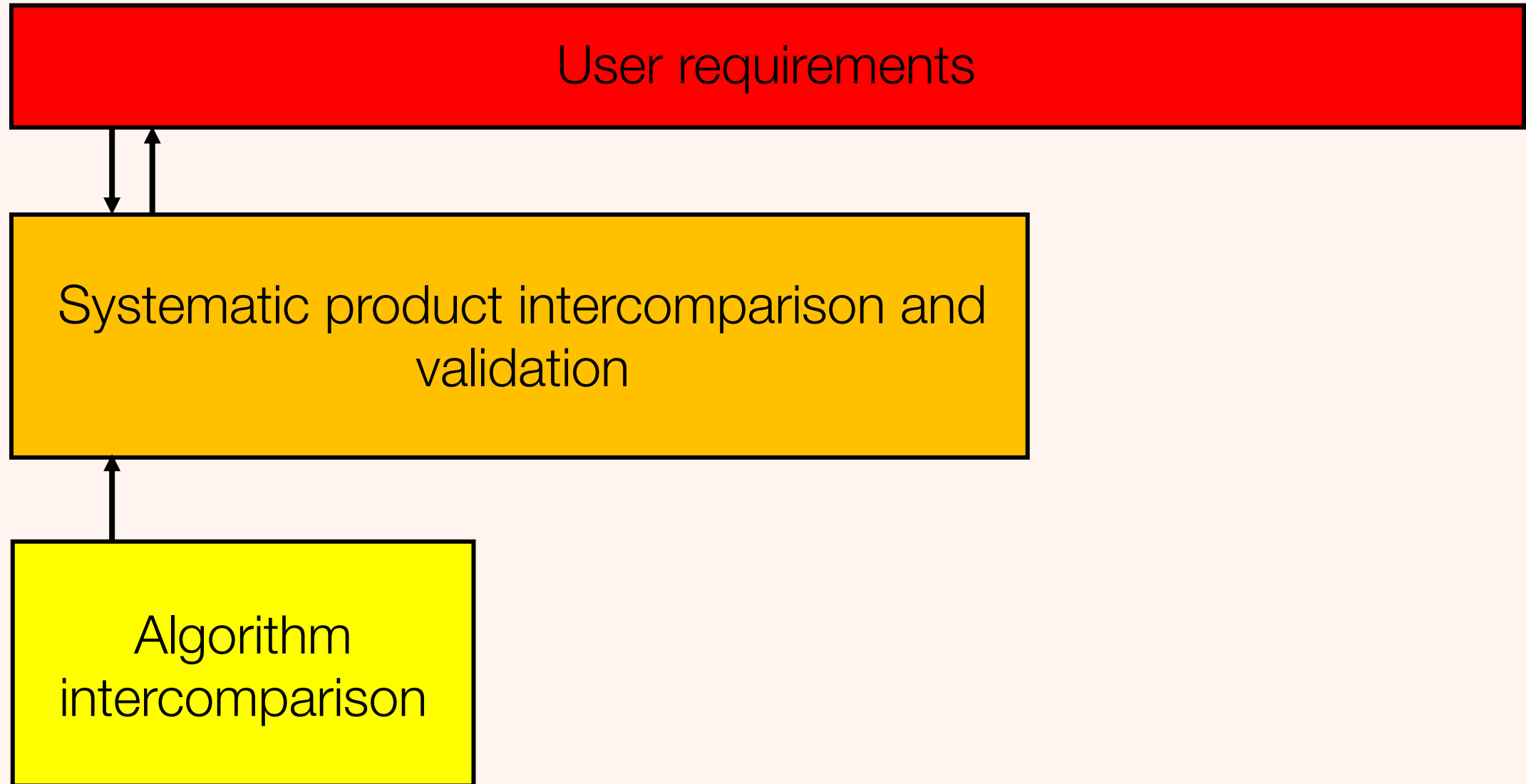
MEDUSA

We are building a validation framework linking the entire family of instruments observing methane hotspots. Instruments from the first phase of MEDUSA are shown below.



MEDUSA Core Project Structure

Work is spread across multiple work packages.

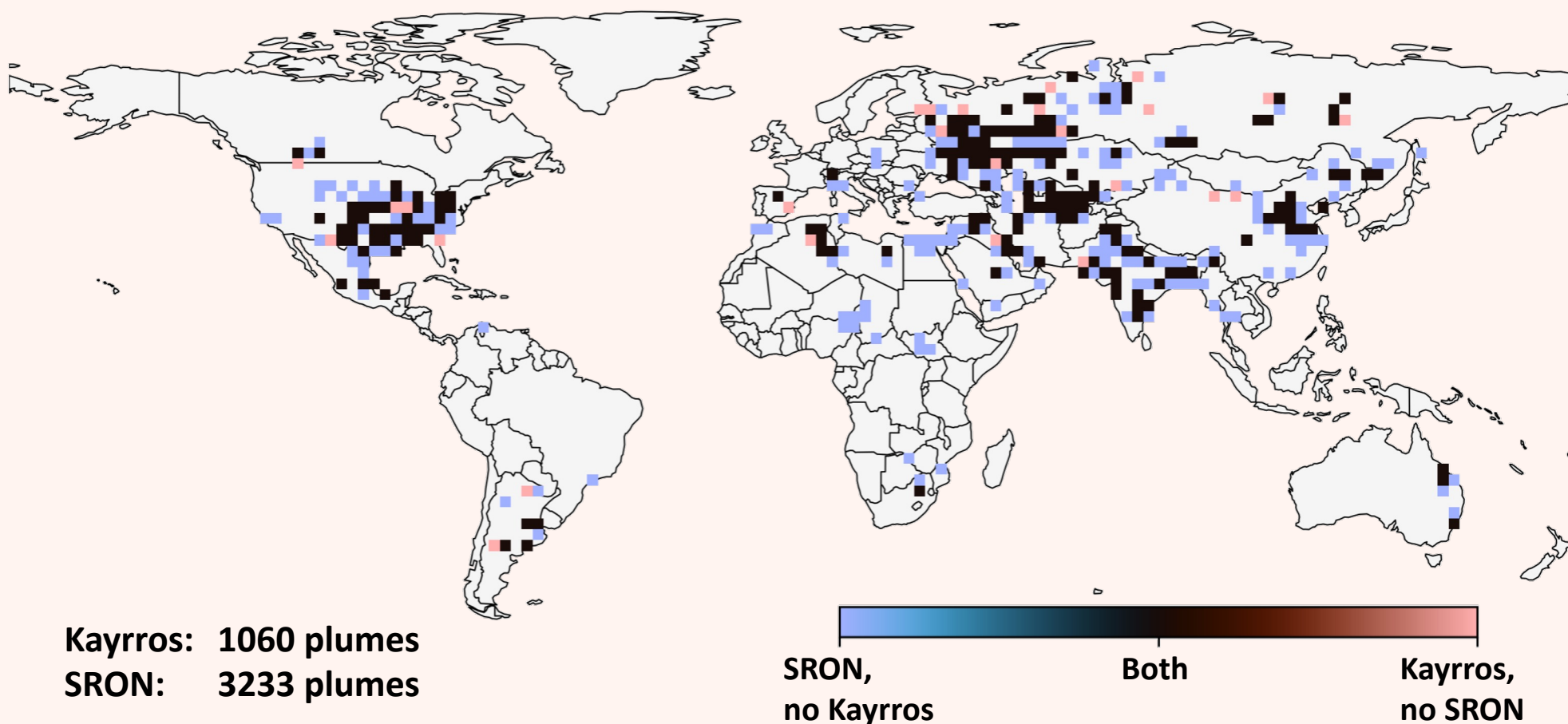


Algorithm intercomparison

Comparison of plume detection and emission quantification across teams, identifying causes of differences. Report available on climate.esa.int/en/supporting-the-paris-agreement/medusa/.

Global TROPOMI methane plume detections in 2021

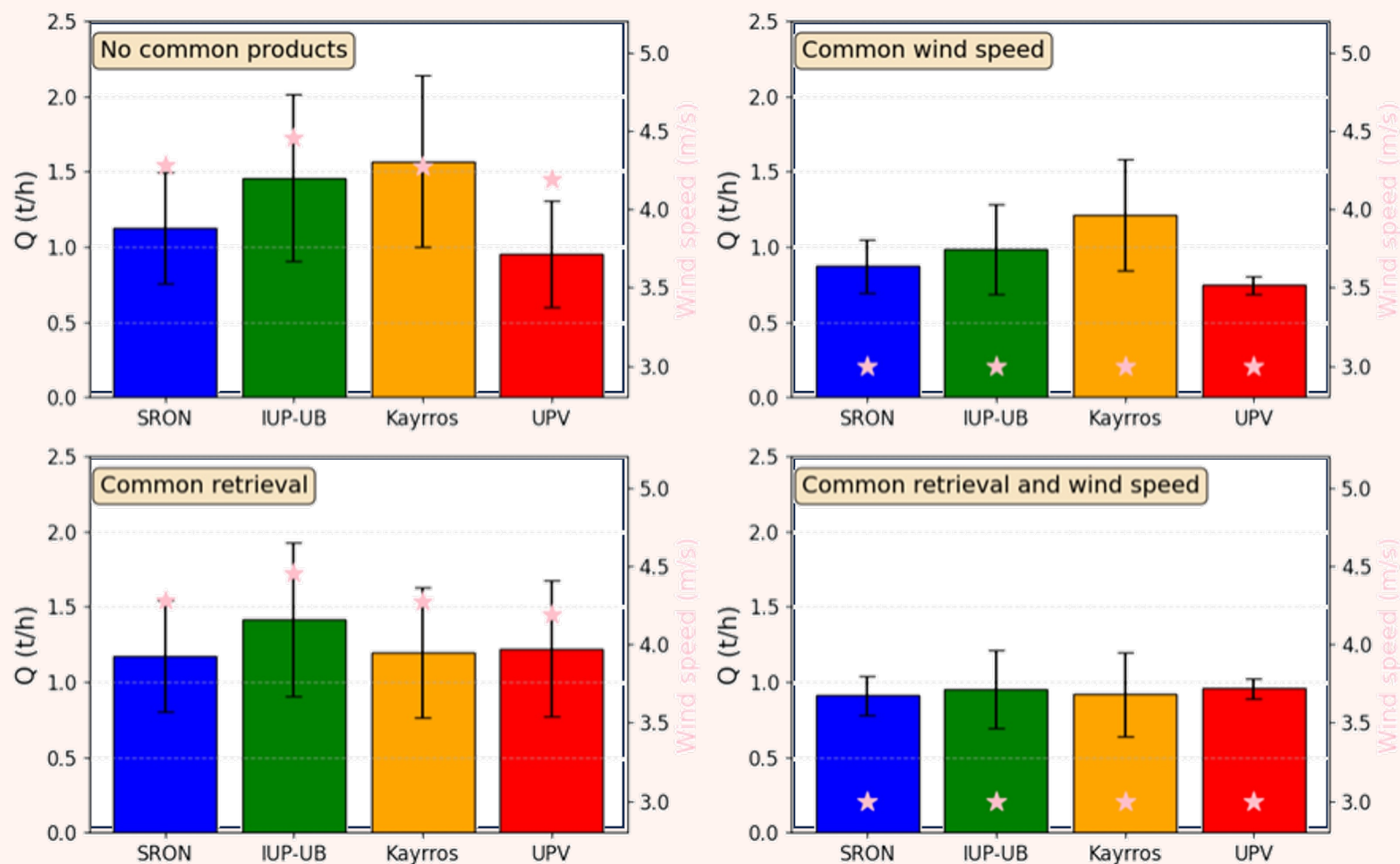
Binary detection differences



Algorithm intercomparison

Comparison of plume detection and emission quantification across teams, identifying causes of differences. Report available on climate.esa.int/en/supporting-the-paris-agreement/medusa/.

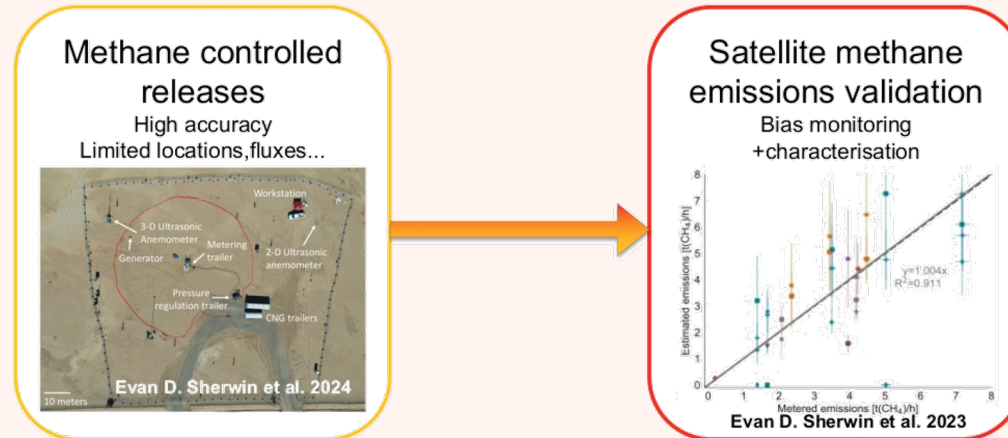
EnMAP quantification comparison



Systematic Product intercomparison and validation

Define a framework for the systematic validation of satellite-based methane emission hotspot information.

Anchored to controlled releases, the absolute gold standard.



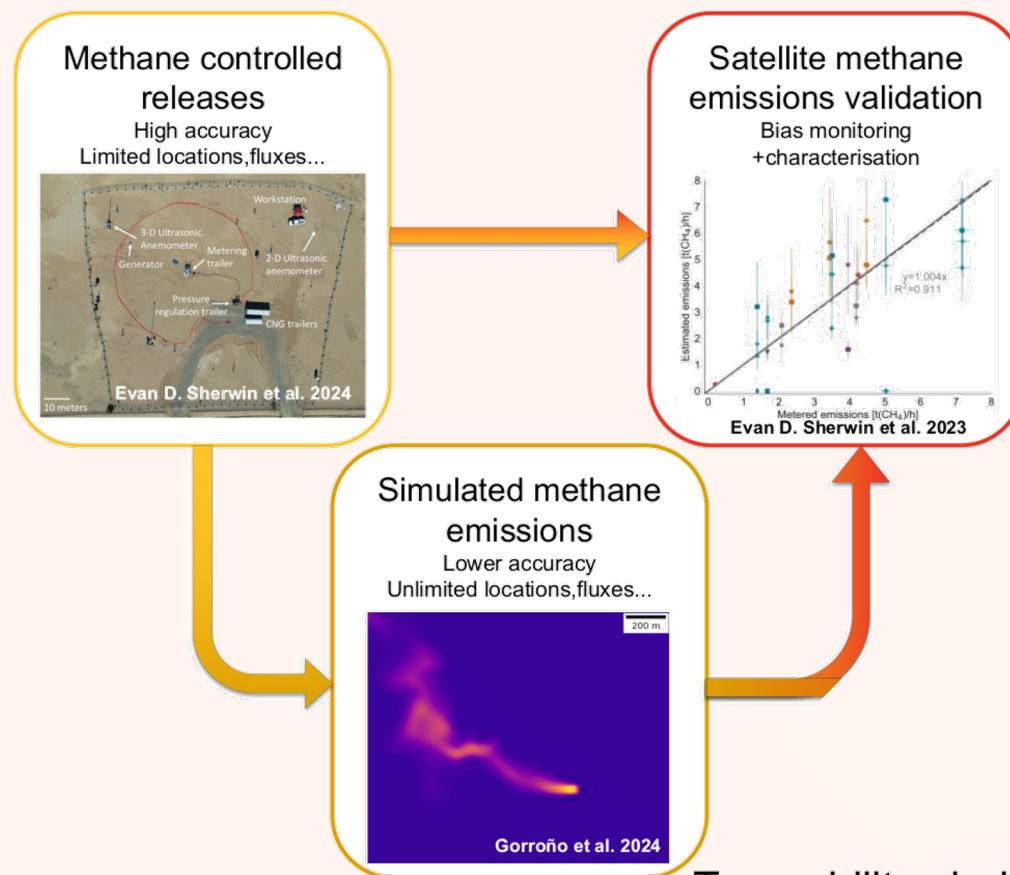
Systematic Product intercomparison and validation

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Expanded using:

- Simulations adding plumes to Level-1 data.



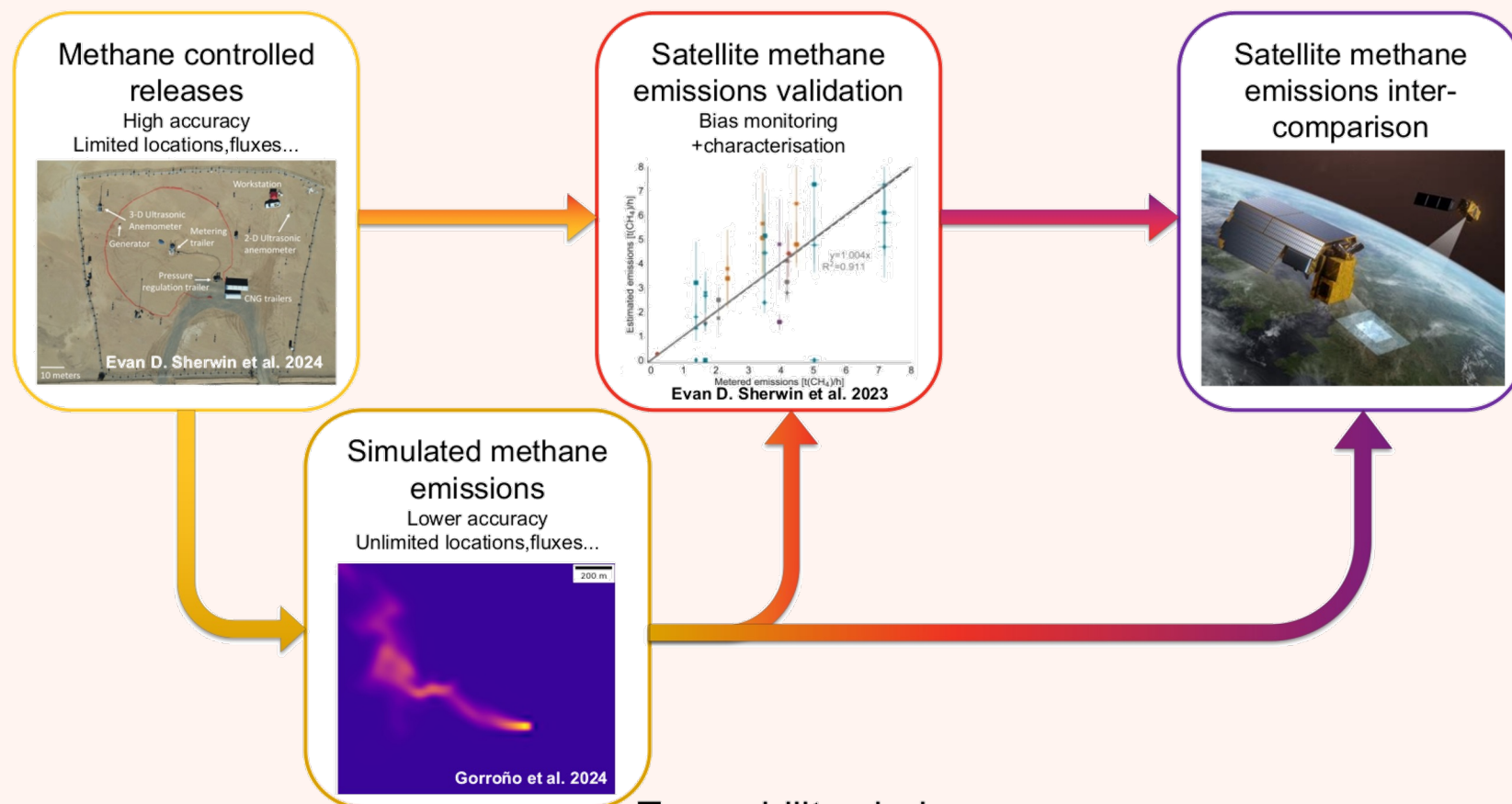
Systematic Product intercomparison and validation

Define a framework for the systematic validation of satellite-based methane emission hotspot information.

Anchored to controlled releases, the absolute gold standard.

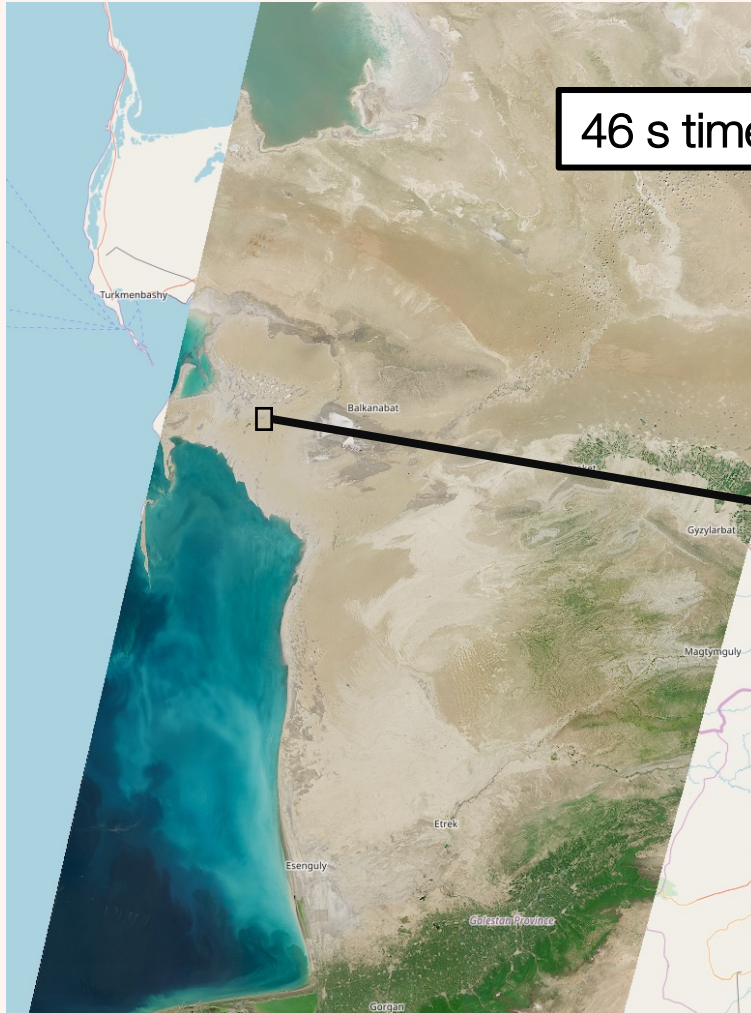
Expanded using:

- Simulations adding plumes to Level-1 data.
- Large coordinated releases.
- Observations of the same emissions.



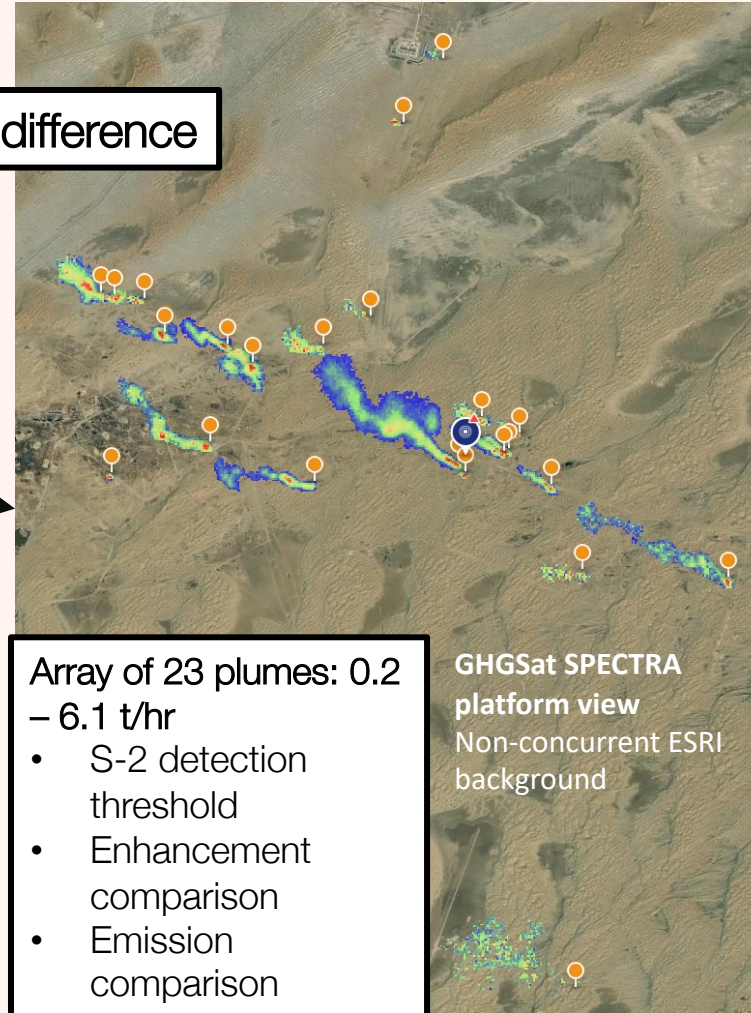
Systematic Product intercomparison and validation – Satellite comparisons

Sentinel-2:
2026-04-23 **07:18:46**



46 s time difference

GHGSat:
2026-04-23 **07:18:00**

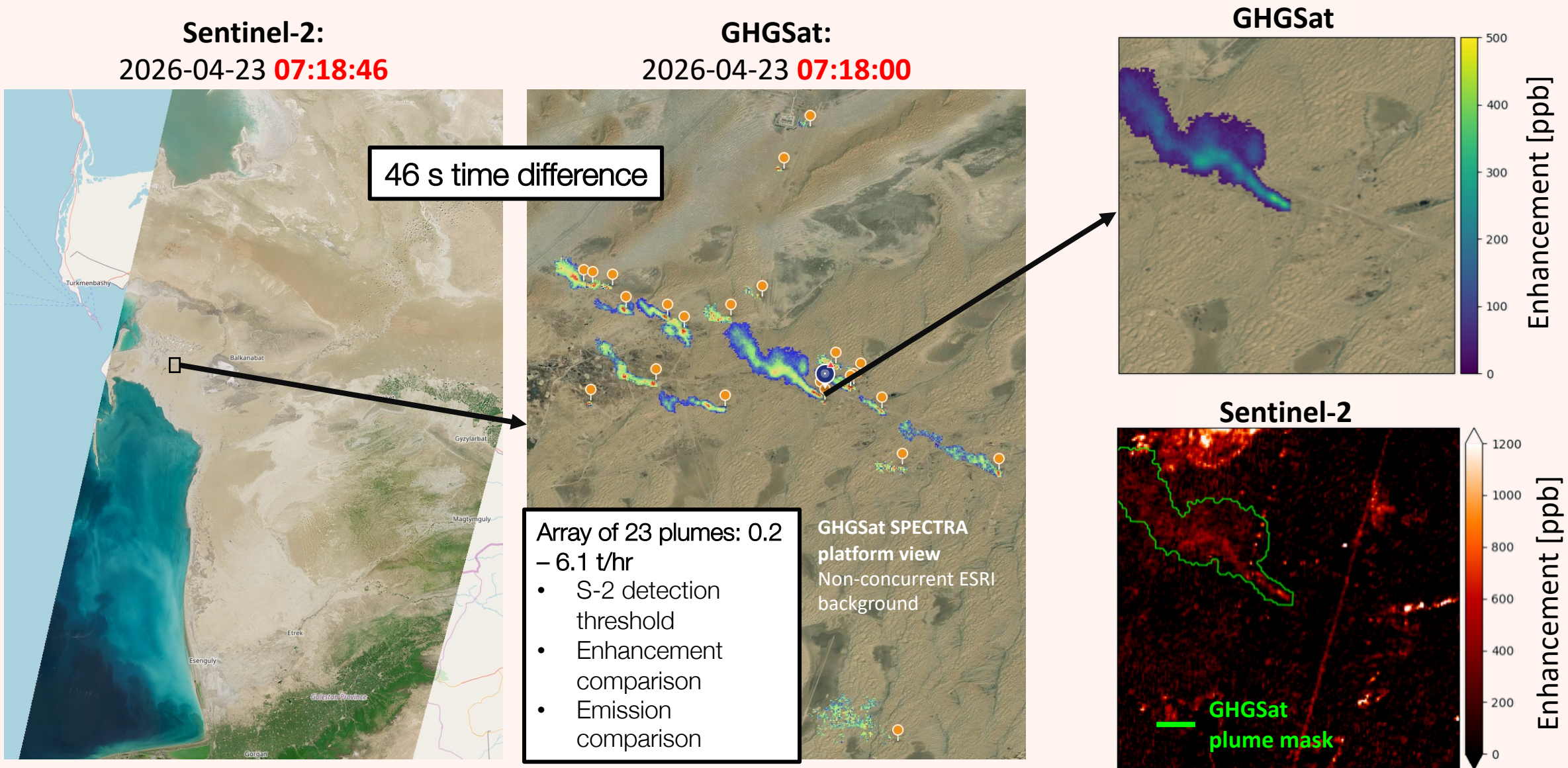


Array of 23 plumes: 0.2
– 6.1 t/hr

- S-2 detection threshold
- Enhancement comparison
- Emission comparison

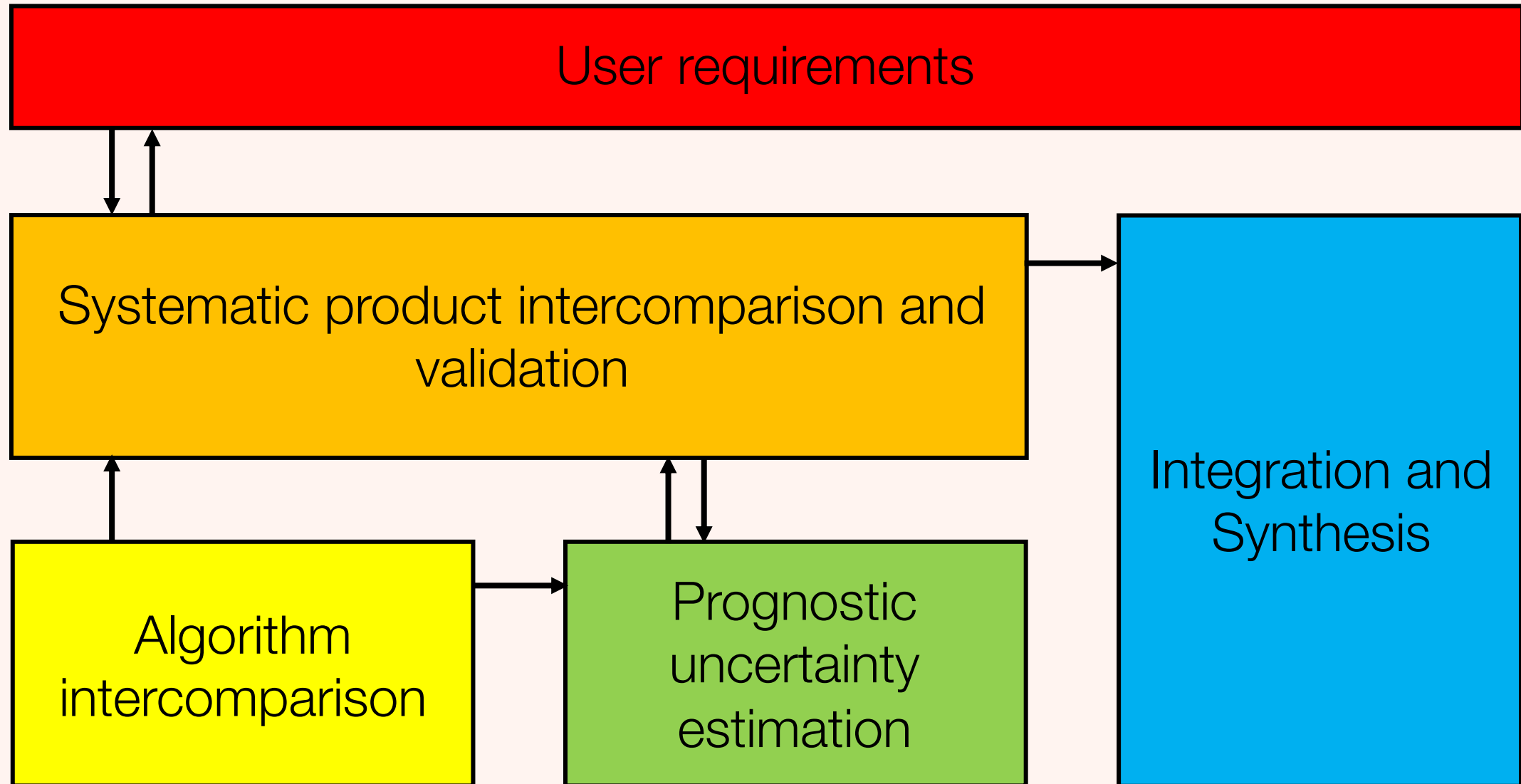
GHGSat SPECTRA
platform view
Non-concurrent ESRI
background

Systematic Product intercomparison and validation – Satellite comparisons



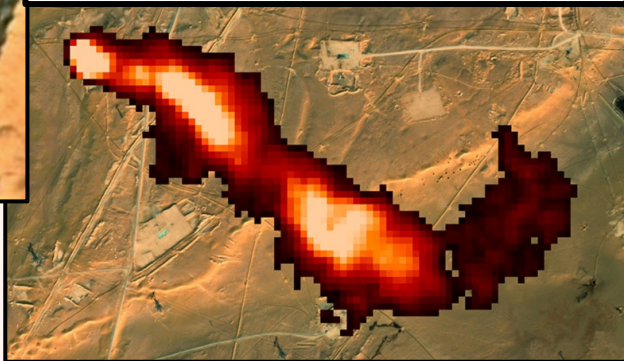
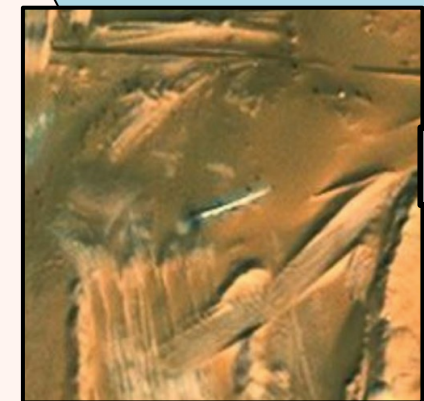
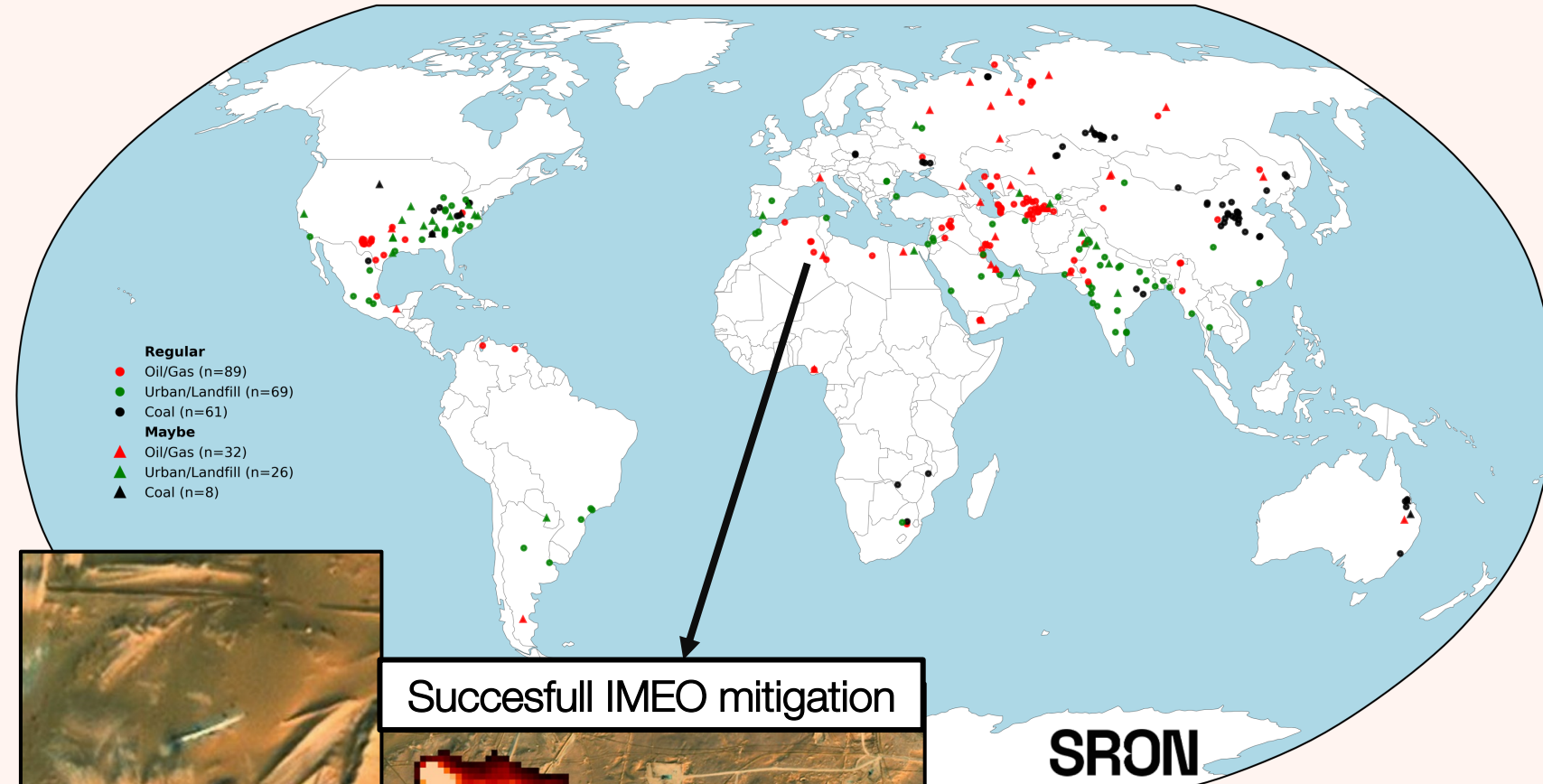
MEDUSA Core Project Structure

Results from the intercomparison and validation link to other MEDUSA activities.

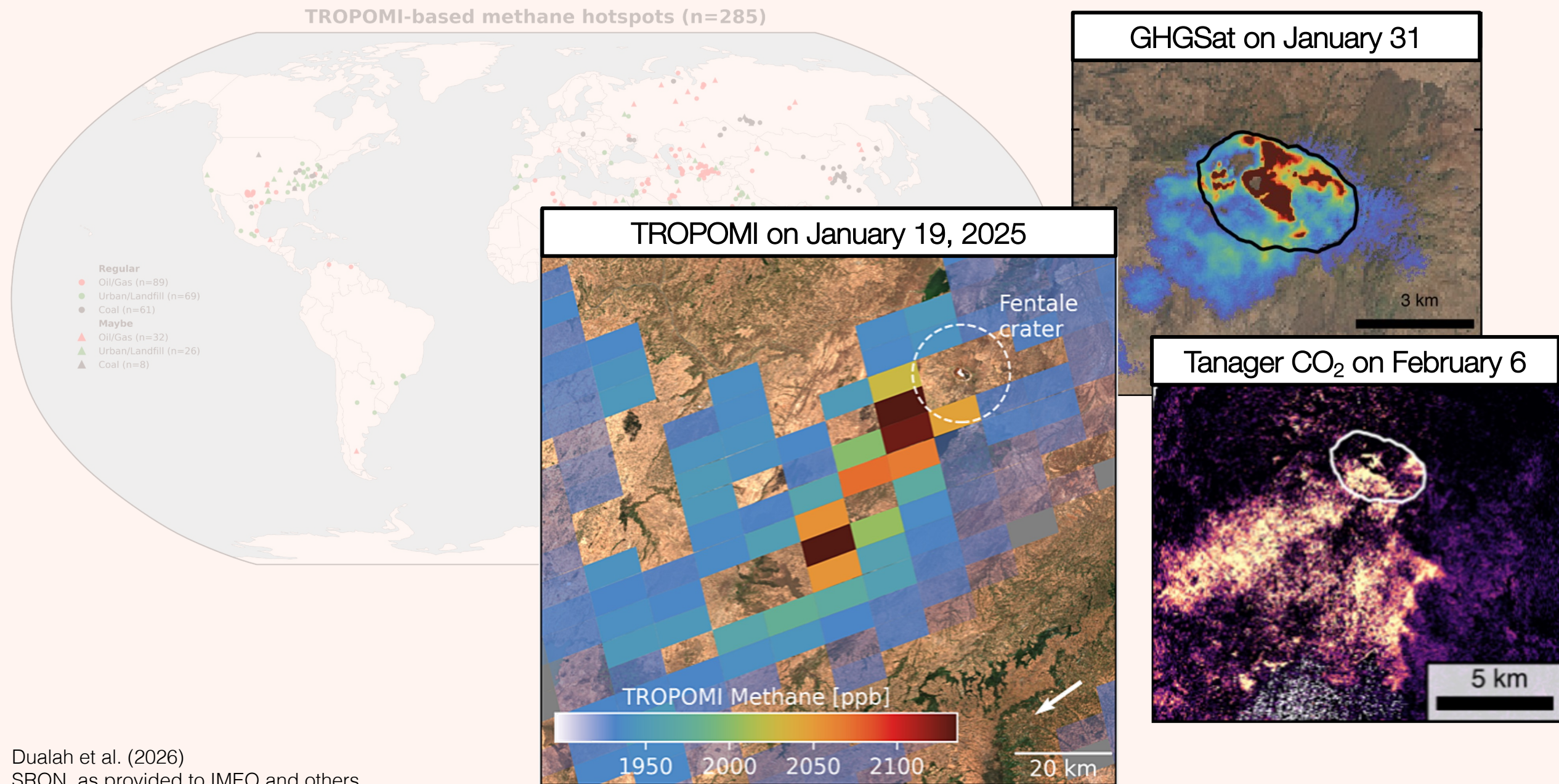


Tip & Cue – Persistent hotspots

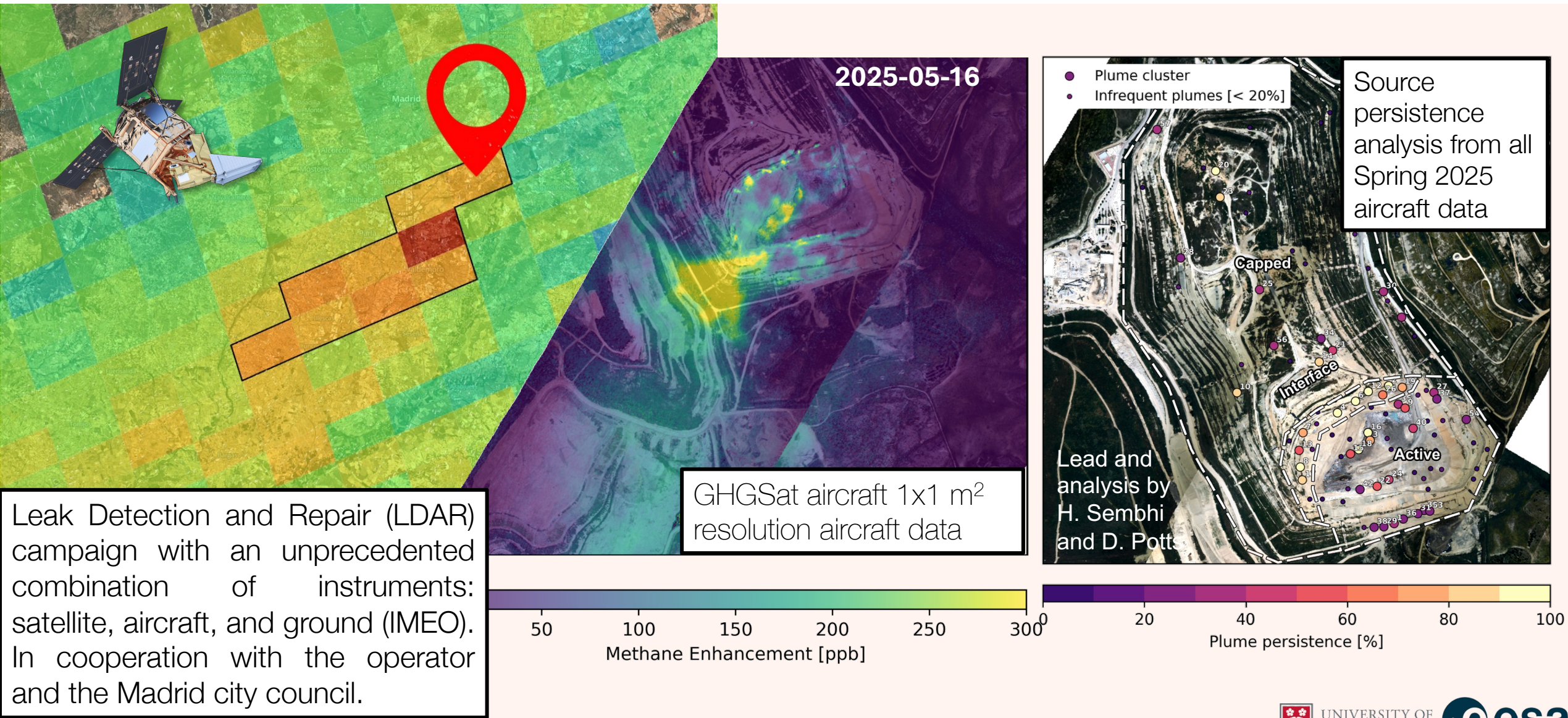
TROPOMI-based methane hotspots (n=285)



Tip & Cue – Transient emissions



Integration and Synthesis – Madrid Tip & Cue LDAR case study



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