



**GHGSAT**



At the heart of the remote sensing industry

**Remote Sensing Technology Center of Japan**

# MEASURING METHANE EMISSIONS WITH SATELLITES AT HIGH- RESOLUTION AND LOW DETECTION THRESHOLD: THE GHGSAT CONSTELLATION

October 2022

# ROUTINE MONITORING OF METHANE EMISSIONS AT INDUSTRIAL SITES – FROM SPACE

GHGSat is the only entity in the world (private or public) with satellites designed to monitor emissions from individual industrial facilities anywhere in the world.



GHGSAT



Satellite Data



Aircraft Data



Analytics



Data Repository

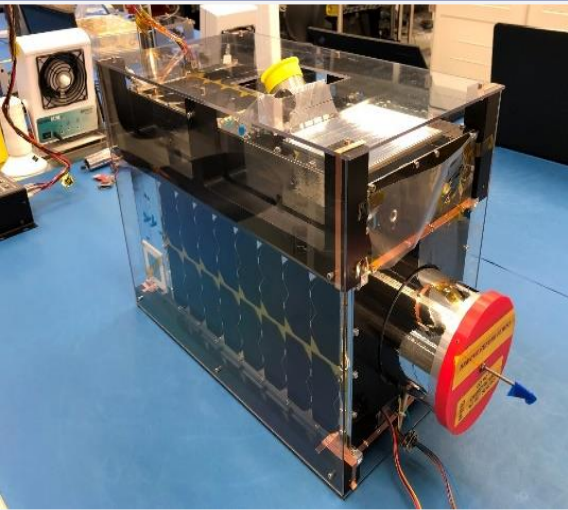
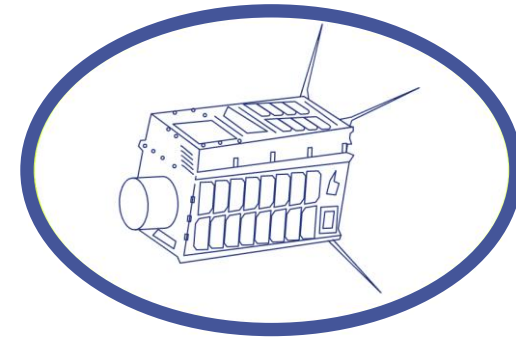


Our patented technology operates on nanosatellites and aircraft, enabling **rapid, low-cost and complementary** deployments

Approved for Public Release

# OUR TECHNOLOGY

Satellites (DATA.SAT)



Area of Interest	Specifications
Spatial Resolution	~25m
Field of View	12km x 12km
Orbit	Sun-Synchronous Polar
Altitude	~500km
Orbits per day	15
Measurements per Orbit	Up to 4
Min Detection Threshold*	~100kg/hr (86.7scfm)

\*Note: Dependent on wind and acquisition parameters



- Company Owned Constellation (6 satellites)
- 6 more satellites coming in 2023; 100+ by 2026
- Targeted Satellite Imaging
- Patented Short-Wave IR Spectrometer
- Highest CH<sub>4</sub> Spatial Resolution from Satellite



# A SCALABLE SYSTEM OF SYSTEMS READY FOR PRIME-TIME TODAY



## Q2 2022

### IN FOCUS

A look into GHGSat's latest satellite emissions data



## BIGGER CONSTELLATION MORE DATA

In May, GHGSat launched **3 new satellites** into orbit aboard a SpaceX Falcon 9 mission.

Our constellation of 6 satellites delivered

# 43%

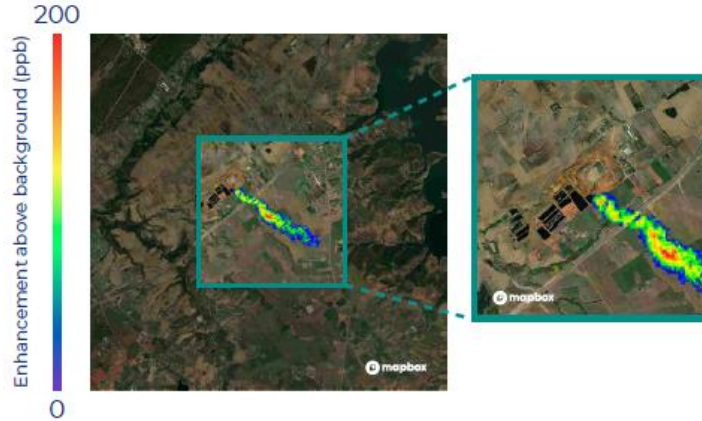
more observations  
in June!



GHGSat analysts calibrated and validated the new satellites' performance using controlled methane releases.



Controlled release over Alberta, Canada in June.



## FIRST OBSERVATIONS

Of the three new satellites launched, GHGSat-C5 "Diako" measured the largest emission of the first observations.

The satellite observed a landfill methane leak over Morocco emitting over **4 tonnes/hr.**

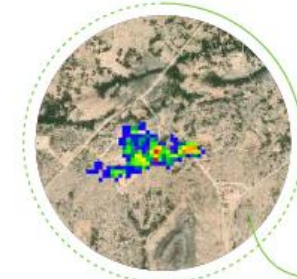
## Cost of leaks

Timely data on methane leaks helps oil & gas companies take immediate action to secure gas production and keep it out of the atmosphere.

In June, our constellation detected a small emission from an oil & gas facility in the Permian with a rate of **102 kg/hr.** If this leak had continued at the same rate for a day, the product value lost is estimated at **US \$1,100 per day** based on current wholesale natural gas prices.

In Q2, the average emission rate seen at oil & gas facilities in the US by GHGSat satellites was 0.85 tonnes/hr. Clear opportunities for impact are there for the taking.

Try our calculator →



0.85 tonnes/hr  
CH<sub>4</sub> emission  
for 1 year =

# 3.3M \$

estimated in  
lost product

# GHGSAT'S MODEL: COLLABORATION



- GHGSat believes that collaboration is the ultimate force-multiplier when it comes to addressing the emissions challenge head on

- Academic Partnerships

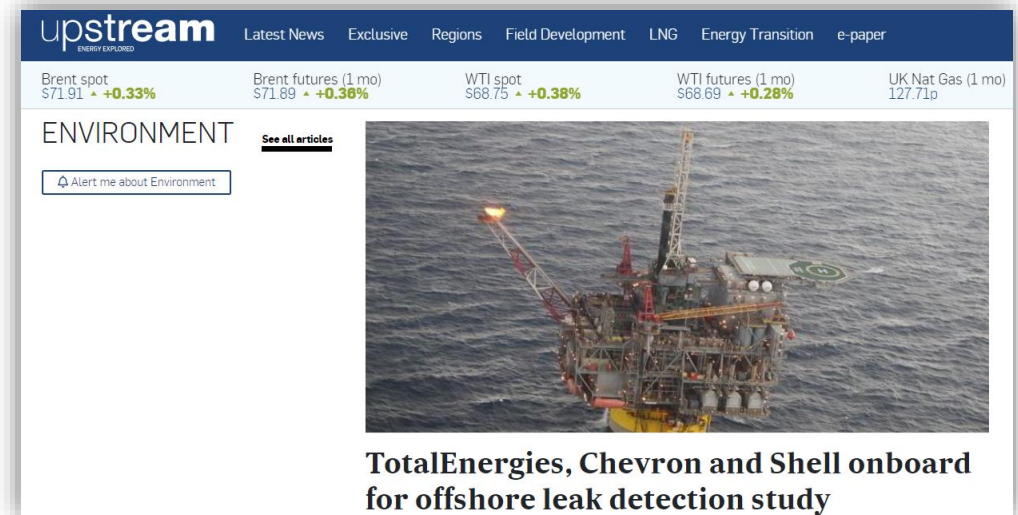
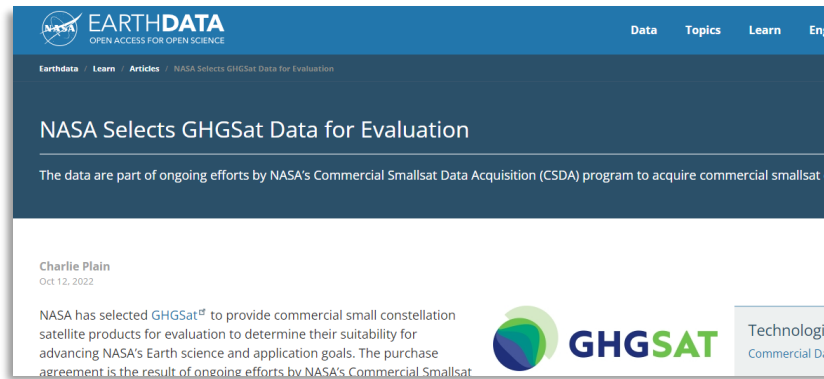
- Harvard
- SRON

- Institutional Partnerships

- European Space Agency (ESA)
- Canadian Space Agency (CSA)
- NASA

- Industrial Partnerships

- Glint mode development/demonstration



# WORKING WITH REGULATORY BODIES



**\$20M**  
**SDTC**  
**FUNDING**

**Sustainable Development  
Technology Canada**  
support towards climate  
change technologies

## Enabling Canada as 1<sup>st</sup> IMEO contributor

UNEP climate change initiative to report on global methane emissions

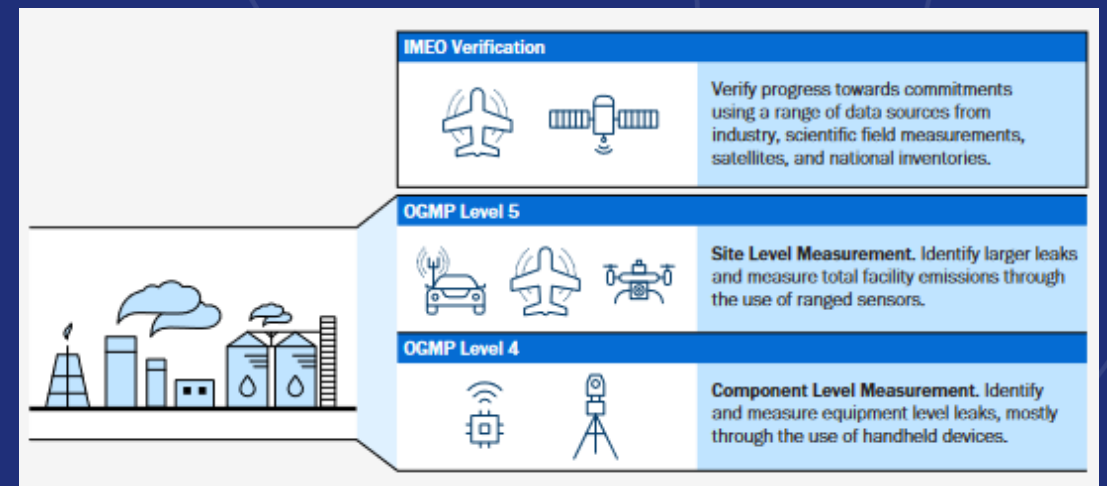
International Methane Emissions Observatory reports on impacts and trends

## OGMP 2.0 – LEVEL 5

### Facility Level Measurement for both satellite and aircraft

UNEP managed reporting framework for oil and gas companies to accurately measure and report emissions

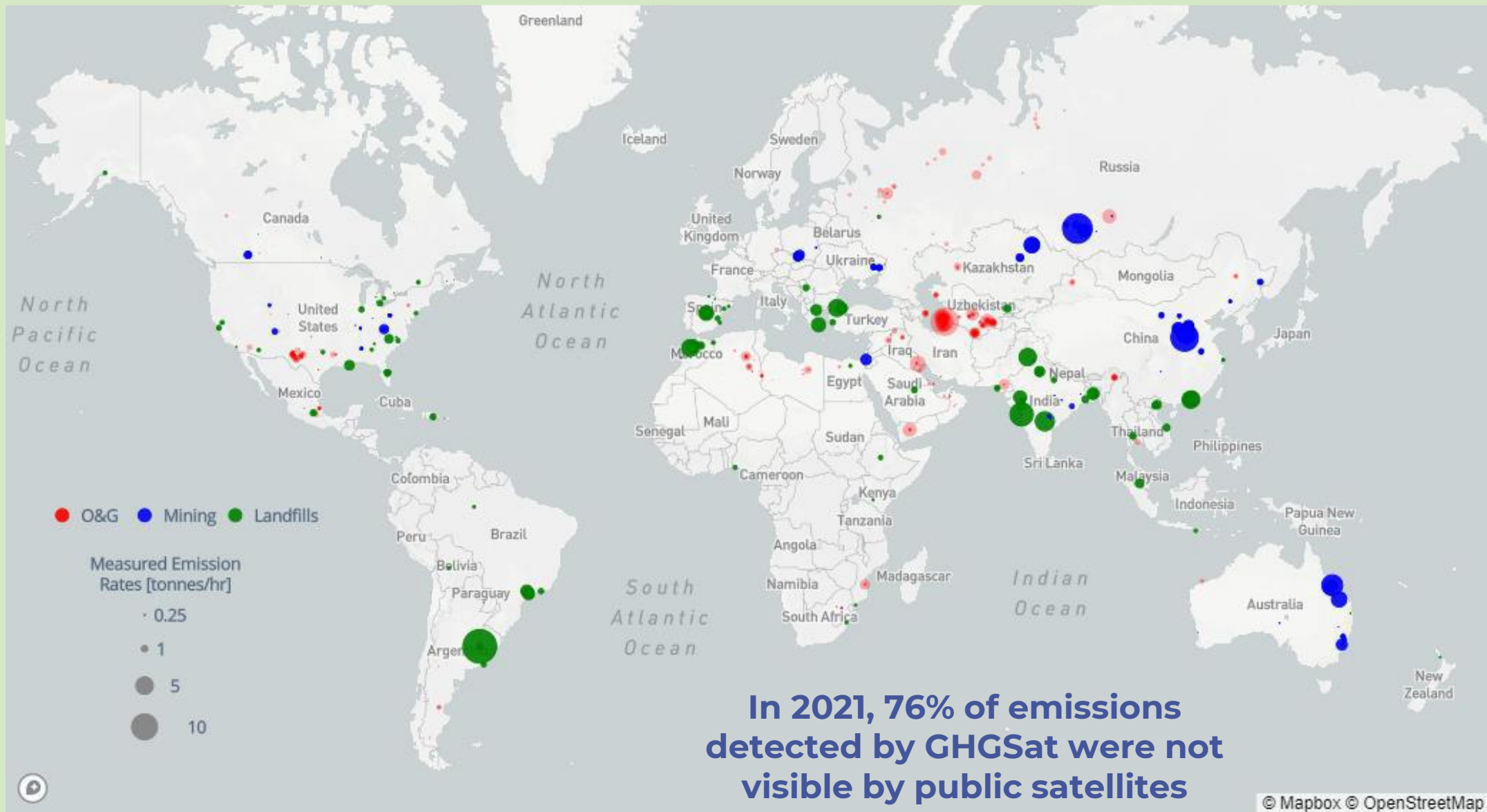
Collaborating with Oil and Gas Industry to attain individual required approvals by regulators for operations in-country





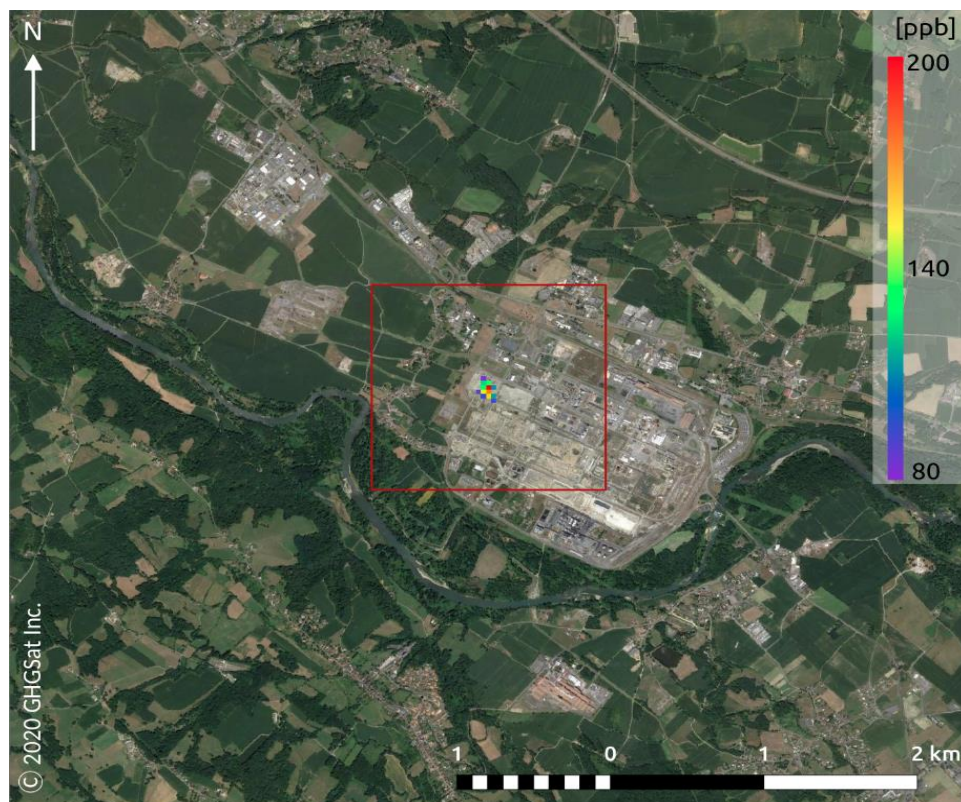
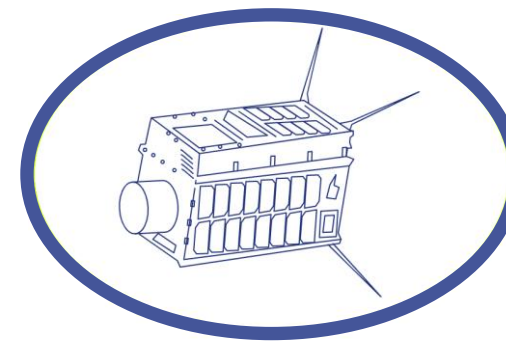
# GLOBAL SOLUTION TO A PLANETARY CHALLENGE

Public and GHGSat satellites at work



# OUR TECHNOLOGY – CASE STUDY

Satellites (DATA.SAT)



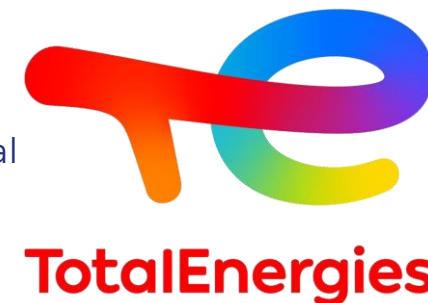
GHGSat had no knowledge of release rate or position

Our retrieval:  
 $250 \pm 140$  kg/hr

Ground truth:  
234 kg/hr

Wind 1.6 m/s

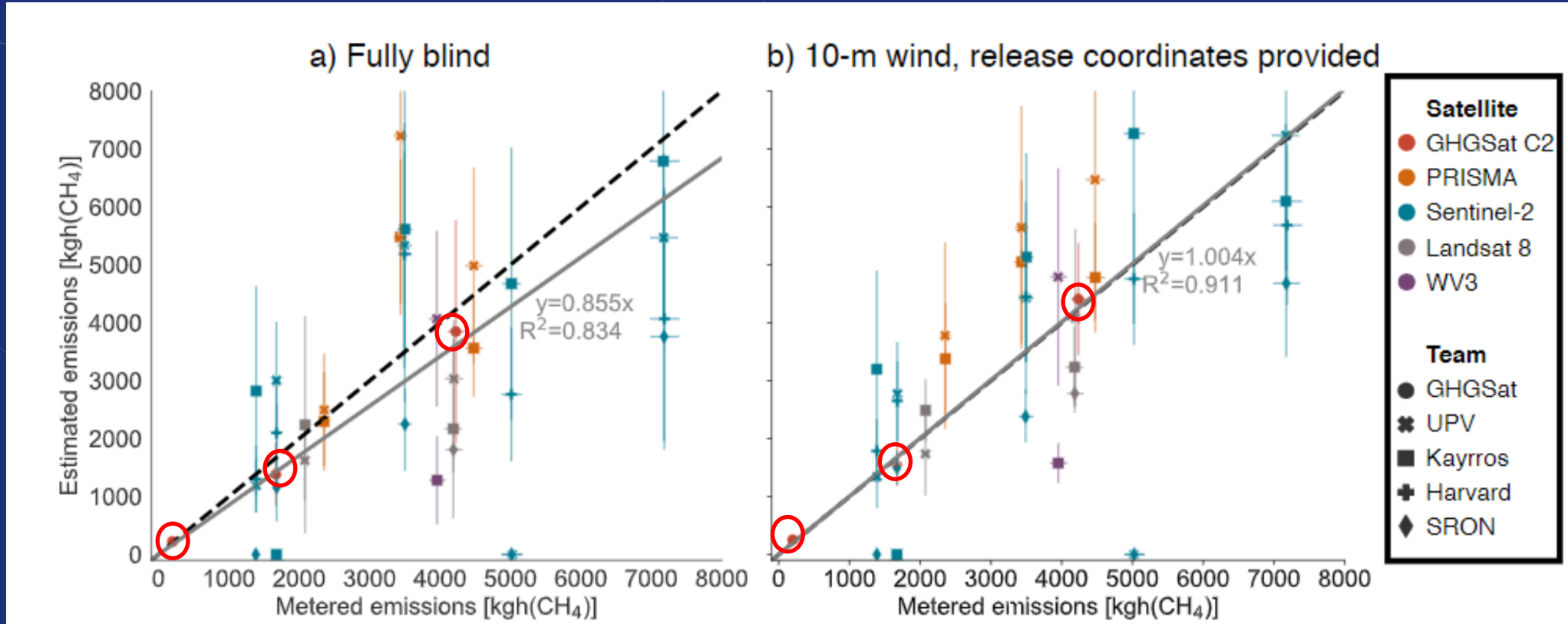
“In developing the technical solutions of tomorrow to monitor methane emissions, Total uses its TADI facility to validate emerging technologies on the market, notably those selected by OGCI Climate Investments.”





# Independent Validation

Paper submitted for review by Adam Brandt's lab at Stanford in July  
Graphs below from <https://eartharxiv.org/repository/view/3465/>



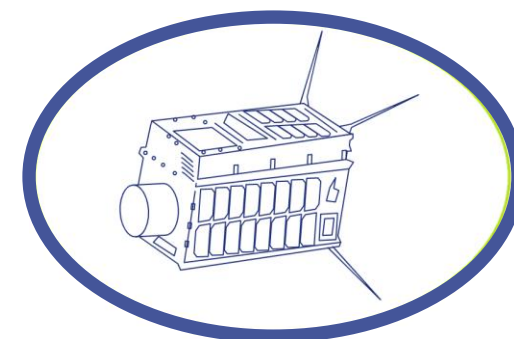
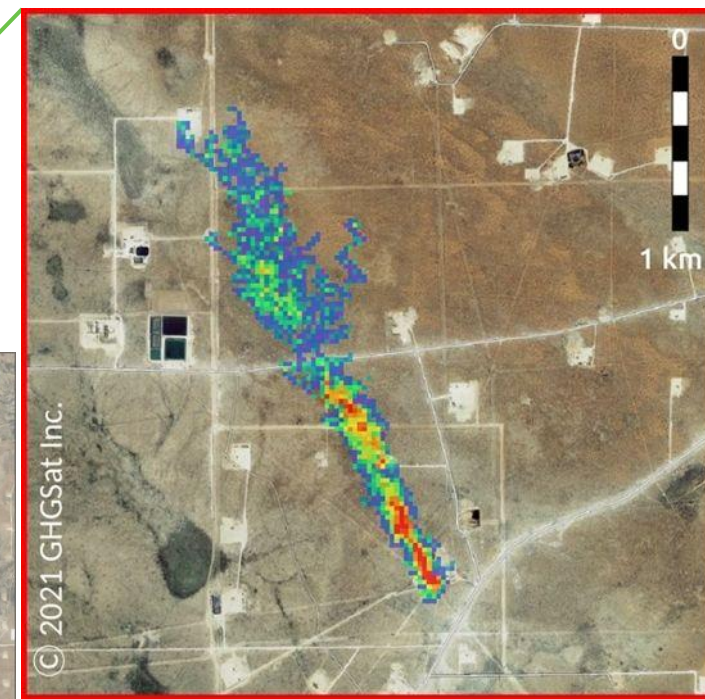
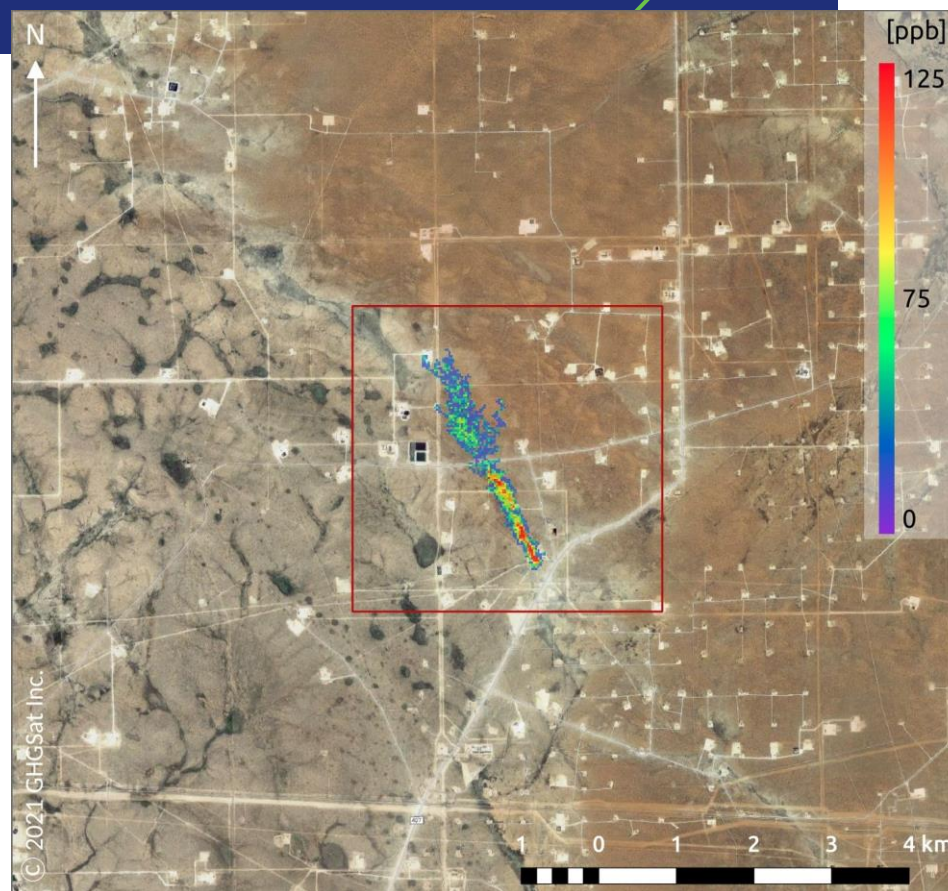
**GHGSAT**

# TECHNOLOGY

Satellites (DATA.SAT)

Threshold: < 1,000 tCH<sub>4</sub>/yr

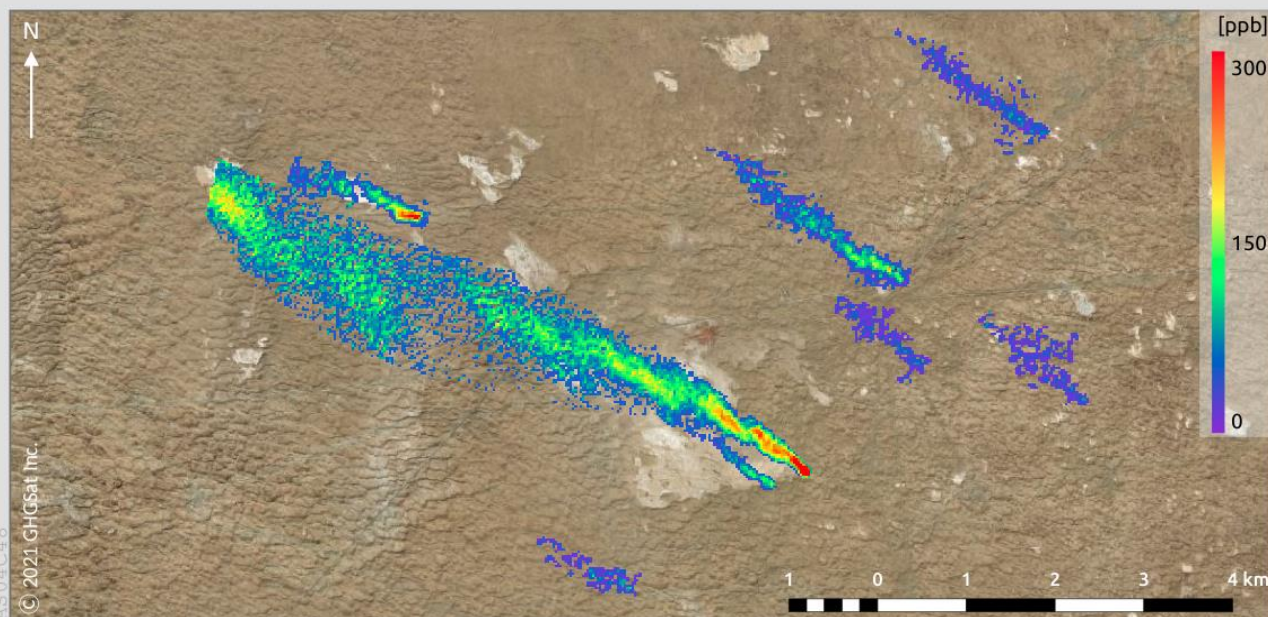
Resolution: ~25 m



# USE CASES



Oil & Gas Facility - Central Asia  
GHGSat-C2 - CH<sub>4</sub> Measurement

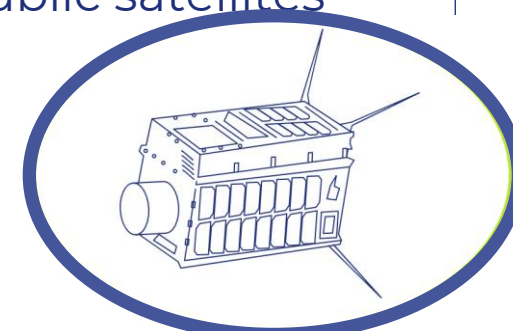


Product:  
CH<sub>4</sub> column-averaged concentration  
in excess of local background level

Timestamp:  
2021-02-01 05:41:16 UTC

Background:  
© 2021 Bing Maps Data

- 8 methane plumes on the same satellite pass
- Mix of unlit flares and leaking pipeline valves
- Only 2 of the 8 plumes may have been visible with public satellites



Approved for Public Release





< Analytics From  
Jan 23 to Jan 29, 2022 >

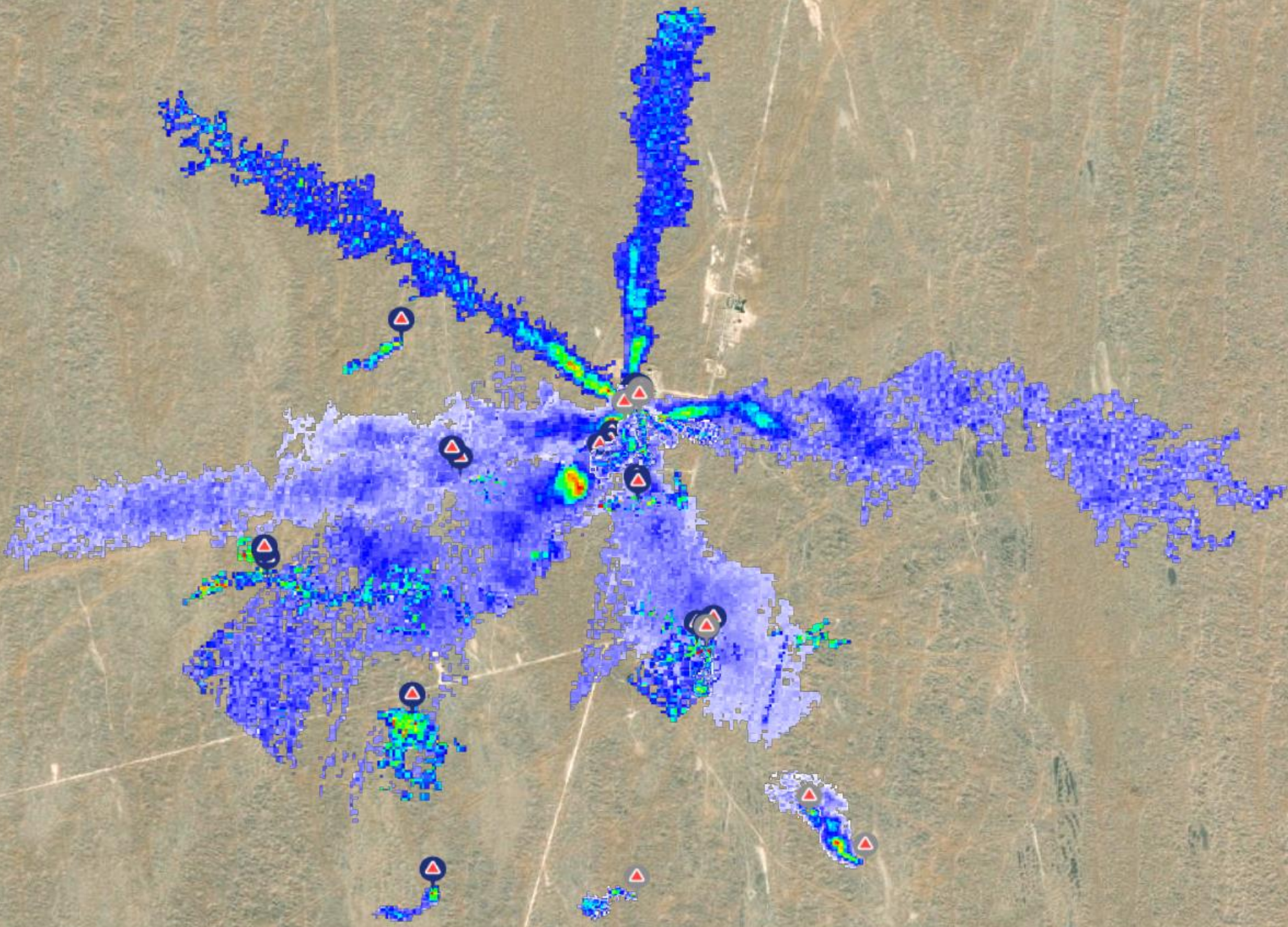
Measurements From  
Aug 30 to Feb 20, 2022



2 km  
1 mi

Analytics From  
Jan 23 to Jan 29, 2022

Measurements From  
Aug 30 to Feb 20, 2022



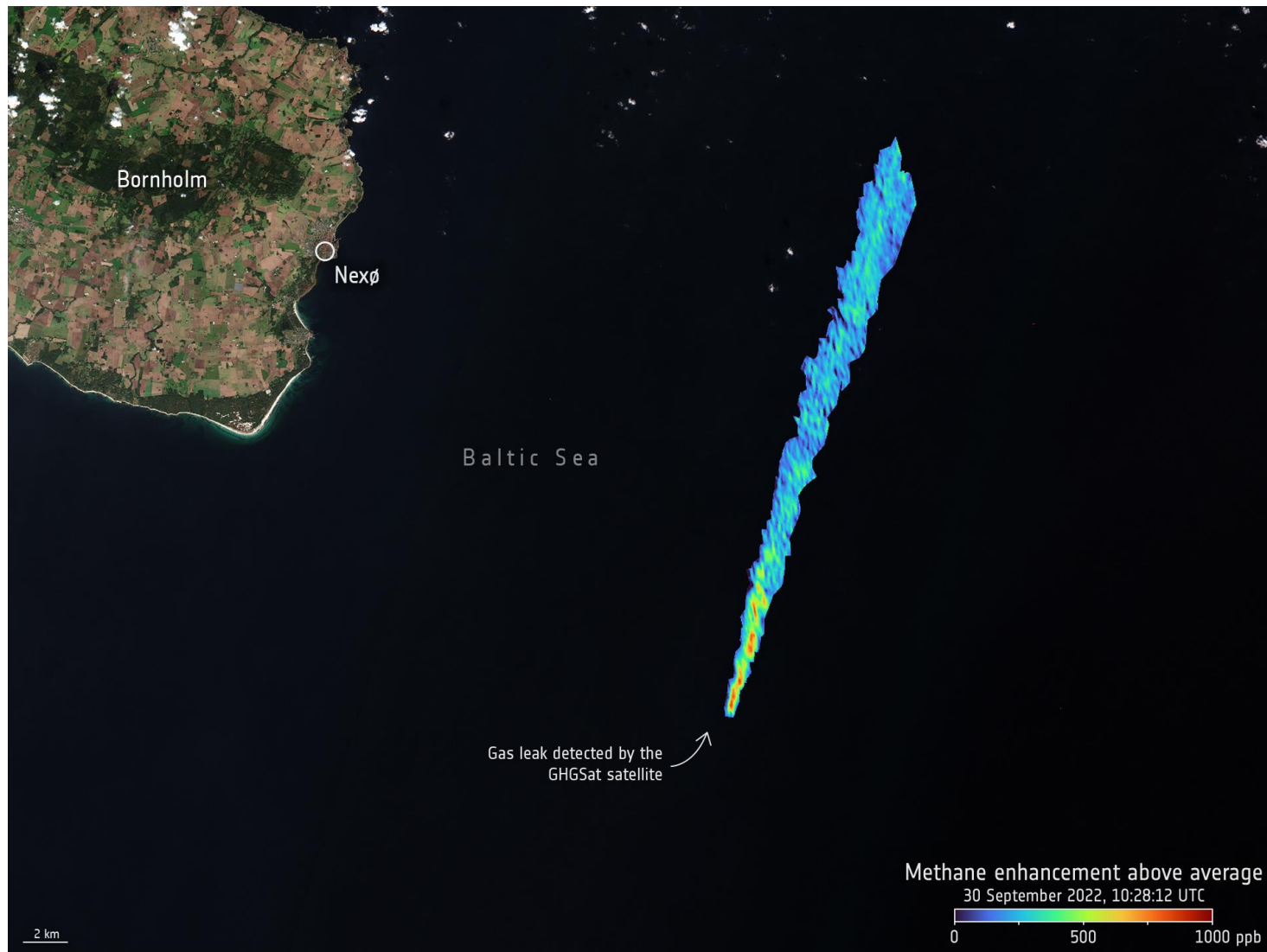
2 km  
1 mi

↑  
+  
-



# GLINT MODE CAPABILITY DEVELOPMENT

Only entity to image the Nord Stream Leaks at high-resolution



- Estimated at 79,000 kg/hr
- 4<sup>th</sup> day of event
- Single largest emission ever detected by GHGSat
- 3 captures, each 2 hours apart



# GLINT MODE CAPABILITY DEVELOPMENT

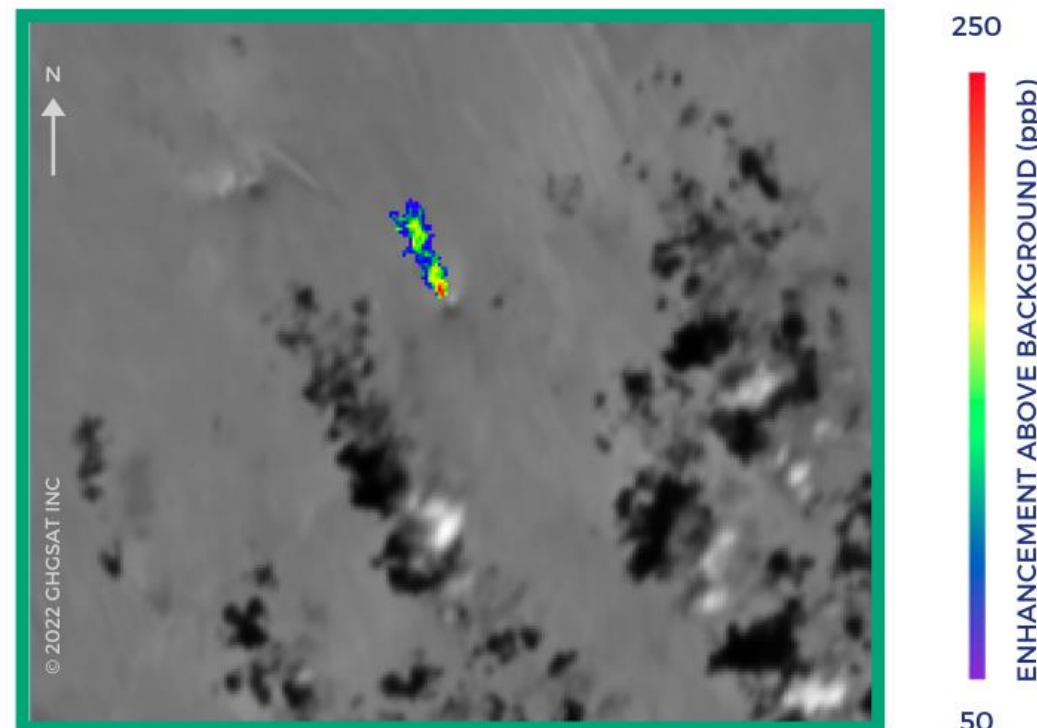
Smallest offshore emission ever seen from space

- Captured 17 days before the Nord Stream leak
- Gulf of Mexico
- Estimated at 1,500 kg/hr

**Satellite  
CH<sub>4</sub> Measurement**  
Glint Mode  
Observation

**Product:** CH<sub>4</sub> column-averaged concentration in excess of local background level

**Date:** 2022-08-13  
**Time:** 16:35:23 UTC

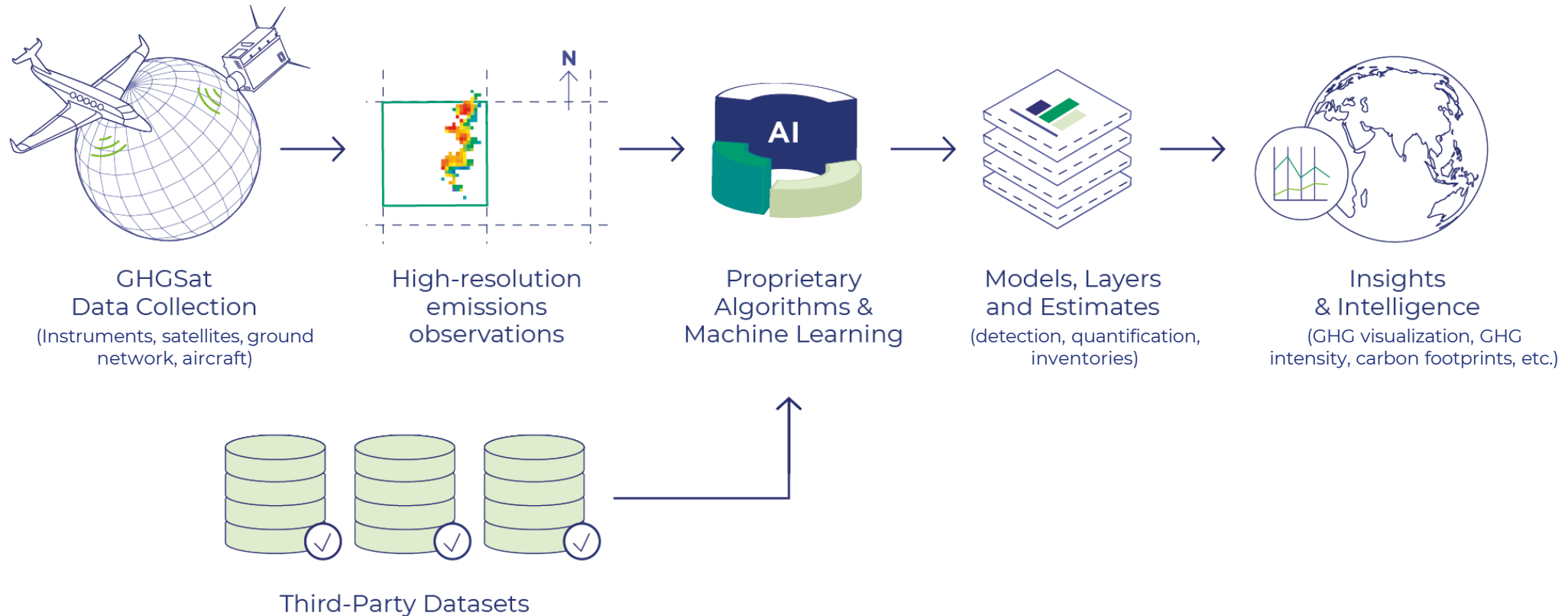


# OUR TECHNOLOGY

## Emission Analytics

### Emission Analytics

- Concentrations
- Flares
- Emission Risks
- Hotspots







# AN INTEGRATED PORTAL

Emissions Data Visualization Performance

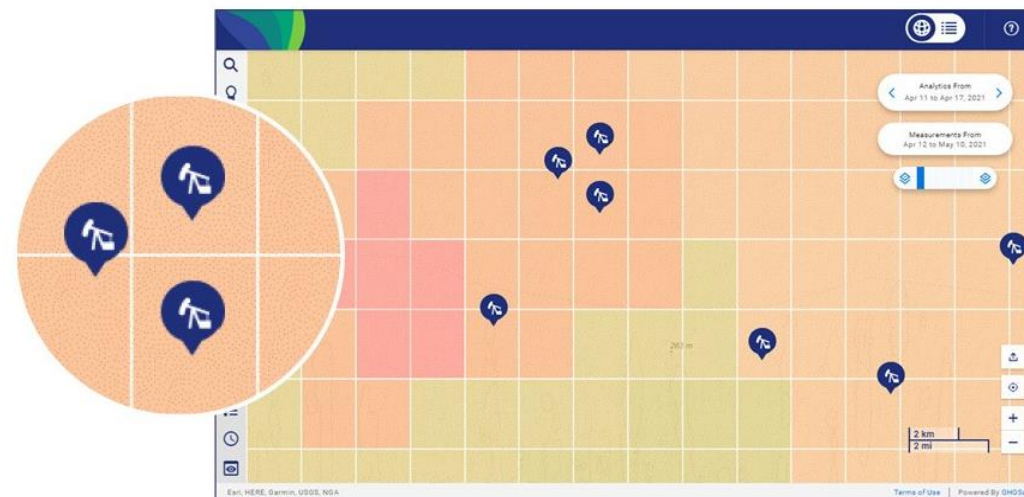
# SPECTRA

GHGSAT

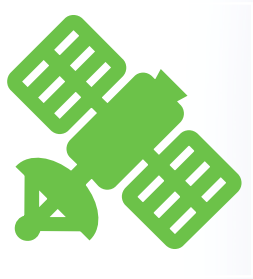
The first portal to combine GHGSat high-resolution satellite and aircraft campaign data as well as third-party datasets.

Data can also be shared through APIs

**Data visualization is essential to address emission reduction and prevention operations.**



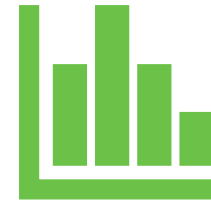
# KEY POINTS



**High resolution** satellite data exists **TODAY** to measure methane emissions directly from sites



Emissions can be pinpointed **precisely**, sites can be monitored **repeatedly and accurately**



With increased validation and **collaboration**, the data can be used for inventory and policy making



A satellite is shown in orbit above the Earth's surface. The satellite is a rectangular box with a grid of solar panels on one side and a large cylindrical antenna on the other. The Earth's horizon is visible in the background, showing a blue sky and white clouds. Another satellite is visible in the distance.

# EVERYTHING, ALL AT ONCE, RIGHT AWAY

Satellites are critical for a coordinated effort on all fronts to fight climate change. We're ready – now.

→ [GHGSAT.COM](https://ghgsat.com)

