Validation and Metrics for Methane Plume Imaging and Quantification

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GHGSAT™

ABOUT GHGSAT

GHGSat is the global leader in high-resolution greenhouse gas **emissions monitoring** from space. Our instruments identify **precise** sources of methane down to the individual facility level.

Accurate detection, measurement and monitoring of assets using DATA.SAT supports informed decision-making to **take action** and **reduce emissions**.

Our satellites

Our constellation features a unique, patented sensor technology enabling us to measure small, facility-level methane leaks, anywhere in the world.

Spatial Resolution:
~25 m (82 ft)

Field of View:
12 km x 12 km
(7.5 mi x 7.5 mi)

Weight:
15 kg (33 lbs)

Size:
~ 20 x 30 x 40 cm

Orbit:
Sun-synchronous polar

Orbits per day: 14

2016 **CLAIRE**
GHGSat technology demonstrator satellite.

2020 **IRIS**
2021 **HUGO**
GHGSat's commercial methane detecting satellite fleet is growing rapidly increasing measurement capacity and revisit frequency worldwide.

2022 **LUCA PENNNY DIAKO**

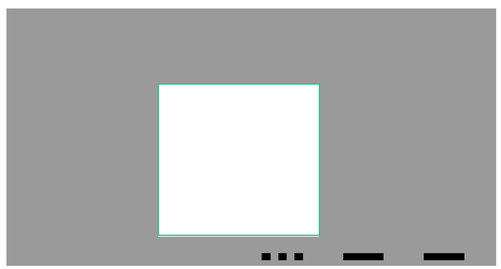
2023 **MEY-LIN GASPARD OCÉANE JUBA ELLIOT**

CH_4

2023 **VANGUARD** CO_2
First high-resolution instrument dedicated to industrial carbon dioxide emissions.

ONWARDS
Successful investment rounds and growing revenue streams has put us on track to rapidly scale the constellation to 40+ satellites across methane and carbon dioxide.

Data product



DATA.SAT CH_4 MEASUREMENT
Oil & Gas Facility
Central Asia

PRODUCT:
CH_4 column-averaged concentration in excess of local background level.

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

Background:
©2021 Bing Maps Data

LAND OPERATION

Methane column precision

Dataset

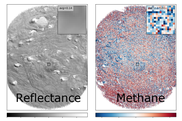
This analysis includes 4 years of activity spanning for GHGSat-C2 to GHGSat-C8.

Statistics-based "empirical" error

Standard deviation of CH4 within small window

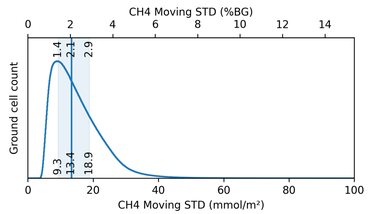
Window Size
~ 500 m

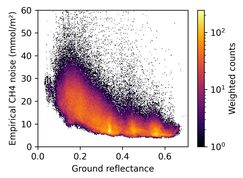
Comparable to small methane plumes



Results

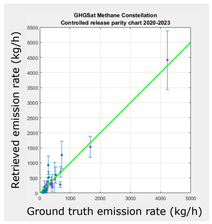
Empirical noise performance for all observations
- Mode ~ **1.4%**, median ~ **2.1%** of background
- The column precision varies with the amount of signal (reflectance)





Quantification Accuracy

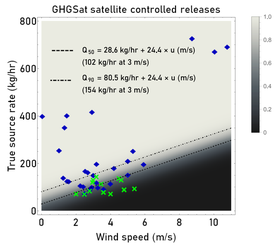
Ongoing controlled releases between 2020 and 2023



Controlled releases are performed at variable rates – both self-organized and on a **single-blind** basis with third parties (magenta points).

Detection limit

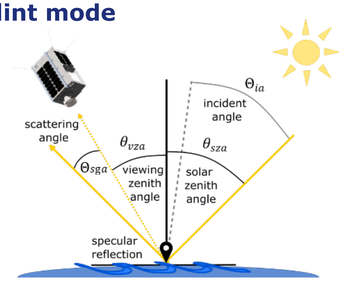
We characterize the wind-dependent detection limit using a binary regression analysis. The data is from 2021-2023 including C6-C8

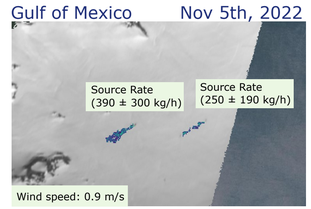


Detection limit of
102 kg/h (50% POD, 3m/s)

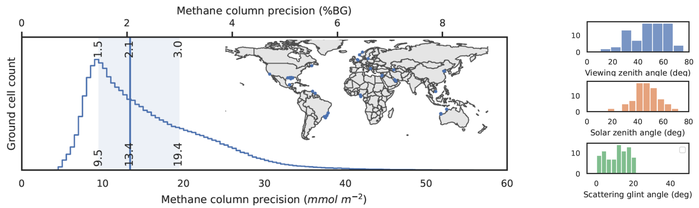
OFFSHORE OPERATION

Glint mode

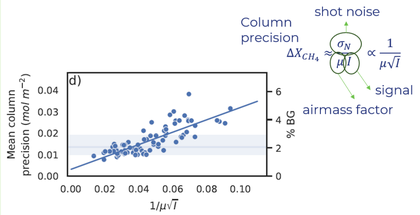




Methane column precision



Viewing geometry



Viewing geometry depends on latitude and season and drives:
1. Reflected signal
2. Air mass factor
3. Ground sampling distance (GSD)

A column precision model based on measured noise given viewing geometry was created. This model is used to estimate detection limit given the GSD resulting from the viewing geometry.

Estimated detection limit

Latitude	Spring/Fall	Summer	Winter
$0-30^{\circ}$	170 - 250 kg/h	170 - 250 kg/h	170 - 290 kg/h
$30-60^{\circ}$	170 - 250 kg/h	170 - 280 kg/h	200 - 400 kg/h

25-75 percentiles