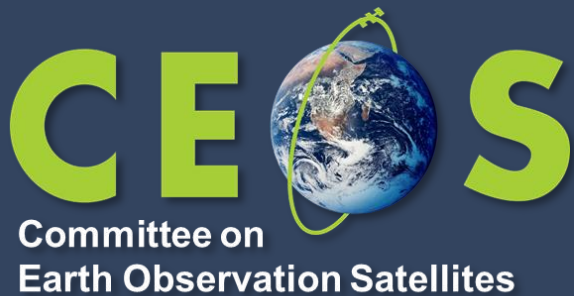


GHG Mission Portal

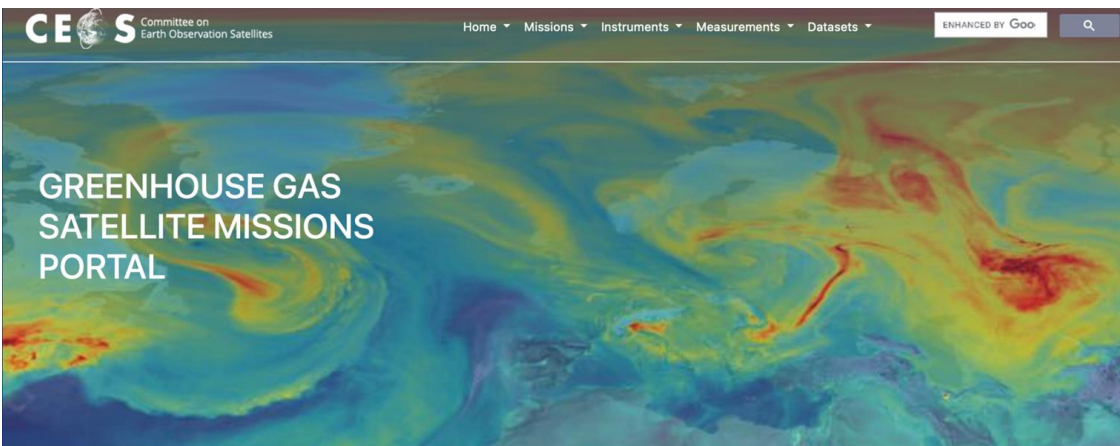


**Y. Meijer (ESA)
and S. Ward (ESA MIM Team)**

19th AC-VC Meeting

- ❖ Need for a centralised overview to ensure continuity and coordination
- ❖ Need to split of CO₂ and CH₄ missions, but also keep combined overview
- ❖ Need for greater awareness of current and planned missions
 - ❖ ESA MIM Team (Symbios) developed with support and cooperation of incoming SIT Chair team (JAXA) a GHG Missions portal summarising all known missions
 - ❖ Technical support from GHG Task Team (Dave Crisp, Mark Dowell, John & Yasjka)





GREENHOUSE GAS SATELLITE MISSIONS PORTAL

Greenhouse Gas Satellite Missions Portal

This Portal aims to provide a comprehensive and up-to-date list of all current and planned satellite missions with the ability to measure greenhouse gases. This includes those planned and operated by both public and commercial organisations, as well as NGOs. The Portal is based on data from the [CEOS MIM Database](#) and aims to support the analysis and planning of GHG measurement continuity by providing visualisation and export capabilities such as measurement timelines and tables of missions and instruments. The CEOS Database team will undertake to ensure the Portal is both comprehensive and current so that it may be applied with confidence for these studies.

Missions are categorised under three headings according to their purpose and capabilities.

The Portal aims to support coordination and planning of initiatives world-wide that are seeking to exploit these valuable data in support of emission reduction measures. It should assist those researching which data sources may be suitable for their information needs and can provide a basis for the high-level coordination needed among space agencies and other data providers to ensure that society has continuity of these key measurements into the future in support of our long-term climate data records and processes such as the Global Stocktake of the Paris Agreement.

At the heart of the Paris Agreement is an understanding that governments will develop and meet GHG emission reduction targets. The global community recognises the need for urgent and collective actions on the mitigation of GHG emissions if we are to limit global warming. Data and knowledge of global GHG emissions, trends and sources will become increasingly important to support national and international climate policymaking. Transparent reporting processes will demand more and better data to satisfy society's needs, and satellite Earth observation (EO) has the potential to play a critical role to support policymakers at the intersection between science and action. EO satellites are increasingly capable of monitoring GHG emissions with precision, accuracy, resolution, and coverage needed to support policymakers at all levels, from the sub-national and national level for the establishment and operation of national GHG inventories, through to the global reconciliation and accounting processes that will seek to match aggregated national reports with the latest global observations. Refer to the [CEOS Global Stocktake Portal](#) for more information on relevant datasets.

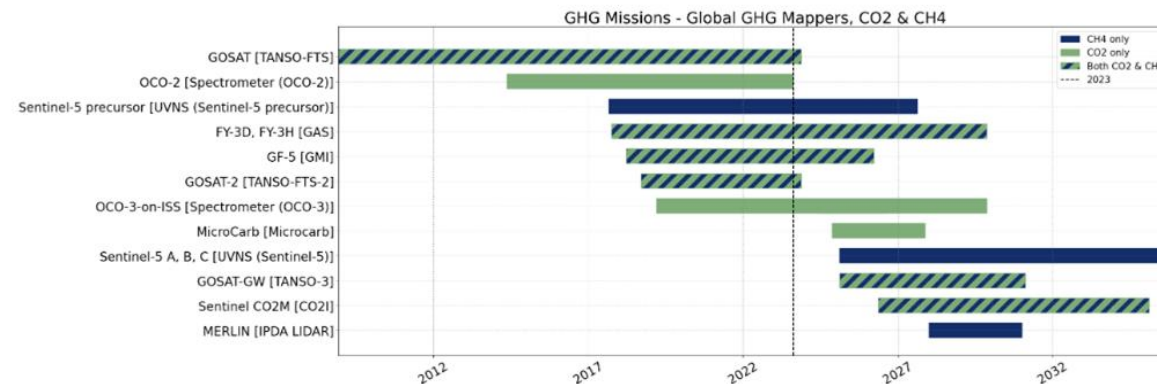
This resource is a product of the overall [Greenhouse Gas Roadmap](#) being implemented by CEOS and CGMS agencies.

[Download GHG Mission Timelines](#) 

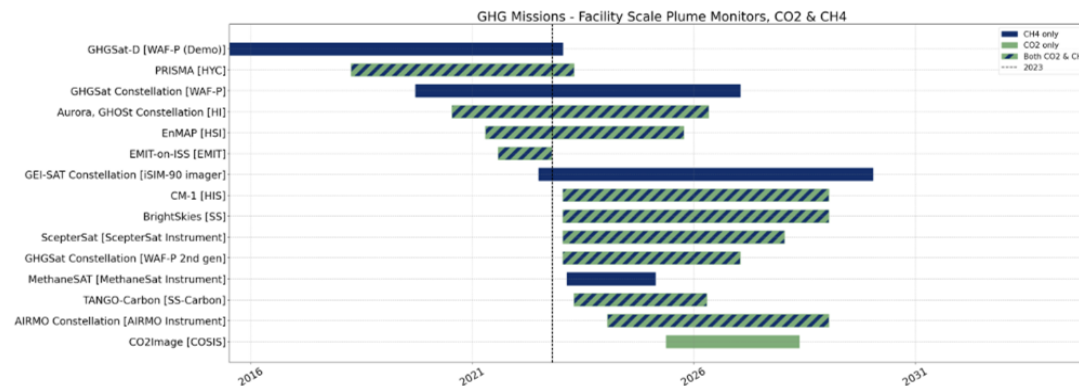


Carbon Dioxide and Methane Observing Satellites [Source: [copernicus.org](#), Credit: [GeoSapien!](#)]

GHG Mission Timelines Global GHG Mappers



Facility Scale Plume Monitors



Comm: Commercial Mission Govt: Governmental Mission NGO: Non-Governmental Organisation Mission

Limited: Some constraints to data access Open: Data publicly available Paid: Data available for a fee

Global GHG Mappers

Typically undertaken by CEOS space agencies, these missions are the most important sources of information for tracking emissions and removals of GHGs from natural as well as anthropogenic sources and sinks on spatial scales spanning large urban areas to nations. These sensors typically do not have the spatial resolution to attribute emissions from individual facilities but are the only sensors with the precision and accuracy needed to track fluxes from diffuse sources of CO₂ from the biosphere and oceans, and of methane from natural wetlands and agricultural lands. Data from Global GHG Mappers are being used in national inventory development and to assess the completeness and accuracy of country reporting to the UNFCCC.



CO2M

CO₂ CH₄

Govt Open

The Copernicus CO2M mission measures human-induced carbon dioxide and methane emissions. It deploys satellites to reduce uncertainties in fossil fuel combustion estimates at national and regional levels, offering an independent information source for policy assessment and tracking Europe's decarbonisation progress and emission reduction goals. [More...](#)

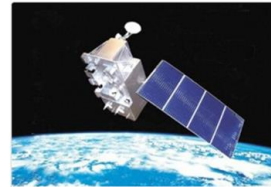


FengYun-3D

CO₂ CH₄

Govt Limited

FengYun-3D is an operational meteorology mission, playing a significant role in ocean and ice monitoring, climate monitoring, atmospheric chemistry, and space weather. It retrieves greenhouse gases (GHGs) such as CH₄, CO₂, and other atmospheric gases. [More...](#)



FengYun-3H

CO₂ CH₄

Govt Limited

FengYun-3H, the 7th flight unit of the FY-3 series, is dedicated to operational meteorology and will contribute significantly to ocean and ice monitoring, climate monitoring, atmospheric chemistry, and space weather. It will also measure concentration distributions of major greenhouse gases (CO₂, CH₄, etc.) in the global atmosphere. [More...](#)



Gaofen-5

CO₂ CH₄

Govt Limited

Gaofen-5 is a hyperspectral mission that observes Earth's environments, tracking environmental impacts, water quality, and atmospheric changes. It measures carbon dioxide and methane in the troposphere to understand the processes affecting these greenhouse gases (GHGs). [More...](#)

Facility Scale Plume Monitors

A wide range of public, commercial and NGO groups are operating or planning missions (often smallsats) in this category, with many of them targeted at helping the fossil fuel industry address emission reductions from their operations, particularly for CH₄ extraction and transport. Many of the relevant sensors are multi-purpose hyperspectral imagers, which can track intense plumes of CO₂ and CH₄. Sensors assigned to this category must have a spatial resolution of 1 square km or finer, but do not require the precision, accuracy, or coverage of the Global GHG Mappers.

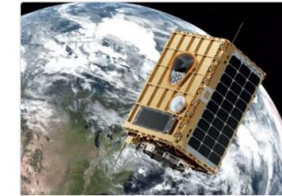


Airmo Constellation

CO₂ CH₄

Comm Paid

The mission aims to monitor diverse and remote locations for GHG emissions, especially CH₄. By 2030, it seeks to identify all super emitters, particularly within the Oil & Gas industry, contributing to improved greenhouse gas monitoring efforts. [More...](#)

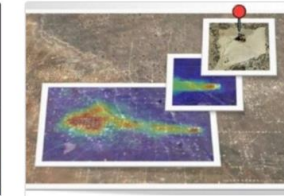


Aurora

CO₂ CH₄

Comm Paid

The Aurora mission is a precursor to GHOST, capturing 450 spectral bands from visible to shortwave infrared. This advanced capability observes key greenhouse gases (GHGs) like CO₂, CH₄, N₂O, and more, enhancing greenhouse gas monitoring efforts. [More...](#)

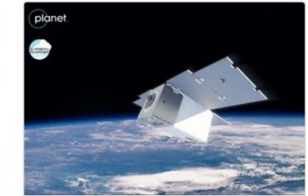


Brightskies

CO₂ CH₄

Comm Paid

The Brightskies mission employs hyperspectral observations to track environmental impacts, water quality, and atmospheric changes. Its application involves measuring carbon dioxide and methane in the troposphere and understanding the source and sink processes affecting these greenhouse gases (GHGs), contributing to our understanding of climate dynamics and environmental changes. [More...](#)



Carbon Mapper

CO₂ CH₄

NGO Open / Paid

The mission's goal is to pinpoint, quantify, and monitor CH₄ and CO₂ emissions at individual facility scales, promoting global accessibility and transparency of methane and CO₂ data. The application includes fast methane leak detection for facility operators and regulators, aiding in certifying methane intensity for oil and gas supply chains. [More...](#)



GOSAT

CO₂ CH₄

Govt Open

The GOSAT mission aims to monitor the global distribution of greenhouse gases (GHGs), including CO₂ and CH₄, at a subcontinental scale. Its goal is to verify the effectiveness of GHG emission reduction measures and contribute to



GOSAT-2

CO₂ CH₄

Govt Open

The GOSAT-2 mission aims to extend the GHG monitoring record initiated by GOSAT. Its goal is to measure the global distribution of greenhouse gases (GHGs) such as CO₂ and CH₄ at a subcontinental scale, verifying the effectiveness of GHG



GOSAT-GW

CO₂ CH₄

Govt Open

The mission's goal is to monitor Greenhouse gases (GHGs) like carbon dioxide and methane in the atmosphere, aiding in understanding climate change rates. Additionally, it seeks to enhance our understanding of the water cycle

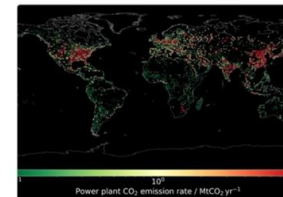


MERLIN

CH₄

Govt Open

The MERLIN mission aims to achieve high precision and accuracy in obtaining spatial and temporal gradients of atmospheric CH₄ columns on a global scale. It seeks to enhance knowledge of both natural and anthropogenic CH₄.

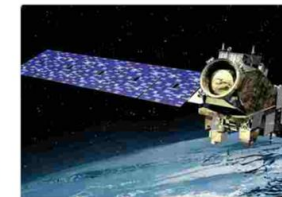


CO2Image

CO₂

Govt Open

The mission goal of CO2Image is to precisely measure trace gas emissions at a high spatial resolution, offering valuable insights into greenhouse gas dynamics and their impact on the environment. By providing accurate data, it aids in understanding and addressing climate change challenges effectively. [More...](#)



EMIT

CO₂ CH₄

Govt Open

EMIT's mission goal is to fill the crucial gap in dust source information, enabling scientists to create a comprehensive mineral map of Earth's dust-producing regions. By providing this missing data, EMIT supports better understanding and management of dust-related environmental impacts and atmospheric processes. [More...](#)



EnMAP

CO₂ CH₄

Govt Open

The EnMAP mission aims to measure, derive, and analyse essential parameters for Earth's surface, including agriculture, forestry, soil, geology, coastal zones, and inland waters. It assesses ecosystem status and responses to environmental changes, aiding carbon emissions accounting and monitoring land surface changes like forest degradation and deforestation. [More...](#)



GEI-SAT Constellation

CH₄


Comm Open / Paid

As part of a dedicated constellation, GEI-SAT will aim to provide near-continuous coverage of any sub-polar point on the globe (during daylight hours) to identify CH₄ emission sources. This high-frequency monitoring enhances our ability to understand and mitigate methane emissions impact on climate change and the environment. [More...](#)

MIM Database Entry



- ❖ More details per entry
- ❖ Global GHG Mappers (usually public)
- ❖ Facility Scale Plume Monitors (mixed)
- ❖ Operational Sounders
- ❖ Links through to MIM profile for each

CEOS  **THE CEOS DATABASE**
Updated for 2023

Home Database Agencies EO Handbook | Missions Activity Table Index | Instruments Table Index | Measurements Overview Timelines | Datasets Activity | ENHANCED BY Google |

CEOS EO HANDBOOK – MISSION SUMMARY - Sentinel CO2M-C - [i](#)

Full Name CO2M-C	Status Planned
Mission Agencies ESA ^[1] , COM ^[C] , EUMETSAT ^[C]	Launch Date 2026
Mission Links mission site	EOL Date 2034
EO Portal Info	NORAD Catalog #
	International Designator
Orbit Type Sun-synchronous	Orbit Period 99.5 minutes
Orbit Sense Descending	Orbit Inclination 97.7 deg
Orbit Altitude 735 km	Orbit Longitude
Orbit LST 11:30 (at DN)	Repeat Cycle 11 days

Objectives and Applications To provide Copernicus with a CO2 monitoring and verification support capacity, capable of estimating anthropogenic CO2 emissions at country and megacity scales.

Mission Measurements	Category	Parameter	Instrument(s)
	Atmosphere	Aerosols	MAP
		Cloud type, amount and cloud top temperature	CLIM
		Trace gases (excluding ozone)	CO2I

Mission Instruments [CLIM](#) - 3-band CCloud Imager^[F]
[CO2I](#) - Integrated CO2 & NO2 Imaging spectrometer^[F]
[MAP](#) - Multi-Angular Multi-band Polarimeter^[F]

OpenSearch Datasets No IDN OpenSearch datasets found.

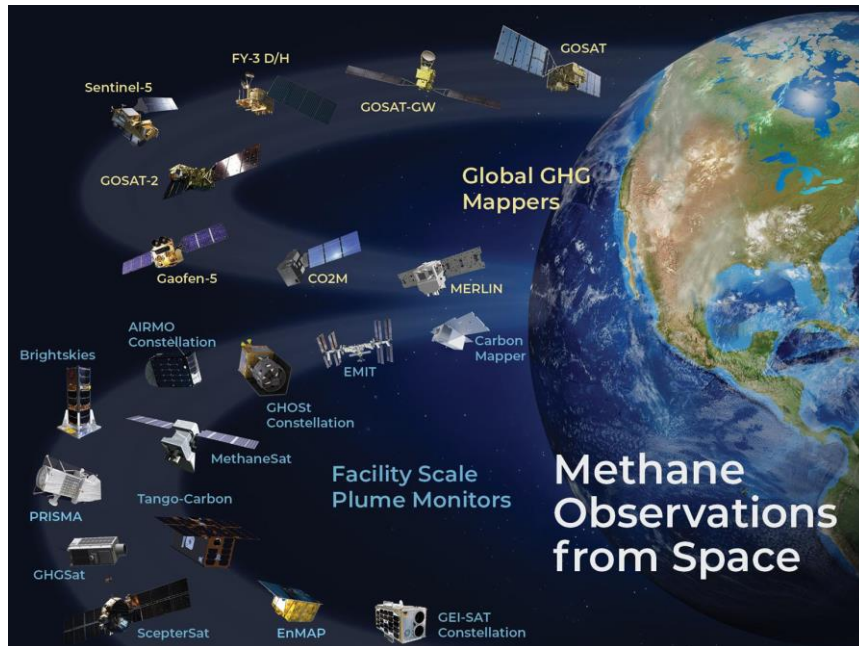
Want to explore more? Try [FedEO](#) by ESA ^[E] or [CMR OpenSearch](#) by NASA ^[E]

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Already in use!

- ❖ Being deployed in the IMEO Roadmap document
- ❖ Further comments and updates welcome
- ❖ Ready to demo at COP-28 and beyond
- ❖ Includes various types of mission operators, i.e., public, philanthropic, private, NGO & mixtures

ceos.org/ghg



CH₄



CO₂

Other GHG related observations



- ❖ Besides column-averaged mixing ratios of CO_2 & CH_4
- ❖ Also other relevant gases and/or related products:
 - Plume mappers looking at local enhancements of (mainly) CH_4 (& CO_2)
 - NO_2 leading to to plumes of CO_2
 - Biomass, vegetation indices, landcover, deforestation maps and other land products
- ❖ Or other input in upport of models
 - Vegetation SIF
 - Nightlights
 - Inundation maps

Europe at Night
Courtesy: DMSP and NASA

