Carbon neutrality and net zero emissions

2021	Regulation EU 2021/1119	EU Climate law
2021	COM(2021) 572 final	EU forest strategy for 2030
2021	COM(2021) 800 final	COMMUNICATION on Sustainable Carbon Cycles
2020	COM(2020) 633 final	Communication on an EU strategy to reduce methane emissions
2020	COM(2020) 788 final	European Climate Pact
2022	COM(2022)230	Communication REPowerEU Plan
2022	COM(2022)240	Communication EU Save Energy
2021	COM(2021) 400	Communication EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil'
2010	Directive 2010/75/EU	EU Directive on industrial emissions (integrated pollution prevention and control)
2022	COM/2022/542 final	Proposal for a Directive on ambient air quality and cleaner air for Europe (recast)
2022	SWD(2022) 545 final	COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT REPORT Accompanying the document Proposal for a Directive of the European Parliament and of the Council on ambient air quality and cleaner air for Europe (recast)

***Darker background indicates policy documents mentioning Copernicus**

Highlights on key policy aspects supported by Copernicus

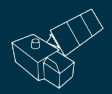
The **Copernicus Services** play an essential role in monitoring the different facets of climate change:

- anthropogenic greenhouse gas emissions (CO2 and METHANE) through the **Copernicus Atmosphere Monitoring Service,** including the Methane **Super Emitter monitoring tool** mentioned in the EU Methane Strategy.
- status and trends of essential climate variables through the **Copernicus Climate Change Service**.
- through the **Copernicus Land Monitoring Service,** as a substantial percentage of GHG emissions come from Land Use, Land Use Change and Forestry (LULUCF).

Key Copernicus supporting elements

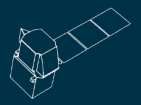
Atmosphere Monitoring Service
atmosphere.copernicus.eu

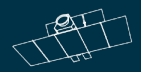
Land Monitoring Service



Copernicus Marine Service

Climate Change Service
climate.copernicus.eu

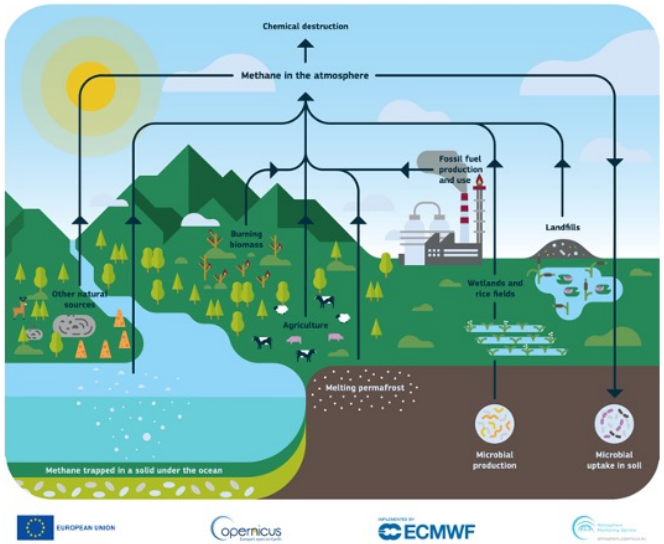


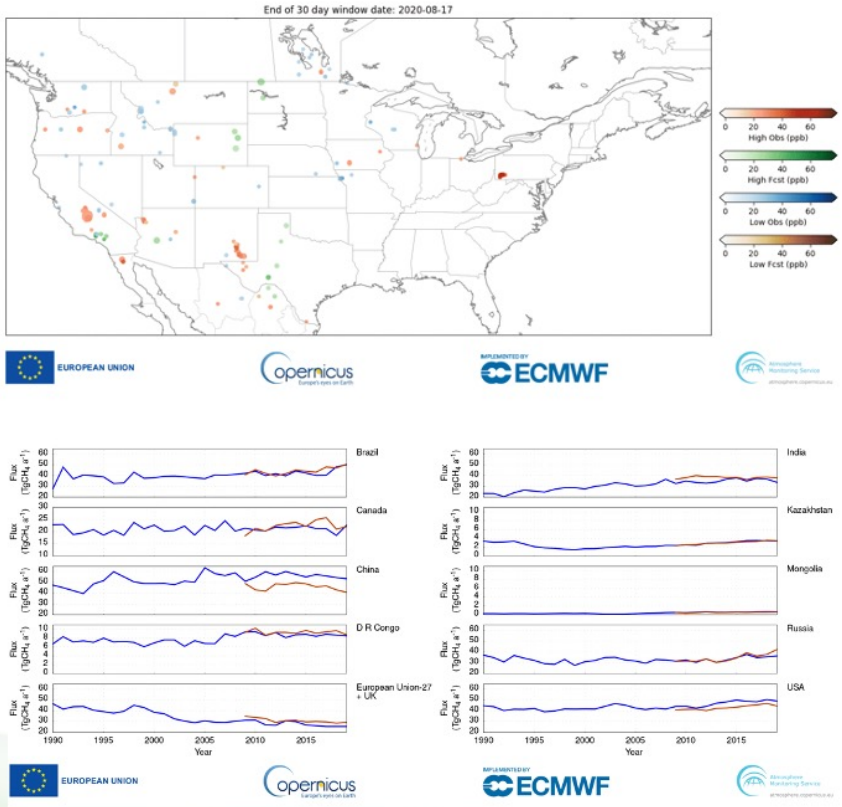


Copernicus Atmopshere Monitoring Service and Methane (CH_4) emissions

IMPLEMENTED BY ECMWF

Atmosphere Monitoring Service
atmosphere.copernicus.eu



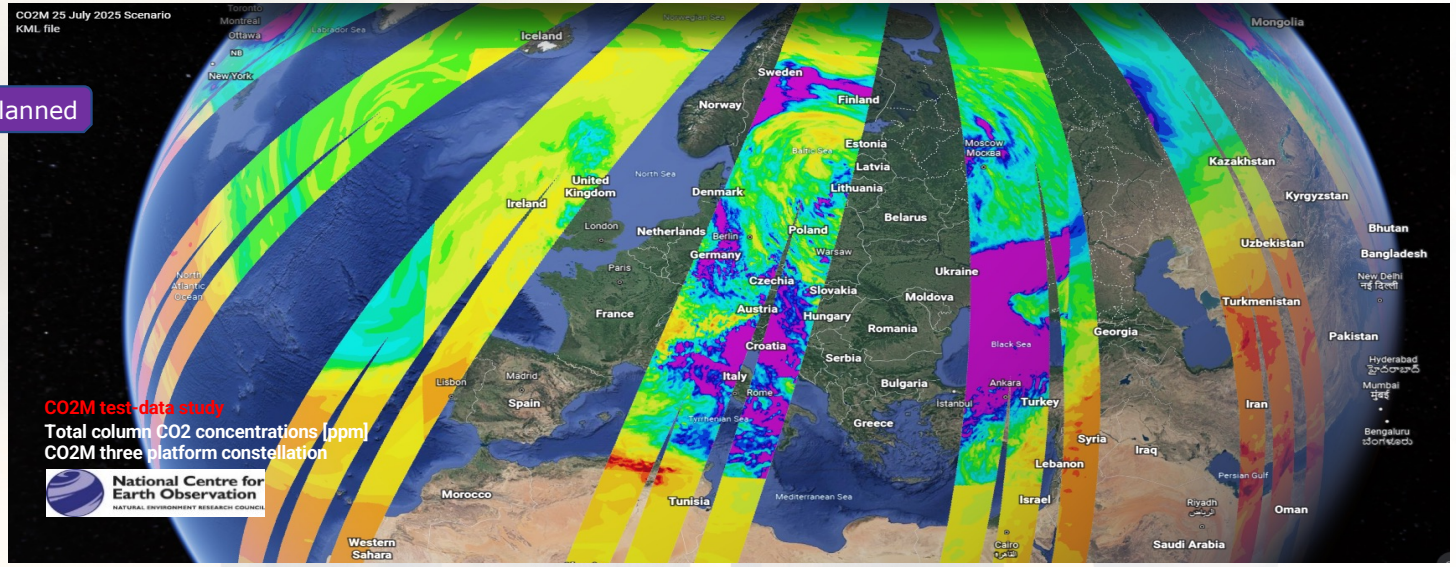


Explainer

- CAMS provides observation-based information on CO_2 and **CH_4natural fluxes and anthropogenic emissions** and their trends in support of the **Paris Agreement.**
- In support of **the EU strategy to reduce methane emissions (COM(2020)663 14/10/2020)** and support private sector for **adaptation to a green economy**
- **Detecting CH_4 anomalies:** up-to-date **model simulations of methane** based on emission inventories, routinely compared with observations from the **Sentinel-5**.
- Link: https://atmosphere.copernicus.eu/ghg-services
- Contact person: Richard.Engelen@ecmwf.int

CO2M - Copernicus Anthropogenic CO_2 Monitoring Mission

The only way to provide for transparent CO2 reduction policies



PARIS AGREEMENT on Climate Change

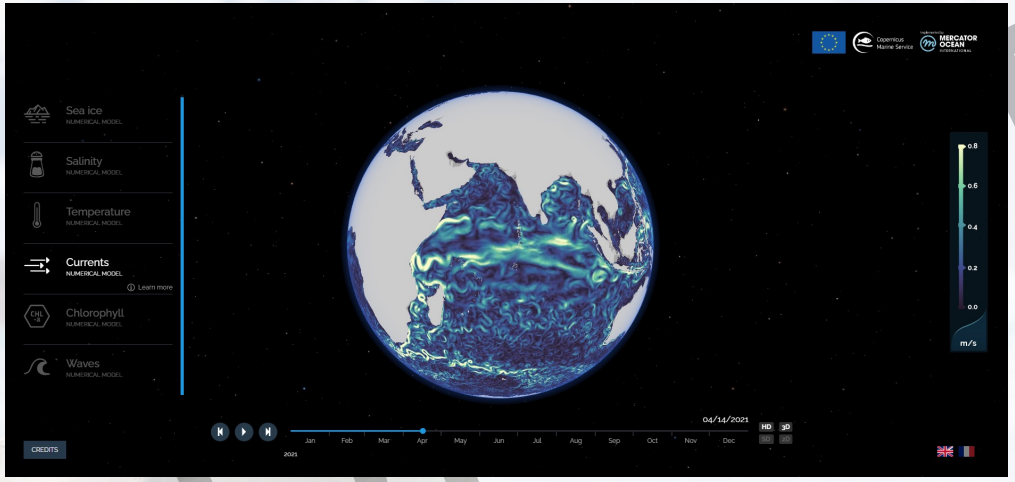
- ✓ CO2M is currently the only planned operational satellite mission worldwide to monitor anthropogenic CO_2
- ✓ It supports the implementation of Paris Agreement, Green Deal and Methane Pledge and is a key input to the UNFCC Global Stock Takes through **objective and independent evidence on, and verification of, nationally reported anthropogenic CO_2 and CH_4 emissions worldwide**

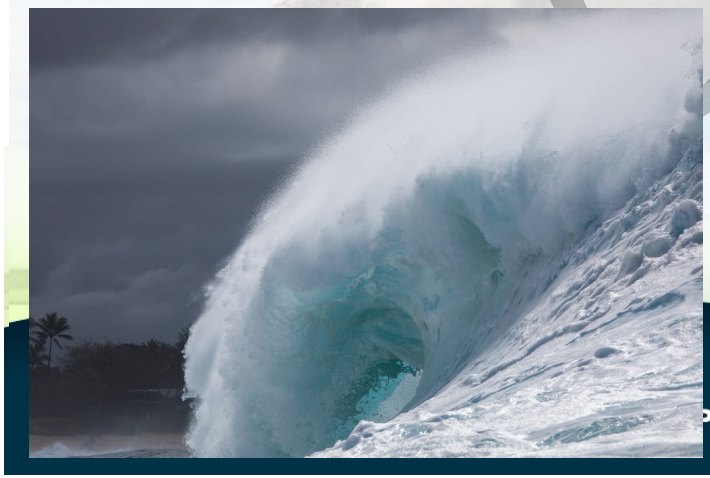
Explainer

- CO2M will measure Total Column Carbon Dioxide (CO_2) and Methane (CH_4) in support to local as well as country-scale applications globally, with 4sqkm spatial resolution and 3-6 days repetitiveness.
- CO2M will be the core data provider for the EC-funded *"Copernicus Anthropogenic CO_2 Emissions Monitoring & Verification Support Capacity"* ("Blue, Red and Green Reports")
- The monitoring system will provide a policy support information by combining satellite and in-situ data with Earth system modelling to estimate anthropogenic CO2 and CH4 emissions and their trends.
- CO2M is a Sentinel Expansion Mission. Two units are being developed and planned for launch in 2026. A 3rd unit, currently not funded, would improve the probability of detection of large CO_2 emitters (e.g. power plants and city scales)
- Know more AT THIS LINK

Copernicus Marine Service

It provides critical data for shipping route optimization, minimizing fuel consumption, and reducing emissions. Ocean Renewable energy (wave and ocean heat) contributes in transitioning to sustainable energy solutions.





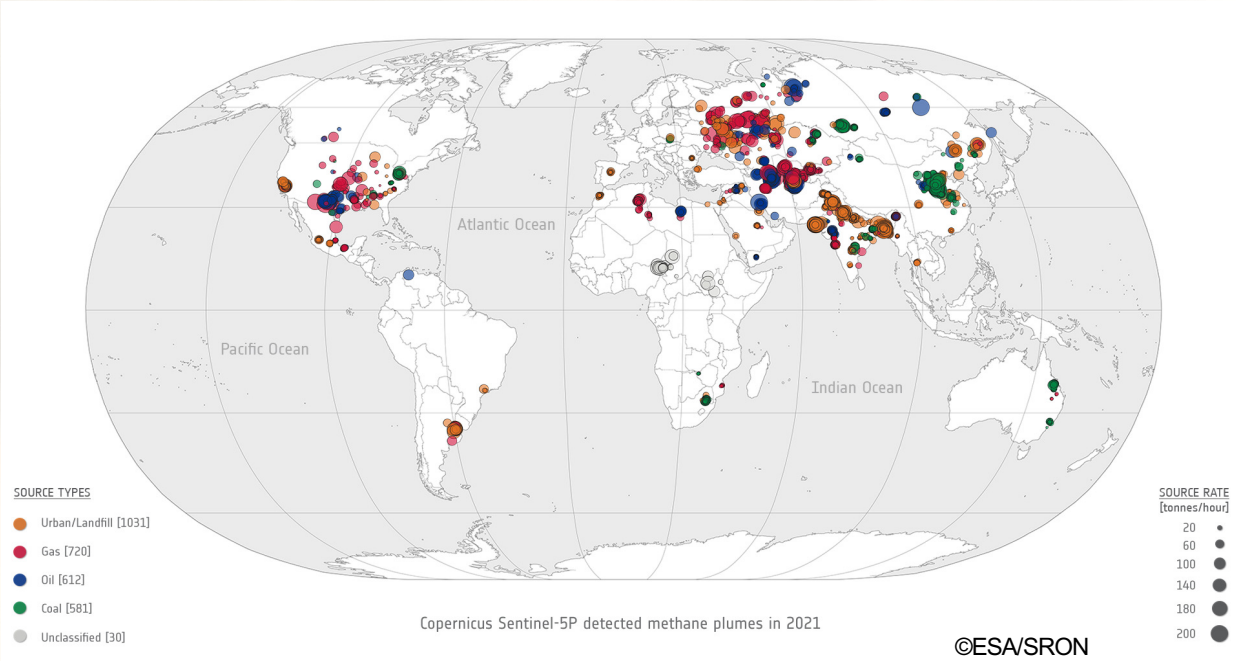
Explainer

- **Key features**: Accurate and up-to-date oceanographic data, including information on wind, waves, currents, and sea ice cover. This data is crucial for optimizing ship routes and minimizing fuel consumption. Additionally, the data on wind, wave and currents is vital for planning, designing, and operating renewable energy projects and marine operations.
- **Added value:** By providing data for route optimization and navigation safety, Copernicus Marine contributes to reducing the environmental impact of shipping operations which aligns with efforts to decrease carbon emissions and reach net zero targets. With support it provides to different marine renewable energy projects, this data is crucial for the shift to sustainable energy solutions.
- **Main products:** Global Ocean Physics Analysis and Forecast; Global Ocean Waves Analysis and Forecast
- **Main application**: Optimal ship routing and control; Met-Ocean conditions for Marine Renewable Energy test site
- **Ocean Monitoring Indicators**: Sea Ice Change

Parliament

Sentinel-5P

The only mission currently in space that maps Methane daily, globally



Copernicus Sentinel-5P detected methane plumes in 2021

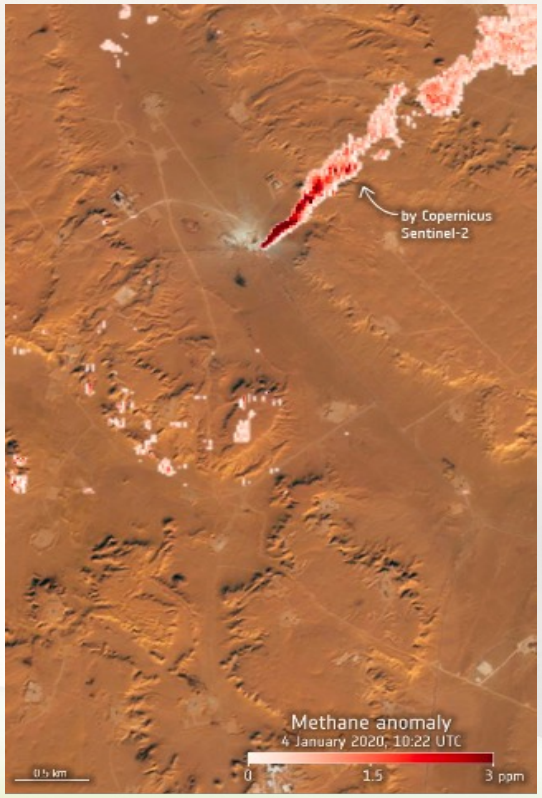
✓ Global overview of location and magnitude of all 2974 **methane super-emitter plumes** detected in 2021 using Sentinel-5P. From the map, it emerges that 45% of super-emitters originate from oil and gas facilities. Visible are also plumes from urban areas (35%) and coal mines (20%).

Explainer

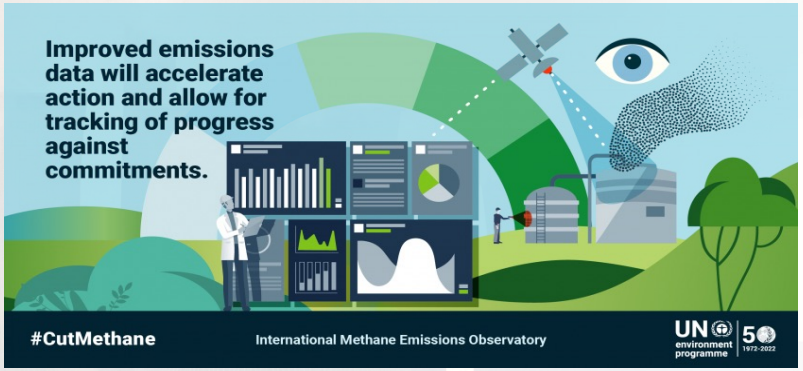
- Sentinel-5P is the only satellite that produces a global maps of Methane concentrations every day.
- Sentinel-5P's TROPOMI spatial resolution of 20sqm enables the detection of so-called super-emitters. Thanks to Sentinel-5P, for the first time we now get a good global picture of methane super-emitters.
- In addition to Methane, TROPOMI measures a range of chemical species crucial to the climate and other atmospheric processes (e.g. nitrogen dioxide, ozone and CO).
- Sentinel-5P is a precursor to Sentinel-5. Its continuity will be ensured by the Sentinel-5 series
- Know more AT THIS LINK

Sentinel-2

An innovative support for pinpointing the precise location of major methane leaks



✓ Sentinel-2 derived information is already used by the United Nations' International Methane Emissions Observatory (IMEO) to find solutions to methane leaks, together with the responsible companies or authorities. Read more at this LINK



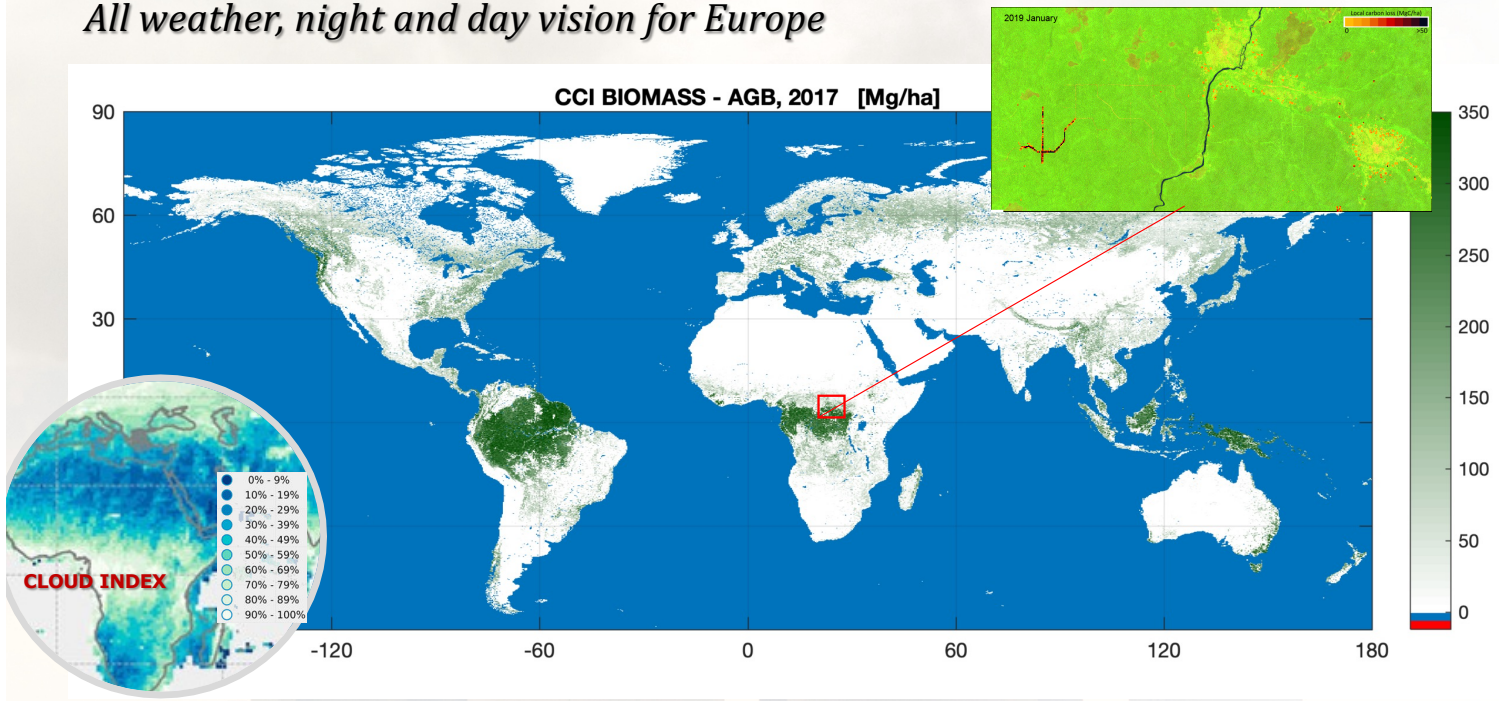
ESA (Data: GHGSat/contains modified Copernicus Sentinel data (2021), processed by ESA)

Explainer

- Sentinel-2 multi-band instruments are not designed to observe Methane concentrations but can identify precise locations of major methane leaks (emitting more than one tonne per hour) with a remarkable resolution of 20 m.
- Sentinel-2 lacks daily global coverage, however, so it might miss out on capturing crucial data during certain emission periods and volatile conditions.
- No observations are available during the night and through clouds
- Long-term continuity will be ensured through Next Generation Sentinels
- Know more AT THIS LINK

Copernicus Sentinel-1

All weather, night and day vision for Europe



✓ About 30% of Earth's surface is covered by forests that are declining annually through small scale disturbances such as illegal logging, or conversion of forestland for agriculture, clearing to pastures for livestock and urban landscapes.

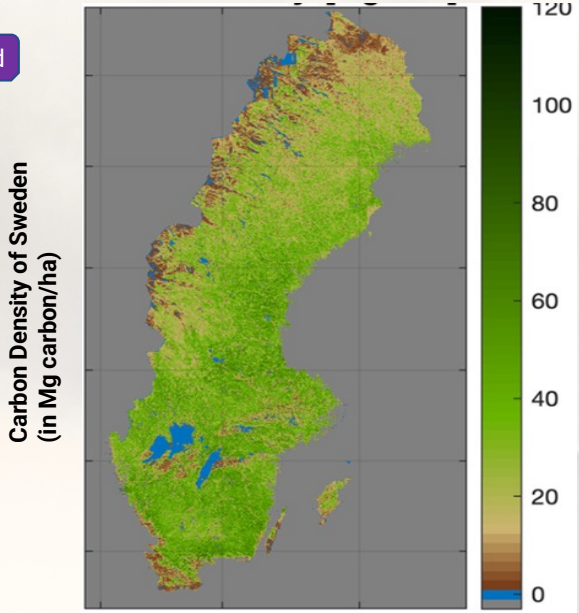
Explainer

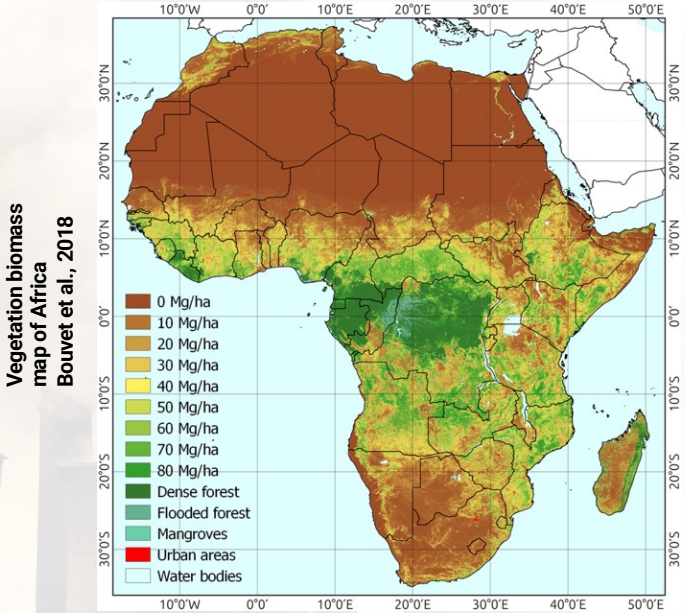
- Sentinel-1 allows to monitor global forest biomass, which is vital to know how much carbon is being held in forest biomass and to measure changes in biomass carbon stock.
- Sentinel-1 mission allows to produce global forest above-ground biomass maps at a spatial resolution of 1 ha.
- Sentinel-1 C-band allows to measure biomass through the clouds, which is essential to have a gap-free coverage given the persistent cloudiness over large forested areas
- Sentinel-1C needs to be launched soon following Sentinel-1B unavailability
- Long-term continuity of Sentinel-1 and ROSE-L missions is the guarantee that these climate trends can be monitored
- Know more AT THIS LINK

ROSE-L - Radar Observation System for Europe in L-band

Monitoring global forest carbon stocks (and time changes) with no gaps

Planned





PARIS AGREEMENT on Climate Change

- ✓ Forests are an important component of the global carbon cycle, and forest carbon stocks are a key indicator of sustainable forest management at the national, European and global level.
- ✓ Biomass monitoring supports the implementation of Paris Agreement and is a key input to the UNFCC Global Stock Takes

Explainer

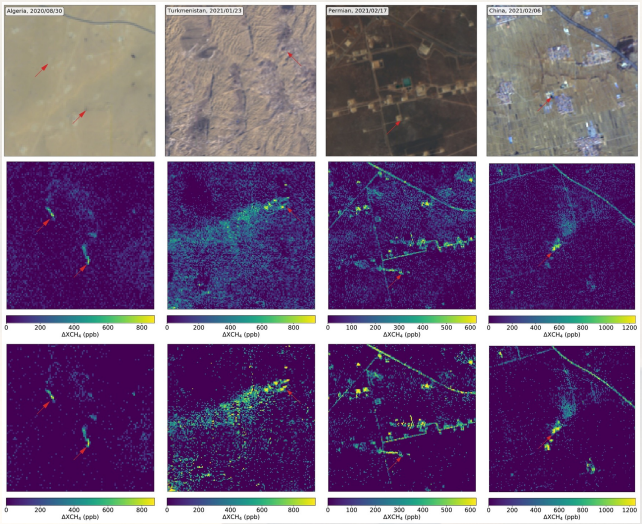
- ROSE-L will be the only operational mission to allow **gap-free*** mapping of global forest carbon stocks over time, allowing an objective and independent assessments of land carbon stocks and how these change with time
- ROSE-L will provide high-resolution (50m) reliable assessments and long-term monitoring of forest disturbances, deforestation and reforestation rates at local, regional, national and global levels in all weather conditions
- ROSE-L capabilities in this area demonstrated based on pre-cursor missions
- ROSE-L is a Sentinel Expansion Mission. Two units are being developed and the first satellite is planned for launch in 2028 pending budget availability.
- Know more at THIS LINK

*With no gaps over densely vegetated areas thanks to L-band improved capability to deep-penetrate into vegetation (wrt C-Band)

CHIME - Copernicus Hyperspectral Imaging Mission for the Environment

A complementary tool for monitoring methane point emissions

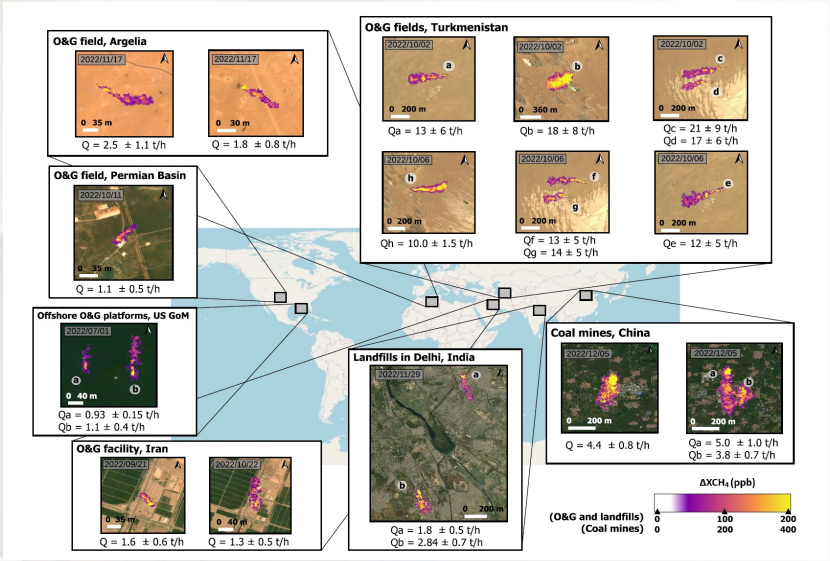
Planned



Guanter et. al (2021)

Information based on CHIME data will be also used by the UN-IMEO to find solutions to methane leaks, together with the responsible companies or authorities. Read more at this LINK.

✓ Current hyperspectral satellite missions (PRISMA, EnMAP, EMIT) are already used to identify and map plumes of methane released by power plants, landfills, mines and oil & gas facilities.



Roger et. al (2023)

Explainer

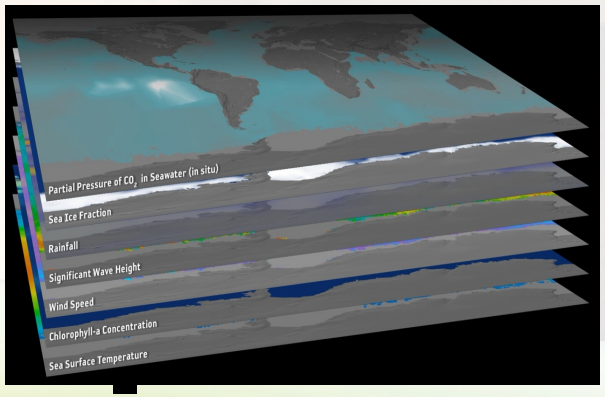
- CHIME will help improve global efforts to quantify methane emissions, with its high 30m resolution and continuous spectral sampling (200+ bands) in the visible, near infrared and shortwave infrared, giving it more sensitive detection thresholds.
- Revisit of 11 days with 2 satellites (cloud free)
- CHIME follows heritage from existing missions PRISMA, EnMAP, EMIT
- Limited sensitivity to natural diffuse emissions
- CHIME is a Sentinel Expansion Mission. Two units are currently being developed and will be available for launch as from 2028 subject to budget availability.
- Know more AT THIS LINK

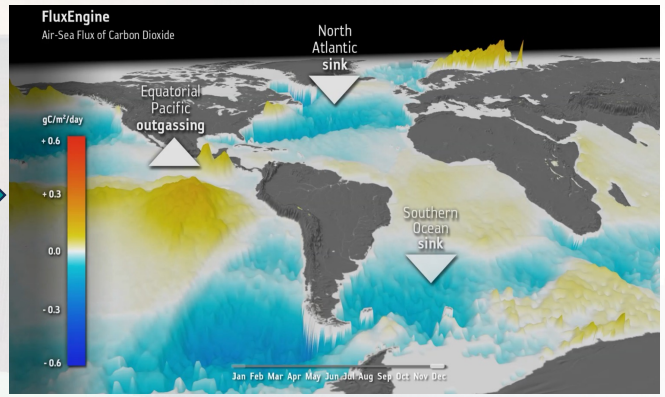
CIMR - Copernicus Imaging Microwave Radiometer

Understanding the exchange of CO2 between the ocean and atmosphere

Planned

- ✓ CIMR will be unique in its ability to deliver colocated and contemporaneous measurements of sea ice concentration, ocean surface temperature and salinity, surface wind over the ocean and precipitation rate.
- ✓ When combined with chlorophyll measurements from Sentinel-3 and in situ observations of partial pressure CO2 in the ocean, the location and dynamics of ocean CO2 uptake can be derived.





http://www.oceanflux-ghg.org/Products/FluxEngine

Explainer

- CIMR will provide measurements that are fundamental to understanding the exchange of CO2 between the ocean and atmosphere.
- CIMR is currently the only planned operational satellite mission worldwide to monitor sea surface temperature, salinity and wind speeds at the same time and location, with a daily revisit.
- Under the European Green Deal, CIMR will be a core data provider for new EC-led blue carbon initiatives dedicated to the role of our Oceans in carbon capture and storage.
- CIMR is a Sentinel Expansion Mission. Two units are currently being developed and will be available for launch as from 2028 subject to budget availability.
- Know more AT THIS LINK

Question Time!

BACK TO POLICY AREAS

BACK TO MEETING AGENDA