



Copernicus Contribution to Global Efforts on Monitoring CO₂ Emissions

COPUOS-65, 1 June 2022

Earth Observation unit, Directorate-General for
Defence Industry and Space,
European Commission



Space



Copernicus EU



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Copernicus

The EU Space Programme

EU SPACE PROGRAMME OVERVIEW



COPERNICUS

Earth Observation (EO) and monitoring based on satellite and non-space data

Nr.1 world provider of space data and information



GALILEO

Global satellite navigation and positioning system (GNSS)

10% of the EU GDP enabled by satellite navigation



EGNOS

Reliable navigation signals for safety of life use

Operational in 360+ airports & helipads in 23 countries



SSA

Space situational awareness monitoring and protecting space assets

Providing surveillance and tracking services to 210+ satellites

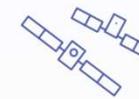


GOVSATCOM

Secure satellite communications for EU security actors

Delivering rapid support over crisis areas

AN INVESTMENT IN A FUTURE READY EUROPE



Competitive edge

Completing current satellite constellations, developing and launching the next-generation of satellites



Research innovation

Ambitious research and innovation programme benefiting from Horizon Europe



Fighting Climate Change

Monitoring biodiversity, environmental compliance and CO2 emissions (Paris Agreement)



EU as a global actor

Supporting disaster relief, humanitarian assistance and security operations



Copernicus

Copernicus Components

FROM GLOBAL EARTH OBSERVATION DATA TO LOCAL INFORMATION AND PRODUCTS

SENTINELS & CONTRIBUTING MISSIONS



IN SITU SENSORS

DATA

SERVICES

INFORMATION

TAILORED PROCESSES

PRODUCTS

DATA ACQUISITION

DATA PROCESSING

DATA & INFORMATION ACCESS

USER UPTAKE

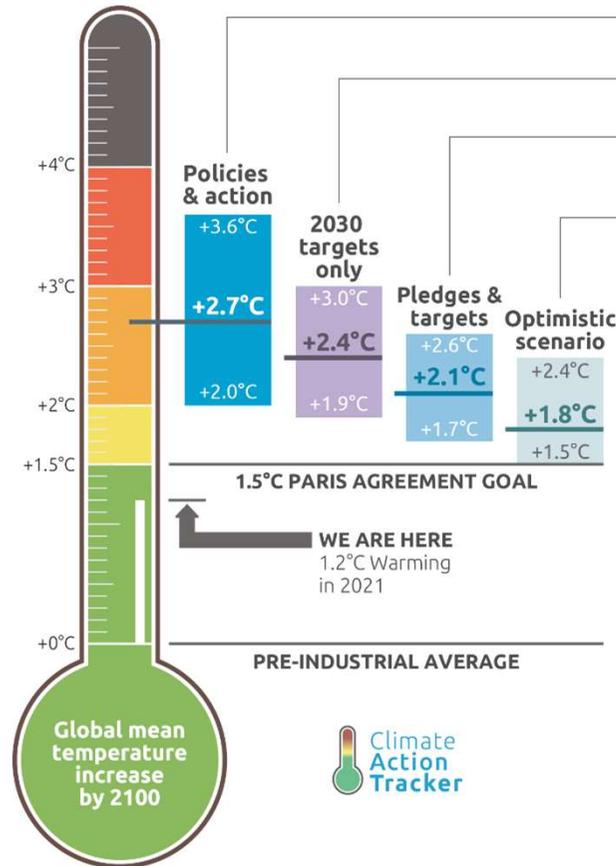






Atmosphere Monitoring

Why monitoring CO₂ emissions?



Policies & action

Real world action based on current policies

2030 targets only

Full implementation of 2030 NDC targets*

Pledges & targets

Full implementation of submitted and binding long-term targets and 2030 NDC targets*

Optimistic scenario

Best case scenario and assumes full implementation of all **announced** targets including net zero targets, LTSs and NDCs*

* If 2030 NDC targets are weaker than projected emissions levels under policies & action, we use levels from policy & action

CAT warming projections Global temperature increase by 2100

November 2021 Update



UN CLIMATE CHANGE CONFERENCE UK 2021

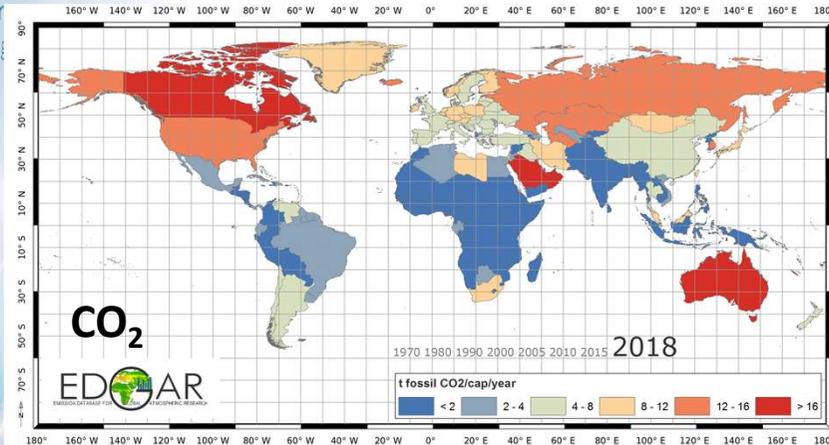
IN PARTNERSHIP WITH ITALY





Atmospheric
Monitoring

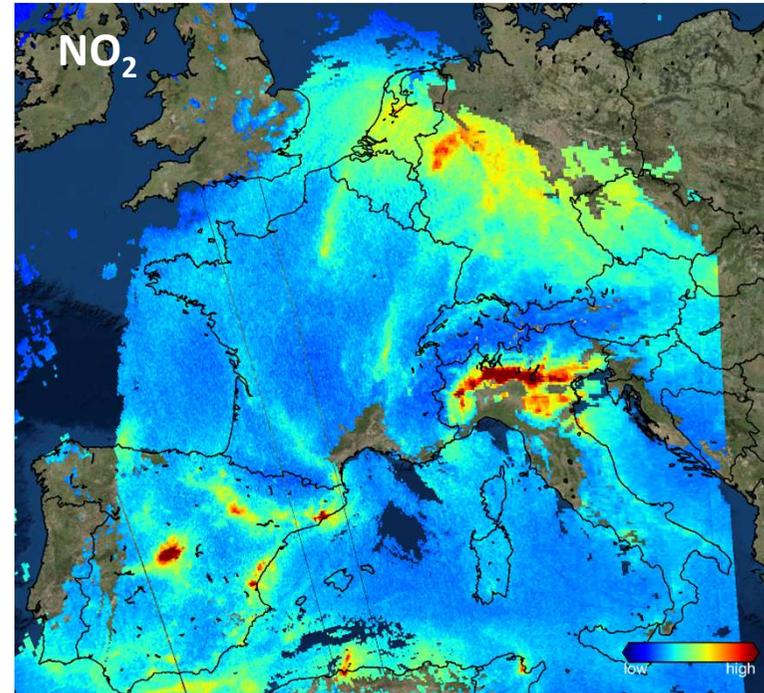
Understanding our emissions and how they change



CO₂ emission estimates based on nationally reported data

Observing atmospheric composition from space is a rapidly developing field. Many exciting new instruments, large and small, are being developed and launched.

Can we use Earth observations to improve our knowledge of anthropogenic emissions?



contains modified Copernicus Sentinel data (2017), processed by KNMI/ESA

NO₂ tropospheric columns observed by Sentinel-5p



PROGRAMME OF
THE EUROPEAN UNION



IMPLEMENTED BY
 **ECMWF**

CO2M – Overview Slide



Supporting the Paris agreement

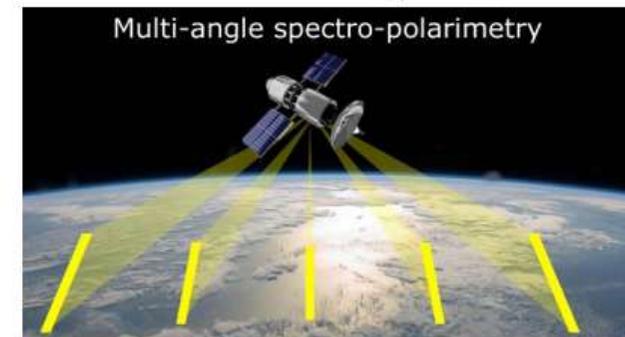
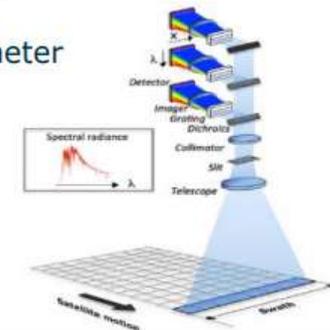
- with independent measurements
- monitor emissions of hot spots & cities
- assess and support trends in NDCs & global stocktake

Satellite mission requirements:

- Spatial resolution **4 km²**
- Imaging swath **> 250 km**

Product	Spatial	Precision
CO ₂	4 km ²	0.7 ppm
CH ₄	4 km ²	10 ppb
NO ₂	4 km ²	1.5 10 ¹⁵ molecules cm ⁻²
Vegetation SIF	4 km ²	0.7 mW m ⁻² sr ⁻¹ nm ⁻¹
Aerosol params	16 km ²	0.05 AOD, 500 m LH
Cloud fraction	1%	Water clouds & cirrus

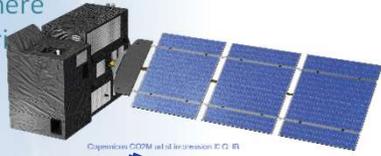
Pusbroom imaging spectrometer





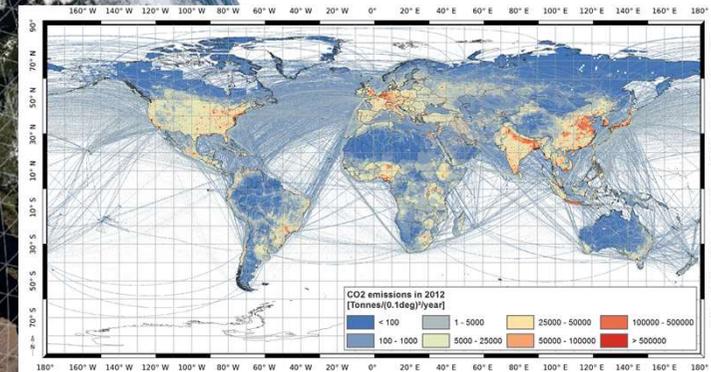
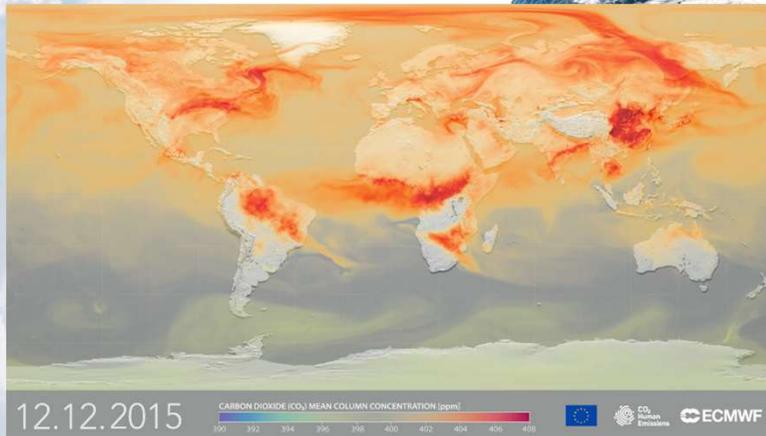
Atmosphere
Monitoring

Challenges of observation-based emission monitoring



1. Satellites do not measure emissions directly; they measure the impact of emissions on the atmosphere.
2. Satellites see only the total impact of anthropogenic and natural effects.

Earth System models are used to translate the observations into emission estimates.



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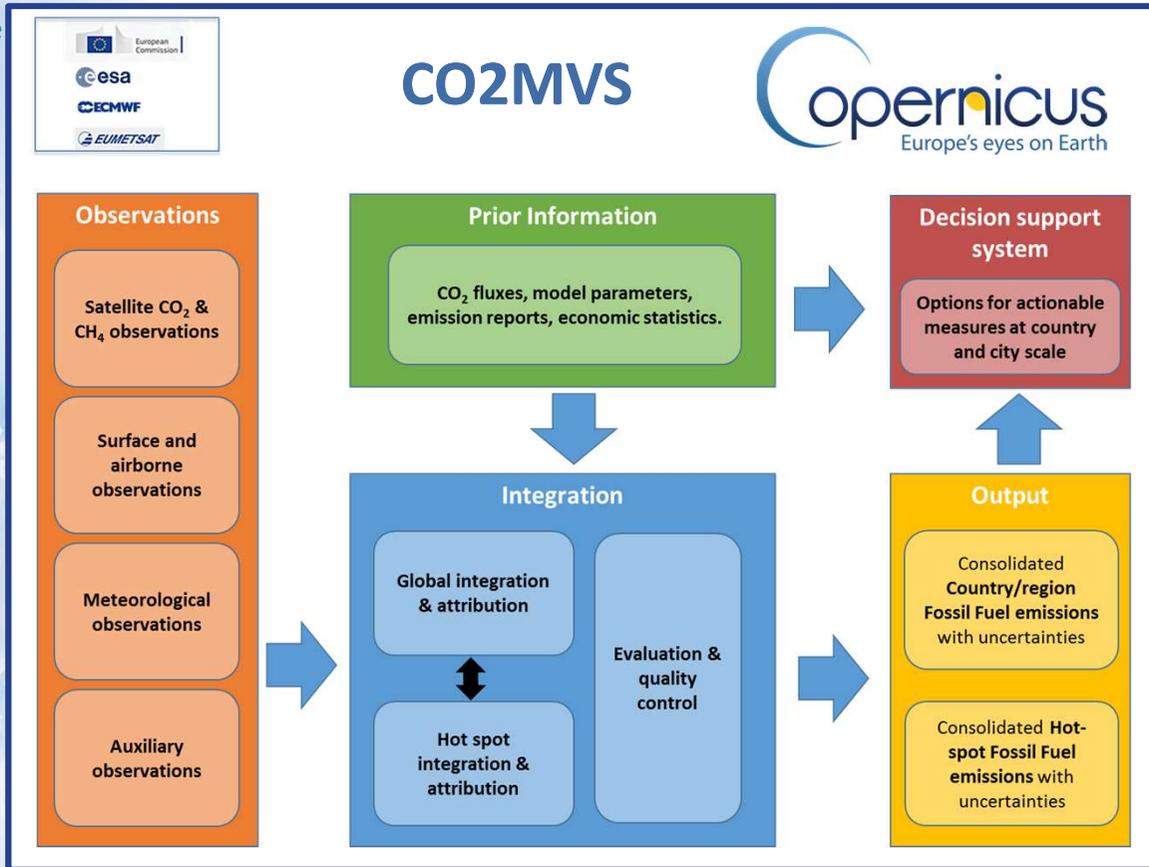
Copernicus
Europe's eyes on Earth

ECMWF



Atmosphere Monitoring

Developing a new Copernicus CO₂ monitoring service



Atmosphere Monitoring Service

atmosphere.copernicus.eu



The integrated system approach has also been adopted by CEOS as a valuable framework and is supported by WMO.





Atmosphere
Monitoring

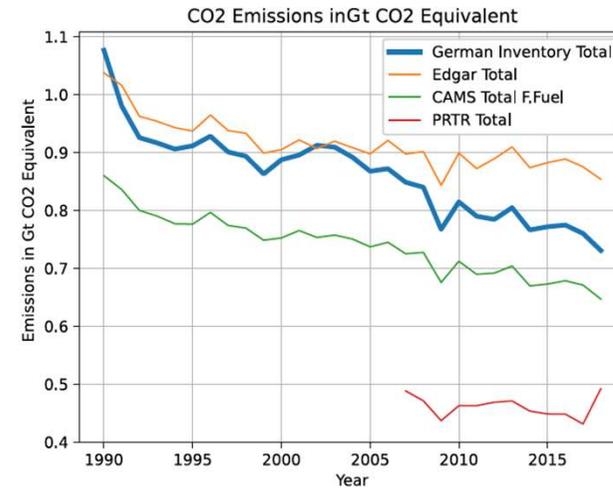
Early applications

CLIMATE CHANGE National Inventory Report, Germany – 2022

Submission under the United Nations Framework Convention on Climate Change and the Kyoto Protocol 2022

National Inventory Report
for the German Greenhouse Gas Inventory
1990 – 2020
Federal Environment Agency

UNFCCC Submission
15 April 2022



Current operational CAMS data is already used by Germany for evaluation in their submission to UNFCCC with an outlook to increase the usage as products further mature in the coming years.



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IMPLEMENTED BY
 ECMWF



Copernicus

Summary

- Provide monitoring information to inform European policies
- Support member states with national emission estimates
- Support member states with input data for national activities
- Support developing countries with emission estimates
- Support downstream commercial activities with operational monitoring



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