

living planet  
symposium

BONN  
23–27 May  
2022



Atmosphere Monitoring

# Copernicus Atmosphere Monitoring Service

## Status and upcoming evolutions

Vincent-Henri Peuch (ECMWF)



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THE EUROPEAN UNION



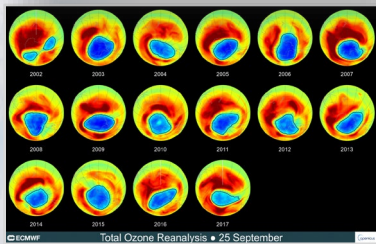
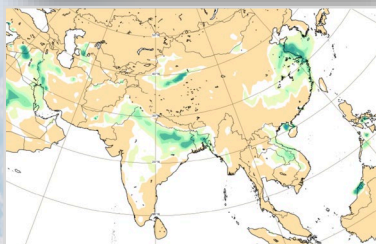
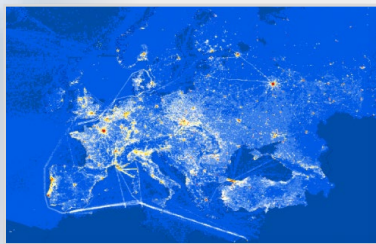
IMPLEMENTED BY  
 ECMWF





Atmosphere  
Monitoring

# CAMS SCOPE



Implemented by Copernicus as part of The Copernicus Programme  
Atmosphere Monitoring Service

News Events Press Tenders Help & support  
DATA ABOUT US WHAT WE DO QSEARCH

European Commission Copernicus ECMAW

We provide consistent and quality-controlled information related to air pollution and health, solar energy, greenhouse gases and climate forcing, everywhere in the world.

Today's air quality forecasts

CAMS provides open & free information products based on Earth Observation about:

- past, current and near-future (forecasts) global atmospheric composition;
- the ozone layer;
- European air quality;
- emissions and surface fluxes of key pollutants and greenhouse gases;
- solar radiation;
- climate radiative forcing.

<http://atmosphere.copernicus.eu>

<http://ads.atmosphere.copernicus.eu>



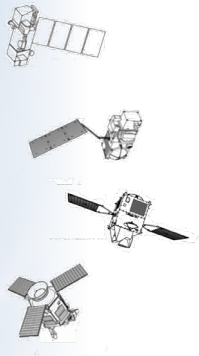
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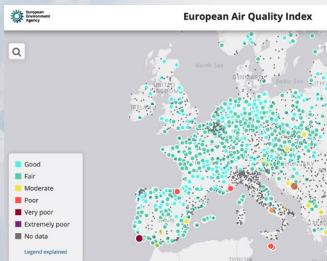


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# CAMS MAIN WORKFLOW



**Earth Observation** from  
satellite (>95 instruments)  
and in-situ (regulatory and  
research)



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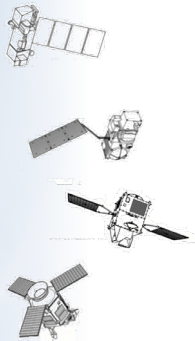


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**ECMWF**

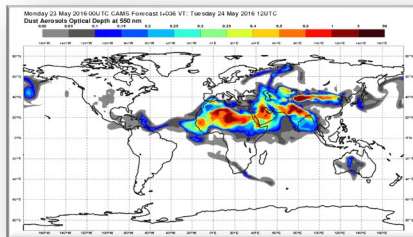


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# CAMS MAIN WORKFLOW

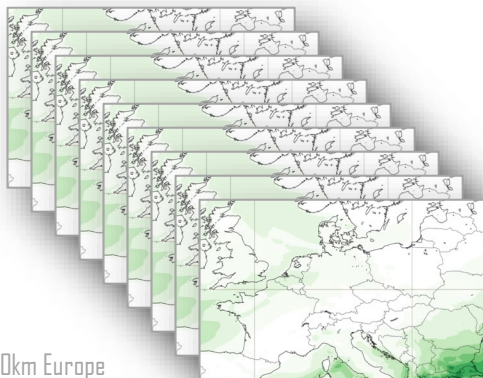


Earth Observation from satellite (>95 instruments) and in-situ (regulatory and research)

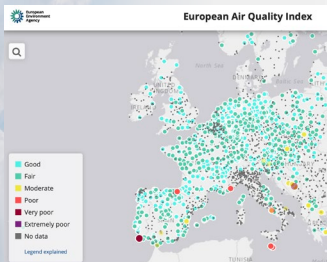


40km Globe (twice daily, d+5)

CAMS main operational data assimilation and modelling systems



10km Europe  
(daily, d+4)

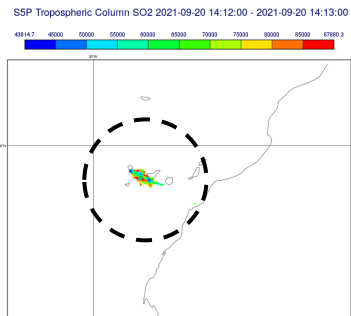
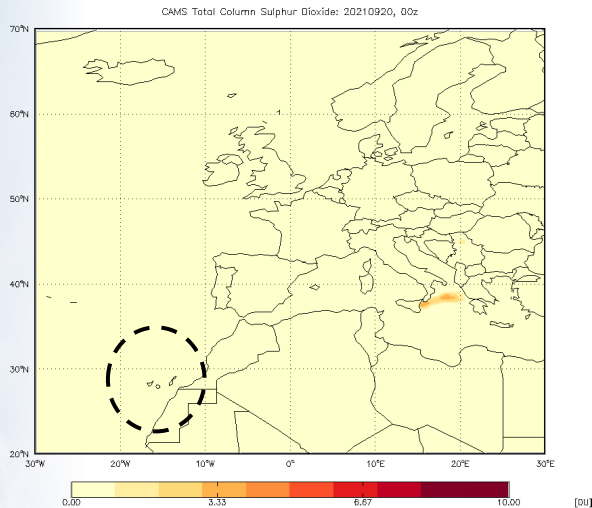


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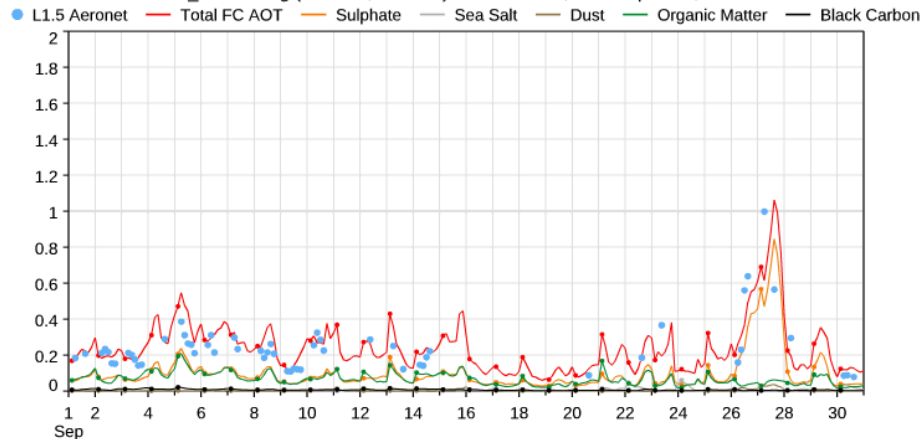


# EUROPE'S EYES ON EARTH: CUMBRE VIEJA (09-10/21)



- Cumbre Vieja volcano on La Palma erupted on 19 September 2021 for first time since 1971
- First SO<sub>2</sub> detections from **GOME-2 & S-5P** assimilated in IFS at 06z on 20 September (layer height ~550 hPa)
- Initial transport to the NW across N Africa, Europe and Mediterranean

Comparison of model (oper) and L1.5 Aeronet AOT at 500nm over MetObs\_Lindenberg (52.21°N, 14.12°E). Model: 00UT, 1-30 Sep 2021, T+3 to T+24.



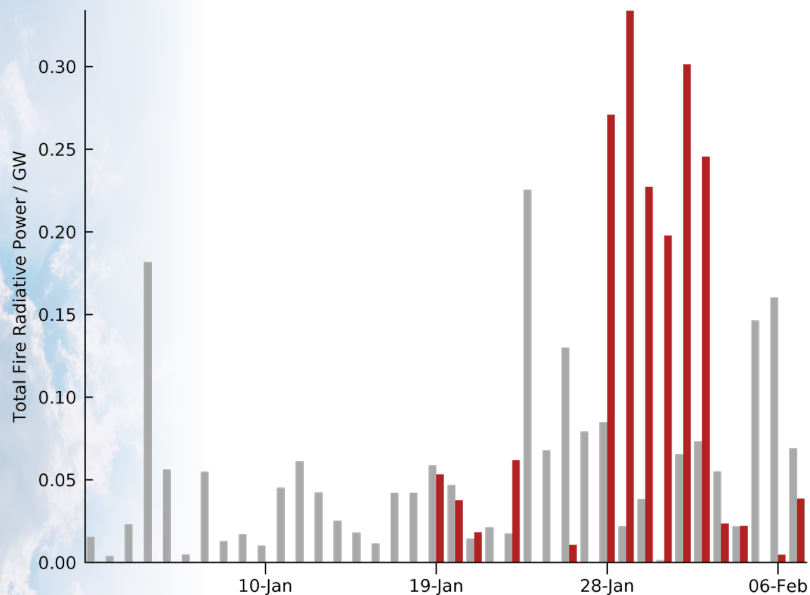




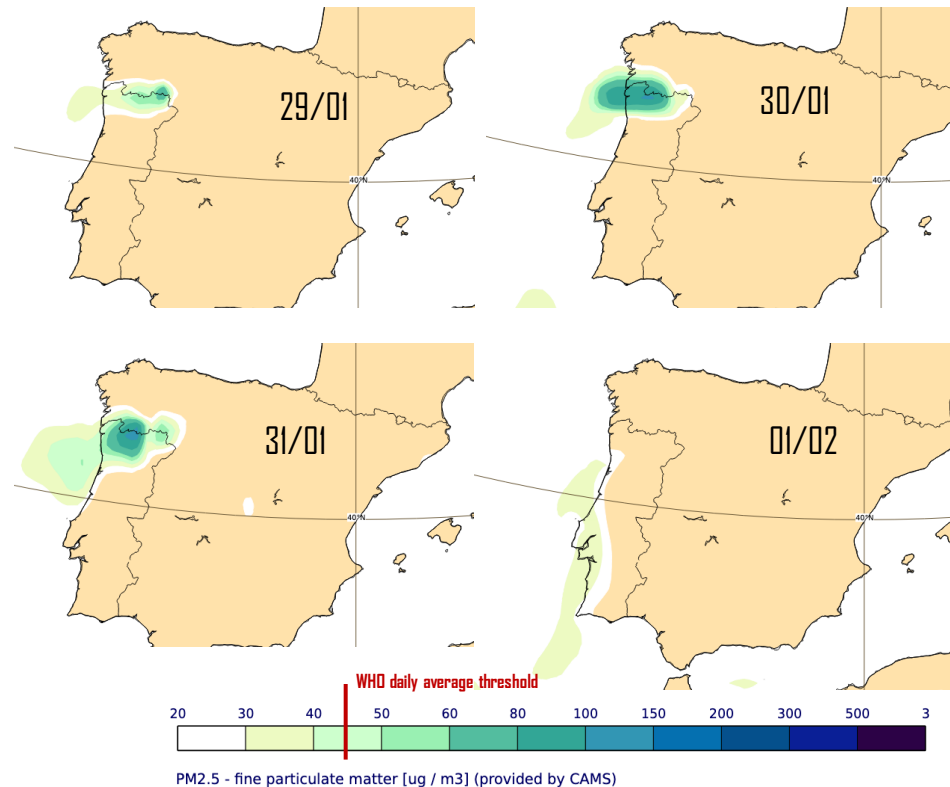
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# EUROPE'S EYES ON EARTH: FIRES IN NORTH PT (01-02/22)

CAMS Daily Total Fire Radiative Power (GFASv1.2) for Northern Portugal



- CAMS captured the exceptional fires from end January / early February in Portugal and their impact on air quality.



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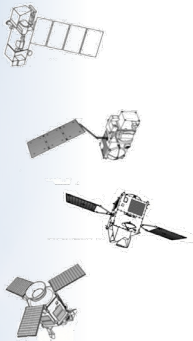


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**ECMWF**

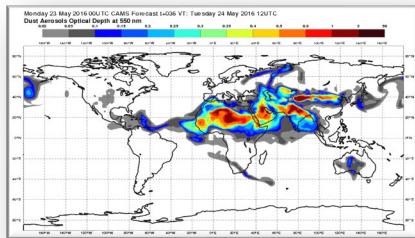
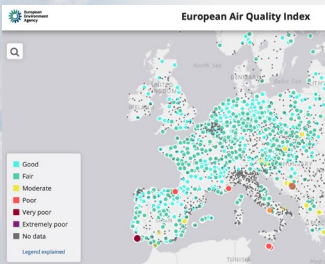


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# CAMS MAIN WORKFLOW

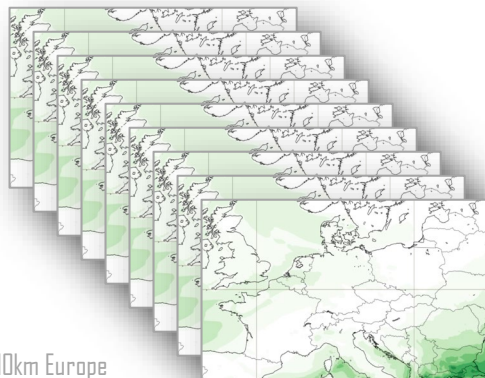


Earth Observation from  
satellite (>95 instruments)  
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40km Globe (twice daily, d+5)

CAMS main operational data assimilation and  
modelling systems



10km Europe  
(daily, d+4)

PREVAIR L'air en France aujourd'hui et demain

Pollution forecast provided by the Met Office

Today  
Air pollution levels will be mainly Low today with only localised pockets of Moderate.

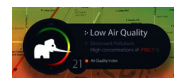
Know full 5 day air pollution forecast: @DefraUKair daily forecasts

Health advice for: moderate, high or very high pollution...

CAMS users  
>24k  
(>2.5k routine)



Major multiplier effect  
(100Mil+)



The  
Weather  
Channel

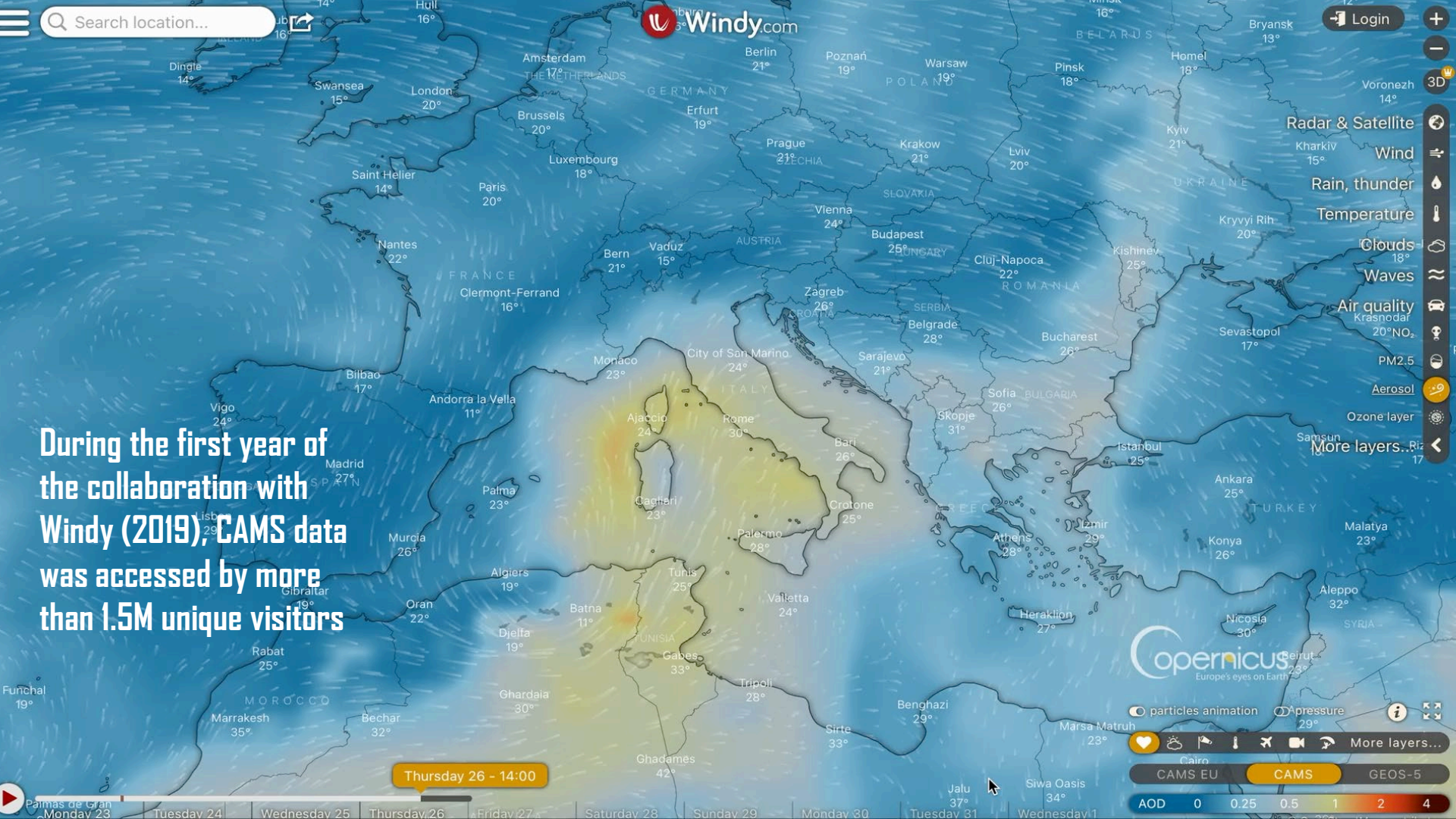


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Search location...

Windy.com

Login

During the first year of the collaboration with Windy (2019), CAMS data was accessed by more than 1.5M unique visitors

- Radar & Satellite
- Wind
- Rain, thunder
- Temperature
- Clouds
- Waves
- Air quality
- Aerosol
- Ozone layer
- More layers...

Thursday 26 - 14:00

Monday 23 Tuesday 24 Wednesday 25 Thursday 26 Friday 27 Saturday 28 Sunday 29 Monday 30 Tuesday 31 Wednesday 1

Copernicus Europe's eyes on Earth

particles animation pressure

More layers...

CAMS EU CAMS GEOS-5

AOD 0 0.25 0.5 1 2 4





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# NOW A GO-TO SOURCE IN GLOBAL MEDIA



The Economist

Today Weekly edition Menu

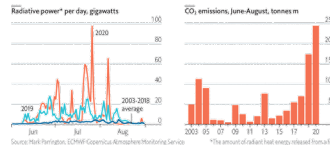
Graphic detail

Daily chart

## This year's Arctic wildfires are the worst on record, again

Fires in 2020 have already released more carbon than in any year since records began

Northern lights  
Arctic Circle wildfires



## What's a 'zombie fire'? Dangerous underground fires spark record-setting wildfires in Arctic Circle

Jordan Culver | USA TODAY  
Published 6:10 PM EDT Sep 6, 2020

In a year where fires in the United States and Australia have already set devastating records, scientists are seeing more devastating fire issues in the Arctic Circle.

Wildfires primarily in Russia's Sakha Republic have caused a spike in carbon dioxide emissions this year when compared to 2019, according to the World Wildlife Federation. Wildfires early in the season are believed to have been sparked by "zombie fires," which burned underground during the winter, the agency reported.

The Copernicus Atmosphere Monitoring Service (CAMS), part of the European Union's Earth observation program, reported from January 1 to August 31, the estimated carbon dioxide emissions for the Arctic Circle "were 244 megatonnes, compared to 181 megatonnes for the whole of 2019."

World Africa Americas Asia Australia China Europe India Middle East United Kingdom LIVE TV Edition

## Summer 2020's Arctic wildfires set new emission records

By Amy Woodruff, CNN  
Updated 07:02 GMT (15:02 HKT) September 3, 2020



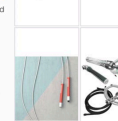
Aerial view of a forest fire in central Yakutia, in Russia's Sakha Republic. Forests are estimated to cover at least 256,307 hectares in Yakutia -- 83.4% of its whole territory.

**CNN** — Wildfires raging in the Arctic Circle smashed last year's records for carbon dioxide emissions, according to scientists at the Copernicus Atmosphere Monitoring Service (CAMS). Using CAMS' Global Fire Assimilation System (GFAS) data, scientists estimated that CO<sub>2</sub> emissions from fires in the Arctic Circle have increased by more than a third, compared to 2019, with 244 megatonnes of carbon produced from January 1 to August 31, 2020. By comparison, 181 megatonnes of carbon were produced for the whole of 2019.

News & buzz



Trump pushes misleading claim on...  
Hill... says she would...  
Trump if health...



NEWS WEBSITE OF THE YEAR

The Telegraph

Coronavirus News Politics Sport Business Money Opinion Tech Life Style Travel

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UK news - World news - Royals - Health - Defence - Science - Education - Investigations - Global Health Security

## Orange skies across UK caused by California wildfires burning 5,000 miles away

14 people have been killed in wildfires across California, Oregon and Washington

By Jessica Carpani and Olivia Rudg...  
11 September 2020 - 11:37

## FINANCIAL TIMES

HOME WORLD UK COMPANIES TECH MARKETS CLIMATE OPINION WORK & CAREERS LIFE & ARTS HOW TO SPEND IT

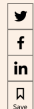
## Climate graphic of the week: Saharan dust coats the ski slopes

Larger quantities of particles than usual deposited during annual wea...

Steven Bernard FEBRUARY 13 2021

## Saharan dust cloud leaves its mark across southern Europe

Dust aerosol optical depth analysis at 550nm



00:00

Sciences  
Un nouveau nuage de sable du Sahara attendu ce dimanche en fin de journée et le nord de la France, selon le service européen de surveillance de l'atmosphère.



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# POWERED BY COPERNICUS

NEWS • MAKING THE INVISIBLE VISIBLE: PERSONALISED AIR QUALITY INFORMATION FOR SOCIETY

**Making the invisible visible: personalised air quality information for society**

DATE: 24th, June 2019

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • AIRTEXT

**airTEXT: air quality information at-a-glance**

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • MON TOIT SOLAIRE

**Mon Toit Solaire**

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • PASYFO

**PASYFO: forecasts of personal allergy symptoms**

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • ATMOSYS-CAMS

**ATMOSYS-CAMS: policy support**

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • DISCOVER

**DiscoverAir**

DiscoverAir provides information to visitors so that they can plan ahead and organise their stay in Greece.

OVERVIEW HOW CAMS HELPS IMPACT VIDEO

NEWS • TAKING THE MEASURE OF AIR POLLUTION IN INDIA

**Taking the measure of air pollution in India**

DATE: 27th, February 2020

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • METEOPOLLEN

**MeteoPollen: forecasting pollen in France**

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • PLUME LABS AIR REPORT

**Plume Labs: Air Report to dodge the smog and find clean air**

OVERVIEW HOW CAMS HELPS IMPACT

WHAT WE DO • USE CASES • IMPACT OF WILDFIRES IN ASIA

**Impact of wildfires in Asia**

OVERVIEW HOW CAMS HELPS IMPACT

NEWS • IMITATING BRAINS TO FORECAST AIR QUALITY

**Imitating brains to forecast air quality**

DATE: 03, March 2019

OVERVIEW HOW CAMS HELPS IMPACT

NEWS • AIR-QUALITY INFORMATION FOR POTENTIAL HOUSE OWNERS

**Air-quality information for potential house owners**

DATE: 19th, December 2018

OVERVIEW HOW CAMS HELPS IMPACT



HEALTH



ENERGY



EDUCATION



TOURISM



URBAN DEVELOPMENT

But main success is in successful use/application by CAMS users. And we've only scratched the surface.

<https://atmosphere.copernicus.eu/use-cases>



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# A TRUE EUROPEAN EFFORT

CAMS 4<sup>th</sup> General Assembly, Budapest, September 2019 (next in Bonn, 7-10 June 2022)



- Implementation by ECMWF with a large number of contractors (50+ parallel contracts) about half public and half private entities
- “CAMS 2.0” now well underway with the vast majority of activities procured for the next 3.5 to 4 years
- Enhanced continuity with a few but important new elements



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# INTERNATIONAL AND EU POLICIES CONTEXT



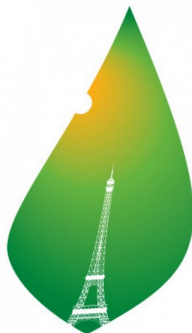
## SUSTAINABLE DEVELOPMENT GOALS

<b>3</b> GOOD HEALTH AND WELL-BEING	<b>11</b> SUSTAINABLE CITIES AND COMMUNITIES
<b>13</b> CLIMATE ACTION	<b>15</b> LIFE ON LAND



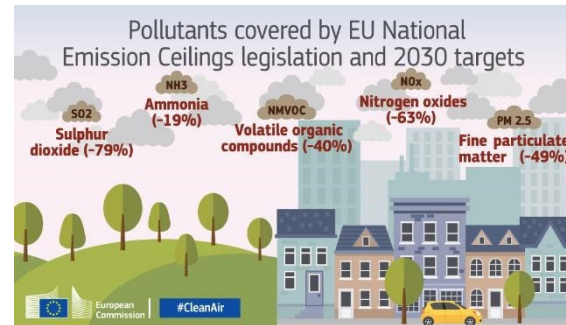
## MONTREAL PROTOCOL

caring for all life under the sun



## PARIS2015

UN CLIMATE CHANGE CONFERENCE  
COP21·CMP11



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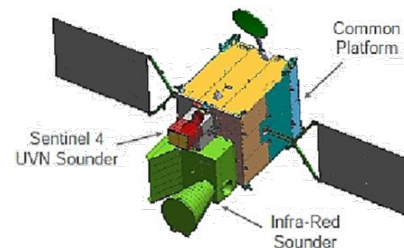
# EXCITING TIMES FOR ATMOSPHERIC COMPOSITION

## MetOp-SG-A



- Sentinel-5
- IASI-NG
- 3MI

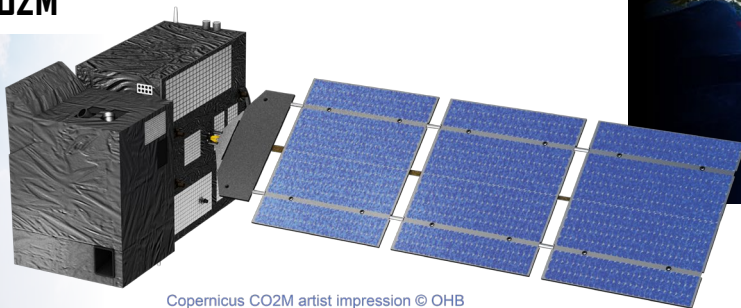
## MTG-S



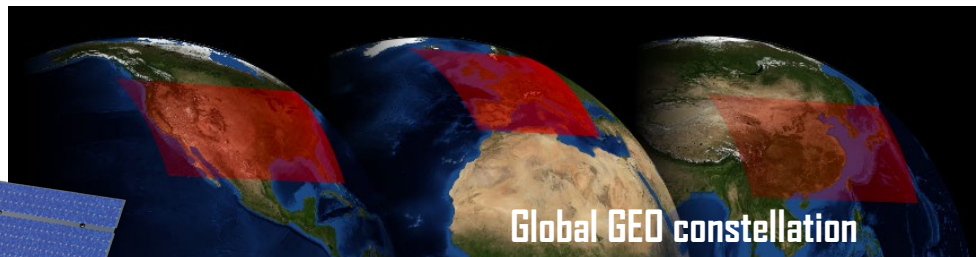
- Sentinel-4
- IRS



## CO2M



Copernicus CO2M artist impression © OHB



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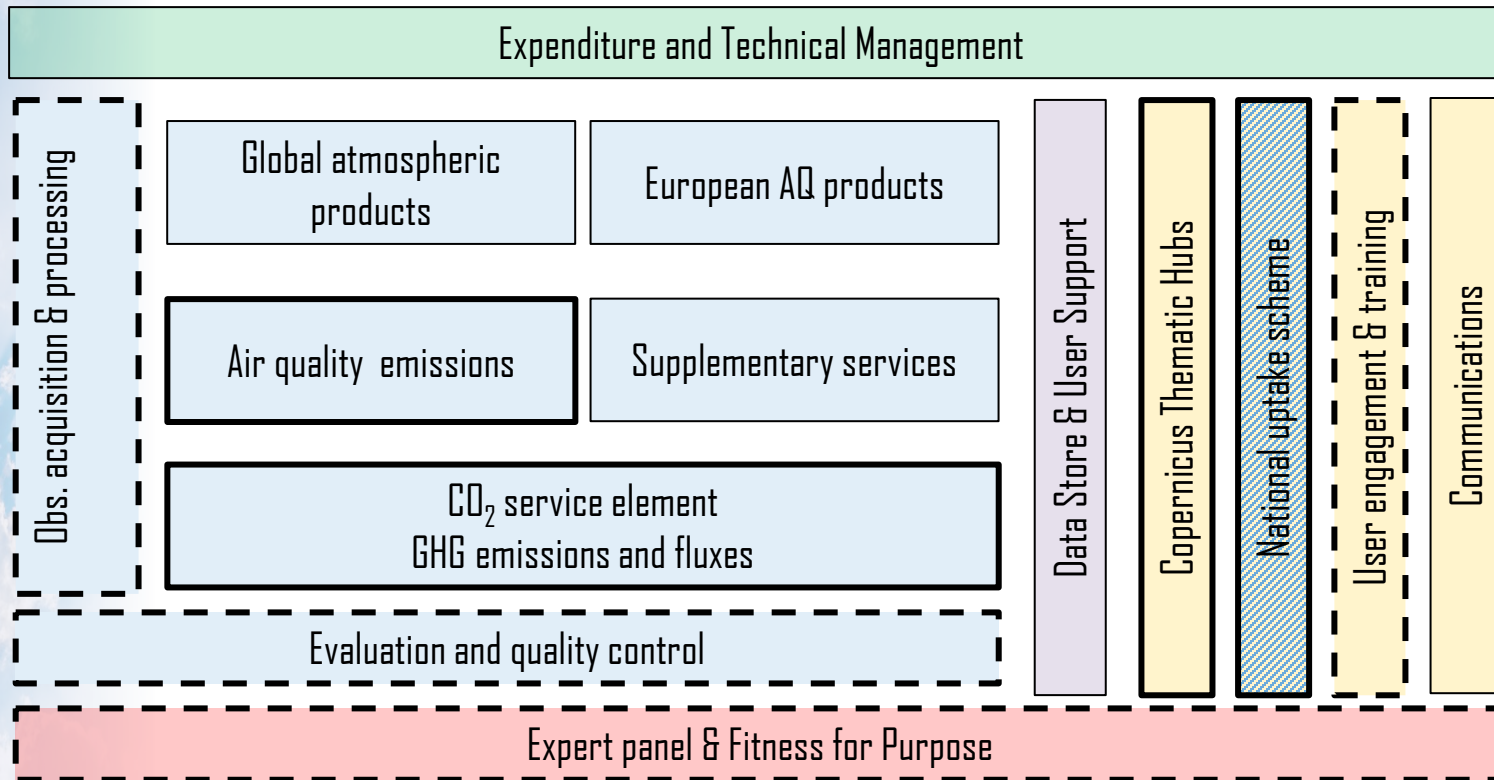
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# CAMS 2021-2028



Degree of change compared to CAMS 2014-2021

Continuity +

Step up

Major / new

Management

Production

Data Store

User facing

Advice & Evaluation



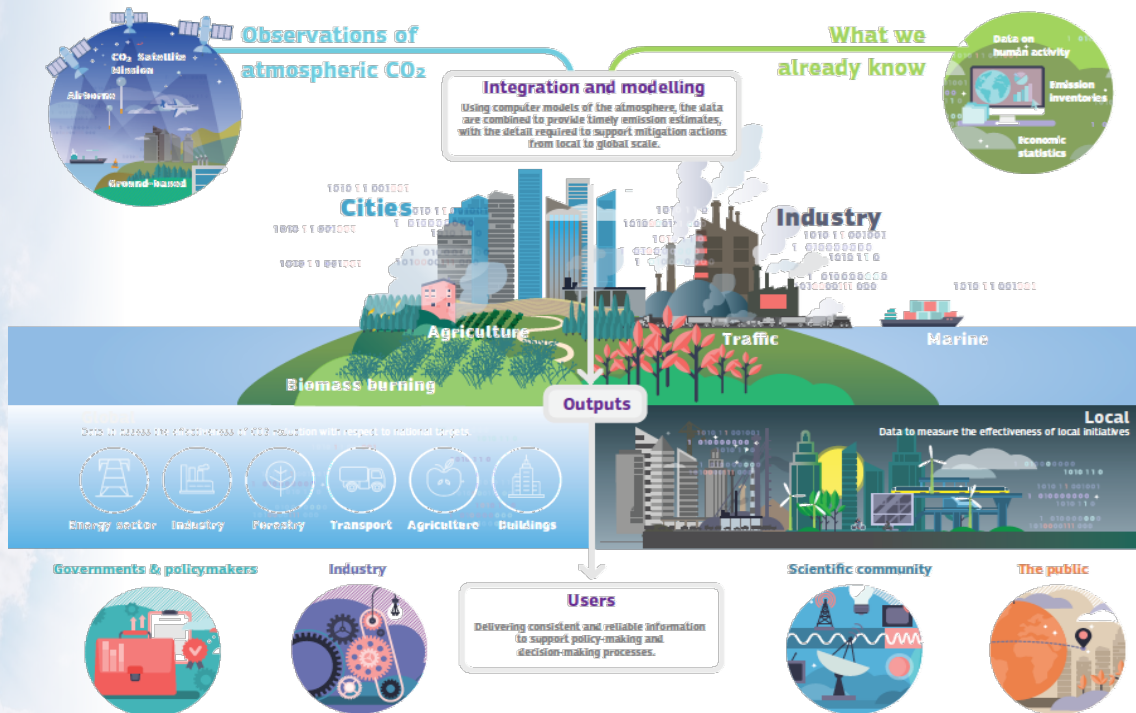
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# DELIVERING COPERNICUS CO<sub>2</sub> EMISSIONS MONITORING



A new European anthropogenic CO<sub>2</sub> emissions monitoring & verification support (CO2MVS) capacity will support countries and regions with observation-based policy-relevant information.

Combining satellite and in-situ observations with Earth system models by expanding the existing GAMS operational infrastructure.



**A European contribution to CEOS, GCOS, GEO, and WMO (IG3IS) efforts in support of the Paris Agreement.**



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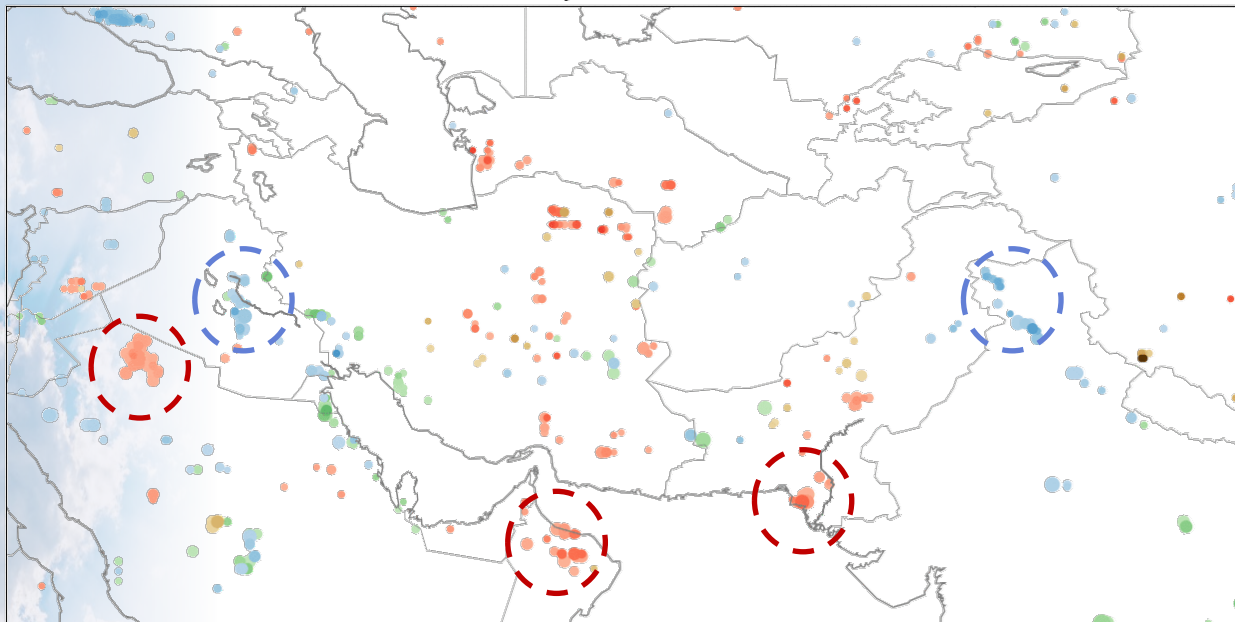




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# CAMS METHANE "ANOMALIES" MONITORING

End of 30 day window date: 2020-12-01

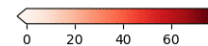


Missing or underestimated sources?

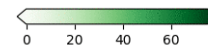
Source overestimated in emission inventory?

Are "expected" CH<sub>4</sub> concentrations  
(model + GOSAT & IASI) and  
incoming Sentinel-5P observations  
differing?

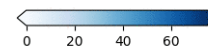
Are there potential anomalies  
worth investigating?



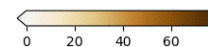
High Obs (ppb)



High Fcst (ppb)



Low Obs (ppb)



Low Fcst (ppb)



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# CAMS NATIONAL COLLABORATION PROGRAMME (NCP)

Support uptake by national core users. Pilot contracts in negotiations with DK, FR, DE, IT. Contracts with all countries between Q3 2022 and Q1 2023.

## CAMS main products lines

1. European air quality products
2. Global products (troposphere and stratosphere)
3. Supplementary products
4. Emissions datasets from inventories
5. Pollutants emissions datasets based on observations
6. CO<sub>2</sub> emissions service element



## CAMS NCP activity modules

- a. *Reporting*
- b. *Monitoring and forecasting*
- c. *Air quality downscaling*
- d. *Emissions inventory evaluation*
- e. *Support monitoring in-situ network*
- f. *Communication*
- g. *Training*



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# Keep in touch with CAMS!



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[atmosphere.copernicus.eu](http://atmosphere.copernicus.eu)



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@VHPeuch  
@RichardJEngelen  
@m\_parrington  
@AntjelInness

...



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We look forward to seeing you on our booth in the centre of the exhibition area, attached to the central ESA booth...

**#OneECMWF**



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