



Atmosphere Monitoring

The Copernicus Atmosphere Monitoring Service

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ECMWF





Atmosphere
Monitoring

The EU Copernicus programme



Observations
feeding into
value-added
Services



Atmosphere



Climate



Land



Marine



Emergency



Security

Copernicus is the European Union's operational Earth Observation and Monitoring programme, looking at our planet and its environment for the ultimate benefit of all citizens.

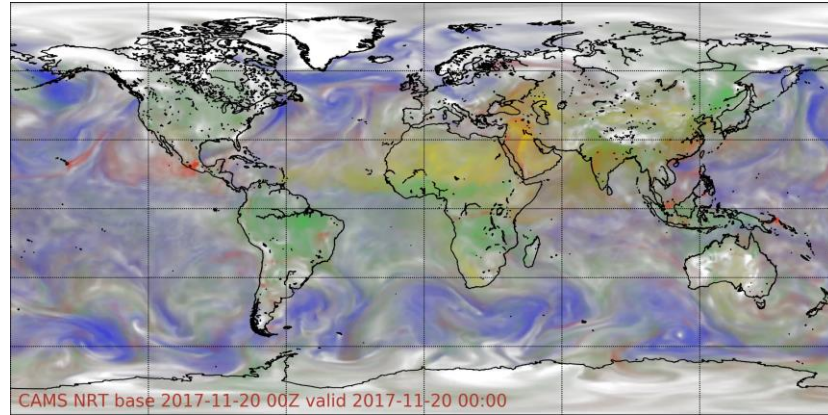
User-driven with free and unrestricted data access





Copernicus Atmosphere Monitoring Service

Atmosphere Monitoring



© BMU



Transforming satellite observations into user-driven services.



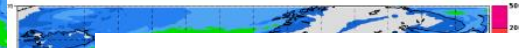
Tuesday 28 November 2017 00UTC CAMS Forecast t+000 VT: Tuesday 28 November 2017 00UTC Model: CHIMERE Height level: Surface Parameter: PM10 Aerosol [µg/m3]



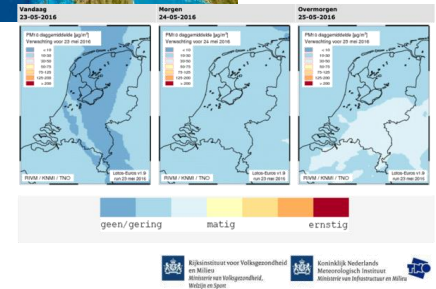
Tuesday 28 November 2017 00UTC CAMS Forecast t+000 VT: Tuesday 28 November 2017 00UTC Model: EMEP Height level: Surface Parameter: PM10 Aerosol [µg/m3]



Tuesday 28 November 2017 00UTC CAMS Forecast t+000 VT: Tuesday 28 November 2017 00UTC Model: LOTOS-EUROS Height level: Surface Parameter: PM10 Aerosol [µg/m3]



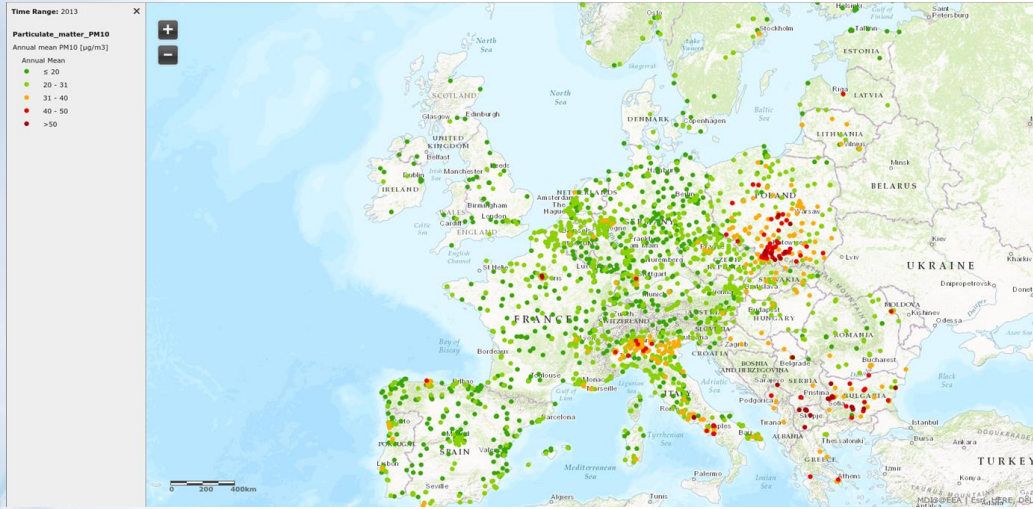
Tuesday 28 November 2017 00UTC CAMS Forecast t+000 VT: Tuesday 28 November 2017 00UTC Model: ENSEMBLE Height level: Surface Parameter: PM10 Aerosol [µg/m3]





Atmosphere
Monitoring

CAMS: Adding value to observations



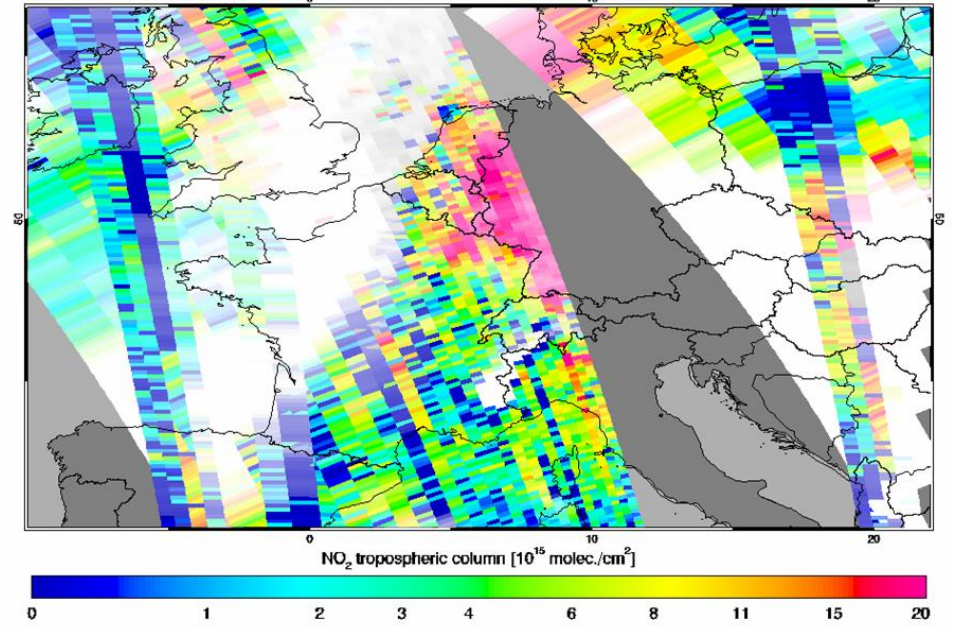
In-situ observations

European Environment Agency



OMI NRT tropospheric NO₂ 12 Nov 2016

KNMI/NASA



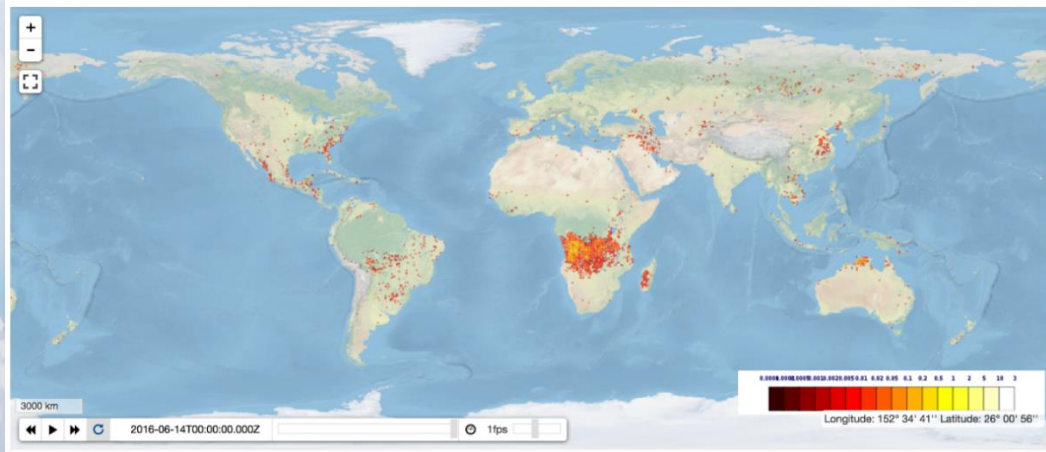
Satellite observations

CAMS adds value to today's observations, providing consistent information anywhere in Europe (and the rest of the world).

CAMS forecasts allow you to anticipate the situation of tomorrow.

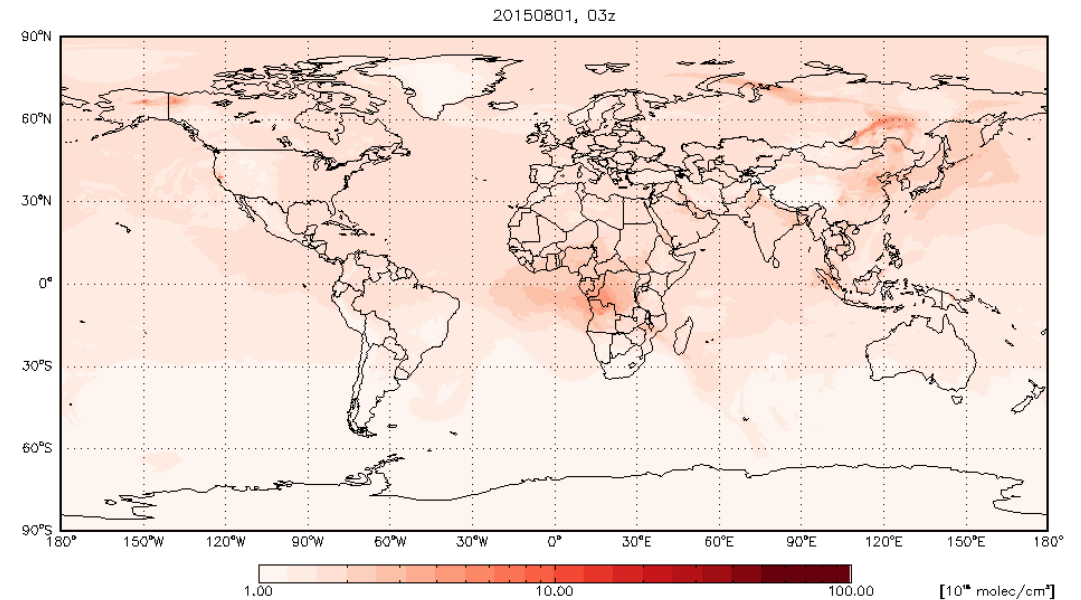


Newspaper: Will the smoke from wildfires in Indonesia affect air quality in our country later this week?



CAMS satellite-based Fire emissions (GFAS)

- daily estimates
- Aerosols, chemical species and greenhouse gases



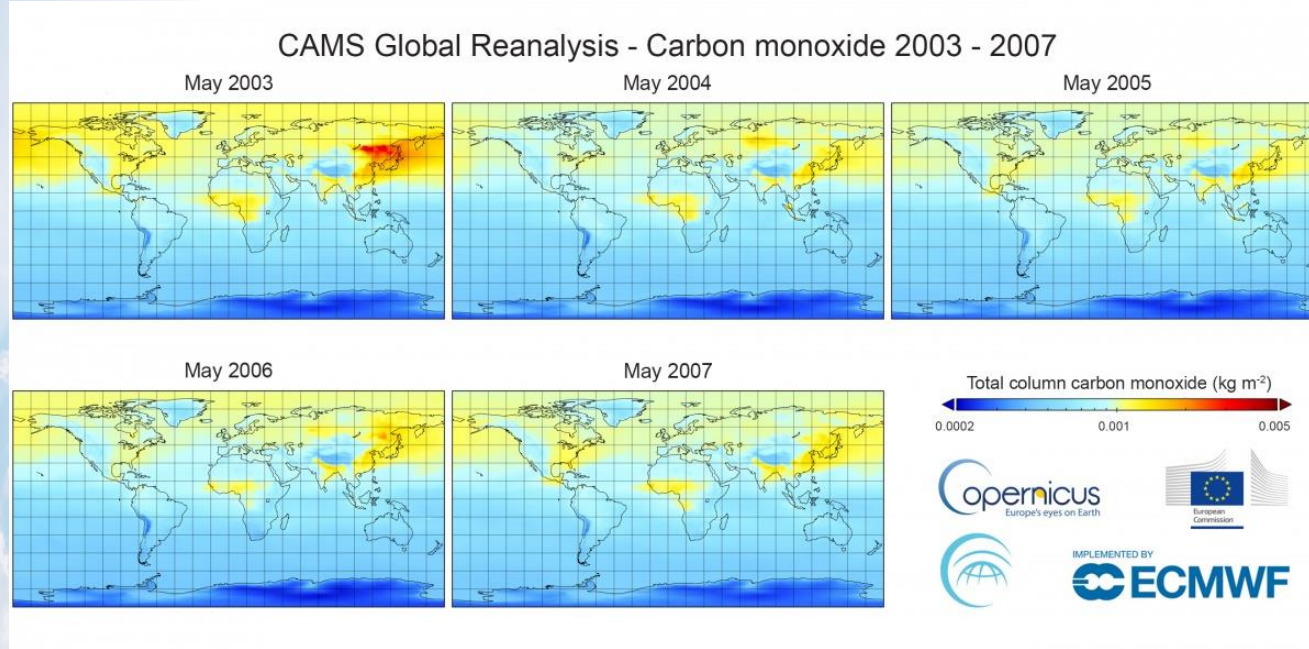
CAMS global forecasts

- twice-daily 5-day forecasts
- Aerosols, 13 chemical pollutants, CO₂ & CH₄
- 40 km spatial resolution



Global reanalysis

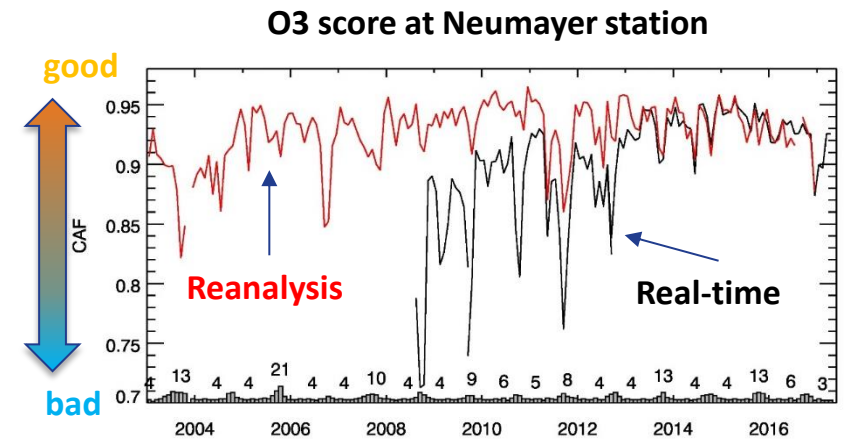
Scientist: I need a consistent well-documented data set to look at trends.



Release of full data set in
September/October 2018.

CAMS global reanalysis

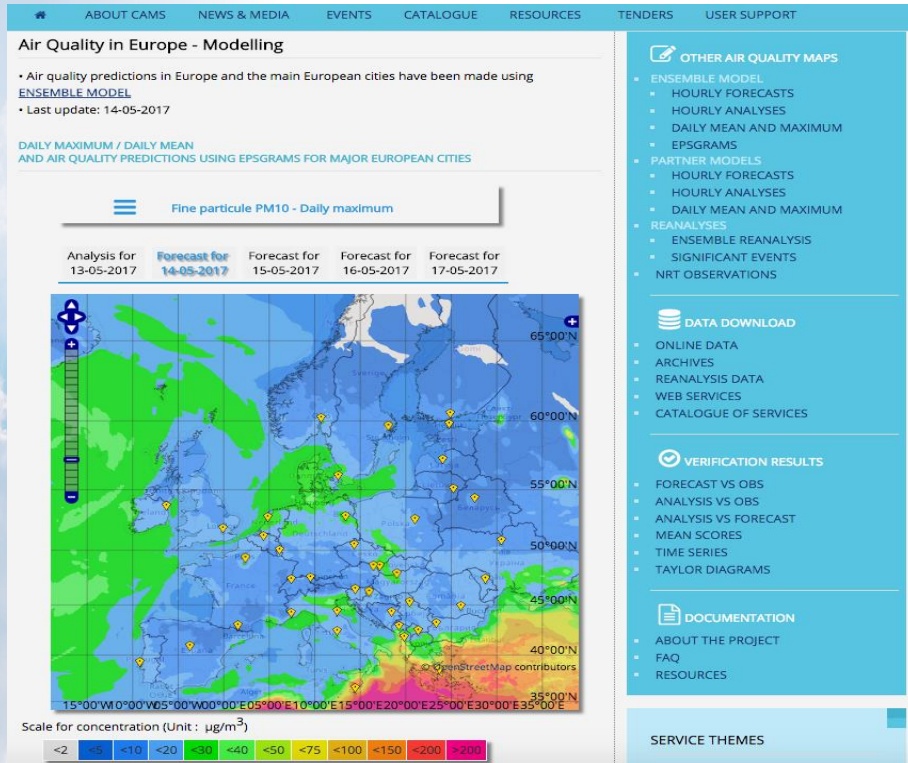
- 2003 – 2016, with new years being added
- Aerosols, 13 chemical pollutants, CO_2 & CH_4
- 80 km spatial resolution



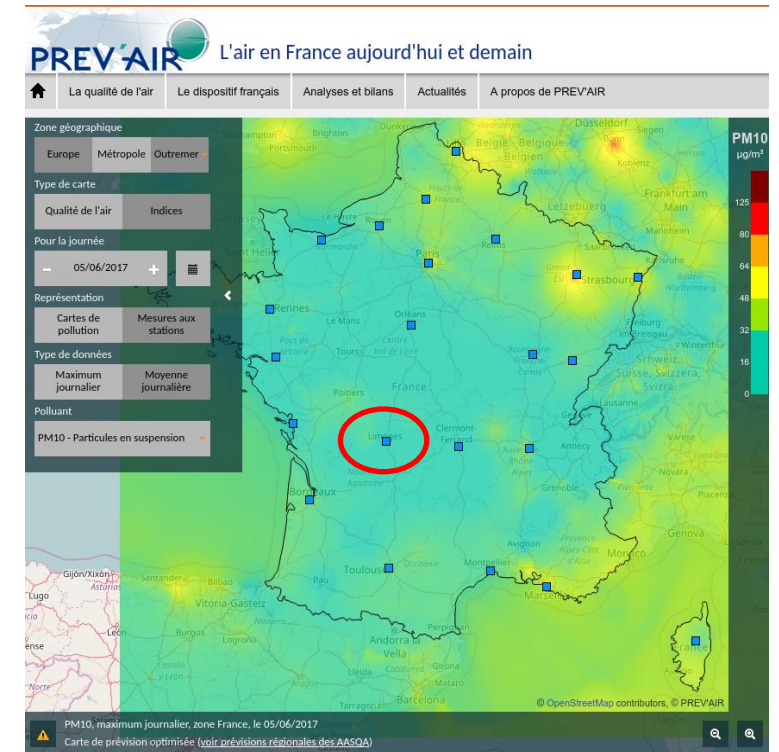


Regional forecasts

French citizen: What will the air quality in Limoges be tomorrow?



CAMS provides background air quality forecast maps, but more importantly boundary conditions for national forecast models.



CAMS regional forecasts

- Daily 4-day forecast using forecast model ensemble
- 10 chemical pollutants + pollen
- 10 km spatial resolution



Energy firm: What is a cost-effective place to build our solar power plant?

CAMS NoClear SERVICE FOR ESTIMATING IRRADIATION UNDER CLEAR-SKY

The CAMS NoClear Clear-Sky Irradiation service delivers time series of irradiation that would be observed in a specific site in the world under cloudless conditions, with a time step ranging from 1 min up to 1 month. The Global, Direct and Diffuse Horizontal Irradiation, as well as the Beam Normal Irradiation are provided. The time coverage of the data is from 2004-01-01 up to current day-1.

The research leading to these results has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 218793 (MACC project, 2009-2011), no. 283376 (MACC-II project, 2011-2014) and from the European Union's Horizon Programme (FP7/2007-2013) under grant agreement no. 433686 (MACC-III project, 2014-2018). The service is part of the Copernicus Atmosphere Monitoring Service (CAMS).

[License terms](#)

NoClear

Map search: Search Address (Type an address or a position as "lat,lon")

Coordinates: 50.0, 0.0 (lat,lon) (50.0000, 0.0000) zoom: 8

Latitude (in DMS): 50°0'0" N
 Longitude (in DMS): 0°0'0" E
 Altitude (in meters): Automatic

Start Date (from 2004-01-01): 2004-01-01
 End Date (up to today): 2004-01-31
 Time Step: 15 min

Time Reference: Universal Time
 Include metadata into an atmosphere (if not set): No
 Output Format: Comma Separated Value (.csv)

Log in | My Account | Sign Out

© ECMWF

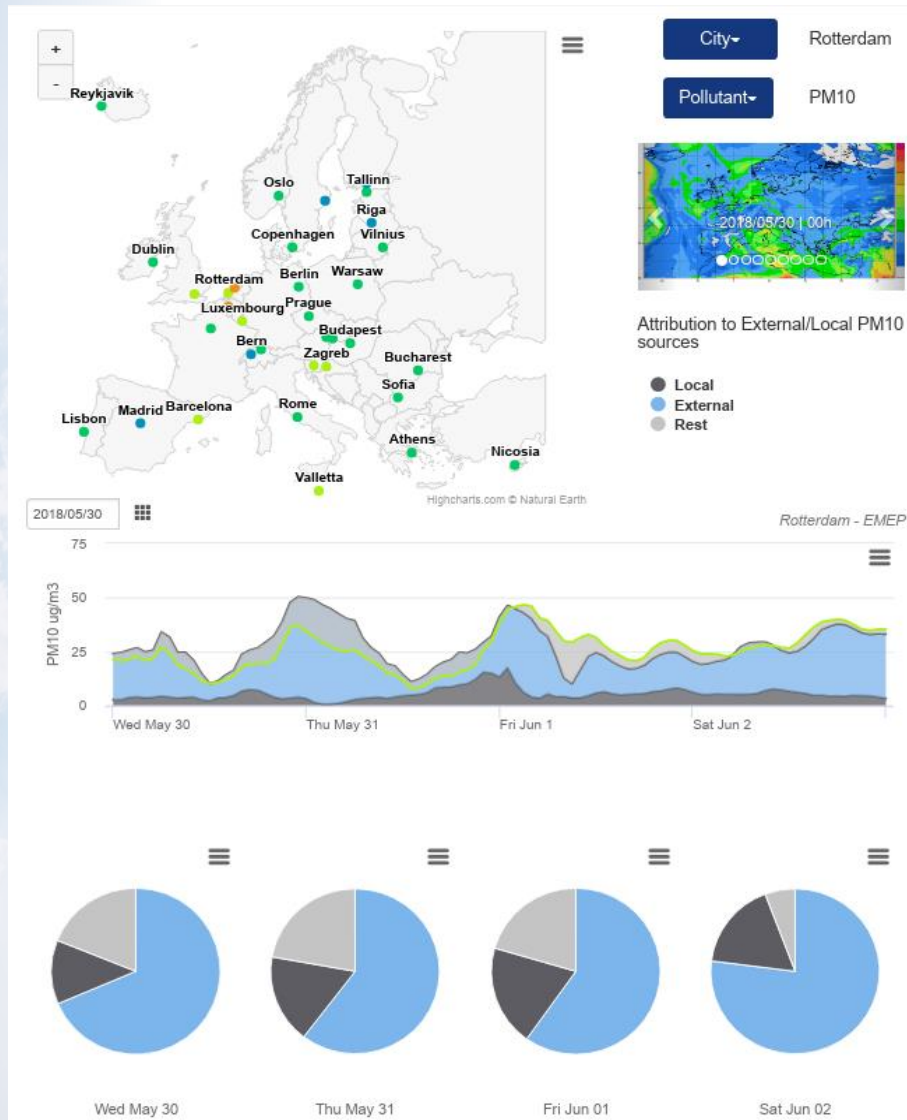


CAMS solar radiation

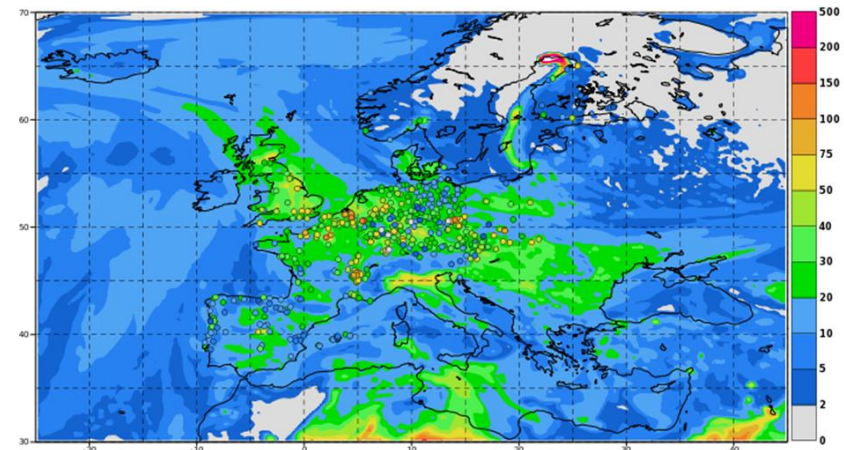
- 2004 – current
- 1-minute resolution
- Clear-sky and total sky global, direct and diffuse radiation at surface



National Environment Agency: Where did PM₁₀ come from during the latest pollution event?



Tuesday 06 December 2016 00UTC CAMS Verification t+012 VT: Tuesday 06 December 2016 12UTC Observations + LOTOS-EUROS Forecast Surface PM10 Aerosol [$\mu\text{g}/\text{m}^3$]

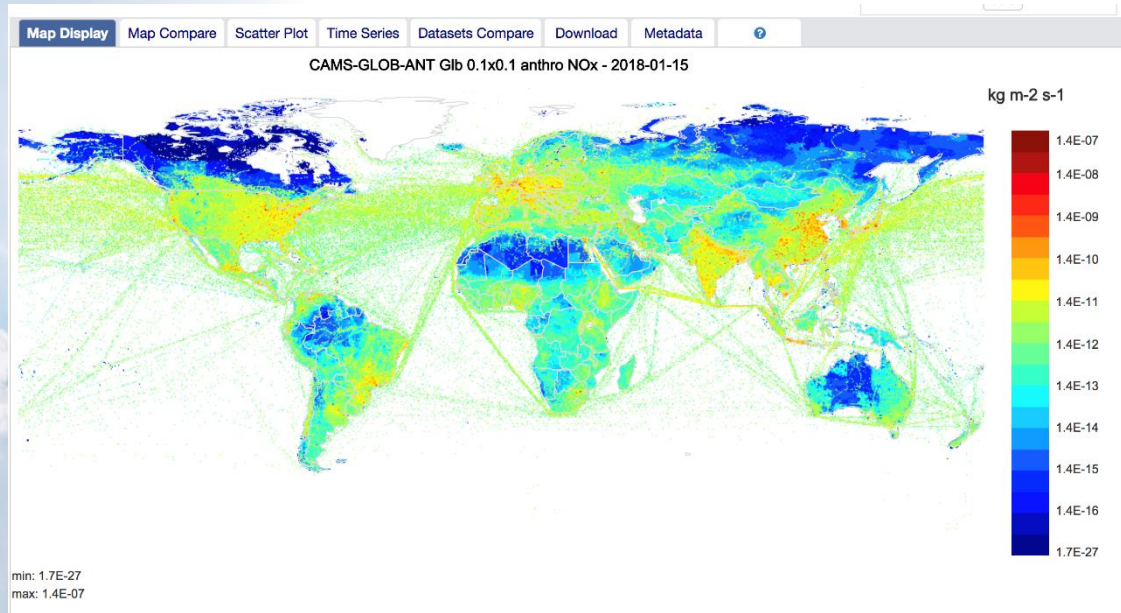


CAMS policy tools

- Source-receptor calculations and emission scenarios
- Daily and on-demand
- Main regulatory pollutants
- 10 km spatial resolution



Air quality forecaster: Where do I get consistent up-to-date emission data sets?

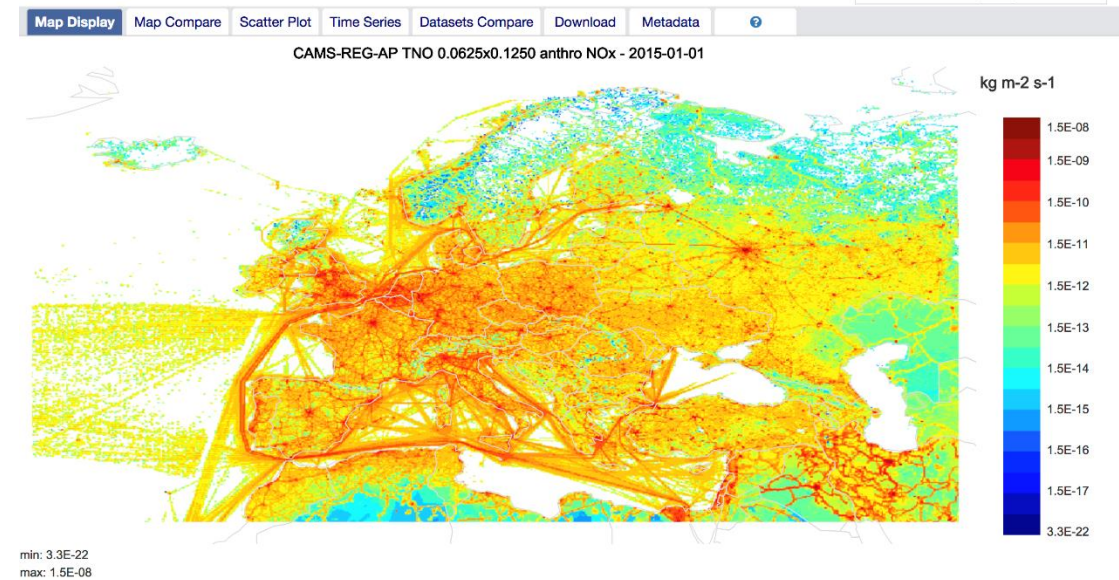


CAMS global emissions

- Anthropogenic emissions
- Ship emissions
- Natural emissions
- Biogenic emissions
- Volcanic emissions

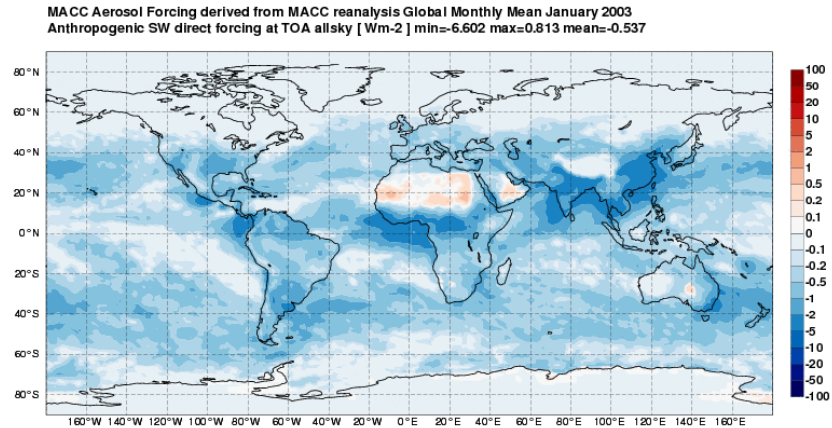
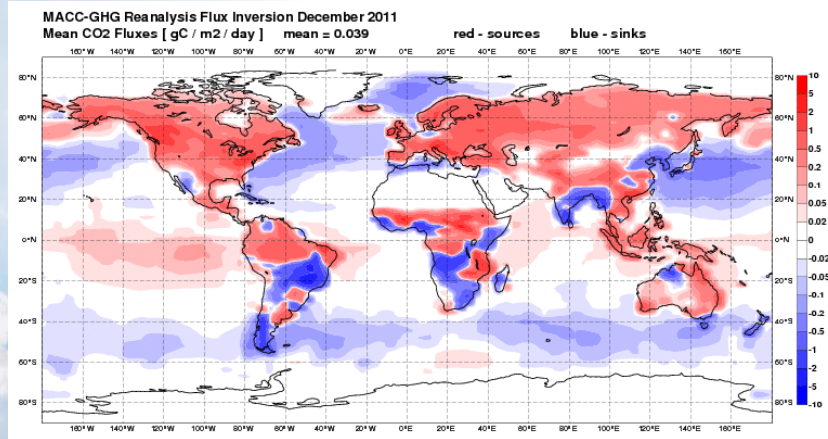
CAMS regional emissions

- European anthropogenic emissions - air pollutants
- European anthropogenic emissions - greenhouse gases





Scientist: what has been the impact of greenhouse gases and aerosol on the Earth's climate over the last few decades?



CAMS greenhouse gas flux estimates

- CO₂, CH₄ and N₂O
- Decadal time series

CAMS radiative forcing

- Aerosol-radiation radiative forcing based on global reanalysis
- Aerosol-cloud radiative forcing based on global reanalysis
- Radiative forcing of CO₂ and CH₄ based on global reanalysis
- Radiative forcing of tropospheric and stratospheric O₃ based on global reanalysis



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CAMS Portfolio



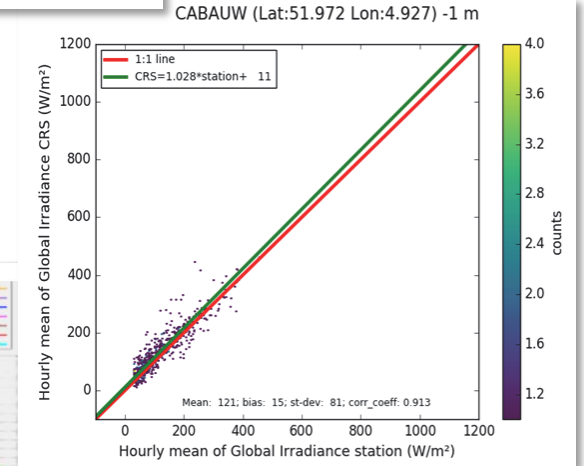
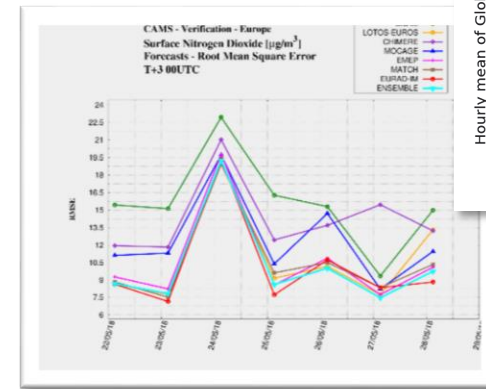
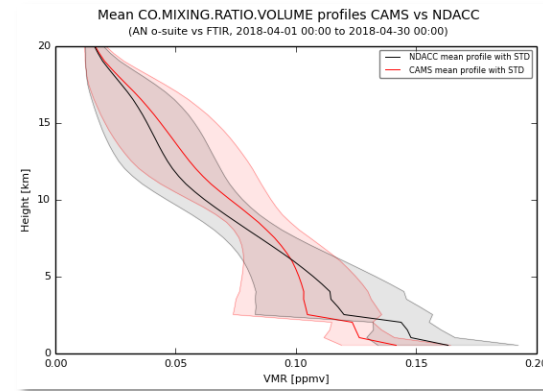
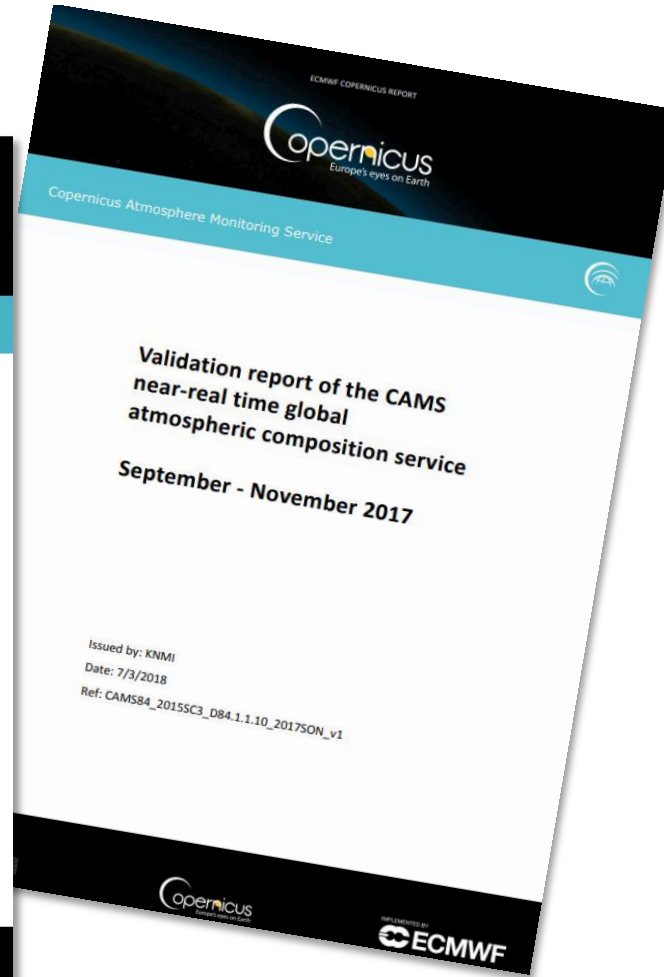
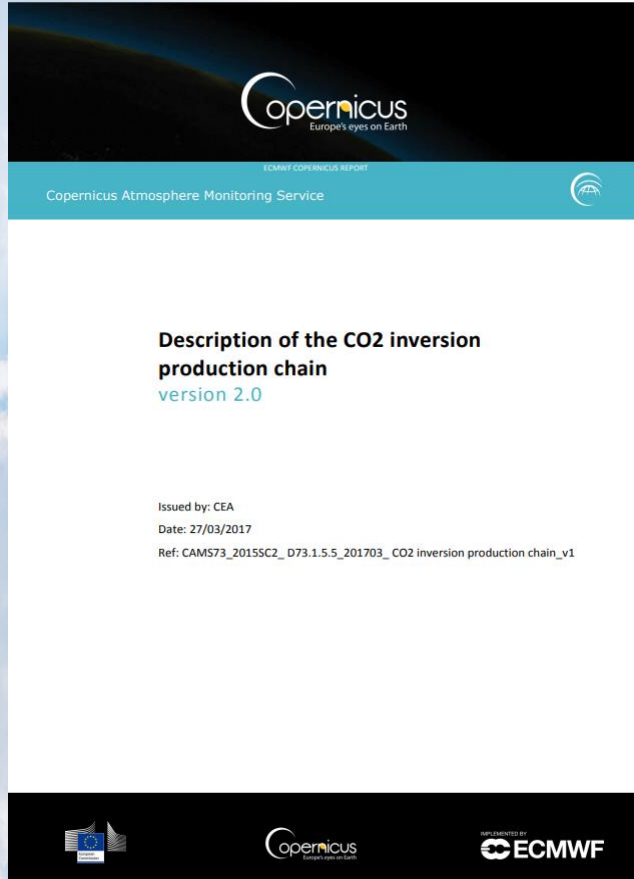
CAMS delivers the portfolio of products outlined in the Delegation Agreement with the EC

Portfolio	Product groups
A. Regional products	Real-time analyses
	Real-time forecasts
	Interim annual reanalyses
	Annual reanalyses
B. Global products	Real-time analyses
	Real-time forecasts
	Reanalyses
C. Supplementary products	Policy support products
	Solar radiation
	Greenhouse gas flux inversions
	Climate forcings
D. Emissions products	Anthropogenic emissions
	Fire emissions
	Natural emissions



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Documentation & validation



CAMS provides detailed information about how its products are produced and how good the quality is.





Accessing the Products

PRODUCT FAMILY

- Global forecasts
- Global reanalyses
- Global analyses
- Regional analyses
- Regional forecasts
- Climate forcings
- Anthropogenic emissions
- Solar radiation
- Greenhouse gas fluxes
- Fire emissions
- Policy support

PARAMETER FAMILY

- Aerosol
- Greenhouse gas
- Reactive gas
- Radiation
- Fire

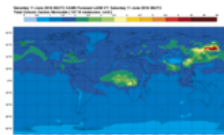
PARAMETER

- Sulfates concentration
- Organic carbon concentration
- Black carbon concentration
- Sea-salt concentration
- Dust concentration
- PM10

CURRENT FILTERS:

Product family: Global forecasts

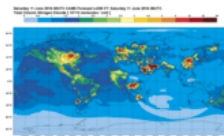
Total results: 5



Global forecasts of chemical species - carbon monoxide

This service provides chemical species observations

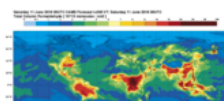
Parameter: Carbon monoxide



Global forecasts of chemical species - dioxide

This service provides chemical species observations

Parameter: Nitrogen dioxide

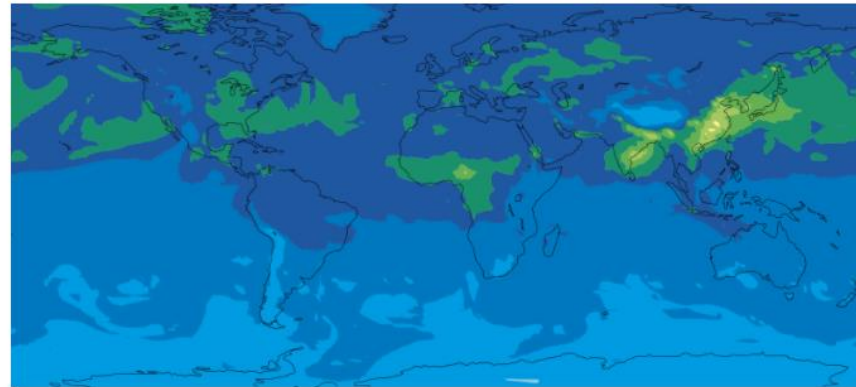


Global forecasts of assimilated chemical species - formaldehyde

More details

Global forecasts of chemical species - carbon monoxide

[Back to index](#)



This service provides daily forecasts up to 5 days of chemical species

Theme: Air quality and atmospheric composition

Product family: Global forecasts

Parameter: Carbon monoxide

Geographical area: (-180, 180, -90, 90)

Time coverage:

Metadata: XML



Data download



Verification results



Validation reports



Plots



Documentation

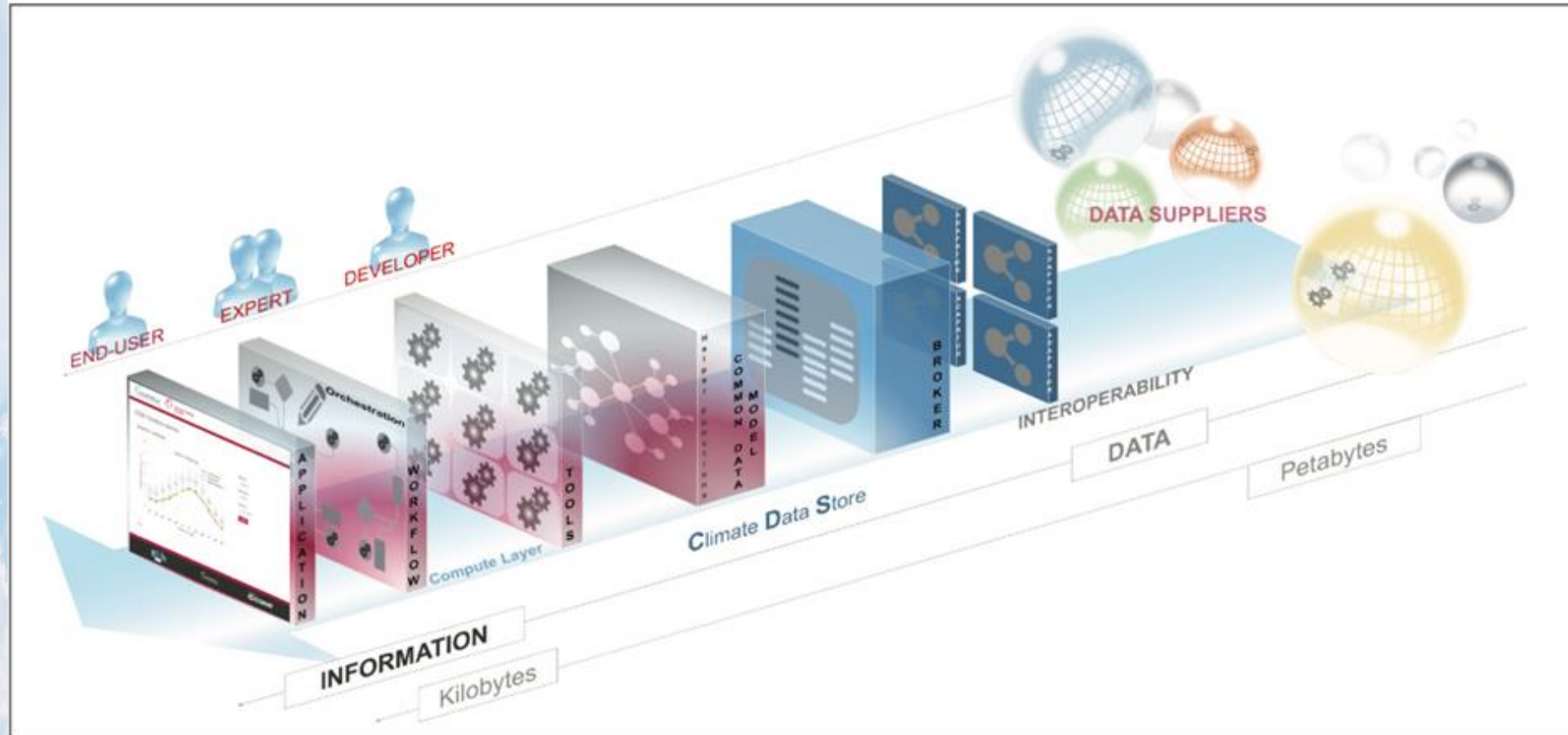


Contact us





Looking forward: Data Platforms



C3S and CAMS are putting in place a distributed data platform with consistent workflow and tools for all products.

Together with EUMETSAT and the Marine Service this will be expanded to also include access to other Copernicus data and provide cloud computing facilities.



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To summarize



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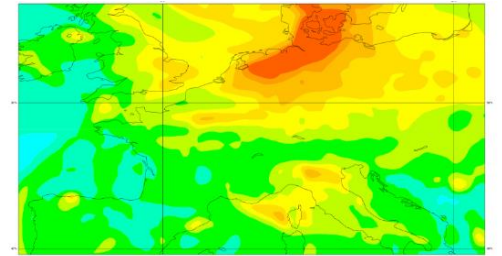
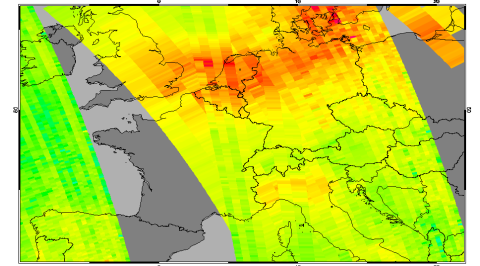
atmosphere.copernicus.eu

User-driven

Free and unrestricted data access

Making observations more meaningful to you

Provide information for past, present and future



IMPLEMENTED BY
 ECMWF

Copernicus
Europe's eyes on Earth

European
Commission



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How CAMS data is used

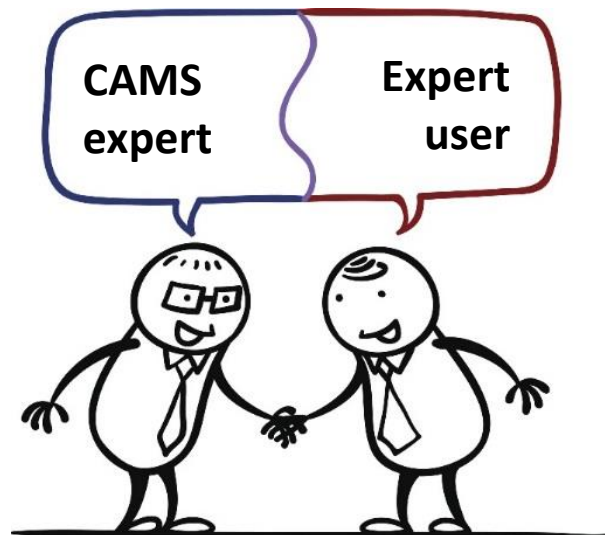
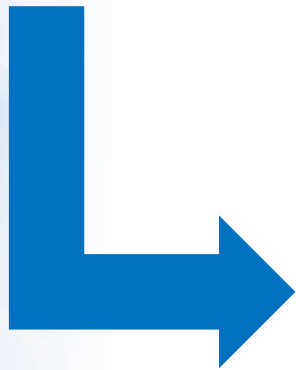


CAMS: big data for local applications



CAMS provides big data with the corresponding technical and scientific expertise to support expert users.

In doing so, we allow the CAMS information to reach millions of users in and outside Europe.



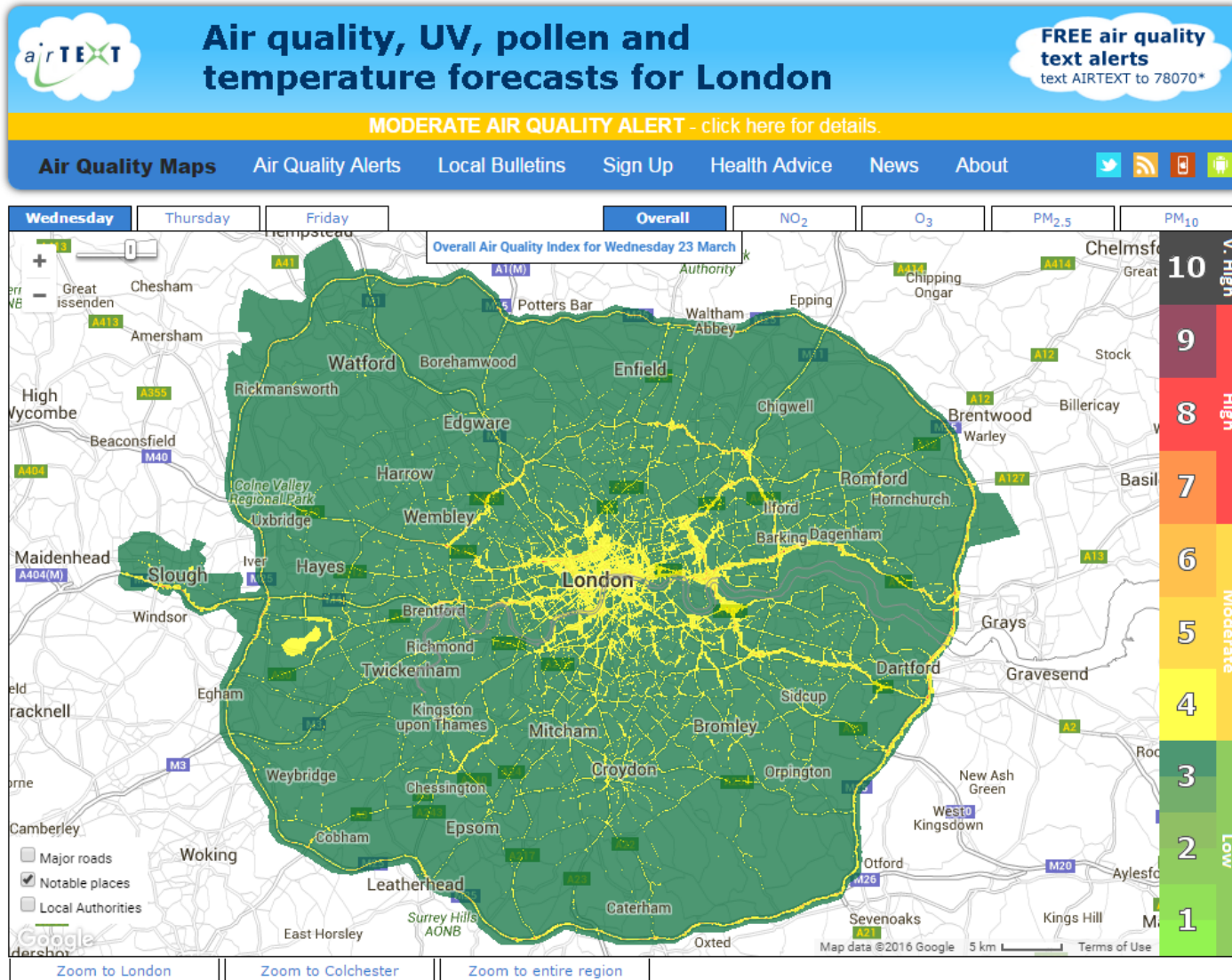
Downstream applications



Atmosphere
Monitoring

airTEXT

CERC



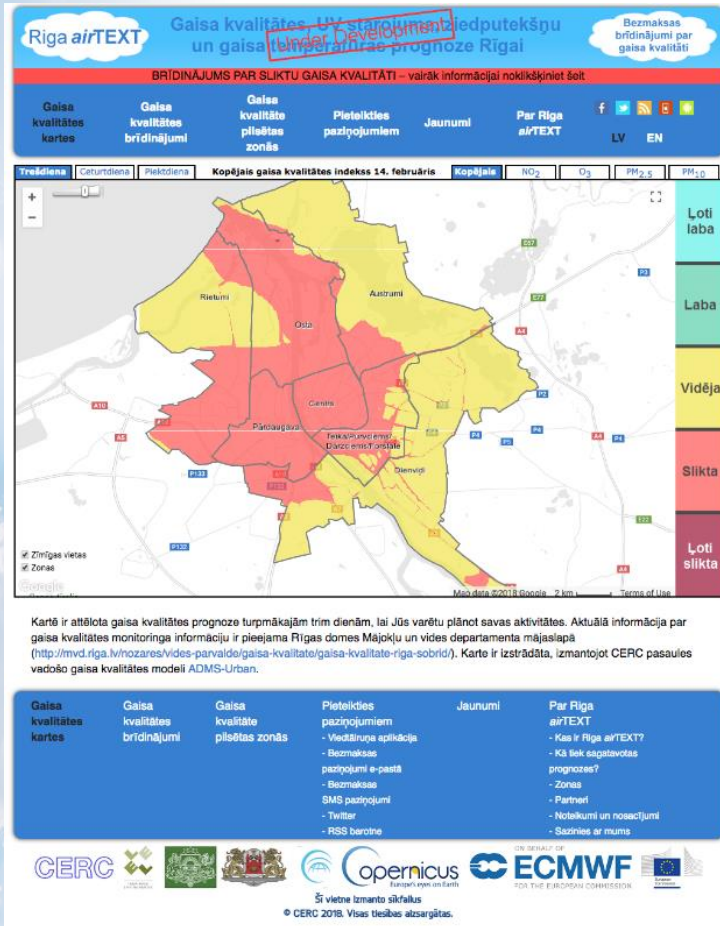
Free air pollution, UV, pollen and temperature forecasts for Greater London and the South East.

Local forecast models need information on how much pollution flows into and out of the domain to provide an accurate service. This is provided by CAMS European air quality forecasts.



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airTEXT: Business model



AirText Riga

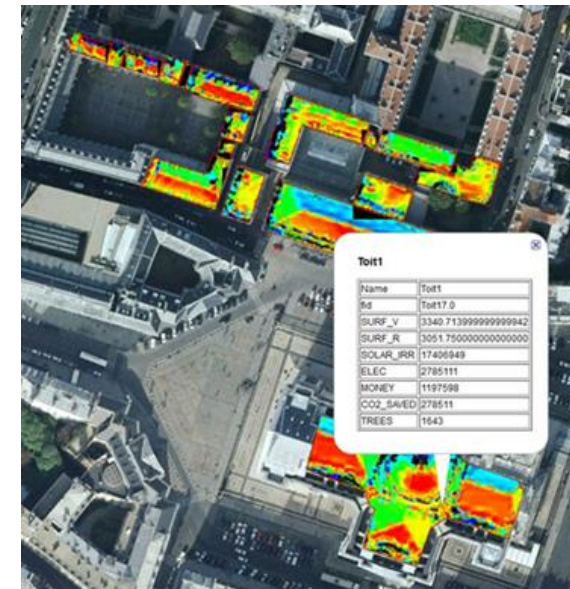
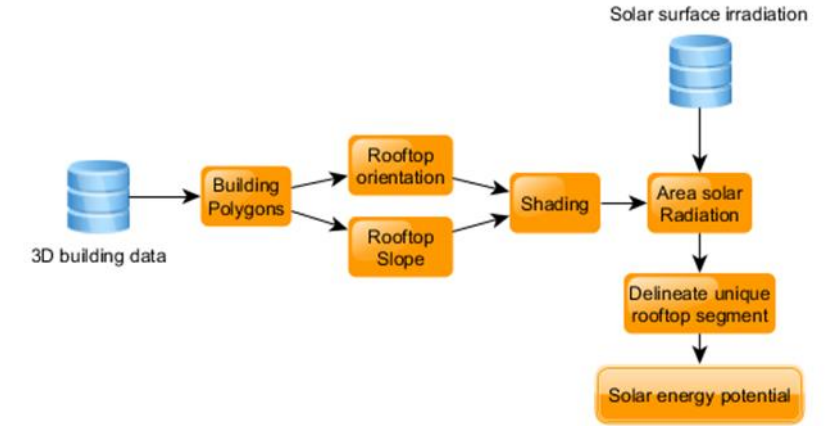
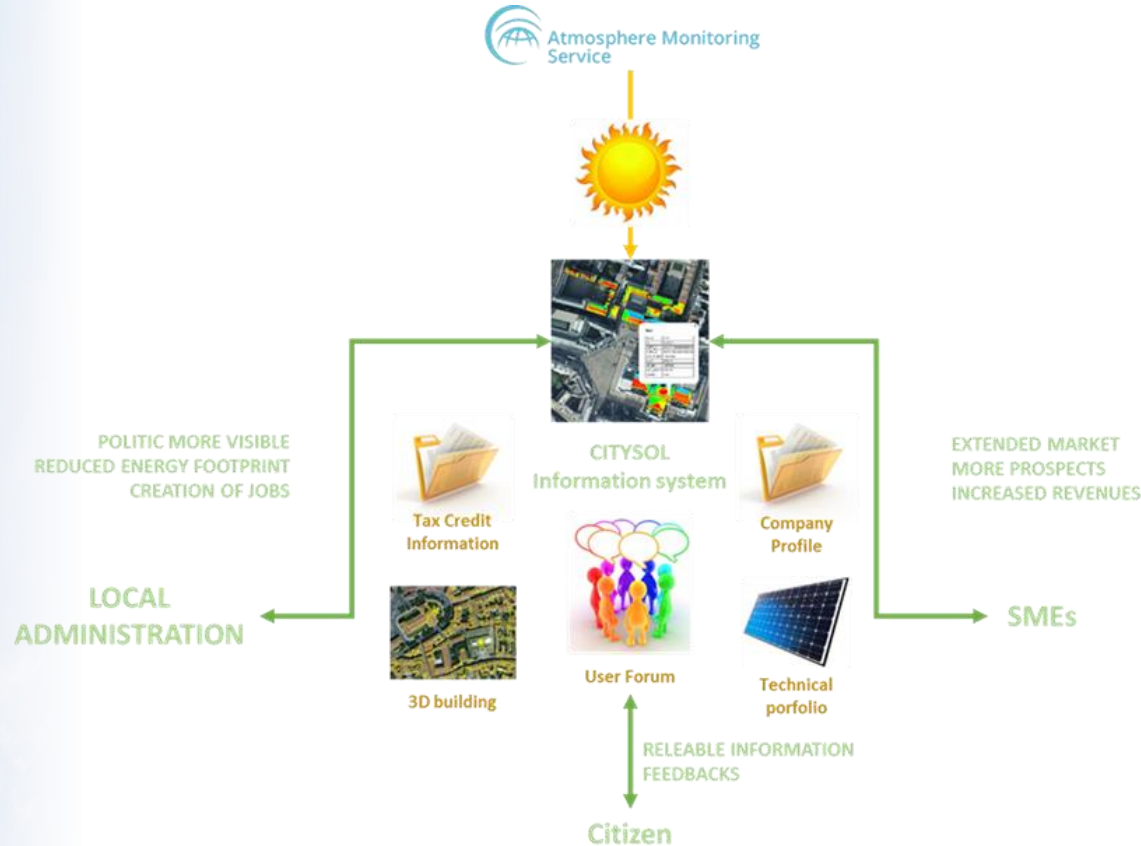
Business model

- The service is free for its users, citizens in the city or region (e.g., 15,000 subscribers in London)
- The city or region authorities pay a set-up fee followed by an annual maintenance fee
- The public economic benefit from the investment in airText comes from improvements to health and well-being in Riga.
- airText brings wider public awareness of air pollution and therefore helps to build public support for action to improve air quality.
- airText will directly enable users with particular vulnerabilities to better manage their health conditions.



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Mon Toit Solaire



Mon Toit Solaire provides a web-based decision support system for the development of rooftop photovoltaic solar panels.

CAMS provides the satellite-based time series of available solar radiation for the specific location, taking into account the amount of clouds and aerosols.





Mon Toit Solaire: Business model

L'ENERGIE SOLAIRE POUR TOUS
Estimez facilement le potentiel solaire de votre toiture.

Découvrez ce service fiable et gratuit sur **Toulouse**

Assurez à l'essai votre **Mon Toit Solaire Toulouse**

Qu'est ce que Mon Toit Solaire ?

Mon Toit Solaire a été réalisé sur Toulouse en 2017 par **NOVELTIS** à partir de données fournies par la **Métropole de Toulouse** et avec la participation de l'**ONERA**, les associations **GPPEP**, **IndeCo** et **Citoy'ENR**.

Un **outil gratuit**, accessible aux citoyens, permettant d'évaluer le potentiel solaire photovoltaïque de leurs bâtiments.

Une **plateforme participative** permettant aux utilisateurs de s'informer et de partager leur connaissance sur les installations photovoltaïques en toiture.

Un **moyen de stimuler un projet photovoltaïque** et d'entrer en contact avec des installateurs certifiés.

Les données solaires utilisées proviennent du programme européen **Copernicus Atmosphere Monitoring Service**.

**LA MEILLEURE DONNÉE SOLAIRE DISPONIBLE,
UNE ESTIMATION FIABLE,
UN ACCOMPAGNEMENT INDÉPENDANT,
DES INSTALLATEURS RÉFÉRENCÉS DE QUALITÉS.**

Nos Partenaires

ECMWF Copernicus Atmosphere Monitoring Service European Union

toulouse métropole Citoy'enR GPPEP

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TSS, 7 rue du Lac
F-31670 Labège

NOVELTIS

Tel : +33 (0)5 62 88 11 11
Fax : +33 (0)5 62 88 11 12

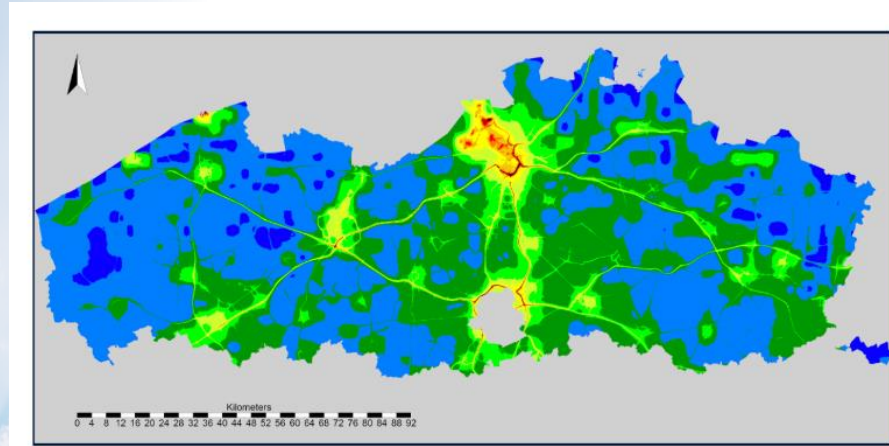
Business model:

- Free for users (landlords, citizens)
 - City authorities pay set-up and maintenance fees
 - Local PV installers pay a broker percentage for being included in the service web site
-
- Stimulate the use of solar PV panels on rooftops in the city as part of green energy strategy



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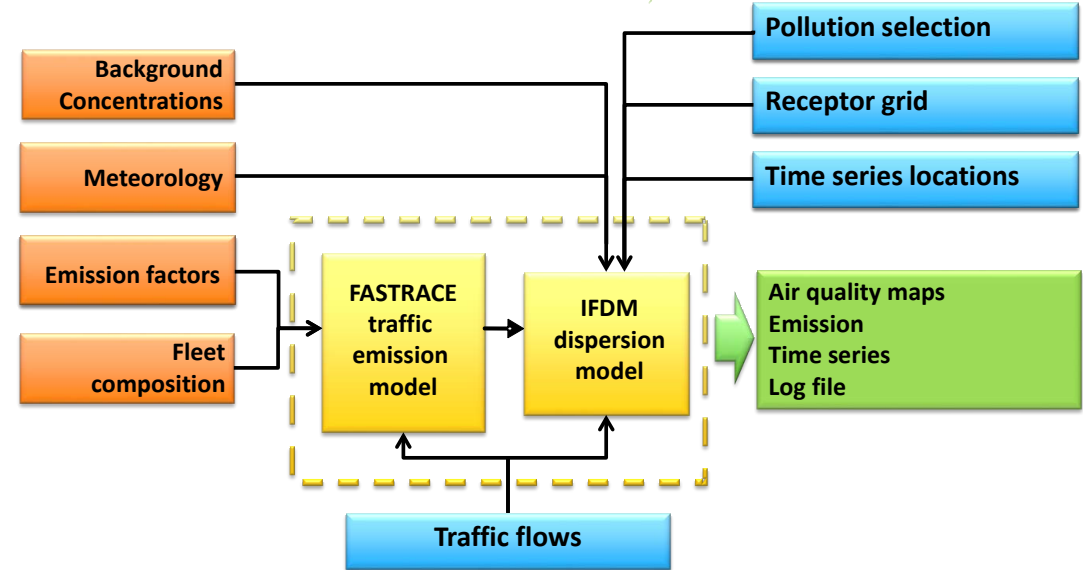
ATMOSYS - CAMS



2015 - jaargemiddelde NO₂ (µg/m³)

ID	Name	Is predefined	Is finalized	Status	Created	Action
9	reference_2015	false	false	finished	2017-10-03 17:59:45	Select Edit
7	CAMS 2015	false	false	finished	2017-09-14 11:22:43	Selected

ID	Name	Status	Is finalized	Created	Action
3	CAMS 2015	finished	false	2017-09-14 11:22:44	Select



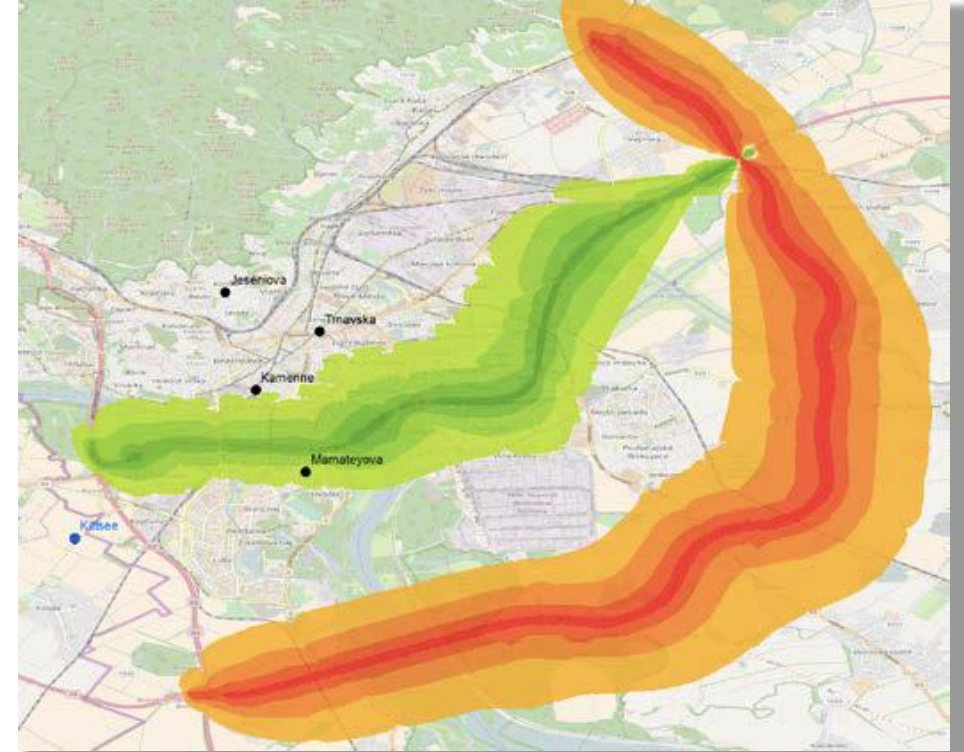
VITO developed a web application for the Flemish Environmental Agency to calculate road traffic emission scenarios in support of regional air quality management.

Using CAMS European air quality reanalysis data, they can much easier implement their service in other parts of Europe.

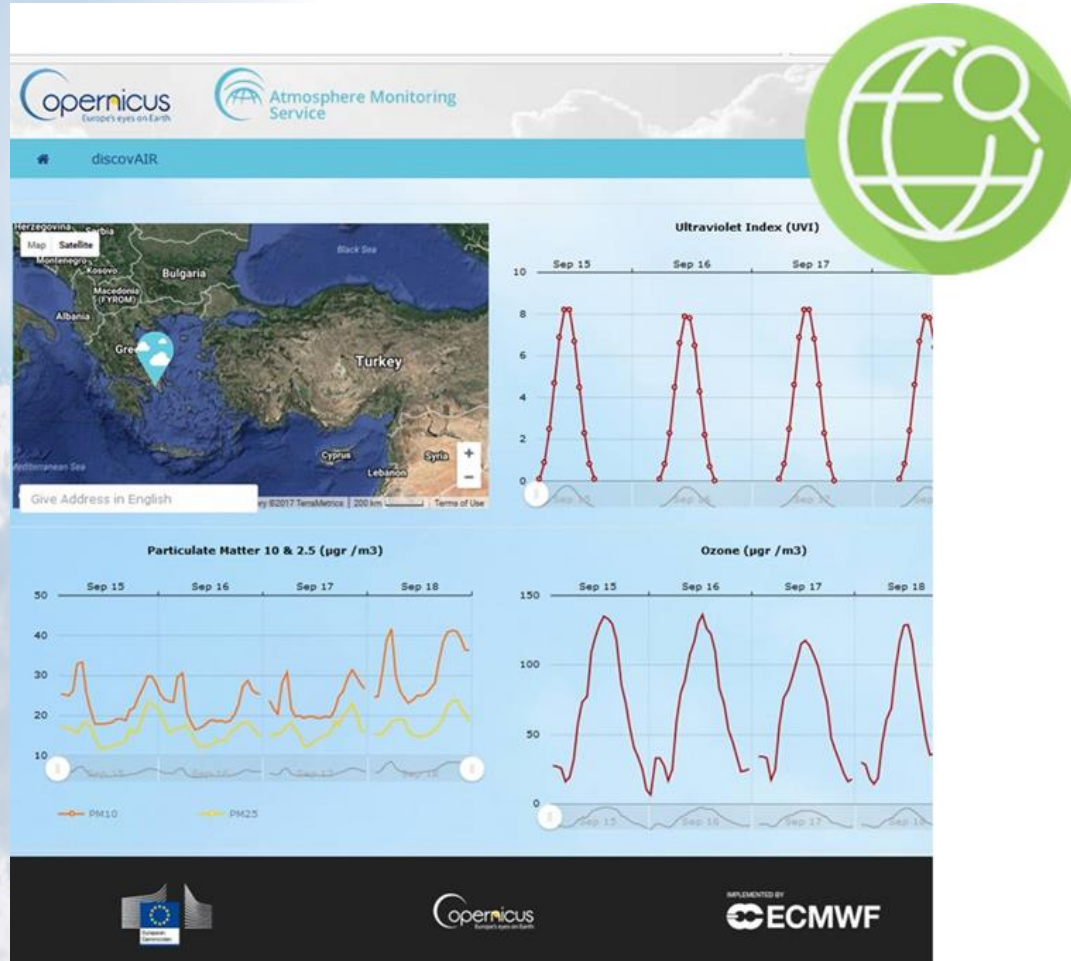


Business model:

- Users: national and regional governmental environmental agencies that do not have sufficient tools required to assess and report on air quality and evaluate planning and local emission reduction scenarios
- Over the past 6 years the application has been used for 40 studies by various Flemish agencies
- Extended service is now being tested and promoted in Slovakia, Poland, Italy and Portugal. Outcome will determine pricing model.



Example of impact of new bypass road on NO2 levels in Bratislava



Based on the weather and other environmental conditions, DiscovAir provides location-specific, personalised advice and alerts for comfort and health.

DiscovAir enhances your trips, travels and days out.

CAMS European air quality forecasts are used to provide the up-to-date information on air pollution, pollen, UV and dust.



DiscovAIR: Business model

Business model:

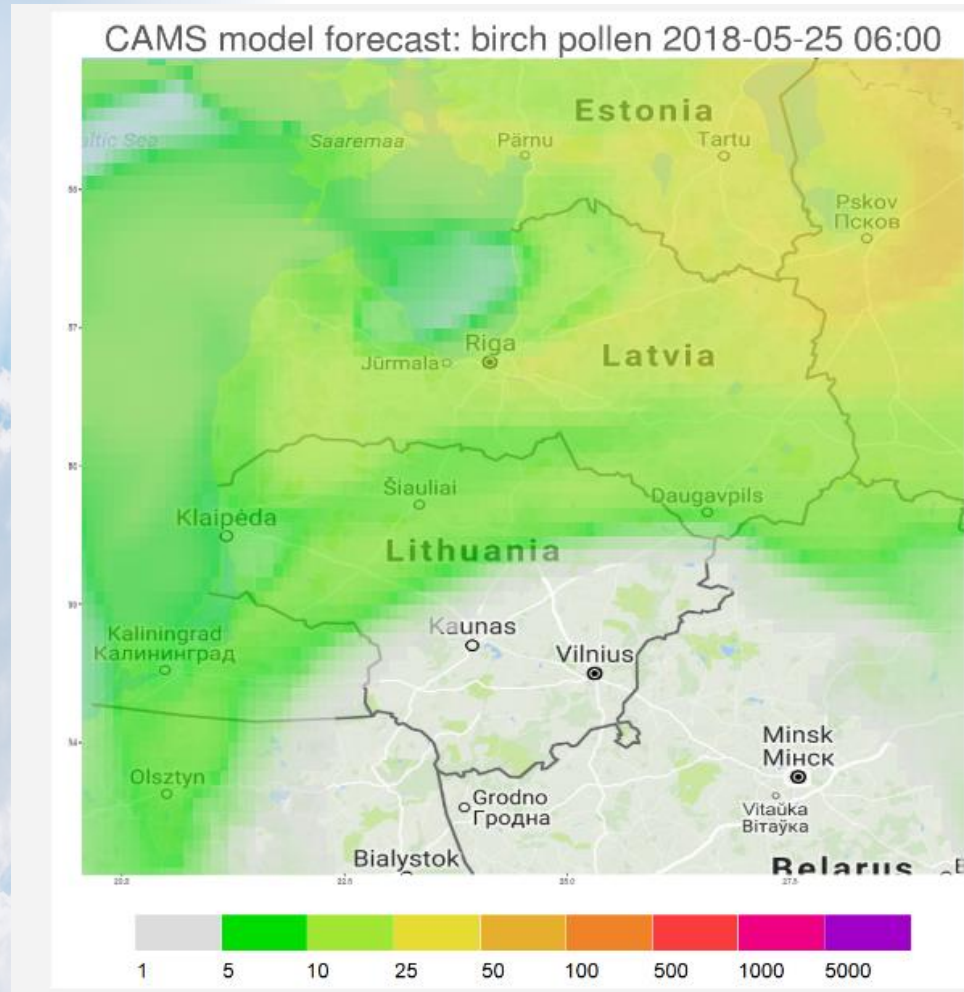
- Users: tourists & citizens, tourism operators and public authorities
- Revenues through e.g., premium version of smartphone app and advertising on mobile and web apps.
- Intention to expand the product beyond the borders of Greece and Cyprus. The service can be applicable to all EU countries and beyond; this is ensured through the utilisation of CAMS products.



	Tourists & Citizens	Tourism operators	Public authorities
Mobile Application	Primary		
Information Portal		Primary	Primary
Service Portal	Secondary	Secondary	Secondary

Target Audience





The aim of PASYFO is to provide a high-resolution regional system for predicting the personal allergy symptoms of pollen-sensitive people using personalised sensitivity information.

CAMS European pollen forecasts are used to provide the up-to-date information on pollen for the European domain.



C A M S U s e C a s e s

- **PRINCIPLE:** Based on market analysis, the Use Case will develop and demonstrate end-to-end applications (product, software or service) based on CAMS products.
- **OBJECTIVE:** Stimulate innovative ideas and support the development of downstream applications.
- **SELECTION CRITERIA:**
 - innovative use of one or more CAMS products,
 - the sustainability of the application business plan,
 - the potential for increasing the use of CAMS services and reaching out to wider communities,
 - the quality and value for money of the proposals.
- **Expected SCOPE and IMPLEMENTATION of USE CASE :**
 - cover a single application (tenderers may submit other separate proposals covering other applications) using 1 or more CAMS products
 - design and development phase (duration between 3 and 6 months);
 - market trial phase (duration between 12 and 24 months)
 - Max. price: 95kEUR (additional in-kind contributions possible)



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Multiplication factors



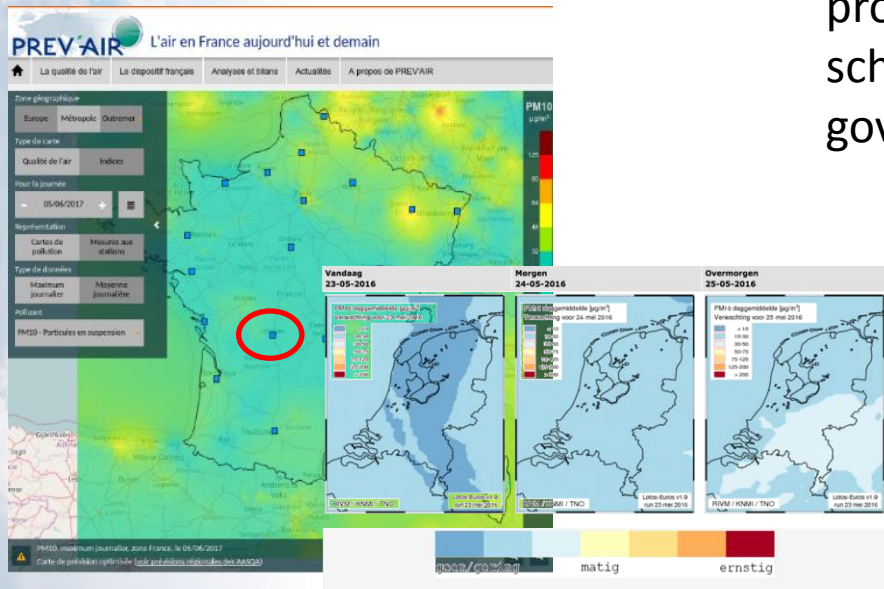
Plumelabs
~ 500,000 downloads



Part of the Australian SunSmart programme, working with schools, workplaces, and local governments.



Euronews
~ 9 million viewers in December 2017



The success of CAMS relies on the success of the downstream applications.

National AQ forecasts
Millions of viewers





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Looking ahead – CAMS post-2020



THE CONTEXT

Four main aspects to take into account:

- The planned evolution of the Copernicus Space Infrastructure: Sentinel-4 (2022...), Sentinel-5 (2023...)
- Its further evolution: proposed CO₂ mission “Sentinel-7” ...
- CAMS outstanding expressed User Requirements
- Mid-term review, surveys & economic impact analysis (PwC...)





HOW DO WE KNOW WHAT USERS NEED?

The CAMS User Requirements Database:

- Main objective is to ensure detailed traceability
- Residual requirements from precursor projects have been loaded and new requirements are continually added (user events, service desk...)

CAMS 94 User Requirements Data Base

Visualize Columns: reporter, description, class, t13, t4

Sort Requirements: t13 Descending Ascending

Filter: Bilthoven

reporter, raw_requirement, class, parameter, t4 Filter for all Categories

Bilthoven reporter,raw_requirement,class,parameter,t4

Select	reporter	description	class	t13	t4	Requirement	Analysis	Implementation	View
<input type="checkbox"/>	franziska.schnell.dlr	Connect air quality data with economic, agricultural, and public health data in a uniform way.	General	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	High resolution (street level) air quality data	Product	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	Drone development to monitor emissions at about 12 km for one whole month	General	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	How can you improve dealing with uncertainties in future versions of the global CAMS model?	General	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	The pollutant Benzo(A)pyrene should be provided.	Parameter	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	More data related to aerosols & CO2 on an urban scale.	Parameter	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	The PM speciation shall be improved.	Parameter	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	The N / S deposition shall be improved.	Product	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details
<input type="checkbox"/>	franziska.schnell.dlr	Need for high resolution AQ-data in cities and streets	Product	2017-06-13	User workshop Bilthoven June 2017	+R	+A	+I	Details

URDB

Similar requirement	Number repeated
Provide high spatial resolution AQ data	10
Provide sub-setting / OGC interfaces for download (regional)	9
Extend historic length of reanalysis	6
Provide regions, cities source apportionment	5
Accompany atmospheric composition with meteorological data	5
User forum	5
User survey / online questionnaire	5
Provide uncertainties with the data	4
Provide daily AQ forecasts earlier in the morning	4
Provide interim reanalysis earlier	4
Provide multi-annual regional air quality datasets	4

Analysis





OUTLINE

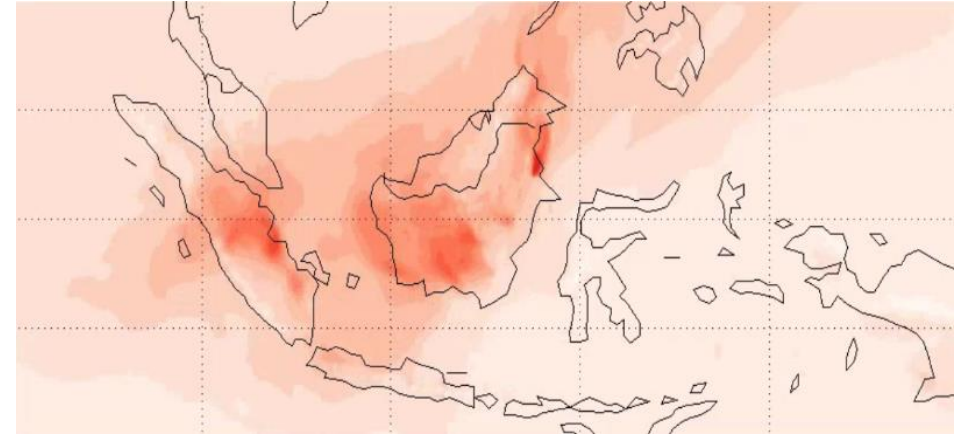
- **Improve global products**
 - **reliable air quality information anywhere on the planet**
- **Improve regional products**
 - **local air quality and exposure information anywhere in Europe**
- **(Near-Real-Time) anthropogenic emissions monitoring**
- **Deposition fluxes**
- **Past & Future Air Quality**
- **New Copernicus CO₂ service**



Users demand **higher resolution** to enable Air Quality and solar applications **anywhere** on the planet.

Users demand **uncertainty** information.

S-5 (and S-4 over Europe) will **strengthen** atmospheric composition operational capabilities.



- Higher global resolution (scale of hot spots / megacities) in order to feed directly local air quality applications
- Global cloudy sky solar radiation using geostationary instruments and model in between (monitoring and forecasts)?
- Estimate uncertainty with each product: single model with perturbations? Model with different chemical packages? Ensemble of Data Assimilation? Statistical perturbation schemes (emissions, parameters...)?



ENHANCE REGIONAL PRODUCTS

Sentinel-4 is a **game changer** for European Air Quality .

Users demand **uncertainty** information.

- Higher regional resolution? Challenge: getting closer to exposure while respecting downstream sector. “Copernicus to national” uptake support scheme.
- Bigger/better ensemble (dozen models in Europe). Perturbations within each model in the ensemble (cost/benefit)?
- More pollen species



Plant species	Popular name	Allergenicity of Pollen		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
- Corylus	Hazel bush	Moderate to high	T R E E S													
- Alnus	Alder	Moderate to high														
Cupressaceae	Cypress, Juniper	Moderate														
Populus	Poplar	Low														
Acer	Maple	Low to moderate														
Salix	Willow	Low														
- Fraxinus	Ash tree	Moderate to high														
- Betula	Birch	Very high														
Carpinus	Hornbeam	Low to moderate														
- Platanus	Plane tree	Moderate to high														
Juglans	Walnut tree	Low to moderate														
Quercus	Oak tree	Moderate														
Morus	Mulberry	Insufficiently studied														
Fagus	Beech tree	Low to moderate														
Tilia	Linden	Very low														
Dactylis	Cocksfoot		G R A S S													
- Poaceae	Grass	Very high														
- Triticum	Wheat	Moderate to high														
Cannabaceae	Cannabis, hop	Low	W E E D S													
Plantago	Plantain	Low to moderate														
- Rumex	Sorrel	Moderate to high														
Urticaceae	Nettle	Low														
Chenopodiaceae	Cindarella	Low to moderate														
- Artemisia	Wormwood	Very high														
Ambrosia	Ragweed	Very high														



There's a **deadlock** between:

- the agreed “boundary” between CAMS and downstream air quality applications in Europe (no higher resolution than 8-10km);
- the strongly expressed requirement by several national environment agencies to be able to use CAMS very directly (higher resolution please!).

Vision: the national official air quality forecast information in “all” EU MS is based on CAMS products and benefits from support/coordination from CAMS

Proposed **solution:**

- set-up a scheme similar to the use cases (CAMS_95) so that targeted downscaling developments can be supported in each EU country without making it a CAMS service component.
- Build a “contract” with each Member State’s agency in charge of Air Quality management to define appropriate downscaling chain (depends strongly on local context/expertise –no one-for-all solution). Scientific & technical support provided by CAMS. Of course, MS can decide to delegate contract to private sector.



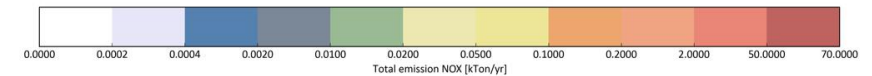
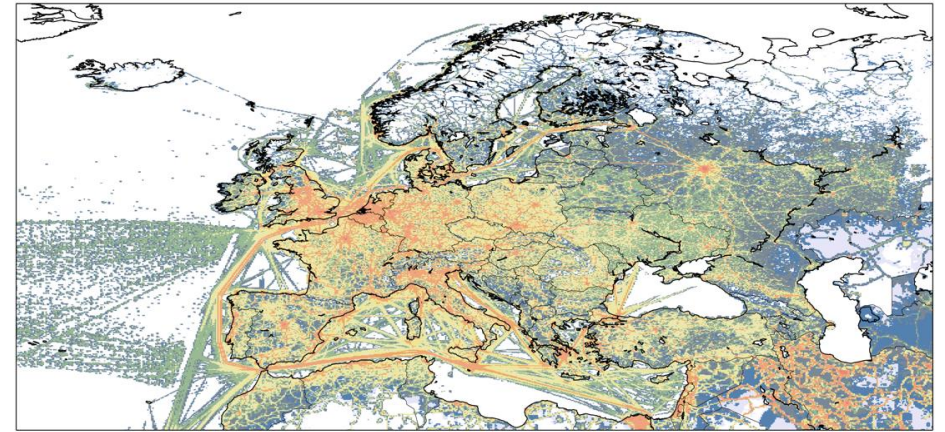
EMISSIONS MONITORING

The **quantification of emissions** is crucial for monitoring the effectiveness of abatement strategies (short- to long-term) and consolidating bottom-up reported estimates.

Hourly NO₂ emissions will (probably) be THE “headline” application for Sentinel-4

Priority (joint with C3S): **CO₂ emissions from fossil fuel combustion**

- Significant methodological developments needed, some common and some specific to the different compounds (e.g. lifetime of species, top-down/bottom-up hand-shaking, combine *in situ*, ground based and satellite)
- Targets: NO₂, anthropogenic CO₂, CO (tracer of all combustion processes)





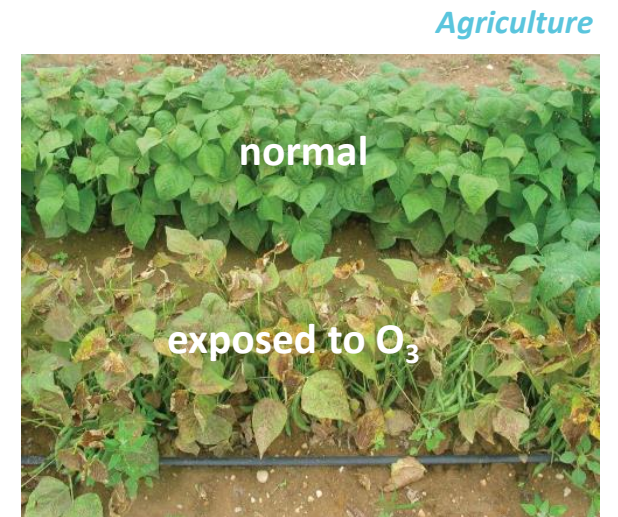
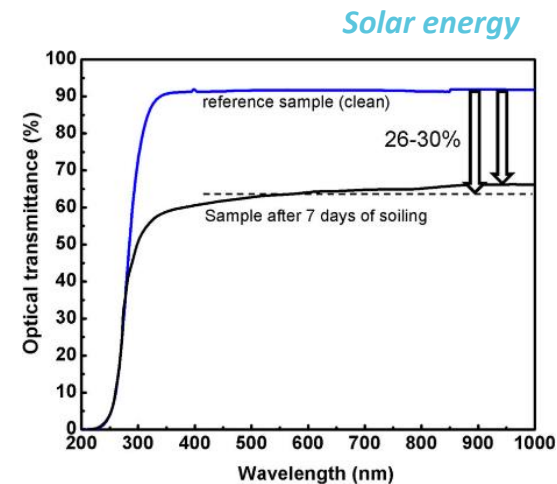
DEPOSITION FLUXES MONITORING

This is a long-standing user demand. Still very much a research area, but **feasible to aim for operations post-2020** (currently = experimental).

A significant number of potential application areas: climate policy, forestry, agriculture/crops, biodiversity, solar panels (soiling)...

Liaison needed with the Climate Change, Land Monitoring and Marine Services

- deposition of NO_x
- deposition of SO_x
- deposition of aerosol (soiling)
- deposition of ozone





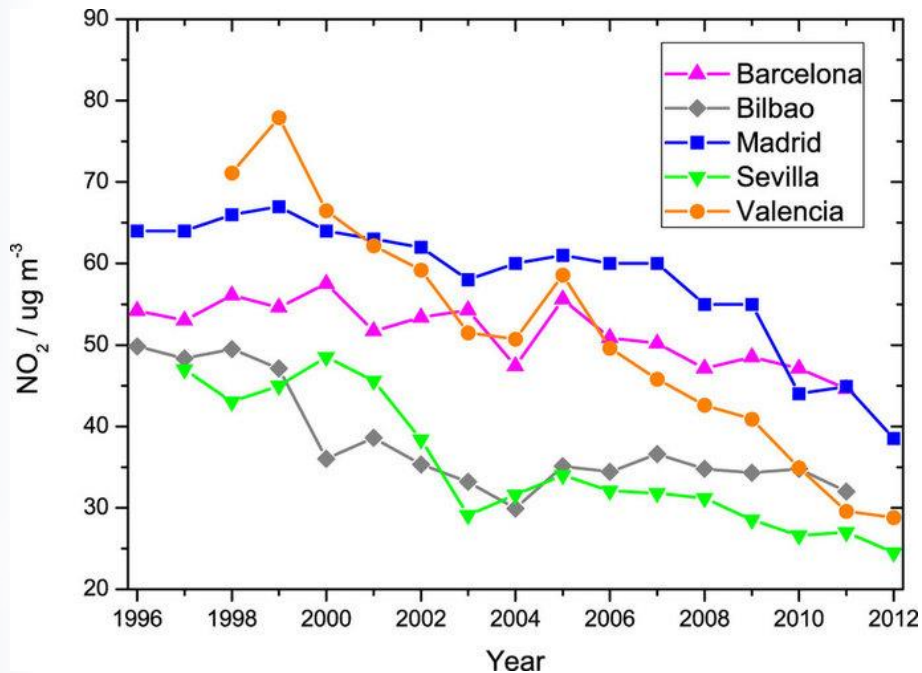
PAST ATMOSPHERIC COMPOSITION

Pre-industrial reference needed for climate forcings

Use of a **different reference** than 18th or 19th century (1980s)?

Past 10/15 years or more is a recurring user requirement (health applications in particular)

Limited by **past observing capacity** for air quality and atmospheric composition



- global pre-industrial 1750/1850s?
- extend CAMS global reanalysis in the past: to 1980's (ozone, AOD) or before (model only)? Joint activity with C3S, including interactive aerosol.
- extend annual CAMS regional reanalyses in the past to ~2000?



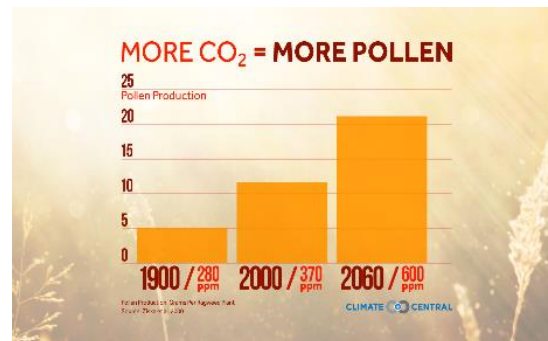
FUTURE ATMOSPHERIC COMPOSITION

Outstanding user requirements

“Interesting” horizons could be **2030’s** (emissions reduction target), **2050’s** (climate has changed) and **2080’s-2100’s** (climate has changed further)

Largely same infrastructure as for current global and regional products but **future climate projections needed** (incl. emissions)

- global future “time slices”
- regional future “time slices”
- would feed several C3S Sectoral Information Systems (health, energy...)





Copernicus Monitoring and Verification Support (MVS) capacity

Precision & Accuracy



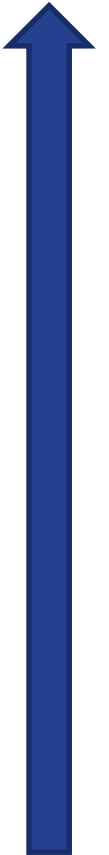
Detection of emitting hot spots such as megacities or power plants

Monitoring the hot spot emissions to assess emission reductions of the activities

Assessing emission changes against local reduction targets to monitor impacts of the NDCs

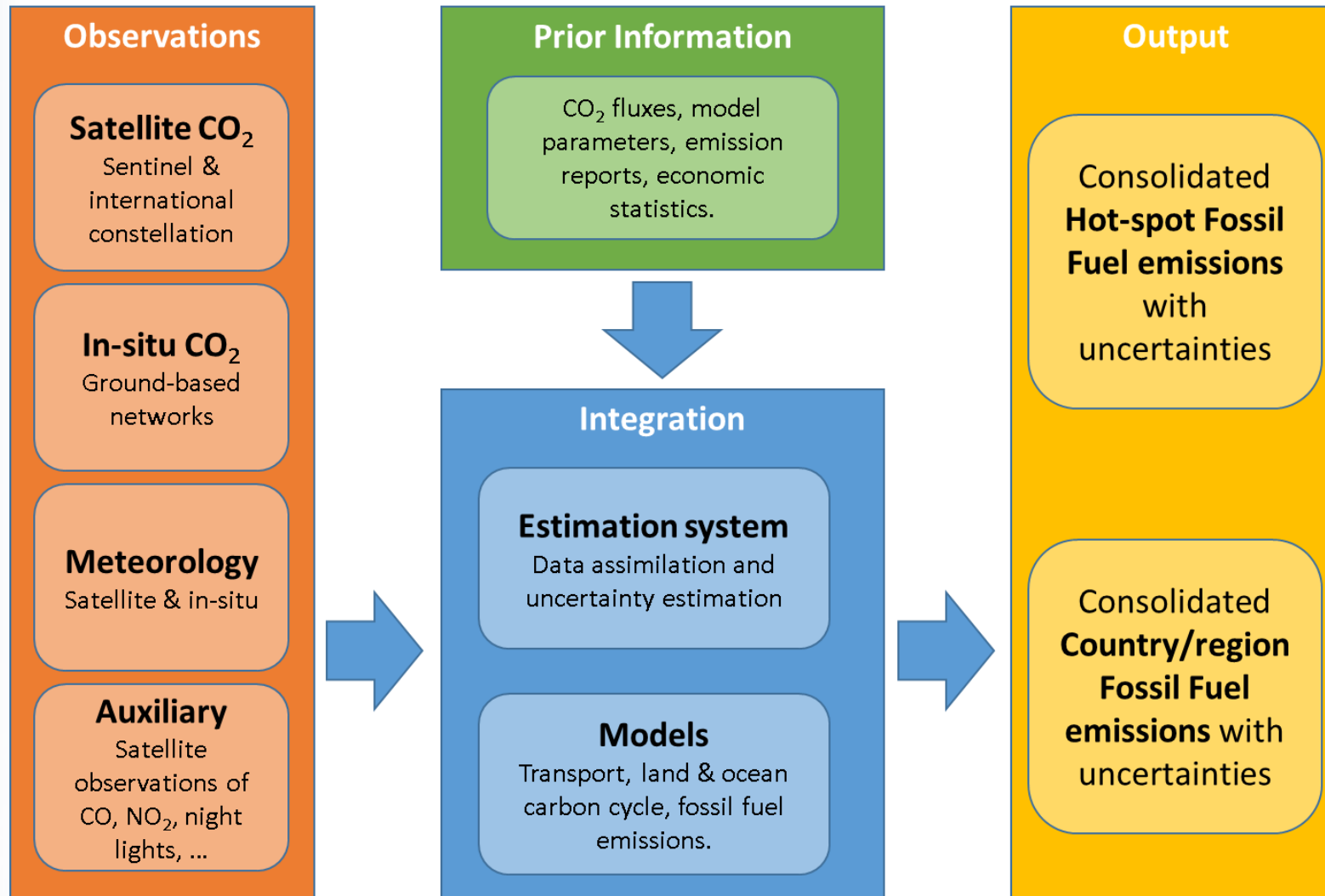
Assessing the national emissions and changes in 5-year time steps to estimate the global stock take

Spatial and temporal resolution





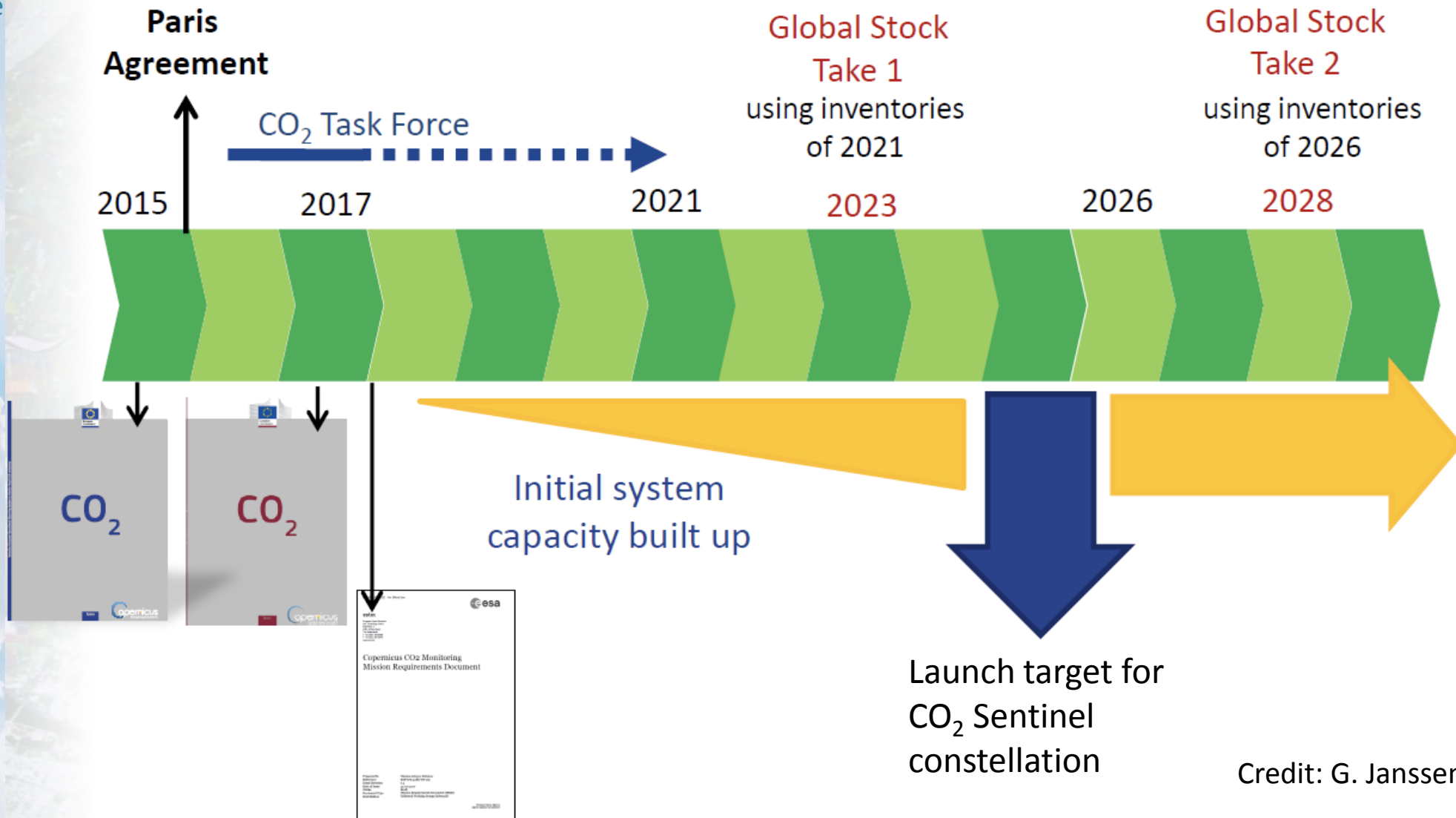
Implementation of CO₂ MVS





Atmosphere
Monitoring

Expected timeline of service development

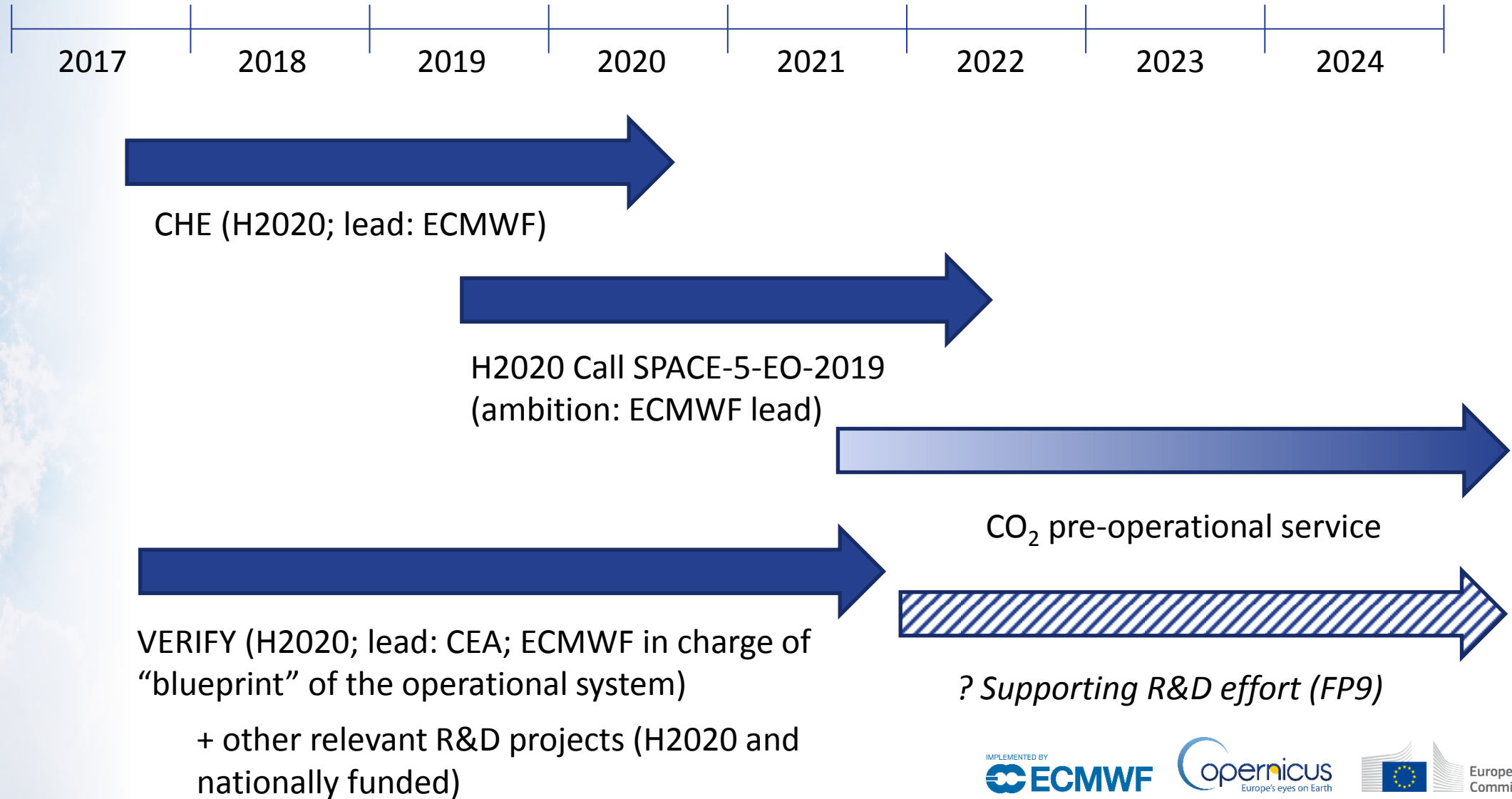


Credit: G. Janssens-Maenhout



Towards an operational service

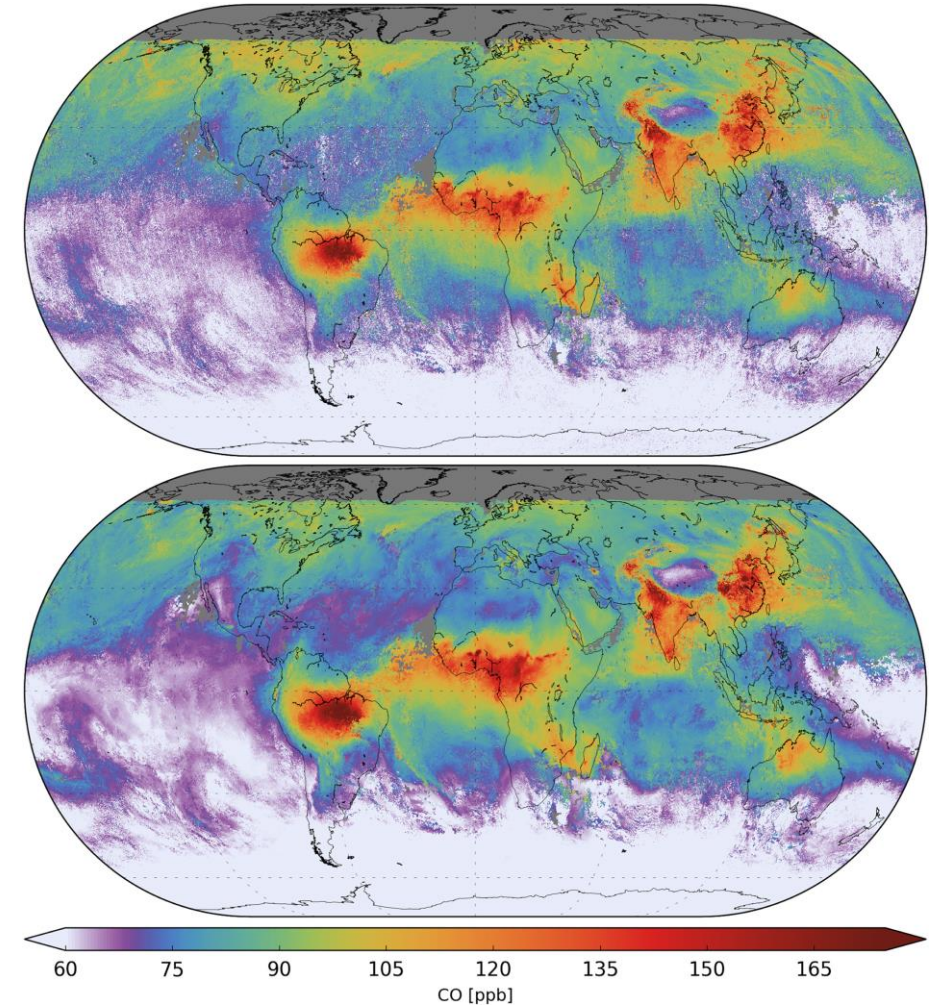
International context: IG3IS, GEOCARBON...





Sentinel-5p is the first Sentinel mission that will be used in CAMS.

Unprecedented spatial resolution and accuracy will improve CAMS forecasts and open up new opportunities to get a better handle on air quality issues.



<http://atmosphere.copernicus.eu>

The screenshot shows the Copernicus Atmosphere Monitoring Service (CAMS) website. At the top, there is a navigation bar with the Copernicus logo and the text 'Atmosphere Monitoring Service'. Below the navigation bar is a search bar and a 'Contact us' button. The main content area is divided into three columns: 'IN FOCUS', 'CATALOGUE', and 'NEWS'. The 'IN FOCUS' section features a large image of a landscape and a 'CAMS General Assembly' event. The 'CATALOGUE' section includes a 'EUROPEAN AIR QUALITY' map. The 'NEWS' section lists several articles, including 'CAMS contribution to estimate the largest fire carbon emissions over Southeast Asia since 1997' and 'Discovering the first Sentinel-3A results at European Space Solutions 2016'.

Twitter

The screenshot shows a Twitter feed from the account 'Copernicus ECMWF'. The feed displays two tweets. The first tweet is from a user named 'Our Dr @m_parrington & #Copernicus Atmosphere Monitoring Service' and mentions '@uktropicalpeat #Indonesia #fires blog'. The second tweet is from 'Copernicus ECMWF @C...' and mentions '#Copernicus Atmosphere Monitoring Service tracks Asia's #fires atmosphere.copernicus.eu/news/copernicu... #CAMS #haze'. The tweets include images of peatland fires and a map of Asia.

Newsletter

The screenshot shows the Copernicus Atmosphere Monitoring Service newsletter. The newsletter features the Copernicus logo and the text 'Copernicus Atmosphere Monitoring Service'. It includes a large image of a satellite in orbit. The newsletter text states: 'You are receiving this email because you have registered for the Copernicus newsletters. Copernicus is the European Commission's flagship Earth Observation programme that freely provides governments, scientists and industry with the tools and information to make better, evidence-based decisions. ECMWF is delivering two key parts of the programme, the Copernicus Atmosphere Monitoring Service (CAMS) and the Copernicus Climate Change Service (C3S) and assisting with a third Copernicus Emergency Management Service - Floods (CEMS)'. The newsletter also includes a 'SAVE THE DATE' section for the '1st CAMS General Assembly' on June 14-16, 2016, in Athens, Greece.

copernicus-support@ecmwf.int

