



Atmosphere Monitoring

# Analysis of DOD and Dust Emissions over Middle East by using CAMS

Richard Engelen

ECMWF



Copernicus EU



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

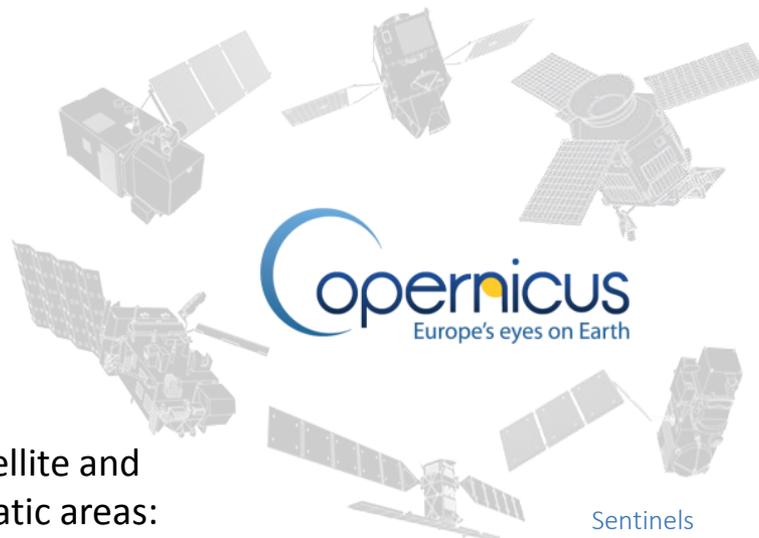
**User-driven with free and unrestricted data access**

**Sustained and operational**

The Copernicus Services transform the wealth of satellite and in-situ data into value-added information for 6 thematic areas:  
**Atmosphere, Marine, Land, Climate, Emergency and Security**



Services





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Monitoring

# Copernicus Atmosphere Monitoring Service



**Providing policy makers, businesses, scientists and citizens alike with reliable information about atmospheric composition.**

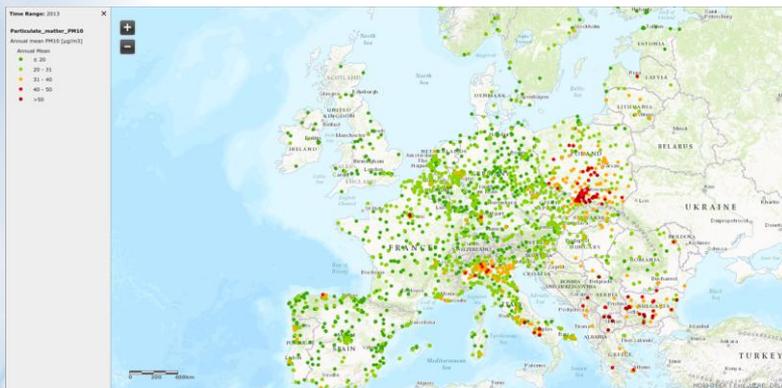


**Building up knowledge and boosting informed decision-making on topics such as air quality, health, solar energy, weather and climate.**



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# CAMS: Adding value to observations



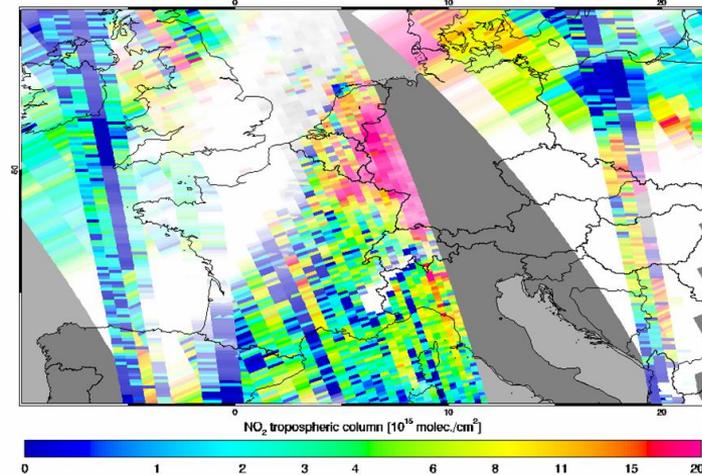
**In-situ  
observations**

European Environment Agency



OMI NRT tropospheric NO<sub>2</sub> 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).**

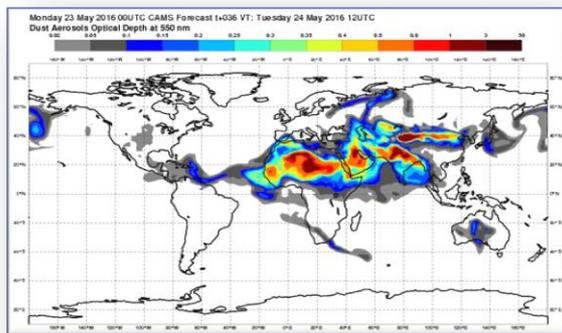
**CAMS forecasts allow you to anticipate the situation of tomorrow.**



# How do we do that?

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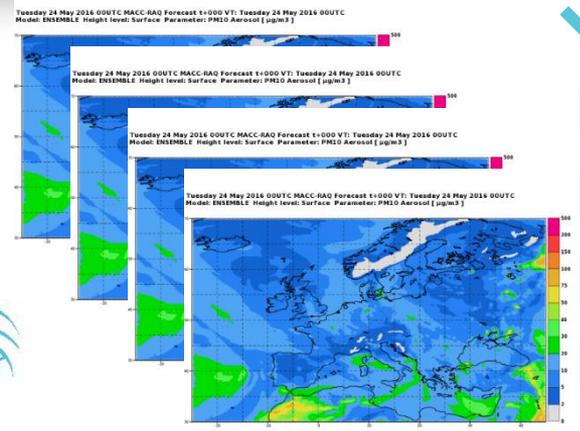
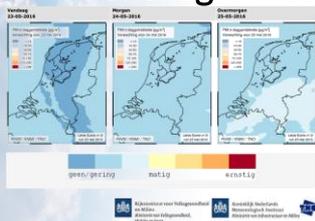
Space Agencies



In-situ observations



National agencies



SMEs



Citizens

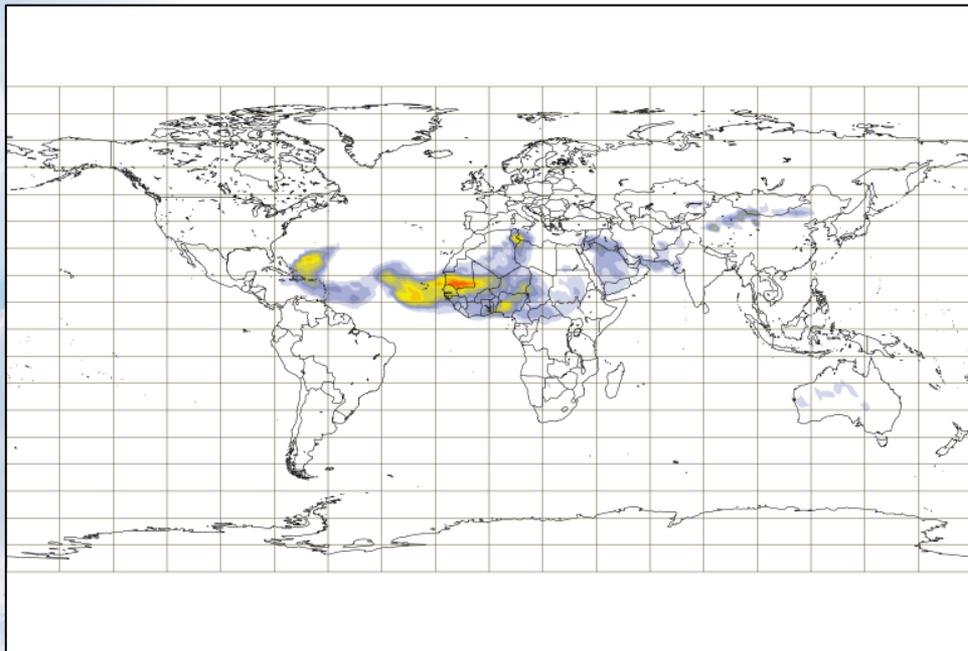


Scientists



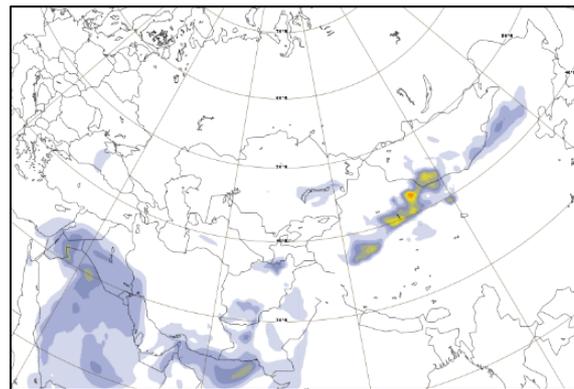
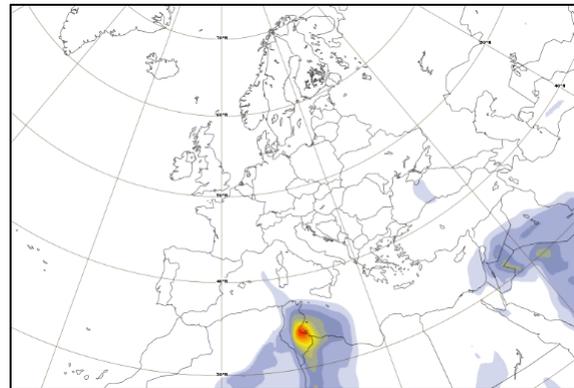
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# Twice-daily forecasts from global system



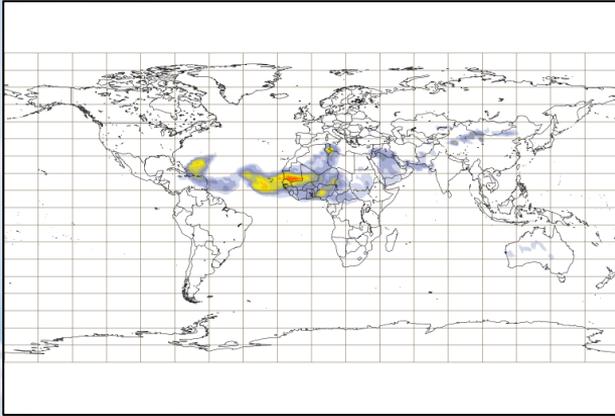
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DOD

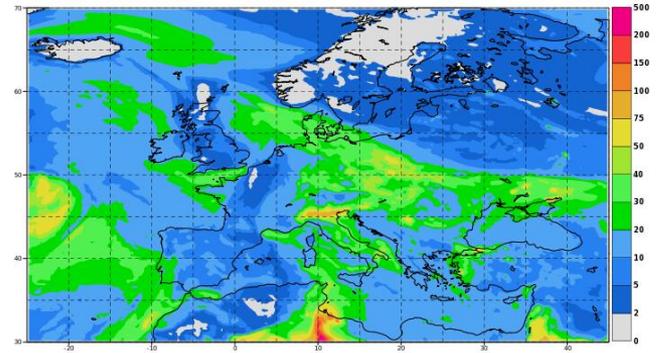




# From global to regional



Friday 20 October 2017 00UTC CAMS Forecast t+003 VT: Friday 20 October 2017 03UTC  
Model: ENSEMBLE Height level: Surface Parameter: PM10 Aerosol [ µg/m3 ]



The CAMS global system provides boundary conditions for the daily CAMS regional ensemble forecasts.

**Boundary conditions are also available for CAMS users running regional models for other domains.**

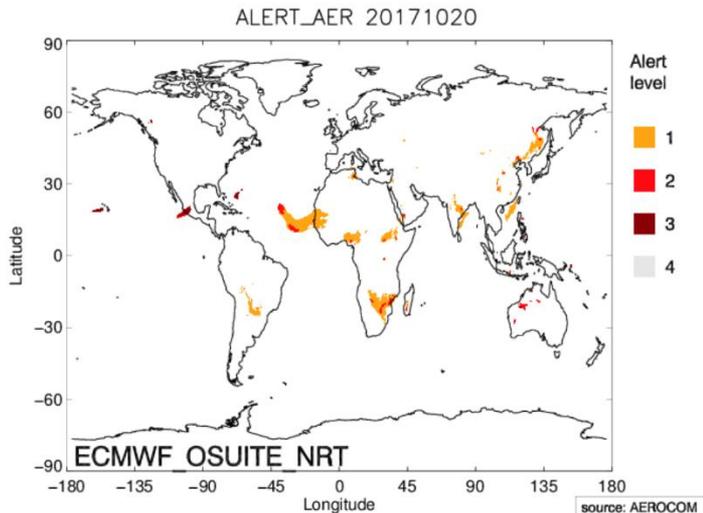


# Aerosol warning system (in development)

## AEROSOL ALERT MAP

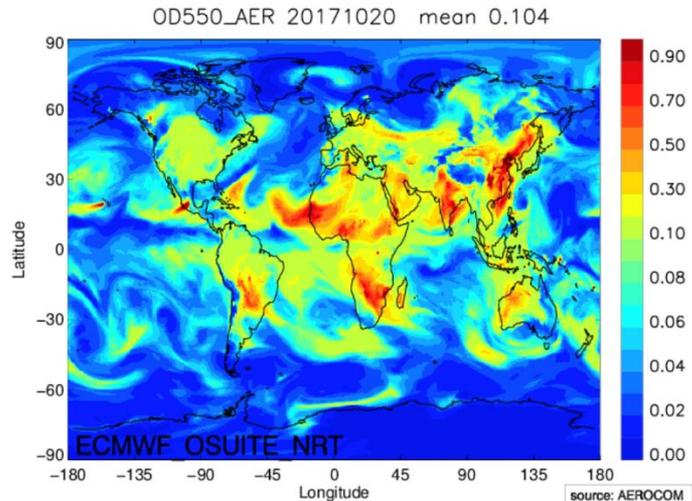
Daily mean Aerosol AOD simulated  
as being significantly larger than climatology

WORLD  an2017  d20171020



Aerosol AOD DUST OD ORGANIC OD SULFATE OD

WORLD  an2017  d20171020



CAMS is testing an aerosol warning system that could send automatic emails in case of exceedances relative to climatology.



### WMO SDS-WAS

**NORTHERN AFRICA-MIDDLE EAST-EUROPE (NA-ME-E) REGIONAL CENTER**  
WMO Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS)

WMO SDS WAS | Asia Regional Center | America Regional Center

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**Dust forecasts**

You are here: Home > Forecast & Products > Dust forecasts > Forecast comparison

**Forecast comparison**  
by Francesco Benincasa — last modified Feb 16, 2017 11:49 AM

Date: 2017-10-21 H+ anim

Doc on model inter-comparison Forecast evaluation Ensemble forecast

*Please be sure to read the data policy.*

*NOTE: Click on the images to enlarge.*

**Dust optical depth:**

Search Site Search

**Latest News**

- Atmosphere. Special issue "Studying the effects of dust on weather" Oct 20, 2017
- Impact of dust deposition on wheat production Oct 19, 2017
- Paper on the pulsating nature of large-scale Saharan dust transport Oct 17, 2017

### ICAP

**NRL Monterey ICAP Multi-Model Ensemble**

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Marine Meteorology Division (Code 7500)  
U. S. Navy Navy Recruiting Navy FOIA ONR

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T+HOUR

ICAP Multi-Model Global Dust Aerosol Optical Depth Archive

Monday 6 February 2017 00UTC ICAP Forecast t+006  
Monday 6 February 2017 06UTC Valid Time  
DUST Aerosol Optical Depth at 550nm ( nMEM = 5 )

0.1 0.2 0.4 0.8 1.2 2.5 5.0 9.0

Plots Generated Tuesday 7 February 2017 12UTC NRL/Monterey Aerosol Modeling

- sulfate
- dust
- smoke
- sea salt
- total
- global
- nisea
- byzantium
- eastasia
- subtropical
- pacific
- corpus
- satlantic
- sioaus
- npolar

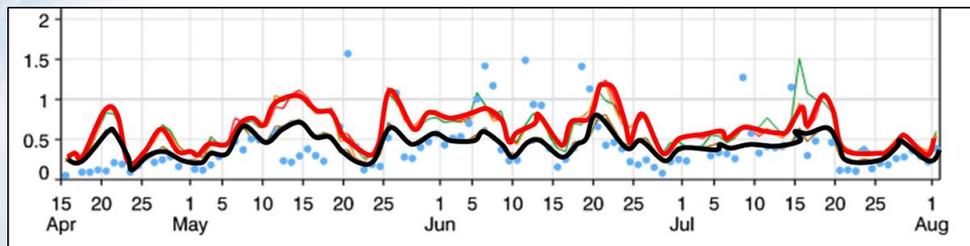


## Under the hood

Dust emissions are based on the bare soil fraction, soil moisture content, wind speed above a threshold and a regionally-defined constant source potential (Morcrette et al. (2009), Ginoux et al. (2001)).

Online dry deposition velocities for all aerosol species as a function of particle size, surface friction, roughness length and soil type, following Zhang et al (2001).

Data assimilation uses observations from MODIS and PMAp to constrain total Aerosol Optical Depth. This means that speciation and size distribution are provided by model.



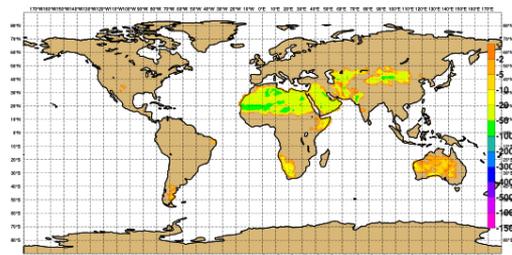
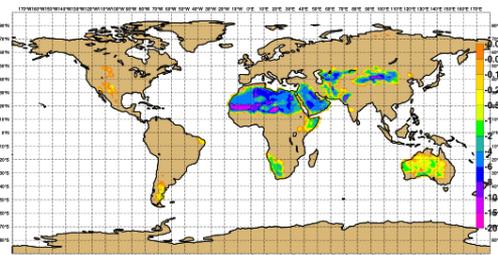
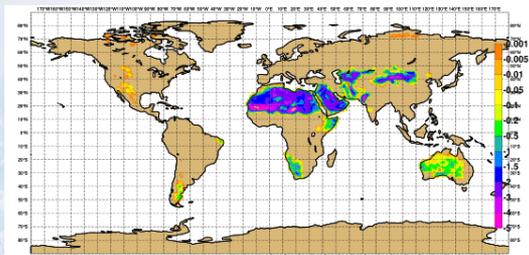
Total AOD at the Tamanrasset (Algeria)  
AERONET station



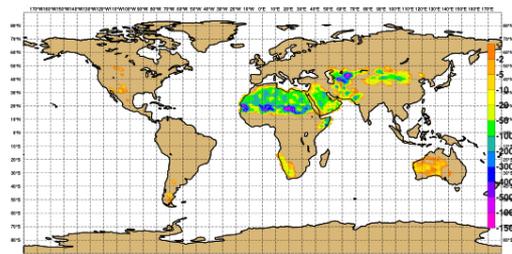
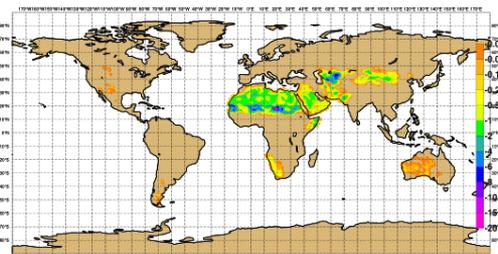
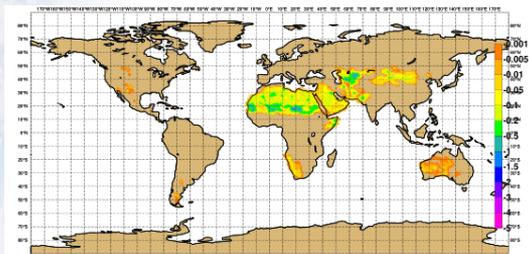
# On-going developments

A new dust emission scheme is adapted from Nabat et al. (2012, ACP), which itself uses the work of Zakey et al. (2006, 2008), based on Marticorena and Bergametti (1995).

Old



New





Search

Reset

### 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

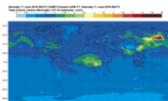
### PARAMETER

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

### CURRENT FILTERS:

Product family: Global forecasts

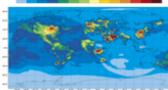
Total results: 5



### Global forecasts of chemical species - carbon monoxide

This service provides daily forecasts of chemical species observations

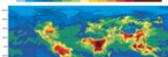
Parameter: Carbon monoxide



### Global forecasts of chemical species - dioxide

This service provides daily forecasts of chemical species observations

Parameter: Nitrogen dioxide

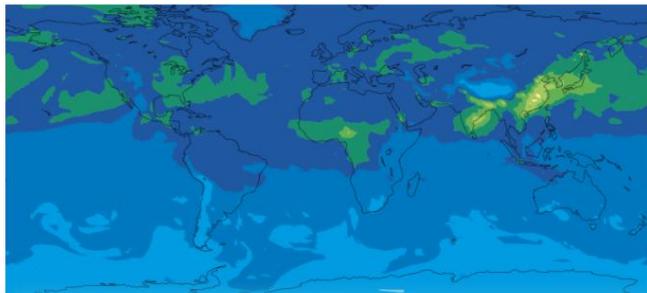


### Global forecasts of assimilated chemical species - formaldehyde

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



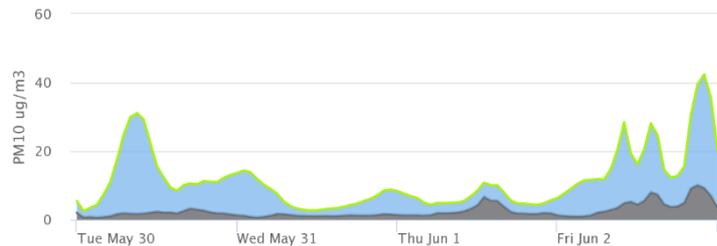
Contact us



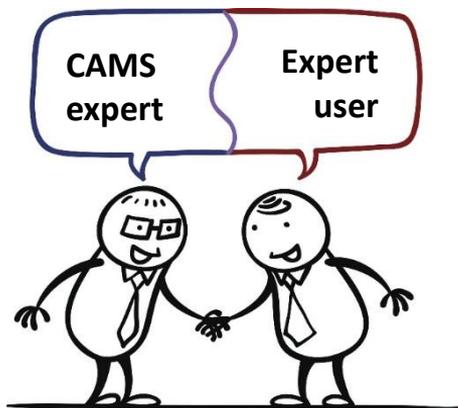
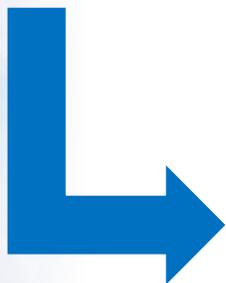


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# Using CAMS data



CAMS forecast charts and policy tools



Downstream applications



Atmosphere  
Monitoring

To summarize



Atmosphere  
Monitoring Service

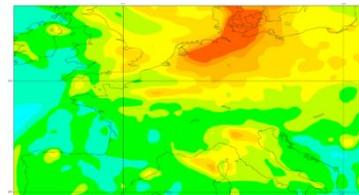
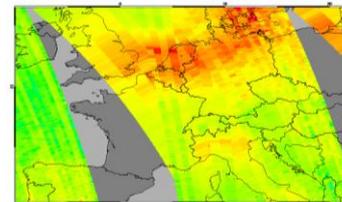
[atmosphere.copernicus.eu](https://atmosphere.copernicus.eu)

**User-driven**

**Free and unrestricted data access**

**Making observations more meaningful to you**

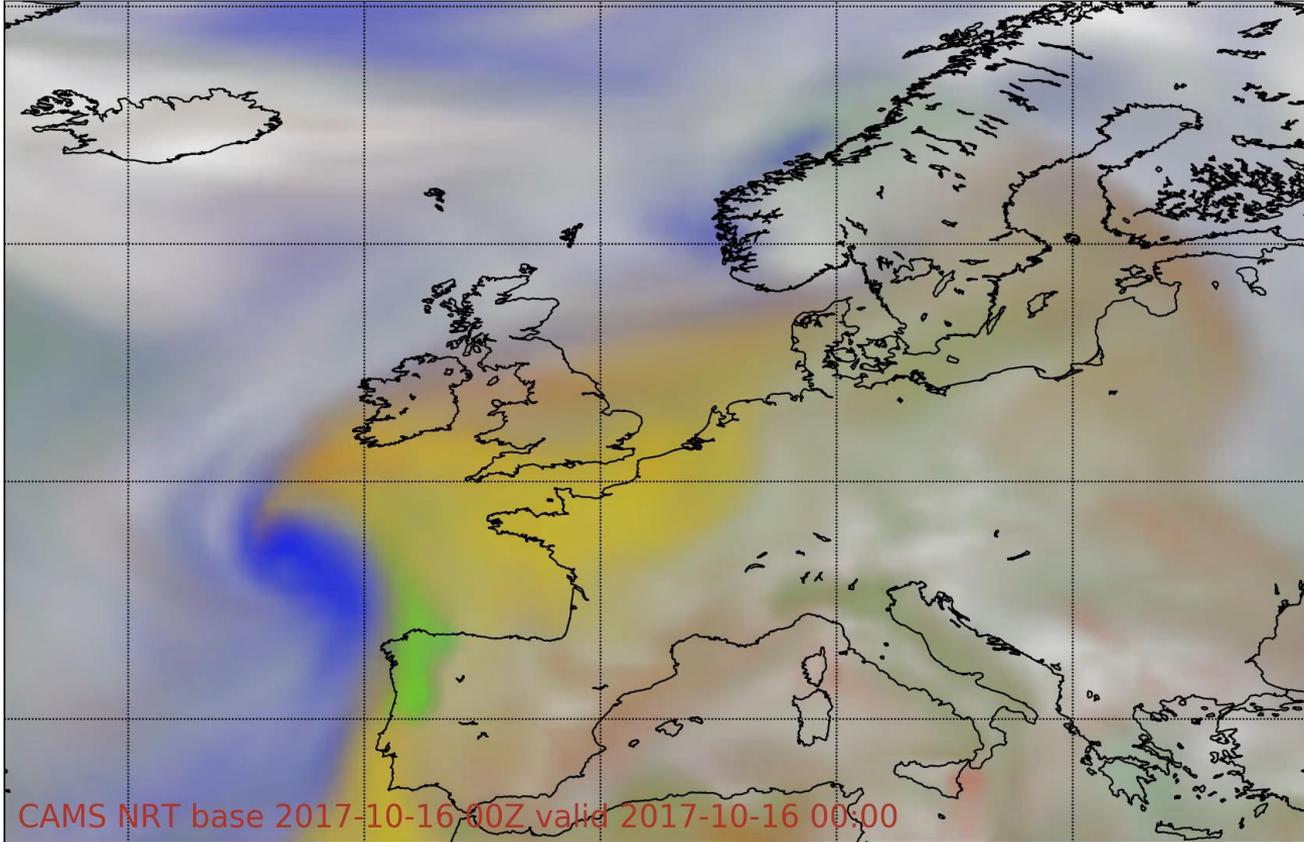
**Provide information for past, present and future**





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# Recent example of dust mixed with smoke



<http://atmosphere.copernicus.eu>

The screenshot shows the Copernicus Atmosphere Monitoring Service website. At the top, there is a navigation bar with the Copernicus logo and 'Atmosphere Monitoring Service' text. Below the navigation bar is a large banner image of a landscape under a bright sun. The main content area is divided into three columns: 'IN FOCUS' with a 'CAMS General Assembly' article, 'CATALOGUE' with a 'EUROPEAN AIR QUALITY' map, and 'NEWS' with 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'. There are 'READ MORE' and 'ARCHIVE' buttons at the bottom of the main content area.

Twitter

The screenshot shows a Twitter feed on a mobile device. The top tweet is from Copernicus ECMWF (@CopernicusECMWF) mentioning a blog post about peatland fires in Southeast Asia. The second tweet is from Copernicus ECMWF (@CopernicusECMWF) dated 18/09/2015, mentioning the Copernicus Atmosphere Monitoring Service tracking Asia's haze. The bottom of the screen shows the Twitter navigation bar with icons for Home, Notifications, Messages, and Me.

Newsletter

The screenshot shows an email newsletter from Copernicus Atmosphere Monitoring Service. The header features the Copernicus logo and the service name. The main content includes a satellite image of Earth with the Copernicus satellite in orbit. Below the image, there is a paragraph explaining the newsletter's purpose and a section titled 'SAVE THE DATE' for the '1st CAMS General Assembly' on 14-16 June 2016. The assembly details include location (Elexia Palace Hotel, Athens, Greece), registration information, and a list of activities: service updates, requirements and feedback gathering, and providing lead contacts.

# Follow us!



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