



Atmosphere Monitoring

CAMS products (for policy users)

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Atmosphere
Monitoring

C o p e r n i c u s A t m o s p h e r e M o n i t o r i n g S e r v i c e



- **Copernicus** is the European Union's Earth Observation Programme, divided into six thematic streams, including '*Atmosphere*' (*CAMS*)
- **CAMS** products are available free of charge
- **CAMS** products cover the global and regional scales (not local)

<https://atmosphere.copernicus.eu/>



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Copernicus Atmosphere Monitoring Service

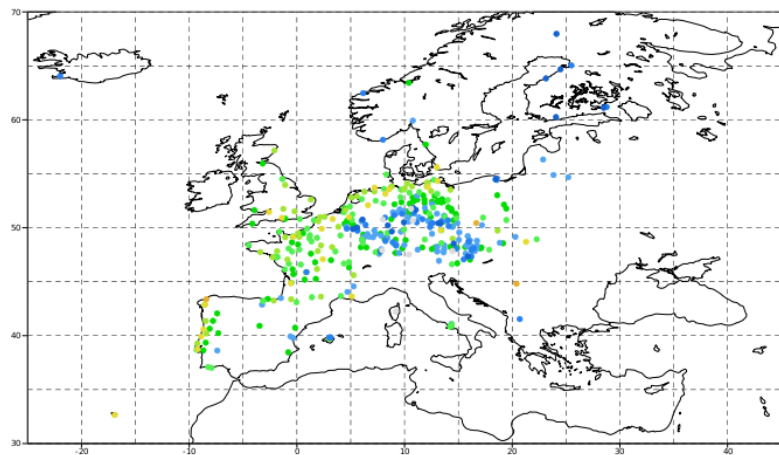
- This presentation focuses on *a selection* of **CAMS** products that are relevant for *air quality policy* users
- **CAMS** products for policy use are mainly based on modelling (but measurements are being used for **data assimilation** and **product evaluation**)
 - forecasts and alert services
 - (re-)analyses and air quality reports
 - source allocation and green scenarios for mitigation and action





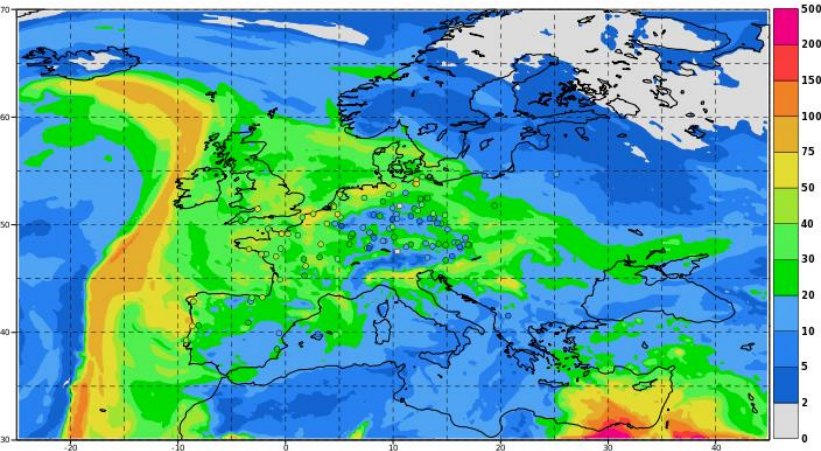
26 Feb

CAMS Observations VT: Tuesday 26 February 2019 01UTC
Surface PM10 Aerosol [$\mu\text{g}/\text{m}^3$] N:376 mean:26.3 max:90.6



PM₁₀ (observed)

CAMS Verification t-024 VT: Tuesday 26 February 2019 00UTC
Model: ENSEMBLE Median Height level: Surface Parameter: PM10 Aerosol [$\mu\text{g}/\text{m}^3$]



PM₁₀ (analysis)

❖ *Dust and SIA are scheduled to be added as separate components in May 2019*



METEO
FRANCE

<http://macc-raq-op.meteo.fr/>



Copernicus
Europe's eyes on Earth





EU air quality standards for PM

EU Air Quality Directive				WHO Guidelines	
Pollutant	Averaging Period	Objective and legal nature and concentration	Comments	Concentration	Comments
PM _{2.5}	Hourly			25 µg/m ³	99th percentile (3 days/year)
PM _{2.5}	Annual	Limit value, 25 µg/m ³		10 µg/m ³	
PM ₁₀	Hourly	Limit value, 50 µg/m ³	Not to be exceeded on more than 35 days per year	50 µg/m ³	99th percentile (3 days/year)
PM ₁₀	Annual	Limit value, 40 µg/m ³		20 µg/m ³	

EU Air Quality Directive (2008/50/EC)

WHO Air quality guidelines (2005)

<http://ec.europa.eu/environment/air/quality/standards.htm>

❖ Exceedances are assessed by measurements, at measurement sites!



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C A M S – P o l i c y U s e r w o r k s h o p s

- ❑ Find out about policy user needs by:
 - learning about their tasks and obligations
 - developing and promoting products (incl. training)
 - receiving feedback
- ❑ E.g., compliance monitoring still based primarily on measurements
 - in case of exceedances, natural contributions may be derived with models and subtracted, but the method is subject to approval by the European Commission

<https://policy.atmosphere.copernicus.eu/Workshops.html>



Air Quality - Policy User needs

- ☐ tools for monitoring and reporting
 - concentrations and exceedances of air quality standards
- ☐ tools for source attribution
 - natural vs. anthropogenic contributions
 - local vs. imported contributions
 - national vs. international contributions
 - sector contributions
- ☐ tools to evaluate air quality policy measures
- ☐ alert services



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CAMS - ACT (Air Control Toolbox)

Pollutants

Forecast Base Time

Valid Time

PM10

2019-02-21

2019-02-22

Natural / background concentrations

☐ include

☒ remove

Emission of the main activity sectors

Traffic

reduction: 0%

Industry

reduction: 0%

Residential

reduction: 0%

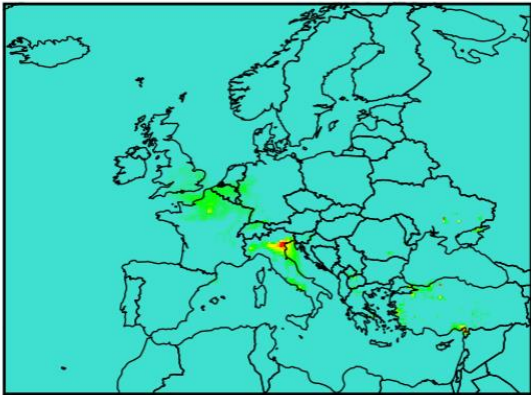
Agriculture

reduction: 0%

User scenario

Difference

PM10 - daily mean ($\mu\text{g}/\text{m}^3$)



only the main anthropogenic sources: (agriculture, industry, traffic and residential heating). it and sea salt for particulate matter) but also a few anthropogenic sectors such as shipping.

Tool developed
and maintained
by:

INERIS

https://policy.atmosphere.copernicus.eu/CAMS_ACT.html





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CAMS - ACT (Air Control Toolbox)

PM10 - daily mean ($\mu\text{g}/\text{m}^3$)



hropogenic sources and the user scenario assuming a Europe-wide uniform reduction of:
Agriculture: 0 % ; Traffic: 100 % ; Residential: 0 % ; Industry: 0 %

PM10 - daily mean ($\mu\text{g}/\text{m}^3$)



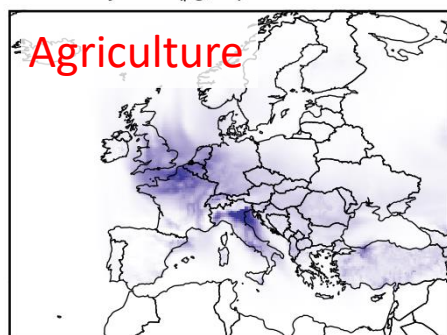
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PM10 - daily mean ($\mu\text{g}/\text{m}^3$)



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PM10 - daily mean ($\mu\text{g}/\text{m}^3$)



hropogenic sources and the user scenario assuming a Europe-wide uniform reduction of:
Agriculture: 100 % ; Traffic: 0 % ; Residential: 0 % ; Industry: 0 %

Example: Effect of
removing emissions
from individual sectors





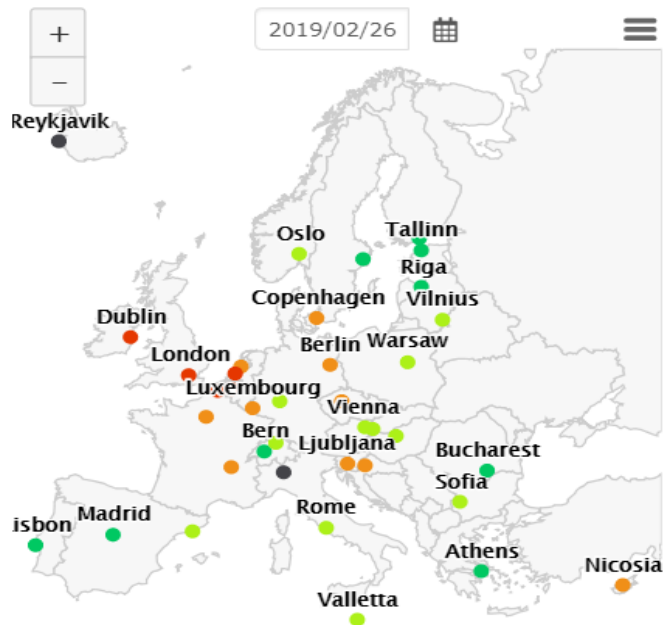
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CAMS – Daily Source allocation

Daily Forecast

Country Attribution

Chemical Species



City -

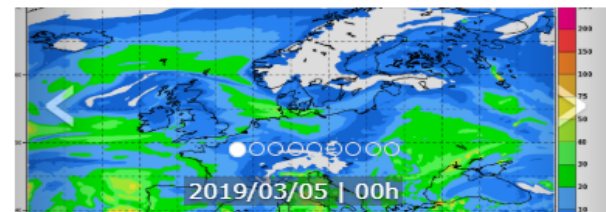
Paris

Pollutant -

PM10

Model -

EMEP



Attribution to External/Local PM10 sources

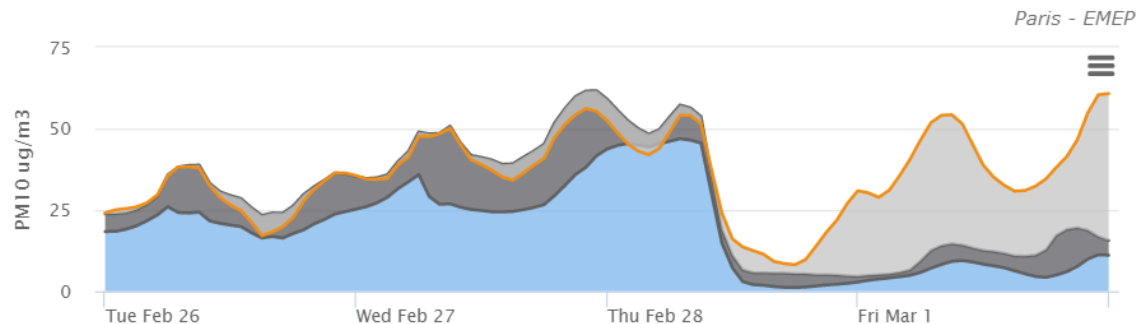
Tool developed
and maintained
by:

<https://policy.atmosphere.copernicus.eu/DailySourceAllocation.html>

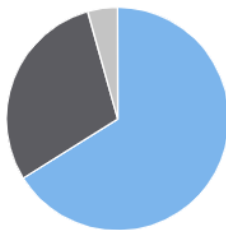


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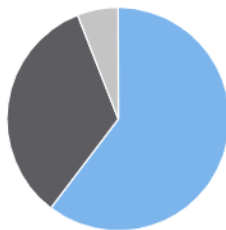
CAMS – Daily Source allocation



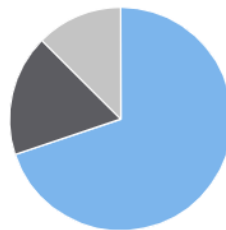
● Rest of Europe
● Local
● Others



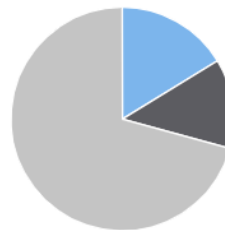
Tue Feb 26



Wed Feb 27



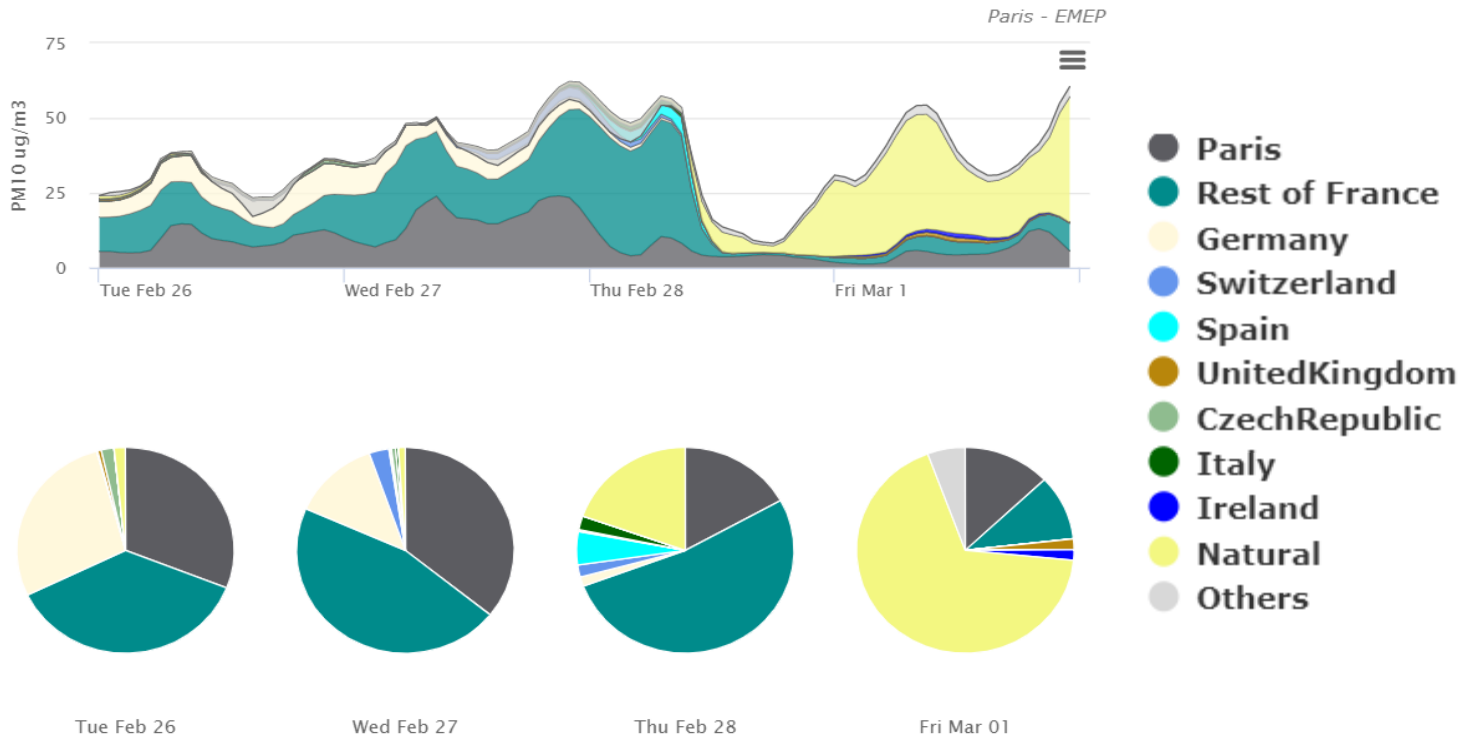
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Fri Mar 01



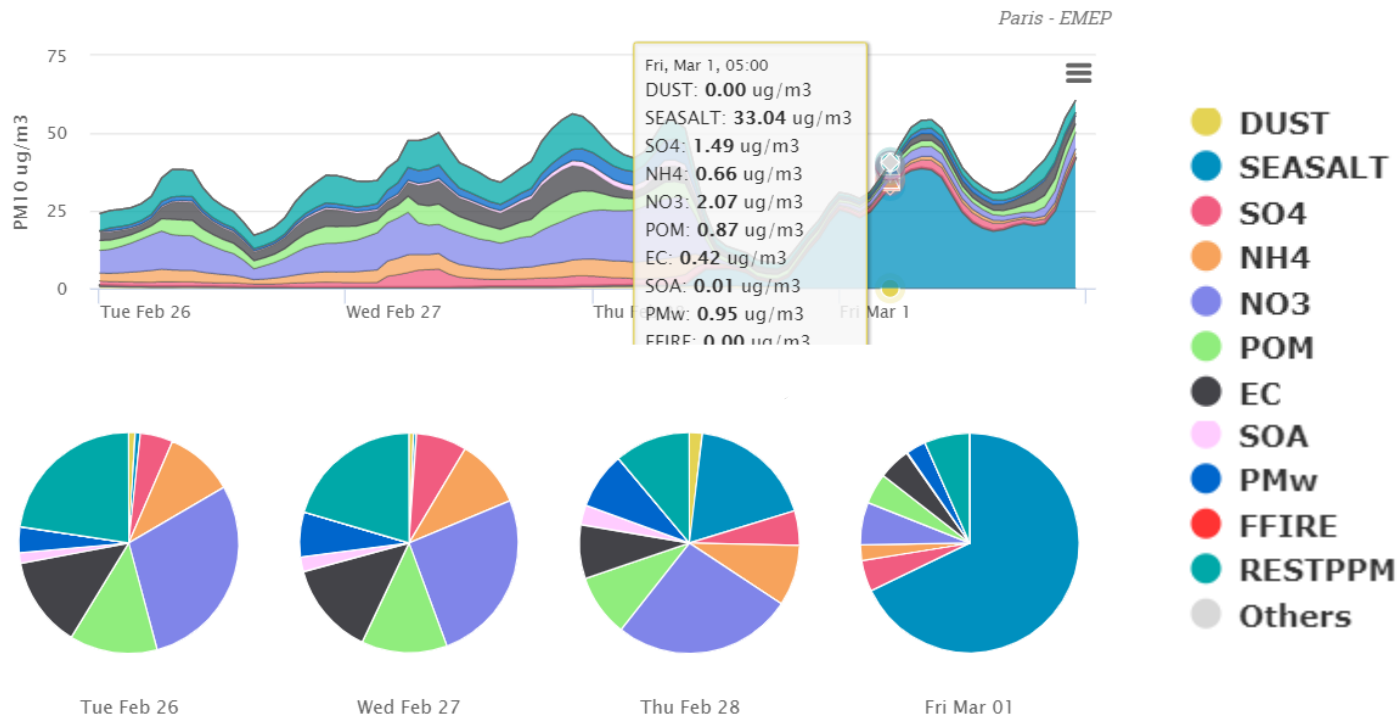
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CAMS – Daily Source allocation





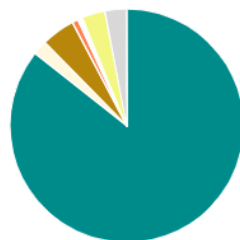
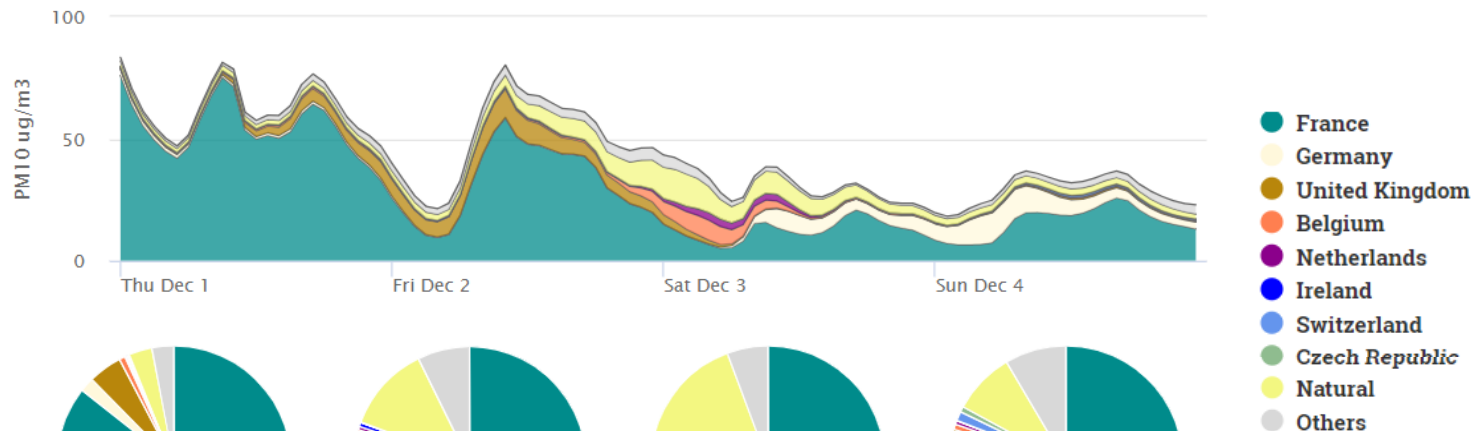
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CAMS - Previous episodes analyses

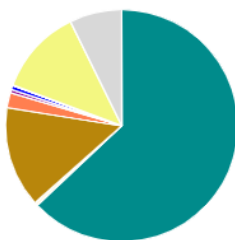
2016/12/01



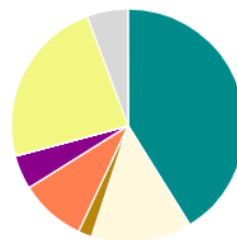
Paris - TNO



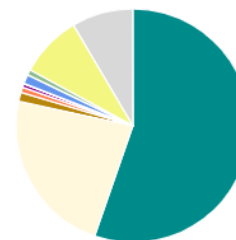
Thu Dec 01



Fri Dec 02



Sat Dec 03



Sun Dec 04

Tool developed
and maintained
by:

TNO innovation
for life

Norwegian
Meteorological
Institute

<https://policy.atmosphere.copernicus.eu/EpisodesAnalysis.php>

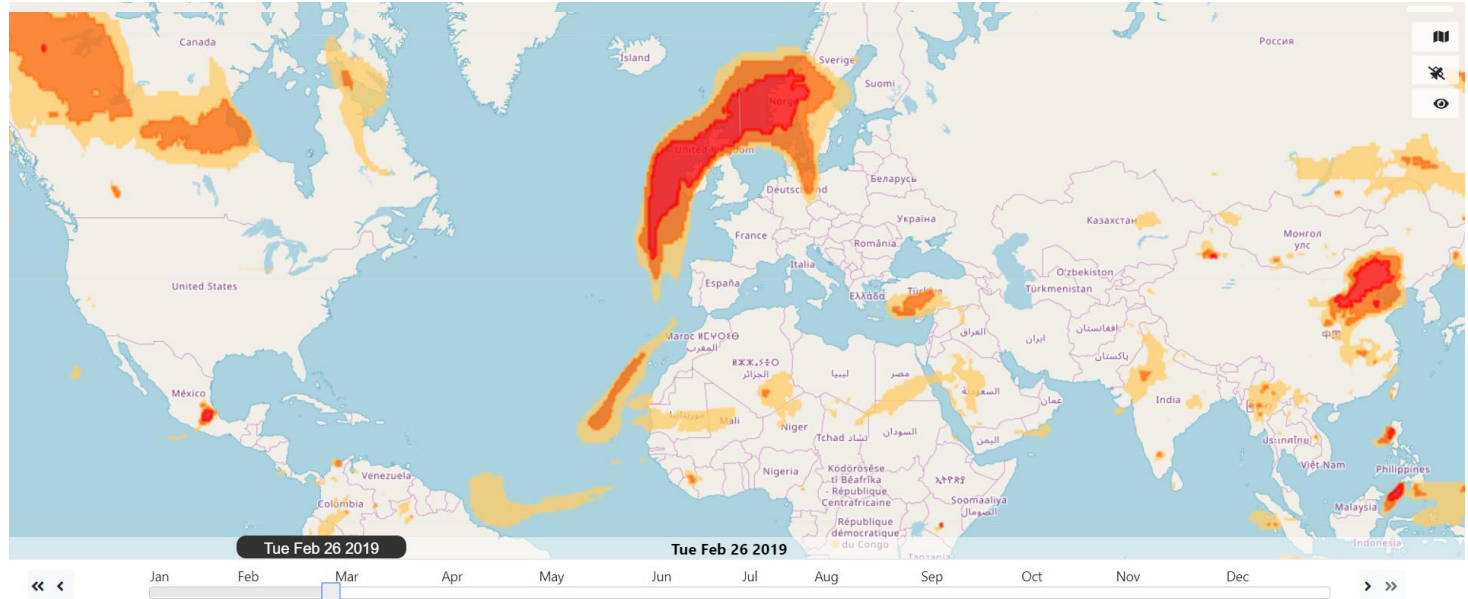
ECMWF Copernicus
Europe's eyes on Earth

European
Commission



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CAMS – Aerosol Alert Service



CAMS aerosol alert service, based on AOD (@550nm) from the CAMS global model with data assimilation. Colors indicate by how much the climatological average is exceeded.

Will be extended to surface concentrations!



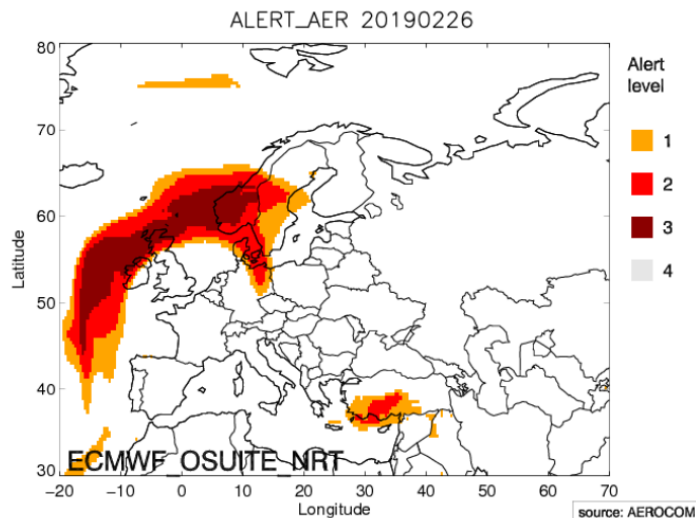
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CAMS – Aerosol Alert Service

AEROSOL ALERT MAP

Where aerosol AOD is at least factor 2 larger than climatology

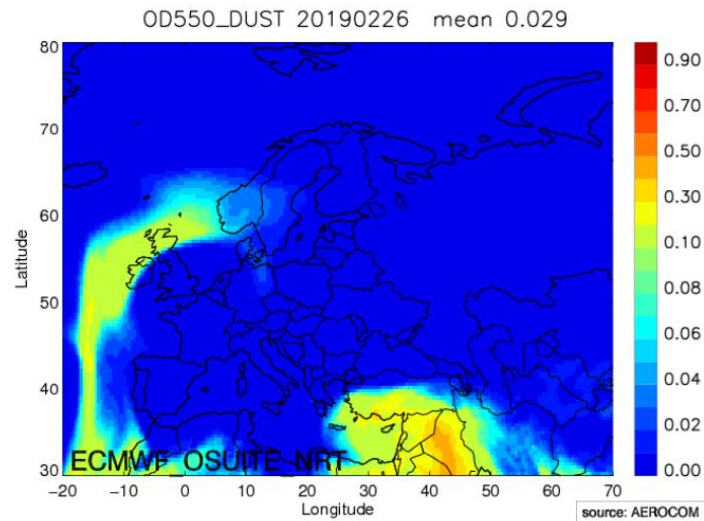
EUROPE ▼ an2019 ▼ d20190226 ▼



Aerosol Alert levels

Aerosol AOD **DUST OD** ORGANIC OD SULFATE OD

EUROPE ▼ an2019 ▼ d20190226 ▼



AOD / ECMWF OSUITE-NRT

https://aerocom.met.no/cgi-bin/surfobs_annualrs.pl



Conclusions

- ❑ CAMS products help...
 - to learn about causes of air pollution
 - alert the population
 - to assess the effects of air quality policy measures
- ❑ Data and reports are available for download, also backward in time
- ❑ Ongoing work:
 - include dust and SIA as separate output in regional forecasts/analyses
 - include surface PM in aerosol alert service
 - include more cities in the source-receptor tool
 - to assist in correct use and interpretation of the results
 - single out more natural sources