



# C A M S

Defining UV related risk zones  
Assessment of solar resources  
Regional Air Quality



# C A M S

Defining UV related risk zones



- Local authorities and health agencies deliver products for the general public under their citizen protection mandate.
- Information from CAMS (Copernicus Atmosphere Monitoring Service) products related to the **UV index** can be used :
  - To define **risk areas with high levels of UV** for dissemination to the general public.
  - To define **risk areas, especially in winter time at high latitude with low levels of UVB**, since the lack of UVB radiations increases the risk of vitamin D deficiency at high latitudes and dietary supplements are needed (Lamberg, Allardt et al., 2001).
  - To define **good UV index areas**, where levels of UV are efficient for the good health of people (UV are necessary for human beings).
- This submodule will show how to access the CAMS UV reanalysis service and to use this data to define UV-related risk **zones (for too high and too low UV areas)**.

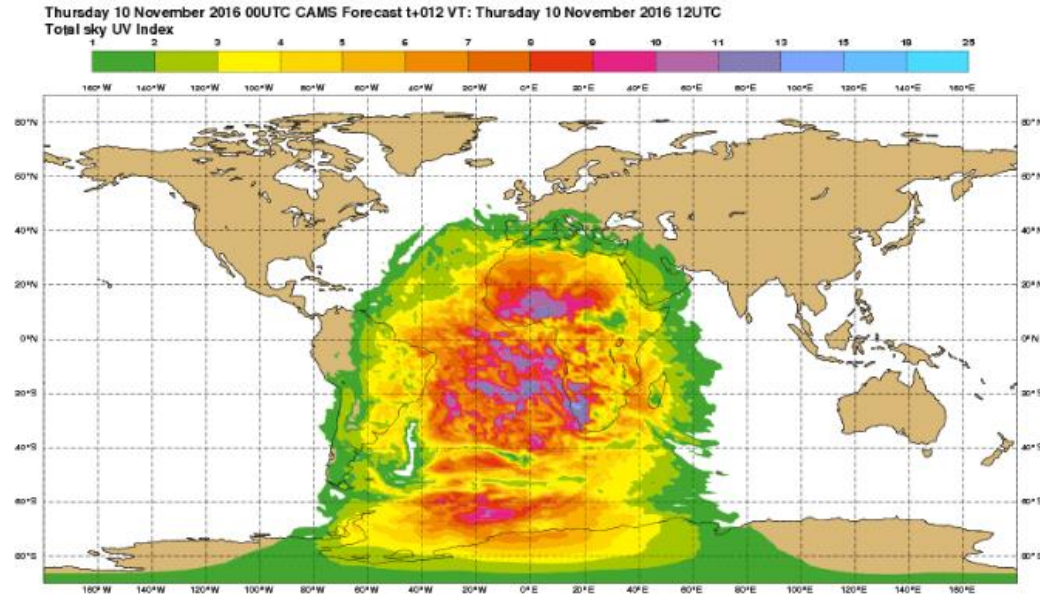


- Go to CAMS catalogue (<http://atmosphere.copernicus.eu/catalogue#> )
- Find the UV radiation data.
- Select 'Download data' and fill in the request form or login.
- Connect to the ECMWF portal: <http://apps.ecmwf.int/datasets/>
- Go to the MACC Reanalysis product.
- Select **Downward UV radiation at the surface**
- Retrieve Netcdf file
- Get maximum values from netcdf file
- Visualise the result and define UV related risk zones



# Downward UV radiation at the surface

- This service provides reanalysis and daily forecasts up to 5 days for the total sky and clear sky UV index





# Video 1: Get UV data from ECMWF portal

The screenshot displays the Copernicus Atmosphere Monitoring Service (AMS) Catalogue website. The browser address bar shows 'atmosphere.copernicus.eu/catalogue/'. The website header includes the Copernicus logo, the text 'Atmosphere Monitoring Service', and a search bar. Below the header is a navigation menu with links: ABOUT CAMS, NEWS & MEDIA, EVENTS, CATALOGUE, RESOURCES, TENDERS, and USER SUPPORT. The main section is titled 'Catalogue' and shows a search results page with 100 total results. On the left, there is a sidebar with filters for 'PRODUCT FAMILY' and 'PARAMETER'. The 'PRODUCT FAMILY' filter includes options like Anthropogenic emissions, Climate forcings, Fire emissions, Global analyses, Global forecasts, Global reanalyses, Greenhouse gas fluxes, Policy support, Regional analyses, Regional forecasts, and Solar radiation. The 'PARAMETER' filter includes options like Aerosol, Greenhouse gas, Radiation, and Reactive gas. The main content area displays four search results, each with a map thumbnail, a title, a description, and a 'Data Download' button. The results are: 1. 'Global forecasts of aerosol concentrations - sulphates' (Parameter: Sulphates concentration), 2. 'Global forecasts of aerosol concentrations - black carbon' (Parameter: Black carbon concentration), 3. 'Global forecasts of aerosol concentrations - dust (3 bins)' (Parameter: Dust concentration), and 4. 'Global forecasts of aerosol concentrations - PM2.5' (Parameter: PM2.5 concentration). Each result also has a 'More details' button. In the bottom right corner, there is a 'BETA' label.



Atmosphere  
Monitoring

# CAMS Success Story

**UV Index**

11+ **Extreme**

8,9,10 **Very High**

6,7 **High**

3,4,5 **Moderate**

1,2 **Low**

Sun protection is generally not needed unless outside for extended periods.

**5 ways to protect yourself**

- Slip on sun-protective clothing
- Slip on SPF30+ sunscreen. Reapply every 2 hours
- Slap on a broad brimmed hat
- Seek shade
- Slide on wrap-around sunglasses

**Check and Protect**

It is important for all Australians or visitors to Australia, to look and listen for UV Index levels in local weather forecasts.

**Remember**

You should use a combination of sun protection measures to keep you safe from UV radiation - never rely on just one.

**Further Information**

For more complex systems such as GIS tools or mapping tools we recommended that gridded UV information is used. This is available through our registered user services. Note that some fees and charges apply.

Note that the information is supplied by the Bureau of Meteorology but produced by the European Centre for Medium Range Weather Forecasts (ECMWF) Copernicus Atmosphere Monitoring Service (CAMS). If you use the UV and sun protection information then the Bureau asks that you acknowledge the ECMWF CAMS in any product or service derived from these data using the following or any similar notice 'Generated using Copernicus Atmosphere Monitoring Service Information [Year]'.

Element	Example	Comments
Lat	-34.92	Latitude (minus sign indicates degrees south) to two decimal places
Long	138.62	Longitude to two decimal places
Region	SA	Abbreviations for states and territories
Location	Albury-Wodonga	Place name
Day/Mon/Year	28 04 2016	DD MM YYYY
UV Alert period (local time)	Sun protection recommended from 11:00 am to 3:00 pm, Or Sun protection not recommended.	Sun protection times when the UV Index exceeds 3. Previously called UV Alert. In am/pm format and in local time. If the UV Index is not expected to reach 3 during the day then the words "Sun protection not recommended" are used.
UVI max	UV Index predicted to reach 4 [Moderate]	Maximum index plus worded intensity in square brackets.

**Australian Website of the  
Bureau of Meteorology:**

<http://www.bom.gov.au/uv/data.shtml>

- Real Time web app for UV and sun protection Index Data.
- Information produced by the European Centre for Medium Range Weather Forecasts (ECMWF) Copernicus Atmosphere Monitoring Service (CAMS).





# CAMS : Success Story

www.bom.gov.au/uv/index.shtml

[About UV and sun protection times](#)

## About UV and sun protection times

[UV Home](#) | [About the UV Index](#) | [FAQ](#) | [More UV Info](#) | [Data Services](#) | [Average UV Index](#)

The Bureau, Cancer Council and Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), have adopted Sun Protection Times based on the World Health Organisation's Global Solar UV Index.

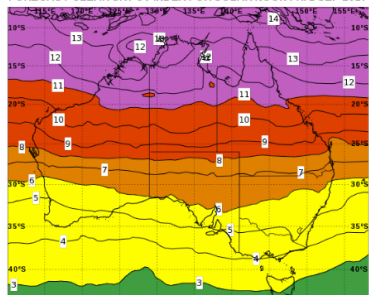
The Bureau's weather forecasts contain 'Sun protection times' in line with the Cancer Council's recommendation. For example:

"Sun protection recommended from 9:50 am to 4:10 pm, UV Index predicted to reach 10 [Very High]"

### Capital city forecasts

[Sydney](#) | [Melbourne](#) | [Brisbane](#) | [Perth](#) | [Adelaide](#) | [Hobart](#) | [Canberra](#) | [Darwin](#)

### FORECAST CLEAR SKY UV INDEX FOR SOLAR NOON FRI 1 SEP 2017



## UV Index

11+ Extreme

8,9,10 Very High

6,7 High

3,4,5 Moderate

1,2 Low

Sun protection is generally not needed unless outside for extended periods

## 5 ways to protect yourself

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Slip on a broad brimmed hat

Seek shade

Slide on wrap-around sunglasses

## Check and Protect

It is important for all Australians or visitors to Australia, to look and listen for UV index levels in local weather forecasts.

## Remember

You should use a combination of sun protection measures to keep you safe from UV radiation - never rely on just one.

## Further Information

- SunSmart
- SunSmart App

Browser tabs: Your dashboard, Isabelle Sole, CAMS\_subm, Roundcube W, RUS.Chat, USRisk #23, Recherche d'i, Ultraviolet (U...

Address bar: www.bom.gov.au/uv/data.shtml

Australian Government Bureau of Meteorology

HOME | ABOUT | MEDIA | CONTACTS | Enter search terms | Search

NSW VIC QLD WA SA TAS ACT NT AUSTRALIA GLOBAL ANTARCTICA

Bureau Home > About the UV Index > Ultraviolet (UV) Index Data Services

### Ultraviolet (UV) Index Data Services

[UV Home](#) | [About the UV Index](#) | [FAQ](#) | [More UV Info](#) | [Data Services](#) | [Average UV Index](#)

A range of services that contain UV and sun protection is available from the Bureau via its registered user catalogue. Ongoing systems or apps then it is highly recommended that you are kept you informed. Note that some fees and charges apply.

#### UV Index

11+ Extreme

8,9,10 Very High

6,7 High

3,4,5 Moderate

1,2 Low

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It is important for all Australians or visitors to Australia, to look and listen for UV index levels in local weather forecasts.

#### Remember

You should use a combination of sun protection measures to keep you safe from UV radiation - never rely on just one.

#### Further Information

- SunSmart
- SunSmart App

sign indicates degrees south) to two decimal places for states and territories

times when the UV index exceeds 3. Previously in am/pm format and in local time, is not expected to reach 3 during the day then the protection not recommended" are used.

plus worded intensity in square brackets.

recommended that gridded UV information is that some fees and charges apply.

but produced by the European Centre for here Monitoring Service (CAMS). If you use the knowledge the ECMWF CAMS in any product or

16:57 31/08/2017

## What they offer :

- Commercial service
- Different data format
- Different data offers



# C A M S

Assessment of solar resources



- Solar farm developers need to make a first assessment of solar resource in order to identify suitable sites.
- Time series of solar data are necessary to produce solar resource assessment reports that are requested by bankers to finance a solar plant
- Copernicus Atmosphere Monitoring Service is useful to do that.
- This assessment is based on several years of solar radiation data.
- Developers analyze the time series data to:
  - Assess daytime, inter-monthly and inter-yearly variabilities.
  - Compare several candidate sites
  - Produce solar resource assessment reports
  - Compare with measurements and assess accuracy



## U s e c a s e

- This submodule describes how to access solar data from the **CAMS McClear Clear-Sky Irradiation** service.
- This service delivers time series of irradiation:
  - Clear sky conditions
  - Time step ranging from 1 min to 1 month
  - Global, Direct and Diffuse Horizontal Irradiations are provided
  - Data are available from Jan. 2004 up to current day -2.



- Go to CAMS catalogue  
(<http://atmosphere.copernicus.eu/catalogue#/>)
- Select Solar radiation.
- Choose Global clear-sky surface solar irradiance.
- Login or register to access the solar radiation service  
(<http://www.soda-pro.com/webservices/radiation/cams-radiation-service> )
- Choose location on map
- Extract 10 years of data and save it as csv file
- Using MS excel/OpenOffice:
  - aggregate the data on yearly base
  - Calculate the yearly and monthly means
  - build the corresponding inter-monthly and inter-yearly variabilities
  - build the daytime variability



# Global Clear-Sky Surface Solar irradiance

- Video 1 :
  - Access service and download data
- Video 2 :
  - Analyse data in Excel

CARE RADIATION SERVICE

Map of Africa and the Middle East showing a location marker.

Coordinates:  $\phi = 19.3523$ ,  $\lambda = 7.3770$  (lat = 19.3523, lon = 7.3770) (units = 0)

Latitude (from -66 to 66 deg):

Longitude (from -66 to 66 deg):

Altitude (in Automatic if empty):

Start Date (from 2004-02-01):

End Date (up to 2 days ago):

Time Step:

Time Reference:

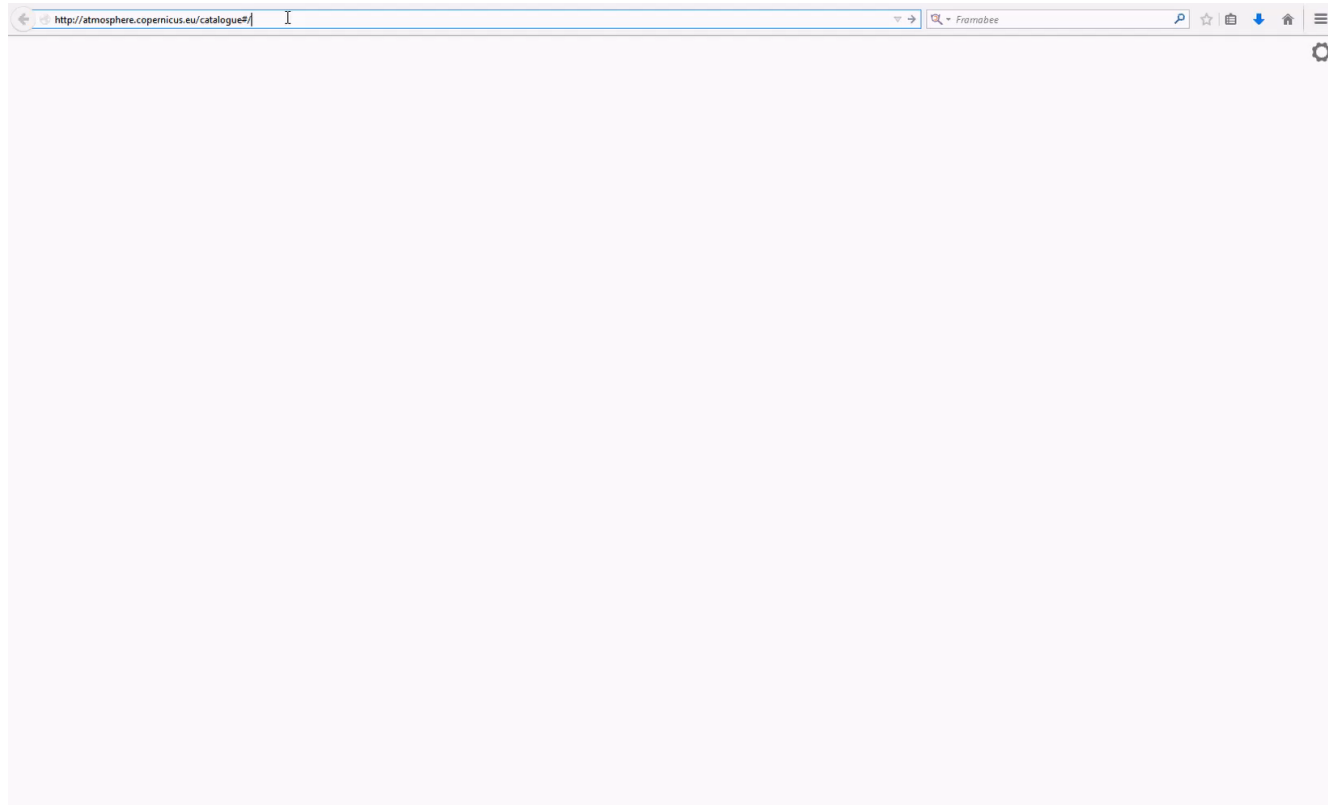
Include detailed info in atmosphere (1 min UT -01):

Output Format:



Atmosphere  
Monitoring

# Video 1 : Access CAMS service





# Video 2 : Data Analysis in Excel

irradiation-2016.xlsx - Excel

Vincent Maupas

FICHIER ACCUEIL INSERTION MISE EN PAGE FORMULES DONNÉES RÉVISION AFFICHAGE

Couper Copier Reproduire la mise en forme Presse-papiers Police Alignement Nombre

Standard Mise en forme conditionnelle Mettre sous forme de tableau Styles de cellules Insérer Supprimer Format Remplissage Effacer

2016-10-26T23:45:00.0/2016-10-27T00:00:00.0

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	# Coding: utf-8															
2	# File format version: 2															
3	# Title: CAMS McClear v2.7 model of clear-sky irradiation.															
4	# Content: A time-series of solar radiation received on horizontal plane and plane always normal to the sun rays at ground level assuming clear sky.															
5	# Calls on the McClear clear-sky model. Returns the global, beam and diffuse irradiations integrated over a selected time step,															
6	# for a selected location (worldwide coverage) and a selected period.															
7	# The research leading to these results has received funding from the European Union within the Copernicus programme.															
8	# Provider: MINES ParisTech (France)															
9	# More information at: <a href="http://www.soda-pro.com/web-services/radiation/cams-mcclear">http://www.soda-pro.com/web-services/radiation/cams-mcclear</a>															
10	# Date begin (ISO 8601): 2016-05-01T00:00:00.0															
11	# Date end (ISO 8601): 2016-10-27T00:00:00.0															
12	# Latitude (positive North, ISO 19115): 43.5290															
13	# Longitude (positive East, ISO 19115): 1.5295															
14	# Altitude (m): 152.00															
15	# Time reference: Universal time (UT)															
16																
17	# Encoding partly from D2.8.III.13-14 INSPIRE Data Specification on Atmospheric Conditions and Meteorological Geographical Features - Technical Guidelines (2013-12-10) and CF (Climate and Forecast) metadata (2013-11-11)															
18	# CF Standard Names registry of ObservablePropertyValue															
19	# <a href="http://cfconventions.org/Data/cf-standard-names/27/build/cf-standard-name-table.html">http://cfconventions.org/Data/cf-standard-names/27/build/cf-standard-name-table.html</a>															
20	# urn:x-inspire:specification:DS-AC-MF:observable-property-name:cf-standard-name:1.6															
21	# ObservableProperty															
22	# basePhenomenon:"integral_of_surface_downwelling_shortwave_flux_in_air_assuming_clear_sky_wrt_time"															
23	# uom:"Wh m-2" [unit]															
24	# StatisticalMeasure															
25	# statisticalFunction:"sum"															
26	# Summarization (integration) period: 0 year 0 month 0 day 0 h 15 min 0 s															
27	# noValue: nan															
28																
29	# Columns:															
30	# 1. Observation period (ISO 8601)															
31	# 2. TOA. Irradiation on horizontal plane at the top of atmosphere (Wh/m2)															
32	# 3. Clear sky GHI. Clear sky global irradiation on horizontal plane at ground level (Wh/m2)															
33	# 4. Clear sky BHI. Clear sky beam irradiation on horizontal plane at ground level (Wh/m2)															
34	# 5. Clear sky DHI. Clear sky diffuse irradiation on horizontal plane at ground level (Wh/m2)															
35	# 6. Clear sky BNI. Clear sky beam irradiation on mobile plane following the sun at normal incidence (Wh/m2)															

irradiation-2016 irradiation-2016 + graphs (1) irradiation-2016 + graphs (2) irradiation-2016 + graphs (3)

PRÉT



## Copernicus CAMS Solar App: a Copernicus CAMS based App, operated by NOVELTIS & ECMWF

- Integrated Decision Support System for the  
**development of rooftop photovoltaic power stations**



- **Context:**

**Sun** = most important source of renewable energy available, free energy and inexhaustible resource that can be acquired by installing rooftop photovoltaic power stations.

**Integration of photovoltaic panels on rooftops** = simple, running cost low and maintenance reduced.

The installation pays for itself in a few years with financial aid, i.e. tax credit and the sale and/or credit of electricity to various suppliers.



**Looking for solution to analyse the relevance of Solar panels installation**

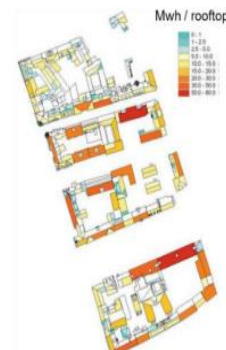
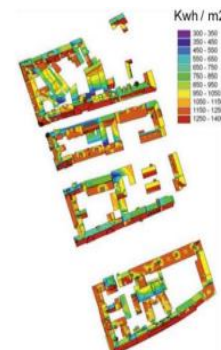


# Success story : Copernicus CAMS Solar App

- **Solution using Copernicus CAMS:**



- Developed by NOVELTIS and ONERA over Toulouse.



- This decision support system **integrate among others solar radiation data produced by the Copernicus service of the European Commission** operated by the European Center for Medium-range Weather Forecasts (ECMWF).
- **This service provides to the user concrete estimation of the feasibility and the relevance of installing photovoltaic panels on his roof.**



# CAMS

## Regional Air Quality



# Outline

- Regional quality forecasting in CAMS
- Data access:
  - Pollutants: maps and data
- Fire emissions and smoke dispersion
- Tools to view data
- Summary



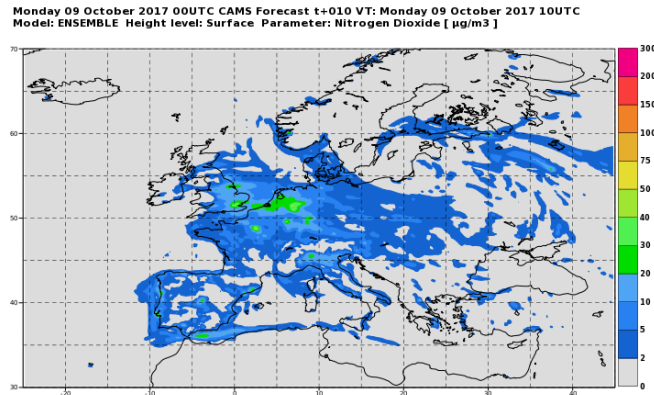
# General

- Air quality forms a significant risk factor for health conditions
- Various source of pollutants (anthropogenic & natural)
  - Industry, energy production, transportation
  - Agriculture, waste burning
  - Wildland fires
  - Pollen
  - Volcanoes, sea salt
- Regulated: NO<sub>x</sub>, SO<sub>x</sub>, O<sub>3</sub>, CO, PM<sub>10</sub>, PM<sub>25</sub>
- Other species in CAMS: NH<sub>3</sub>, NMVOC, PAN, Grass, Birch and Olive pollen
- Different models -> Different errors: Ensemble

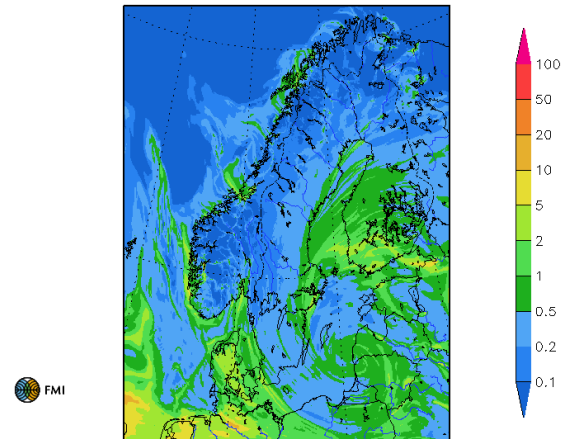


## Available data and models

- Global atmospheric composition forecasting system operated at ECMWF (~130km resolution)
- Ensemble of seven regional models 4-days forecast validated daily (~10km resolution)
- Downstream models (kilometer-ish resolution)

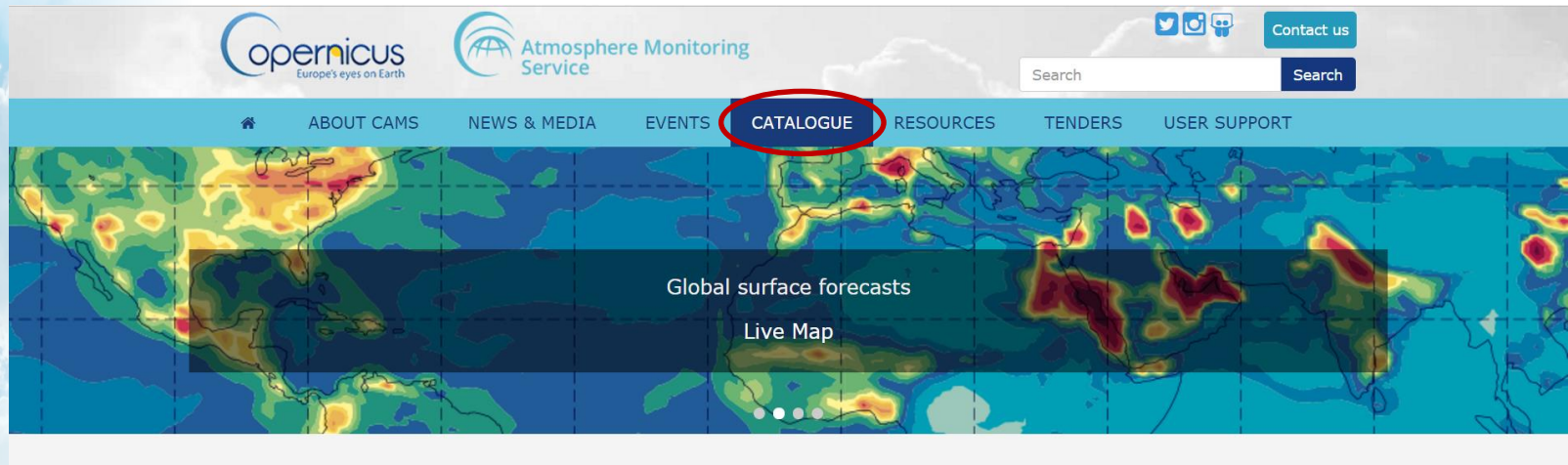


Forecast for NO<sub>2</sub> gas. Last analysis time: 2017-10-09 00:00  
Concentration,  $\mu\text{g}/\text{m}^3$ , 10:00 09 OCT 2017





- This demonstration will show how to view and extract **an ensemble surface forecast for  $O_3$**  for one year.
- Have a look at CAMS catalogue:  
([\*\*https://atmosphere.copernicus.eu/catalogue#/\*\*](https://atmosphere.copernicus.eu/catalogue#/))





# Hands-on demo / Surface forecast

The screenshot displays the Copernicus Atmosphere Monitoring Service (AMS) Catalogue interface. The top navigation bar includes links for ABOUT CAMS, NEWS & MEDIA, EVENTS, CATALOGUE, RESOURCES, TENDERS, and USER SUPPORT. A search bar is located on the right. The main content area is titled 'Catalogue' and shows a list of products. On the left, a sidebar contains a 'PRODUCT FAMILY' section with a list of categories: Anthropogenic emissions, Climate forcings, Fire emissions, Global analyses, Global forecasts, Global reanalyses, Greenhouse gas fluxes, Interim regional reanalyses, Policy support, Regional analyses, and Regional forecasts. The 'Regional forecasts' option is selected and circled in red. Below this is the 'PARAMETER FAMILY' section with options for Aerosol, Greenhouse gas, and Radiation. The main content area displays a list of products. The first product, 'European-scale air quality forecast from model ensemble - ozone', is highlighted with a red box. It includes a map thumbnail, a description, and a 'Data Download' button, which is also circled in red. The second product, 'European-scale air quality forecast from model ensemble - carbon monoxide', is partially visible below it. The bottom of the screen shows a Windows taskbar with various application icons and a system clock indicating 14:44 on 17.1.2017.

atmosphere.copernicus.eu/catalogue/#/

Copernicus Europe's eyes on Earth

Atmosphere Monitoring Service

Search

ABOUT CAMS NEWS & MEDIA EVENTS CATALOGUE RESOURCES TENDERS USER SUPPORT

Catalogue

Home

Search

Reset

PRODUCT FAMILY

- ☐ Anthropogenic emissions
- ☐ Climate forcings
- ☐ Fire emissions
- ☐ Global analyses
- ☐ Global forecasts
- ☐ Global reanalyses
- ☐ Greenhouse gas fluxes
- ☐ Interim regional reanalyses
- ☐ Policy support
- ☐ Regional analyses
- ☒ Regional forecasts

PARAMETER FAMILY

- ☐ Aerosol
- ☐ Greenhouse gas
- ☐ Radiation

CURRENT FILTERS:

Product family: Regional forecasts

Total results: 87

European-scale air quality forecast from model ensemble - ozone

This service provides the ensemble median of the European-scale air quality forecasts for every hour up to 4 days in advance. The maps provided are only representative for large scale phenomena, they cannot reproduce local aspects of air pollution.

Parameter: Ozone

More details

Data Download

European-scale air quality forecast from model ensemble - carbon monoxide

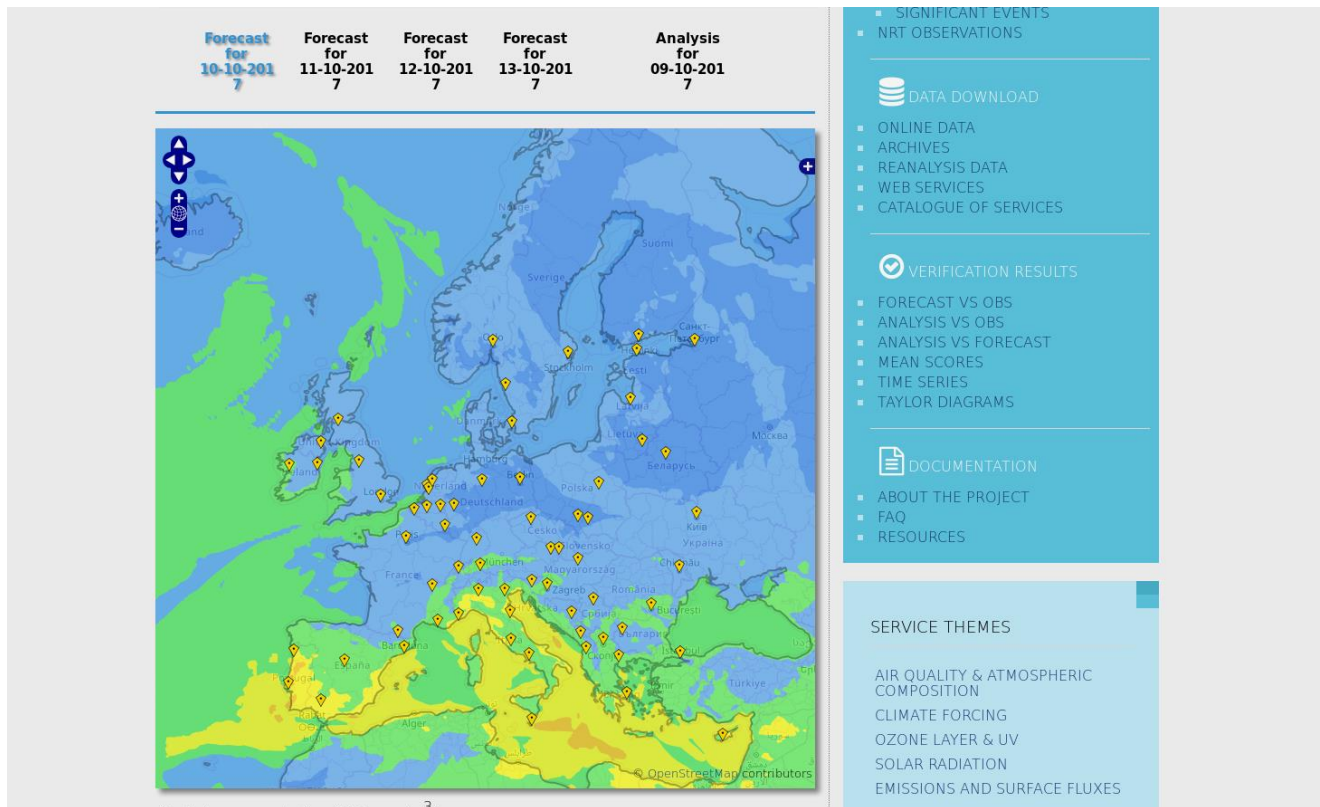
More details

14:44 17.1.2017



# Interactive maps

Atmosphere  
Monitoring





## ▼ About the ENSEMBLE model

### DOWNLOAD CAMS EUROPEAN AIR QUALITY DATA

#### About European air quality DATA ACCESS:

Data issued by the Ensemble model and partner models are available for download after reading and accepting the **CAMS data licence terms**.



**DOWNLOAD ONLINE DATA** (less than 30 days old)



**DOWNLOAD ARCHIVED DATA** (more than 30 days old)



**DOWNLOAD REANALYSIS DATA** (yearly average, seasonal statistics, ...)



**WEB-SERVICES** (registration required):



## ▼ READ MORE

### FORECASTS

Reactive Gases  
Aerosols  
European Air Quality  
Ozone Layer  
CO<sub>2</sub>





Atmosphere  
Monitoring

# Form for data access

Scale  
<20

**WARN**  
Daily m  
degree  
Please  
peak c

▼ A

▼ A

DO

About  
Data is  
after

DOW


DOW

DOW

WEB-

▼ B

## EUROPEAN AIR QUALITY - DOWNLOAD ONLINE DATA

 CAMS Regional Air Quality - Online data (less than 30 days old)

Select a model ⓘ : ENSEMBLE

Select a type for your data ⓘ : ANALYSIS

Select a species ⓘ : CO

Select a type of level ⓘ : Surface

Select a time step package ⓘ : From -24H to -1h

Select a reference time ⓘ : 2017-10-10T00:00:00Z

Select a format for your data ⓘ : NetCDF

Get data :

☒ In order to download CAMS data products, the CAMS data license available [here](#) must be accepted

[https://download.regional.atmosphere.copernicus.eu/services/CAMS50?token=\\_\\_M0bChv6QsoOFqHz31VRqnpr4GhWptcpaRy3oeZjBNSg\\_\\_&grid=0.1&model=ENSEMBLE&package=ANALYSIS\\_CO\\_SURFACE&time=-24H-1H&referencetime=2017-10-10T00:00:00Z&format=NETCDF&licence=yes](https://download.regional.atmosphere.copernicus.eu/services/CAMS50?token=__M0bChv6QsoOFqHz31VRqnpr4GhWptcpaRy3oeZjBNSg__&grid=0.1&model=ENSEMBLE&package=ANALYSIS_CO_SURFACE&time=-24H-1H&referencetime=2017-10-10T00:00:00Z&format=NETCDF&licence=yes)



## PRODUCT FAMILY ▼

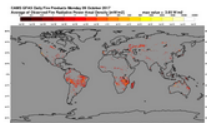
- ☐ Anthropogenic emissions
- ☐ Climate forcings
- ☐ Fire emissions
- ☐ Global analyses
- ☐ Global forecasts
- ☐ Global reanalyses
- ☐ Greenhouse gas fluxes
- ☐ Interim regional reanalyses
- ☐ Policy support
- ☐ Regional analyses
- ☐ Regional forecasts
- ☐ Solar radiation

## PARAMETER FAMILY ▼

- ☐ Aerosol
- ☒ Fire
- ☐ Greenhouse gas
- ☐ Radiation
- ☐ Reactive gas

## PARAMETER ▼

Total results: 1



### NRT Biomass burning emissions of carbon and various trace species based on assimilated Fire Radiative Power (FRP) (GFAS)

This service provides daily biomass burning emissions of various aerosol, greenhouse gas, and chemical species based on Fire radiative Power (FRP) satellite observations

**Parameter:** Fire Radiative Power

BETA

More details



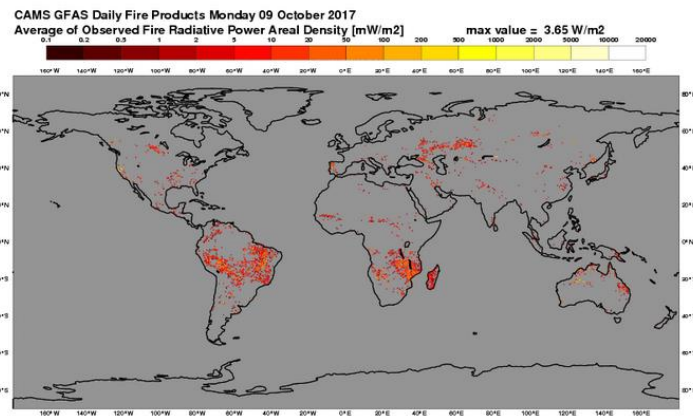
Data Download

#1



## NRT Biomass burning emissions of carbon and various trace species based on assimilated Fire Radiative Power (FRP) (GFAS)

[Back to index](#)



This service provides daily biomass burning emissions of various aerosol, greenhouse gas, and chemical species based on Fire radiative Power (FRP) satellite observations

**Theme:** Emissions and fluxes

**Product family:** Fire emissions

**Parameter:** Fire Radiative Power

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

**Time coverage:**

**Metadata:** [XML](#)



Data download



Plots

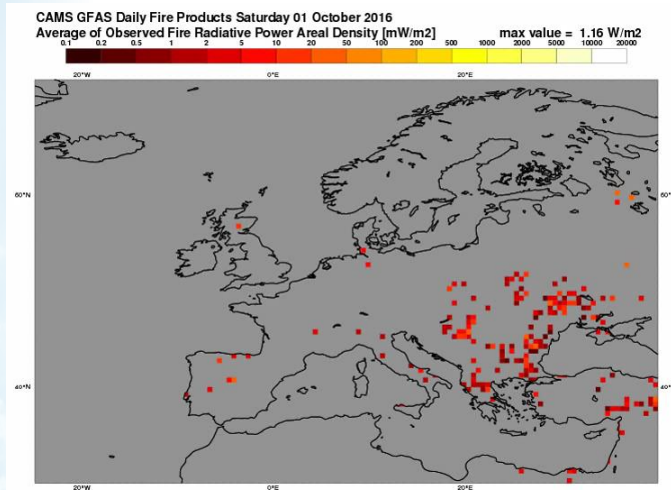


Contact us



Atmosphere  
Monitoring

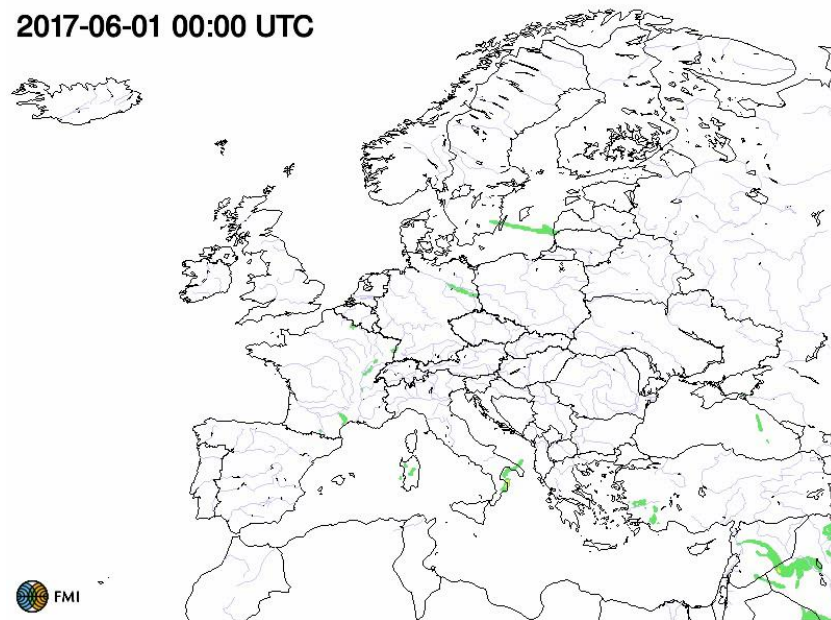
# Fire emissions and pollution



↑ GFAS FRP (emissions)

Silam simulations of fire PM→

2017-06-01 00:00 UTC





- **Panoply:**
  - Panoply is developed by the NASA
  - It plots geo-referenced arrays from netCDF, HDF, GRIB, and other dataset
  - Panoply is a cross-platform application that runs on Macintosh, Windows, Linux and other desktop computers.
  - Download link: <http://www.giss.nasa.gov/tools/panoply/>
- **QGIS:**
  - QGIS is an Open Source Geographic Information System (GIS).
  - QGIS is an official project of the Open Source Geospatial Foundation (OSGeo)
  - It runs on Linux, Unix, Mac OSX, Windows and Android
  - It supports numerous vector, raster, and database formats and functionalities.
  - Download link: <https://www.qgis.org/en/site/forusers/download.html>
- **Others:**
  - GrADS, Python, others





## S u m m a r y

- Plenty of AQ information available
- Both reanalysis and forecasts
- Scales from global to European to regional
- Various tools to access the data in different formats
- Feel free to explore
  - <https://atmosphere.copernicus.eu>
- Each application needs specific data in specific format
- More detailed and/or specific data from CAMS members
- Feel free to ask more!