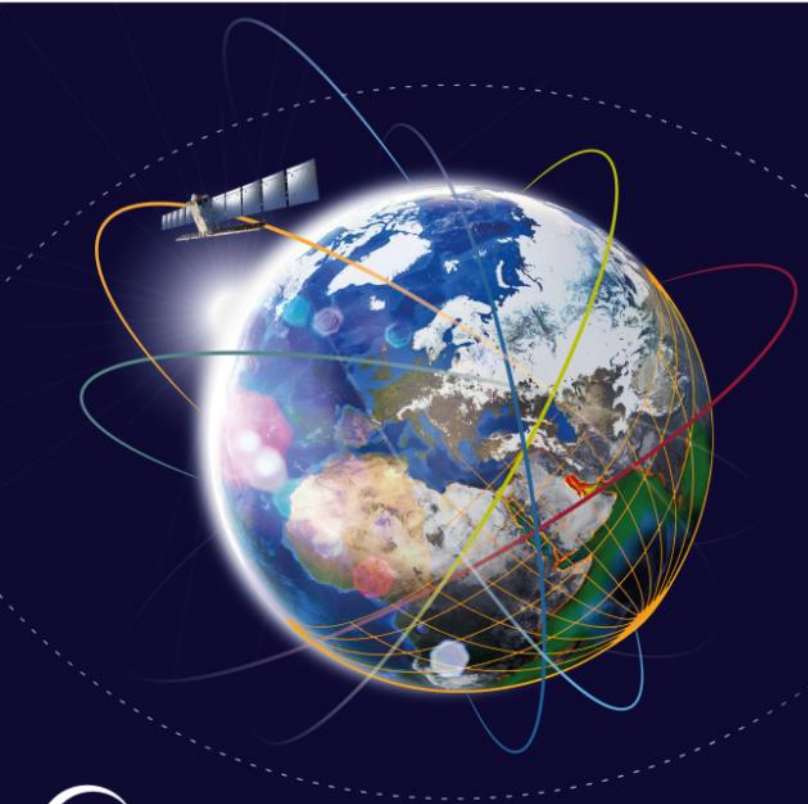
European Commission



C A M S

Defining UV related risk zones

Assessment of solar resources

Regional Air Quality

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Atmosphere Monitoring

Use case

- 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 beeings).
- 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)*.

Atmosphere Monitoring

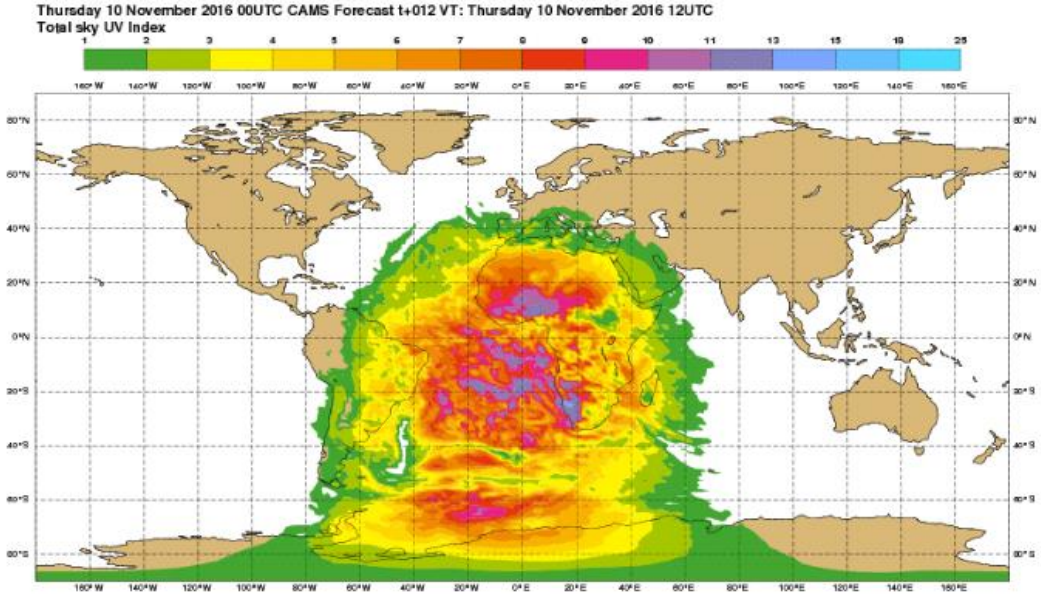
Hands-on demo

- 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

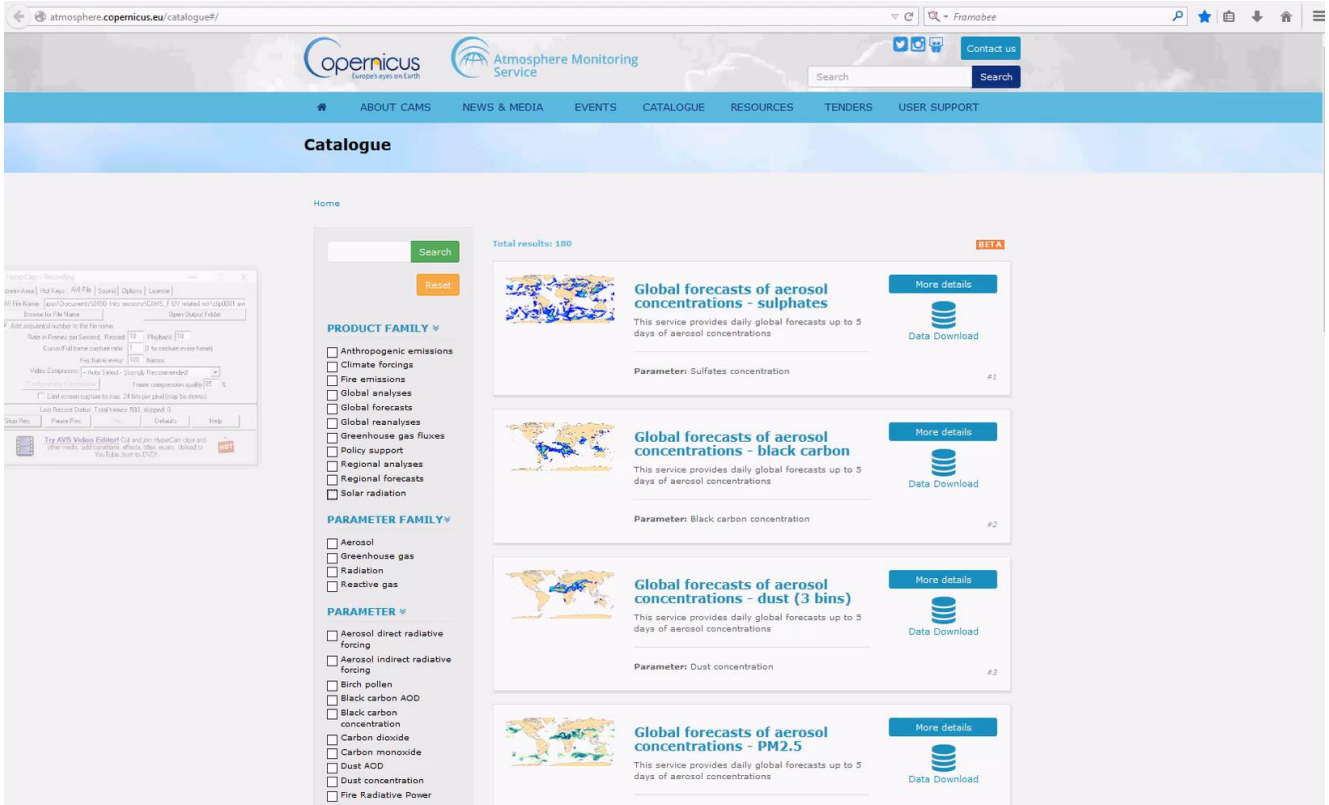
Atmosphere Monitoring

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



Atmosphere Monitoring

Video 1: Get UV data from ECMWF portal



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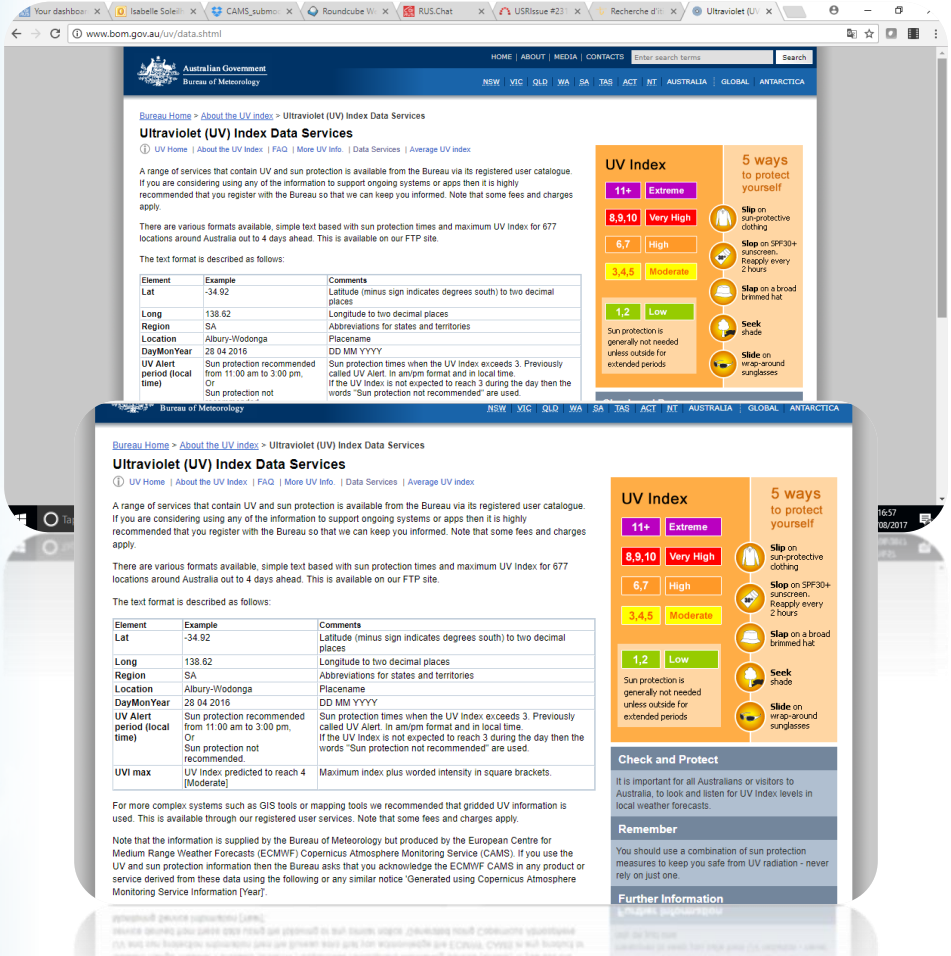
CAMS Success Story

Atmosphere Monitoring



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).

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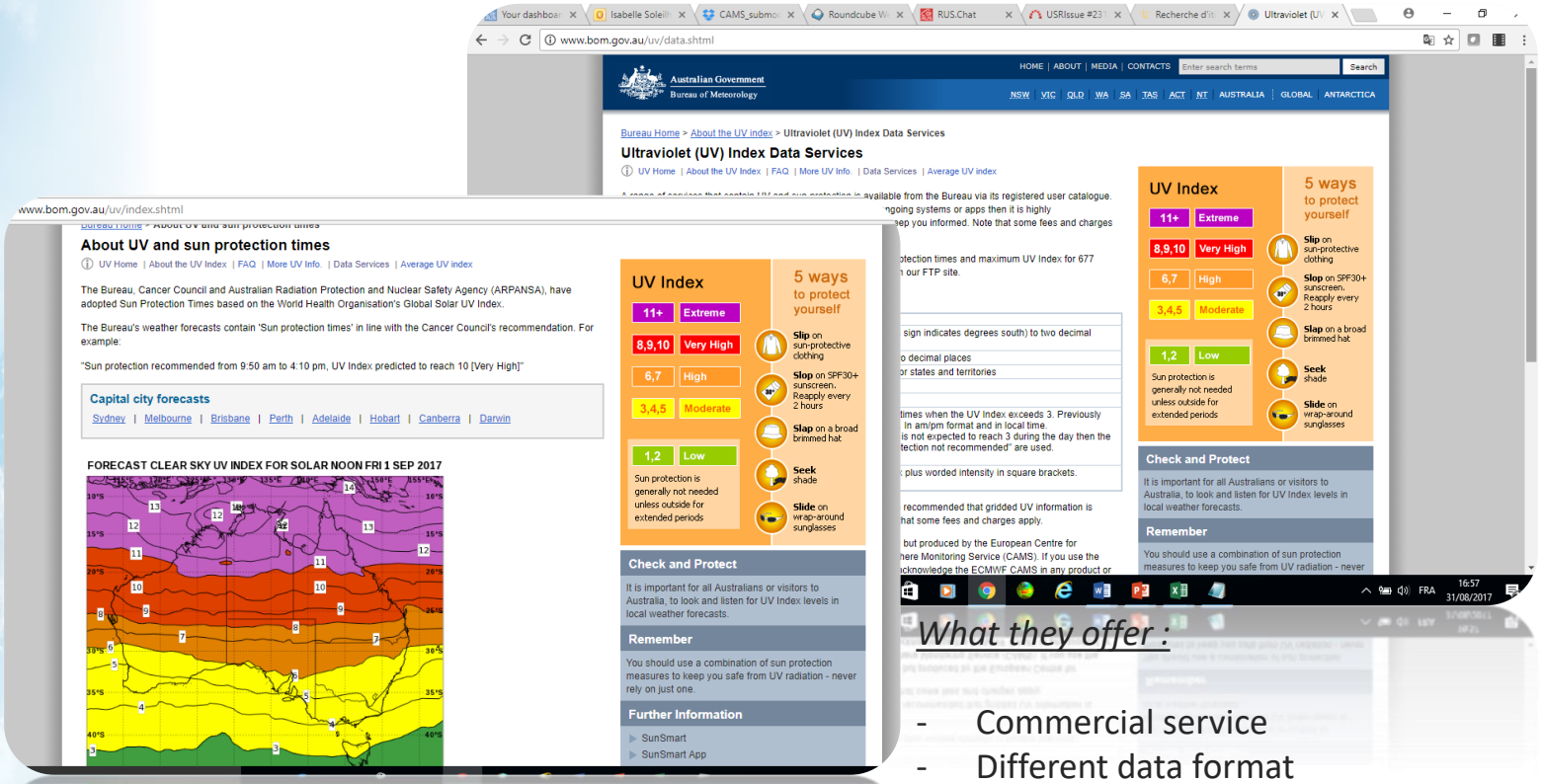
CAMS : Success Story

Atmosphere Monitoring



What they offer :

- Commercial service
- Different data format
- Different data offers

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Atmosphere Monitoring

Context

- 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

Use case

- 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.

Atmosphere Monitoring

Hands-on demo

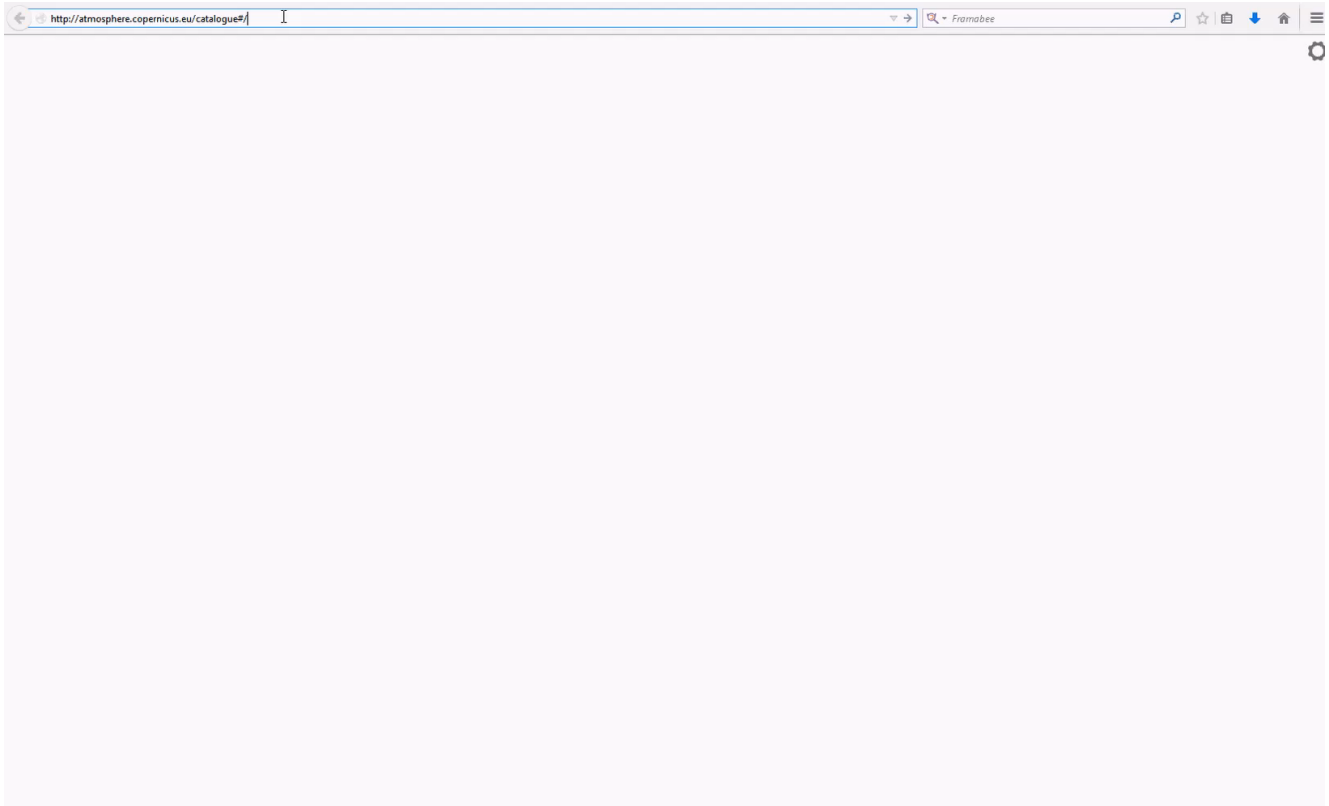
- Go to CAMS catalogue (http://atmosphere.copernicus.eu/catalogue#/)
- Select Solar radiation.
- Choose Global clear-sky surface solar irradiance.
- Login or register to access the solar radiation service (http://www.soda-pro.com/webservices/radiation/cams-radiation-service)
- Choose location on map
- 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

Atmosphere Monitoring

Video 1 : Access CAMS service



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Video 2 : Data Analysis in Excel

irradiation-2016.xlsx - Excel

A28837 | 2016-10-26T23:45:00.0/2016-10-27T00:00:00.0

```
# Coding: utf-8
# File format version: 2
# Title: CAMS McClear v2.7 model of clear-sky irradiation.
# 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.
#        Calls on the McClear clear-sky model. Returns the global, beam and diffuse irradiations integrated over a selected time step,
#        for a selected location (worldwide coverage) and a selected period.
# The research leading to these results has received funding from the European Union within the Copernicus programme.
# Provider: MINES ParisTech (France)
# More information at: http://www.soda-pro.com/web-services/radiation/cams-mcclear
# Date begin (ISO 8601): 2016-05-01T00:00:00.0
# Date end (ISO 8601): 2016-10-27T00:00:00.0
# Latitude (positive North, ISO 19115): 43.5290
# Longitude (positive East, ISO 19115): 1.5295
# Altitude (m): 152.00
# Time reference: Universal time (UT)
#
# 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)
# CF Standard Names registry of ObservablePropertyValue
# http://cfconventions.org/Data/cf-standard-names/27/build/cf-standard-name-table.html
# urn:x-inspire:specification:DS-AC-MF:observable-property-name:cf-standard-name:1.6
# ObservableProperty
#   basePhenomenon:"integral_of_surface_downwelling_shortwave_flux_in_air_assuming_clear_sky_wrt_time"
#   uom:"Wh m-2" [unit]
# StatisticalMeasure
#   statisticalFunction: "sum"
# Summarization (integration) period: 0 year 0 month 0 day 0 h 15 min 0 s
# noValue: nan
#
# Columns:
# 1. Observation period (ISO 8601)
# 2. TOA. Irradiation on horizontal plane at the top of atmosphere (Wh/m2)
# 3. Clear sky GHI. Clear sky global irradiation on horizontal plane at ground level (Wh/m2)
# 4. Clear sky BHI. Clear sky beam irradiation on horizontal plane at ground level (Wh/m2)
# 5. Clear sky DHI. Clear sky diffuse irradiation on horizontal plane at ground level (Wh/m2)
# 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)

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Success story : Copernicus CAMS Solar App

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.

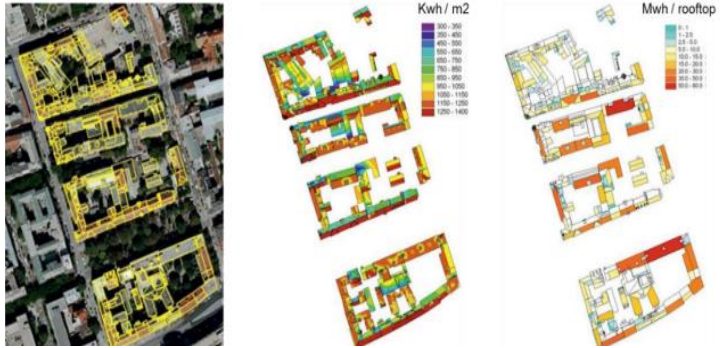
Looking for solution to analyse the relevance of Solar panels installation

Atmosphere Monitoring

Success story : Copernicus CAMS Solar App

- **Solution using Copernicus CAMS:**

CAMS SOLAR APP



- 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.**

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Atmosphere Monitoring

Outline

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

Atmosphere Monitoring

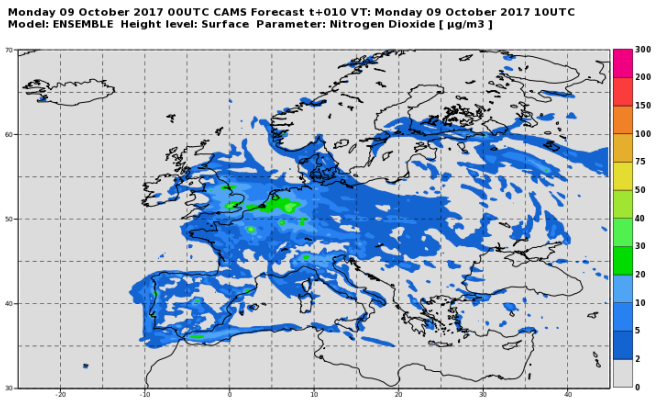
General

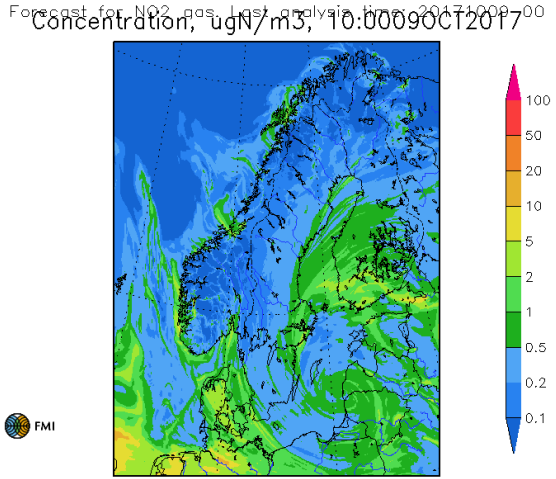
- Air quality forms a significant risk factor for health conditions
- Various source of pollutants (anthropogenic & natural)
  - Industry, energy production, transportation
  - Agriculture, waste burning
  - Wildland fires
  - Pollen
  - Volcanoes, sea salt
- Regulated: NOx, SOx, O3, CO, PM10, PM25
- Other species in CAMS: NH3,NMVOC, PAN, Grass, Birch and Olive pollen
- Different models -> Different errors: Ensemble

Atmosphere Monitoring

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)





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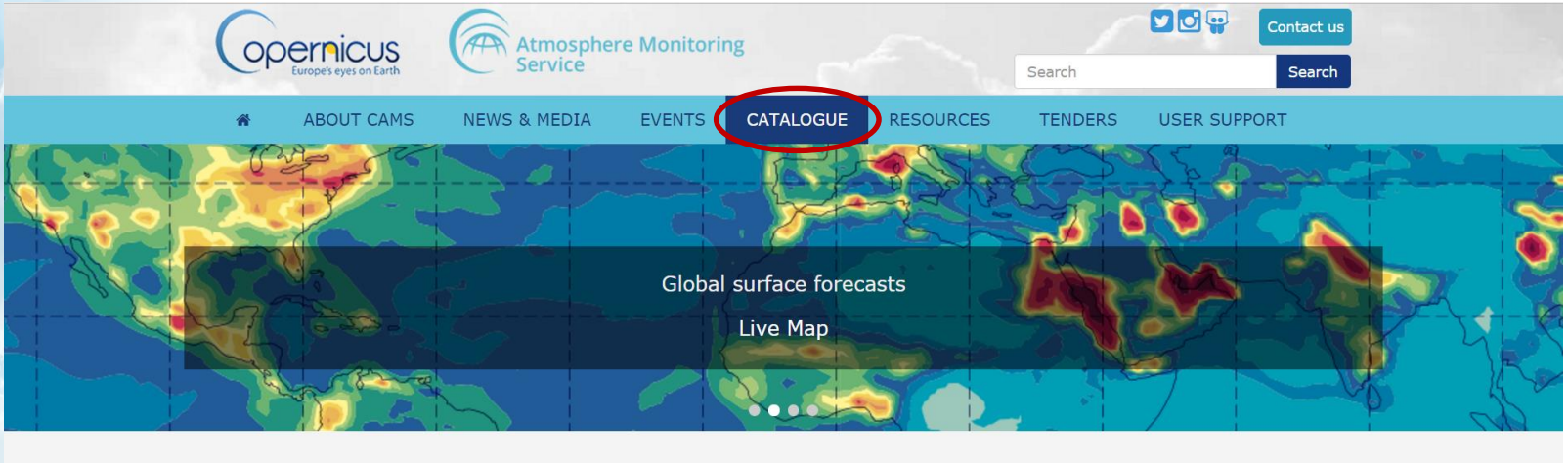
Hands-on demo

- 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#/**)



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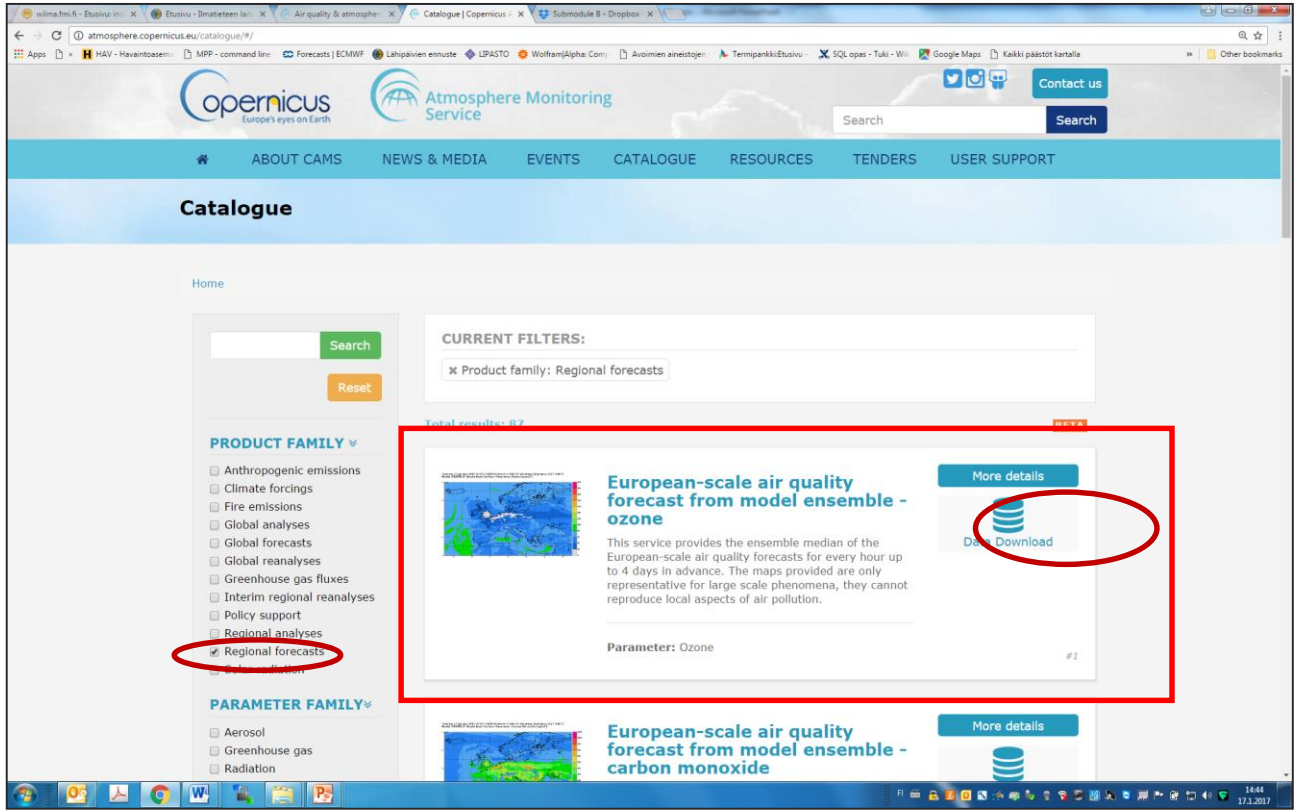
Hands-on demo/Surface forecast



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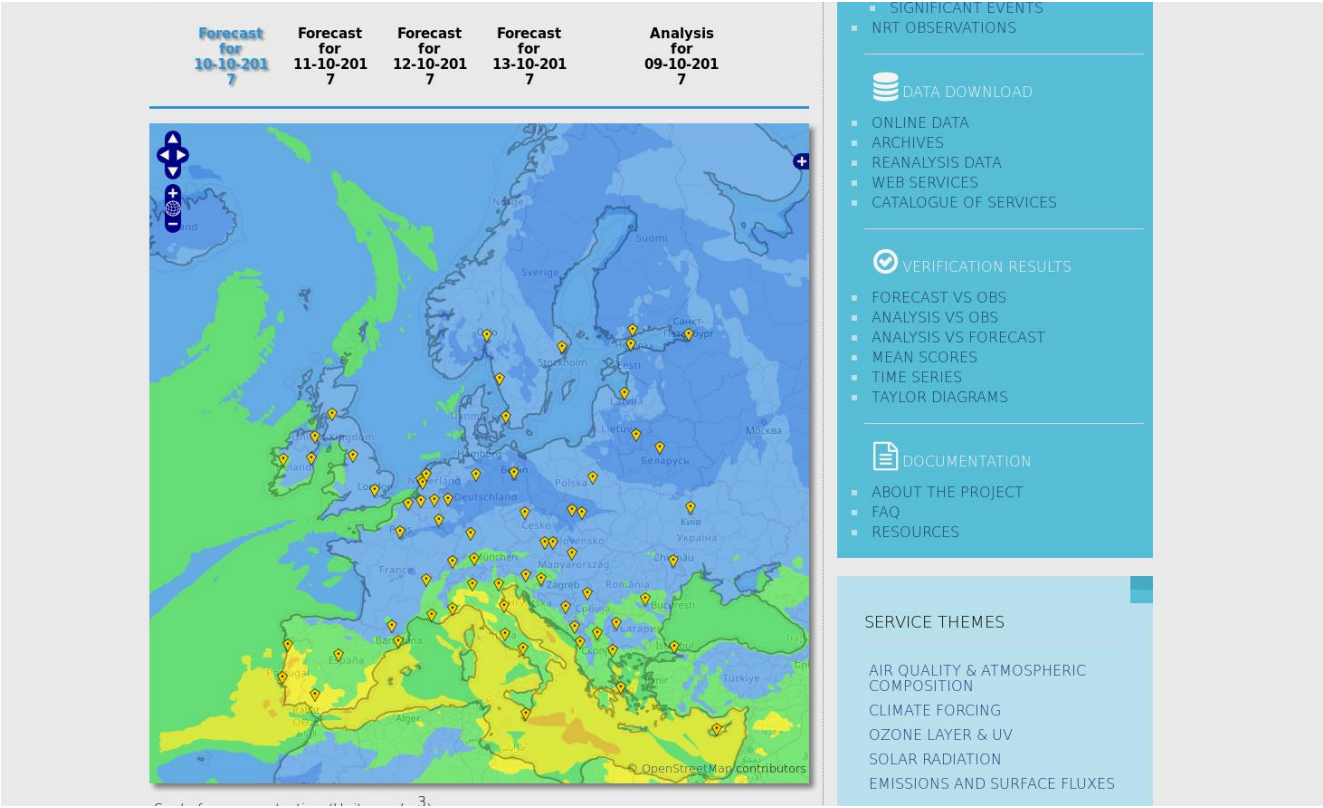
Interactive maps



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Data access

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):

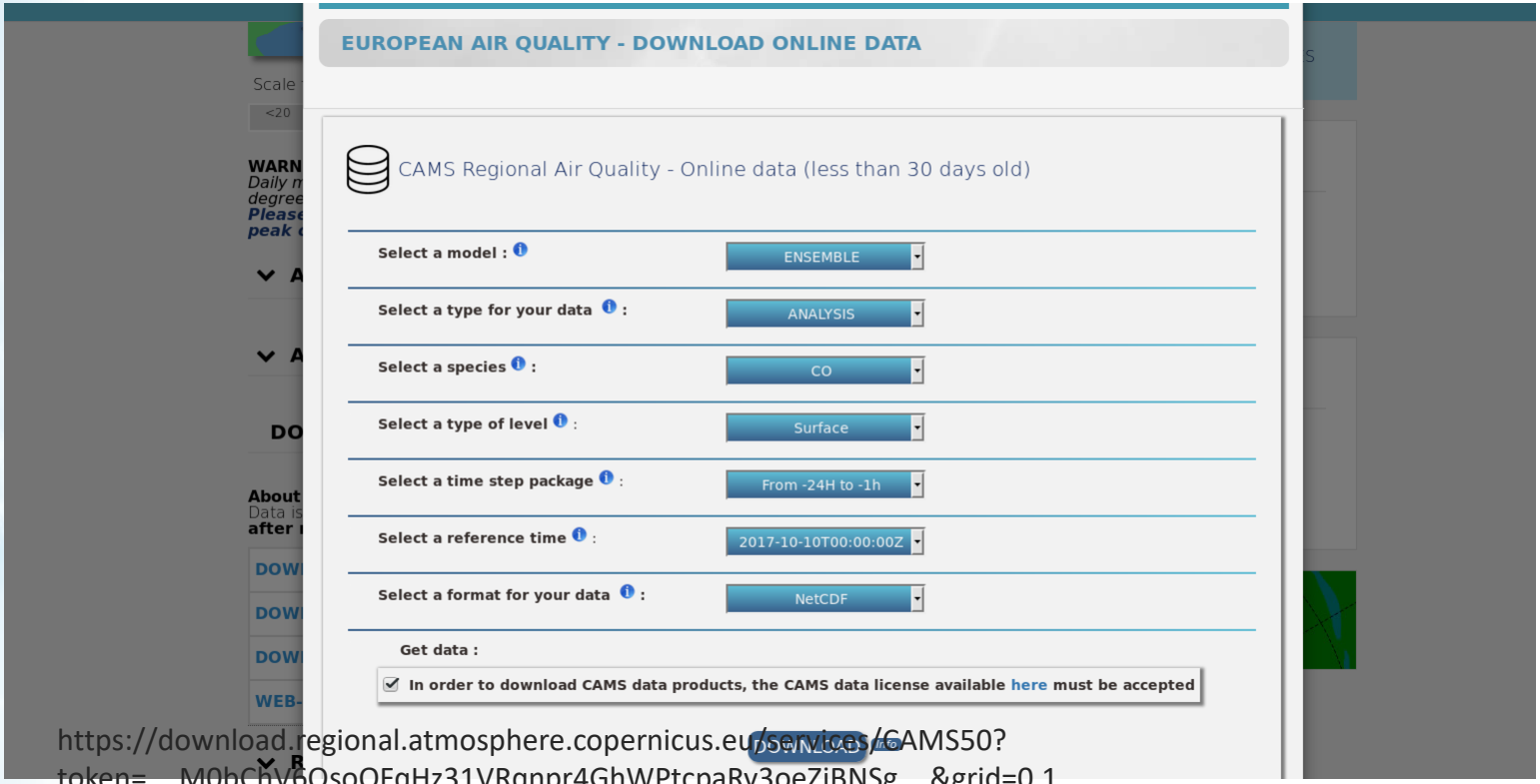
READ MORE

FORECASTS

Reactive Gases
Aerosols
European Air Quality
Ozone Layer
CO2

Form for data access

Atmosphere Monitoring



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

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Atmosphere Monitoring

GFASfire data

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

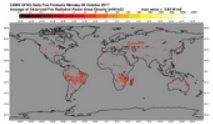
PARAMETER FAMILY

- [ ] Aerosol
- [x] Fire
- [ ] Greenhouse gas
- [ ] Radiation
- [ ] Reactive gas

PARAMETER

Total results: 1

BETA



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

More details

Data Download

#1

GFASfire data

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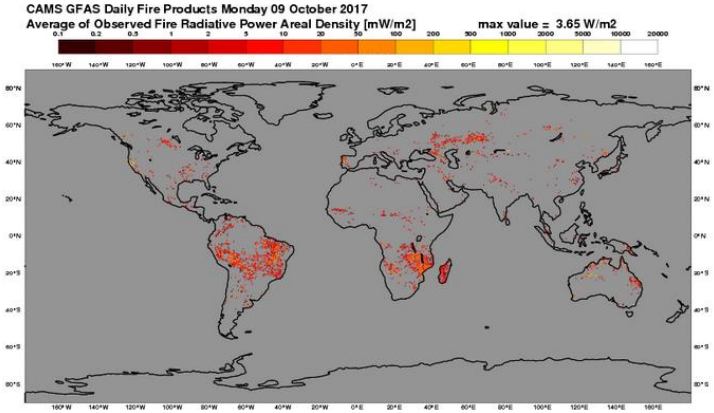
NRT Biomass burning emissions of carbon and various trace species based on assimilated Fire Radiative Power (FRP) (GFAS)

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

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Fire emissions and pollution

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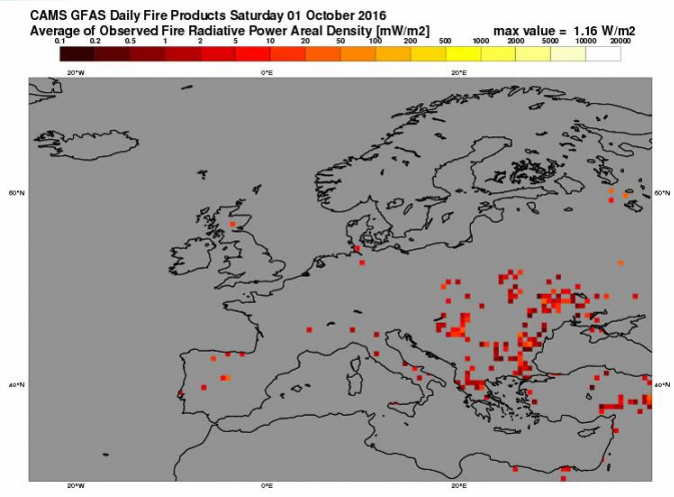

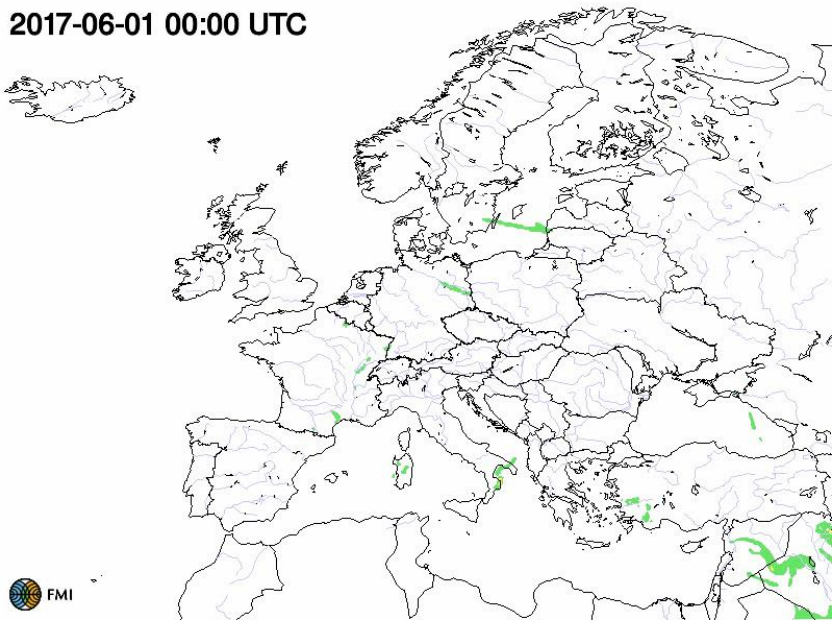

↑ GFAS FRP (emissions)

Silam simulations of fire PM→

Atmosphere Monitoring

NetCDF viewers

- 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

Atmosphere Monitoring

Summary

- 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!