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EU SPACE WEEK 2023

7 - 9 November - Sevilla, Spain

Copernicus Climate Change and Atmosphere Monitoring Services for FORESTRY

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European Centre for Medium range Weather Forecasts
(ECMFW)





Climate change

Understanding Climate Impacts on Forestry

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Forest cover is important from an ecological (e.g., habitat, biodiversity) and socio-economical (e.g., timber harvest, recreation) perspective

- Forests are affected by climate and non-climatic drivers

Climate drivers (e.g., warming temperatures and precipitation changes) will impact forests in several ways, including:

- Biodiversity of forest (sp. distribution)
 - Frequency & intensity of disturbances
 - Ecological process & functions (growing season, productivity, stress)
 - Prevalence of pests & disease
-
- Species abundance (forest cover)
 - Ecosystem services
 - Carbon storage
 - Productivity
 - Health



Warming trend



Extreme temperature



Drying trend



Extreme precipitation

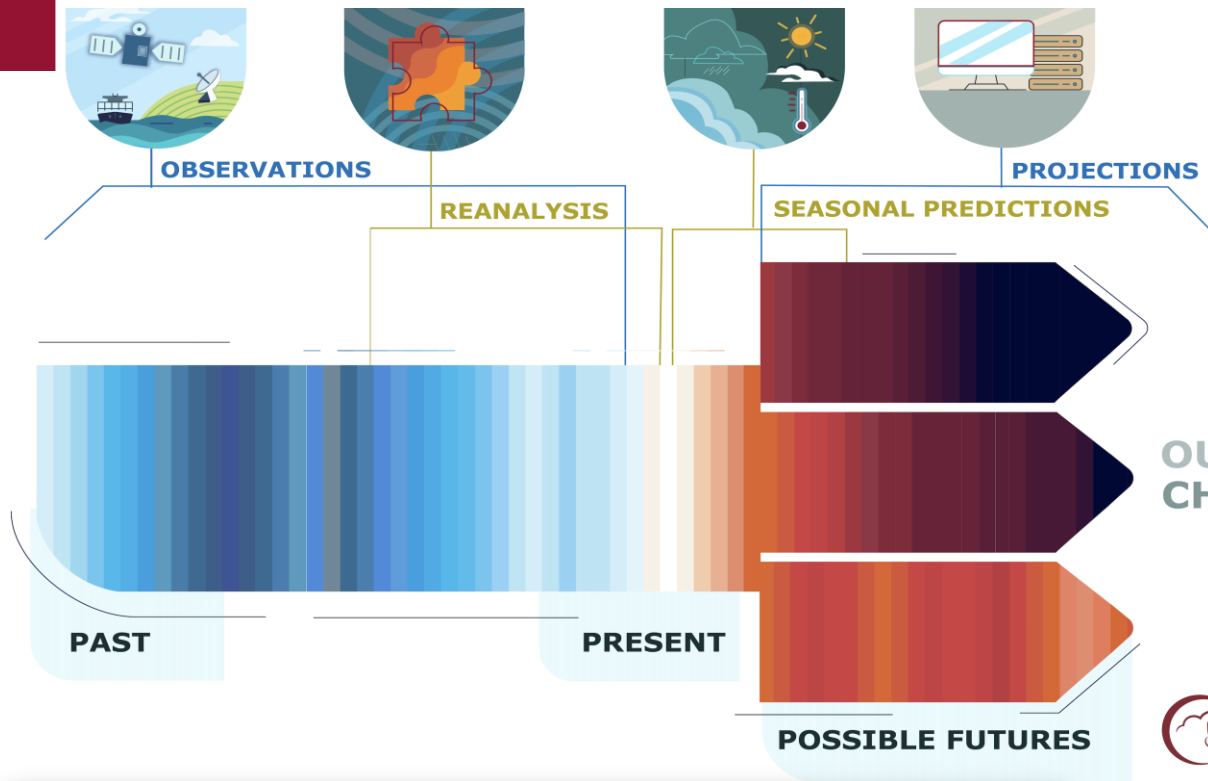
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Climate change

All the climate data you had always dreamed of and never dared asking

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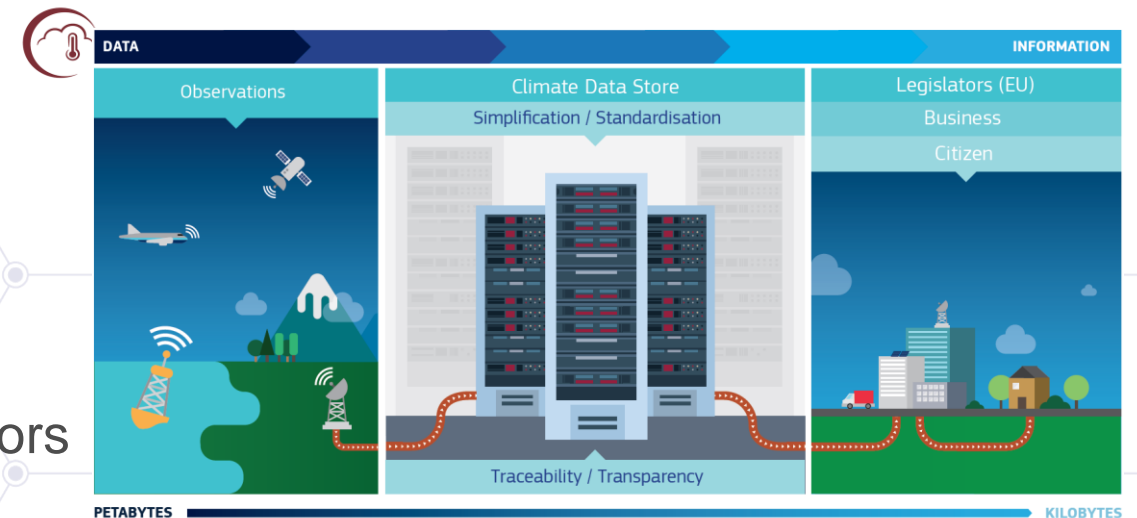
climate.copernicus.eu
cds.climate.copernicus.eu

OUR CHOICES

Operational (not research)
Unrestricted **OPEN AND FREE**

Typical download: ~100 TB /day
Typical number of requests: 500k/day

- Global - Regional climate datasets
- Sectoral datasets (energy, water, agriculture, biodiversity, extremes,...)
- Open source applications running on a cloud platform and able to generate tailored indicators on the fly





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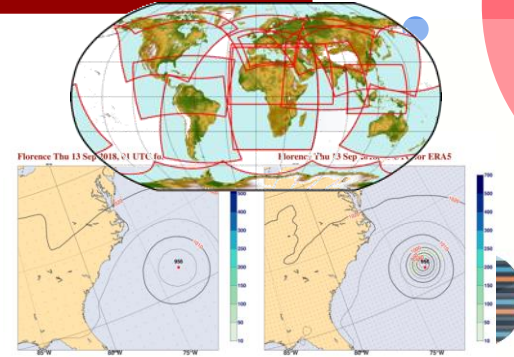
Overview of Copernicus Climate Change Service Co-Development in Key Sectors



- Agriculture
- Biodiversity
- Coastal areas
- Energy
- Health
- Infrastructure
- Insurance
- Shipping
- Storm surges
- Tourism
- Water management



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Benchmarks of good practice

Quality assured data

Tools

PRACTICAL EXAMPLES

Documentation

Tools and applications

Case studies

Sector relevant data

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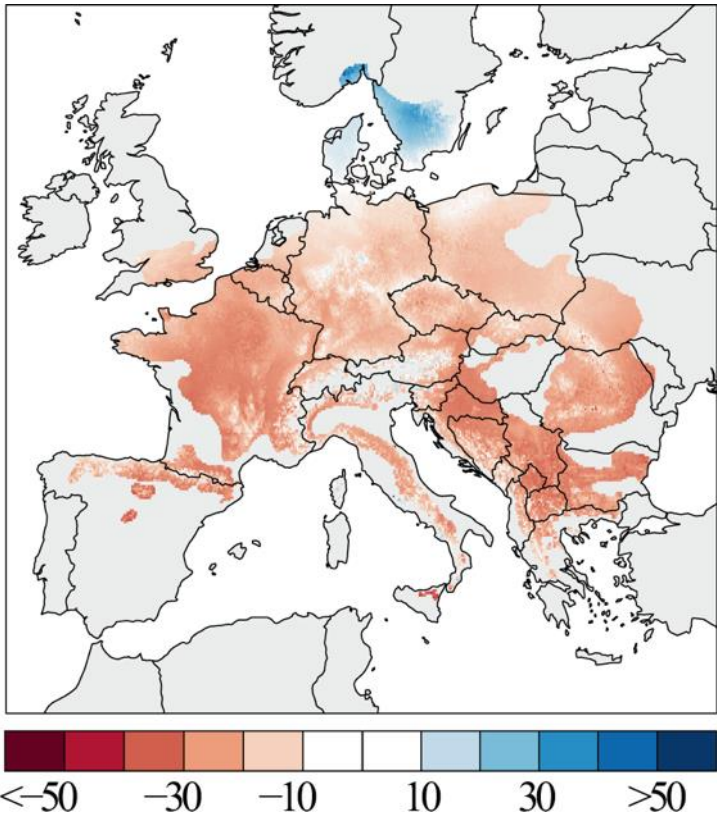


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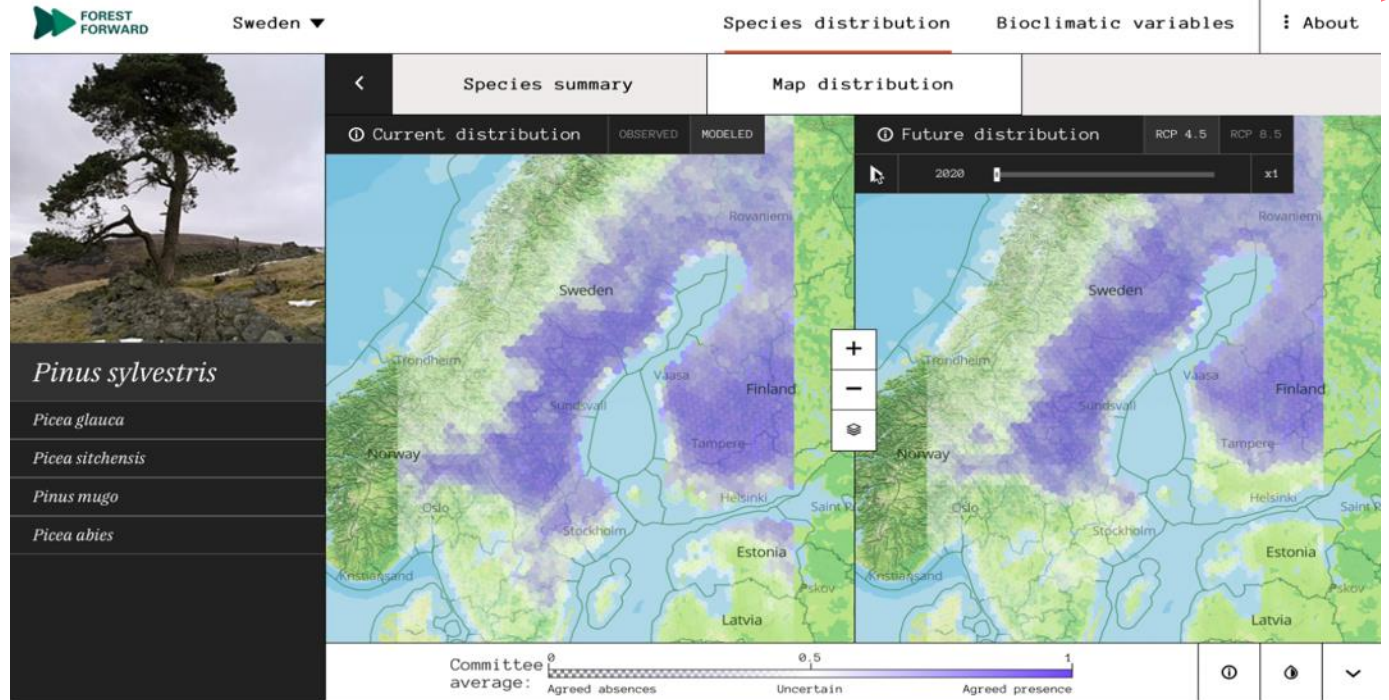
Examples: Climatic suitability of key tree species

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Climate data can help inform the forestry sector of future species distribution and productivity – supporting commercial logging and biodiversity applications



Beech tree growth changes from 1986 to 2016 relative to the 1955–1985 period mean. Source: [Martinez del Castillo et al, 2022](#).



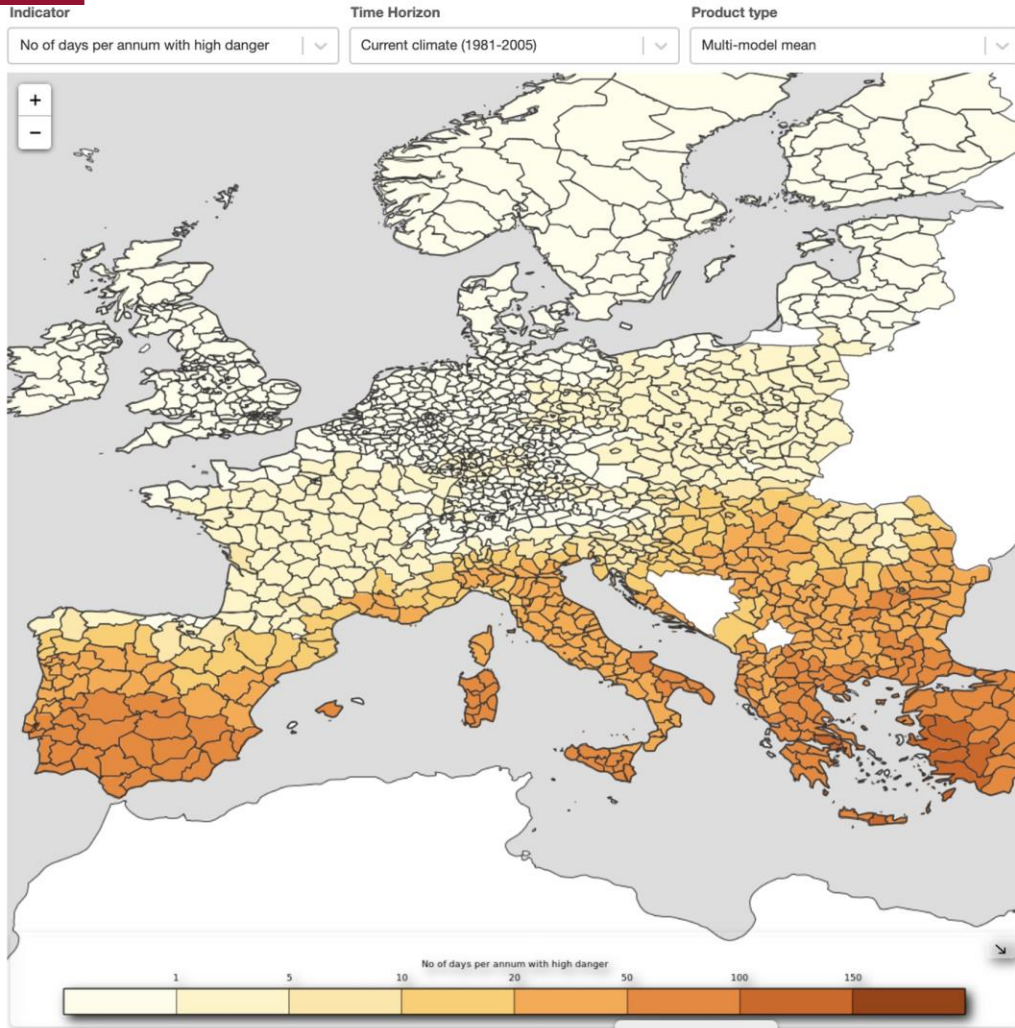
C3S data enabled Tecnalia (Spanish SME) to provide distribution maps for key European tree species. Such info can support establishing climate resilient forest



Climate change

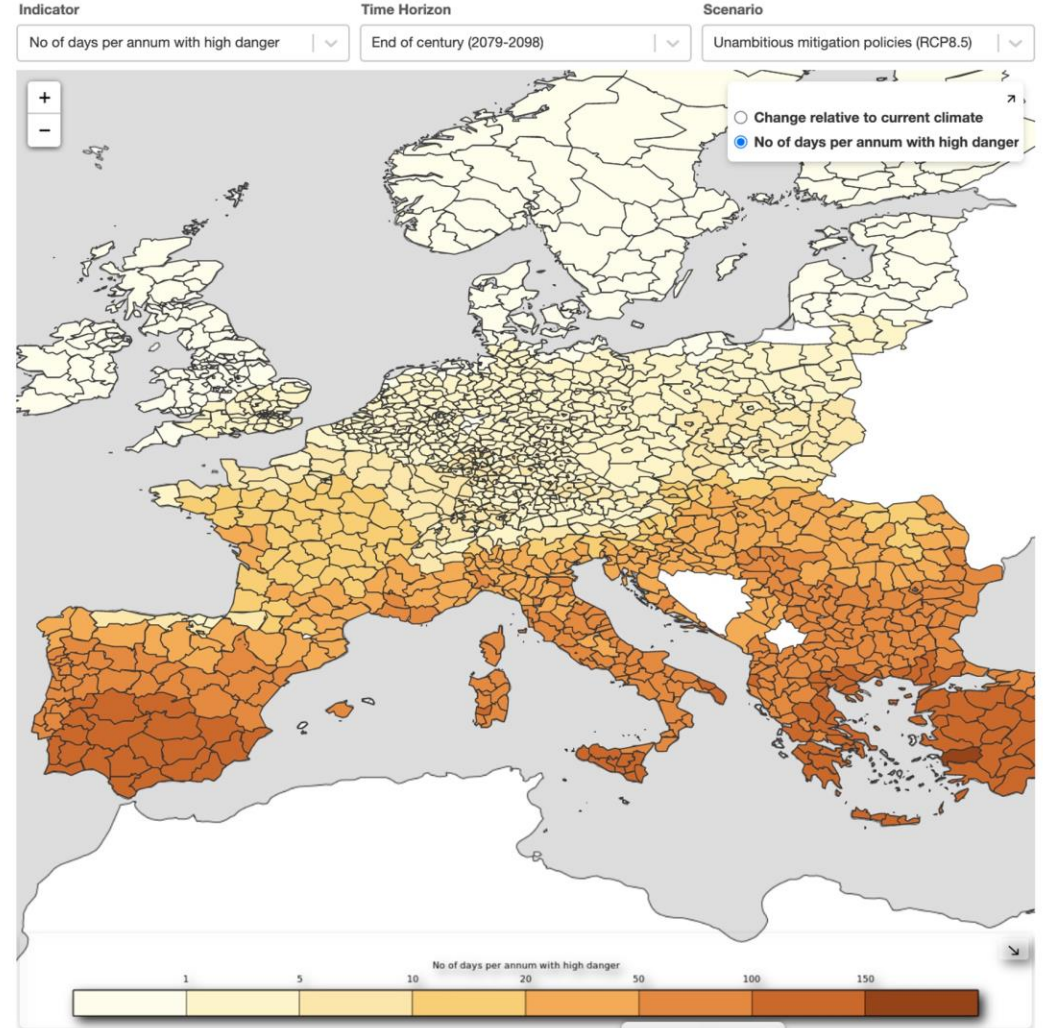
Europe's evolving fire hazard

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1981-2005

Screenshot



2079-2098

Screenshot

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Services to support agri-forestry

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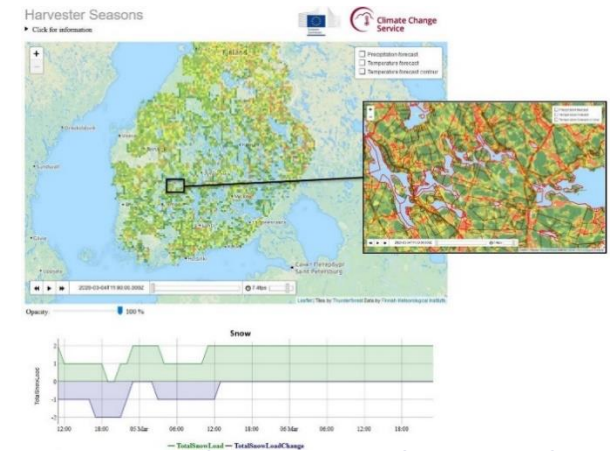
The Finnish Meteorological Institute (FMI) & industry stakeholders in the forestry sector developed a application that gives information on soil conditions to highlight good or bad conditions for vehicles to access plantations.

The application uses **Copernicus Season predictions** and hydrological models to help plan harvesting up to seven months ahead, based on needs of the harvesting industry

By combining weather forecasts, Copernicus seasonal forecasts, and satellite measurements of the soil with a hydrological model, FMI offers a trafficability information service in real-time as well as forecasts of future soil conditions.

“Previous forecasts ran to just ten days, so Harvester Seasons represents a huge step forward for forestry planning.”

→ Mikko Strahlendorff, Space Adviser (FMI)



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Atmosphere

COPERNICUS ATMOSPHERE MONITORING SERVICE

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CAMS provides consistent and quality-controlled information related to air pollution and health, solar energy, greenhouse gases and climate forcing, everywhere in the world.

AIR QUALITY OBSERVATIONS



MODELLING



OUTPUTS



1. Monitoring the current situation

- Air quality
- Solar radiation
- Greenhouse gases
- Fire emissions



2. Forecasts for the next few days

- Global
- Europe



3. Tools to explore further

- Emissions and impact of reductions
- Origins of pollution
- Annual air quality assessments

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- Industry
- Businesses
- Government and policymakers
- Scientific community
- The public

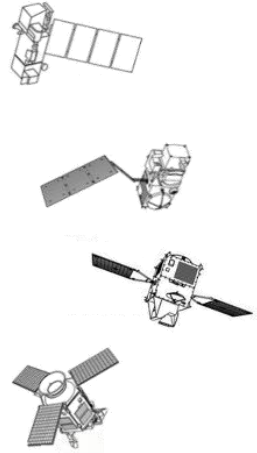
atmosphere.copernicus.eu
ads.atmosphere.copernicus.eu

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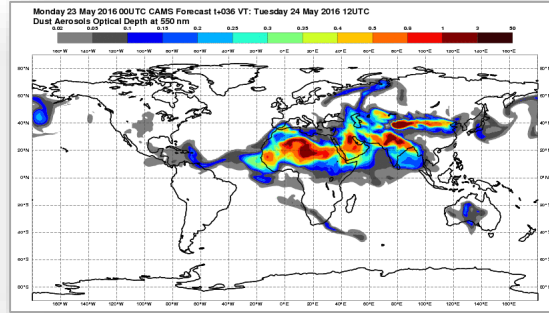


Atmosphere

CAMS WORKFLOW (Combining observations with models)

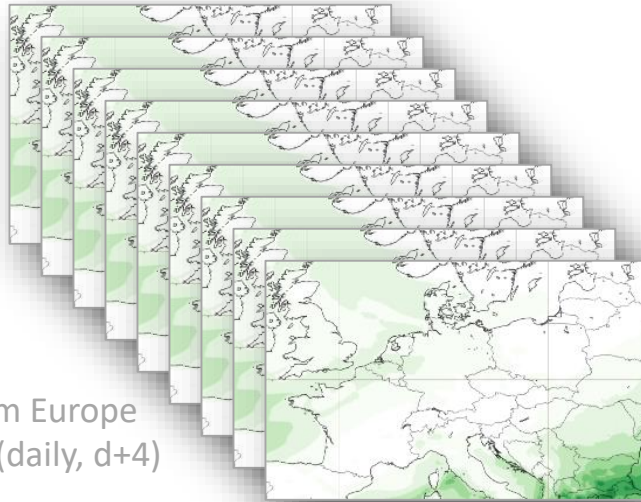


Earth Observation from satellite (>80 instruments) and in-situ (regulatory and research)

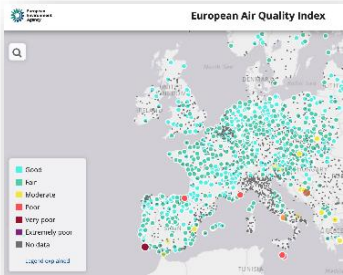


40km Globe (twice daily, d+5)

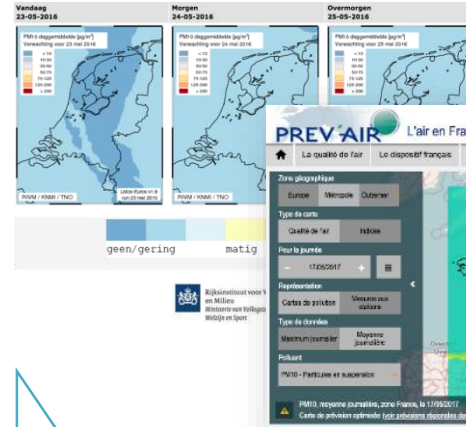
CAMS main operational data assimilation and modelling systems



10km Europe (daily, d+4)



Routine validation and EQC of products



Major multiplication factor

CAMS users >31000 (>3050 routine)

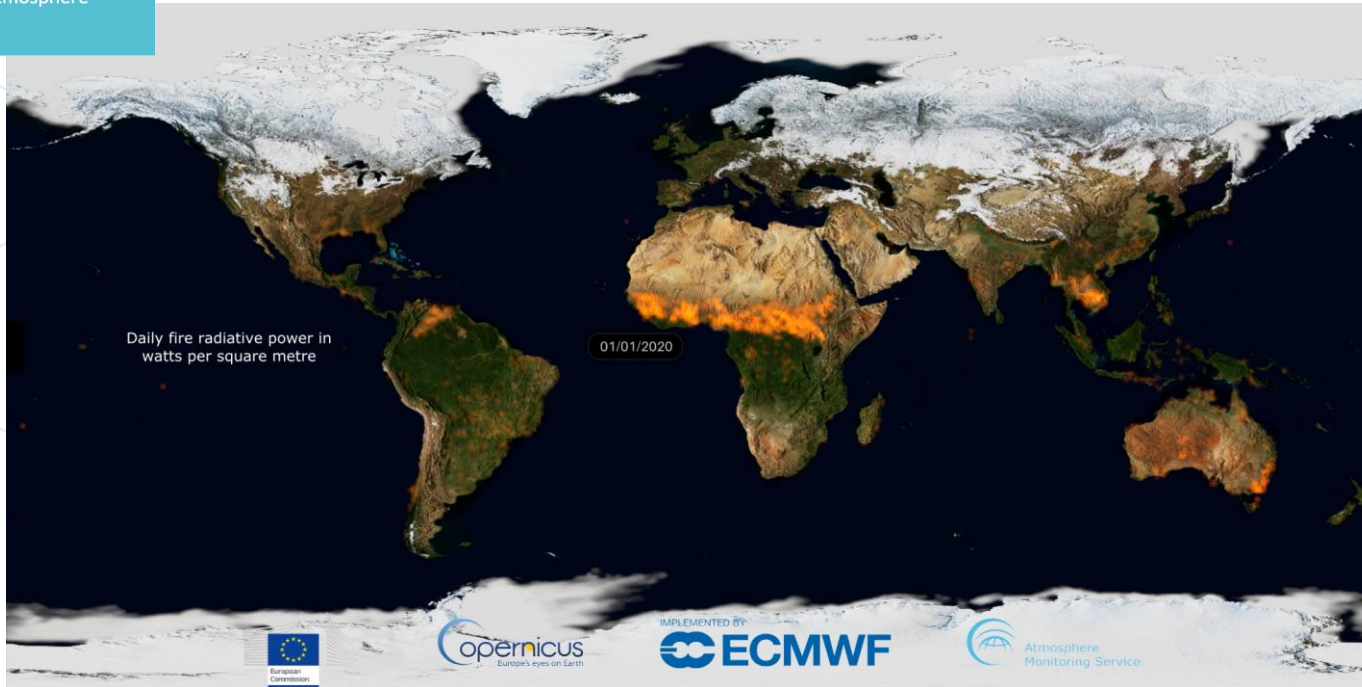


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Estimating Global Wildfire Emissions



Global Fire Assimilation System (**GFAS**)

<https://ads.atmosphere.copernicus.eu/cdsapp#!/dataset/cams-global-fire-emissions-gfas?tab=overview>

Uses satellite observations of Fire Radiative Power (FRP)

- Currently Aqua and Terra MODIS FRP observations
- FRP from VIIRS, Sentinel-3, and geostationary satellites are being tested for future implementation

Global Coverage at ~10km Resolution

- *Daily Output: 1-day behind NRT*
- Hourly Output (+24-h means): 7-hours behind NRT

- Satellite observations of fire locations and estimated emissions available from a number of “inventories” (e.g., GFED, FINN, FLAMBE, FEER, GBBEPx, QFED).
- Based generally on similar observations but can differ in the technique used:
 - Burnt area vs. fire radiative power.

- Emissions of aerosols and gases are estimated using factors dependent on vegetation type.
- Injection heights calculated with Plume Rise Model and IS4FIRES





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CAMS news on fires

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Northern Hemisphere wildfires: A summer of extremes

<https://atmosphere.copernicus.eu/northern-hemisphere-wildfires-summer-extremes>

August wildfires ravage northern & central Greece

<https://atmosphere.copernicus.eu/august-wildfires-ravage-northern-central-greece>

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Q&A - wildfires

<https://atmosphere.copernicus.eu/qa-wildfires>

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23rd August 2023



[EXTREME CONDITIONS](#) | [TENERIFE WILDFIRE ACTIVITY](#) | [QUALITY-ASS](#)

[CAMS MONITORING AND FORECASTS](#) | [WILDFIRES: CAUSE AND SCALE](#) | [AIR POLLUTION, HEALTH AND CLIMATE CHANGE](#)

CAMS monitoring and forecasts

How does CAMS monitor wildfires?

CAMS provides up-to-date information on the location, intensity, and emissions of wildfires, vegetation fires and open burning around the world through its Global Fire Assimilation System (GFAS). This information is based on measurements from instruments on satellites that are able to detect the fire radiative power (FRP), essentially the heat signal, of active fires. Using these FRP observations, CAMS is able to estimate the intensity and related emissions of fires. Fire emissions can also be estimated from satellite observations of the burn scar of fires, but this information is not available in near-real-time like the FRP observations. For this reason, CAMS does not use or provide any information on the physical size of any wildfires.

What exactly is CAMS monitoring?

In addition to wildfire emissions, CAMS monitors the transport of smoke in the atmosphere by the winds and the smoke composition. That means, CAMS utilises observations of particulate matter and key trace gases (e.g., carbon monoxide) released into the atmosphere by burning vegetation. CAMS can also forecast the direction and path smoke pollution will take in the atmosphere, according to respective wind and weather conditions. Some pollutants in smoke have a lifetime of a few weeks in the atmosphere and can be transported thousands of kilometres across the globe – at international and intercontinental scales.

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