#EUSpace

EU SPACE WEEK 2023

7 - 9 November - Sevilla, Spain

Copernicus Climate Change and Atmosphere Monitoring Services for FORESTRY

European Commission

EUSPA European Union Agency for the Space Programme

UE23 PRESIDENCIA ESPAÑOLA CONSEJO DE LA UNIÓN EUROPEA

Samuel Almond & Stijn Vermoote
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

Climate change

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

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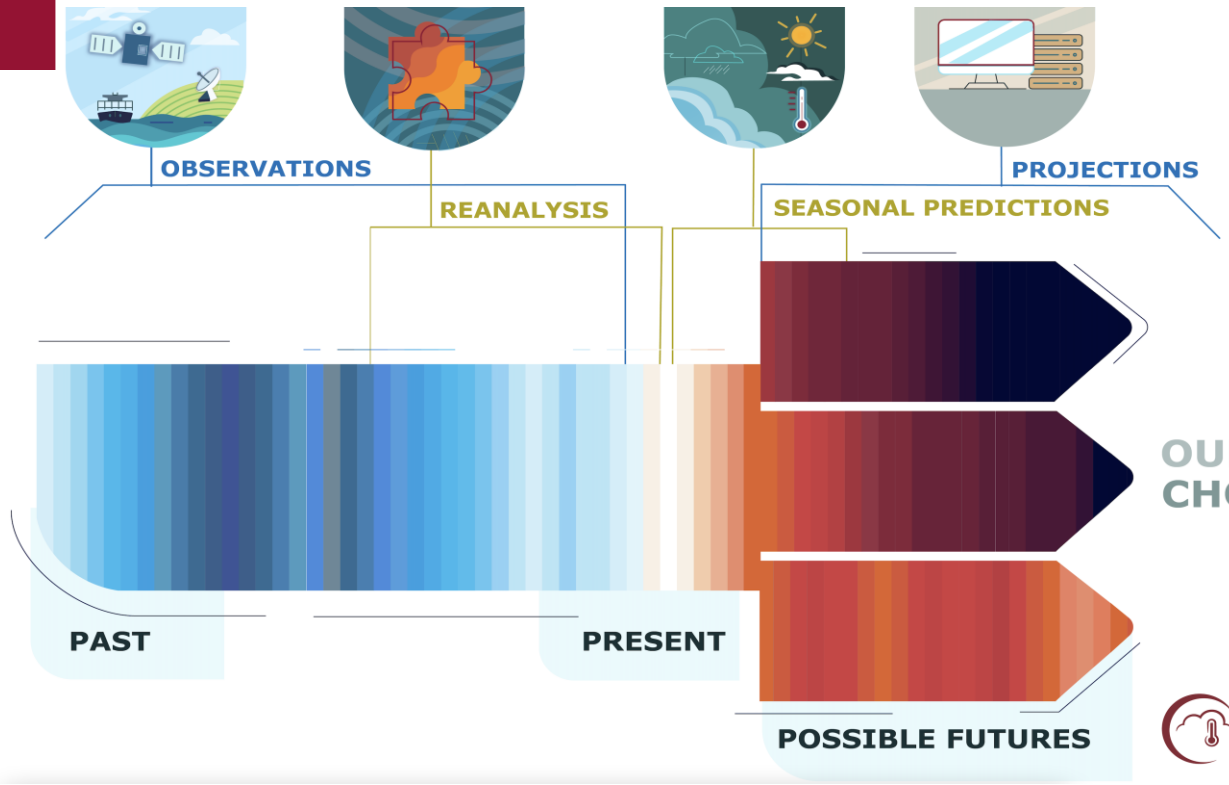
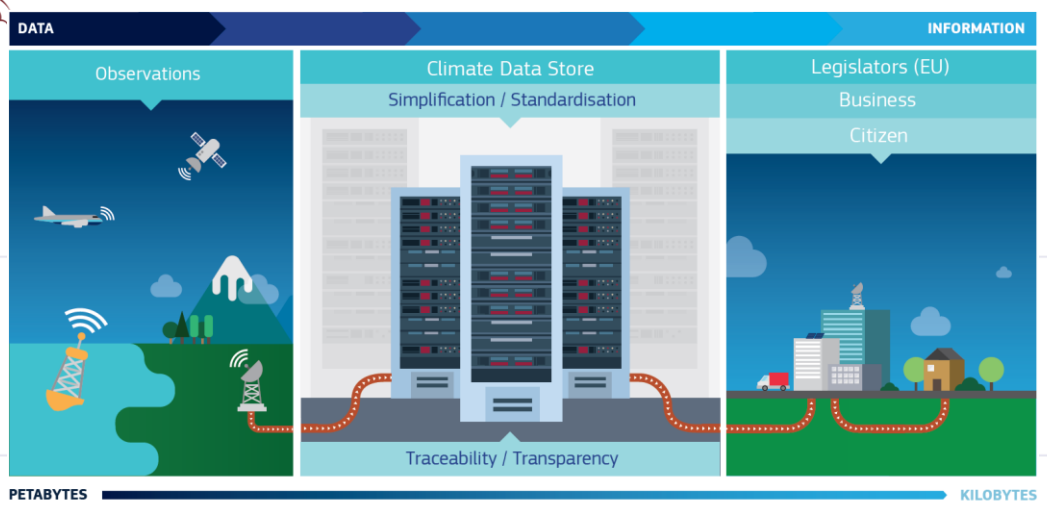


climate.copernicus.eu
cds.climate.copernicus.eu

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



Climate change

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

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Agriculture

Biodiversity

Coastal areas

Energy

Health

Infrastructure

Insurance

Shipping

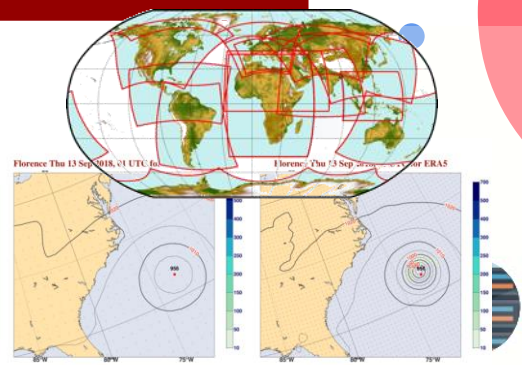
Storm surges

Tourism

Water management

USERS

CLIMATE DATA STORE



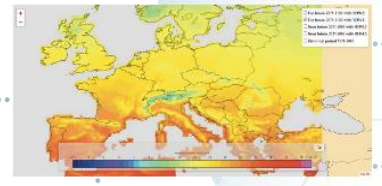
Benchmarks of good practice

Quality assured data

Tools

PRACTICAL EXAMPLES

Documentation



Tools and applications

Case studies

Sector relevant data

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Examples: Climatic suitability of key tree species

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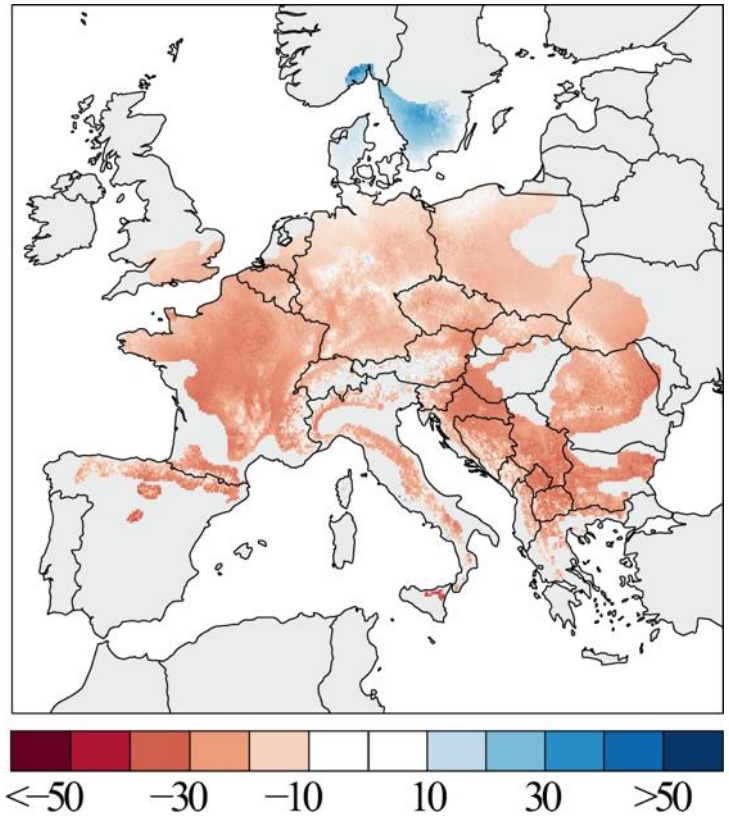
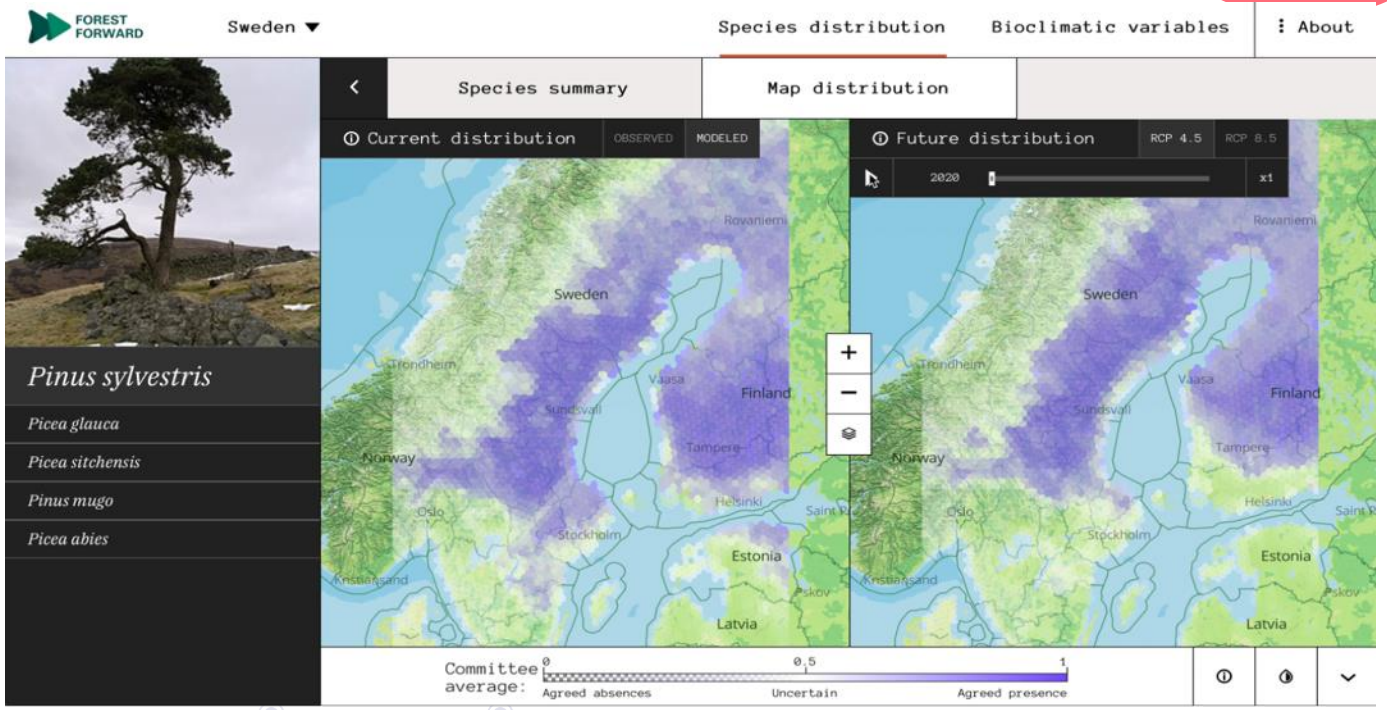
Climate data can help inform the forestry sector of future species distribution and productivity – supporting commercial logging and biodiversity applications



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

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Europe's evolving fire hazard

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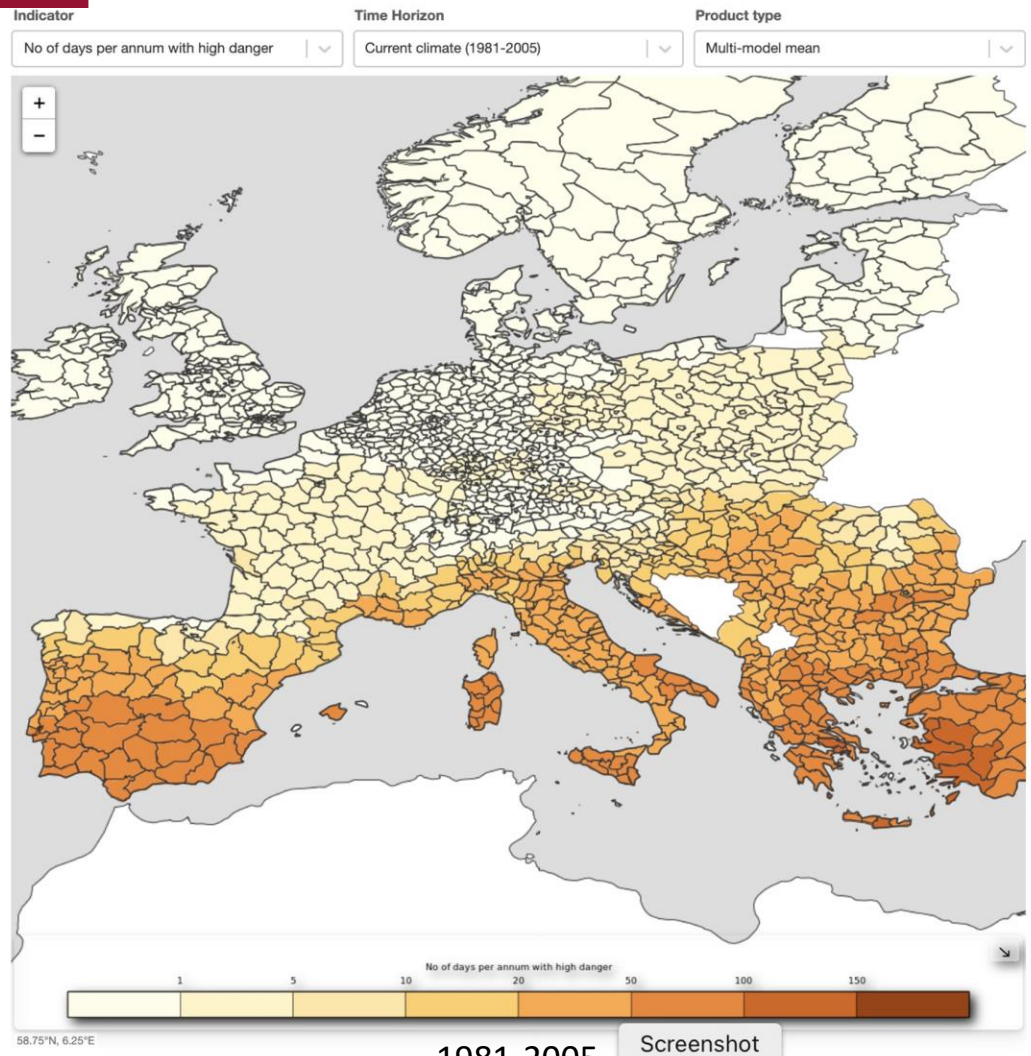
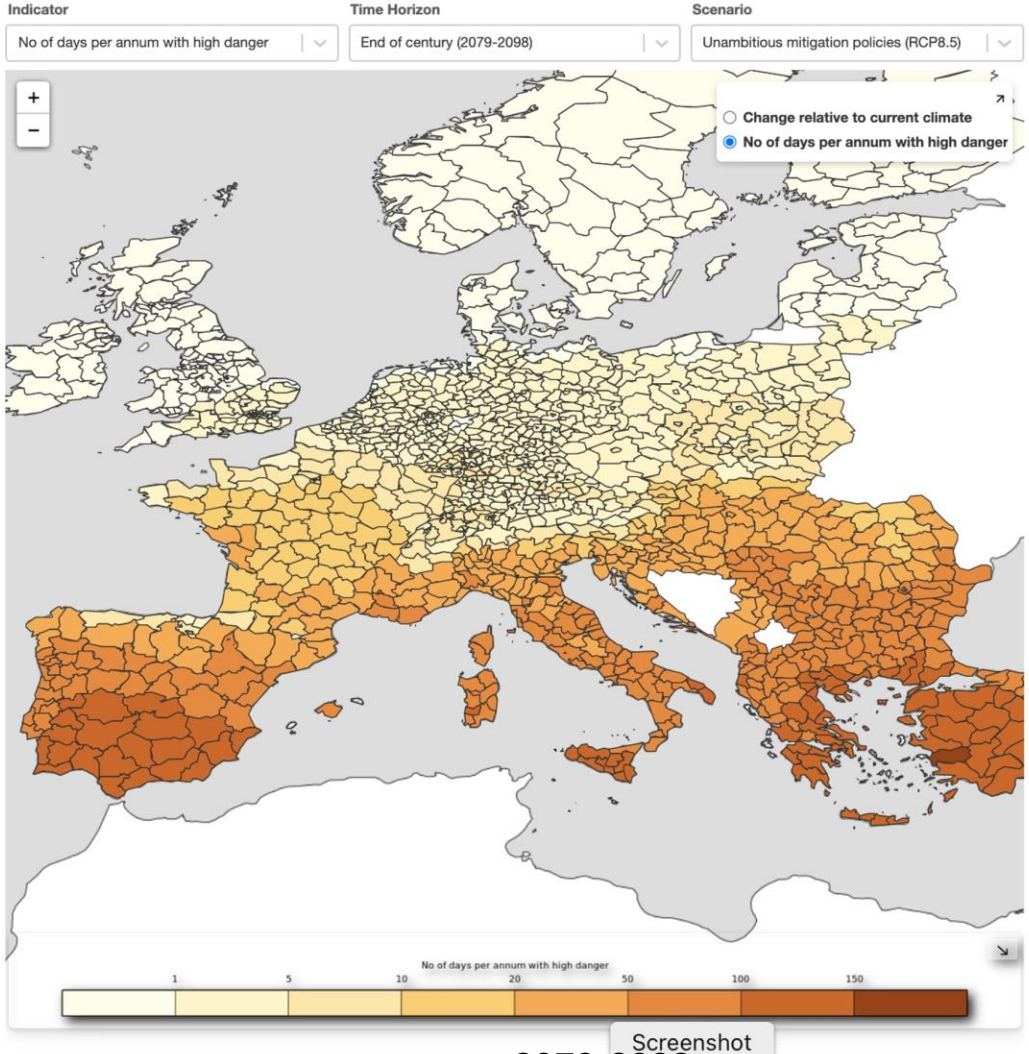


1981-2005

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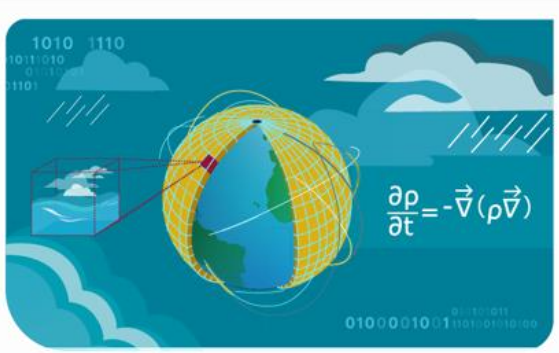
CAMS provides consistent and quality-controlled information related to air pollution and health, solar energy, greenhouse gases and climate forcing, everywhere in the world.

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

USERS

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

atmosphere.copernicus.eu
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CAMS WORKFLOW (Combining observations with models)

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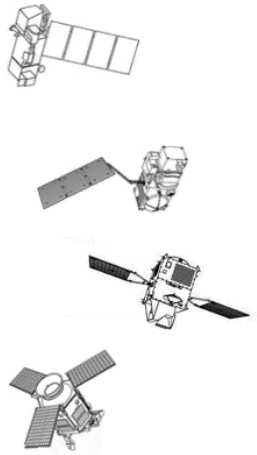
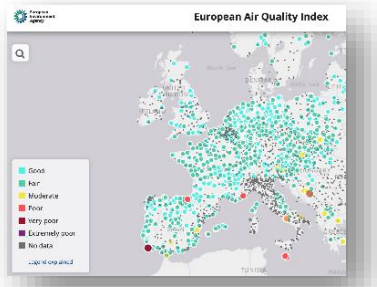
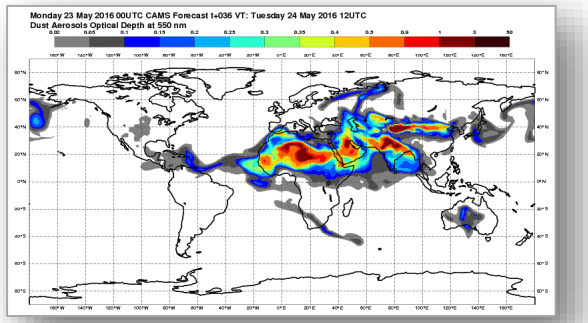


Earth Observation from satellite (>80 instruments) and in-situ (regulatory and research)

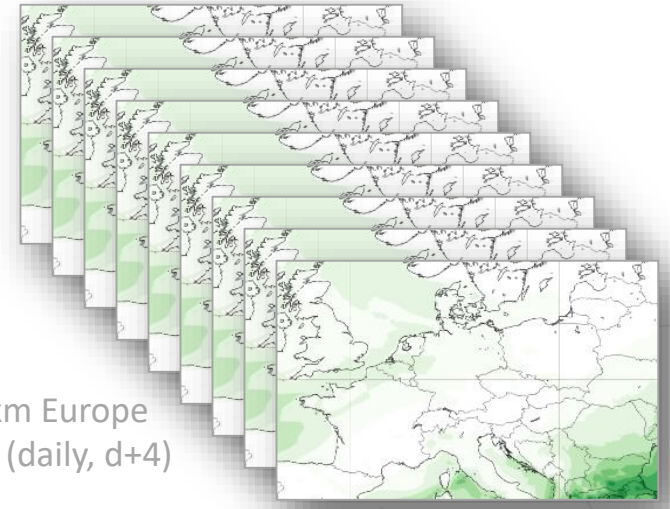


Routine validation and EQC of products

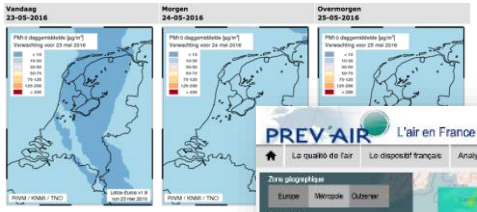


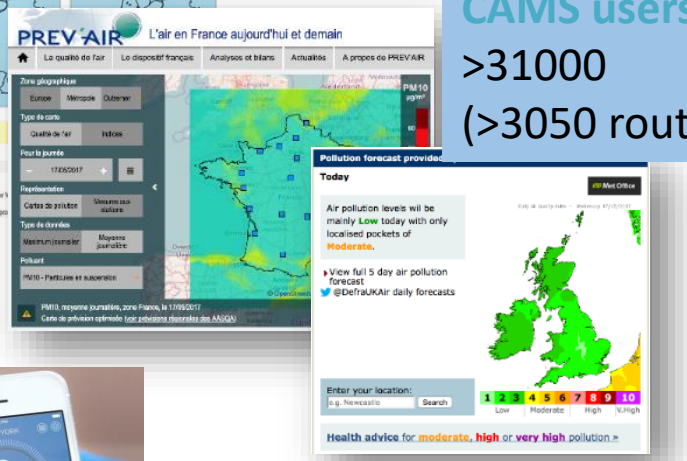
40km Globe (twice daily, d+5)

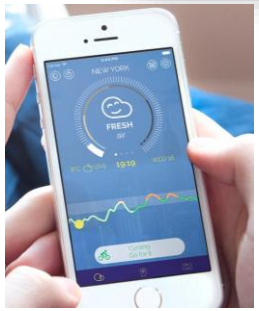
CAMS main operational **data assimilation and modelling systems**



10km Europe (daily, d+4)







CAMS users
>31000
(>3050 routine)

Major multiplication factor

Windy.com

The Weather Channel

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Estimating Global Wildfire Emissions

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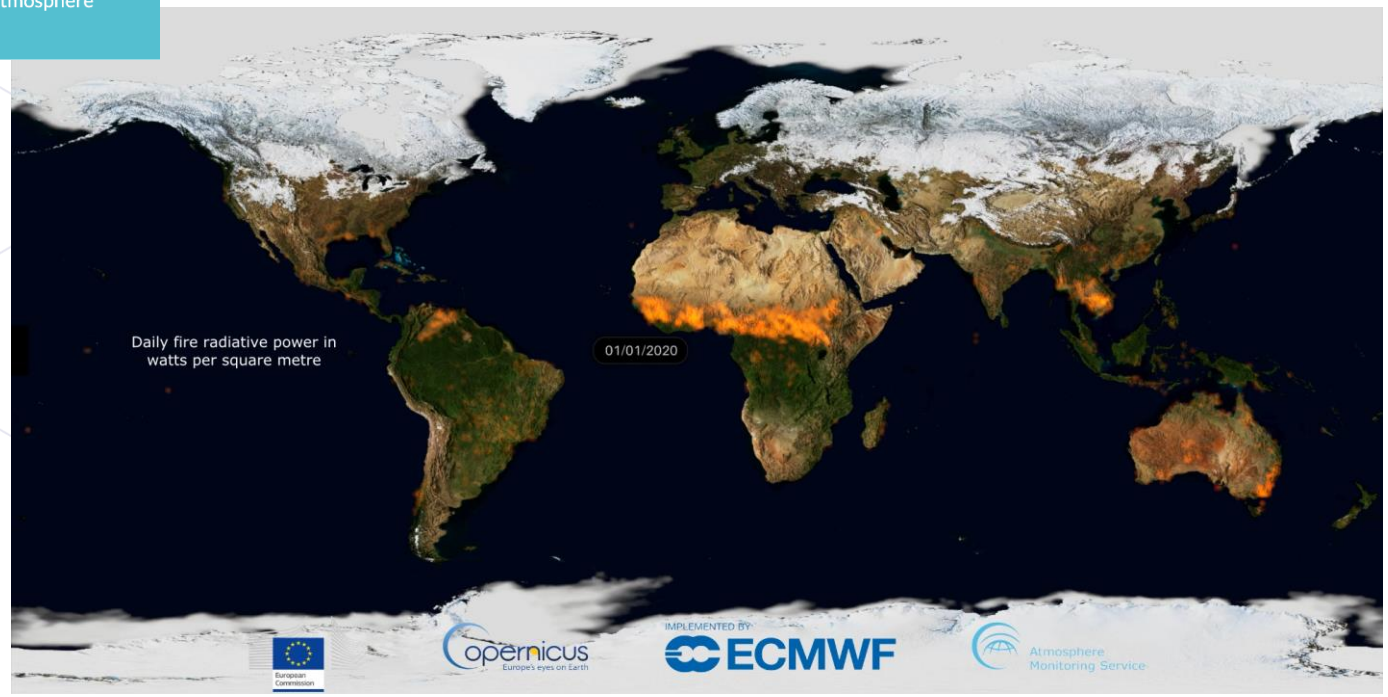

- Satellite observations of fire locations and estimated emissions available from a number of "inventories" (e.g., GFED, FINN, FLAMBE, FEER, GBBEPx, QFED).
- Based generally on similar observations but can differ in the technique used:
  - Burnt area vs. fire radiative power.

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

- 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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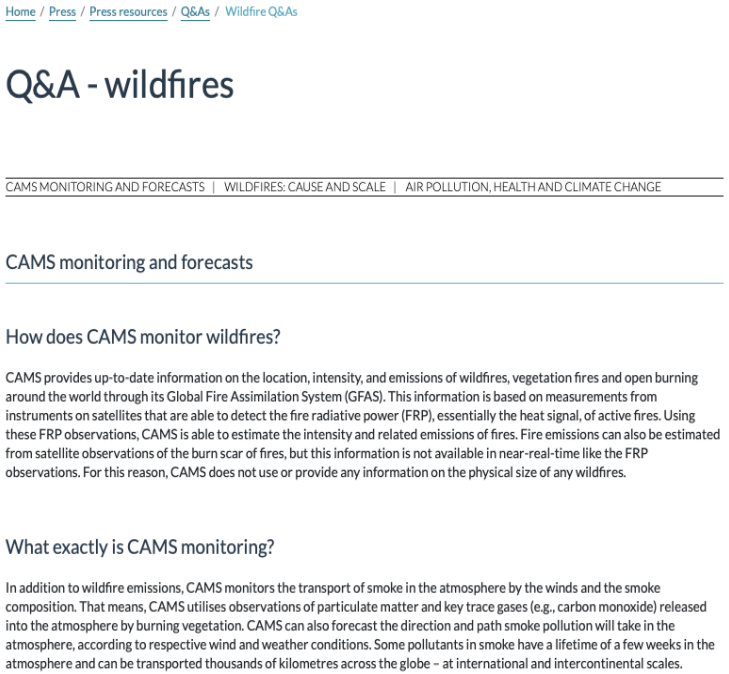
CAMS news on fires

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

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



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

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