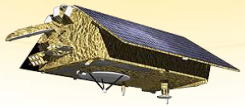
Consiglio Nazionale delle Ricerche

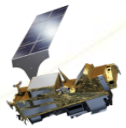
European Commission

Copernicus Europe's eyes on Earth

EUMETSAT



Federico Fierli, EUMETSAT
Consiglio Nazionale delle Ricerche
Universita' Roma Tor Vergata



Who is who: EUMETSAT - Copernicus

EUMETSAT - from 1986

Monitoring weather and climate from space

Maintain satellites

Distribute data ensure uptake

Build know/how

Observations
Infrastructure

Services

Copernicus - Space & Environmental monitoring program of the European Union

What is a wildfire

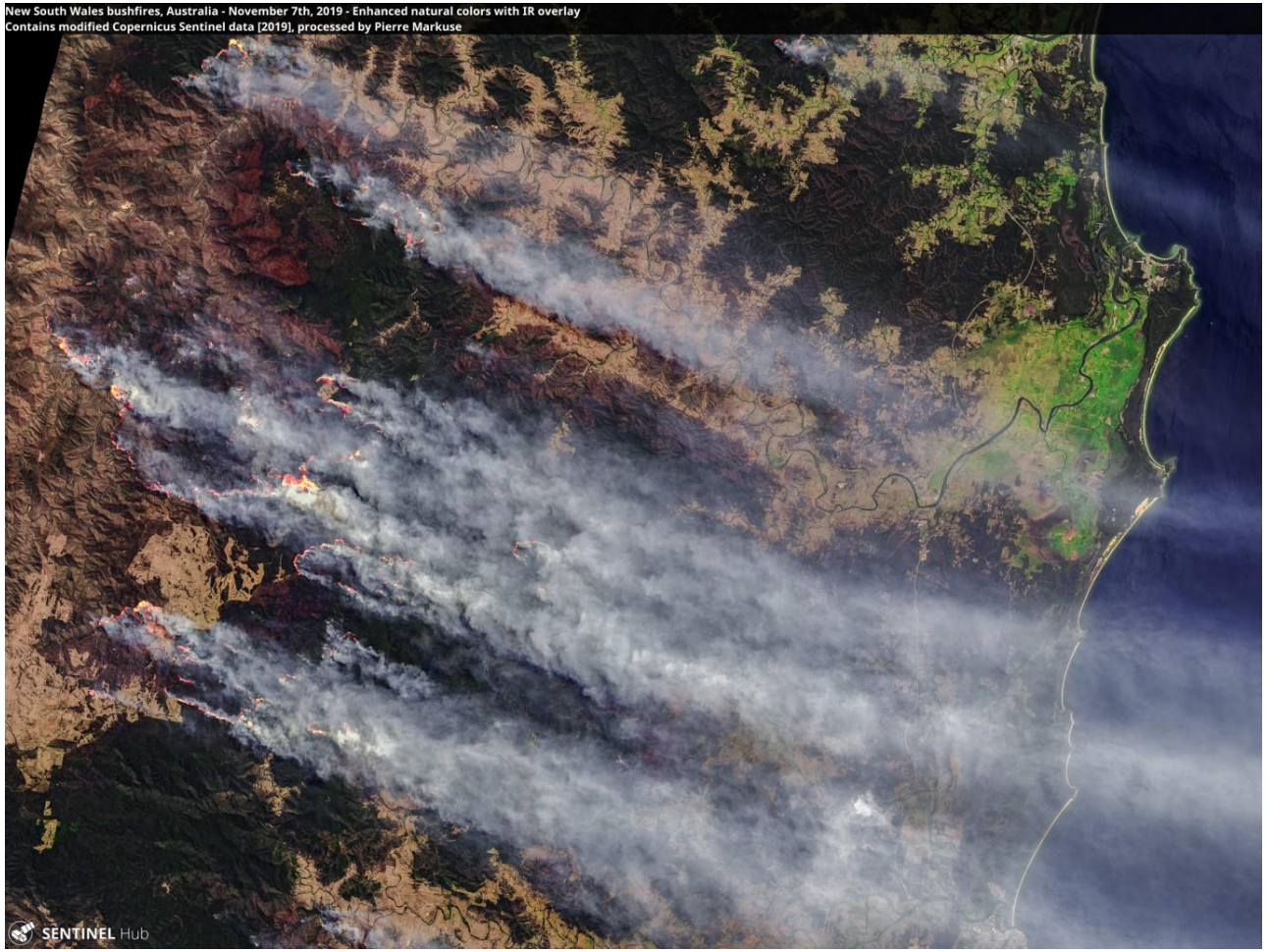
394 to 519 million hectars burned per year

19000 fires in July 2019 spotted by Sentinel-2

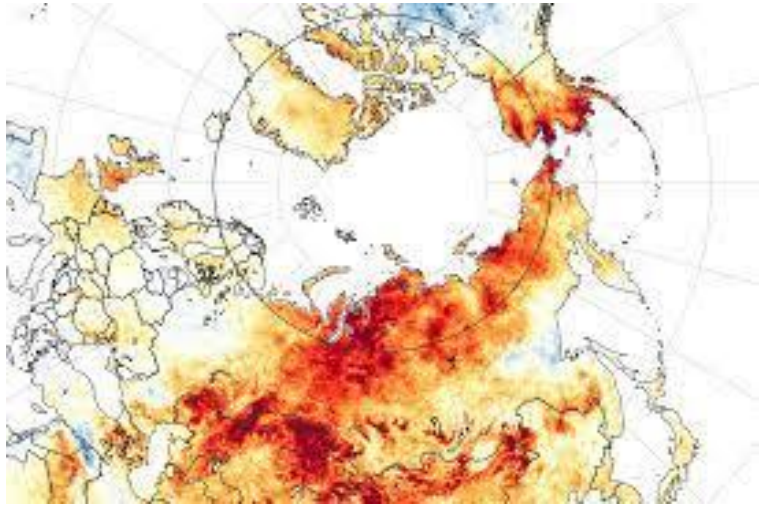
Indonesia in 1997 → 0.81 and 2.57 gigatonnes of CO_2 into the atmosphere, (13%–40% of the annual global carbon dioxide emissions from burning fossil fuels)

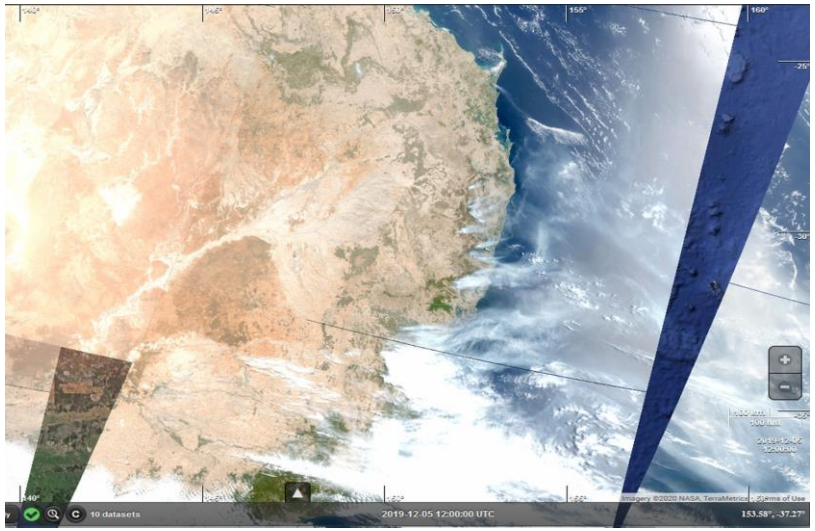
In June and July of 2019, fires in the Arctic emitted more than 140 megatons of carbon dioxide, according to

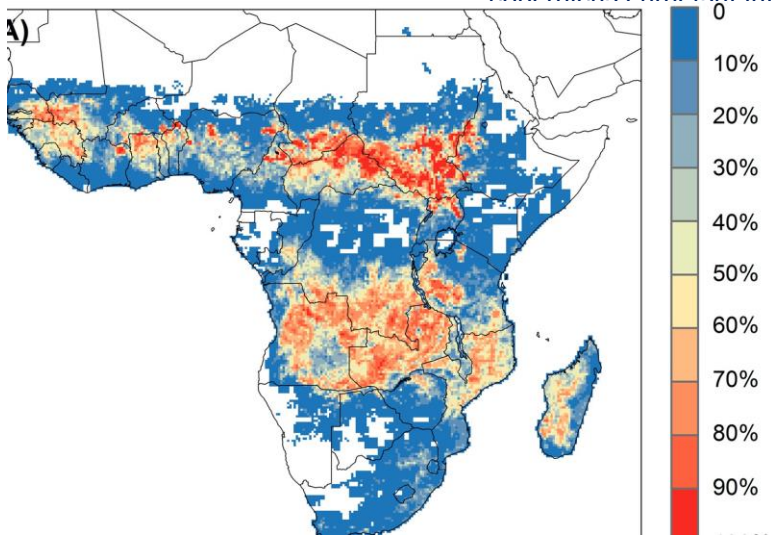
Atmosphere Monitoring Service



Wildfires at the global scale







IPCC 2019

Climate change is crucial for the current and future fire regime

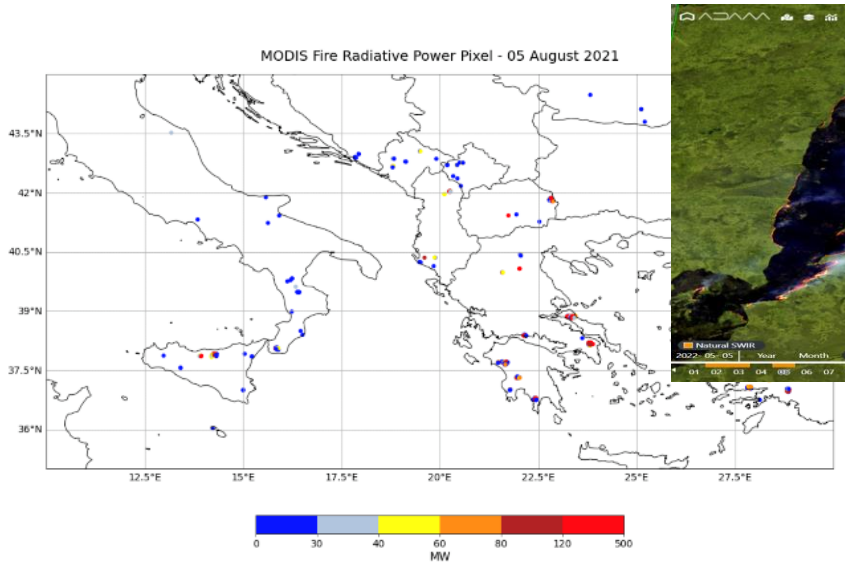
Risk will increase including tropical forests

Prolonged fire seasons

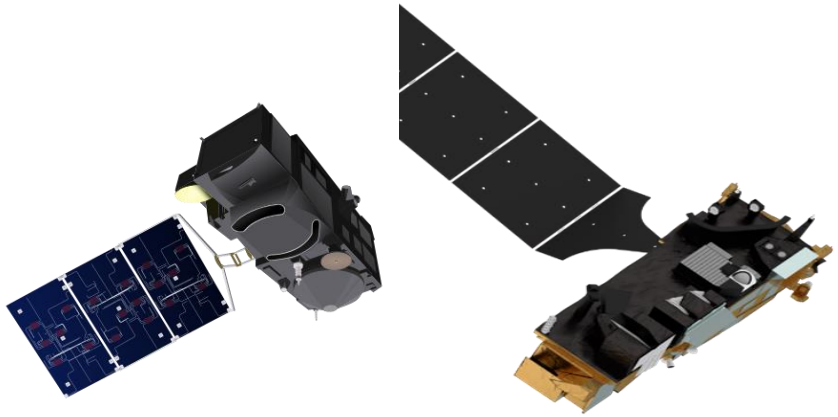
However - burnt area decreased in 1979-2018 - possible bias in resolution

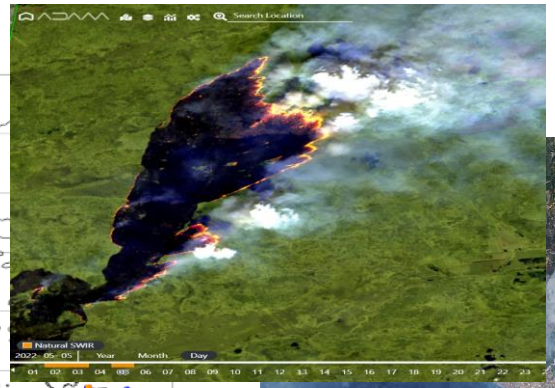
Global data - long-term coverage - high resolution - fires happens at small scales

Monitoring from space

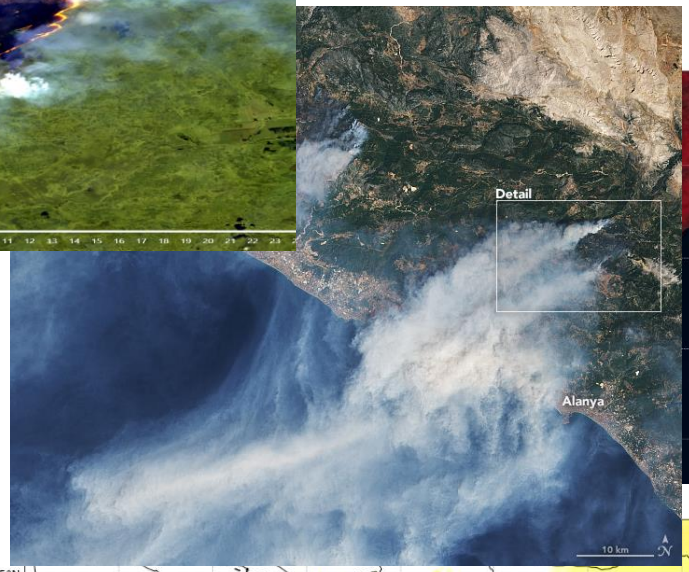


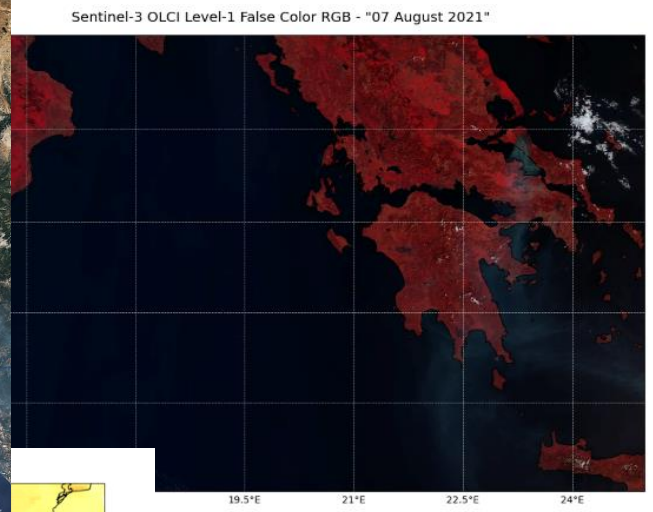
active fires

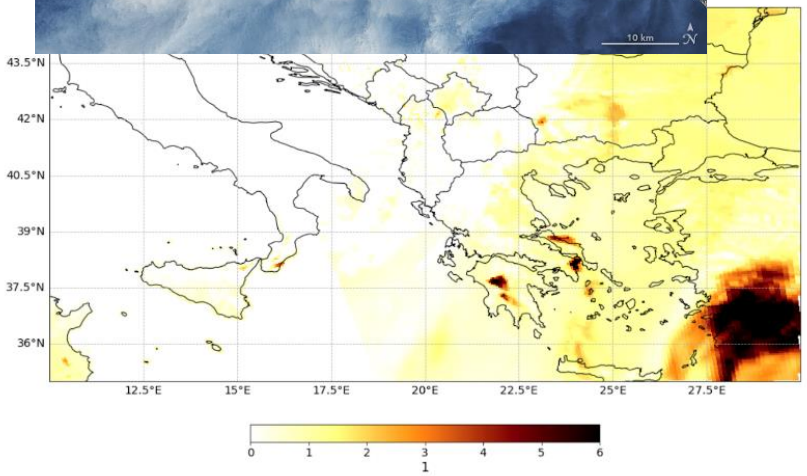




smoke plumes





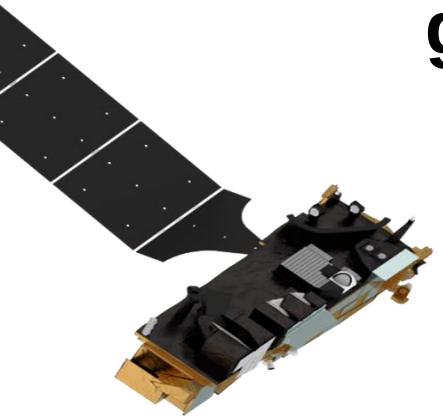


reflected sunlight
thermal heat radiation

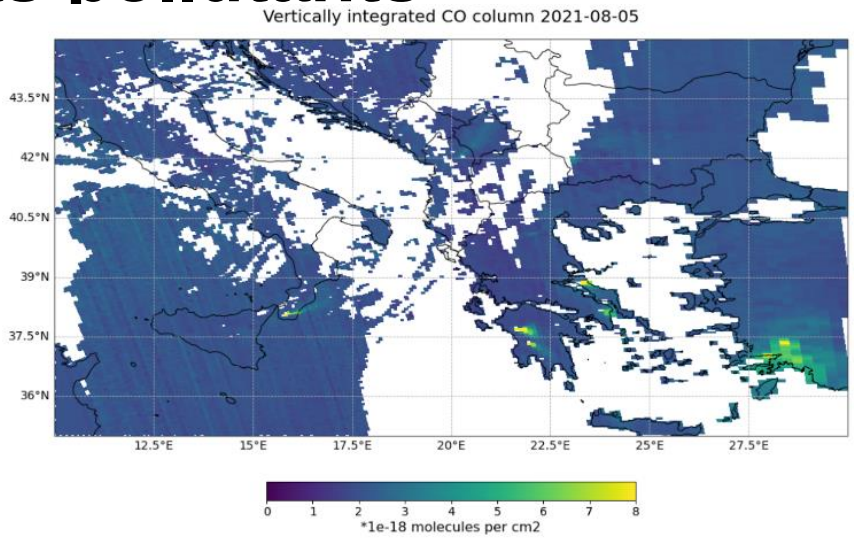
atmospheric particles

Monitoring from space

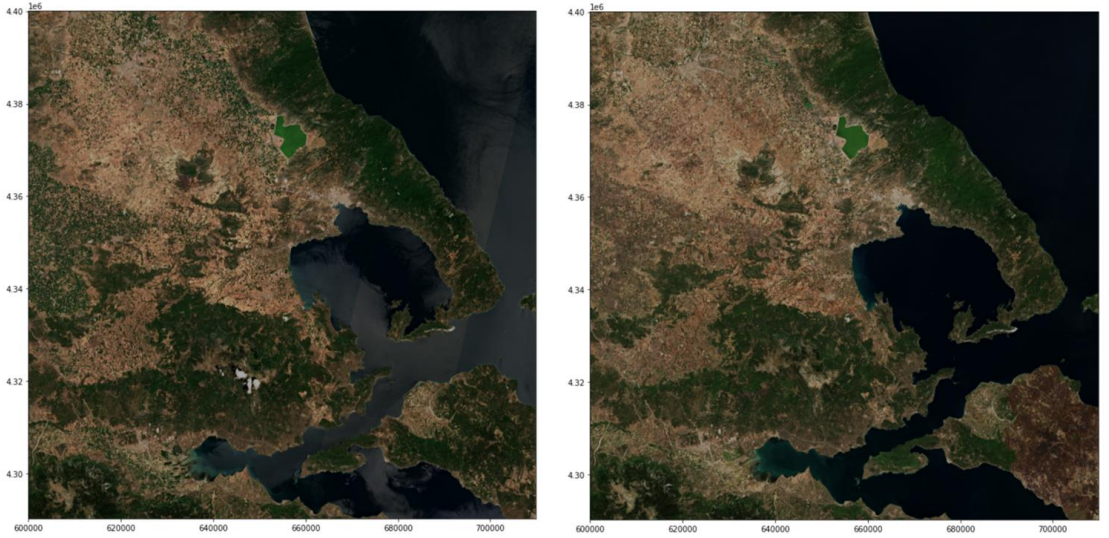
www.eumetsat.int

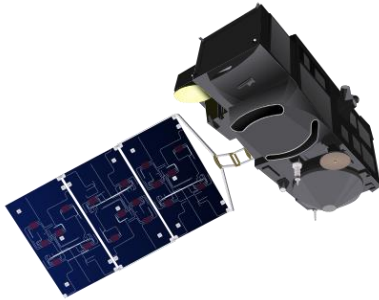


gas pollutants

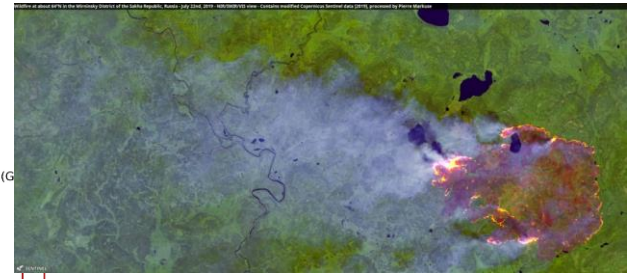


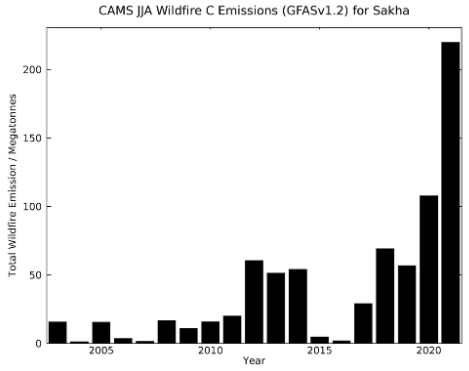
burned area & scars

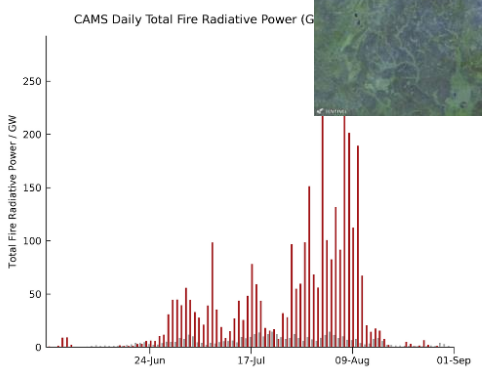




emissions & trends

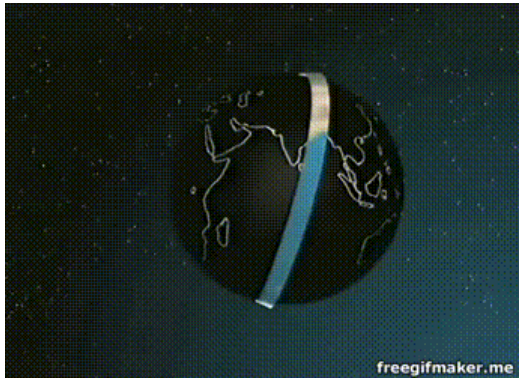


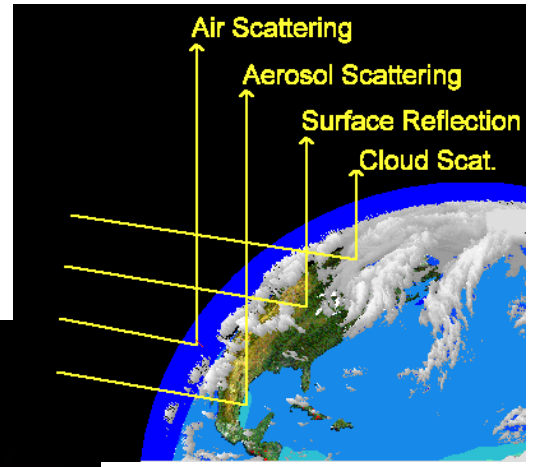




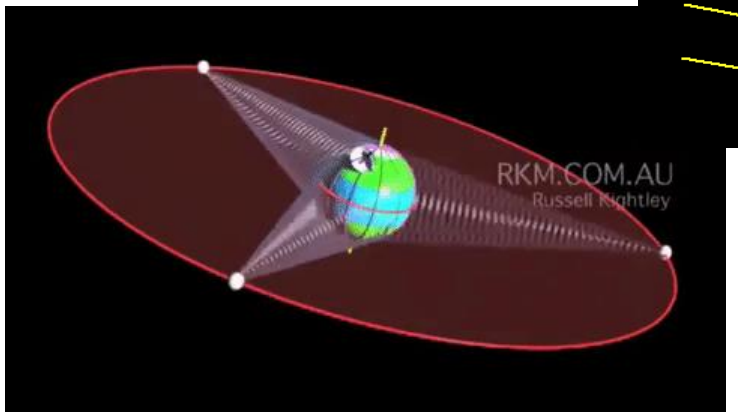
Satellite detection

Advantages:
More near to Earth -> Higher spatial resolution
Used also for Active Obs.(Radar/Lidar) and PMW
Disadvantages:
Poorer time resolution -> needs of constellation





Advantages:
Better time resolution
Disadvantages:
One side of the Earth -> needs of constellations
large viewing angles at the borders -> geometrical distorsions
Only VIS/IR and passive



Example: observe aerosols

AOD (Aerosol Optical depth) = How much Solar light attenuated by aerosols – proxy of mass

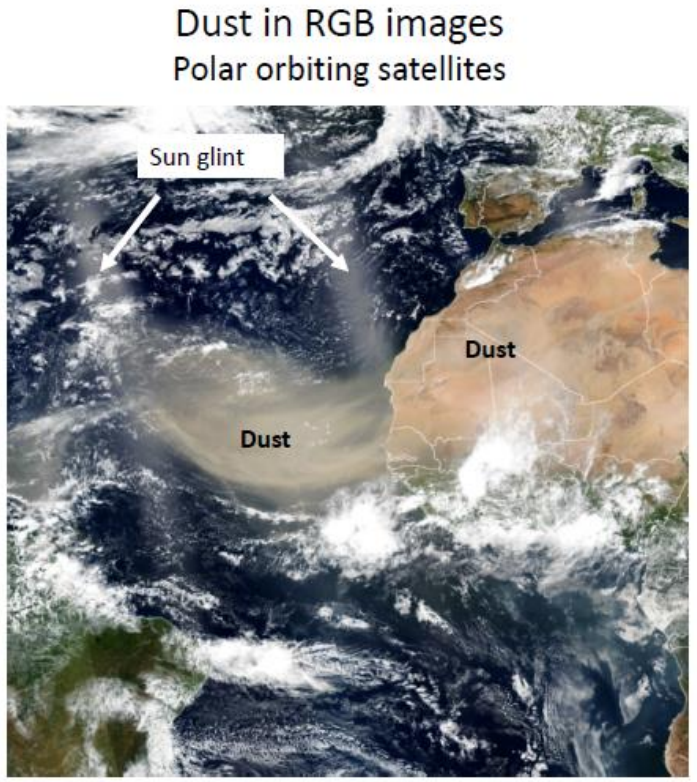
AAI aerosol index –

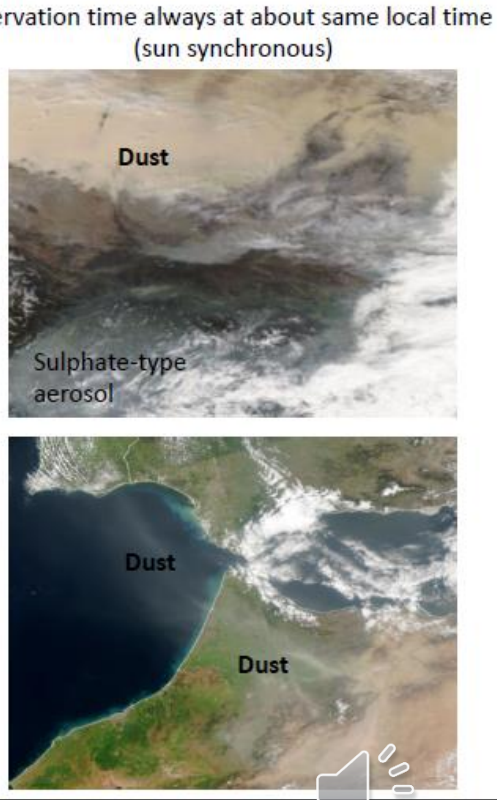
Visible imagery -

Aerosols **add** to the reflectance and sometimes **reduce** the reflectance of surface objects

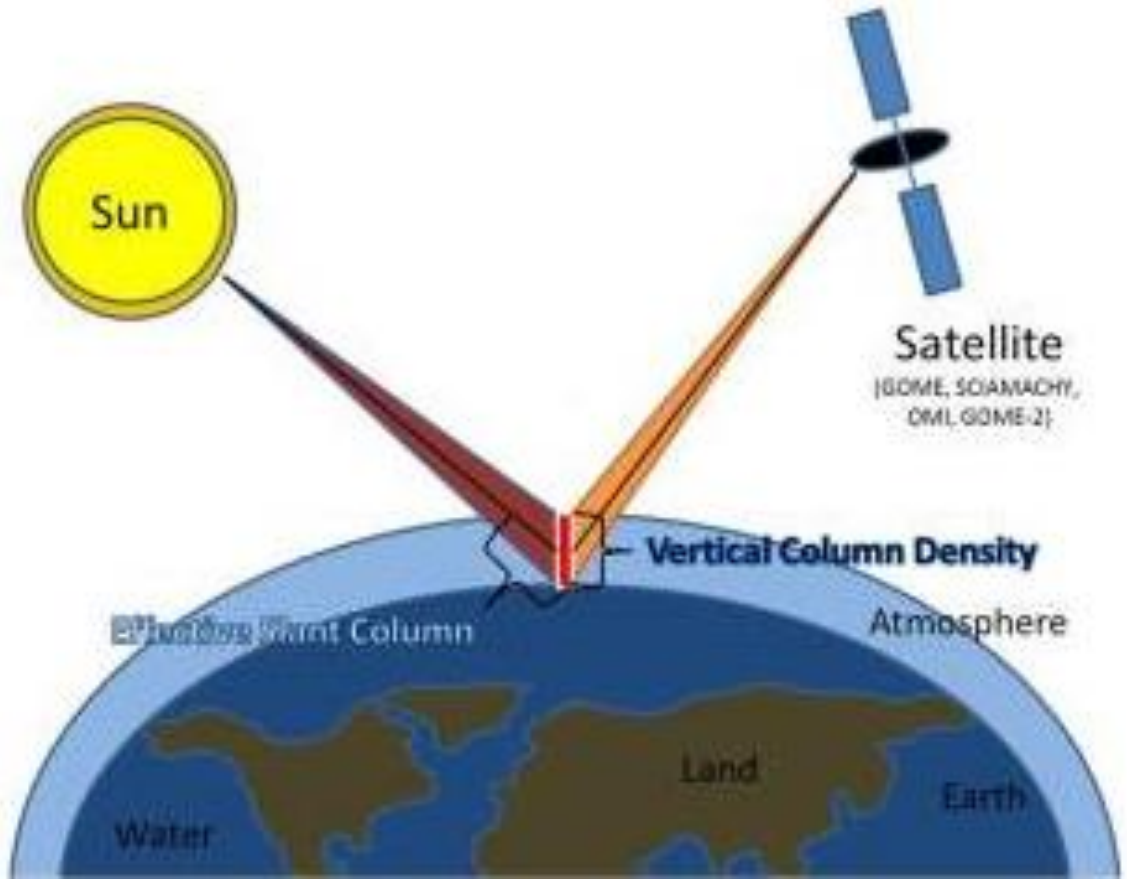
Aerosols always **diminish** the **contrast** between dark a bright surface objects

Haze and smoke aerosols **change the color** of surface objects to bluish while **dust** adds a yellowish tint.





Observe total column …

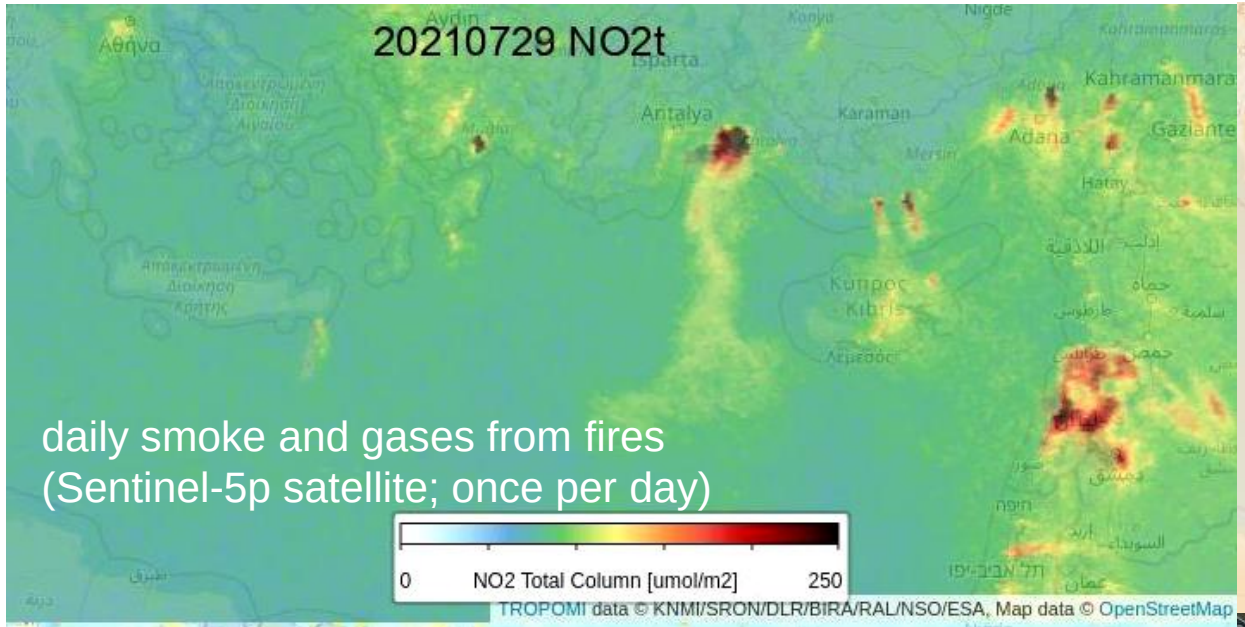


Satellite measurements
Radiation emerged from the interaction with the Atmosphere-Surface system

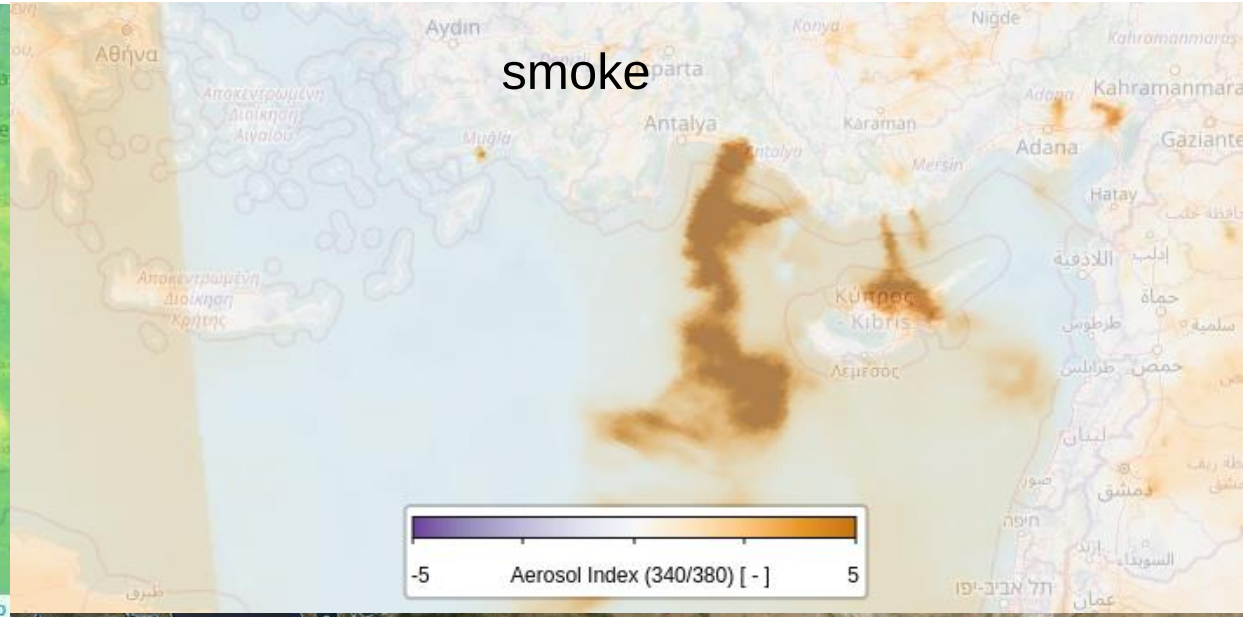
COMPARED TO

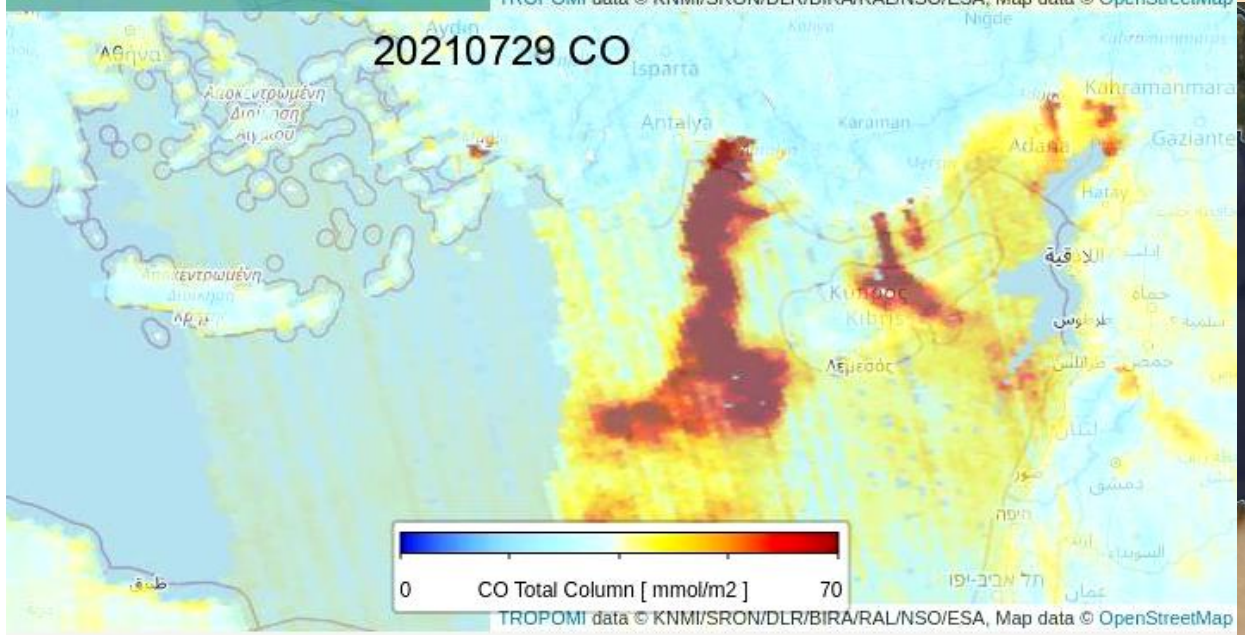
Modelled measurements
- A priori information on the system (atmospheric scenarios)
- Model of the system (Forward model)

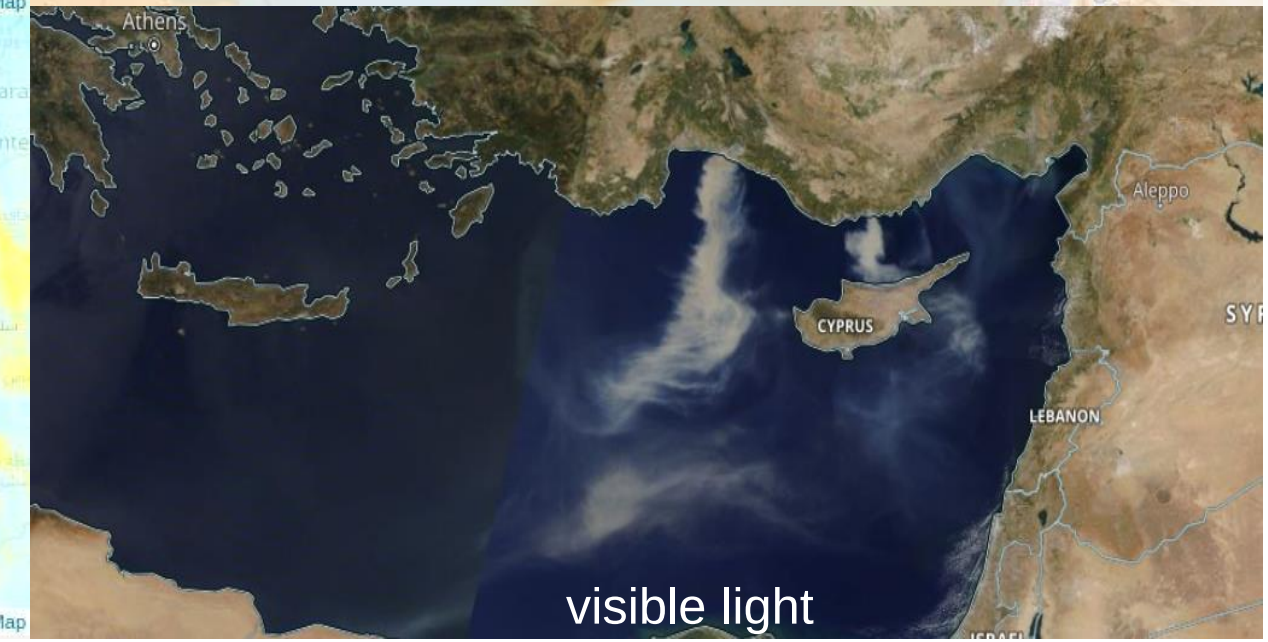
Monitoring from space



daily smoke and gases from fires
(Sentinel-5p satellite; once per day)

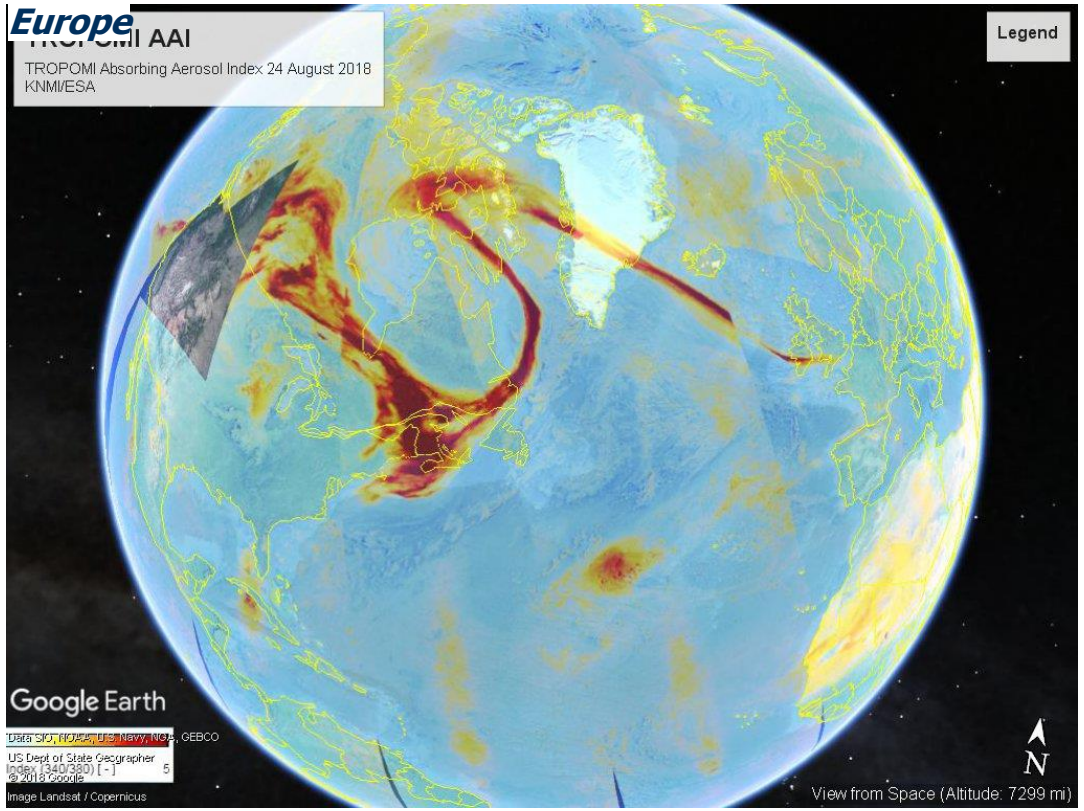




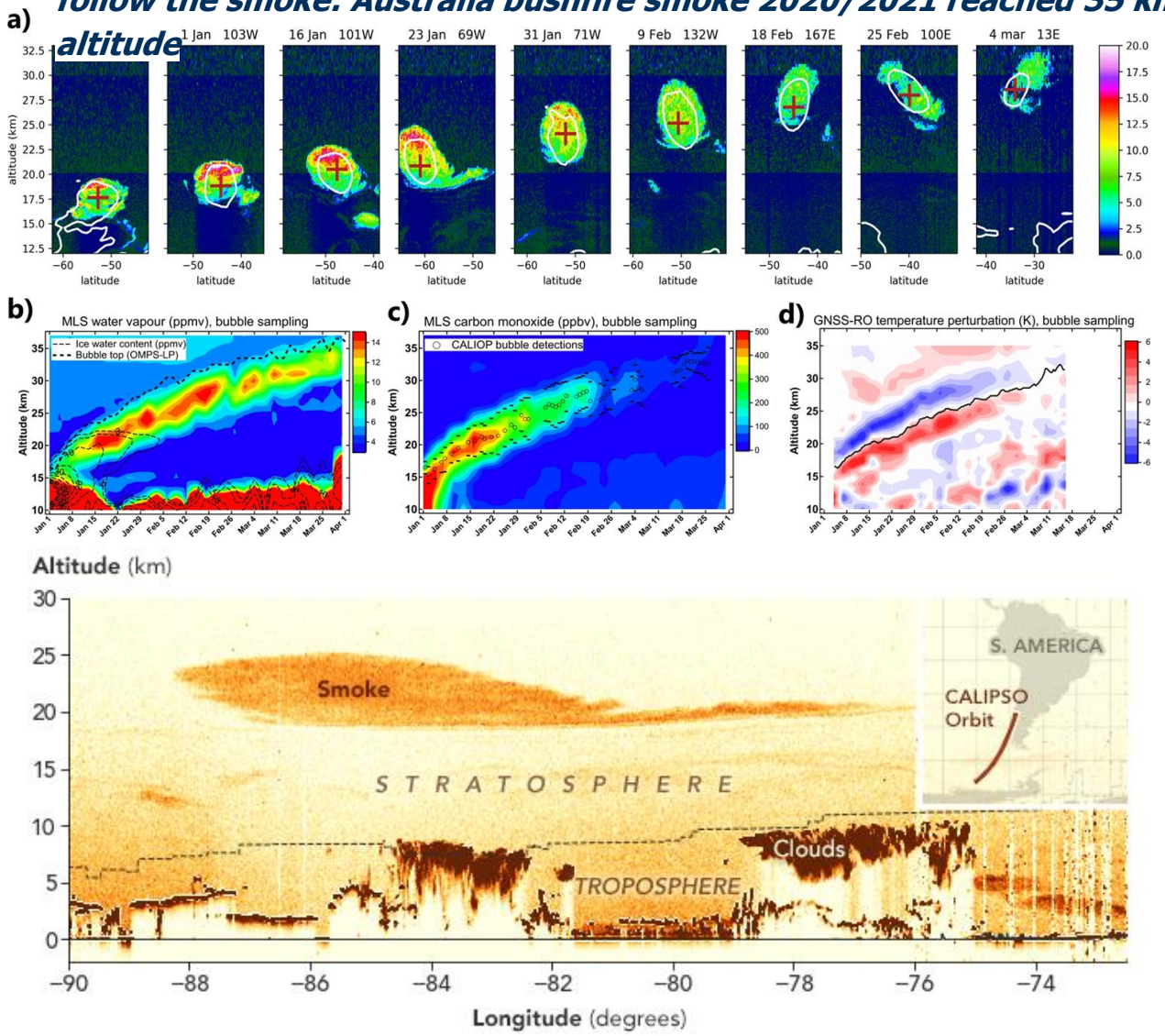


worldwide monitoring of wildfire smoke and air pollution

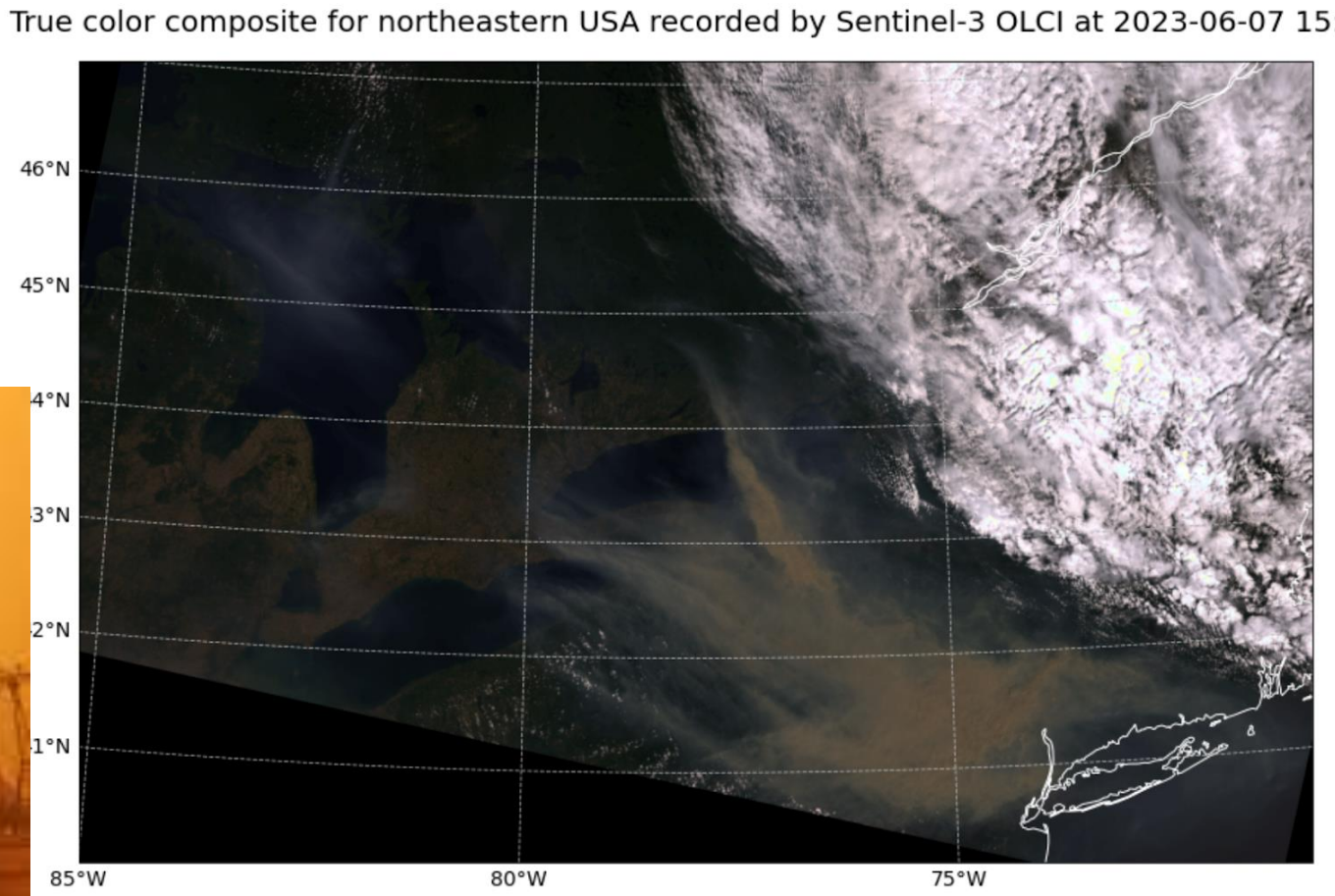
follow the smoke: smoke from Canada fires 2018 reached Europe



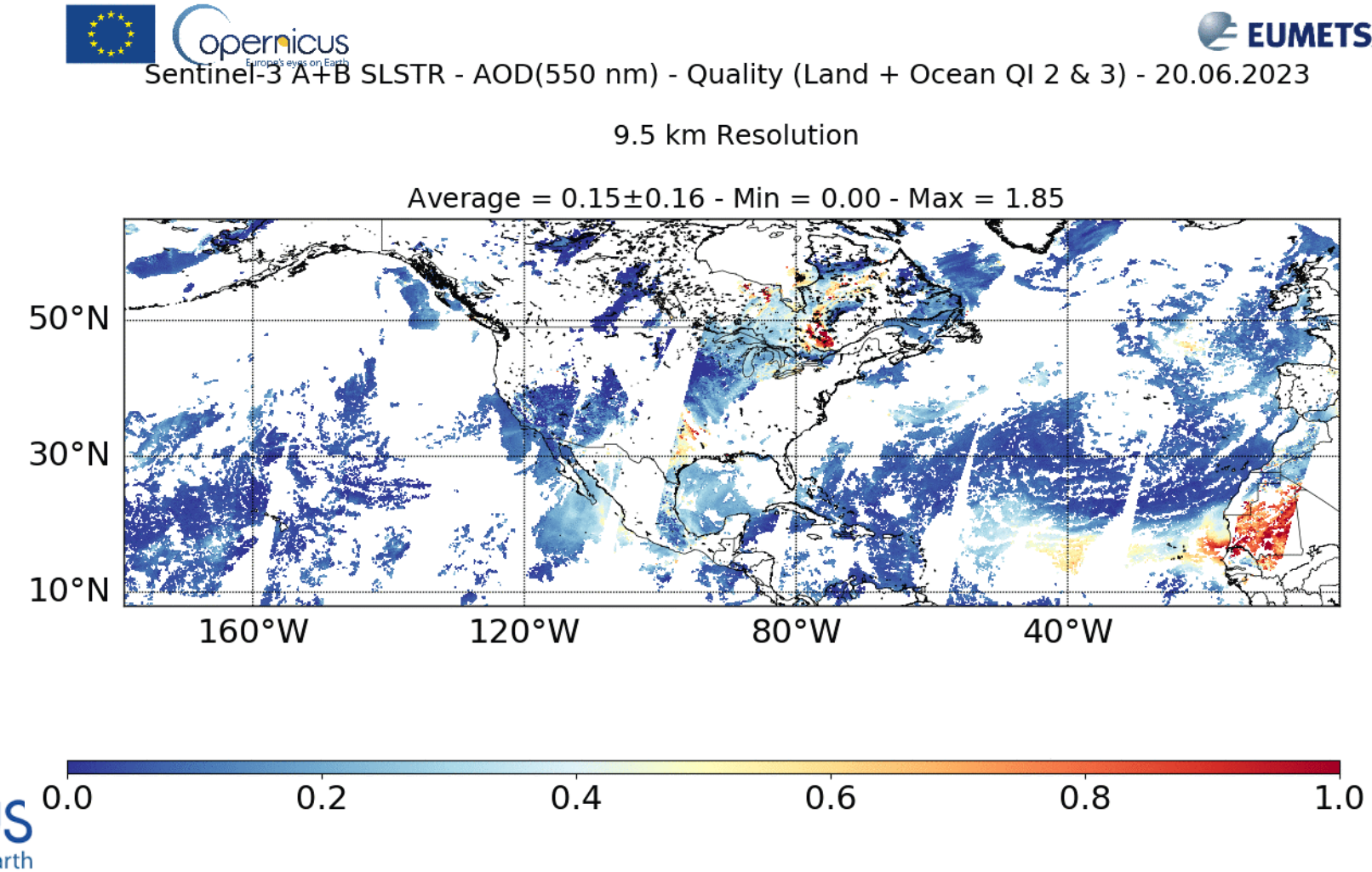
follow the smoke: Australia bushfire smoke 2020/2021 reached 35 km altitude



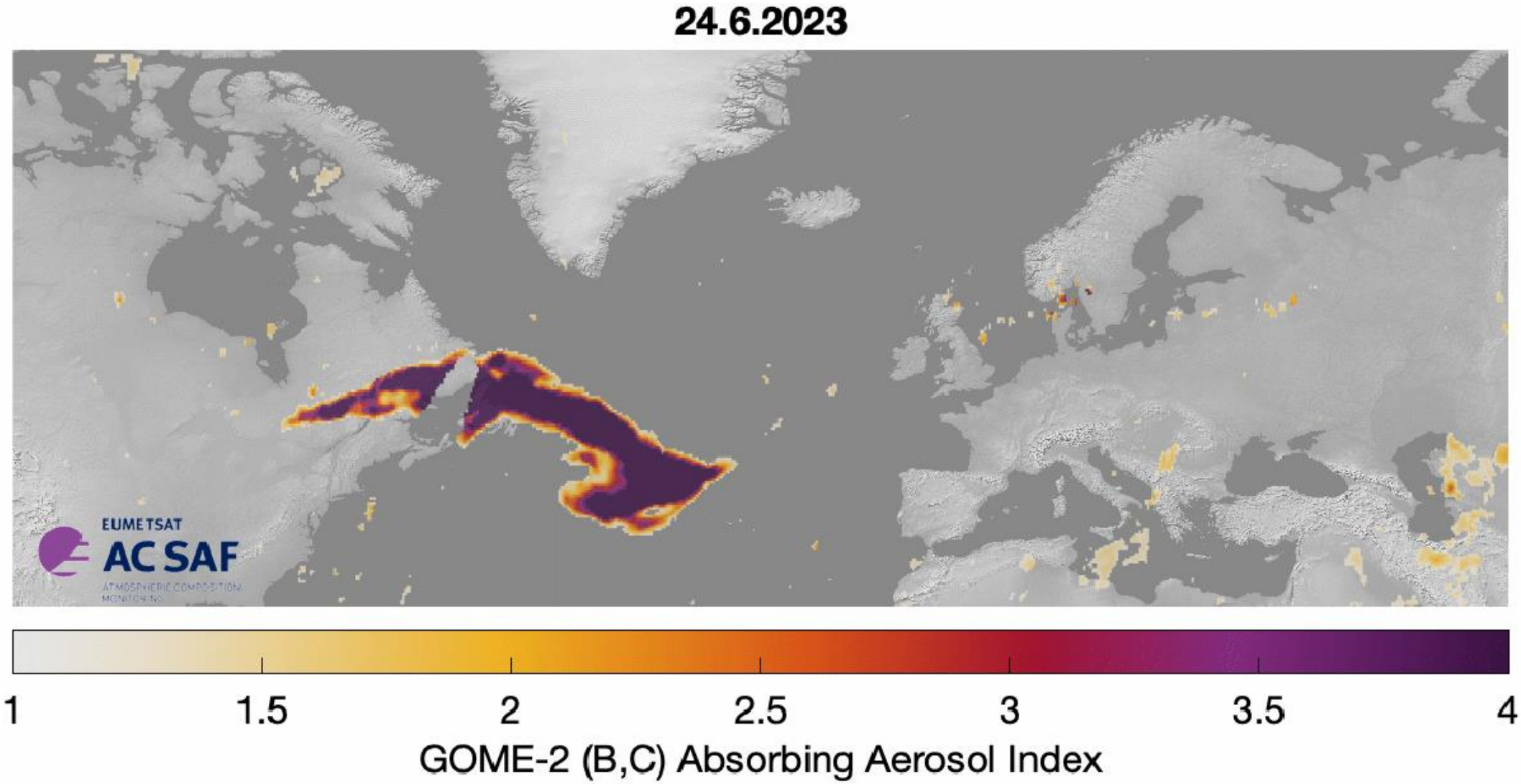
Reuters -


True color composite for northeastern USA recorded by Sentinel-3 OLCI at 2023-06-07 15:27
46°N
45°N
4°N
3°N
2°N
1°N
85°W
80°W
75°W

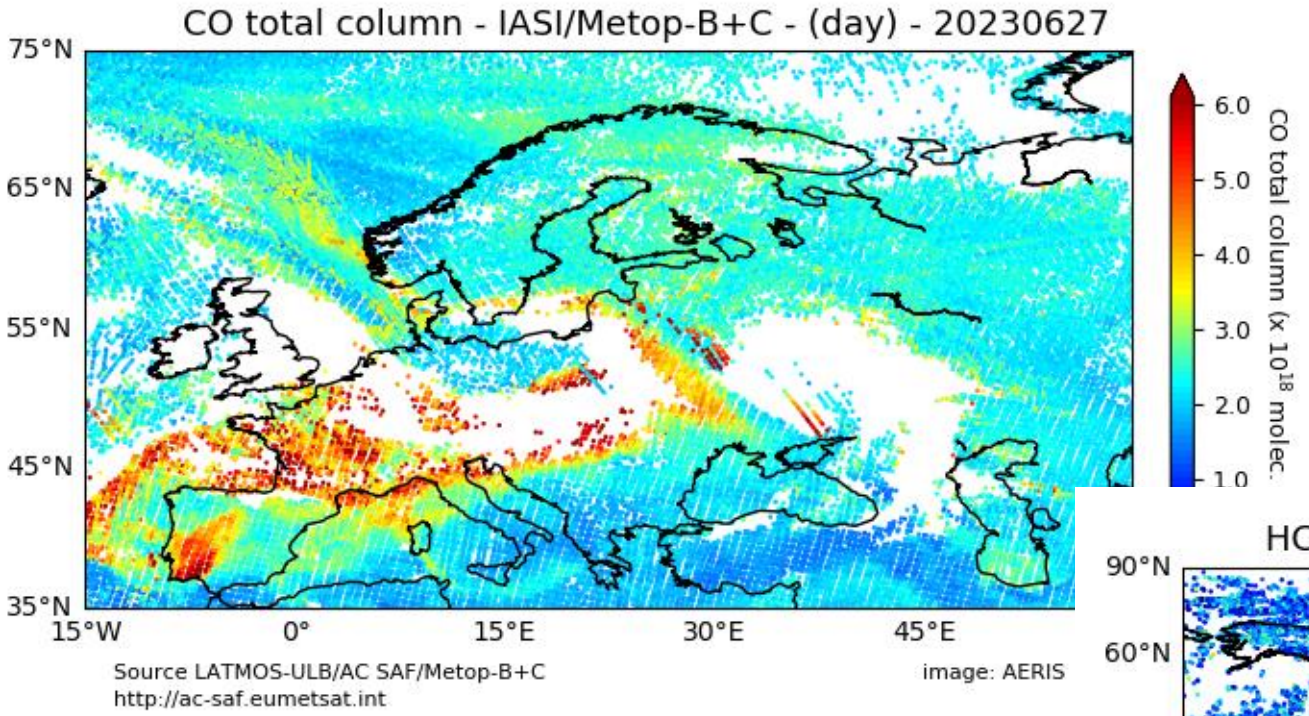
Monitoring from space

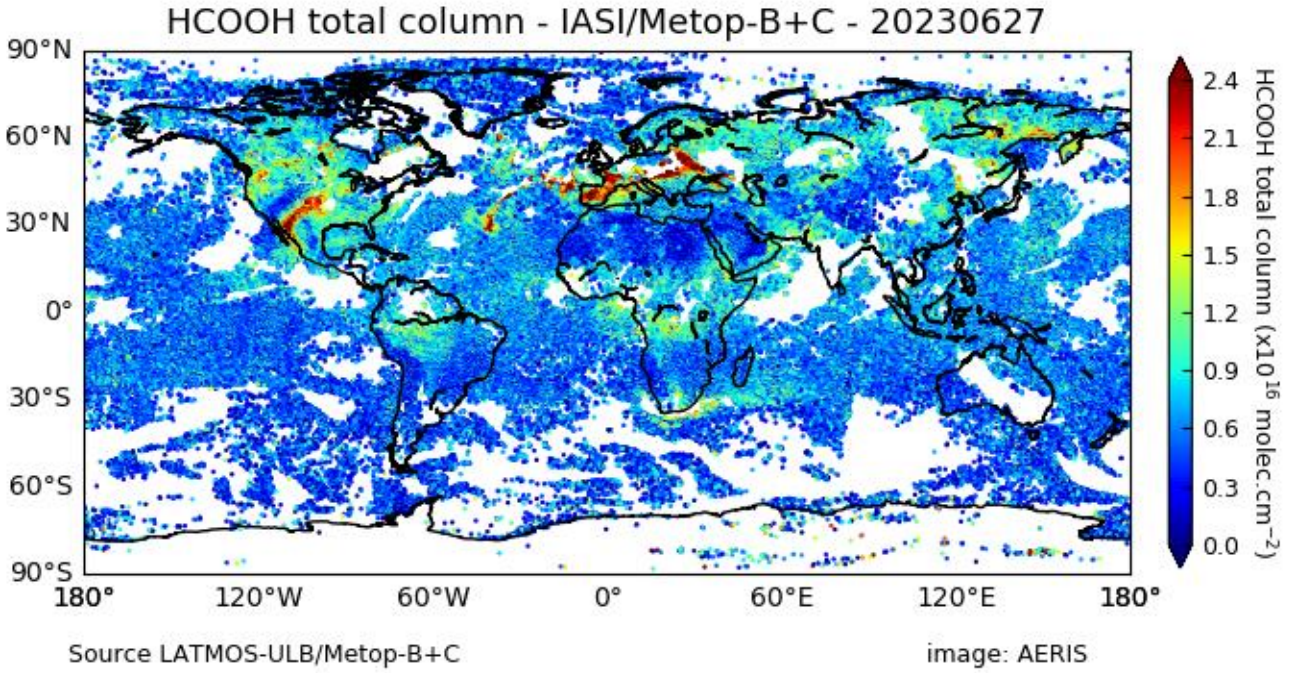


Aerosol Index

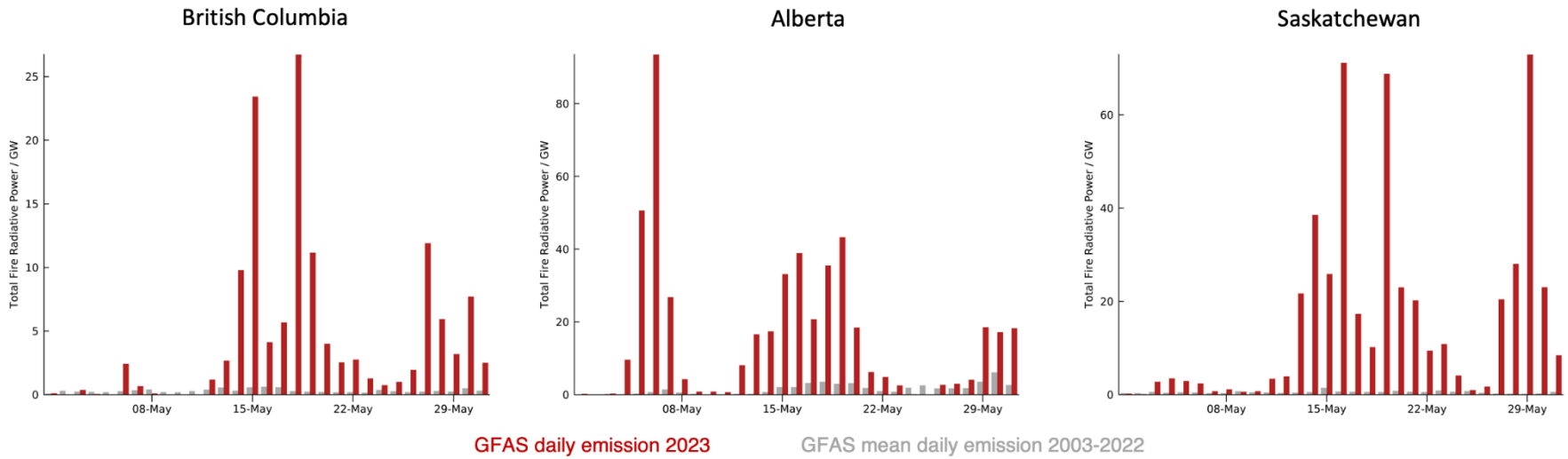


Chemicals – pollution from wildfires

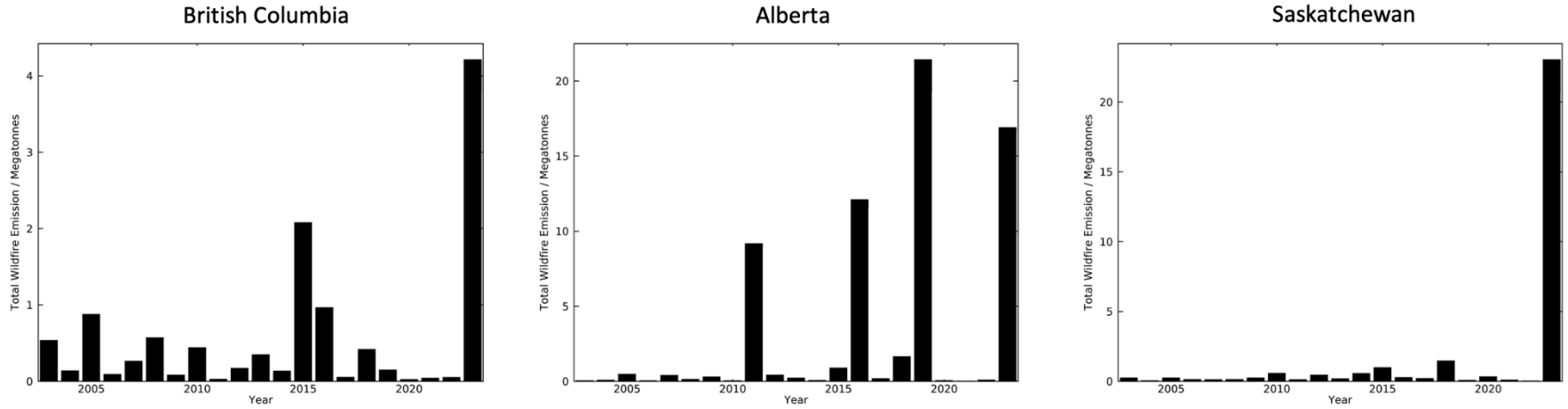




CAMS Daily Total Fire Radiative Power (GFASv1.2)



May Total Estimated Wildfire Carbon Emissions



Monitoring from space

The future is now: METEOSAT Third Generation (2023 onwards)

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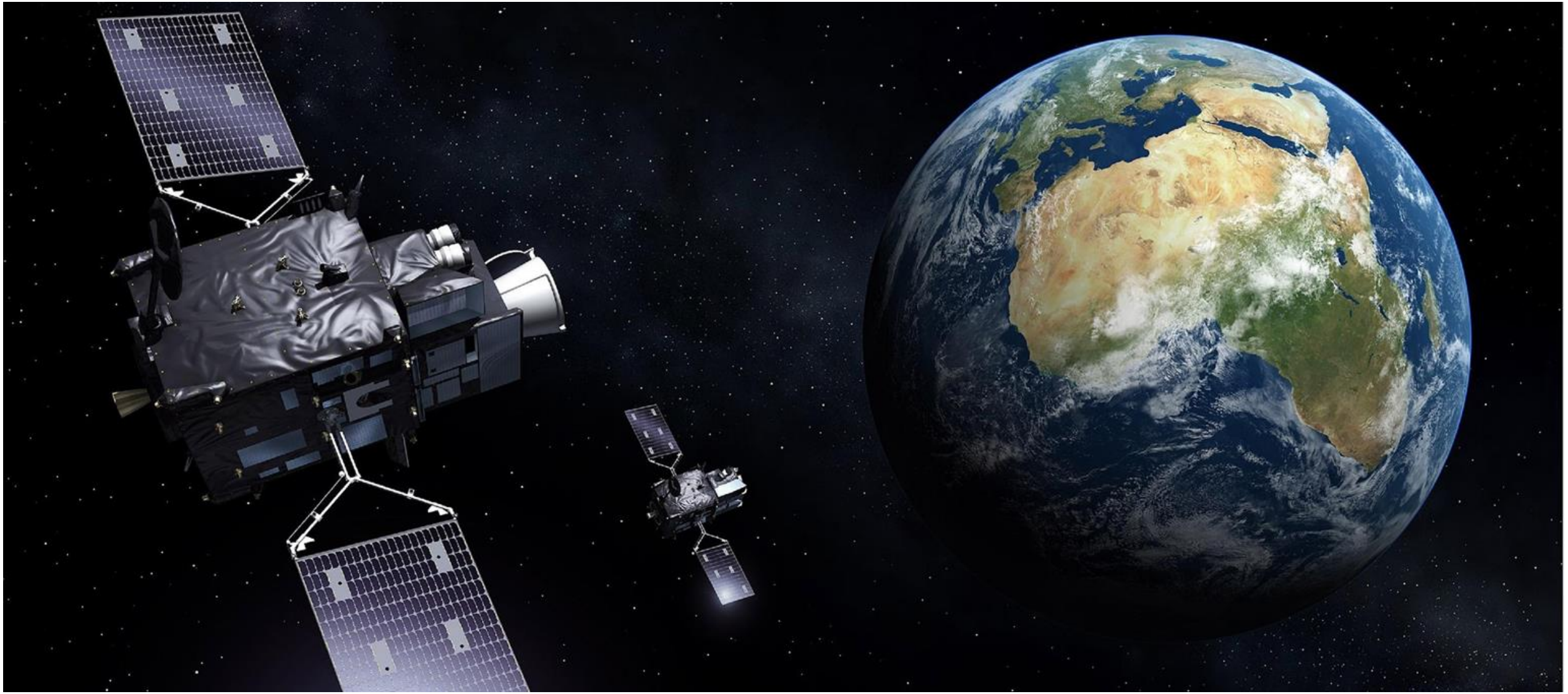

Monitoring from space

a whole new dimension will be explored by Sentinel-4:

daytime hourly air quality data over Europe