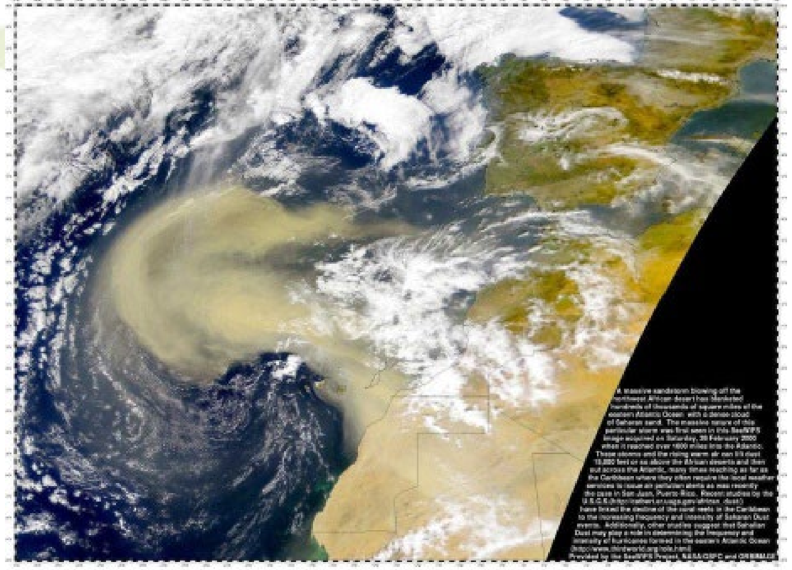
POLLUTANTS FROM “NATURAL SOURCES” (WILDFIRE SMOKE & SAHARAN DUST): INNOCENT BYSTANDERS OR IMPORTANT ONES?



Clean Air in Europe For All, Brussels, 24th May 2023

ERS HEI ISEE

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Content

- **Natural emissions of atmospheric pollutants influencing air quality**
- **Desert dust**
- **Wildfires (natural?)**
- **Final considerations**

Natural atmospheric pollutants influencing air quality

The problems are qualitative and quantitative different in the emission and receptor regions

NATURAL EMISSIONS

- Biogenic (VOCs, PM, bioaeros.)
- Sea salt (PM)
- Volcanic (PM, SO_2, NOx, CO)
- Wildfires (PM, NOx, NH_3, CO)
- Desert dust (PM)

These tend to coincide both in time and space, and with heatwaves

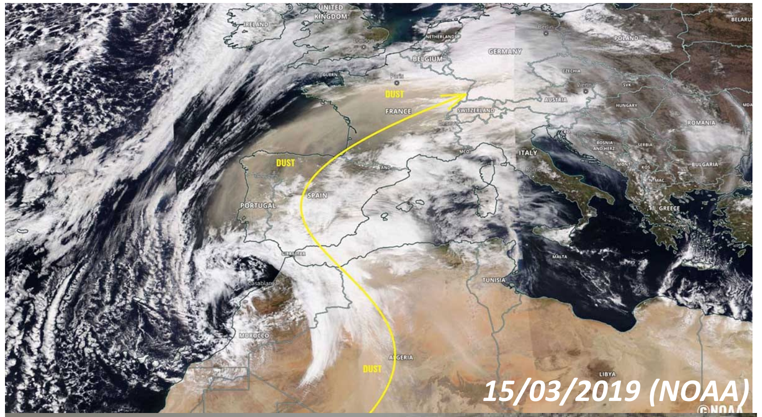
EMISSION REGION


06/09/2019 M'Hamid, Moroco


24/03/2023, Villanueva de Viver, Spain (El País)

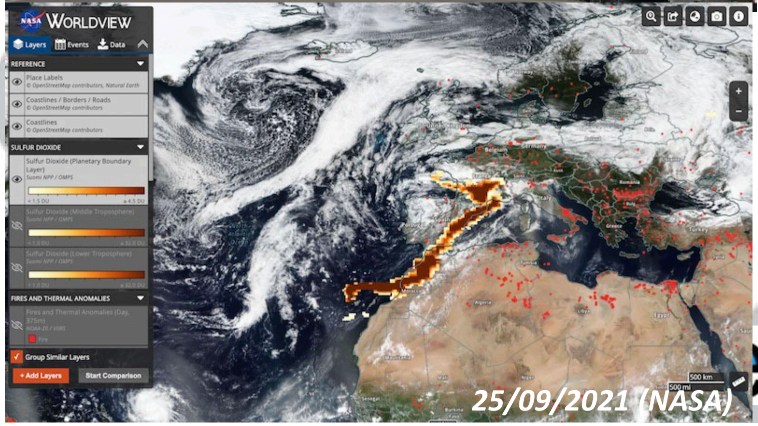

04/10/2021, La Palma, Spain (Ass. Press)

RECEPTOR REGION



15/03/2019 (NOAA)


Castellón City, Spain



25/09/2021 (NASA)

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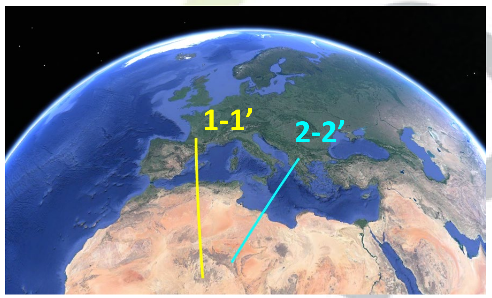
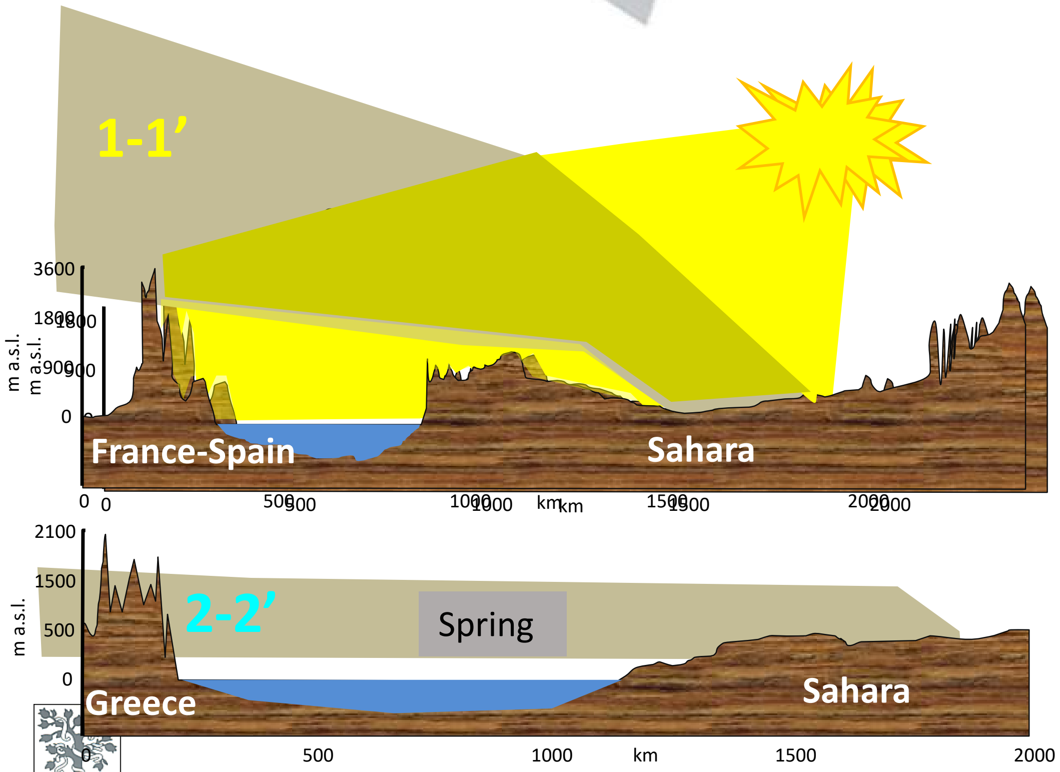
Desert dust

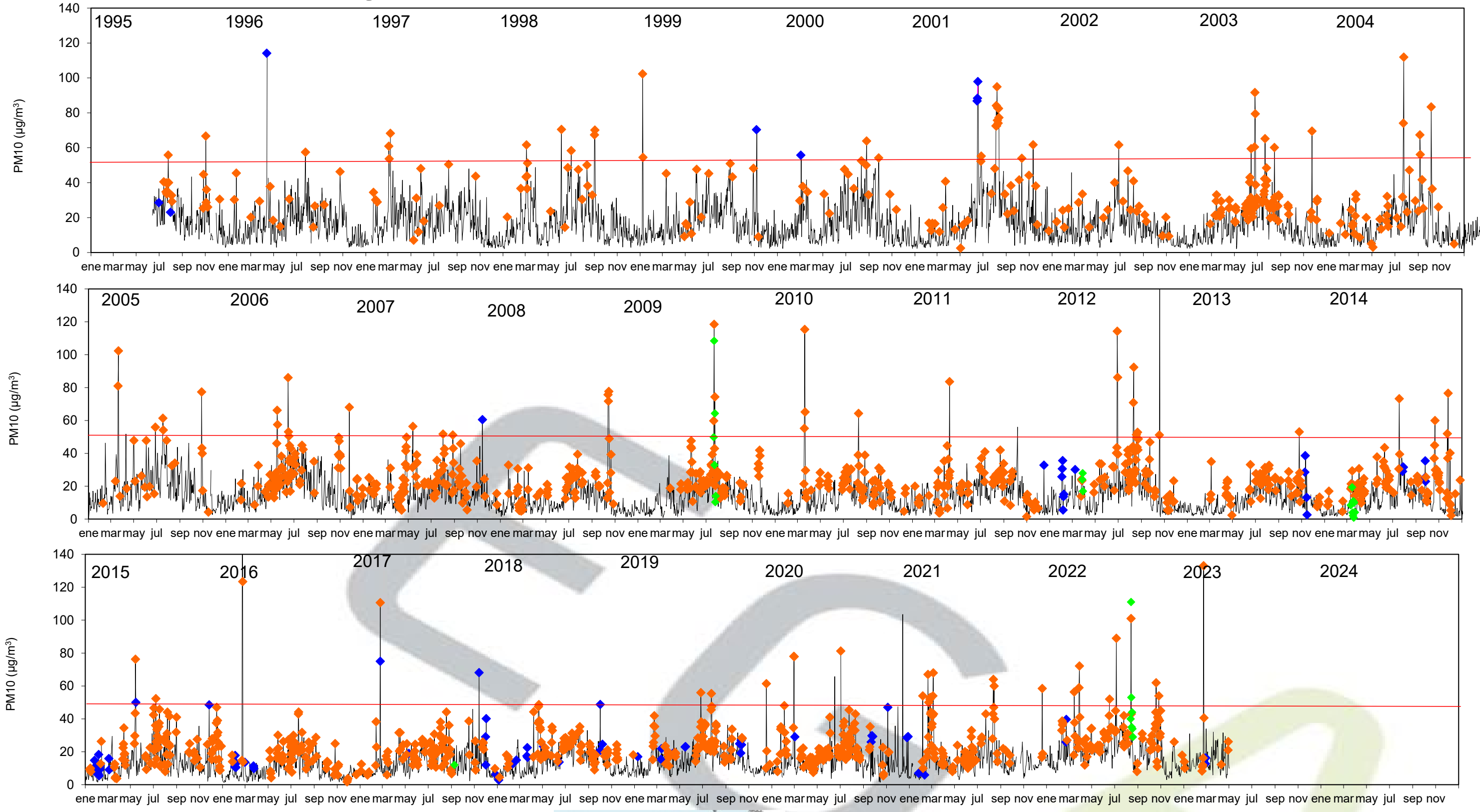
Querol X., et al., 2019. Environment International





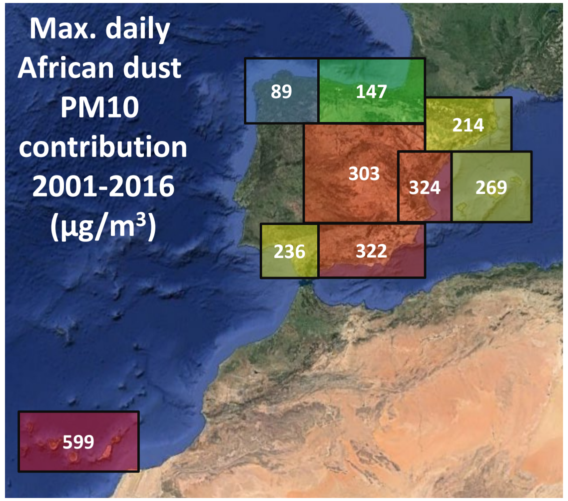
PM_{10} MONAGREGA (REMOTE SITE) SPAIN

115 out of 128 exceedances of the DLV registered in 29 years are caused by African dust outbreaks



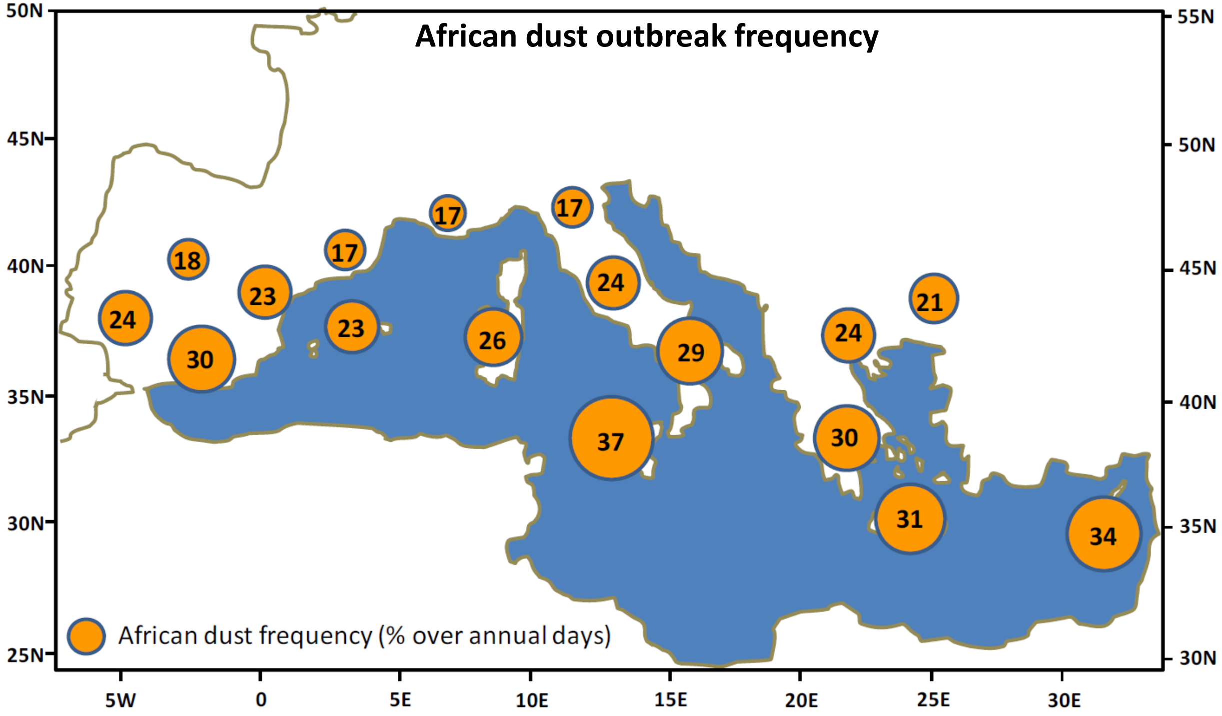
- African dust outbreaks
- Local dust from Monegros
- Forest fires

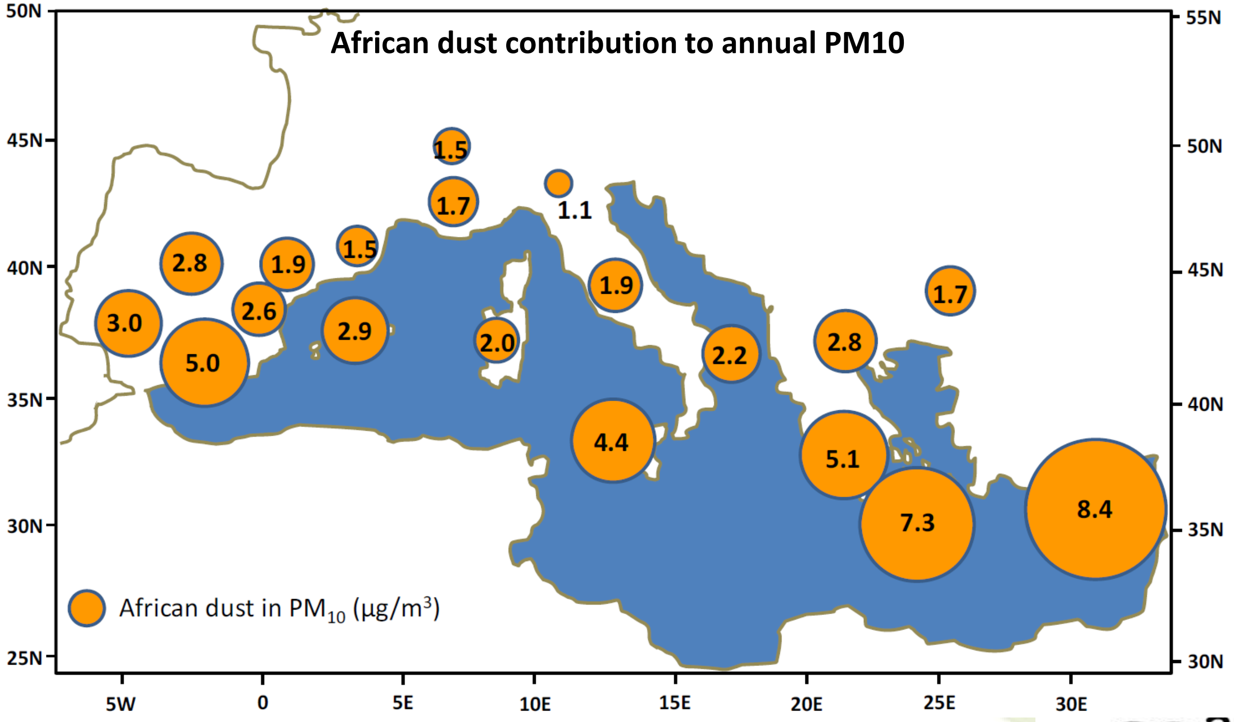
Desert dust



Querol X., et al., 2019. Science of the Total Environment

Pey J. et al., 2013, Atmospheric Chemistry and Physics,





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SYSTEMATIC REVIEW MORTALITY-DUST: META-ANALYSIS

Tobias et al., 2023. Under review, Environment International

SHORT-TERM ASSOCIATIONS (GENERAL POPULATION, STUDIES 2002-2022)

Premature mortality increase in dust/non-dust days

	N	Lag %IRR (95%CI) p-value
All-cause	25	Lag 0, 1.25 (0.63, 1.88) <0.001
Cardiovascular	25	Lag 0, 1.66 (0.40, 2.91) 0.010

Morbidity increase in dust/non-dust days

	N	Lag, %IRR (95%CI) p-value
Respiratory	10	Lag 0, 4.73 (3.31, 6.14) <0.001
	6	Lag 1, 3.07 (1.45, 4.69) <0.001
	5	Lag 3, 3.07 (1.36, 4.79) <0.001

Effect modification of premature mortality PM10 (per each increase of 10 µg m^{-3})

	N	Lag %IRR (95%CI) p-value
Non-dust days	5	Lag 0, 0.77 (0.44, 1.10) <0.001
	8	Lag 1, 0.94 (0.90, 0.97) <0.001
Dust Days	5	Lag 0, 0.81 (0.46, 1.15) <0.001
	5	Lag 2, 0.49 (0.21, 0.75) 0.001
	4	Lag 3, 0.73 (0.35, 1.11) <0.001
	4	Lag 4, 0.41 (0.02, 0.79) <0.001

IRR: Increase Risk Ratio
CI: Confidence Intervals
N: n. of studies

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SHORT-TERM HEALTH EFFECTS FROM OUTDOOR EXPOSURE TO BIOMASS BURNING EMISSIONS: A REVIEW

Karanasiou A., et al., 2021, Science of the Total Environment

SHORT-TERM ASSOCIATIONS (GENERAL POPULATION, STUDIES 2002-2020)

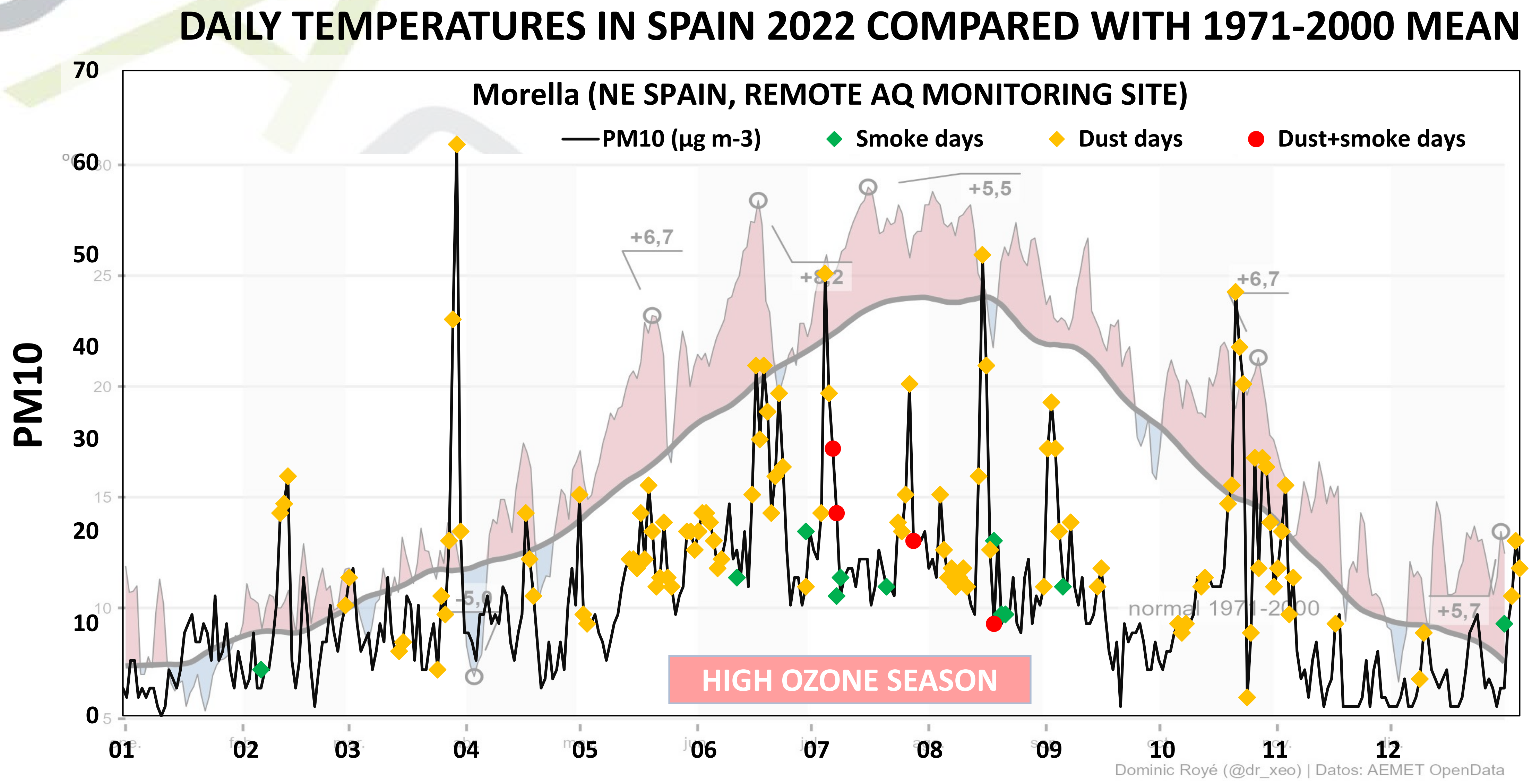
Premature mortality increase in smoke days

	N	%IRR (95%CI)
All-cause		
Smoke (yes/no)	4	2.65 (1.02, 4.20)
PM10 (10 µg m^{-3})	5	1.31 (0.91, 1,71)
Cardiovascular		
Smoke (yes/no)	4	4.45 (0.96, 7.95)

Morbidity increase in smoke days

	N	%IRR (95%CI)
Respiratory		
Smoke (yes/no)	7	10.52 (3.87, 17.18)
PM2.5 (10 µg m^{-3})	13	4.10 (2.86, 5.34)
PM10 (10 µg m^{-3})	5	4.83 (0.06, 9.60)
Asthma		
Smoke (yes/no)	5	38.26 (7.91, 68.60)
PM2.5 (10 µg m^{-3})	13	9.19 (5.71, 12.68)
PM10 (10 µg m^{-3})	5	10.35 (4.44, 16.26)
COPD		
Smoke (yes/no)	4	13.33 (7.31, 19.34)
PM2.5 (10 µg m^{-3})	12	3.92 (1.13, 6.70)
PM10 (10 µg m^{-3})	4	3.95 (1.65, 6.24)
Ischemic heart disease		
Smoke (yes/no)	3	5.45 (0.80, 10.10)

Wildfires, dust and heatwaves



Wildfires, dust and heatwaves

Salvador P., et al., 2022. npj Climate and Atmospheric Science

Number of dust episodes over the Iberian Peninsula increase near 0.8 day year^{-1}, in 1948-2020, and probably with more frequency affecting Central and Northern Europe

Table 1. Trend analysis for days under any ADO CT for the 1948–2020 period.

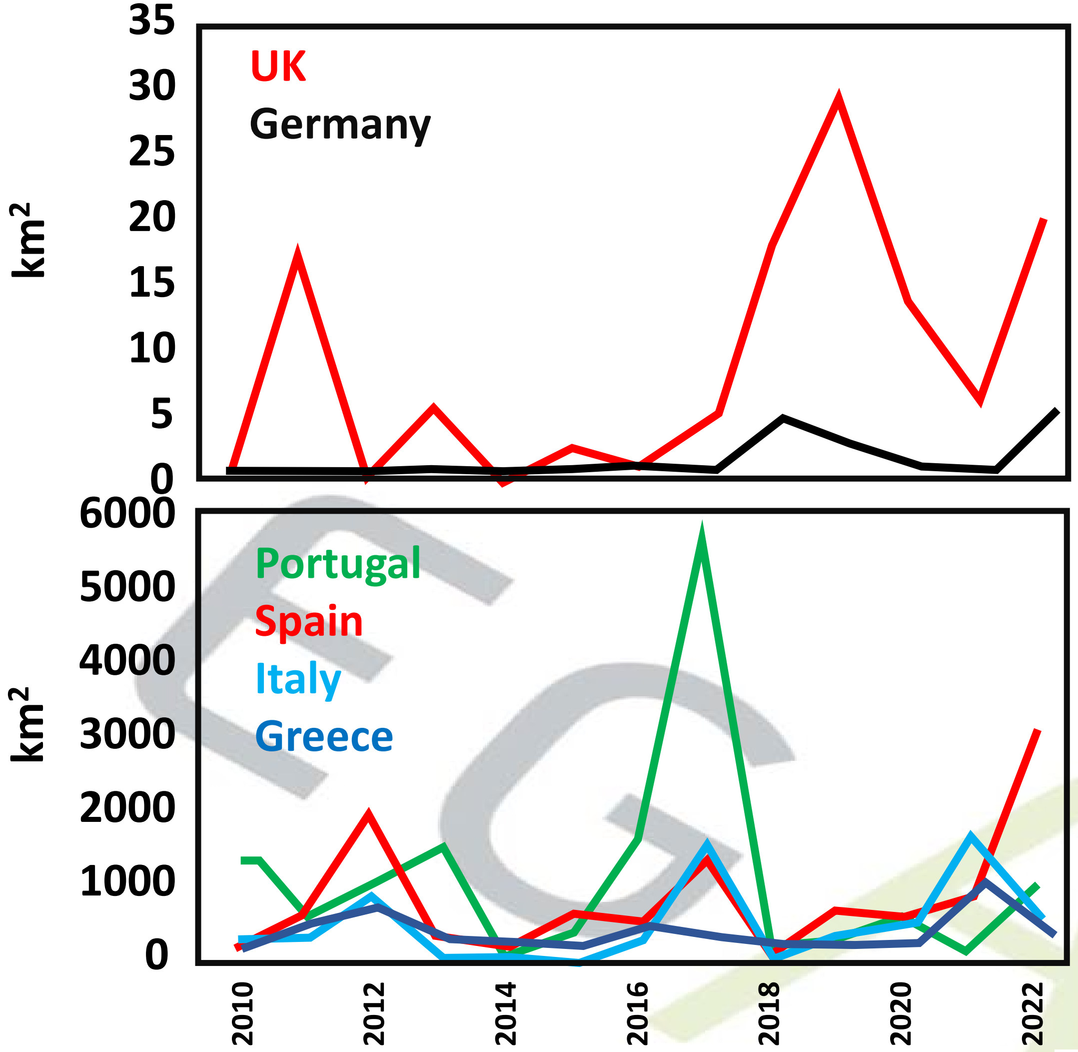
Days under ADO CT	Number of days	GT	TPOT	TANOM
All days	0.77***	0.41**	0.02**	0.02**
Spring	0.98**	0.39*	0.02*	0.02***
Summer	0.78**	0.52***	0.04***	0.03***
Autumn	NT	NT	NT	0.02***
Winter	0.67*	0.38***	0.02***	0.02*

Results of the Theil-Sen trend analysis. Values of the Slope estimator in days year^{-1}, for the number of days under ADO atmospheric circulation types (ADO CT) and the mean levels of GT (m year^{-1}), TPOT (°C year^{-1}) and TANOM (°C year^{-1}) averaged over the Iberian Peninsula and the Balearic Islands during those days. ***, **, * and +: statistically significant value at the 99.9%, 99%, 95% and 90% confidence level, respectively, NT: no trend.

Joint Research Centre (European Commission)

doi:10.2760/091540

Total burnt are for fires >30 ha



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Final considerations

- There is a body of evidence for health effects (mortality and morbidity) of PM arising from forest fires and desert dust
  - Dust as effect modifier (in Europe) show an increase of risk for cardiovascular mortality and for respiratory and child asthma morbidity
  - Wildfires increase all-causes and cardiovascular mortality and respiratory morbidity
- Dust and smoke days coincide very often, and these together with heatwaves, and in the high ozone season, thus synergistic effect probably occur
- Alert systems should be implemented (existing for dust since 2001 in some areas of Europe) to alert the most susceptible population to take protection measures. Also clear messages should be given for the protection
- Actions should be taken to decrease human exposure to susceptible pollution in the affected areas and abate emissions (when possible)
  - Implement short-term action measures to decrease emissions of local pollutants
  - Alert the population
  - Promote remote working during episodes
  - Abate resuspension of deposited dust by road traffic after major episodes (washout with phreatic, non-drinking, water)

Thank you very much for your attention!!!!!

European Respiratory Society (ERS)
Health Effects Institute (HEI)
International Society for Environmental Epidemiology (ISEE)

For supporting the reviews on health effects of dust and biomass burning

For supporting the Spanish desert dust alert system since 2001

EC Horizon 2020, LC-GD-9-1-2020, Research & Innovation Action Number: 101036245

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