Event Week on Heatwaves and Droughts 2023

Session 4 - 1 June 2023

Impacts on air quality

Ana Russo
acrusso@fc.ul.pt

INSTITUTO DOM LUIZ

Ciências ULisboa

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Context

1

Global Health Impacts of Air Pollution

Global context

2

Compound Events

Co-occurring or consecutive events

3

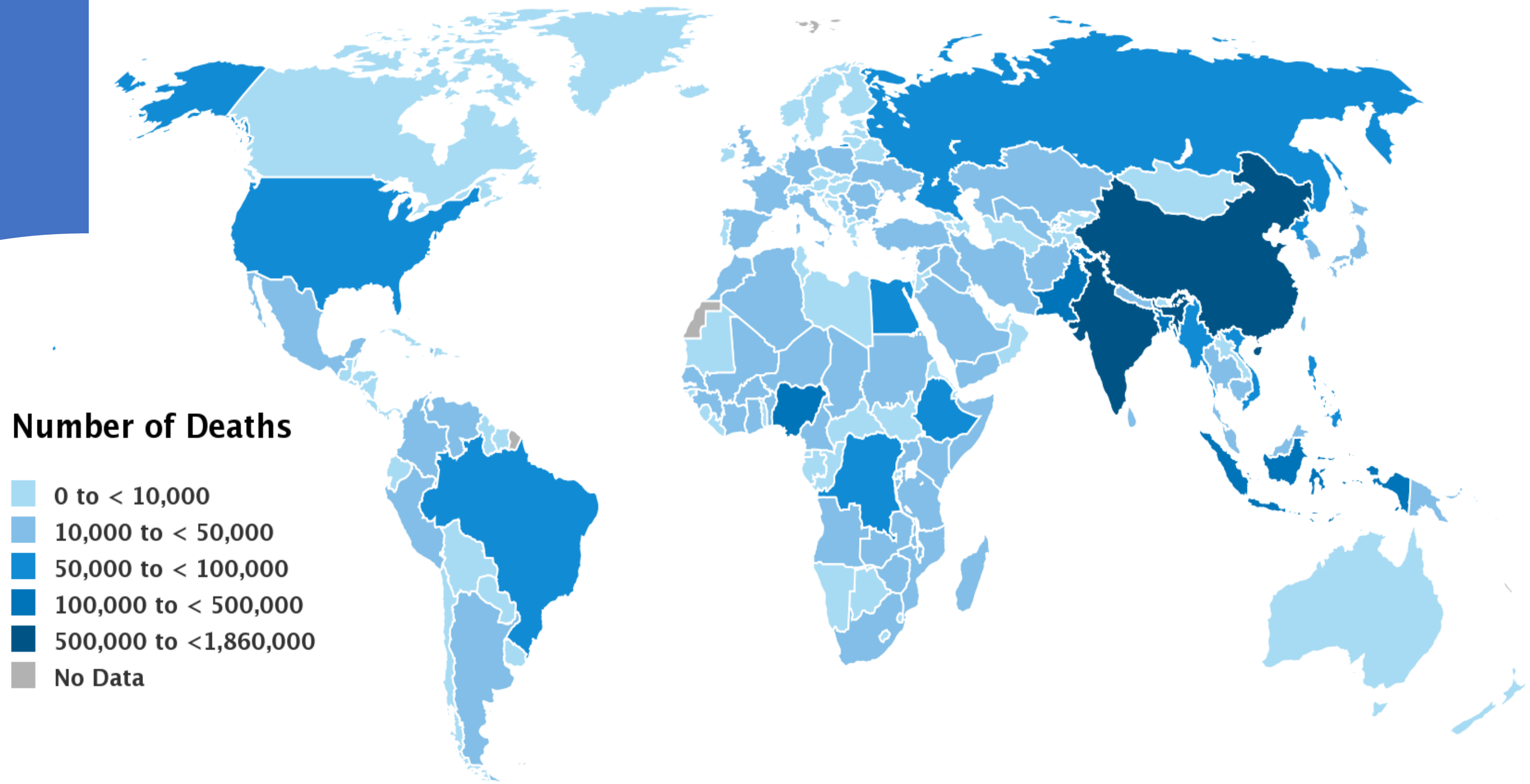
Health Impacts

Examples: Legionella, Ophelia and Compound Hot and O3 events

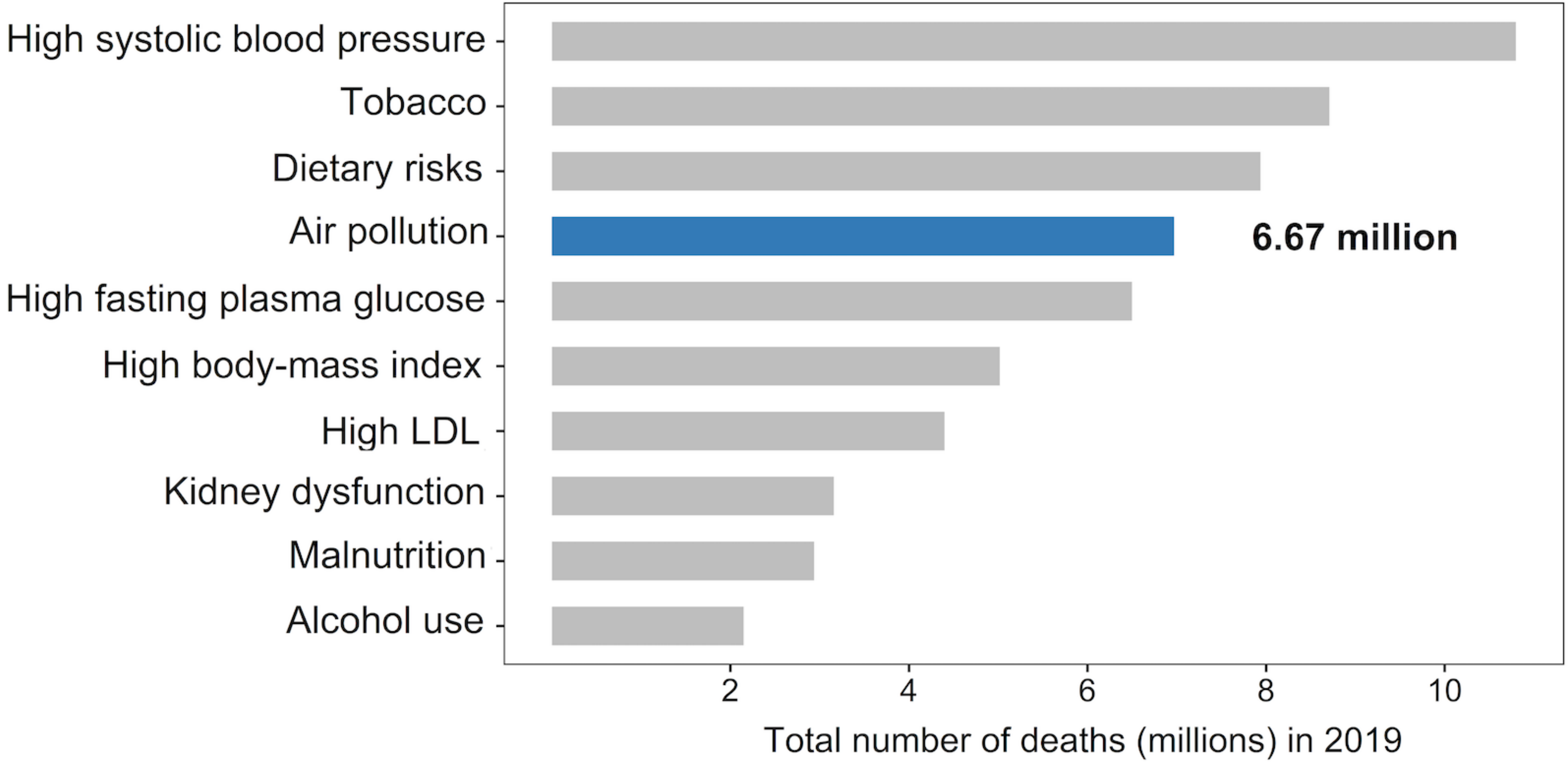
How about climate change?

Global Health Impacts of Air Pollution

Number of Deaths Attributable to Air Pollution in 2019



State of Global Air


High systolic blood pressure
Tobacco
Dietary risks
Air pollution
High fasting plasma glucose
High body-mass index
High LDL
Kidney dysfunction
Malnutrition
Alcohol use
6.67 million
2
4
6
8
10
Total number of deaths (millions) in 2019

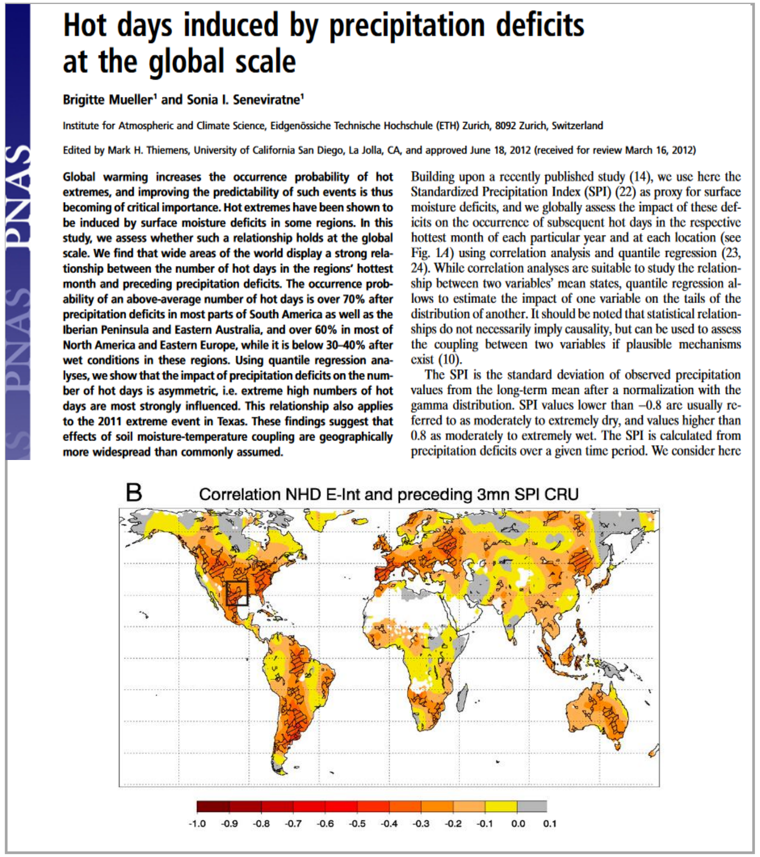
Conversations are like cherries; we never pick just one!

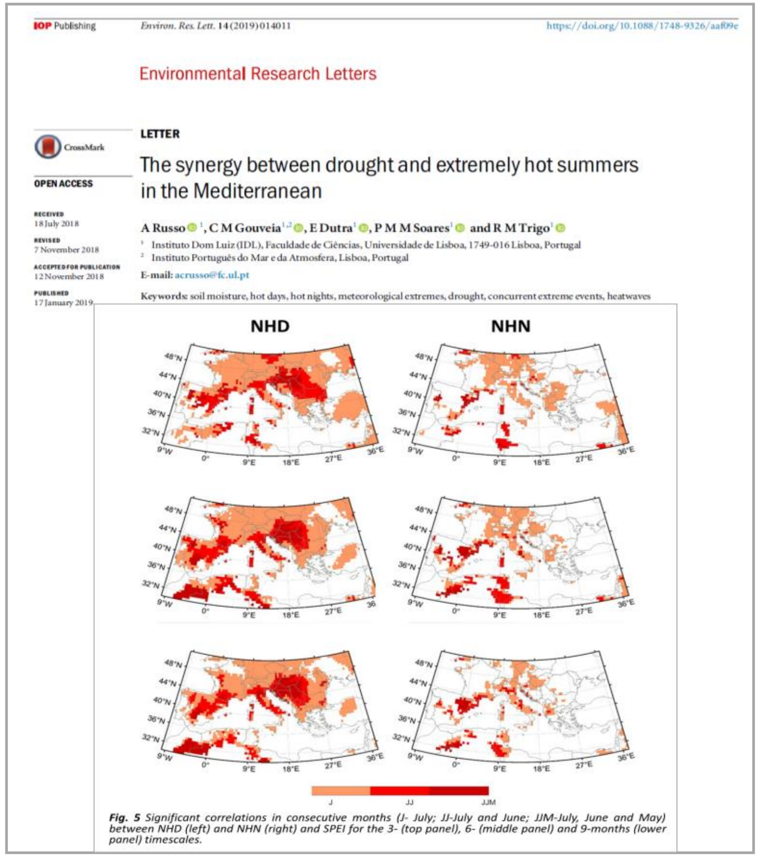
Wildfires, heatwaves and droughts often result from a combination of interacting physical processes across multiple spatial and temporal scales, leading to significantly higher impacts

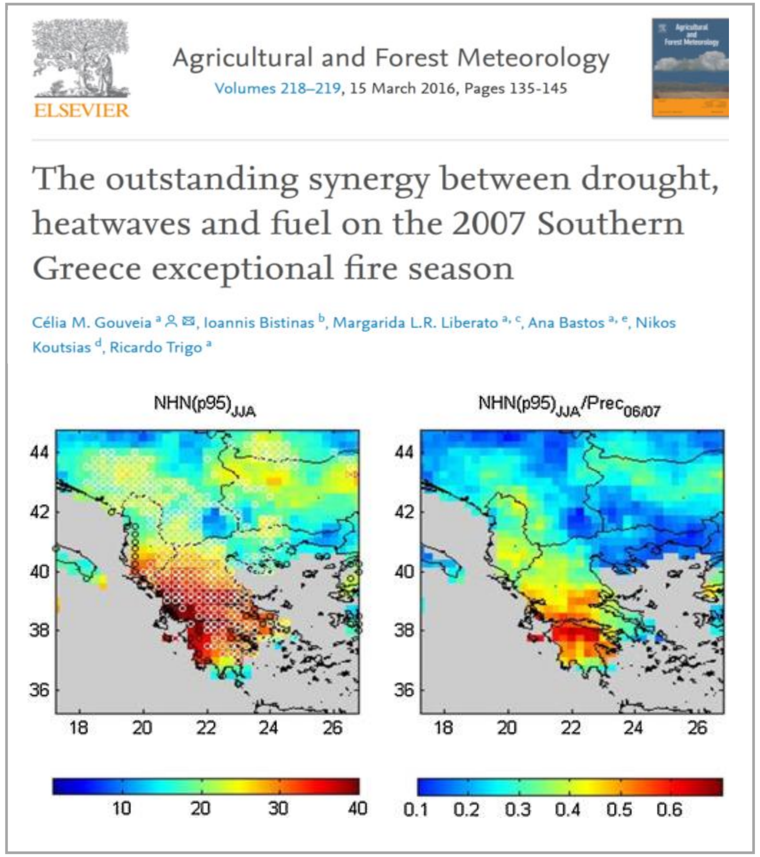
= Compound Events =

Strong evidence that droughts and heatwaves are at times synergetic – with subsequent impacts on fires

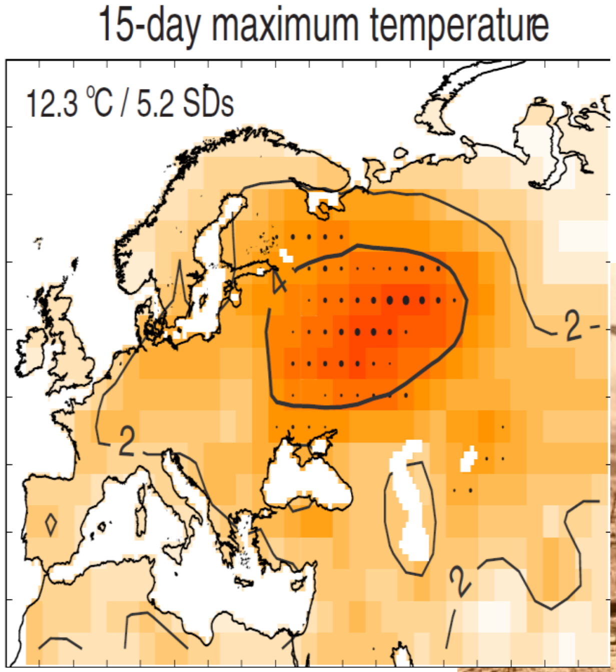
COMPOUND FRAMEWORK







2010 Extreme Heatwave



Barriopedro et al. (2011) *Science*

2010 | Precipitation Deficit | Blocking | High Temperatures | Drought | Fires | Crop losses | Vegetation Mortality | Pollution | Mortality | time

How the weather can negatively affect air pollution and consequently our health

Health Impacts

1) Legionnaire Disease

How were the recirculation and the synoptic conditions?

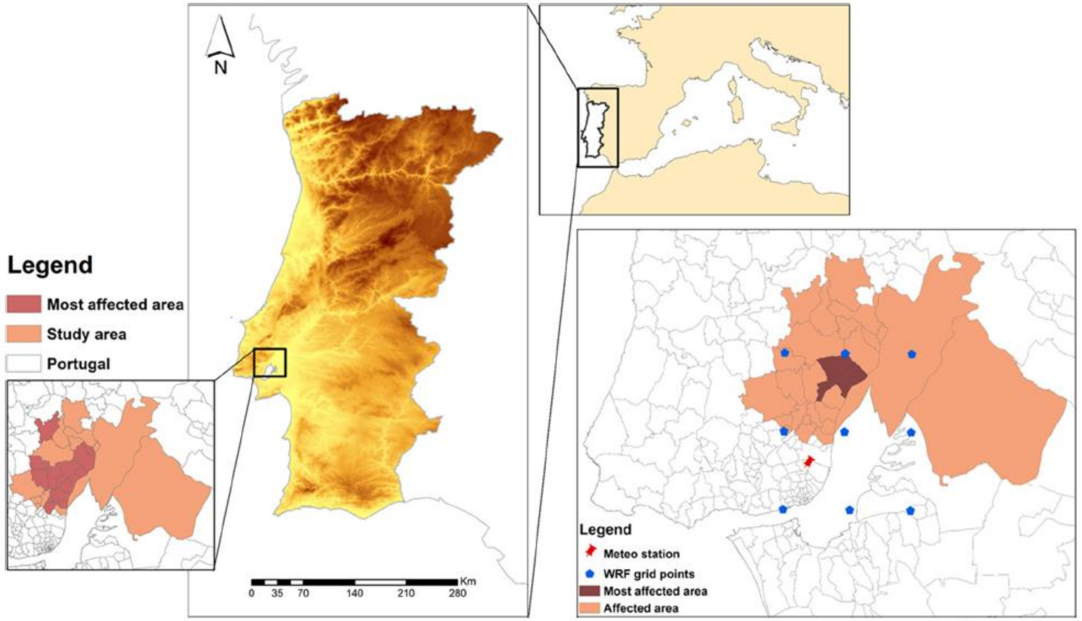
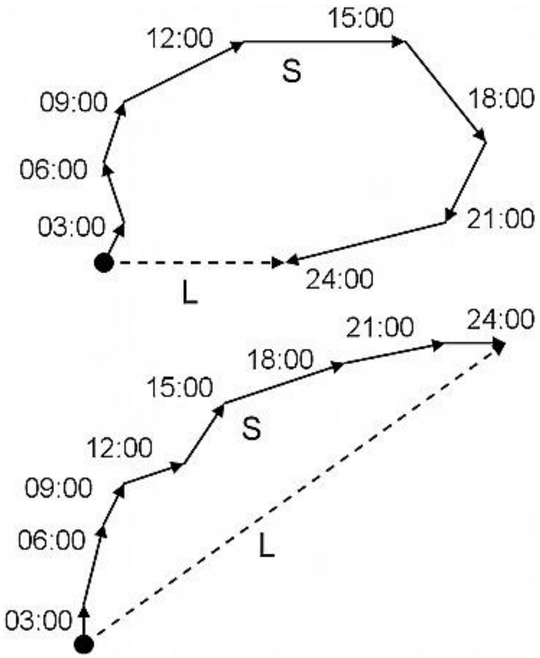
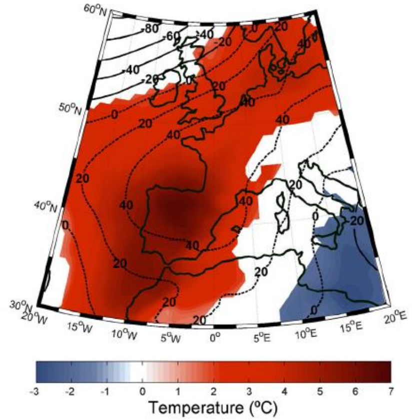
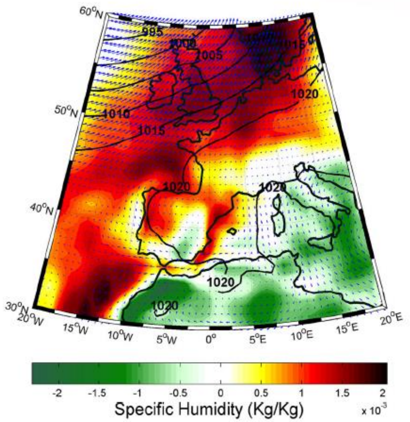


Fig. 1 Location of the affected area and of the meteorological station (red pin) and wind model output point locations (blue dots). The *X*-axis shows the months of the year from January to December: J-January, F-February, M-March, A-April, M-May, J-June, J-July, A-August, S-September, O-October, N-November, D-December. For color specifications, please refer to the online version

Recirculation Potential



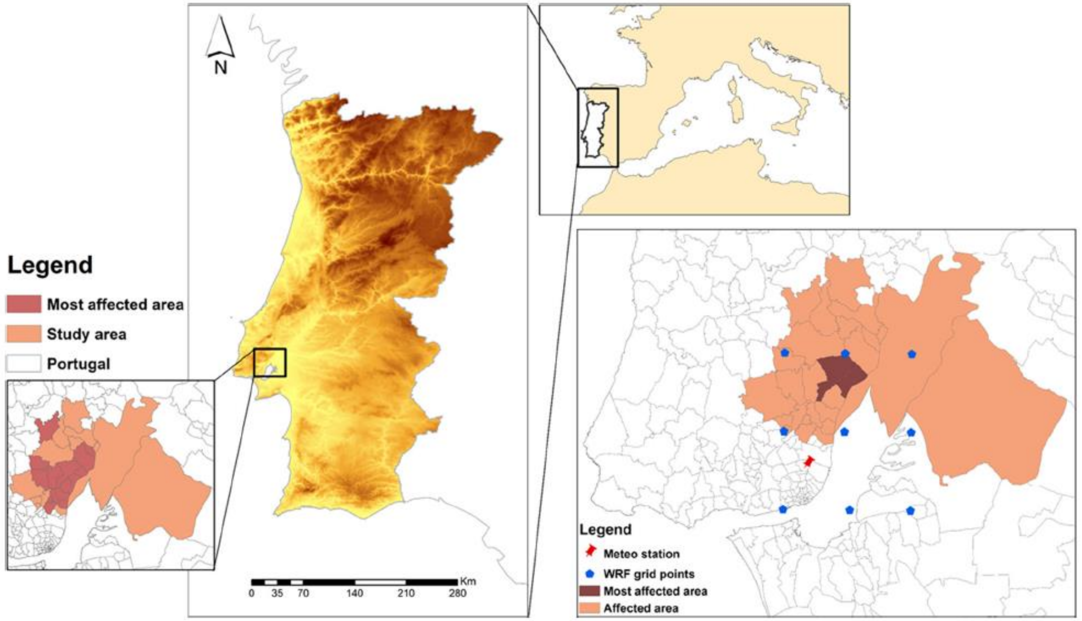




How the weather can negatively affect air pollution and consequently our health

Health Impacts

1) Legionnaire Disease



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Three **factors essential for Legionella proliferation** were present:

(1) susceptible population;

(2) pathogen proliferation in the cooling towers;

(3) aerosol exposure, which was supported by the meteorological conditions (warm temperatures, low winds, and humidity values above 50%, low recirculation).

Health Impacts

2) Wildfire-pollution From Storm Ophelia

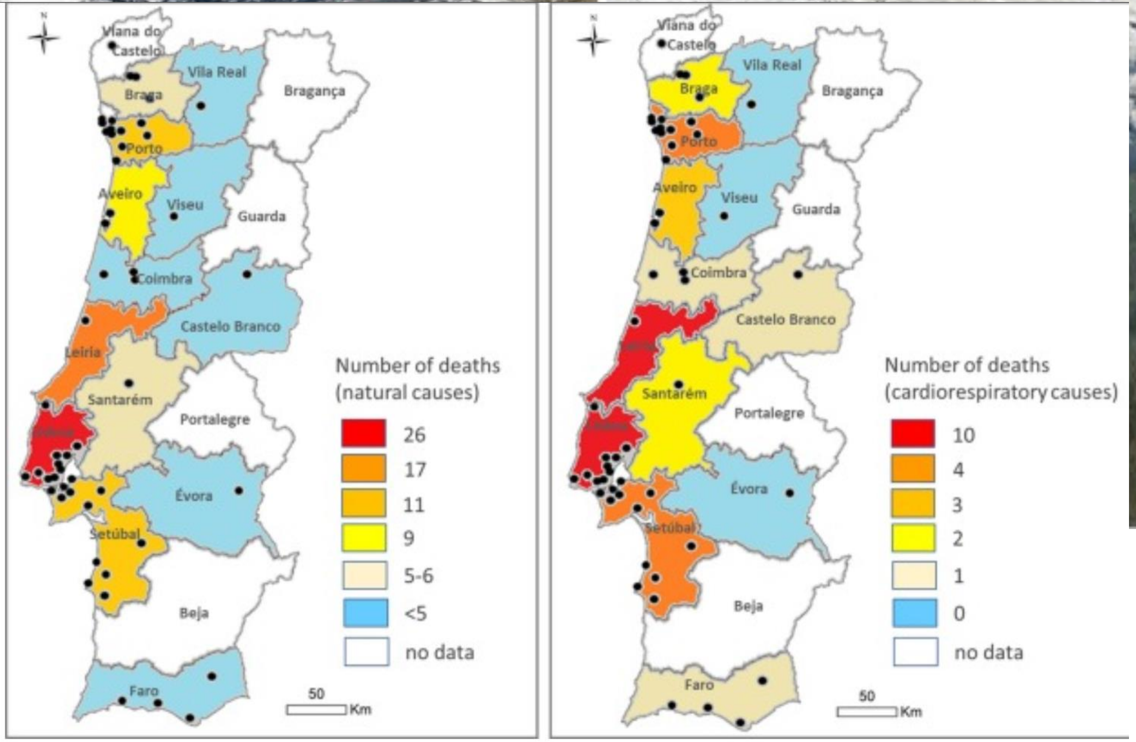

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Fig. 7. (Left) Number of natural deaths attributable to PM_{10} from the wildfires of October 2 in Portugal; additional information in SM1. (Right) Number of cardiorespiratory deaths attributable to PM_{10} from the wildfires of October 2017 in Portugal; additional informatic SM2.

(1) Storm Ophelia dragged up smoke from Portuguese wildfires into Western Europe

(2) Storm Ophelia picked up dust from North Africa and added it to the wildfire smoke

(3) Smoke and dust caused increases in PM levels in Portugal and in the UK

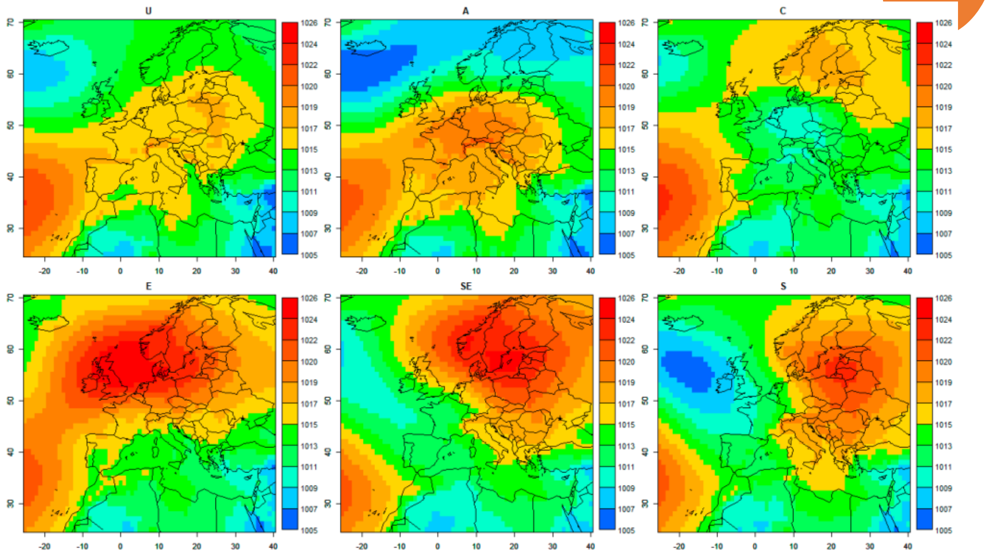
(4) PM10 had a significant effect on the same day natural and cardiorespiratory mortalities

How the weather can negatively affect air pollution and consequently our health

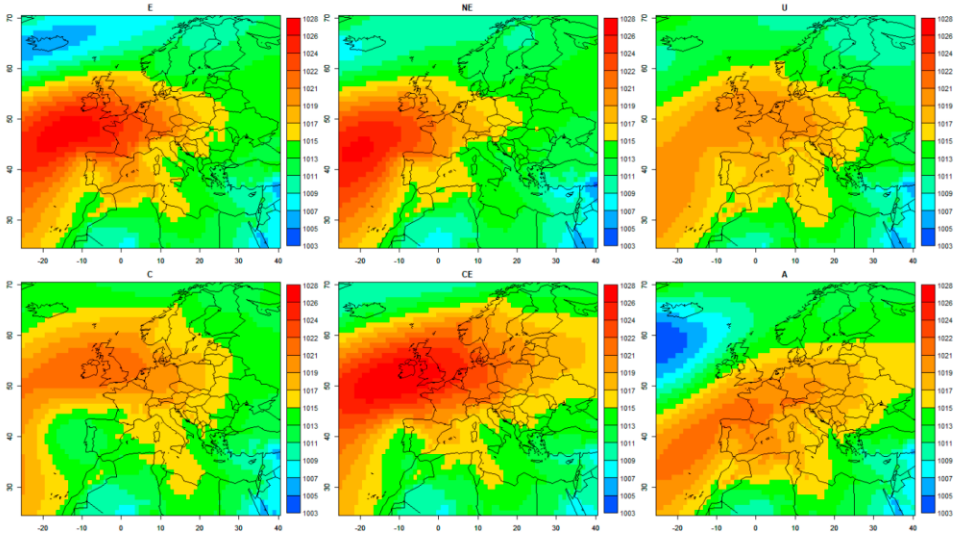
Health Impacts

3) Compund O3 and Heatwave

CWT Bavaria



CWT Portiugal



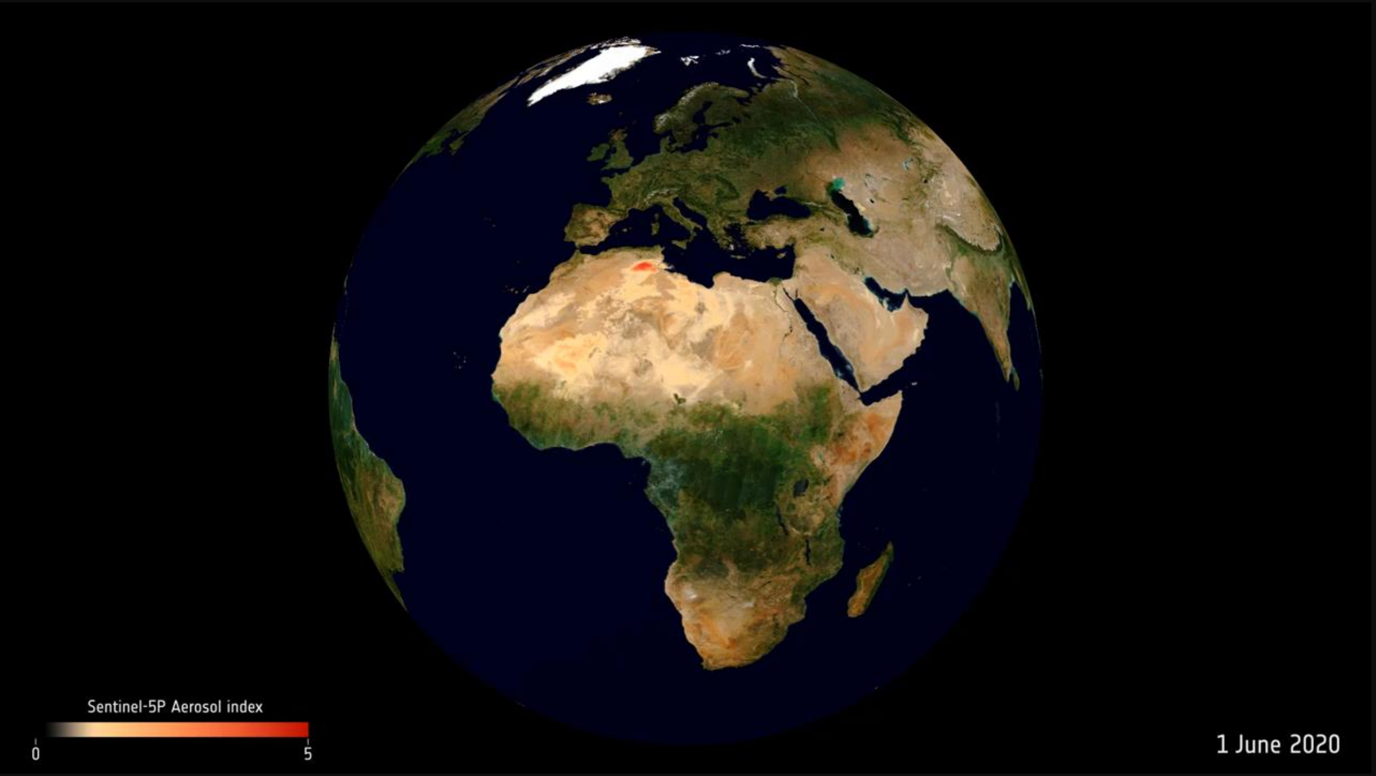
(1) Heat waves were identified as the most frequent wave type

(2) Comparable exposure to heat and ozone waves was found in Central and South Europe

(3) Bavaria waves showed the strongest connection with autochthonous weather conditions

(4) Portugal showed the strongest relationship appeared for eastern and north-eastern inflow

(5) The most severe events, as measured by excess mortality, were always associated to compound heat-ozone waves



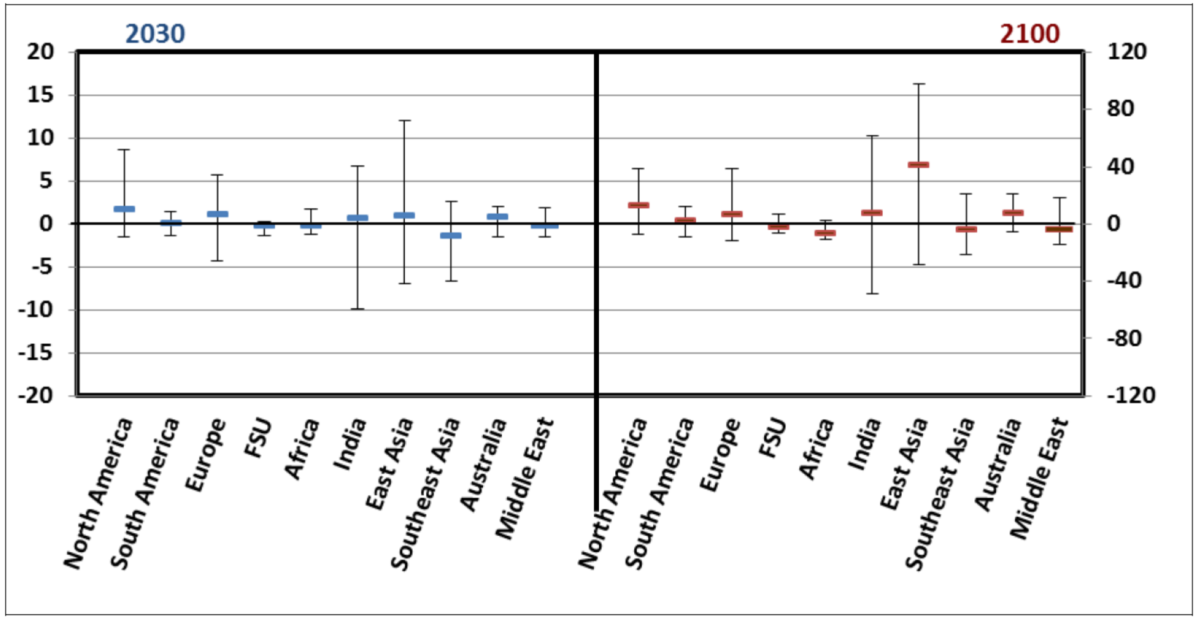
Take Home Messages

- Overall, pollutants have different influences on mortality and morbidity depending on the location and season
- The elderly, children and people with previous illness are more susceptible
- In some places, and for some types of pathologies, there is greater gender susceptibility
- High heat and air pollution are even deadlier combined

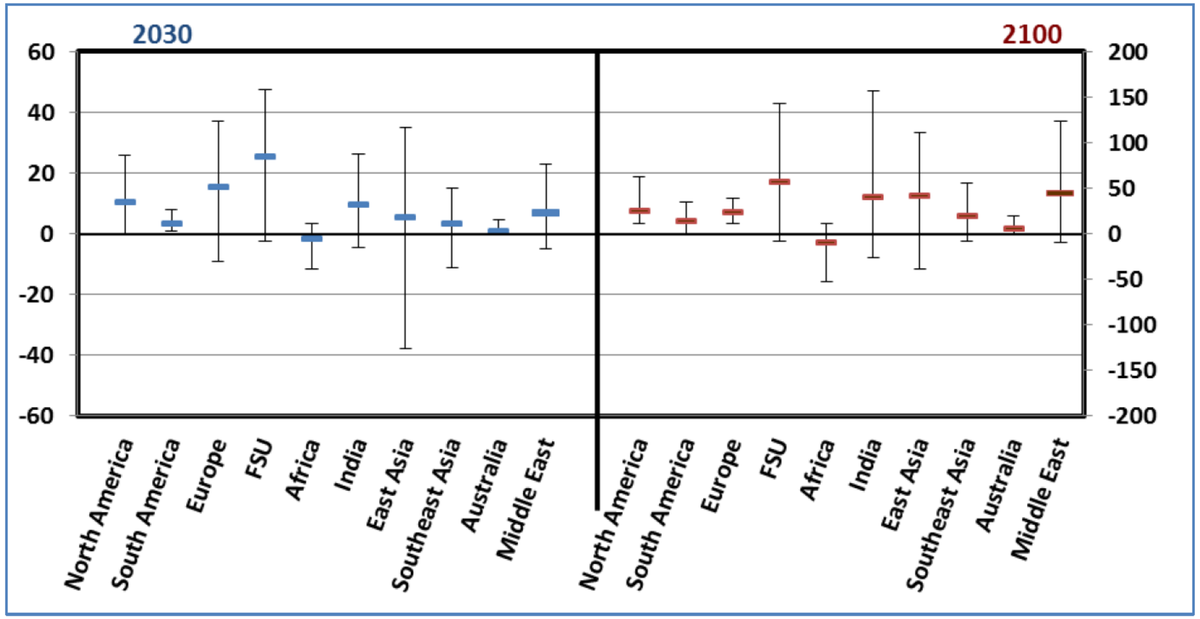
Silva, R., West, J., Lamarque, JF. *et al.* **Future global mortality from changes in air pollution attributable to climate change**. *Nature Clim Change* **7,** 647–651 (2017). https://doi.org/10.1038/nclimate3354

Climate change

a. Ozone mortality



b. $PM_{2.5}$ mortality



Million Inhabitants

Premature mortality attributable to climate change is expected to positive in all regions, except for Africa, being higher in India and easterner Asia.

slido

Add a keyword highlighting your key takeaway from this session

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acrusso@fc.ul.pt