



Assessing Climate-Related Risks: Heatwaves, Droughts, Fires, and Pollution in Vulnerable Regions of the Globe

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Understanding the risks associated with climate change and variability, particularly related to the frequency and intensity of heatwaves, droughts, wildfires, and pollution, is crucial for safeguarding public health and safety. As global temperatures rise, hot and dry conditions become more prevalent, exacerbating the likelihood of devastating wildfires that not only destroy ecosystems but also release harmful pollutants into the air. Pollutants from these events, desert plumes, industry, and other sources, including particulate matter, pose significant respiratory and cardiovascular risks to the population, particularly vulnerable groups such as children, the elderly, and those with preexisting health conditions. Comprehensive awareness and proactive measures are essential to mitigate these risks, ensuring that communities are better prepared to adapt and respond to the escalating challenges posed by our changing climate.

In this work, we adopt the IPCC's definition of risk, which encompasses the potential for adverse consequences due to the interplay of hazards, exposure, and vulnerability. We analyse climate-related hazards including heatwaves, droughts, fires measured by fire radiative power, and pollution quantified as PM_{2.5} levels. These hazards are assessed in conjunction with population characteristics that determine exposure, such as population density. Furthermore, we evaluate vulnerability through socio-economic variables like the Human Development Index (HDI) and GDP per capita, which provide insights into the sensitivity and adaptive capacity of the different communities. By integrating these elements, our study aims to comprehensively understand and quantify the risks posed by climate to human and ecological systems at the global level.

Results indicate that populations in Western and Eastern Africa, as well as Southeastern Asia, are most at risk from the combined impacts of heatwaves, droughts, and fires. The Mediterranean region, particularly the African Mediterranean and Greece are also at risk concerning hot and dry events. However, the Mediterranean regions are not particularly at risk from the combined effects of fire and pollution. These regions are characterized by significant exposure to extreme weather events and varying levels of vulnerability due to socio-economic factors. When considering pollution alone, regions such as Western Africa, the Indian subcontinent, and Eastern and Southeastern Asia face particularly high levels of risk, primarily due to elevated concentrations of PM_{2.5} pollutants. The intersection of high exposure and vulnerability in these areas underscores the urgent need for targeted interventions and adaptive strategies to mitigate the adverse health and environmental impacts of these climate-related hazards.

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