

## **Increasing weather-related impacts on European population under climate and demographic change**

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Over the last three decades the overwhelming majority of disasters have been caused by weather-related events. The observed rise in weather-related disaster losses has been largely attributed to increased exposure and to a lesser degree to global warming. Recent studies suggest an intensification in the climatology of multiple weather extremes in Europe over the coming decades in view of climate change, while urbanization continues. In view of these pressures, understanding and quantifying the potential impacts of extreme weather events on future societies is imperative in order to identify where and to what extent their livelihoods will be at risk in the future, and develop timely and effective adaptation and disaster risk reduction strategies.

Here we show a comprehensive assessment of single- and multi-hazard impacts on the European population until the year 2100. For this purpose, we developed a novel methodology that quantifies the human impacts as a multiplicative function of hazard, exposure and population vulnerability. We focus on seven of the most impacting weather-related hazards – including heat and cold waves, wildfires, droughts, river and coastal floods and windstorms – and evaluated their spatial and temporal variations in intensity and frequency under a business-as-usual climate scenario. Long-term demographic dynamics were modelled to assess exposure developments under a corresponding middle-of-the-road scenario. Vulnerability of humans to weather extremes was appraised based on more than 2300 records of weather-related disasters. The integration of these elements provides a range of plausible estimates of extreme weather-related risks for future European generations. Expected impacts on population are quantified in terms of fatalities and number of people exposed.

We find a staggering rise in fatalities from extreme weather events, with the projected death toll by the end of the century amounting to more than 50 times the present number of people killed. Approximately two-thirds of European citizens could then be exposed to a weather-related disaster each year, which will bring about huge rises in health costs to society. Future impacts show a prominent spatial gradient towards southern regions, where weather extremes could become the greatest environmental risk factor for people. The projected changes are dominated by global warming, mainly through a rise in heatwaves, but ongoing urbanization, development in hazard-prone areas and ageing population will likely further increase human risk. The results call for immediate action to achieve the Paris goals on climate mitigation and adaptation in order to protect future European generations.