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Rising human cost of weather-related hazards in Europe

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The observed increase in the effects on human beings of weather-related disasters has been largely attributed to the rise in population exposed, with a possible influence of global warming. Yet, future risks of weather-related hazards on human lives in view of climate and demographic changes have not been comprehensively investigated. We assessed the risk of weather-related hazards to the European population in terms of annual numbers of deaths in 30 year intervals relative to the reference period (1981–2010) up to the year 2100 (2011–40, 2041–70, and 2071–100) by combining disaster records with high-resolution hazard and demographic projections in a prognostic modelling framework. We focused on the hazards with the greatest impacts—heatwaves 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 scenario of greenhouse gas emissions. We modelled long-term demographic dynamics through a territorial modelling platform to represent the evolution of human exposure under a corresponding middle-of-the-road socioeconomic scenario. We appraised human vulnerability to weather extremes on the basis of more than 2300 records collected from disaster databases during the reference period and assumed it to be static under a scenario of no adaptation.
We found that weather-related disasters could affect about two-thirds of the European population annually by the year 2100 (351 million people exposed per year [uncertainty range 126 million to 523 million] during the period 2071–100) compared with 5% during the reference period (1981–2010; 25 million people exposed per year). About 50 times the number of fatalities occurring annually during the reference period (3000 deaths) could occur by the year 2100 (152 000 deaths [80 500–239 800]). Future effects show a prominent latitudinal gradient, increasing towards southern Europe, where the premature mortality rate due to weather extremes (about 700 annual fatalities per million inhabitants [482–957] during the period 2071–100 vs 11 during the reference period) could become the greatest environmental risk factor. The projected changes are dominated by global warming (accounting for more than 90% of the rise in risk to human beings), mainly through a rise in the frequency of heatwaves (about 2700 heat-related fatalities per year during the reference period vs 151 500 [80 100–239 000] during the period 2071–100).
Global warming could result in rapidly rising costs of weather-related hazards to human beings in Europe unless adequate adaptation measures are taken. Our results could aid in prioritization of regional investments to address the unequal burden of effects on human beings of weather-related hazards and differences in adaptation capacities.