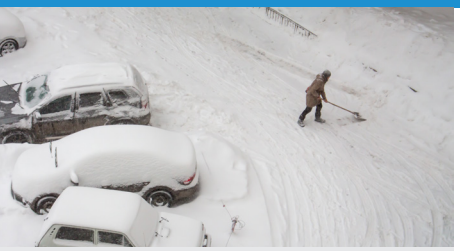

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KEY MESSAGES

Mortality from extreme heat could increase by 30 times

Without climate mitigation and adaptation, the annual death-toll from extreme heat in the EU+UK will be over 30 times more than nowadays, by end of the century.

x30

Milder winters will significantly reduce exposure to, and deaths from, extreme cold.

Mitigation can strongly reduce the impacts

Limiting warming to 1.5°C in 2100 reduces the impact from around 90,000 annual deaths (3°C) to around 30,000.

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About PESETA IV

The JRC PESETA IV project aims to better understand the biophysical and economic consequences of climate change. It does this by using projections of climate change for Europe from several climate models along with a set of climate change impact models. The project covers several sectors that are relevant to society and the natural environment, such as freshwater, agriculture, and coasts.

ec.europa.eu/jrc/en/peseta-iv

Climate change impacts of heat and cold extremes on humans

Since 1980, heat and cold waves have caused nearly 90,000 fatalities in Europe. If temperatures are stabilised at 1.5°C global warming in 2100, each year more than 100 million Europeans will be exposed to a heatwave that nowadays is seen as 'intense'. With unmitigated climate change (3°C in 2100) the exposure rises to nearly 300 million per year, or more than half of the European population. This compares to around 10 million per year in the present climate. Societies will need to increase their resilience to cope with more frequent and intense heatwaves.

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Projections of future heat and cold extremes

Global warming will increase the frequency and severity of heatwaves and result in a decline in the intensity and frequency of extreme cold spells. With 3°C global warming, an 'intense' heatwave (this is a heatwave that under present climate is expected to happen once every 50 years) may occur almost every year in southern Europe, whereas in other regions of Europe such events may happen every 3 to 5 years.

Future effects of heat extremes

The projected changes in heatwaves leads to a large increase in the number of people exposed to extreme heat with global warming (Figure 1).

Even if emperatures are stabilised at 1.5°C in 2100, each year more than 100 million Europeans will be exposed to an intense heatwave, compared to nearly 10 million annually nowadays. With 2°C, this grows to nearly 170 million/year and with unmitigated climate change (3°C in 2100) this climbs to nearly 300 million per year.

base	1.5°C	2.0°C	3.0°C
People annually exposed to a 50-year heatwave (million)			
9.6	103	168	288
Annual fatalities from heatwaves (x1000)			
2.7	28.8	49.4	89.0

Figure 1. Human exposure to, and fatalities from, heatwaves in Europe, in present and for three global warming scenarios in 2100.

Joint Research Centre

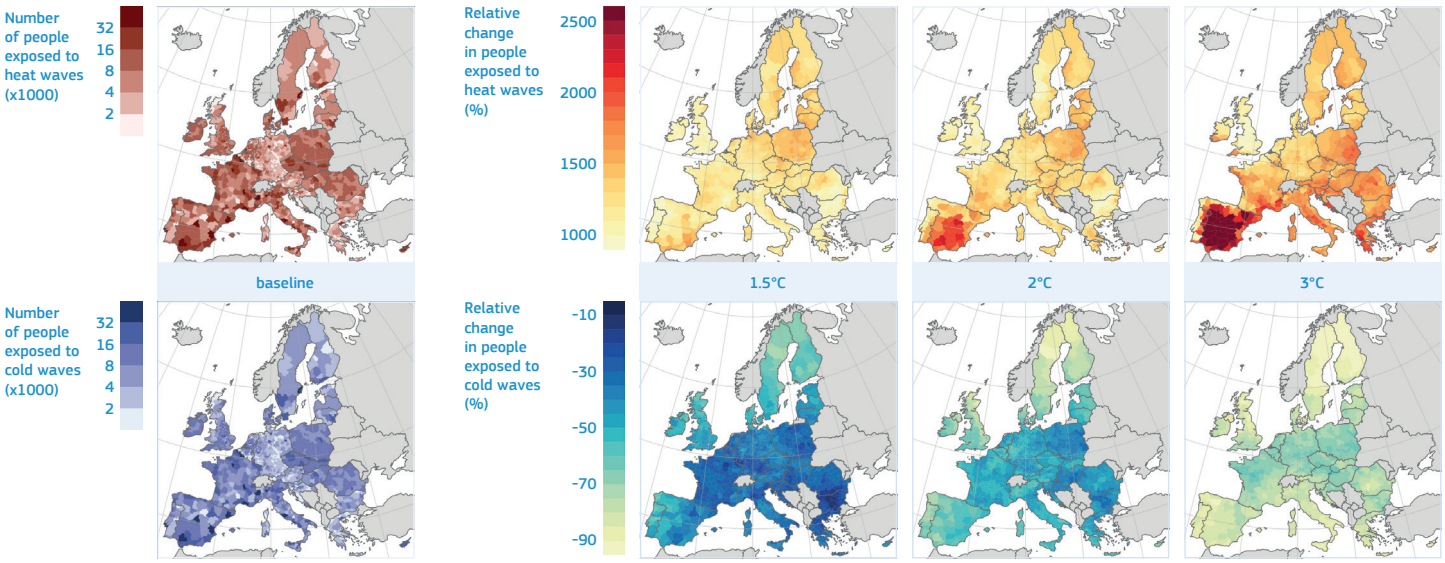

Figure 2. Number of people annually exposed to a present 50-year heatwave and cold wave respectively (left), and projected changes in human exposure to these events for 1.5°C, 2°C, and 3°C global warming (right).

	base	1.5°C	2.0°C	3.0°C
People annually exposed to a 50-year cold wave (million)	9.6	4.9	2.7	1.2
Annual fatalities from cold waves	80	33	19	8

Figure 3. Human exposure to, and fatalities from, cold spells in Europe, in present and for three global warming scenarios in 2100.

Annual fatalities from extreme heat could rise from 2,700 deaths now to around 30,000 in 2100 with 1.5°C global warming. This rises to 50,000 at 2°C and 90,000 at 3°C (Figure 1). The increase in human exposure to, and fatalities from, extreme heat, is most pronounced in southern European countries (Figure 2) and the highest number of fatalities will occur in France, Italy and Spain.

Future effects of cold extremes

Conversely, milder winters significantly reduce exposure to, and fatalities from, extreme cold (Figure 3). The population expected to be annually exposed to a cold wave that is expected to happen once every 50 years in present climate conditions, is projected to decrease from approximately 10 million nowadays to 5 million in 2100 at 1.5°C, 2.7 million at 2°C and 1.2 million at 3°C. The strongest reductions in exposure to cold extremes are projected for southern and northern European countries (Figure 2).

Adaptation to temperature extremes

Even if limiting global warming to 1.5 or 2°C, the rise in people exposed to extreme heat is significant. Therefore, societies will need to increase their resilience to cope with more frequent and intense heatwaves.

There exist a wide range of adaptation measures, including improved design and insulation of buildings, education and awareness raising of potential risk factors and responses, and early warning systems. It is also important to consider other impacts of extreme temperature on ambient air quality, such as ozone pollution under heatwaves, in order to identify the most appropriate response.

Also, sound urban planning could minimise the urban heat island effect. This can be achieved, for example, by increasing tree and vegetative cover, installing green or reflecting roofs, or using cool pavements (either reflective or permeable). There is a substantial lack of observations and quantitative information on the effectiveness of these measures, yet several of them can provide important co-benefits, such as reduced energy-demand of thermo-efficient buildings, or water retention and mental health benefits of green spaces.

Approach

Contact information: Gustavo Naumann, JRC Disaster Risk Management Unit.

PESETA IV integrated empirical data on human losses from disasters, past climate information, EUROSTAT demographic data and high-resolution climate and socio-economic projections, to assess the impacts of the present climate (1981-2010) and three global warming scenarios (1.5, 2 and 3°C above preindustrial levels) on human exposure to, and fatalities from, heatwaves and cold spells respectively, in Europe. The results presented here use population projections derived from the ECFIN 2015 Ageing Report to account for future population dynamics but do not account for the strong increase projected in the number of people older than 65 years. Adaptation and acclimatisation mechanisms were not considered in the modelling approach. Only deaths attributable to hot and cold extremes were estimated – this represents a fraction of the deaths associated with less extreme temperatures.