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Climate Change

Impact on Environment and Society

Human Health

The Impact of Climate Change on Human Health

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The COIN project evaluates the impact of climate change with respect to heat-related deaths in Austria.

Main findings

- According to three climate change scenarios (mild, moderate, strong) and three socio-economic scenarios (low, medium, high sensitivity), the burden of climate change (analysed by reference to heat-related deaths) will increase over the next decades.
- Depending on the respective scenario, the annual number of heat-related deaths varies considerably, with the intensity of climate change having a stronger influence on the variability than the socio-economic assumptions.
- Under a strong climate change scenario, approx. 1,200 heat-related deaths are to be expected for the 2016–2045 period and 3,000 for the 2036–2065 period. An estimation for years of extreme heat results in twice as many heat-related deaths for both periods.
- Besides heat impairing the general population's quality of life, heat waves can pose an extreme challenge to the medical care system by causing peak loads for medical attention and care.

Climatic changes influence human health in many ways: while temperature and precipitation changes can have a direct impact on human health, health consequences can also be caused by indirect impact chains, such as climate-related proliferation of pathogenic agents, parasites, or allergenic plants.

As past findings have shown, exceptionally high temperatures in particular can have dramatic health consequences. One example is the European heat wave of 2003 during which in only 14 days throughout 12 European countries 39,000 more people died than during the reference period of 1998–2002 (Robine et al. 2008). Austria reported a 13 % increase in deaths.

Project info box

The interdisciplinary COIN (Cost of Inaction – Assessing Costs of Climate Change for Austria) project evaluates economic impacts of climate change in Austria. For this purpose, a scenario-based analysis of and across twelve key sectors is conducted, which assesses the possible impact of climatic change in combination with socioeconomic developments. The main scenario assumes a temperature rise within the two degrees Celsius margin for the period up to 2050. This assumption presupposes stronger climate policies than the ones currently in place. The analyses presented here only show that part of all potential impacts which has already been quantified and takes into consideration individual adjustments made.

What has been analysed?

The COIN project investigates the impact of rising temperatures and of heat on the number of deaths in Austria. Heat waves during which the daily maximum temperature on three or more consecutive heat days[1] rises to at least 30 °C, and the mean maximum temperature never falls below 25 °C, have a strong influence on heat stress for humans. For the 2003–2012 period there has been an annual average of six heat days as defined above in Austria. Depending on how rapidly climate change will advance in Austria, the annual number of such heat days could rise to an average of 8 to 27 over the 2036–2065 period.

What impacts are to be expected?

The current study shows that under a moderate climate change scenario[2] and medium-level socio-economic development[3] 400 annual heat-related deaths would occur over the 2016–2045 period and 1,060 deaths during the 2036–2065 period, respectively (see Table 1).

1 Heat days are days that belong to a heat wave as defined above.
2 Under a moderate climate change scenario, the annual number of heat days (during heat waves as defined above) is estimated at 7.1 over the 2016–2045 period. During the period of 2036–2065 there will even be 16 heat days.
3 Assumptions regarding socio-economic developments:
1) demography: while in 2011 1.5 million people in Austria were aged 65 and above, this number will increase to 2.2 million by 2030 and to 2.6 million by 2050, respectively; 2) air-conditioning systems: the study assumes that 10 % of all households with elderly members will have air-conditioning, thus reducing the mortality risk by 50 %.

Do alternative projections for the future change the results?

Taking into consideration the given inaccuracies of forecasting, additional climate change scenarios assuming weak and strong climate change were carried out for both periods of analysis. Table 1 shows that changed model assumptions as to future climatic developments influence the results to a large extent: thus, strong climate change results in approx. 1,100 annual deaths between 2016 and 2045, compared to 580 deaths assuming weak climate change. Moreover, the study takes into account that changed socio-economic assumptions[4] (an aging population, the implementation of airconditioning systems) will influence public health's sensitivity the climate. However, these changed model assumptions merely lead to a 20–30 % increase and/or decrease in deaths (see Table 1), whereas different climate-related assumptions change the results for annual heat-related deaths by 150–180 %. The critical constellation combining strong climate change and a high level of sensitivity due to socio-economic developments results in almost 3,000 deaths per average year of the 2036–2065 period. This corresponds to a tenfold increase of the 240 heat-related deaths reported for consecutive heat days during the 2003–2012 period, which are to be added to the number of deaths on normal summer days (calculation based on Moshammer et al. 2006).

Table 1: Average annual heat-related deaths on consecutive heat days, based on different climatic and socio-economic developments.

Heat-related deaths p.a. Relative to Ø 1981-2010			Climate change		
			mild	moderate	strong
Ø 2016-2045	Socio-economic development (sensitivity*)	low	540	370	1010
		medium	580	400	1100
		high	640	430	1200
Ø 2036-2065		low	640	920	2280
		medium	730	1060	2610
		high	830	1200	2960

*Result sensitivity with respect to socio-economic development parameters.

What consequences can arise from years of extreme heat?

To assess the possible effects years of extreme heat may have, the study selected heat years which occur once every 20 years (95 percent percentile; only 5 % are more extreme) for both periods, assuming a moderate climate change scenario. Under this assumption, the number of consecutive heat days increases to 59 during the 2016–2045 period (before 8 to 14), and to 77 during the 2036–2065 period (before 8 to 27). Based on the respective amount of heat days, the study estimated the changes in the number of heat-related deaths when assuming that in addition to the population older than 65 patients with chronic pulmonary and cardiovascular diseases are also affected. In accordance with literature, the assumption is that 10 % of all 20 to 64-year olds fall into the latter category; as a result, the number of deaths occurring in years of extreme heat almost doubles compared to approx. 3,000 deaths estimated for an average year of the 2036–2065 period (see Table 1).

What are other impacts that can result from heat?

Beyond causing the above estimated number of deaths, heat waves not only impair the general population's quality of life, but also affect the Austrian health care system. Among other things, heat periods can subject emergency services, resident physicians, and hospitals to peak workloads. Hospital buildings with insufficient thermal properties and no air conditioning could become problematic areas. On the one hand, heat stress increases the risks for inpatients, and on the other hand, heat can also impair the performance of nursing and medical personnel, especially during times of peak loads for medical attention and care. These impacts may additionally burden the already strained health care budget.

4 Assumptions regarding socio-economic developments:
1) low sensitivity: a) demography: smaller increase in the elderly population (2.5 million elderly people in 2050); b) air-conditioning systems: the study assumes that 20 % of all households with elderly members will have airconditioning, thus reducing the mortality risk by 50 %.
2) high sensitivity: a) demography: high increase in the elderly population (2.8 million elderly people in 2050); b) air-conditioning systems: the study assumes that the number of air-conditioned households with elderly members will not rise compared to the 2003–2012 period (e.g., due to negative economic developments which leave this vulnerable demographic with insufficient financial resources).

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