Group for
Weather and Climate Risks

A probabilistic city-level heat mortality risk assessment

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1 Research question

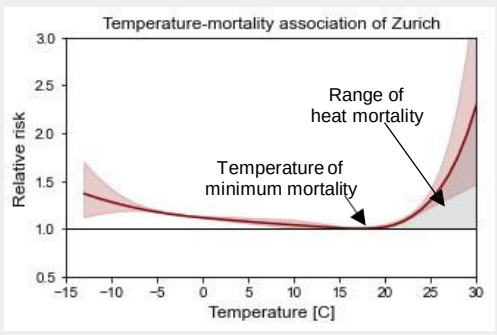
- What is the expected excess mortality of a 100-year heat event at city-level worldwide in the current as well as in a near-term future climate?

2 Epidemiological data and methods

- The analysis requires time series data of daily mean temperature and daily mortality at city scale
- We express the relative risk of exceedance mortality as a function of temperature[1]

Time series of local daily mean temperature

Time series of local daily mortality

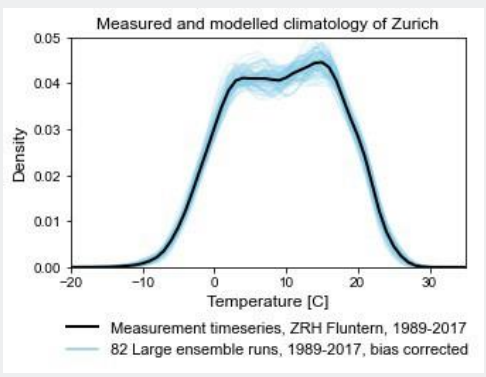


3 Climate data and methods

- We use *single model initial condition large ensemble* (SMILE) climate model output. This approach uses one single climate model (in our case the CESM) and runs it 82 times.[2]
- It thus indicates 82 physically plausible pathways of the climate which can be used for a probabilistic risk assessment.
- We apply bias correction (quantile mapping) for the whole ensemble to adequately represent the city climate

Time series of local daily mean temperature

82 large ensemble model runs (CESM)

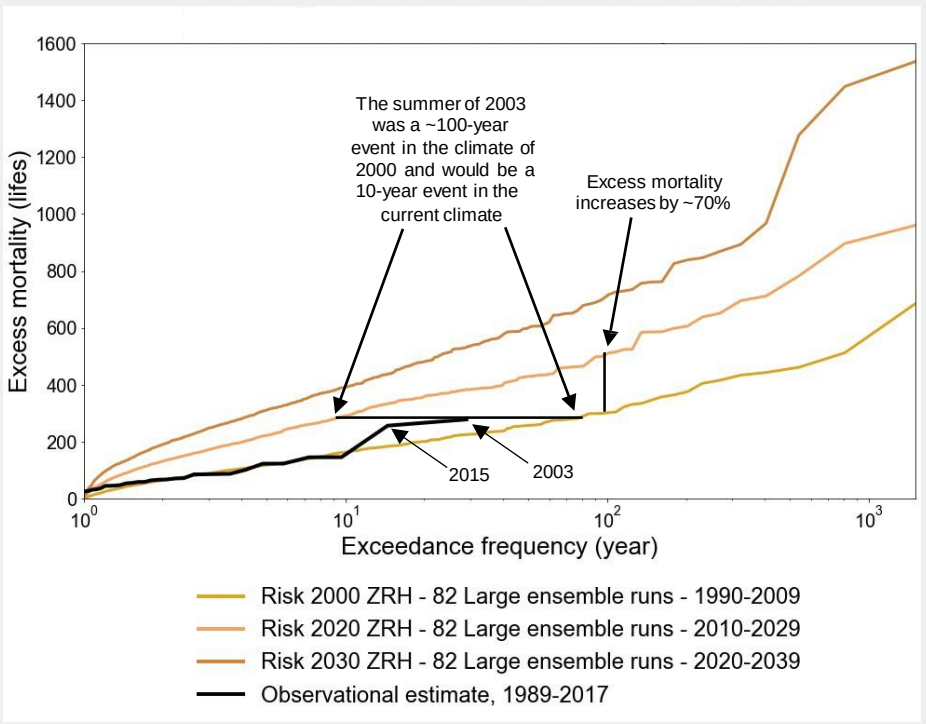


4 Exceedance frequency curves

- Heat related excess mortality is calculated on a daily basis using the SMILE data and summarized to annual impacts
- Using climate periods of 20 years yields 1'640 (82 x 20) physically consistent years with equal probability of occurrence

5 Results: Risk of heat mortality in Zurich (CH)

- Past extreme summer seasons are the *new normal* by 2030
- Expected excess mortality from 100-year events have increase by ~70% over the past 20 years



6 Conclusion

- The risk of heat mortality is intensifying rapidly, highlighting the need for adaptation
- Quantifying risk as shift in return periods eases communication, as the public and decision makers are used to such metrics
- The probabilistic analysis informs decision makers if a city needs to adapt to rare extreme seasons or to mean summers – or to both

7 Outlook

- This analysis is extended to 750+ locations in 43 countries
- Incorporation of SMILE output of 6 other climate models to assess robustness of results

References

1)Vicedo-Cabrera AM, Sera F, Gasparrini A. Hands-on tutorial on a modelling framework for projections of climate change impacts on health. Epidemiology. 2019;30(3):321-329.

2)Kay, J. E., et al. (2015). The Community Earth System Model (CESM) Large Ensemble Project: A Community Resource for Studying Climate Change in the Presence of Internal Climate Variability. Bulletin of the American Meteorological Society, 96(8), 1333–1349.

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