Review of Stalhandske et al. "Projected Impact of Heat on Mortality and Labour Productivity under Climate Change in Switzerland"; https://doi.org/10.5194/nhess-2021-361

This study presents spatially explicit and aggregated projections of heat-related mortality and heat-related losses in labor productivity for Switzerland under different climate change scenarios. The topic is important given that more frequent and more intense heat events are one of the major manifestations of climate change to be expected in Central Europe. Yet, I do have a number of concerns regarding the methodology adopted, especially with regard to the estimation of heat-related mortality.

Major:

1) Currently, the description of the methods to compute heat-attributable mortality is difficult to follow. I would suggest moving the formulas from the supplementary material to the main text, making sure that all of the variables and parameters are properly explained.
2) To the extent I have understood the approach taken, my specific doubts concern the following

i) Why did the authors choose to model the functions coming out of Ragettli et al. (2017) as polynomial functions instead of adopting the model structure employed in Ragettli et al. (2017)? In that case, the uncertainty in the RR curves could have been assessed via the distributions of the original parameter distributions. Most importantly, there is a well-established methodological framework for computing attributable mortality based on distributed lag nonlinear models (dlnm, e.g., Gasparrini & Leone 2014, Gasparrini et al. 2015, Gasparrini et al. 2017) that the authors could have employed here.

ii) In the presentation of the current approach, it is unclear what is meant by "the fraction of the population exposed to heat" in Section 8 of the supplementary material. Using the notation of Perez & Künzli 2009, one would think that $AF_{pop} = AF_{exp}$, because all of the population should potentially be exposed to heat. Therefore, my understanding is that the formula for computing the attributable fraction per cell and T_{max} value should be AF = (RR-1)/RR

iii) In Section 9 of the supplementary material, it seems like a binning of temperature values are introduced by computing the number of days within certain limits of T_{max}. I don't see the necessity of this. As mentioned under point (i) I would have employed the dlnm framework directly, but if you would like to start from RR curves, to my understanding you could compute the total heat-attributable mortality as

$$I_{Mortality} = \sum_{c=cells} \sum_{d=days} N_c AF_{c,d}$$

$$AF_{c,d} = \begin{cases} \frac{RR(T_{c,d})-1}{RR(T_{c,d})} & if\ T_{c,d} \geq\ reference\ temperature\ from\ Ragettli\ et\ al.2017 \\ 0 & if\ T_{c,d} < reference\ temperature\ from\ Ragettli\ et\ al.2017 \end{cases}$$

You could even consider using the cell-specific, average daily death per day of the year ($N_{c,d}$), in order to account for the seasonal structure of the baseline mortality (or for present-day the observed daily mortality). The population fractions would be used to scale the nationally available mortality data to the cell level.

3) I was also surprised to read that the authors only find a doubling of heat-related mortality by the end of the century, even under the high-emission scenario RCP8.5. Other studies, such as Gasparrini et al. 2017, Huber et al. 2020, usually find much higher rates of change for heat-related mortality under high emission-scenarios in Central Europe. Maybe this is due to the unusual approach chosen here for estimating heat-related mortality.
4) Another aspect that is currently not well explained in the method section is the definition of the baseline and future time periods. ll. 158-160 do not, e.g., mention the central years chosen. Also, it should be made explicit that "today's mortality" is based on simulated temperatures, and averaged mortality data. Given that the authors seem to have access to observed mortality data for 2010 to 2019, the question arises why the authors did not choose the 2010s as the present-day baseline, computing future impacts for selected decades in the future. If the authors decide to keep the timeslice definition adopted now, it should be justified why the 2020 baseline is only shown based on RCP8.5 data, and not for the other RCPs.

Minor:

l. 8: Better „We estimate that about 670 death per year are associated with heat exposure today in Switzerland." – To me "die because of heat" is quite strong, since your models are based on statistical associations

l. 22: I would suggest: "the impacts of heat on human health" rather than "metabolism". Alternatively, I would use the word "physiology" instead of "metabolism"

l. 29: Better: "people older than 75 years"

ll. 54-55: "The data and methods…" seems to be a repetition. Delete sentence?

l. 79: Would be good to include 1-2 sentences explaining the type of impact functions used.

ll. 238-9: "The influence of heat waves…": incomplete sentence

Section 4.2. Check referencing format; author names appear outside of parentheses

l. 242: references cited do not point to the pertinent literature; there are a number of studies out now including adaptive processes/demographic changes into projections of heat-related mortality under climate change (e.g., Rai et al. 2019; Lay et al. 2021, Wang et al. 2018)

ll. 202-209: You discuss here the spatially explicit results on labor productivity. It would be nice to also mention the results for mortality (currently only shown in the supplementary material) and discuss whether the areas of high risks are the same for both labor productivity and mortality.

Fig 4 and Fig. 5. To me no need to show panel (a) without error bars as differences between RCPs are visible even at larger y-axis scale.

References:

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