

General comments

The paper presents a 38-year quantification of the risks from heatwaves (HW) and coldwaves (CW) in the region of Trentino-Alto Adige in Italy. In precise, the authors try to quantify hazard, exposure, and vulnerability from HW and CW using the Heat Wave Magnitude Index daily/Cold Wave Magnitude Index daily, the Tweedie zero-inflated distribution, high-resolution maps of the population, and a set of eight socioeconomic indicators. They claimed that this new method for the calculation of human risk from HW and CW is applicable to other regions. The manuscript has an important aspect as it offers an additional contribution to understanding the spatio-temporal risk of HW / CW. Although, I have several comments on the methodology and the presented results. In general, the level of discussion is almost minimal, while most of the statements are too often very general, missing any proper citation and profound discussion that would put their results in a comparative context. My impression is that the paper is incomplete and can be improved. I, therefore, recommend that the paper goes a major revision, and the authors need to respond to the issues I list below before the paper can be accepted for publication in NHESS

Main comments

1. The abstract is very extended. It must be much shorter including only the key points of the manuscript.
2. I would propose a reconstruction of the introduction. It does not have coherence, especially when going from one paragraph to another, and it is extended compared to the other sections. The novelty of the study is not being appropriately highlighted. Concerning novelty, the authors could also emphasize the advantages of applying specifically the form of Tweedie for the zero-inflated distribution. The limitations of this method should be accounted and properly included in the manuscript.
3. Lines 153-160. The used gridded temperature dataset includes uncertainties due to the interpolation of the observed data. Have the authors considered how these uncertainties may impact the results of their study?
4. In line 165, it is not clear how the cumulative indices are calculated and how someone can interpret these indices. I assume that the HWMId is the sum of the daily magnitude of the most severe heatwave in each year, something that is not clear in the manuscript.
5. Line 215. What are exactly the outcomes of the Tweedie distribution? I assume it is only the return period. Please be more clear in the manuscript.
6. Lines 213-219. These lines need more analysis as they are essential for the computation of the return period. Also, the authors must include abbreviations for the legends in the Fig S-1
7. Lines 218-219. Why have the authors chosen to keep only 5 and 10 return periods? Most extreme episodes may fall into a higher return period (e.g. 20 or 30 return years)
8. In line 253, the authors claim that the vulnerability is computed only for precise years while exposure has been calculated for each year. In line 275 the authors said that the computation of the risk was made based on the closest year. This limitation must be highlighted in the results (line 370 and further). Also, why the authors have chosen to use the “closest year” and not to interpolate the data?

9. Line 280. This section must be divided into subsections in an organized structure in order to be more clear and effective when presenting the findings of the paper. Also, the discussion section must be clearer in order to defend your research and to emphasize the significance of your research.

Specific and minor comments:

1. Please insert the proper citations in lines 71-72.
2. Line 76: Is there an advantage to defining hazards by return period? Please add the information at the introduction or the methodology section.
3. There is a piece of misleading information in the citations in lines 136 and 162
4. Line 178. Please revise the sentence
5. Lines 189-190. Please revise the sentence
6. Lines 235-237. Please clarify better this sentence
7. Line 255. Please elaborate on this
8. Line 269. It is not clear in the manuscript how the hazard is defined
9. Line 282. Why the authors have chosen the median and not the mean for the intensity of the HW?
10. Line 343. The authors must comment on the uncertainty in increasing and decreasing values found for vulnerability. Also, they must highlight that these trends are not statistically significant.
11. Fig 4. The vulnerability is calculated for hw or cw?
12. Line 413. "HW have occurred more frequently and have become more intense". This sentence is not properly justified in the results section.
13. Line 417. Please rephrase in order to highlight the limitations of this result
14. Line 428. Why "will be exposed"? This work is not a future projection analysis