Manuscript "Compound flood events: different pathways–different impacts–different coping options?" by Annegret H. Thieken et al., Nat. Hazards Earth Syst. Sci. Discuss., 2021

Comments of Referee 2

This is a simple but useful article that is using historical flood loss data to compare flood types. It presents observations such as that dike breaches typically have longer flood durations or that flash floods typically have higher flow velocities. Many of the conclusions are obvious but its good to have data that confirms these intuitions. I'm not aware of another study doing the same and I think no other dataset would be more suitable for such a study. The article is very well written but I do have some minor comments.

Answer 1: Thank you for this positive assessment of our manuscript.

Are the samples independent enough to draw generalizable conclusions? Could some of the conclusions not be statistical significant because of a high spatial correlation between the samples? For example, you only have 128 flash flood samples but over how many different locations (e.g. villages) are they really collected? Some of the variables you look into could be highly spatial correlated (e.g. the same for the whole village or even the entire flood event). The most extreme example is table 5 which is somewhat correlated throughout the event (e.g. media coverage, quality weather forecast, etc.). So arguable the sample size for table 5 is just 1? I think this drawback of the study should be highlighted more throughout the results and discussion section so that the readers know which conclusions can be generalized to other areas/countries and which conclusions could be just a local coincidence.

Answer 2: Fig. 1 in the paper shows the wide geographic distribution of our data. In total, households from 249 municipalities located across 14 out of the 16 federal states of Germany have answered the survey. We now had a closer look and found that the smallest subset of 128 cases (flash floods) comes from eight different municipalities, distributed across four different federal states (see again Figure 1). We will add this information in the revised manuscript.

The geographic distribution also holds for the analysis shown in Table 5. For example, the information about the lead time in the flash flood subset was retrieved from 42 cases in six different municipalities located in three different federal states (Bavaria, Baden-Wurttemberg and Rhineland-Palatinate). Early warning and flood risk management in Germany is in the responsibility and thus separately organized by the federal states. And the early warning chains might differ between municipalities.

The definition of flash flood is a bit subjective in this paper and the conclusions will be very sensitive for this classification. It seems like some circular reasoning could be occurring. That is you seemed to have used some flood intensity information from the household surveys to label observations a flash flood and then you seem to have concluded that flash floods are typically more intense in the same survey data. Is this observation correct or did you merely validate your flash flood classification with the household survey? Could you discuss the potential consequences of your labeling technique on conclusions of the paper? Furthermore, I wonder whether there isn't a more objective way of classifying flash floods. Maybe extreme rainfall in a terrain that isn't flat? Have you done some literature review on this?

Answer 3: As described in section 3 (line 209-221), we used EXTERNAL data to distinguish pluvial from flash floods. In fact, we started with rainfall data from the German Meteorological Service (DWD) for a first classification, in which we selected places that experienced rainfall exceeding the severe weather warning threshold of hourly rainfall (25 mm/h) – a method that has been applied in other studies, too, e.g. in a DWD-GDV project on heavy rainfall (Winterrath et al. 2017). We continued to verify the rainfall-driven selection of affected places by media reports. In a last stage, we used the survey data for a validity check of our classification. In fact, no changes were made after this cross-check. We will double check our classification by including terrain/topographic information and will rephrase the section (lines 209-221) accordingly.

The following reference will be added to the paper:

Winterrath, T., Brendel, C., Hafer, M., Junghänel, T., Klameth, A., Walawender, E., Weigl, E. & Becker, A. (2017): Erstellung einer radargestützten Niederschlagsklimatologie, Berichte des Deutschen Wetterdienstes Nr. 251, Deutscher Wetterdienst, Offenbach am Main. https://www.dwd.de/DE/leistungen/pbfb_verlag_berichte/pdf_einzelbaende/251_pdf.pdf?__blob=publicationFile&v=2

Finally, we would like to highlight that the hydraulic characteristics shown in Table 2 confirm the expected differences between the pathways, although the survey data on these hydraulic characteristics were NOT used to classify the cases. So, there is no circular reasoning in our view.

The use of the term "compound flood event" is causing confusion. From just reading the title most readers would assume this is about the coincidence of coastal and fluvial flooding. This makes the paper title somewhat misleading and also confusing because the link to the rest of the title is then no longer clear. The abstract adds to this confusion as the term compound flooding is introduced in an unexpected context. The start of section 2 clarifies everything very well and I understand why the term is appropriate but I still recommend either explaining the unconventional use of the term compound flood event early in the abstract or using different terminology (e.g. why not use the word flood type in the title).

Answer 4: Thank you for this suggestion. In fact, we changed this several times in earlier versions of the manuscript and obviously introduced some inconsistency here. We propose to change the title of the paper to "Compound **inland** flood events: different …" and to explain the term "Compound **inland** flood events" in the abstract to avoid confusion.

Section 3 doesn't explain the approach at a high level. This approach is quite simple so you can keep it short.

Answer 5: We will further shorten section 3 in the revised paper.