



EGUsphere, author comment AC2
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Reply on RC2

Matthew Preisser et al.

Author comment on "Intersecting near-real time fluvial and pluvial inundation estimates with sociodemographic vulnerability to quantify a household flood impact index" by Matthew Preisser et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-52-AC2>, 2022

We thank the reviewer for taking the time to review our paper and provide some discussion points as well as minor comments to improve the clarity and presentation of our work. We address your comments as follows:

(R2.1) *My main concern is about vulnerability and resilience. The vulnerability variables used in this study can be regarded as resilience variables. Is it reasonable? And, the impact index is a very complex issue in the evaluation of the risks. I think you should be careful about the selection of Variables. Some variables maybe not that representative or maybe there is relationship between variables which make these variables used more than once in the computation of the flood index.*

The reviewer brings up a great point in that vulnerability and resiliency represent two related but different concepts. To further complicate it, there is also the concept of adaptive capacity; there are entire papers dedicated to discussing the interrelated nature of some or all of these three concepts (Gallopín, 2006; Miller et al., 2010). Being able to directly estimate any of these concepts is a difficult, if not impossible, process, which inspired the creation of the first Social Vulnerability Index, or SVI, (Cutter et al., 2003), from which our paper draws motivation. The SVI serves as a proxy for these more complex concepts because we are able to estimate it using widely available Census data. For this paper we are using the IPCC definition of vulnerability (please refer to the paragraph starting at line 209), in that vulnerability is the degree to which a system is susceptible to, or unable to cope with, the adverse effects of a hazard. Trends in the 29 Census variables that can potentially be in the SVI calculation have been shown to reflect either an increase or decrease in an individual's vulnerability. The authors refer the reviewer to Cutter et al., (2003) for how different concepts of socioeconomic status, gender, race, ethnicity, age, employment, education, etc. influence vulnerability.

The reviewer is also correct in that some variables are highly related, which is what leads to similar variables being grouped into components. For example, the variable "Median housing value" and "Percent households earning over \$200,000 annually" are most assuredly related. There continues to be an ongoing debate on the usefulness of specific vulnerability indices, as we discuss in section 6.4. Sensitivity analyses of the specific SVI methodology used have shown that different configurations of the parameters still yield fairly stable results (Schmidtlein et al., 2008). While some papers have found substantial problems with SVIs, they also recognize that SVIs serve a role for being able to estimate a

complex concept quickly (Spielman et al., 2020). As we state in section 6.4, our proposed methodology for estimating a near-real time flood impact index is robust because any SVI estimate can easily replace our own based on the user's goals, preferences, and expert opinion.

(R2.2) *Since you provide effective near real-time estimates providing dynamic information for householders or others, did you consider that variables should be updated frequently to make sure the efficiency of the evaluation? This is a very important issue for practical use.*

This is an excellent point and highlights one of the advantages of using a social vulnerability estimate built on Census data. As stated in section 3, for this study we used information from the 2017 American Community Survey (ACS) 5-Year Estimate, an aggregate of 5 years' worth of survey data. We chose this year because it might best represent the socio-economic conditions of 2015, as it is the midpoint of the years used to determine the 2017 estimates. For more recent events, the most recent ACS 5-Year Estimate should be used to calculate the SVI, which can easily be recalculated. For a widely applicable flood impact index, yearly updates to socio-economic data are sufficient as there are no other more frequently updated socio-economic datasets, and changes within a single year are often not drastic enough to have an impact on estimates.

(R2.3) *Furthermore, the proposed method is relatively efficient when compared with conventional approaches. But the reasonability and accuracy are still the fundamental issue of the impact map should be addressed. So as the uncertainty.*

The reviewer is correct in that this methodology trades a potential decrease in accuracy for an increase in speed. While literature exists to support that emergency managers are willing to accept a decrease in accuracy for an increase in speed (McCarthy et al., 2007), we must still produce a result that is reasonable and accurate as well as be able to recognize the sources of uncertainty. To assert the reasonability and accuracy of our methodology, we compared our results to those obtained from a full hydrodynamic model, because the overarching goal is to be able to produce a comparable impact map in a fraction of the time. We therefore take the full hydrodynamic model to be the absolute truth and define accuracy as how well our methodology creates a similar impact estimate. As we discuss in section 5.1, our methodology produced an inundation extent that was only 31% accurate. However, when we use our reclassification scheme at the residential parcels, we classify 92% of residential parcels similarly. And of those parcels that are misclassified, 94.4% are misclassified by only one impact level. By reporting impact at the parcel level and by using hazard classes for flood depths, a common practice in flood communication research (Eq. 3), we achieve our goal and produce comparable impact maps. This impact map serves as an estimate for residential parcels that are going to be the most affected, and similar to many social vulnerability indices, should still rely on a certain level of local expert opinion and objective interpretation.

(R2.4) *The authors give us a background in a very detailed way. A very nice Review. maybe it is too wordy for this study. I'm not sure the background section needs so much description, I suggest cutting some down.*

Some material has been eliminated from the background section, as in response to the first reviewer's comments.

(R2.5) *I am curious about the application scope of fill-spill-merge. Is there any requirement for topographic difference or complexity of surface landscape? Would it be more helpful for reader to add some terrain information through DEM and the number or location of depressions in Figure 1?*

The authors explored showing the extent of depressions, but due to their nature of being a few meters in size and highly dispersed, it was difficult to render a figure that meaningfully conveyed that information. We refer the reviewer and readers to figure 4 (figure 5 in the original manuscript), specifically the insets A2 and B2 to examine the nature of depressions in two different representative locations in the study area.

(R2.6) *In Line 593-595: "Our pluvial hazard estimate was shown to be accurate in determining the parcel level impact index 94.4% of the time when compared to a full hydrodynamic model". It was confusing for me to understand how to define the "accurate in determining the parcel level impact index"? Is the drainage network from FSM and hydrodynamic model compared here are both out of consideration, differing only at the depressions? Setup differences between the two methods should be made clear.*

Clarification was added to expand upon this accuracy in section 5.1 (please refer to line 407 in the new draft). We also make this clarification in response to your previous comment, R2.3.

(R2.7) *Figure 1: To those readers who are not in the US, they have no idea where Austin is. It is better to add a figure about the general location of the study region in the US.*

An inset map was added to show Austin in the context of the US.

(R2.8) *The residential area is the main focus of this study, it should be shown on figure 1.*

To avoid overcrowding, residential parcels are not shown on this map and we refer the reviewer and readers to Figure 4 (Figure 5 in the original manuscript). Figure 1's intended purpose is to highlight the watershed basins in the study area.

(R2.9) *Table 1: The basic information about these watersheds, such as the size and imperviousness, should be added.*

The area of each watershed is conveyed in Table 4. We decided against including impervious surface information in any table because land cover characteristics are not included in our simplified methodology.

(R2.10) *Figure 3 is not needful. The process is quite straightforward and has been documented clearly in the text.*

Figure 3 was removed.

(R2.11) *Line 420: the full stop after "sources" should be deleted*

This typo was corrected.

References:

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