Interactive comment on "Rapid Assessment of Damaged Homes in the Florida Keys after Hurricane Irma" *by* Siyuan Xian et al.

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Thanks for the constructive responses that R1 raised up. I would like to response to some of the comments he/she made.

"Comment item 4. Are the scientific methods and assumptions valid and outlined clearly? The paper is based on. 1. Hydrodynamic hurricane storm surge and waves modeling providing the hazard description assessed by coastal measures (3 points) and off-shore measures (3 Buoys). This modelization already published is not the subject of the paper, but is used to state the intensity of the hazards which have affected the two areas of interest. 2. Satellite images are exploited by photo interpretation and used to provide: i) the overall geographic context and ii) to inform the Hurricanes'

damages, with a focus on wind damages to buildings' roofs. 3. Field work producing GPS-informed pictures (3700 pictures for 1600 buildings) is providing information on: i) building typology, ii) wind and ocean surge (building) damages, iii) interpretations on the possible origin of damages. 4. Field analysis is validated using the p-value method, applied to the considered critical damages governing factors-parameters: building size and distance to the coast It seems to be considered that wind strength is more or less homogeneous for each site, by the way not a discriminating factors for damages. There is a discussion on the relevancy of doing a Rapid assessment of damages causes. Post event damage assessment provide for sure indispensable information necessary for risk management. Nevertheless "vulnerability" analysis of damages causes should rely on thorough analysis rather than on rapid evaluations which are usually oriented toward management of the crisis response. Yet, an argument for rapid mapping could be the necessity to get field damages observations before the starting of clearing operations, complementing, from ground, imagery and particularly satellite and aerial imageries which, when they are timely acquired, are established means to record event's memory for further analysis."

Response: thank you for the positive comments on our short manuscript. It is for the brief communication section and a 'rapid' report for the data we collected. We have follow-up work to do more in-depth analysis together with the data collected from Hurricane Harvey.

"Comment Item 5. Are the results sufficient to support the interpretations and the conclusions? Restrictions are: i) statistical method used to assess the conjectural results is sometimes considered as controversial (but I am not specialist), ii) the reduced number of considered damage factors (coherent with the used statistical method): 1. Distance to coastline 2. Building types, but we have no idea on the exact used number of building types. In the discussion two types of buildings are considered: 'true buildings' and trailers. 3. Building size, but this third attribute is very close to the previous one (Building type), because trailers are smaller than buildings; hence there is certainly a (very)

strong correlation between type and size."

Response: Thanks for thre suggestions. The statistical method is actually rigorous as logistic regression models are widely applied in the study for vulnerability/fragility in civil engineering. See the papers: Xian, S., Lin, N., & Hatzikyriakou, A. (2015). Storm surge damage to residential areas: a quantitative analysis for Hurricane Sandy in comparison with FEMA flood map. Natural Hazards, 79(3), 1867-1888. Hatzikyriakou, A., Lin, N., Gong, J., Xian, S., Hu, X., & Kennedy, A. (2015). Component-based vulnerability analysis for residential structures subjected to storm surge impact from Hurricane Sandy. Natural Hazards Review, 17(1), 05015005. Hatzikyriakou, A., & Lin, N. (2017). Simulating storm surge waves for structural vulnerability estimation and flood hazard mapping. Natural Hazards, 89(2), 939-962. distance from the coastline is common factor indicating vulnerability. See above literatures or from empirical evidence: Botzen, W. J., Aerts, J. C., & van den Bergh, J. C. (2009). Dependence of flood risk perceptions on socioeconomic and objective risk factors. Water Resources Research, 45(10). Shao, W., Xian, S., Lin, N., Kunreuther, H., Jackson, N., & Goidel, K. (2017). Understanding the effects of past flood events and perceived and estimated flood risks on individuals' voluntary flood insurance purchase behavior. Water research, 108, 391-400.

For building types, it is a good suggestion. We added the number of building types in Florida Keys in our manuscript. For building size, it is a common sense that building size could matter. But a statistical analysis by controlling other vulnerability variables give us a more scientific reasoning on the observation. Also, it may be cases that building size is not that important if they are located far from the coast. Therefore, statistical analysis does give more insight and information than a simple correlation analysis.

"Item 6 Comments: 1. In the explanations-discussions, damages related to wind and damages related to water surge are distinguished to explain the results, and this is of course relevant and could guide the approach. A question is: if this is an observation or an inferred result? 2. If it is possible to distinguish in the database, combining field sur-

vey and remote imagery, the two damage types (produced by wind or by surge), then it should be possible to test if ocean surge damages are maximum close to the coast line !! I.e. the fact that buildings close to the coast line, including coastal waterways, are more vulnerable to ocean surge will be easily inferred from spatial distribution of the ocean surge damages and it is not exactly the same conclusion than saying that undifferentiateddamages are more important close to the coastline. 3. It would be interesting also to test the correlation between the damage severity and the damage type. Intuitively, from the figure 3c in Big Pine Key: it can be imagined a rough equivalence between minor damages and roof damages = wind damages = spatially scattered and widespread damages, contrary wise major damages are close to the coast line and are mainly induced by ocean surge ? From Marathon example (Figure 3d), major damages are almost entirely linked with landlocked trailers close to the coast line. More or less all the other buildings are showing minor damages (yellow). Again, it would be interesting to check if these moderate damages are mainly due to the wind or not. 4. Regarding conclusion 2: Small buildings are more damaged than big ones, most of the time (always ?) small buildings are trailers ; hence the conclusion could be as well that trailers are more affected than true (solid) buildings ! 5. Regarding conclusion 3: this seems to be a quite obvious observation, but reasserting a correlation between vulnerability (building location and building strength) and income can be added to the risk management discussions. As a recommendation following comments 1 to 4; stating in the beginning of the paper that two hazards linked to the hurricane event are considered: the wind and the ocean surge would be an important improvement, because both the spatial distribution and the severity of the damages are dependent on the nature of the hazardous phenomena. "

Response: 1. it is observed; 2. it is very challenging to distinguish for many cases as some sides of buildings are invisible (due to low accessibility). However, we are confident that the majority of the damage was due to the water (storm surge) rather than wind (some communities were entirely washed away by water. 4. yes, the summary is right. 5. the result is not obvious if we control other variables. Statistical analysis helps

us to understand which variables are the most important features (compared to a correlation test). The suggestion to test income is great, however, building-level income data is not available in US due to privacy. We only found out the average income for the two locations which is not sufficient to do a rigorous statistical test. For the suggestion for differentiating water and wind damage, we will consider that in our follow-up work with a longer paper that focuses on the analysis only and include the case of both Hurricane Harvey (wind damage is kind of dominant) and Hurricane Irma (where water is more important).

"Comment Item 8. Does the title clearly and unambiguously reflect the contents of the paper? Yes. Why using 'Homes' instead of 'buildings' in the title ?"" Response: because we only investigated the residential buildings rather than commercial buildings.

"12. Is the size, quality and readability of each figure adequate to the type and quantity of data presented? 1. Globally, figures are correct and understandable; it would be great to publish them with a proper size. 2. For the figures with the spatial distribution of hazards (3a. 3b) a magnifying for both sites would be welcome to better see the local environment of the use cases . Would be also informative to show waterways on the map in Pine Key to highlight the proposed correlation with damages (and the coastline?). Background images are a bit dark (size?)"

Response: thank you for the suggestions. We modified the figure as suggested. However, given the limit of the brief communication paper, we cannot include more figures. The current organization of figures cannot allow us to show waterways super clear but it can still be visible. The background image is the same format as google earth.

"Comment Item 18. Is the length of the paper adequate, too long or too short? Additional information could be given on the following elements: ïĆů Confirm that for the sites building state evaluation is exhaustive, otherwise please give order of magnitude of the studied sample ïĆů Line: 55-58: a more detailed explanation of satellite imagery exploitation would be welcome. Have the flood surge traces been mapped using these

images? ïĆů Line 73: if possible precise if these trailers 'debris are mainly linked to wind or ocean surge effects? ïĆů Line 80: But a few buildings, near the coast line are only moderately damaged, this element could perhaps be used in the lessons learnt discussion. ïĆů Line 86: what is the list of the building types ïĆů Line 86: What about the correlation between building size and building types and its impact on statistical values? This is confirmed by table 1.b, where p-values are 0.000 both for House Type and House Size ïĆů Line 95: Perhaps the correlation between income and house type (true building of trailer) would be interesting-better? Would be interesting to have the ratio trailers/Buildings for both sites. And also an idea of their spatial distribution.""

Response: for Line 55-58, we add one sentence to explain the satellite image. 'The satellite image was taken right after the Hurricane Irma and can be used to compare with prior-damage image."Line 73: the debris links to water damage; LIne 80: we take the suggestion. Line 86: we only distinguish the building into trailer type and the single family homes (the normal buildings). There are very few other types of the buildings given that our analysis focuses on residential only. The correlation of building size and type is a good suggestion. we added it to our manuscript. yes, p-value indicates the high significance for both house size and house type. Line 95: that is a great suggestion. However, as I said, the income data at building-level is not available due to privacy issues. there is no way to analyze that at the current stage. Yes, the report of the number of different types of buildings give us such information of the ratio of trailer vs buildings.