Learning from success, not catastrophe: using counterfactual analysis to highlight successful disaster risk reduction interventions

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This is an excellent and interesting contribution to the literature that leverages downward counterfactual analysis to shed positive light on disaster risk reduction strategies that have been or could be implemented in places affected by a catastrophe. The manuscript is well written and well presented, containing some highly impressive figures. Having said that, there are a few comments (provided below) that I think the authors should address before this manuscript can be published, to improve its clarity and readability:

Comments on the text:

1. Abstract: The abstract should also mention the second case study using the 10% in 50 year PGA values, to more accurately reflect the scope of the work.
2. Line 43: I think the term "downward counterfactual" should be explained here, for readers that may be unfamiliar with the term
3. Line 100: "that conducted" – it would be more appropriate for this to be replaced by "that led to"
4. Equation 3:
    a. This equation suggests negative benefits, because the impacts from the counterfactual will be higher than those from the realized case. I would suggest the authors reverse the right hand side of the equation, to make the benefits positive if the realized impacts are less than those of the counterfactual – it would also better reflect the calculations conducted in the case studies of the manuscript. You can find a similar comment on Figure 1 below.
    b. To better reflect the calculations conducted in the case studies of the manuscript, it might be better to write this equation in terms of expected values of impacts.
5. Section 4:
    a. Why use only 70 retrofitted buildings if 300 had been retrofitted (as mentioned in line 117)?
    b. Please justify your designation of the retrofitted buildings as specially designed reinforced concrete buildings (Building Class C3)
    c. One thing that is not quite clear to me is how building classes are assigned to the retrofitted buildings in the counterfactual case. Was the required information obtained from a particular source or was it assumed based on the distribution of building classes of non-retrofitted buildings?
6. Section 5:
    a. The first paragraph of this section is a bit confusing. The first sentence seems to suggest that the counterfactual considers a school day and therefore a different exposure to the original case. However, the last sentence of the paragraph seems to suggest that the exposure remains the same. The authors should clarify this apparent contradiction.
    b. Line 186: How does daytime occupancy affect the probability of exceeding a school building's collapse damage state?
    c. Line 193: The authors should clarify that the fatality rate is conditional on building collapse.
    d. Section 5.1: This section should also detail how uncertainty in the daytime occupancy is captured in the analyses, both in the realized and counterfactual

scenarios. Reference to the violin plots provided in Figures 2 and 3 could help to clarify these calculations.

e. Line 221 to 222: “meaning…its occupants do not change”. Are the authors referring to a distribution of building occupancy here or a discrete number? This should be clarified in the text.

7. Section 7:
    a. Line 295: The authors should comment on how the number of lives saved for this analysis compares to the number of lives saved using the main PGA map.
8. General Note: The authors describe the second application of the framework as an estimation of the lives saved “throughout the program’s lifetime”. I am not comfortable with this description for two reasons:
    a. The authors investigate the number of lives saved assuming all buildings have been retrofitted, and are therefore technically investigating the number of lives saved at the end of the program’s lifetime.
    b. The authors investigate the number of lives saved based on just one point on the hazard curve, whereas the word “lifetime” seems to suggest a time-based hazard assessment that considers multiple points on the hazard curve.

    I therefore think that the authors should modify their description of the second application accordingly (including in Section 7).

Comments on figures:

The figures are impressive, effectively and clearly demonstrating large amounts of information. Having said this, the reviewer has a few comments below on how they might be improved:

1. Figure 1: This plot implicitly assumes that a risk intervention can only influence the vulnerability component of risk. But risk interventions can also influence the two other components of risk, as well-detailed by the authors in Section 7.4 and as implied by equation 2. On this basis, I suggest the authors either make it clear in the caption that the figure is only one demonstration of how counterfactual risk analysis can be conducted or else they also shift hazard and exposure in the counterfactual section of the figure. Furthermore, I think the figure would be more intuitively laid out if the counterfactual was presented first, because the subtraction sign in front of the counterfactual implies that the risk benefit is negative.
2. Figure 2: The violin plot of daytime occupants is an excellent visualization tool. Does this daytime occupancy encompass all days of the week or only days in which school is in session? Furthermore, what times of the day are captured by the plot? It would be useful to provide this information in the caption and in the relevant position of the text. Same comment applies to Figure 3.
3. Figure 3: Figure 3 is referred to in the text at Line 153, but the caption of Figure 3 suggests that the figure is only relevant for the 10% in 50-year analysis. I think the connection between the text and the figure needs to be made stronger here.
4. Figure 4: I think it would improve readability of the figure if both the x- and y-axes started at 0.