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Comment on nhess-2021-250

Alexander Densmore (Referee)

Referee comment on "Insights from the topographic characteristics of a large global catalog of rainfall-induced landslide event inventories" by Robert Emberson et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-250-RC1, 2021

This is an interesting and highly timely manuscript that will make a strong contribution to our understanding of rainfall-triggered landslide occurrence. It builds logically on prior work by the authors and others on large-scale analysis of the growing body of landslide inventories, and also adds to those inventories by providing some additional datasets to the community. I strongly recommend publication after fairly minor revisions. Most of my comments are aimed at clarifying aspects of what the authors have done. The writing is mostly clear, but in places there are some minor inconsistencies or elements of the explanation that feel less complete or a little rushed. I've made some comments and suggestions on the annotated PDF; I won't repeat all of those here, but instead I've included the more substantive comments below, tied to line number.

Line 80: I agree with all of the statements in this introduction, but at the same time I feel like part of the argument is missing. The previous paragraphs make the case for why inventories are important and why landslide location data are useful, but there isn't really a problem statement - what is the gap that the authors are trying to fill? The abstract makes the point that prior work (like that of Milledge et al. NHESS, and also work by Jeandet and Gallen and colleagues) has looked at the characteristic locations of coseismic landslides to try to derive some underlying patterns or rules that can be useful for understanding exposure. It's logical to extend that work to look at rainfall-triggered landslides, for all of the reasons listed above, but that point isn't made explicitly here. I think the paper would be strengthened by making that case in the intro, to help convince the reader of why this is needed. This need not be a lengthy addition, but a few extra sentences could make a big difference.

83-84: 'We suggest that...' - I agree, but for the reasons outlined above I think this also undersells what you are doing. If there really are patterns or rules that can be gleaned from this kind of analysis, then that is incredibly valuable for hazard assessment in areas where more detailed models or investigation have not or cannot take place. Similarly, if there are no such patterns, that's also valuable. Milledge et al. 2019 NHESS made this point explicitly and I think you could do the same here.

119: This point about image resolution is a tricky one, because it depends upon the definition of completeness - even 1 m imagery will not catch every event, especially in areas of either sparse vegetation or very dense vegetation (where for example small events are still hidden under the canopy, or contained within channels). I mostly agree with this statement, but it is an oversimplification to say that higher resolution = 'better' in all cases. It's also true that high resolution imagery suffers more from issues with rectification (and sometimes thus georeferencing), which can have an impact on inventory creation and analysis - again, see Williams et al. 2018 NHESS for an example of this.

138: 'We therefore consider...' - I'm sure you're right, but this is a pretty broad-brush statement. Quality in terms of landslide location, or information on size and geometry, or both? Does it matter for 'quality' that two of your new inventories were produced with Sentinel-2 and the others with Planet imagery?

140: Does the 'Date' column in Table 1 represent the dates of the triggering rainfall? What were the time windows over which images were collected (given that those are almost certainly longer)? This has implications for the relationship between rainfall data (which themselves are aggregated or simplified compared to what actually hit the ground) and landslide occurrence – put simply, for many inventories we cannot be certain of when landslides occurred unless the images very closely bracket the dates of the storm. This is relevant because of the discussion of the potential differences between extreme and persistent rainfall in triggering landslides in different parts of the landscape (lines 505-510).

235: Does this mean that you have rasterised all of your inventories? Are you assuming some kind of majority rule to go from landslide polygons (in your inventories) to pixels (for comparison to the continuous raster variables)? And is the resolution of those rasters 1 arcsec? Are you therefore censoring the smaller events? I think this needs to be clarified. Further down in the ms it emerges that in fact the inventories have been rasterised and with a 'presence' rather than 'majority' rule, but to address the questions that I had at this point in the ms, I think that information needs to come sooner.

253-254: 'We utilize the method...' - I think it would be useful to give a very brief description of how this is done, so that the reader does not need to go to the Marc et al. (2018) paper to understand this.

Related to this: I think you use 'scar' and 'headscarp' interchangeably throughout the ms, and I would suggest focusing on one or the other. To me, the headscarp is a particular part of the scar area - they are not synonymous

406: 'While we have attempted…' - this does raise the question, though, of how we 'ground truth' landslide inventories in a meaningful and rational way. I think that is an

issue that's beyond the scope of this ms, but at the same time there is an implicit assumption in this kind of phrasing that inventories can be 'corrected' by hand and presumably brought closer to a true representation of landslide occurrence. Whether that's the case or not and what we mean by 'better' are both open to discussion. I'm not suggesting that you address these points in any detail, but some recognition that 'correction' is challenging might be useful here.

450-453: ‘Characterizing these parameters…’ - this is a little confusing, because you HAVE used a globally available rainfall product as well as a globally available forest cover and loss product. So I don't see how the final sentence is correct. Or am I misunderstanding what you mean?

506-510: ‘Nevertheless, we also suggest…’ - I agree that this would be a really instructive comparison, and it's great to point that out here. But this also raises the issue that I flagged above, of the difference between (1) the time window over which high-intensity rainfall occurred in these areas and (2) the time window over which landslides were mapped. If the latter is much greater than the former, then I think you need to be a little careful about the inferences you draw from the landslide patterns. I don't think this invalidates what you have done, but I think it's important enough to warrant a mention.

Figures

Despite the fact that Figs 3-8 all show essentially the same thing, you use variable labels for both x- and y-axes. I suggest choosing a consistent naming convention and sticking to it, to make things easier for the reader. Otherwise, it’s necessary to repeatedly work out what is being shown.

Also, the color scheme used in these figures for the different inventories is really hard to distinguish. Maybe this doesn't matter, if the point is to show that all datasets show similar performance, but picking out an individual dataset and distinguishing it from the others (which is required to evaluate some of the statements in the text) is really tough. Perhaps use a progressive colour scheme instead (e.g., blue to white to red)?

Fig 3: the x axis labels are not very clear or informative on panels a and b. I think these could usefully be made more precise.

Figs 4-5: it’s not clear why the x axes are reported to different levels of precision here (integers on the one hand, real numbers on the other).

Fig 11: this figure isn't really explained in the text, and the axis labels here are identical to

those for Figs 6 and 9. The reader could therefore be forgiven for not recognising what you are showing, and not really understanding how this figure is distinct from those earlier figures. I think it would be good to provide a more clear explanation of what this figure shows and how it is distinct from the other figs. The caption is factual but confusingly worded, and as a result I don't think this is very effective.

Please also note the supplement to this comment:
https://nhess.copernicus.org/preprints/nhess-2021-250/nhess-2021-250-RC1-supplement.pdf