

Constraining landslide frequency across the United States to inform county-level risk reduction

Lisa V. Luna, Jacob B. Woodard, Janice L. Bytheway, Gina M. Belair, and Benjamin B. Mirus

Dear reviewers, dear editors,

We thank Maria Teresa Brunetti and an anonymous reviewer for their positive assessments of our study and their constructive feedback. Below we respond to the reviewer comments (marked as *paragraphs in bold italics beginning with A*) and outline how we plan to address these suggestions in a revised manuscript. All figure and section numbers refer to the original manuscript.

We are convinced that these moderate revisions should address the reviewers' remarks and will result in an improved and clearer manuscript.

Best wishes,

Lisa Luna on behalf of all co-authors

Response to RC1: Maria Teresa Brunetti

The work aims to estimate the frequency of landslides in the US using available landslide inventories. Landslides are those triggered by earthquakes and precipitation.

The manuscript overall is well written and the objectives of the work are clear. The approach is also promising. Nevertheless, the part describing the models and techniques used (section 2.4) is somewhat cryptic and not easy to read for those with non-advanced skills on statistical distributions, such as negative binomial, applied to overdispersed data. I strongly suggest expanding the part on the models used, giving a more accessible explanation related to the purpose of the work.

A: We thank the reviewer for the positive assessment of our manuscript and approach. We appreciate the feedback that our methods description was not easy to follow for readers with less background in statistics. To address this comment, we will expand section 2.4 to include a more accessible explanation of our methods with more background information that better clarifies their purpose for our research objectives.

Figures (especially 1, 2 and 6) are too dense of information and not easily readable. As a consequence, figure captions are also too long. Please consider moving some figures to a Supplementary Material section.

A: We appreciate this feedback. U.S. Geological Survey publications are required to specify data sources and cartographic projection information in figure captions. Although this leads to lengthier figure captions, it results in increased transparency and allows individual figures to stand on their own. To address this comment, we will consider if parts of some figures can be moved to Supplementary Materials and enlarge others for improved readability.

In addition, as a general rule, figures must be cited in advance in the text. For multiple maps/graphs in the same figure, they must also be cited in the text in the order given.

A: We will ensure that all figures are properly cited in order in the final manuscript draft.

Specific comments

See attached PDF.

A: We are grateful for the specific comments, which we group into three categories to summarize our intended approach to addressing them:

Category 1: Citations and figure references

A: We will add references where suggested and ensure all figures are properly cited in the text.

Category 2: Methods and statistical notation

A: We will ensure that our statistical notation is consistent. As described above, we will expand the methods section to be more accessible to readers with a variety of backgrounds in statistics. We will also clarify our choice of priors.

Category 3: Question: Could [the observed right skew in landslide counts] result from biased information sources?

A: Although any landslide study relies on incomplete reporting and we understand the reviewer's concern, we consider it exceedingly unlikely that the observed right skew in landslide counts results from biased information sources. If, hypothetically, landslide counts followed a Gaussian distribution in which most years had approximately the same number of landslide counts, the mean count would need to be very high to produce the highest values observed in these inventories. For example, if we disregard the years with no reported landslides in Marin County, CA, the mean count in years with reported landslides is 41 (Figure 1i). If biased reporting were to produce the observed right skewed distribution from a hypothetical underlying Gaussian distribution, it would imply that ~41 landslides per year would have gone unreported in most years. However, missing dozens of landslides per year is inconsistent with our assessment of monitoring in this area, as this area is a population center that is monitored by both the California Geological Survey and the U.S. Geological Survey. Furthermore, this issue would need to occur repeatedly across the inventories we included this study, requiring a consistent reporting bias across the various state and local actors that

produced these inventories, which we would find extremely surprising. We will add this point to the discussion.