Earth Surface Dynamics Discussions

Earth Surf. Dynam. Discuss., referee comment RC2
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Comment on esurf-2022-67

Anonymous Referee #2

Referee comment on "Revealing the relation between spatial patterns of rainfall return levels and landslide density" by Slim Mtibaa and Haruka Tsunetaka, Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2022-67-RC2, 2023

The study relates a large data set of landslides with rainfall characteristics in Japan, using 7,500 landslides over an area of 400km^2. The study uses radar precipitation at 25km2 resolution with 1 to 72 h durations. Land cover and lithology are deemed homogenous in the study site.

A power-law distribution is used to identify the landslide size cutoff for moderate and large sizes.

Landslide densities are only calculated where slopes exceeded a threshold of 16.26 degrees (slopes that include >90% of slides). Landslides are separated into total landslide density (TD), which includes all the observations, and medium and large landslide size density (MLD), which includes the slides greater that the size cutoff (>439 m2).

A standardized rainfall that accumulates maximum rainfall over 72h period is used as Pstd. Within this Pstd, multiple time periods that record maximum intensities were also identified (1h to 72h). That aided the authors to develop a rainfall intensity-duration relation threshold curves based on I-D data.

Figure 3 presents a map of 1h to 72h maximum rainfall depths (25km2 resolution) along with TD and MLDs. Higher landslide densities are observed where rainfall intensities are high.

More landslides occurred with rainfall exceeded 100 year return interval.

Observations:

P1, P2, P3-- can you clarify how the populations of landscape slopes similar in these groups, do you report any statistics somewhere? Where are those populations? Are they identified within each selected rainfall grid or can they be located in different rainfall grids?

Lines 195-220: I'm not sure what the objective here, if one is interested to find out where rainfall plays a stronger role, then shouldn't you go and investigate the local conditions (area, slope, soil veg properties) of individual slides. I think the selection process of P groups are based on some random selection routine, if you shuffle these landslides into another set of 3 populations you may get all three look like P1 and P2 with smaller differences in rainfall rate differences, then what would you do.? I also could not figure out what those two different groups are within each plot in Figure 4. Why do the gray symbols have smaller landslide densities than red symbols? I think those were referred to as "pairs" but not sure how paired and why with different densities? Beyond all what is the purpose of pairing.

Rainfall data is very coarse for a rugged terrain to obtain any detailed and new science with respect to landslide process understanding and how rainfall controls it. The study may be useful for regional early warning systems, though still very coarse. How do you take the next step from coarse-grain analysis to finer scale hazard mapping?

What is the point of Figure 5, what is the question you are trying to address? As far as I understood you have some randomly selected data pairs with different landslide densities and they seem to show some narrow range of variable ID trends, but this is expected isn't it. Another point I did not understand—in Figs 3 and 4, do each of the circles average many points with different landslide densities?

Not having a clear research question and/or hypotheses makes it difficult to follow this paper. In addition, the methods rely on some comparisons of three similar slope populations (P1,2,3), and pairing of data among them, the purpose of which was not clear. If the whole point of the paper is to show that rainfall patterns and return intervals matter, that is no surprise to anyone, that is why those intensity-duration thresholds were used for nearly a century. In addition, the rainfall data is at 5km spatial resolution, which for mountain ranges, is very coarse, and radar rainfall is usually not a good option for estimating mountain rainfall. And finally, which is probably more important than any of the comments I made above, besides local slopes, the authors have not factored in elevation in their analysis. Elevation is also a good predictor of rainfall and variations in soils and vegetation. They used a slope threshold in their analysis to select landslides but a quick grouping by elevation would probably reveal a strong elevation control. All in all, the paper left me with no new information. If the authors would want to salvage this paper, they would probably reconsider a set of new methods and pose clear questions and objectives.