Review of Marc et al. “Towards a global database of rainfall-induced landslide inventories:

first insights from past and new events” by David Milledge.

Major Comments

This is a well executed study with novel and interesting findings. I have three general comments and a large number of minor comments but neither the major nor minor comments reflect a fundamental problem in the research in my view.

I am not convinced that it is essential (or helpful) to present your inventories as the only inventories that are suitable for this type of analysis (as you seem to do on P2-3). Instead you could simply say they are one set of inventories and they demonstrate the power of this type of approach. I am not convinced of the need for landslides beneath an entire storm footprint to be mapped and am sceptical that entire storm footprints can be convincingly defined so I’m not convinced by your critique of studies that analyse far smaller study areas (other than on sample size grounds).

The methodology description could be more consistent between inventories. Similar information is reported for each case but the style of the reporting differs and some key information reported in some cases is not present in others (e.g. image source, image resolution, acquisition date).

I am not convinced that your focus on ‘comprehensive’ inventories is necessary nor that examination of total landslide numbers, volumes or areas are particularly meaningful in relation to rainfall triggered landslide inventories (though I think the findings on landslide density and slope are extremely interesting and thought provoking). This focus might reflect a desire for comparability to co-seismic landslides but I think the two triggers are importantly different. For example, it is extremely difficult to define the spatial and temporal limits on a single storm. In addition I find the results relating to total numbers, volumes and areas less convincing because they are predicted from a small number of point rainfall records. A clearer explanation of why ‘comprehensive’ inventories and total statistics are important would be a valuable addition to the paper.

Minor Comments

P1L4: Associated to: How do you know that these events are associated to one another.

P2

L8: deterministic approaches inapplicable: I think this statement is a little strong. Is it really fair to say that they are inapplicable given their data requirements.

L30: comprehensive: this term needs defining.

L34: Why is it insufficient? I think you need to demonstrate this. Is this a sample size argument? Some things won’t be possible to calculate but others will. What can you and can’t you do with a subset inventory and how big does the subset need to be?. Is it ever possible to capture the full inventory for a storm? How do you define its bounds?

P3

L4: landslide scale: I am not clear what this means. Could you define it?

L7: comprehensive mapping: where do you start and finish. Your definition of a storm is very important here and I don't see it at the moment. For example shouldn't the Morakot mapping extend to the Phillipenes and China on this basis?

L14: adequately: how do you quantify adequate representation, what would inadequate representation look like and how do you know whether a representation is adequate?

L30: this gets at a difficult issue, what do you include as a landslide? I think you need a clear definition that can be applied across all inventories and I don't see one at present. Divergence from the definition in different inventories will introduce bias to your results.

P4L4: whether or not the statistical properties of a subset are representative: you need to demonstrate that they are not representative for your argument here to hold and it is not obvious that this is the case. They might not be representative because of the sample size but why should you need the all landslides triggered by a particular storm, it seems reasonable to assume that one catchment is independent of another for these processes and on these timescales.

P5

L15-19: why take this approach rather than breaking up the multi-headed polygons manually?

L6-17: this methods description is difficult to follow. Image acquisition dates and image resolution information is missing in some cases. It would also be useful to give some indication of the performance of the automated classification with respect to manually mapped landslides.

P7

L1: there is quite a long window between pre and post event imagery in some cases. How confident can you be that another storm did not trigger some of the landslides? What evidence do you have that this is the case?

L2: mapped automatically: I think you need to include a methods description for this automatic mapping and some information on how the quality of this mapping was evaluated.

L4: fluvial system: How do you define the fluvial system and how did you identify it for the study area?

L5: to map at least the largest: I don't understand what this means, were there some areas of your study area that you did not have high resolution imagery for? If so what fraction of the study area was this and what impact does this have on the inventory as a whole?

L12: Specific dates are missing for the Landsat images. This is a 2 year window, which seems a very long time. How confident can you be in assigning landslides to a single event within that window and what is the basis for this confidence? This is particularly important given your earlier critique of other inventories.

L20-21: maximal forcing: this doesn't seem to be consistent with your argument for the importance of complete landslide footprints. You are comparing the forcing at a single location within the footprint to the properties of the entire footprint.

L30: landslide densities: calculated over what window size, I think that this choice will be critically important. On a small window density will have multiple local peaks.

L33: why not use 3 gauges for Colorado? Where were the next nearest gauges and why were they discounted?

P8L11: continuous period: I'm not totally clear what this means, does it mean that if there was no rain in a 3 hour period then that is the end / start of the storm? Was the same duration criteria applied to all records?

P9

L5: how, and where, did you measure landslide width?

L6: I think you could state this more simply by saying that you assume that scars have equal length and width. This is the same assumption used by Pelletier et al., 1997.

P10

L23: isolated remote landslides: how were these defined?

L24: to what extent is the landslide distribution area constrained by your study area (i.e. the extent of available images). Taking this to an extreme did Typhoon Morakot trigger landslides in China or the Phillipenes and should these also be included? This again reflects something that I think you need to discuss somewhere, the differences between rain storms and earthquakes as triggers: where are they similar enough to borrow frameworks from one another and where do they differ?

P11

L3: typically have power law: they have typically been fit with these distributions but do we know that they typically follow that distribution or do we fit power laws tailed distributions without testing alternatives (e.g. log-normal).

L19: must also: must is a strong statement, could it alternatively be due to different mapping criteria?

L24: peculiar distributions: are these distributions peculiar if you are seeking power laws but not if other alternatives are considered? Have you tried a log-normal distribution? Negative curvature of the tail in log-log space sometimes indicates better fits for log-normal distributions?

L26: Why use a least square fit to represent the power law tail? The problems associated with using least squares fits to binned data rather than an MLE have been widely discussed (e.g. White et al., 2008; Clauset et al., 2009) and Clauset et al. (2009) provide appropriate tools to fit only the power law tail using an MLE.

L29: aspect ratio below 2: why below 2? What are the specifics of the equation? I had understood it to be A=w^2, which would give an aspect ratio of 1.

P12

L4-8: Why is this censoring of low slopes necessary? I am not clear on what you are trying to achieve by removing them?

L8-10: generating a histogram then smoothing it seems an unusual approach to this problem, results will likely be sensitive to both the smoothing window and smoothing function. Given the theoretical basis for Kernel density estimation (e.g. Cox, 2007), why not use this approach?

P13

L5: initiation point: I don't think you have previously defined this or explained how these points are identified.

L11: focussing on scar areas seems sensible but this particular approach seems strange and the choice of modal topographic slope somewhat arbitrary, could you provide a more robust explanation for this choice? Alternatively couldn't you have used your previously defined scar area (w^2) to identify scars as the highest w^2 area of each polygon? This would be consistent with your previous definition and would avoid introducing an arbitrary slope threshold which could bias the results.

L14: Could you use line thickness to indicate the slope beyond which small numbers of cells in the value range preclude interpretation of the line? It would be useful for the reader to know where that point is for each dataset. Also could you colour the lines in Fig 5 by storm duration? This might make it easier to pick out the behaviour you are identifying in the text and to make a connection between 5A and 5B.

P17L9: Total storm rainfall: These results are extremely interesting. They suggest that absolute rainfall properties are good predictors for landslide properties. In the rainfall threshold literature there has been debate over whether absolute rainfall properties are driving failure or whether it is the degree of deviation from normal conditions (e.g. expressed as percentiles). It might be useful if you could reflect on this in relation to your findings. Would a plot of rainfall percentiles for these storms look very similar to the plot of absolutes that we see here?

P18L17: we have no clear physical explanation: isn't this something that either extreme rainfall community or the hurricane community have thought about? It would be useful to point readers to key reference from that literature here even if you don't strongly back one particular explanation.

References

Clauset, A., Shalizi, C.R. and Newman, M.E., 2009. Power-law distributions in empirical data. SIAM review, 51(4), pp.661-703.

Cox, N.J., 2007. Kernel estimation as a basic tool for geomorphological data analysis. Earth surface processes and landforms, 32(12), pp.1902-1912.

White, E.P., Enquist, B.J. and Green, J.L., 2008. On estimating the exponent of power-law frequency distributions. Ecology, 89(4), pp.905-912.

Typographic errors and wording suggestions

P1

L10: storm -> storms

L15: rainfalls -> rainfall

P2

L7: At this day -> at present

L22: allow to make -> allow

L23: region -> regions

L23: (large slope -> (hillslope

L26: These progresses have - > this progress has

P3

L7: delete: , and thus

L15: inventory > inventories

L17: it isn't clear what you mean here, perhaps add: size (total area), geometry (length, width and depth) etc.

L25 were > was

P4

L15: N-s should be Ns

L34: avoid > avoids

P5

L2: twice more: or twice the number (i.e. 3n or 2n)?

L31: you use a variety of date formats which is a little confusing.

L34: dates are needed for the FORMOSAT-2 image acquisition.

P6: letters missing from Fig 1. Colours of landslides are very difficult to distinguish.

P7

L23-27: I don't think this is relevant here, I suggest moving to the discussion.

L30: average record properties: it isn't immediately clear what you mean here.

L33: closest of > closest to

P8

Table 1 caption: Reference are as follow > References are as follows

L10: other > over

L20: is > are

P9

L1: polygons > polygon

L3: allows > allows us

P10

L25: the built > the

L26: 0.2 and > 0.2 to

P11

L10: with important total precipitation: this doesn't seem the right set of words

P13

L13: artifact due to > artefacts of

P16

L4: S??: figure details missing.

P18

L23: prime > primary

P21L5: storm tends > storms tend