Dear Reviewer,

Thankyou for your detailed comments. We are in the process of addressing all of them and have found that a number of your suggestions can be directly implemented and some of the queries simply addressed by slight alterations to wording in the text. As a result, we respond here only where there is more to say.

Many thanks,

David Milledge

Detailed comments on “Simple rules to minimize exposure to coseismic landslide hazard”

L15 - Do you present in the end primarily simple rules to identify hazard? Or rules to minimize exposure, cf title? I understand they go hand in hand, but it would be good in my opinion to be aware that the terms Hazard, Exposure and Risk are easily confused by readers. Being consequent in using terminology in the abstract might avoid confusion.
We present rules to identify landslide hazard and we expect their primary use to be in aiding decision making in order to reduce exposure to landslide hazard. We will clarify this in the revised manuscript.

L20 - From reading only the abstract it is difficult to agree that defining "the upslope area with slope >39° that reaches a location without passing over a slope of <10°" does not require prior knowledge or skills and that it is easy understandable. **Agreed, but on line 23 we distil this into a simpler rule: ‘avoid steep (>10˚) channels with many steep (>39˚) areas that are upslope’**

L23 - Show which other metrics were tested besides the two new metrics you introduce so this sentence ("most skilful") has more meaning. **We mention these on lines 16-17 and are conscious that we are short on space in the abstract.**

L26 - How does that work, "minimise local slope especially on steep slopes"? **It is particularly important to minimize local slope on steep slopes. This is explained in more detail in the results and discussion sections. We are not sure if you found the sentence difficult to interpret or were concerned about how robust the finding was. The latter will be addressed in the results and discussion section of the paper.**

L26-28 - This rule seems dubious when stating at the same time "even at the expense of increasing upslope contributing area" and " but not at the expense of [...] hazard area" with the latter also comprising upslope contributing area. **The hazard area is found within the upslope area but these two metrics are very different from one another as we show in the paper. Our results strongly support both parts of the rule that you identify above.**

L46 - I think "respond to that hazard" is of lesser relevance here as you do not deal with hazard response in this paper. **We agree that response is not our focus but information at a scale that enables decisions to be made on how to respond to the hazard is one of the key motivations for this work. Thus, we think it is important to retain the response clause.**

L62 – “hazard maps cannot resolve hazard at those scales” : I doubt that, with the current availability of high-resolution remote sensing data; yet I agree it could be time-consuming. **Agreed, though it is worth highlighting that we are talking about national and regional scale maps in this clause. We will soften the statement by changing from “cannot” to “do not”.**

L97 - How does the “self-recovery” relate to the first part of the sentence? I don't see the relevance of it here. **We will add an inline indication of what self-recovery means such as: “self-recovery after disasters (e.g. where householders rebuild their own homes)”**

L102 - Not only of “less use” but also inherently different; your rules aim to minimize landslide exposure, not to help in hazard response. Please modify. **We disagree, action to minimize your exposure to a hazard can occur both before and during an earthquake, taking the earthquake example this might be the**

difference between relocating away from an earthquake prone area and choosing to 'drop cover and hold on'. Given this we think that 'less use' is the appropriate modifier here.

L112-116 - I don't see much difference between the two questions? **The first relates to absolute performance of the rule set, the second to relative performance of rules within the set.**

L127 – This question is probably related to my lack of knowledge in the earthquake-triggered landslides, but to me it is not clear what you mean here with 'local slope', could you specify? Do you mean the slope at the landslide head ? What is the spatial extent of a "local" slope?
L129 - In Parker et al. 2017, who you cite, they find hillslope gradient as an important driver, which is different than local slope I would think? Parker et al. 2017: "We find that a simple model combining PGA and hillslope gradient provides the most numerically elegant and best fitting model. The use of topographic variables other than hillslope gradient were found to produce models with a lower fit,..."
This comment and the comment above are closely related so we will deal with them together. We have used 'local slope' to refer to the same property that Parker et al. 2017 call hillslope gradient. The term local slope is appealing to us since it indicates that a gradient is being calculated over a (relatively) short length scale rather than over the entire hillslope (from ridge to river). However, we will try to clarify this in our revised manuscript.

L194 - How is this "non-local" when accounting for local slope? **It is non-local in the sense that the value of the metric at a given cell is a function of cells within a wider neighborhood than only its 8 connected (local) neighbors. In this case the property is the gradient (local slope in our terms) of the cells in this wider neighborhood. We see though that local slope is a confusing term here and will seek to clarify this in our revised manuscript.**

L402 - Why would you use NED elevation data? Since SRTM covers each of the inventory, it seems more logical to use consequently the same DEM source to avoid bias. Certainly because you emphasize on the slope factor here, there should not be a biased introduced voluntarily (unless it would be used for an investigation of sensitivity to spatial resolution). **This is a good point, our use of NED data was a legacy of higher resolution analysis at this site. We chose to coarsen the 10 m DEM to 30 m to ensure that the resolution was consistent with other sites. We expect the difference in our results between using NED and SRTM at 30 m to be negligible but we will test this.**

L420 - Could you clarify what you consider here as channel and channel spacing? How is channel spacing related to the skyline?
We define a channel in geomorphic terms (i.e. as a flowpath with identifiable banks) both because this is recognisible in the field and is the basis for the scaling relationships that we use to define characteristic hillslope length. Channel spacing is related to the window size required to evaluate the skyline angle because the skyline is likely to be defined by local ridges and the distance to these ridges to be defined by channel spacing.

L421 - What is meant with 'characteristic hillslope length'?
Characteristic hillslope length can be interpreted as an estimate of the average hillslope length for the study area. It is calculated based on the upslope contributing area at which there is a scaling break in the relationship between slope and upslope contributing area following the approach of Roering et al. (2007).

L423 - What is the relation between the characteristic hillslope length and channel spacing? **Since channels are separated by ridges with hillslopes on each side then the average channel spacing is twice the characteristic hillslope length.**

L422-423 - Since these are parameterized by the chosen inventories, do you estimate that your rules might change for other areas? Or do you argue that the conservative approach is general enough?
The size of the window over which the cone is projected should not have an impact on the rules only on their implementation and testing within a GIS. The objective here is to ensure that the chosen window size is large enough to reproduce the same skyline angle in the GIS that would be measured in the field.

L567 - I do not see a significant difference in the point density (~number of observations) for observations with Upslope contributing area > 1000m./m. **Our point here was that the number of observations per**

bin was very small for upslope contributing area >1000 m2/m. However, reviewer 1 has suggested an approach that should enable us to identify bins in which sample sizes are too small to confidently interpret.

L753-756 – I think it is very valuable that the authors take a step back from there rules while summarizing the main parameters to take into account for hazard assessment, being “hazard area, skyline angle, and the local slope in conjunction with each other”. Yet this idea that is stated as a conclusion “We conclude that decisions on how to reduce landslide hazard most effectively need to be made on a case by case basis, …” is not repeated in the abstract or conclusion, which to me is confusing. It is even in contrast with the conclusion stating (L858-859) “suggesting that the average parameters can be applied to other inventories. These findings can be distilled into three simple rules:”.
The ‘case by case basis’ on L754 refers to application of the rules on a case by case rather than simply resolving to always move upslope or downslope for example. As a result we don’t see a conflict between these two statements. Hazard should be assessed case by case but this can be done using the simple rules. We will try to clarify this in our revised manuscript.

L764-L766 I am not sure what your message is here, helping in decision-making before an earthquake is the same to me as decision making after an earthquake which is in turn also before a future earthquake. What is the differentiation that I am missing here?
The point we are trying to make here is that these rules could be used not only for long-term decision making where the time that it takes to move a certain distance is not the limiting factor in whether you can locate yourself or your assets there but also for short-term decision making during or in the immediate aftermath of an earthquake when you may only be able to move short distances. We will try to clarify this in or revised manuscript.