Responses to Reviewer 1 :

We would like to thank the referee for his review of the paper, helping us to improve the manuscript. The four main remarks are addressed first, followed by our responses to more detailed comments.

CR1 *: It was very difficult to follow the methods description, which is mainly detailed in the supplement, because of English usage problems and misspellings, but also lack of clarity and logical gaps that require more explanation*.

Response: We have completely rewritten the method, including more figures and a clear justification of its use. As it is more detailed than the previous version, we choose to leave it in the supplementary material to avoid overloading the main text with technical considerations. We hope that this new version is clearer.

CR1 : *The authors state several times that they confirmed rainfall-induced landslides cluster at toes and earthquake-induced slides often cluster at crests in general in their analysis, but this statement is made based on comparing against just one rainfall inventory. That is not enough evidence to make such a strong, generalized statement. I'm quite sure there are other rainfall induced landslide inventories out there, adding one or two more to the analysis would provide more support to the general statements made.*

Response: Indeed, in the Chi-Chi epicentral area, we compare the Chichi EQ-induced landslides inventory with the Typhoon Morakot inventory but also with the rainfall-induced landslides inventory covering the period from 1997 to 2013 (Cf figure 1 and table 1). Furthermore, we would like to highlight the fact that this observation is not only from our study but also observed by Densmore and Hovius, 2000 for storm-triggered catalogs in Idaho and California, in Taiwan for the Typhoon Toraji and Herb and for New Zealand storms (Meunier et al, 2008). We have clarified the main text.
Changes: L153 *"This evolution seems to confirm that landslides triggered by earthquakes and rainfall have distinct and different clustering behavior as observed in previous studies (Meunier et al, 2008; Densmore and Hovius, 2000)."*
L 172 "*This observation, added to the results concerning the temporal variation of Rpcrest presented in the section 4.1, suggests that toe-clustering is a signature of rainfall-induced landslides."*

CR1: T*he implementation of the topographic amplification estimation method needs to be explained in much greater detail, for it's not clear what they actually did to compute MAF, especially given that the method is frequency-dependent but they make no mention of assumptions of S-wave velocities or how they dealt with the frequency-dependence or how they chose the wavelength range they mention. But from what I can understand, I'm not sure their exploration of MAF as an explanatory factor for ridge clustering is not really telling us much, given the huge uncertainties in estimating topographic amplification, that they average the results over the very large macrocells, and the fact that the method they use is based on numerical models and has not really been proven effective with real data yet. Note, there is an alternative empirical method that is not mentioned in the paper that might be worth comparing because in contrast to the Maufroy method, it is based on data. The downside is its specific to California data. Rai et al., 2016 https://doi.org/10.1193/113014EQS202M.*

Response: We agree with the referee on this point. The MAF averaged in a macrocell doesn't tell us more than what the concentrations of the ridges does. Therefore we have removed this part. We now refer to it only in the discussion, for area where topographic amplification might be an explanation for landslides position. However, in order to illustrate the fact that high ground motion at the top of ridges may explain the landslides position, as an example, we choose to show the soothed curvature computed for a wavelength similar to ridge sizes (i.e. That should correspond to different frequencies as the shear wave velocity varies spatially) in figure S8. As ridge curvature and relative elevation have a positive covariance (Rai et al, 2016 and figure S17), both indicators may be used to detect amplification at the top of the ridges.

Changes: All concerning the MAF have been removed from the main text. Figures 5 and S15 have been removed. Figure S17 have been added instead.
We only suggest topographic amplification L270 *"In these particular geological configurations, topographic amplification could control the landslide position. For example, in the Tangwanzhai syncline, the sharpest crests are oversampled by landslides (see supplementary topographic amplification, Fig. S17). Several authors have*

shown that ridge sharpness promotes topographic amplification (Maufroy et al., 2015; Rai et al., 2016)." In the supplementary we detail why we think that topographic amplification could explain such pattern in these areas.

CR1: *I'm not convinced they did a thorough job of ruling out bias because they derived the source areas from the original polygons automatically based on a simple assumption of typical aspect ratio and only looked at one inventory. I would be more convinced if they instead used one of the several inventories that did map source areas and deposits separately [e.g., Gorkha (Roback et al., 2017), Mid-Niigata (GSI of Japan, 2005), Kaikoura, (Massey et al.,2018)] to show whether considering entire polygons biases the results.*

Response: More catalogs would be better indeed but as far as we know, 1- the landslide-scar inventory of the Kaikura Earthquake is not available in open source 2- The Mid Niigata earthquake did not produce enough landslides to perform such analysis and 3- we have reasons to think that many of the landslide scars of the Gorkha inventory may be underestimated. We would like to draw the referee's attention on the fact that inventories presenting distinct scars can suffer from miss-mapping and are therefore subject to criticism. Instead, we choose to extract the scars using an empirical relationship relating the scar area to the total landslide area derived from a limited number of well documented cases. The same approach is used to derive landslide volumes from their surface. Since the patterns we observe using the landslide scar, the total landslide surface and the landslide centroid remain the same, we are quite confident in the fact that they are relatively robust. This means that the spatial variation of the landslide position remains the same.
Moreover, this method can be applied to all landslide inventories mapping source areas and deposits altogether and so far, they remain the majority.

CR1: *L13 – The word "confirms" is a little strong for a conclusion based on comparison against one rainfall inventory*
Response: *We have* changed the sentence and added the fact that our observations agree with previous studies. See the answer to the second comment.
Changes : L13 *"A cross check against rainfall-induced landslide inventories seems to confirm that crest-clustering is specific to seismic-triggering as observed in previous studies"*

CR1*: L14-15 – Stating that seismic ground parameters have little bearing on observed patterns is pretty problematic because the landslides wouldn't have happened without the ground motion. The greater likelihood is that we don't have the means to accurately estimate the relevant ground motion parameters at the site where landslides are often triggered. Perhaps rather than saying "have little bearing" one could instead say ground motion parameters from ShakeMap do not seem to exert a primary control on observed clustering patterns.*
Response: We agree with the referee and have clarified this point.
Changes: L15 *"In our three study areas, the seismic ground motion parameters, lithologic and topographic features used do not seem to exert a primary control"*

CR1: *L16-17 By major faults, do the authors mean faults involved in the earthquake that triggered the landslides or all faults?*
Response: We mean "regional major faults", we precise it in the reviewed manuscript.
Changes: L18: "Toe-clustering of seismically-induced landslides tends to occur along regional major faults."

CR1*: L20-21* I *don't think anyone is suggesting that landslide clustering be used as an indicator of seismic parameters*
Response: We agree with the referee and have clarified this point.
Changes: L18: "*As a result the observation of landslide clustering on topographic ridges cannot be used as a definite indicator of topographic ground shaking amplification".*

CR1*: L61 – give reference/source of reported PGA's here and elsewhere. Use commas for thousands in English, dots for decimals.*

Changes: L68 *"(Tsai et al, 2000) "*.
L470 : *"Tsai, Y. B., & Huang, M. W. (2000). Strong ground motion characteristics of the chichi, Taiwan, earthquake of September 21, 1999. Institute of Geophysics, National Central University. "*

CR1*: L95 – What does a random draw of landslide positions with no external forcing even mean? Pretty much every landslide occurs due to external forcing. Perhaps this section needs to be rewritten for clarity?*

Response: It is not very clear indeed. We mean a set of landslides randomly drawn in the landscape so there is no bias (or forcing) on their position. It's the null hypothesis (with regards to landslide position) we use to quantify the statistical robustness of any bias (clusters) observed in the data.

Changes: All the supplementary and the main text has been rewritten for clarification.

CR1*: L121 – How is the Maufroy method actually implemented? Not nearly enough detail is given. The method is frequency-specific, but the relevant frequency depends on the scale of the feature and the wavelength depends on the shear wave velocity.*

Response: See the response to the third remark.

Also how is this applied to the ground motions, none of the ShakeMap outputs are frequency specific except the spectral accelerations, but those are single degree of freedom oscillators with a specific natural frequency, which is not the same thing as ground motion of a specific frequency content. This method is also based on modeling results and to my knowledge, hasn't yet really been validated against real data so I'm a little skeptical that this analysis is telling us much. It's not clear how the Paolucci method is used in the study.

Response: We have not combined the MAF with the ShakeMap. We have not used the Paolucci method in that paper. We have just mentioned its work as an example of a study showing possible relations between the topography and ground motion. The ridge width can be related to frequency of resonance of the topography (e.g. Paolucci, 2002, Massa et al, 2014) and the ridge shape ratio can be linked to the ground motion amplification (Geli, 1988).

Changes: L128 to 133 "*For example, the ridge half width can be related to the frequency of resonance of the topography (e.g. Paolucci, 2002, Massa et al, 2014) and the ridge shape ratio (slope height /ridge width) can be linked to the ground motion amplification (Geli, 1988). To test if the clustering can be associated to the geometry of the ridges we calculate and associate to each macrocell the median slope heights and the median of the ridge half -widths (Fig. S8).*"

CR1: *L130 – Provide some information about the scale of mapping for each of these maps.*

Response: We have reworked the section 3.3 of the main manuscript and added two figures to the supplementary material to address this point.

Changes: L116-124: "Maps of Rp_{crest} and Rp_{toe} were generated by subdividing a study area into macrocells in which Rp is calculated. The size of the macrocells in this study is set at 7.8 km^2 to optimize for two criteria: a) the cell must be small enough to capture the spatial variation within the epicentral area, and b) it must be large enough to be statistically representative in terms of landslide content (see supplementary Methods-Metrics). The second criterion imposes a lower limit to the resolution at which we can observe any spatial variation. Figure S5 shows three Rp_{crest} maps in the Wenchuan epicentral area with increasing macrocell size. Although the patterns remain globally the same, macrocells of 7.8 km^2 produce the most legible map. The mean of Rp_{crest}, averaged over the whole landscape, remains relatively independent of the macrocell size (Table 2, supplementary)."

CR1 : *L143-144 – It is problematic to make such a general statement about all landslides based on an analysis of three watersheds in one location.*

Response: Beside the clear signal we observe in these three watersheds, the Morakot landslides do cluster downslope over more than 1200km^2. This pattern significantly differs from the three patterns associated to EQ-triggered landslides and we find this quite convincing. Moreover, the conclusion is not only made on our observations but also based on previous studies by Densmore and Hovius, 2000 and Meunier et al, 2008.

Changes: L144 "*This evolution seems to confirm that landslides triggered by earthquakes and rainfall have distinct and different clustering behavior as observed in previous study (Meunier et al, 2008; Densmore and Hovius, 2000)*"

CR1: *L154 – Crest-clustering is not dominant for Chi chi either, I'd estimate that more than half of the cells are blue.*

Changes: L158 we have removed *"in contrast to the other two cases"*

CR1: *L163 – Also true for Fig 3*
Response: Fig 3 represents the clustering map of landslides triggered by the typhoon Morakot, for which we observe only toe-clustering.

CR1: *L182-185 Clarify if these values were adjusted somehow for topographic amplification, as described earlier, or if this is just showing the values directly reported by ShakeMap.*
Response: We only used the values from the ShakeMap, no adjustment with any amplification algorithms have been done, as the ShakeMaps already take in account in some way the topography.
Changes: L189 *"published on ShakeMap"*

CR1: *L189 – At what DEM scale is the MAF computed? This definitely could benefit from more clarity earlier on how the MAF was actually computed, (i.e., at what scale) and then presumably averaged over macrocells. Wouldn't averaging it over such large areas tend to remove any possible correlations?*
Response: All the part concerning the MAF has been removed.

CR1: *L230 – What is a dissolution figure?*
Response: We use the wrong expression, we mean high pressure solution evidences.
Changes: L226 "*rock layers are dipping steeply and bear traces of strong deformation, including pervasive schistosity (Robert, 2011)"*

R1: *L249 – Do the authors mean the landslides occurred when slopes were parallel to the stratigraphic dip? That is what is implied by the cited figure.*
Response: In Northridge the landslides occurred on top of the scarp slopes. The legend of the figure S14 and the main text have been clarified (see L245).
Changes: L245 "There, co-seismic landslides preferentially occurred on the top of the scarp slopes steepest slopes cutting across the stratigraphic dip"