

## ***Interactive comment on “Seismic and geologic controls on spatial clustering of landslides in three large earthquakes” by C. Rault et al.***

**C. Rault et al.**

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We thank the referee for his useful comments. We address the two main comments first and then the more detailed remarks.

R2 : Chief among these are the lack of explanation of the statistical methods employed in the analysis. I was unable to fully understand the methodology after reading through either the main text or the supplemental material. In revision, I suggest adding more information to the main text, as well as expanding/editing the supplement, to make it accessible to an audience unfamiliar with the particular statistical methods used in this paper.

Response: This point has also been raised by the first review so we have completely

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rewritten the method, including more figures and a clear justification of its use. 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.

R2 : The second main issue that I have relates to conclusions from the typhoon dataset. It's hard to justify making sweeping, general claims from the study of one storm-induced landslide event. I think the result of toe clustering, in this particular case study, is compelling and that the spatial distribution should certainly be discussed. I would, in doing so, resist the urge to extrapolate the results to all storm-induced landslides. For comparison, consider the variability discovered among the three coseismic study sites. This larger dataset allows the authors to go into detail about the different geologic and seismic circumstances that aligned to drive those spatial patterns. Now imagine if the authors had studied just one of those examples and then generalized the result. It would be an inaccurate representation of the variety in distribution that they actually found when comparing multiple sites. So, in the case of the storm-induced landslides, I feel one is too small of a sample set to draw meaningful conclusions universal to rain-induced slides. In addition to these main points, I also add the following comments/edits:

Response: We were not clear on that point as the 1st referee also pointed out. Actually, we do not base our conclusion from the Morakot dataset only. We also consider the time variation of the crest clustering (RP crest) derived from different rainfall-induced landslide inventories spreading over 16 years (fig. 1 and table 1). Technically, one could argue it constitutes 6 different dataset and both referees consider it being one just because we choose to merge them into one figure. Moreover, we clearly refer to the results of Densmore and Hovius 2000 and Meunier et al., 2007 to build up our conclusion.

Changes : L153 "This evolution seems to confirm that landslides triggered by earthquakes and rainfall have distinct and different clustering behaviour as observed in previous study (Meunier et al, 2008; Densmore and Hovius, 2000)." L 172 "This observa-

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tion, added to the results concerning the temporal variation of Rprcrest presented in the section 4.1, suggests that toe-clustering is a signature of rainfall-induced landslides.”

R2 : Line 41 – “1,2 to 2.5” the use of commas versus periods is inconsistent throughout the manuscript

Changes : We have changed comma for dots for decimals.

R2 : Line 75 – Xu et al., 2014b is not in the references, this should probably be Xu et al.,2014

Change done

R2 : Line 78 – typo with a period before 31.9.

Change done

R2 : Line 143 – the word confirm feels too strong here (see main comment number 2 above)

Change done

R2 : Line 156 – I don't follow what is meant by this statement. Do the combined three case study site really show this, I thought you just described many differences between the sites. Also, should be show not shows.

Response:.The 3 study cases show patterns of crest and toe clustering of landslides induced by earthquakes. Therefore, all show similar behavior even if their spatial extension strongly differs.

Changes : "Therefore, the three cases show ..."

R2 : Line 163 – 174 – I suggest moving this section about scars vs. deposits to the supplemental material. It feels out of place and unnecessary at this position in the main text.

Changes : L163 toL174 have been removed from the main text and added to the

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supplementary

R2: Line 265 – So does this mean that the toe clustering in this case is a coincidence based on the position of weak rocks and/or faults? In other words, if weak busted up rocks or faults crossed through the middle of hillslopes (rather than toes) would you see more slides concentrated there or is there something particular about the toes?

Response: We are talking about major regional faults. In the case of the Sichuan, some major rivers (such as the Minjang river) flow along them. Therefore the most weakened rocks are located downslope in those valleys, producing toe clustering. So yes, it's the results of the rivers lining up with major fault zones.

R2 : Line 274 – typo – is should be in

Change done

R2 : Line 278 – what is meant by “may be revealed”, is this meant to be a future study?

Changes: This sentence has been removed. Instead we refer the reader to the supplementary.

R2 : Line 457 – Xu reference should start on the next line

Change done

R2 : Figure 2 caption – “the black curve” should be the black line

Change done

R2 : Figure 5 caption – Is a word missing after Sichuan? the Sichuan what? Line 493 – I do not understand this sentence.

Changes: The figure 5 has been removed

R2 : Figure 8 – where are the snapshot locations on this map? Am I missing a small box showing location(s)??

Changes: Figure 8 has been changed. Many of the snapshots have been removed, the small boxes of those represented have been added. Legend: "Figure 7: a. Structural map of the Wenchuan earthquake epicentral area (after Robert, 2011) overlaid with the Rprest map. b. Snapshot of the landslide map in a portion of the Wenchuan shear zone. Its location is reported in Fig. 7a. Polygons with red contours represent the co-seismic landslides mapped by Xu et al., 2014. The yellow and blue lines delimit zones of crest- and toe- clustering respectively. c. Cross sections of different structural units after Robert 2011. Cross sections I-J and K-L are presented in Fig. S13. GF: Guanxian fault, BF Beichuan fault, WF Wenchuan fault, Y-B F Yinxiu-Beichuan fault, QF Qinling fault."

R2 : Supplementary Materials: Text has many typos, misspellings.

Corrected

Please also note the supplement to this comment:

<https://www.earth-surf-dynam-discuss.net/esurf-2018-82/esurf-2018-82-AC2-supplement.pdf>

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Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2018-82>, 2018.

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