Response to Reviewers of the manuscript

"Global detection of rainfall triggered landslide clusters"

by Benz and Blum, submitted to *Natural Hazards and Earth System Sciences.*

Manuscript Number: nhess-2018-391

Revision due before: 29 May 2019

Reviewer #1 comments:

Comment I:
The submitted paper deals with the identification of clusters in the Global Landslide Catalogue (GLC) in relation to individual rainfall events extracted from CHIRPS precipitation data. It is therefore also related to the investigation of biasing effects in small-scale (global) landslide catalogues that are not compiled through landslides inventorying but rather based on media or governmental reports. In this respect, the paper is timely, interesting and well suited to NHESS. The presentation is clearly structured and the language of the article is fluent, the Figures are of good quality. The clustering algorithm proposed by the authors to relate reported landslides to individual rainfall events is interesting and may be worth to be published. However, the validity of the constraints of the clustering algorithm is not discussed in detail by the authors. In this respect, a sensitivity analysis is missing in such that different time span thresholds in precipitation may be tested in order to investigate the behavior of the identified clusters. Also, the effect of different values for the spearman coefficient to discriminate clusters may be investigated.

Reply: Thank you very much for the kind words and constructive comments.
We agree and therefore included a sensitivity analysis, which investigates the different time span thresholds in precipitation and the effects of different spearman coefficients. The following discussion is now added:

"The threshold value of the spearman correlation coefficient was determined by testing the robustness of the identified clusters for different threshold values between zero and one (Fig. S2). Our results indicate that mean duration, area, and number of landslides per cluster are comparably robust to changes of the spearman correlation coefficient. In contrast maximum duration, area and number of landslides per cluster change drastically for different threshold values. From a correlation coefficient threshold of 0.35 to 0.7, maximum number of landslide events per cluster decreases from close to 500 to slightly above 100, maximum duration decreases from more than 80 days to approximately 25, and area decreases from 60,000,000 km² (approximately 1/3 of the planet's surface area) to 200,000 km². For threshold values greater 0.7, only minor changes are observed. Hence, the latter was set as the correlation threshold value for this study (Fig. S2).

Additionally, we tested the robustness of the method to the time period of precipitation for which the correlation coefficient was determined (Fig. S3). It appears that the number of days is much less influential than the set correlation coefficient threshold (Fig. S2). Again, maximum number of landslides, area, and duration are impacted most, however remain stable for time period longer than 30 days prior to the second event."

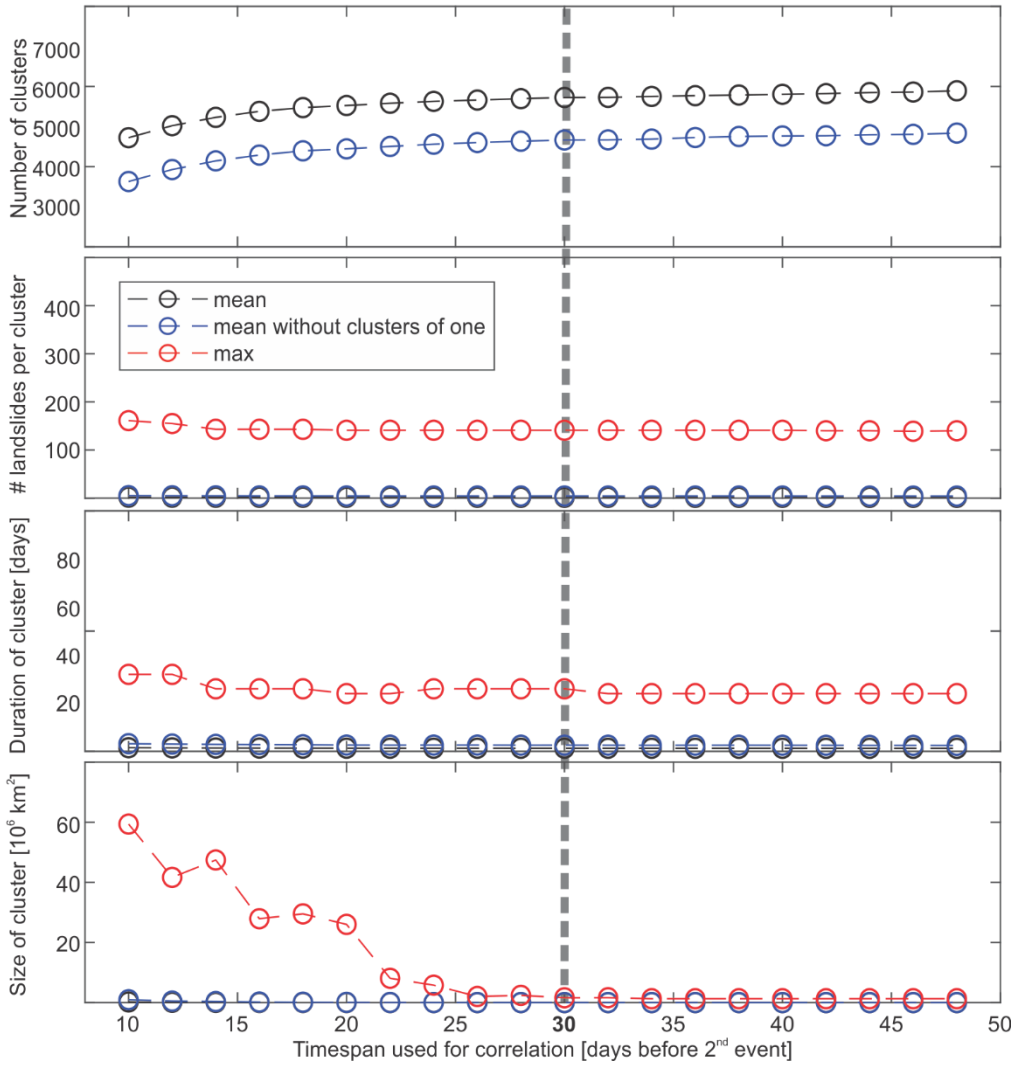

Figure S3. *Impact of the chosen threshold for the timespan for which the spearman correlation coefficient is determined on the total number of clusters in the global landslide catalog, on the average number of landslides per cluster, on the average duration of landslide clusters, and on the average area of landslide clusters. The correlation coefficient threshold was set to 0.7 for this analysis. In this study a threshold of 30 days was chosen, as from this point onwards number of clusters, maximums size of, duration of and landslides per cluster, becomes stable.*

Comment II:

Another issue is that the only constraint applied for landslide clustering is precipitation. Environmental information like e.g. climatic setting, subsoil lithology or relief parameters are

not introduced into the clustering algorithm and the effect of introducing those is not investigated or discussed.

Reply: Correct, the introduced algorithm focus solely on rainfall, detecting clusters of landslides triggered by the same rainfall event. While different lithology and relief parameters impact the rainfall intensity-duration threshold, two landslide events located in different areas with different thresholds might still be triggered by the same rainfall event. We therefore decided to not include any of these parameters in the algorithm. However, an additional sentence was added to the chapter describing the algorithm that discusses this issue:

"*The introduced algorithm is independent of subsoil topography and relief parameters. While these impact the precipitation intensity-duration threshold that is commonly expected to trigger landslides, locations with different thresholds might still experience landslides triggered by the same rainfall event.*"