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Interactive comment on "A new approach to mapping landslide hazards: a probabilistic integration of empirical and process-based models in the North Cascades of Washington, U.S.A." *by* Ronda Strauch et al.

Anonymous Referee #2

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The paper aimed to develop and test a methodology for the assessment of landslides hazard, which combines the probability of occurrence calculated through a data-driven approach and physically-based probabilistic model. The proposed approach is particularly innovative and interesting, compared with the typical approaches used for the assessment of landslides hazard. Instead, several parts of the work need to be clarified in the manuscript, in order to improve the overall quality and comprehension of the proposed approach and of the achievede results.

Proposed revisions follow:

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1) The term "process-based method" should be changed in the more correct "physically-based model" to define deterministic methods of assessment of slope stability. This correction has to be inserted throughtout all the paper. 2) Several examples of both data-driven techniques and physically-based models, and related references, could be add in the Introduction section. 3) I disagree with the choice of the Authors of considering the entire landslides bodies, both triggering and accumulation zones, as predictor variable of the data-driven method. Landslides runout and accumulation zone are related to other predisposing factors than the ones influencing the the landslides triggering. Instead, I know that the approach of using the entire landslide body in a data-driven approach is very common in the literature. Thus, I suggest to add the reasons why the Authors have chosen this approach and to discuss about the potential limits of this choice. 4) It is necessary to describe the main features and the main outputs of the Landlab model considered for the implementation of the physically-based approach. In particolar, how the rainfall features are inserted and considered by this model? 5) A more detailed description of the bedrock geological features and on the main properties of the soil type are required in the presentation of the study area. 6) Considering in the same inventory rockfalls/toppe and debris flows/avalanches is not really correct. These phenomena are characterized by different kinematic behaviors their predisposing factors can be different. Even if the combined probability model between data-driven and physically-based approaches have been obtained only taking into account for the source areas of dbris flows/avalanches, I advise to add an explanation of why you consider different typologies of landslides in the same inventory of your study area. 7) For a further validation of the data-driven model, it could be useful calculating a statistical index such as the Area Under ROC Curve or the values of False Positives/True Positives. This would strengthen the reliability of the proposed model. 8) It could be useful presenting also the results of the application of the physically-based probabilistic model implemented in the study area and its validation. 9) Why did the Authors choose those ranges of probability to consider a slope as relatively stable (< 0.1) or highly unstable (> 0.9). Several Authors identified other ranges for the clas-

sification of the probability distribution. Please, discuss about this aspect. 10) It is necessary adding a section where the Authors will discuss about the main advantages and the limitations of their proposed approach, in particolar compared with the typical methodologies used for the assessment of landslides susceptibility or hazard.

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