

## ***Interactive comment on “Geologic and geomorphic controls on rockfall hazard: how well do past rockfalls predict future distributions?” by Josh Borella et al.***

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Dear NHESS,

We are grateful for the comments made by referee Dr. Alexander Preh (RC2). Below we respond to each of the interactive comments:

(RC2): There is no clear statement on how far and in what form the analyses using numerical model RAMMS can be used for predicting of future events. e.g.: Can the Ramms\_3 model be used to develop a hazard map? How far is Ramms\_3 verified by the models Ramms\_2 and Ramms\_1? Or is the usefulness of the model calculations

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limited to the recognition of the effect of deforestation? The authors should supplement the conclusions in this respect, since chapter 5.8 does not contain any specific statements on model calculations either.

JB et al. Response: The RAMMS models (in particular, RAMMS\_3) have implications for understanding the spatial dimensions of rockfall hazard but are not intended *senso stricto* to be used as rockfall hazard maps without further site-specific investigations. The primary objective of RAMMS\_3 is to show the increased spatial extent (including maximum runout distance) of rockfalls that could result from more widespread source rock detachment (in Purau) under bare-earth (deforested) hillslope conditions. The model does, however, provide a preliminary indicator of low-lying areas (in Purau) that are most susceptible to rockfall hazard and could be used effectively as a means to identify areas that require more in-depth rockfall hazard analyses (which would include an assessment of source rock vulnerability). We recommend that any future rockfall studies using rockfall numerical modeling consider the implementation of boulder morphologies, terrain parameters, and hillslope vegetation attributes developed in this study. We have made additions to the Discussion (Section 5.6.3, lines 817-822) and the Conclusions (Section 6.0, lines 976-981) to address the referee's comments. The additions are presented within the attached revised manuscript and also below:

Discussion (5.6.3) –

‘RAMMS\_3 highlights the increased spatial extent (including maximum runout distance) of future rockfalls that could result from more widespread detachment within the Purau source rock, particularly for detachment sites overlying hillslopes where boulder trajectories are not as strongly influenced (i.e. captured) by nearby valleys. Although we caution against using RAMMS\_3 as a rockfall hazard map, the model results do provide a first-order indicator of low-lying areas that are most susceptible to future rockfall hazard and suggest that development at the S1 and S2 sites could be adversely impacted by future rockfall events (Fig. 10C).’

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Conclusions (6.0) –

‘The RAMMS\_3 model effectively shows the potential spatial extent of rockfalls that could result from more widespread detachment within the Purau volcanic source rock and provides a preliminary indicator of low-lying areas most susceptible to future rockfall hazard. More in-depth rockfall hazard analyses (including numerical rockfall modeling) are required at Purau and should consider the implementation of boulder morphologies, terrain parameters, and hillslope vegetation attributes developed in this study.’

(RC2): In Figures 9c and d, the regression lines are hardly recognizable due to the thick data points. Therefore, it is hardly recognizable to what extent CES and pre-CES differ from each other. This should be corrected.

JB et al. Response: Figures 9C and D have now been modified to ensure that the regression lines are clearly shown and the reader is able to compare/contrast the individual regression lines for the CES and pre-CES data sets. In order to ensure the regression lines are clear to the reader, the CES and pre-CES lines have been colored red and blue, respectively. Further, and for the sake of consistency within Figure 9, we have made the same changes to the regression lines displayed on Figure 9B. The revised Figure 9 is included at the end of the submitted revised manuscript (see supplemental PDF).

Special note: RC2 text changes/additions to the manuscript are colored blue to distinguish from those modifications made to address RC1 comments.

Please also note the supplement to this comment:

<https://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2019-178/nhess-2019-178-AC2-supplement.pdf>

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2019-178>, 2019.