Natural Hazards and Earth System Sciences Discussions

Nat. Hazards Earth Syst. Sci. Discuss., author comment AC1
https://doi.org/10.5194/nhess-2022-32-AC1, 2022

Reply on RC1

Luuk Dorren et al.

Author comment on "Delimiting rockfall runout zones using reach probability values simulated with a Monte-Carlo based 3D trajectory model" by Luuk Dorren et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2022-32-AC1, 2022

Thank you for your comments.

Our analysis suggests that the influence of mapping all SW in comparison to only the SW with longer runouts does not have a significant impact on the results. For sites where all SW were mapped, one would expect that the median PreachSW value, as well as the total variation of the values below our 5% threshold would be larger than is we only would have mapped the long runout SW. The statistical analysis did not confirm this since it only revealed a significant difference for the sites Claro and Taesch. Here only Claro is in accordance to the above expectation, whereas Taesch evinces the opposite characteristics. There is no significant difference between all other sites where the four different mapping strategies were used, indicating that the fact that SW resulted from one or multiple rockfall events do not have a significant effect on the results. We will add this explanation to the discussion in the revised version of the paper.

The values for damping (Rn) used in the Rockyfor3D model have been defined since 2004 and originate from the following references: Dorren and Heuvelink, Int. J. G.I.S. Vol. 18(6) 2004, 595–609; Dorren et al., Natural Hazards and Earth System Sciences, 6, 145–153, 2006; and Dorren, L.: Rockyfor3D (v5.2) revealed – Transparent description of the complete 3D rockfall model, ecorisQ paper, p. 33, 2016. We will add these references to the corresponding section in the revised version of the paper.

Hard evidence of smaller blocks deposited on the lower slope sections being fragments of larger blocks is only available at the site of Evolène, where the rockfall event was filmed (see https://youtu.be/SxdaXGgoQW8?t=56) and at Vaujany where we did rockfall experiments. However, at Vaujany, during those experiments we only mapped the remaining large block volumes and not the released fragments. Another nice movie showing this effect, which was unfortunately not one of our study sites, can be seen here: but was https://youtu.be/fi2dMUT8WAo. However, the fact that all deposited blocks categorized as fragments had a significant lower volume compared to the neighbouring SW affirms our assumption. While mapping the SW at certain sites (e.g., Flaesch and Taesch), our impressions in the field strongly oriented us in the direction of that hypothesis.

Your last remark considers which aspects of the results, input parameters or field validation should be evaluated through experience and what can be a process that becomes part of a standard. We would strongly support that rockfall trajectory modelling,

including a probabilistic component with a sufficiently large number of repeated simulations, to ensure a stable "converged" statistical distribution of the reach probabilities, should be a basis of a standard for rockfall hazard assessment. In addition, we would recommend the comparison of the outcomes of different modelling approaches. The collection of the field input data, as well as the delineation of the rockfall hazard zone based on modelling results and field mapped silent witnesses remains an expert task. This study provides a support for the latter process. We will add this precision to the revised version of the paper.