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Interactive comment on "Towards a model for structured mass movements: the OpenLISEM Hazard model 2.0a" *by* Bastian van den Bout et al.

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In light of the two anonymous reviews, please find below our responses to the raised issues. First, we would like to gratefully thank the reviewers for their work in reading and reviewing the manuscript. Please know that all the proposed changes have been made to the manuscript.

In response to anonymous referee #1.

We thank the reviewer for this time in reading the manuscript. We have rewritten a large part of the introduction to clarify the scope and the potential application of this work. Now, the phenomena is first described, using terminology more commonly used within the literature. Afterwards, a short description of existing modelling approaches

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and their shortcomings is provided. Finally, the introduction ends with the objective of the research: development of a new generalized semi-structured mass movement model.

In terms of the nature of the movements, we have clarified that the model implements structured movements (dynamics of a coherent mass), but similarly can (if required, or if the underlying physics indicates it) simulates fragmentation of the material. We have addressed our usage of the term “debris-flow” in our work. Instead we use “mass movement”, as it more accurately reflects the generalized nature of the equations. Similarly to the work of Pudasaini (2012) and George and Iverson (2014) and Aaron and Hungr (2016), generalized sets of equations which are sometimes referred to as “debris flow” equations allow for simulation of a much wider range of phenomena.

The applicability of the model to granular flow is, when cohesive strength is insignificant, at least as good as the generalized two-phase equations from Pudasaini (2012) which is the predominant underpinning of this work. The influence of the additional work on cohesive strength and fragmentation has been developed with general validity in mind. When fragmentation occurs in the model, further runout reduces to the two-phase equations of Pudasaini automatically. However, full validation of the model to runout of various types of cohesive matrices must be further investigated. Finally, all specific comments have been addressed based on the reviewer suggestion.

In response to anonymous referee #2.

We thank the reviewer for this time in reading the manuscript. All the specific comments provided by the reviewer have been addressed in the manuscript. The sections have been re-labeled to be consistent and in line with the comments. Also, we have addressed our usage of the term debris-flow in this work. As with reviewer 1, we agree that mass movement (to be more generic) and specifically rock avalanches and landslide are more closely related to the applicability of this work.

References: Aaron, J., & Hungr, O. (2016). Dynamic simulation of the motion of

partially-coherent landslides. Engineering Geology, 205, 1-11. George, D. L., & Iverson, R. M. (2014). A depth-averaged debris-flow model that includes the effects of evolving dilatancy. II. Numerical predictions and experimental tests. Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences, 470(2170), 20130820. Pudasaini, S. P. (2012). A general twoâĂŘphase debris flow model. Journal of Geophysical Research: Earth Surface, 117(F3).

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