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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.

Anonymous Referee #1

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The proposed paper, even if interesting, is not acceptable in the present form. Main deficiencies are:

1) The introduction is not clear about the scope of the work and its application. The writer means the unstructured and structured flows. The writer suggests to initially describe the phenomena, highlighting the structured and unstructured flows. After that, models usually implemented to simulate such flows can be discussed. At the end of this discussion, the new modeling approach should be introduced. In the last part of the introduction, authors claim the introduction of a model simulating structured flow followed by simulation of the fragmentation, that is an unstructured flow: this aspect is not clear. 2) In Section 1 it is described the dynamics of landslide or rock failure extending this behavior to all the gravitational flows. Indeed, debris flows, even named in

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the section title “set of debris flow equations incorporating internal structure” and being a gravitational flow, are not part of the phenomena described at lines 78-101. Really, most of debris flows are runoff-generated debris flows: large quantities of sediments are entrained into runoff (Coe et al., 2008; Kean et al., 2013; Hurlimann et al., 2014):. In other words, the shear stress exerted by stream flow causes the entrainment of the sediment. Conversely, landslide-induced debris flows (Iverson et al., 1997; Iverson, 1997) are very few. 3) Figure 1: the colors difference between fragmented, free and confined fluid is not clear. 4) After reading all the paper, the writer summarizes that it concerns the behaviour of blocks in a cohesive matrix. Therefore, the model here presented cannot cover all the mass movements. The authors should explicitly write that it concerns only a class of mass movements. The writer has some concern about its applicability to granular flow. A model that simulates the flow of a cohesive matrix around an obstacle was also presented by Greco et al. (2019).

The writer suggests the partial rewriting of the manuscript according to the issues raised above

The following are the detailed comments and errors.

Line 12: main difference between debris-flow and landslide is the fluid content that rules the rheology of the flow

Line 14 “However, models commonly assume unstructured and fragmented flow after initiation of movement.” Unclear sentence for a reader without knowledge on structured and unstructured flow: rewrite it as “Such type of models assumes an unstructured flow: explanation . . ..”

Line 24 “ground-water flow descriptions”???

Lines 55-58 “However, this approach lacks the process of fragmentation and internal failure. Thus, within current mass movement models, there might be improvements available from assuming non-fragmented movement. This would allow for description

of structured mass movement dynamics." Unclear period. Moreover, it is not well linked to previous period at lines 49-54.

Lines 507-508 "On the separation point of the two planes, a massive and attached obstacle is present that blocks the path of two fifth of the moving material. " the expression "a massive and attached obstacle " is not well suited. Perhaps it is better "A massive obstacle is placed on the separation point of the two planes . . .. . ." Moreover, which is the sense of "that blocks the path of two fifth of the moving material". Perhaps this obstacle blocks two fifth of the flow width. Finally, in figure 4 it seems blocking three fifths rather than two fifths.

Line 632. There are also the approaches of Medina et al., 2008; Armanini et al., 2009, Frank et al., 2015, Cuomo et al., 2016 and Gregoretti et al., 2019.

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