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Earth Surface Dynamics Discussions

Interactive comment on "3-D models and structural analysis of analogue rock avalanche deposits: a kinematic analysis of the propagation mechanism" *by* C. Longchamp et al.

Anonymous Referee #1

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Review – Earth Surface Dynamics Discussion 3-D models and structural analysis of analogue rock avalanche deposits: a kinematic analysis of the propagation mechanism Longchamp C., Abellan A., Jaboyedoff M., Manzella I.

Synopsis and General Comments The stated objective of this study was to analyse rock avalanche dynamics through 3-D structural analysis of laboratory granular flows and real-size rock avalanches. Application of the same digital analysis tool to lab and field deposits is viewed a positive outcome of this research. However, a couple of critical points need to be considered and addressed for this manuscript to be published in a final form: 1. Equifinality of structural features is a problem. The occurrence of the

same structural features in both, friction-controlled laboratory-scale granular flows and highly mobile, dynamically fragmenting rock avalanches simply implies some fundamental and intrinsic behaviour of all granular masses in motion. It does not, however, elucidate the long-runout characteristic of large rock avalanches, and thus limits the extrapolation of dynamic processes from the lab to the field significantly. I would therefore suggest that the authors emphasize that deformations not dynamics are investigated through their methods. 2. No scaling calculations were applied, which is a prerequisite if dynamics are to be compared to phenomena of different scales. This could have furthermore, a priori, solved the problem of grain sizes being too large to capture the deformation features (the scale of which is known from previous experiments of this kind, which should be cited more comprehensively). 3. How do the authors explain that mixing between stratigraphic units is observed in the laboratory but not in the field? 4. The authors should clearly state how (if) their analogue models differ from the many done before and how (if) their analysis technique adds new merit or better insights or easier/cheaper/faster application or more detailed results. a. How does their technique differ from other analyses tools of surface roughness etc.? b. Is the code freely available? c. Who has done such experiments before (in addition to the few papers cited) and how do their results compare? I cannot stress enough that analogue models of this kind are valuable conceptual models for structural comparisons and for the study of processes and sequences of feature formation; however, they do lack important dynamics of real-size rock avalanches. Therefore, in my opinion, the paper lacks comprehensive discussion of the limitations of these types of experiments.

Specific Comments p. 1256, l. 11 Specify "certain amount" p. 1258 Please add more references to previous papers where those general observations of structural features were made. p. 1260 Emphasize that the substrata are inerodible and non-deformable. p. 1261, l. 12 Wordy sentence. Use of word "redundant"? p. 1265, l. 11 How has our "understanding of the dynamics and the reasons of the high mobility of rock avalanches" improved? p. 1266, l. 5 Are these the same as for the Frank Slide? p. 1268, l. 6-7 Wordy, unclear sentence. p. 1268, l. 23 Add additional references

to the observation of preserved stratigraphy. p. 1268, l. 26 What insights into “the dynamics of real rock avalanches” could this give? p. 1268, l. 28 Please be careful not to propose something (giving the reader the impression that this is new) which has already been proposed before (Shea and van Wyk de Vries 2008 in Figure 13)! Thus please rephrase to, e.g. “we agree with...” or “our results concur with...” p. 1269 Repetition of p. 1266-67. Could be replaced by an annotated cartoon? p. 1270, point 2 Yes, but in the lab experiments mixing was observed between the units which is not observed in real-size rock avalanches.

The reviewer is torn. I like that the authors have applied the same analysis technique to laboratory granular flow and to real-size rock avalanche deposits. However, the major points of critique are that (1) rock avalanche dynamics cannot be directly inferred from granular flows as the authors like to allude to, but rather their deformation processes may be compared, (2) not much new is added to previously proposed deformation sequences of laboratory granular flows, (3) not enough references to previous observations and studies are included, and (4) the applied methods should be discussed more critically in terms of their limitations (see e.g. point (1)).

Interactive comment on Earth Surf. Dynam. Discuss., 3, 1255, 2015.