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Earth Surface Dynamics Discussions

Interactive comment on "Tree-roots control of shallow landslides" *by* Denis Cohen and Massimiliano Schwarz

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Thank you very much for your constructive and helpful review. Below are responses to comments and how we have modified/improved our manuscript.

Hydrologic component missing. This is somewhat in contradiction with a comment from reviewer 1 who thought the model description was too detailed. We have kept the description of the model and its hydrological component as is.

more clearly defining range of problems applicable. Our model is applicable to any slope with roots and soil, more specifically tree roots (roots from grass can also be modeled with SOSlope but their importance to the overall slope stability issue is less). This is now stated throughout the paper.

how results improve our understanding of root control on shallow landslides Most of our results could simply not be obtained with a standard apparent cohesion approach. The approach does not consider lateral forces (whether from soil or root) that are key to understanding the triggering of shallow landslides on vegetated slopes. We show ample evidence, by showing specific and general examples using our model, of the difference in results we obtain when root forces are taken into account vs the standard apparent cohesion slope stability models. Illustrations and discussion are found in the abstract, introduction, main text, and conclusions.

why the proposed model is more useful than a model that employs single value for apparent coh The results obtained with our model cannot be obtained without an apparent cohesion approach. Sometimes results are counterintuitive (see examples now cited in conclusions and also discussed in main text). A direct comparison with an apparent cohesion model was not the objective of this paper but could be done as part of future work on a specific site, for example.

Abstract condensed. Done

Intro p. 2 L. 18, Ref. for time scale. Added

Intro p. 3 L. 25-27, Time scale of 100,000+ yr. Could not find reference with such long time scale.

Intro p. 3 L. 21-27, Time scale of 100,000+ yr. We think it is important to mention the main influence of vegetation on hydrologic and geomorphic systems in the context of slope stability. Text kept but format changed (list removed).

Section 1. We have now separated the original Section 1 into an "Introduction" and a "Background and motivation". The introduction is focused on the importance of vegetation for landslides. The background and motivation section is a general

discussion of the geomorphic importance of shallow landslide, a discussion we could not find elsewhere and that motivates our work and work on landslides in general.

Page 4. List removed. Now in traditional text format.

Page 4. L. 23. Need reference. Reference added.

Page 6. L. 18. Need reference. Reference added.

Page 6. L. 26. Rephrased to indicate to what forces this applies.

Page 7. L. 7-9. Vertical variation in root density. Considering that no roots are present at the considered soil depth in the presented simulations, basal root reinforcement was assumed to be zero. However, our plan is to implement the effects of vertical distribution of root reinforcement in future versions of the model.

Page 21 L. 1-9. Define loading term. Now defined at first mention of word.

Page 23 L. 31-34. We agree with the reviewer that initial soil movement can have a large effect on soil porosity and pore water pressure, but this is well beyond the scope of this work. Our focus is on roots first. Such effects could be dealt with in a subsequent version of the model, dedicated more to soil hydrology.

Page 25 L. 1-7. Again this is out of the scope of the paper. Our simple conceptual hydrologic model is used here only to reproduce a typical behavior of water content and pore pressure up to failure as showed in Lehmann et al. (2013). This is discussed in detailed in what is now section 3.5.

Page 27 L. 24. Specify loading term. Done

Fig. 5a. Modified. Grid removed.

References

- Lehmann, P., and D. Or (2012), Hydromechanical triggering of landslides: From progressive local failures to mass release, Water Resour. Res., 48, W03535, doi:10.1029/2011WR010947.

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