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Hydrology and Earth System Sciences
Discussions

# *Interactive comment on* "Modeling root reinforcement using root-failure Weibull survival function" *by* M. Schwarz et al.

**Anonymous Referee #2**

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This paper presents a variation of the fibre bundle model the authors have developed in previous papers. Their approach is original and physically based, something that is continued in this paper. The current paper looks to simplify the modelling approach through the use of a Weibull survival function, something that seems to work very well for the examples provided. This approach is useful, but I think the paper could use some clarification of some of the important concepts in the final version.

The main feature of figures 3 through 6 is the comparison of data with different survival functions. It seems to me that the "best fit" lines do not do a very good job of explaining the trend in displacement as a function of survival in these data. Certainly they fit well for low displacements, but not very well in the higher displacements. If my interpretation of this is correct then the model would predict lower root survival for roots with higher



displacements. Would this then mean that the model underpredicts the contribution of the larger roots (those with higher displacements)? Given this, it was not obvious to me how you went from figures 2 and 3 to figure 4. It seems that using a bundle of fine roots may aid the success of the model. Maybe I am misinterpreting something, but even if I am it would be good to see this section made more explicit and detailed to reflect these potential areas of confusion. Some possible improvements include. How is the line a best fit, did you do statistics on it? Better explanation of survival (I assume this means the proportion of unbroken roots in a bundle), but again this is not explicit. The survival function exponent of 2 seems to work for the one data set you present but does it work for others?

My second general comment regards the potential future applications of the model. The authors note that there are relatively few estimates of root lengths and Youngs modulus. It would be nice to see a short discussion of how these parameters could be estimated for different vegetation types.

The discussion is useful as it covers a wide range of topics. However I think it could use some organisation. It seems to me that there a number of subsections that could be used. 1. The comparison of the model to real data. 2. The comparison of the model to other FBMs and the Wu data. 3. Sources of error in the modelling and the data used to calibrate the model. 4. (This currently is not part of the manuscript but would be a useful addition) implications for estimating root reinforcement for a slope.

Finally there are a large number of spelling mistakes and grammatical errors. The paper needs to be thoroughly edited before final submission. I have tried to pick out a few examples but it is not an exclusive list

Specific comments:

P3844 l4: dynamics not dynamic P3844 l7: aspects not aspect P3845 l6 (and throughout): the pollen and Simon paper is misreferenced throughout. As is the Waldron paper. Please check all references P3847 l2: phi isn't defined P3847 l6: it would be

good to define these parameters somewhere. I realise they are in other papers, but it would be useful to see their range in this context. Also I assume there is a sensitivity analysis exploring how variations in the range of these parameters affect your results P3847 l11: the sentence starting "a way..." Is awkward, I suggest rewording P3848 l5: Xc isn't shown in your equation P3848 l12: survive as a function is a new term to me as related to root reinforcement. It might be worth defining what it means P3848 l16: w should be replaced with omega P3848 l18: also a little confused by what you meant with "fitted maximum displacement at failure" P3849 l6: is measured maximum force the force at which a root failed? P3850 l1: it seems like there are a lot of different methods here, are there likely to be any differences in strength associated with methodological differences? Zhang et al 2012 suggest that there may be, you mention it in your discussion it may be worth adding a little moe here as well. P3851 l12: you do a nice job of describing the individual root result, but the link between that and the fibre bundle model is not well discussed. Section 3.2 needs to be longer to explain how you derived your best fit, and discuss why the model only fits the small values P3851 l20: not sure what tensile solicitations mean P3852 l18: not sure what is meant in sentence starting "variability..." P3853 l19: another awkward sentence that could use rewording. Fig 1 grey dots a little hard to see Fig 5 orange line hard to see Figure caption 7 ratio not ration

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 3843, 2013.