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Hydrology and Earth System Sciences Discussions

Interactive comment on "Mechanisms of vegetation uprooting by flow in alluvial non-cohesive sediment" *by* K. Edmaier et al.

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We thank this Reviewer for his/her very positive comments and constructive suggestions, which have all been taken into account in the revised version as hereafter explained. Please find the authors' responses in bold.

General Comments

I strongly support this paper by Edmaier, Burlando and Perona, which makes an original and useful contribution to understanding vegetation uprooting. As the authors acknowledge, mortality of young riparian vegetation is high and is intrinsically linked to the flow regime; despite this, the mechanisms for uprooting vegetation are not well understood. The authors make important conceptual and experimental advances this area,

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which furthers understanding of vegetation-hydrology-geomorphology interactions and will provide a useful framework for further research.

Specific Comments
The paper includes a comprehensive and multidisciplinary literature review, which provides a useful background for later conceptual discussions. The active role of vegetation is briefly acknowledged, but there are a number of studies which the authors may also wish to include in the discussion, as they demonstrate the anchoring effects of root biomass and its importance in sediment stability at the landform-scale, which would support the argument well (e.g. Tooth and Nanson, 2000; Gurnell et al. 2001).

We found the two references suggested by the Reviewer very pertinent to the content of this paper and therefore we have included both of them within Section 2.5 "River morphodynamics and vegetation interactions" which treats the active role of vegetation for sediment stability and local river morphology.

The concepts in the paper are well presented and very interesting. The paper identifies two types of vegetation uprooting and considers their relative roles in relation to time and flow magnitude. This is an important distinction which forms a useful conceptual basis for further work; for example, this typology may relevant for understanding the relative establishment, growth and survival of sexual (likely to be subject to Type 1 uprooting) and asexual (Type 2) propagules in riparian zones. These concepts are well supported from preliminary findings from flume experimental work, which shows much potential for further investigative work.

Technical Corrections
The figures illustrate the concepts well and complement the text. However, some of these require more descriptive captions and need further explanation in the text; for example, not all arrows in Figures 1 2 are explained

Better explanation of the arrows in Figure 1:
We agree with this observation. The meaning of the red arrows in Figure 1 has

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been emphasized by modifying the formulation on page 1374, line 5 to: "by considering red arrows to highlight the processes that are mostly relevant for erosion dynamics of riparian pioneer vegetation in non cohesive sediment as investigated in this work."

Better explanation of the arrows in Figure 2:
In order to clarify the meaning of the arrows in Figure 2, colors have been modified: orange for root anchoring forces and red for root erosion favoring forces which will was indicated in the text. To additionally clarify the meaning of the arrows "The big filled arrows represent the total resulting force favoring erosion and anchoring respectively." will be added on page 1374, line 17.

and the parameters in Figure 4 need further description.

In the caption of Figure 4 a description of the plots and the axis as well as the different curves was included.
Caption, Figure 4: "Conceptual model of Type II root erosion. Subpanels (a) to (c) illustrate the gradual decrease of anchoring by local erosion until uprooting; (d) describes the interaction of flow magnitude (wall shear stress τ_B) and flow duration (T) in order to uproot vegetation of a certain maturity (curves A – C, A representing the least, C the most mature vegetation)."
Additionally, a red rectangle was added in order to better illustrate how erosion occurs at a higher flow magnitude after shorter flood duration.

In order to better describe Figure 4 within the text, the following modifications have been made:
- Page 1378, line 8: "The temporal trend of such forces proceeds until anchoring equates the forces favoring erosion and uprooting is determined"
- Page 1378, line 11: "maturity stage (curves A – C, A representing the least, C the most mature vegetation)."
- Page 1378, line 23: "effective anchoring of a root structure C to..."

- Page 1378, line 29: “TB* or TA* (orange dots)”
- Page 1379, line 1: “That is, uprooting might occur at either the same flow magnitude as for the green dot but for longer flow duration (red dot) or at a higher flow magnitude for the same duration (red rectangle).

Figure 5 and 6 are fine, but could be omitted if space is an issue in the final paper The paper is generally well written and clearly presents the argument. There are some minor English corrections, which the authors may wish to address in the final version: -Page 1369, line 28: comma needed between environments and nutrients -Page 1370, line 9: “one” should be deleted -Page 1375, line 4: “an” should be deleted -Page 1382, line 1: seed germination rather than “seedsgermination” -Page 1382, line 13: space between “identifyingtwo” -Page 1382, line 22: “The role of Type 1 of erosion” – delete “of” -Page 1382, line 23: “worth of testing” delete “of”

The English has now been corrected by including this Reviewer comments.

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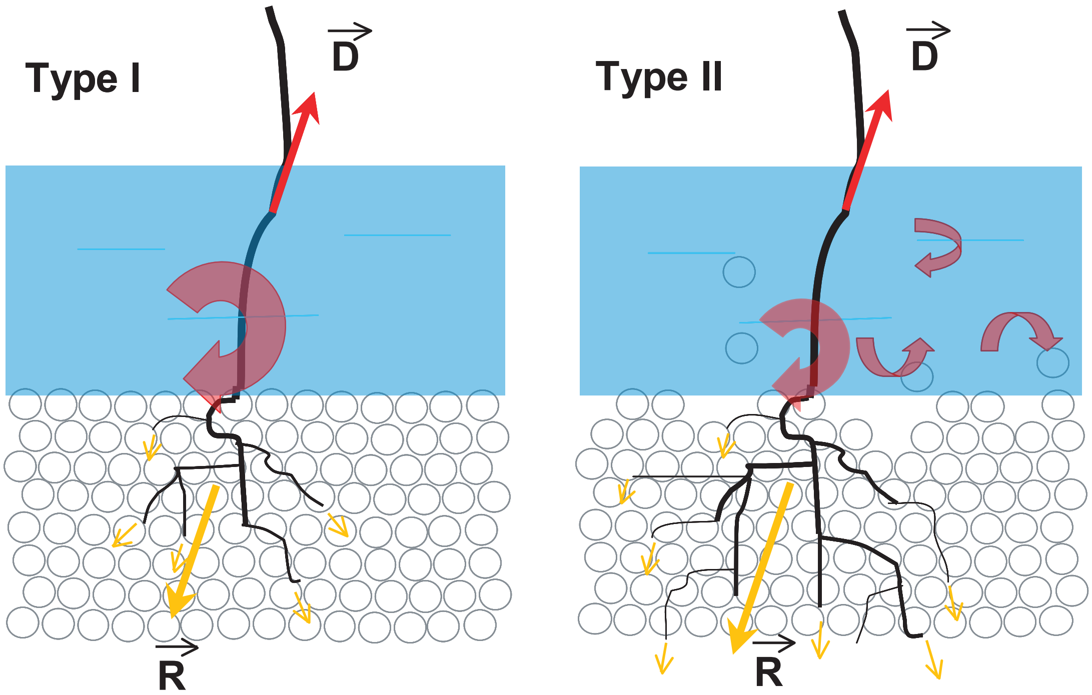

Fig. 1.

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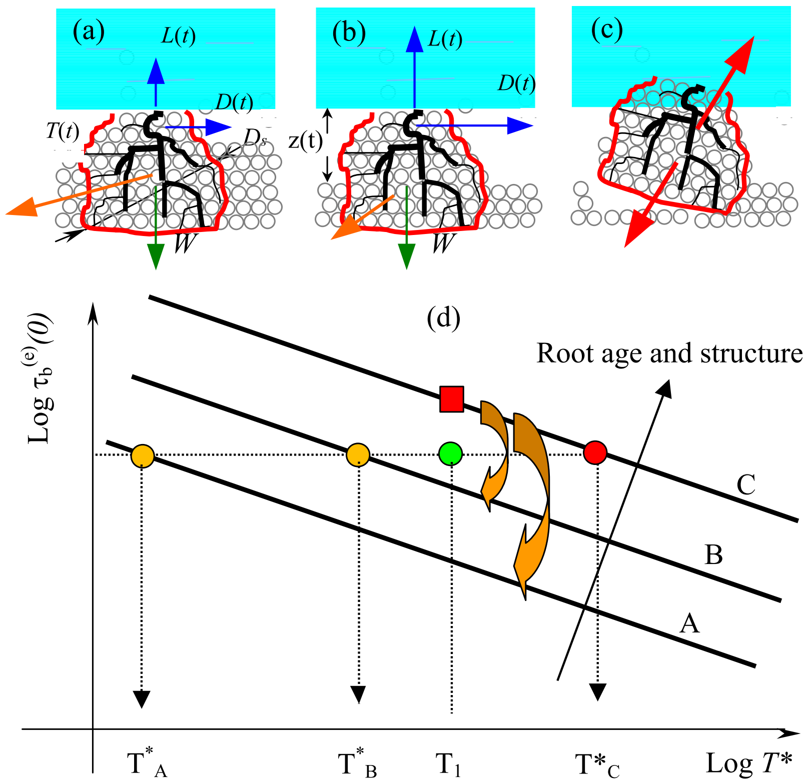

Fig. 2.

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