Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2019-23-AC3, 2019

Earth Surface Dynamics Discussions

Interactive comment on "Stabilising Large Grains in Aggrading Steep Channels" *by* William H. Booker and Brett C. Eaton

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Received and published: 17 July 2019

The general discussion points from Reviewer 3 are presented below. The comments provided by the reviewer were helpful in the improvements we will make to this paper's clarity and organisation, and we would like to thank them for their time and effort. In addition, specific comments are presented afterwards.

General Comments

Reviewer: 1. The Discussion section is outsized relative to the Intro, Methods, and Results. It feels quite speculative in light of the sparse data presented in the Figures

and Tables. Specific notes provided below. The discussion of grain size sorting, armoring, and partial mobility ought to be supported by data on the bed surface grain size in the experiment, but none were presented. Is it possible that the coarsest grains were preferentially deposited along the upstream end of the experimental channel? Was the grain size distribution of the outflow material the same as the feed? These data seem to be essential information if the authors plan to provide a detailed discussion of the impact of the coarsest grains on armoring, size selective transport, etc. The discussion of bar forms is interesting, though it is unsupported by the results, as currently presented. A set of images, a few simple calculations (e.g. sinuosity), would go a long way.

Author: We agree that the relative sizes of the sections needs addressing, therefore we will restructure the introduction with material from the discussion (as also recommended by other reviewers) to more logically and evenly distribute the information. Furthermore, photos will be added into the results section to bolster the evidence provided for our arguments in the paper, rather than present in the supplemental information provided alongside the paper.

Reviewer: 2. In the final paragraph of the Discussion the authors summarize their findings as "3 lines of evidence for GSD2 as less stable": a. Lower slopes (very effectively demonstrated), prograde more quickly (I don't see this demonstrated anywhere, though it seems that the authors have the water surface profiles extracted with which to easily create plots to demonstrate this). b. Grains were more equally mobile due to a lower maximum threshold stress. (I don't see threshold stress quantified anywhere here, and it seems to me that any discussion of equal mobility should be supported by some sort of grain size data). c. Fewer, and less persistent bedforms (I don't see this demonstrated anywhere, though it seems that the imagery the authors collected should allow them to demonstrate this in a figure without too much trouble).

Author: We agree that the current presentation of data in the article leaves a large degree of speculation in the discussion section, aligning with comments of the other

reviewers. Currently the supporting evidence lies in the supplementary material, or not alongside the paper. To address this, we will include more data in the body of the paper in order to support these statements (for a) and c)). The role of shear stress has also been brought up by other reviewers, and we will include more calculations in order to support the statements made (e.g., Alain Recking's transport model from 2013).

Reviewer: 3. The authors should thoroughly proof-read their re-submission. The language was unnecessarily complicated in many places in the manuscript. For example: "raw values for which are shown in. . ."; "The difference varying alongside discharge. . ."; ". . .the superposition of change upon a pre-existing mass. . ."

Author: This is very useful suggestion in order to clarify the message that this paper attempts to convey, and we will make sure to simplify the sentence structure where necessary.

Specific Comments

Specific comments were also provided, and we address those of a non-technical nature here.

Reviewer: Page 1 Line 26) I'm not convinced that armor formation is inherently degradational. Couldn't an armor form through selective deposition of only the coarsest grains from the supply GSD?

Author: We will correct this statement to represent static armour in the classical degrdational sense, but mention mobile armour as separate given that it does form under feed scenarios and represents a more organisational and flow dependent structure.

Reviewer: Page 2 Presentation of Lane balance) This feels like a bit of a straw man, especially given the great set of papers that have come out of Eaton's lab recently. I wonder if a stronger introduction for this manuscript could focus more thoughtfully on

the existing questions about the role of the largest grains, and how the impact of the largest grains has the potential to be very different in aggradational systems (this paper) when compared to degradational systems (e.g. the Mackenzie and Eaton papers).

Author: This comment aligns with the views of the other reviewers and is greatly useful as feedback. We will use Lane as an introduction to Church (2006) and the importance of large grains as the guiding principles for our work, instead. We will also endeavour to make clearer the potential role in aggrading systems.

Reviewer: Line 14) This reviewer has not thought about transport efficiency in this framework, and would have benefited from a bit more context. Transport efficiency is η (eta), yes? What are the units? How should I think about it?

Author: We will add more detail to our definition of transport efficiency, as well as clarity in the organisation of the paragraph.

Reviewer: Page 5 Line 5) Is "relative sediment storage efficiency" the same as "transport efficiency"? (General Methods) When did the experiments end? How long were the runs?

Author: Relative sediment storage efficiency is the proportion of sediment stored, whereas the data presented was in fact the amount transported. We will update both the text and accompanying table in order to remove this confusion. We will also add more information about the conduct of the experiments to methods section.

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