Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2019-23-RC3, 2019

Earth Surface Dynamics Discussions
Open Access
EGU

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

Anonymous Referee #3

Received and published: 1 July 2019

The authors conduct a set of experiments to explore how the largest grains influence the form and evolution of an aggradational channel. They conclude that the largest grains exert substantial influence, with larger coarse grains resulting in deposits of higher longitudinal slope. I think this is a valuable experiment, and am convinced that this work represents a valuable next step in understanding the importance of the coarsest grains in river channel morphodynamics. However, I found the presentation of the work somewhat lacking. I encourage the authors to do additional data analysis and then re-write the manuscript to support the discussion with more specific results.

MAIN POINTS

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.

Printer-friendly version

Discussion paper

Specific notes provided below.

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).

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. . .”

LINE NOTES

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?

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). 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? Line 24) This hypothesis is quite vague. "Different transport regimes"? I would have assumed that referred to bedload vs suspended... Line 29) "...the superposition of change upon a pre-existing mass..." I'm not sure what the authors mean here.

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?

Page 6

Line 3) Given this description of the slope calculation, I think it would be very helpful to add several panels to Figure 4 depicting the method of slope calculation for early/middle/late stage profile evolution, showing the points of max and min elevation selected and length over which the slope is calculated. Along these lines, is it possible that the slope in the experiment varied along the profile? Is the channel concave? Line 9) I suggest using a statistical test to compare between runs. An ANOVA, perhaps?

Page 7

Line 4) One example of a sentence that could use re-phrasing: "For both grain sizes more material is stored at lower discharges correlating to the steeper angles of the deposits". I think the authors mean "both grain size distributions" and I believe a more meaningful way of describing the relationship between storage and slope would be, "...at lower discharges, resulting in steeper sloped deposits." Line 10) Change to "...increases the transport efficiency of..."

Discussion (General Comments)

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.

FIGURES

Fig 1) What is the scale of the experimental setup? That is a great thing to put on a figure of this sort.

Fig 2) Is it possible that the x axis scales are offset between Figure 2a and 2b? How can 100% of the grains be finer than $\sim$6 mm, yet > 3% of the mass is $\sim$8mm?

Fig 3) This figure would benefit from annotations. I couldn't figure out what the roughness elements were until I watched one of the associated videos. A multi-panel figure would help here: Start of experiment, showing roughness elements, progradation of deposit wedge, etc.

Fig 4) Needs horizontal and vertical scales.

Fig 5) Caption is confusing. What is "normal" relative sediment concentration?

Fig 6) What are (a) and (b)?

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