Reviewed manuscript: Evidence of, and a Proposed Explanation for, Bimodal Transport States in Alluvial Rivers.

Manuscript Authors: Kieran Dunne and Douglas Jerolmack

Journal: Earth Surface Dynamics

Reviewer: Shawn Chartrand

General Comments:

The authors present a new hypothesis that all alluvial rivers tend to a state of near-threshold transport condition for the boundary material that is most difficult to mobilize. The bed material of gravel-bedded rivers conditions the near-threshold bankfull geometry. On the other hand, cohesive deposits located relatively low in the channel banks sets the geometry for sand-bedded rivers, when and where cohesive deposits occur. Figures 5 through 7 of the manuscript suggest that the new hypothesis has merit, and may offer a useful framework to help explain alluvial channel geometry from headwater to distal terminus. I think the paper will make a valuable contribution to literature.

The manuscript has undergone a revision following four earlier reviews. I have read through the previous comments and the responses. In many cases the authors adequately address the most pertinent comments. Some comments were not addressed, and in most cases the authors present a reasonable response, although it is clear that there is some disagreement about particular points. This is to be expected for new and big ideas. As a result, I think the revisions adequately address previous comments.

I have read the paper twice and recommend that the authors take an additional pass at improving the presentation of the material. I found the writing in places challenging to follow, and this unfortunately makes it more difficult to appreciate the novelty of the work. The challenging parts of the paper in terms of writing are focused within the middle part of the Introduction (the newly added paragraphs), and in the presentation of results. Figures are not adequately presented in Sections 3 through 5 and it is left to the reader to understand what the Figures present. Additionally, I found extra unnecessary words in some of the new sentences, a lack of needed legend material for Figure 2, and found Figure 1 hard to appreciate given how it is presently constructed. None of the suggested revisions below are difficult to address, but I encourage the authors to carefully step through the paper and revise the writing to be more clear, use less provocative or distracting terms, and use less parenthetical sentence structure. This style of writing made it difficult for me to follow your train of thought when it was used. To assist the authors I offer suggestions for editorial revisions that may be helpful. If the suggestions misrepresent the science or message, that is a reflection of my misunderstanding only. Please do not be discouraged by my comments. I offer the comments because I think the work is valuable, and wish to see it presented in the best and most comprehendible way, for the benefit of the authors and the field.

Specific/Editorial Comments

Figures:

General comment that it was difficult to quickly determine grain size trends in your Figures related to sandy vs. gravelly beds. Without changing your color mapping, I think it would help readers if you used one symbol type for sandy beds and a different symbol type for gravel beds. The suggestion stems from

the fact that throughout your paper you use the words sandy and gravel, or derivatives of the words, and it sure would help in reviewing the Figures to have these sizes jump out.

Figure 1 – I had a very hard time seeing the cross-stream profile sketched in plane with the top of the figure. It would be much easier to see the profile if you rotated it up, and sketched it above the image from bank to bank. In this configuration it would sit perpendicular to the top plane of the graphic and inspection for the reader would be simple.

Figure 2 – I spent about ten minutes trying to figure out which symbols represent sand size sediments and which represent gravel. I could guess…then when I reached Figure 3 I saw your helpful colorbar for grain size. I suspect this is accidentally omitted from Figure 2? Why begin the panels with W*H; seems more natural to begin with W or H, then present W*H. This links to comments below. Last, is the light blue line a measure of error for the seepage data? If so it is not indicated in the caption.

Figure 3 – Second to last sentence in the caption is missing from other Figures. Either move this note to Figure 2 where it is first of relevance, or include wherever it is relevant.

Figure 4 – Caption calls out one point's color (cyan) but not the other (red). Keep it consistent.

Figure 5 – Panel D: how about color coding the bars to help readers relate to your other plots? Or place a vertical lines in the plot at 10^-3 and 10^-2 to highlight your separation of sand beds vs. gravel beds? The suggestion is focused on making it easier for the readers to link information between plots. You may want to indicate units for the x-axis in the Figure caption.

Figure 6 – This Figure is quite small in the PDF; I am not sure what the published size may be, but as presented it was hard to see the details you discuss. It is a nice presentation of Singer's (2010) data. Last sentence in your caption you use the phrase "far above threshold". Can you quantify or characterize this more precisely (i.e. an order of magnitude…)? As stated it is broad brushed and detracts from your work.

Manuscript:

Sections 3, 4 and 5 –

I read these sections several times and found most of the writing challenging to follow due to structure. There is one case where the authors actually present a Figure, what the axes are and what is plotted. The authors generally begin each section with a few prefatory sentences (or more) which in some cases provide a pre-summary of the results. Then results are presented and the section wrapped up. These three sections would greatly benefit from re-structuring of the writing. I encourage the authors to begin each section with presentation of the relevant Figures. Explaining what is plotted, etc. and then connecting their results with the other details they discuss. As it is presently structured, I interpret these three sections as more of a test of others ideas, rather than a presentation of their results, a test of their ideas, and then how it all fits in with the bigger picture. I realize the authors are avoiding the traditional Results section and that this is okay for previous reviewers and ESurf. So the level of discussion they provide seems justified. However, as written, the main results were a challenge to appreciate, and the lack of methodical review of each Figure detracts from the contribution. As a suggestion, begin Section 3 with " Figure 2 shows…". Then work through the results, weaving in Equation 7 where appropriate. The first sentence of the section is not needed.

Line 13: I read the sentence leading up to the ending a few times. I struggled with the last phrase. Tentative evidence seems tricky as a concept. It is more straightforward to just state that you present a set of results which supports your hypothesis or idea. Which certainly seems to be the case from my read of the paper.

Page 2 –

Line 1: Q_* presents a huge range of parameter space, ranging over 14 orders of magnitude in Figure 2. From the formulation the range depends on how the flow magnitude compares to the D_50 raised to a power 5. For grain sizes from 0.0001 to 0.1 m, the square root of this term ranges in magnitude from approximately 1E-10 to 0.003. This may be more an observation, but it might be helpful to point this out because it is pretty uncommon to see a parameter space of 14 orders of magnitude in the associated literature. I can think of only a few, and they come from the same group as the authors.

Line 12: …"the addition of" is not necessary

Lines 19 – 27: These sentences are long and hard to follow. Edit for clarity. Here are some suggestions.

Line 22: …Suggest: "This line of thinking links with the second branch of regime theory established by Parker (1978a). Parker (1978a) solved…"

Lines 26-27: Suggest: "…rivers that demonstrate that bedload dominated gravel-bedded rivers are slightly offset from a threshold channel…"

Page 3 –

Lines 1 – 15: These sentences are also long and hard to follow. Edit for clarity. Here are some suggestions.

Line 1: I don't understand the first part of the first sentence. Suggest: "The last branch of regime theory suggests that alluvial rivers optimize their geometry to maximize flow resistance and hence minimize the boundary fluid shear stress."

Lines 3 – 7: Break into two sentences.

Line 9: This is a particularly key sentence for your argument, and with respect to comments by Maartin Kleinhans. As written it is hard to understand. Suggest: "This paper highlights the bedload-transport state transition between gravel-bedded river segments explained by Parkers theory, and sand-bedded river segments which do not fit within Parkers theory."

Line 13: "…is the that…" the and that should be reversed.

Lines 16 - 18: Break into two sentences

Line 17: Naïve? This word distracts from your point.

Lines 24 - 29: I have read these sentences several times. Where exactly are these results presented? I reviewed both papers by Metivier et al. and it is not obvious to me how these sentences fit within the Metivier et al. papers. Please clarify.

Page 5 –

Lines 8 – 9: Second part of the first sentence is not needed.

Lines 24 – 26: Item (1) is hard to understand as written.

Page 6 –

Line 12: No indent needed. Is “simplicity” the best word? Seems like you used their values for comparison sake.

Page 7 –

Lines 2 – 4: There are other explanations beside a long timescale. Bed slope locally could adjust more readily (i.e. characterized by a shorter response time scale) than bank position, for example. Since you are plotting point values which reflect a range of length scales, my quick review of your data indicates you have a mix of length representations. I do not dispute the perspective of profile adjustment at the basin or many reach scale over relatively long times; but your data do solely reflect these conditions.

Page 8 –

Line 1: Naively? This word distracts from your point.

Lines 2 – 3: Q_* and W*H are normalized by grain size. I don’t understand your grain size point as a result.

Lines 8 – 9: The first sentence is confusing, and the second does not add much. Consider deleting both.

Line 23: Don’t need conspicuous. The data position in the plot says it all.

Lines 23 – 24: Last sentence not needed. It only distracts from your message.

Line 31: I think you mean to reference Figure 5, not Figure 3.

Page 10 –

Line 1: I don’t know where this result is presented.

Line 15: You discuss results which you do not present. Please show the results or delete the last sentence.

Page 11 –

Lines 15 – 20: Here are examples of how you use parenthetical structure to make many points at the same time. Please break the thoughts up and present the material in a manner that is easier to follow.

Page 12 –

Lines 1 – 5: Where is the material of the last sentence presented? I have no idea, but want to know.

Lines 7 – 22: I struggled with the main point of this paragraph. What is your main message and how does it link to the paragraphs around it? I could not piece it together.

Page 13 –

Line 2: There is less data in the 1-10 mm range to < or >, but does it really represent a paucity of data?

Lines 14 – 16: The last sentence doesn’t really fit in with the paragraph. I think you need to link it better.