Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2017-66-RC1, 2017

Earth Surface Dynamics Discussions

Interactive comment on "Evidence of, and a Proposed Explanation for, Bimodal Transport States in Alluvial Rivers" *by* Kieran B. J. Dunne and Douglas J. Jerolmack

A. Wickert (Referee)

awickert@umn.edu

Received and published: 10 December 2017

Dunne and Jerolmack have provided a concicse and timely review of the literature on the threshold conditions that control river width and sediment transport. They then extend this work into a hypothesis for how sand-bed rivers behave – and I believe their approach to be solidly on the right track to solving this problem. Their analysis of the now-available data sets shows the clear bimodal distribution in river morphology and sediment transport – whether it is a gravel-bed channel at the threshold of motion or a sand-bed channel with cohesive banks. This extension of the classic Parker (1978) analysis to the question of particle-mass-controlled banks to cohesion-controlled banks

Printer-friendly version

Discussion paper

is central to understanding not only the form of alluvial and (more generally) transport-limited rivers, but also their sediment transport rates, dynamics, and time-scales and mechanisms of response to perturbation.

This is the best manuscript that I have reviewed this year, and I reccommend it for publication. The following comments are mostly editorial; a couple ask for further explanation, but the paper remains sound without their being answered.

General:

Use `\citep` instead of `\citet` with extra parentheses

Line-by-line:

p.1,l.17-19: I find Tal and Paola (2007) to be a key reference for meandering vs. braiding when involving vegetaion; perhaps it is just not cited due to the many others here, but I suggest that you read it if you haven't!

Equation 1: Consider splitting onto 3 rows for better readability

p.2,l.1: remove indent

Fig. 1: Why does this schematic have to have different bed and bank material? In particular, your statement that the center of the channel is only slightly in excess of critical Shields stress indicates that it is more likely all gravel that you are trying to illustrate. Do you intend to use this for both the gravel-bed and sand-bed channel examples? If so, just a little bit of clarification/generalization will be needed. (As a graphic, this is an excellent block illustration/generalization of the Parker (1978) line drawing, by the way, and one that I'd like to borrow for lectures.)

p.3,l.1: Parker (1978a) predicted... (no need for "Parker's model")

p.3, l.22-24. Note also that Pfeiffer et al. (2017) demonstrate that gravel-bed rivers are significantly above the threshold of motion in rapidly-uplifting settings. They argue that this is due to armoring, though I have my own ideas about this (as-of-yet unpublished,

and therefore nothing that you'll have to tangle with in a review).

p.3,l.24: remove comma after "slope"

Fig. 2: Show legend in only one panel to not overlap with data

Fig. 3: It looks in the figure like you have one point from seepage channels and one fromm experiments. Therefore, I suggest that you reword "River channels ..." to take into account that this is not quite so plural, and is not tested to be generalizable.

p.8,l5-6: Which site-specific variations are you considering, and how/why are they important?

Fig. 5: This is to me, thus far, the figure of the paper.

p.10,l.19-25: Yes, I completely agree, and have spent some time thinking about this myself.

p.11,l.1-3: Could you discuss other reasons for cohesion? Interlocking grains and capillary forces come to mind. Are these significant compared to the surface charge effects?

p.11,l.3: material; –> material:

p.11,l.31-32: Would you like to discuss some of the reasons for the low frequency of channels with 1-10 mm grain size? In particular, do you think that this may have to do with the crystal size / granule break-down problem, or possibly be connected to the transition between cohesion-dominated banks and particle-weight dominated banks that makes these grains either difficult to move or whisked away in a larger-clast gravel-bed river? This is of course ignoring arguments for equal mobility...

Figure 7: I have a sketch that looks quite a lot like this in my notes: I also think that this is how the system must work, in general, with some of the details hidden in the scatter.

Interactive comment on Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2017-66,

2017.