Earth **Surface**
Dynamics
Discussions

Interactive comment on "A probabilistic framework for the cover effect in bedrock erosion" *by* Jens M. Turowski and Rebecca Hodge

Anonymous Referee #1

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This paper emphasizes the need to think about how cover on a bedrock channel evolves, and I am supportive of that pursuit. I generally like the probabilistic approach of the paper. My review is not as deep as I would like it to be, because I got a bit lost in some of the details of the paper. I also had problems seeing how some of the sections tied together. Because the paper is so heavy in equations, and more importantly symbols, I think more reminders about what different symbols mean could make this a bit easier for the reader to follow. The table of symbols certainly helped. But anything the authors can do to improve the flow would be appreciated.

Line by line comments:

17 alleviated = alluviated?

Equation 3 : When I first read this, I thought "isn't this probability actually a function of

many things? Is there a reason that they only show it as A* and M_s*?" It's clear in the text that many variables are important, but I wondered why they were left out of the equation. Eventually I understood that the reason is because this paper focuses on A* and M_s*. Maybe this can be made clear from the start.

Section 2.1 in general – I know that the authors are not going to change this, but I had a very hard time remembering that A* is the fraction of exposed area, as in my head a cover function goes with fraction of area covered, not exposed. It's not that the authors aren't clear about the meaning, but somehow repeating the definition of A* more would have helped me. For example, I suggest that on all figure axes words accompany symbols, so the meaning of the variable is not mistaken (as I did many times.) I also had a hard time getting used to the meaning of P. In retrospect, after reading line 124 it is clear. However I wonder if this could be emphasized somehow. E.g. State what P is on fig 1A y-axis, or at least restate in the caption. I know repetition is frowned upon in scientific writing, but I need it in this paper.

L 159: I've never seen the word run used like this. Exist instead maybe?

Section 2.2: Again I'm not quite sure that you can do anything about this, but I got confused here because now you are talking about the probability of entrainment, in contrast to above which was the probability of deposition. Maybe just make sure this is clear to readers.

In this model all grains move the same length, right? So where they are deposited is not at all affected by whether or not there are grains in that location, right? This is confusing to me given that in the previous section deposition is probabilistic based on whether there are other grains present. So I had a hard time comparing this model with your framework.

Figure 3: Is this plotting the probability of deposition or entrainment? I think I know the answer, but maybe make this clear.

Equation 13 was hard for me. It seems like a new way to write this, but maybe you can walk me through it. Wouldn't E and D be included in d qs / dx? That is, wouldn't material be deposited if qs decreased downstream and entrained if qs increased downstream. I couldn't much evaluate this model because I didn't understand equation 13.

L 347: I think that this is E*(M*s = 0) = 0, right? If so, maybe state explicitly.

L 417 – 419: I was confused about the comparison because you are not plotting the same thing as earlier plots. That is Q* is not M_s*, as was on the x-axes earlier. Can you help the reader relate these two variables? Q* is also not defined in your notation. Is Q* on the x-axes in figure 4 supposed to be Q*_s with a bar over it? Maybe same for Figure 5 and also in the caption of figure 4?

L 465 Where did 5.7/11.5 come from?

Figure 10A – the x-axis is not formatted correctly.

Sentence starting on L 611: Does this mean that A* = 0 at all times? I guess this gets to a point that I didn't understand in the previous section - when you are talking about the evolution of the mass on the bed through time, this could be under conditions of complete cover the entire time. It might be worth stating this directly. Although I'm not sure that I'm correct about this assumption. In Figure 12, assuming that A on the second from top plot is actually A*, implies that there is not complete cover. I don't think I understood this section very well.

Also in this section, in a single flood event I'm having a hard time understanding what the meaning of p, or the period is. The previous section discussed the period in terms of a sine wave in sediment supply. But is that the case for this flood?

Sentence starting on L 669: This is great. Is this shown explicitly and I didn't catch it? If not, can you spell this out more directly?

L 678: This dynamics cover ... typo I think.

Sentence starting on Line 735 has a typo.

Section 4.3: The comparison with Philips and Jerolmack is a bit confusing to me. You state that in contrast to their findings, your findings suggest that bed cover is adjusted. But you didn't actually have channel morphology as a free variable. So I'm not sure how this study can contrast that one. I don't remember exactly, but I don't think they talked about sediment cover. So is this a fair way to compare the two studies?

I like how your conclusions stated this issue - both cover and channel morphology evolve. This makes sense to me, but the discussion in section 4.3 did not.