

May 11, 2020

We have prepared this response to comments document to help understand the changes we made and to make the re-review easier for @pfeiffa and @tdoane. We would like to express our gratitude for the constructive and helpful reviews we have received from @kbarnhart, @pfeiffa and @tdoane. Your time and energy spent considering our research is much appreciated.

### **Comments of @pfeiffa**

#### **Basic Usage Notebook:**

This is an excellent notebook. It is not verbose, but gives me a great sense for how to use and interpret results of pySBeLT.

Minor suggestion: It would be great to add the default parameters to the “parameters and running” table.

**Response:** We have added the default parameters. Thanks.

#### **Data Storage Notebook:**

Accessing Final Metrics section you’re missing a “.hdf5” at the end of the file name in the 2nd and 3rd to last code blocks. Make sure to restart the kernel and clear all outputs (or run all) in your final submission. The version up on your repo currently shows that you’ve re-run cells several times without restarting.

**Response:** We have completed the suggestion.

#### **Manuscript:**

Ln 12: I’d suggest editing to “... a function of local water flow conditions and the grain size distribution of the bed material.”

**Response:** We have completed the suggestion verbatim.

Ln 12-14: The sentence that starts “A predictive approach...” seems like your opportunity to succinctly state the gap pySBeLT is trying to fill. But, as written, it feels a bit muddled (“the approach introduces challenges”). Do you mean something like “This standard approach to modeling bedload transport obscures(? Neglects?) the mechanistic reality of sediment transport: the bed material flux is the integrated transport of individual stochastic particle motions.”

**Response:** Thanks for pointing out that the sentence was a bit challenging to understand. We have modified the sentence for clarity. However, we have not emphasized a gap that the model addresses. Whereas we believe the model can help address the knowledge gap of framing transport as a stochastic process, we also believe that this will ultimately be determined by work we are conducting now and will submit for publication soon, as well as use by the community as a tool to examine transport as a stochastic phenomenon. We hope this reasoning makes sense.

Ln 17: Instead of “examine connections”, how about “reveal the relationship” or “illustrate the relationship” (the user will be the one examining, the tool will make the examination possible)?

**Response:** We have modified this sentence for clarity and with respect to the comment.

Ln 38: “motivated by a...” suggests that your work was motivated by some specific earlier published work. If so, cite. Or maybe “pySBeLT takes a birth-death..... approach to modeling bedload transport”.

**Response:** Thanks. We have added the appropriate citations.

Ln 46: set\_diam should have quotes around it, right? ‘set\_diam’

**Response:** Done.

Ln 51-54: I think these last two sentences should be combined or re-ordered.

**Response:** We have revised the two sentences for clarity, and expanded them into three sentences in the process.

Figure 1. Add a flow direction arrow.

**Response:** Done.

Figure 2. The lower panel is too small to read. Add the units of particle flux to the y axis of the upper plot.

**Response:** We have implemented the suggestions and for the lower panel have increased the font size of the labelling text.

Fix citation issues:

? in Wainwright 2014 and Wu 2019

Some first names or initials included in the in-text citations.

**Response:** All citations issues have been corrected.

## **THEORY.md**

Entrainment section, second paragraph has some odd number typos interspersed in the text. Take a look.

[@kbarnhart](#) should this section be a part of the paper? It seems to me that it describes both the rationale and function of the model, so maybe? Or is it better to keep separate?

**Response:** Thanks for catching that – we have corrected these issues. We have also followed [@kbarnhart's](#) guidance to have this information be stand alone in a THEORY.md source.

## **Comments of @tdoane**

Here's my relatively minor comments. I have not used GitHub much in a collaborative way, so please let me know if I should post these differently!

Paper:

Why pySBeLt? It is an acronym?

**Response:** Yes, just an acronym.

Statement of need, 1st paragraph: roughly twice the shear stress threshold for motion? I assume?

**Response:** Correct. We have added this additional detail to the text so it is more clear

Statement of need, 5th paragraph: For the periodic boundary condition: If a particle passes the lower boundary, it is placed at the upstream boundary, but does not continue with the motion that passed it over the downstream boundary, right? So the travel distance that sends it over the boundary is not recorded except that it exceeds a certain distance?

**Response:** Correct (but we do track the selected travel distance). We have edited these sentences so it is clear that once particles return to the upstream boundary, their subsequent motions are the result of newly sampled travel distances.

Statement of need: What is the significance of the length of the flume to the distribution of particle travel distances. Given the quasi periodic boundary conditions, this might warrant a brief discussion.

**Response:** At this point in our testing of the model we cannot comment on whether the “length” of the domain is significant in terms of outcomes. The shorter the domain, the fewer the number of particles, etc. and hence the

details of transport reflect these conditions. However, it is not clear that the outcomes would be fundamentally different for a shorter domain. It is a good suggestion and one we will test for the publication we are presently preparing. We have not added any text to the document from this comment.

Statement of need: The authors end with a statement about the utility in classrooms. I completely agree and wonder if it could/should be stated near the top.

**Response:** Thanks. We have added a sentence to the end of the Statement of Need.

Theory:

Theory: a normal distribution will have negative travel distances. are these allowed? or is the distribution forced so that particle travel distances are all down stream?

**Response:** Correct, and we have added text here to make this point abundantly clear (i.e. negative or upstream travel distances are not permitted.)

Theory: What about the possibility of adding more probability distributions? Insofar as this has potential to be an excellent teaching tool, do the authors think that there is value in providing more distributions? In particular, a Pareto distribution has a minimum value that may address the issue of isolated piles forming for small or zero mode and it has a heavy tail where the variance becomes undefined for certain shape parameters. This might be an opportunity to illustrate the consequences of heavy-tailed distributions and the influence on the time-series of sediment flux.

**Response:** YES!!! and thanks for raising this point. We have added a few sentences to discuss the Pareto distribution drawing from the text you provided in your comment.

Theory, 4th paragraph: "posiitons"

**Response:** Thanks.

Code:

The only issue was the same one raised by [@pfeiffa](#)

**Response:** Excellent. Addressed above.