

My background relevant to this manuscript: I have led and collaborated on multiple investigations of wood in rivers, including investigations of how logs interact with and store bed sediment, the controls on wood loads in mountainous river basins, and wood jam dynamics (e.g., mobility) in both natural and engineered settings. With regards to wood-influenced hydrology, I have relatively little experience. Similarly, I have very little experience with hydrodynamic modeling, other than through coursework and collaborations.

With the editor's permission, I commented on the most recent version of this manuscript, from the file "hess-2019-35-AC2-supplement.pdf". The line numbers I refer to should match those given in that version of the manuscript, as shown in the pdf, with tracked changes shown.

Broad comments:

This manuscript essentially compares three techniques for modeling large wood-induced roughness in a 2D hydraulic model, using hydrograph shape as a calibration metric. This is a useful endeavor, and could aid applied hydraulic modeling (e.g., I consult with hydraulic modelers who regularly must include wood structures in 2D hydraulic models when evaluating river restoration designs). However, the paper as presented makes it difficult to extract the key results of the study, or even discern exactly what the contribution is. I think there's a great, short paper here, obscured by a presentation that doesn't do it justice. The science seems perfectly fine (and I trust the other reviewers, who are hopefully more experienced with hydraulic modeling than I am, to fully evaluate this). To bring out this paper's potential, I suggest the authors cut it down substantially to more clearly and concisely present their main message (i.e., under what circumstances is it best to model wood as discrete roughness elements, patches of roughness, or just a modulator of reach-scale roughness). I made comments throughout that, if addressed, will make substantial progress towards this goal. However, the authors understand their main message better than I likely do, so I suspect further revision will be necessary to make this an easy-to-digest paper that could then be a good resource for hydraulic modelers tasked with dealing with wood.

The abstract does not adequately explain why the modeling and field observations were compared. I made a line comment about this, but in general, consider providing a clearer explanation of your objectives. The results and implications are adequately explained, and it's clear from the first two sentences why we should care about wood's hydraulic effects, but the reasoning behind your methods is lacking. I think there should be some sentence to the effect of "We compared multiple methods of 2D hydraulic modeling to account for stable LW-induced roughness to determine which method most accurately simulates field-observed hydrographs and provide guidance for future hydraulic modeling of stable large wood."

Due to the aforementioned presentation issues, I want to check with you that your main message is coming across properly. I came away with the following main message: "Modeling wood as discrete roughness elements is not much more effective than simply adjusting reach-scale roughness, and desired model performance (i.e., whether you want a model with a high goodness-of-fit or a shape that replicates real hydrographs) is the only differentiating factor between these two approaches. Thus, you might as well just modulate reach-scale roughness

instead of going through the arduous work of modeling large wood structures as discrete roughness elements.” I’ll admit that in writing that, I’m a bit uncertain if that’s actually the conclusion of this paper, which suggests that you need to make your main message more clear throughout the paper. Does that main message agree with your desired main message?

Overall, I like what I see as the main message of this paper, and I think the authors have a solid bit of work that is adequately presented but could be improved substantially to make a bigger impact. By revising the presentation, the authors can make this paper an effective resource to help the applied and research communities better understand hydraulic modeling of large wood. Even though this case study has limited application, it’s a good incremental advance. I recommend major revisions to address the presentation issues I have brought up.

Sincerely,

Dan Scott (scott93@uw.edu)

Line comments:

Comments are organized by page and line number.

1,13: It strikes me as imprecise to say that wood can improve hydraulic and hydromorphological characteristics. Wood changes those things, but may or may not improve them, depending on one’s valuation, although I certainly don’t dispute that wood can “act positively on a river’s ecology”! Consider rephrasing this statement to be less subjective.

1,14: I’m really happy to see a shift from “large woody debris” to just “large wood”!

1,23: What about the implementations are you testing? Answering that in a few words here will help guide readers through the rest of the abstract.

1,27: The writing here is unclear at times, and somewhat wordy. For instance, “Methodically, in-channel roughness coefficients are changed iteratively for retrieving the best fit between mean simulated and observed flood hydrographs with and without LW at the downstream reach outlet” Could instead be “We iterate in-channel roughness coefficients to best fit the mean simulated and observed flood hydrographs with and without LW at the downstream reach outlet” This is considerably shorter and easier to read, in my opinion. This is a style thing, but consider going through the manuscript (at least the abstract) and tightening up the wording to eliminate redundancy and imprecise verbiage. There are also some grammatical errors, likely stemming from the track changes, to watch out for (e.g., on line 1,29, there is a comma after an “and” that is out of place; there is a word missing on line 2,18). I won’t comment on this further, as I’d rather focus on the scientific content and leave this to the authors and copyeditors. However, I suggest reading through the manuscript and editing for grammar and syntax.

1,31: Do you mean between the observed hydrographs and the model results? The statement as written implies a good fit between individual field observations.

3,14: This statement is likely untrue. For a more nuanced discussion of piece and jam mobility, see Kramer and Wohl (2017, *Geomorphology*, DOI: 10.1016/j.geomorph.2016.08.026). It might be safe to say that pieces longer than channel width are more likely to be stable. Reading on, you seem to acknowledge this, so it would be good to eliminate this contradiction.

4,4 – 4,14: This paper is about the hydraulic effects of wood, not wood mobilization. While all of this is interesting, I don't see how it has any bearing on this paper's objectives. Consider keeping the explanation of model dimensions (always a helpful thing to remind people of), but scrapping the review of wood transport modeling. The topic this paper addresses is plenty interesting, and doesn't really need this extraneous addition of wood mobility ideas to distract readers.

5,8 – 5,20: This addition is good, and seems to better explain your objectives. However, it is currently difficult to read, and a few sentences don't really fit with the overall purpose of the paragraph (to explain why you did this study). For instance, the last two sentences of this paragraph just says "Grabowski et al. (2019) highlight wood alternations of channel roughness and hydraulics as a knowledge gap in identifying local wood-induced risks." That sentence could be better placed at the beginning of this paragraph (or close to it) to motivate this study, as opposed at the end.

5,25: Instead of the vague "integration", consider "roughness modeling" or something similar.

Figure 6: It would be nice to show quantitative metrics of goodness-of-fit on these plots, to help with visual interpretation. One of these is best, and it would be nice if readers could quickly get that from this figure. Something in the caption might also work, but I just notice a lot of white space on the figure, so I feel that you could include this in the plots themselves. I know this information is in Table 2, but summarizing it in this figure would make this presentation more impactful.

10,14: To help people who may be unfamiliar with these goodness-of-fit metrics, please briefly define them in terms of what values indicate high goodness-of-fit and what values indicate the opposite, either here (just before you present the values, or as you present them) or in the methods.

11,2: I'm not sure I understand the justification for altering the previously-calibrated riparian-zone roughness coefficients. Wouldn't it be more rigorous to not alter these after calibration? Or, could you provide a process-based reason for altering them? Reading on, I see that you give this justification in the discussion. Consider alluding to that here to prevent readers from thinking the same thing I did.

11,9: The titles/names you use for each variant should be very consistent throughout the manuscript. That is, if you want to use "spots", make that so everywhere you mention this variant. That consistency will really help readers keep track of your arguments. A summary table, like the one I suggest below, would also be helpful.

13,15-23: I don't understand why this riparian roughness coefficient adjustment is necessary with the variants with wood but not the variant without wood. Is this due to an increase in wetted area to cells that include more vegetation? This might just be my misunderstanding, but consider

clearing this up a bit to justify why you adjusted riparian roughness in the wood-included models, but not the baseline model without wood.

15,24: Is this redundant with your statement on line 15,11? Here is an example where the organization of paragraphs and ideas is not clear. Why contrast V1 and V2, then switch to discussing riparian roughness, then switch back to contrasting V1 and V2? A more logical flow (i.e., making sure that each new idea builds on the last, and relates to the paper's main message) could help shorten and clear up this presentation.

14,7-10: Is this entire paragraph necessary? This sort of thing is well-covered in the introduction, and doesn't seem to need repeating here.

14,11-19: In this paragraph, you lead with some ideas (that discrete elements are simplified in 2D models), then eventually get to a point (that this could cause the behavior seen in V3). Consider leading with the point, then explaining it. That can really help readers keep track of your arguments and get more from your presentation.

Section 5.3: All of these paragraphs begin with "nevertheless", which makes me think that that word might not be necessary here. This section in general is difficult to parse and would be a good candidate for revision. Consider exactly what your main message is here and try to cut out whatever doesn't relate to it. For instance, is the discussion on lines 14,24-33 necessary? Reading it, I don't see how you clearly connect those papers to your work.

15, 8-16: By this point, it's clear that your results only apply to stable large wood. I don't think it's necessary to go through this explanation of how to evaluate wood stability. For starters, it's doubtful that the relationships given in Kramer and Wohl (2017) could even enable robust stability analysis, and hazard-focused wood stability analysis is better covered by other publications. Second, this paper isn't about wood mobility. You could clearly state in a single sentence that your results apply to small, single-thread, steep rivers with stable wood elements, and get the necessary idea across, without going into this level of detail that might derail a reader's attention.

15,26-31: This sentence is very long, and I'm unsure what you're trying to say. Consider cutting this down a bit and making the message clearer. For instance, as what "is the case"?

15,32: Is "SWE" defined anywhere else in the manuscript? I can't find it.

Section 5.4: In my opinion, these sections rarely are read, and often present information that is either obvious to the people who will actually be doing future work, or unnecessary for the people who won't be doing that work. Consider your audience here. Is it really necessary to explain all the ways this study could be improved? I could see a short paragraph stating what your results apply to (see comment on lines 26-31 of this page) being useful, but this reads as being unnecessary. Consider either shortening this section down to a few sentences, or integrating this information throughout the paper (where readers are more likely to actually read it). I know this section is in response to another reviewer's comment, but I suspect that this doesn't fully satisfy their comment either. It would be much more effective for readers to get this

information throughout the paper, instead of the current presentation, which somewhat undermines the results.

Section 6: Consider giving these conclusions in the discussion (throughout it) as well. Readers may get through the discussion wondering what the point of the analyses are, and then will need to get through the limitations sections before making it to the main point of the manuscript. I also suggest you clear up these points using something like a summary table. For instance, it could look something like the following:

Roughness method	Pros	Cons
V1 (reach-scale roughness adjustment)		
V2 (roughness increase near LW)		
V3 (discrete LW roughness elements)		

Such a table could give readers the essential information and recommendations from this modeling, put in context by a succinct discussion comparing the three modeling techniques you tested.