JOURNAL OF COASTAL AND HYDRAULIC STRUCTURES

Review and rebuttal of the paper

Driftwood Accumulation and Passage at V- and I-Rock Weirs in Mountain Streams

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Editor handling the paper: Isabella Schalko

1 Reviewer A:

Dear Authors,

please find attached my revisions.

I found your paper interesting and well organized, although some aspects could be improved.

Please, check carefully my detailed comments, where some minor revisions and typo corrections are reported.

The topic is of interest to the field.
Distinct novel aspects are treated in the paper.
The novelty is well substantiated by a thorough and complete literature review.
These novel aspects are clearly written in the abstract.
Clear objectives are given.
A sound methodology and correct mathematics are used.
The conclusions are supported by the data.
The paper is properly organized.
The paper is to the point and concise.
The paper is written clearly using correct grammar and syntax.
All illustrations and tables are useful and of good quality.
The references are relevant and well-formatted in author-date style.
The format follows the Journal template (for final acceptance).
Appropriate and complete keywords are provided.

The paper presents a field and laboratory investigation on the interaction between driftwood and rock weirs. The Authors refer to an existing case study and then tried to replicate the observed geometry and analyze wood-weir interaction according to the weir geometry, logs geometry, flow characteristics (steady and unsteady).

Performing the experiments in unsteady conditions is a novel aspect that helps in identifying wood dynamics under real flow conditions.

Thank you for this feedback and your global assessment. We have carefully considered these detailed comments and revised the manuscript accordingly. As with Reviewer B, we found this review very helpful and we were able to improve the manuscript. Detailed responses to each comment are included herein in blue.

Overall, the topic is interesting and the paper well organized, with adequate references and adequate pictures. I found some aspects that could be improved: the explanation of scaling procedure, the interpolation of the results in terms of energy/critical depth-Froude number, some sentences which could be clearer and a possible incongruency in Table 2. After adjusting these aspect, the paper could be published.

We have reviewed these main points and made corrections, clarifications, and improvements based upon the detailed feedback and our own efforts to improve. For example, Eq 2 and Fig. 15 are replaced, Table 2 is corrected as we reexamined the calc and made a correction, etc.

Please, refer to my detailed comments below.

I report here a summary for each part of the paper:

- Abstract: fine, clear. Keywords are fine, too.
- Introduction: well organized, quite complete, with some details that should be checked.
- Methodology: overall, well described. I suggest to reorganize the description of the scaling procedure, otherwise it is not clear how the rock dimensions are chosen.
- Results: can be improved. Please see my detailed comments below, especially regarding the experimental part.
- Discussion: can be improved, as they are basically an anticipation of the Conclusions.
- Conclusions: fine.

Detailed comments:

1. Page 3, line 17: check figure numbering, I guess that it is Figure 3c.
2. Page 5, line 12: the Authors refer to Fig. 4 for small irrigation diversions. Actually, they are not clearly visible in the Figure.
3. Page 5, line 17: how were the discharge measurement performed to obtain the rating curve? Please, briefly describe the procedure. In addition, for the event of April 2019 (about 19 m^3/s, lower than the floods reported at line 8) did you observe any section modification?
4. Figure 5 caption: check the units of measurement of the discharge (superscript).
5. Paragraph 2.2: which scale did you use for the model? Which are the dimensions of the model? Which is the flume slope? Which is the distance between the intel and the weir section? The dimensions are reported in Paragraph 2.2.1 but should be placed before the description of the rock dimension, together with scaling parameters. You are implementing a distorted geometrical scale, correct?
6. Page 8, line 11: "Backwater was provided for a short reach downstream". What does this sentence mean exactly? The backwater effect is generally measured upstream of a weir…but I guess I am not catching the proper meaning of this sentence. Please, explain it better.
7. Table 2: please, consider placing the table before Paragraph 2.2.2, as you mention it already in the previous paragraph.
8. Page 8, line 22: "…(i.e., flow depth y)…", the letter "y" should be in italics as it is a geometric variable (as like all the other variables you use in the text).
9. Table 2: at page 8, line 24, the Authors say that $E = H + P$. The sum of the total head in columns 3 and 6 and the weir height at row 4 is not equivalent to the Upstream Energy in columns 2 and 5. For sure I misunderstood something, but please explain how was E measured.
10. Page 10, line 14: "…which correspond to points in the hydrographs shown in Fig. 7.". Points in the hydrograph are not visible.
11. Page 11, line 7: missing capital letter (… entrapment. Driftwood…). The same at lines 15 and 24, page 12 line 2, page 14 line 3, page 15 line 6, page 20 line 11.
12. Page 11, line 15: L should be in italics. The same for the diameter D in the paragraph (lines 16, 18).
13. Page 11, line 23: were the vertical measurement cylinder of about 10 and 15 cm respectively? Water volume displacement was measured for all the logs, including the 150 cm long one? Could it fit the cylinders, vertically? Please, clarify.

14. Paragraph 2.2.3: were not wood samples scaled using the same geometrical scale factors of the flume? In this case, to which "real" dimension they correspond? Are the trees around the considered case study of similar dimensions?
15. Page 12, line 30: Fig. 10a instead of Fig. 14a.

We have replaced all autonumbering fields with actual text to correct these mistakes.

16. Page 13, line 2: "weir" instead of "Weir"

Fixed. Thank you for such a detailed review.

17. Page 13, line 4: please check figure numbering. Figure 10 refers to only weir #5, while Figure 11 shows weirs 5, 9, 10 and 12, while in the text you mention all the weirs.

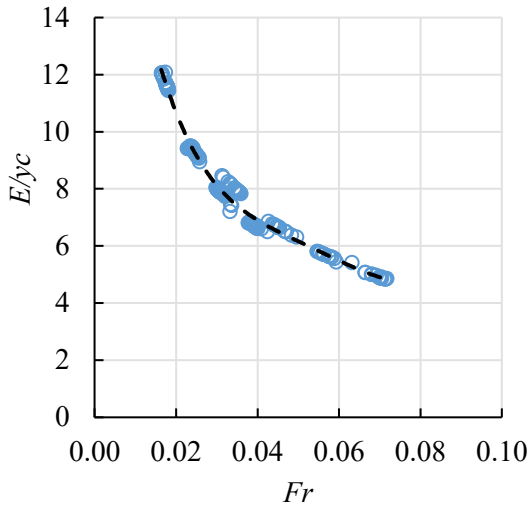
Thank you. The text has been corrected to correctly reference figures corresponding to the specific weirs shown, in the two paragraphs immediately prior to Fig. 10.

18. Page 14, line 13: Figure 12d does not exist.

You are correct. This was an oversight on our part.

19. Figure 15 and Equation 2: please, consider to change the interpolant for the I-shaped rock weir, as for Fr>0.04 it shows under and overestimation of the energy to critical depth ratio. As in this range the results for I-shaped and V-shaped weirs are similar, why don't you use the same equation above Fr=0.05?

This was also noted by Reviewer B and we conducted a new curve-fit effort retaining Fr as independent variable. We have generated a new figure and revised Eq 2. These equations are limited and far from elegant, but it is a quick calc for an engineer. We prefer to have two equations as although they are quite similar, they are for separate geometric shapes.



20. Page 16, lines 9-10: "Relative energy is consistent with data collected at other hydraulic structures of interest, including labyrinth weirs.": the reliability of this observation would benefit from the inclusion of references (shown in the pictures but not placed in the text).

We added a reference to the thesis by Vaughn and then a journal article derived from that thesis.

21. Figure 16: at which times were relative energy values measured?

E was measured every 1 min, allowing calculation of relative energy. This has been added to the text.

22. Page 16, line 13: missing closing bracket.

Bracket removed so that it is consistent with the flow of the paragraph.

23. Page 16, lines 11-12: "Total driftwood volume passage was also directly influenced by changes in relative energy and increased for higher values of energy as illustrated in Fig. 17." The relation between volume passage and relative energy is two-way. Driftwood accumulation generates backwater rise, i.e. changes the relative energy. So the more the accumulation, the more the backwater rise, the more the energy change. Furthermore, from Fig, 17, the reader sees that the retained volume (and not the volume passage) is higher for a wide range of relative energy. The relationship you depict between increasing volume passage and higher values of energy is not represented. Please explain better, including additional figures if needed.

We have completely reworked this section to better convey the trend observed during testing, including a commentary on why there is more scatter for the hydrograph tests vs steady-state tests.

24. Figure 17: if the horizontal line is a percentage, the maximum should be 100% and not 1%. In addition, the differences between the different behavior for the three types of wood (fine, medium, coarse) is not so clear, as the symbols are overlapped. Please, consider to change the vertical axis maximum limit (0.10 instead of 0.2?) to ease figure readability.

We have revised the figure to correctly note the percentages on the x axis. We adjusted the graphs to go from 0 to 0.1 for the y axis, which worked well for Fig. 17b but seemed to make Fig. 17a seem like random scattered data. So, we have opted to keep the graph vertical span the same to help convey the trends.

25. Page 18, lines 20-22: "Two outliers include the fine and coarse driftwood batches at the I-weir for flows of 20 and 40 L/s, respectively (Fig. 19a); these batches did not pass an average expected volume of driftwood.". Which average volume do you expect to pass? Based on which observations?

We revised this paragraph to more clearly communicate, if one examines Fig. 19b there is a clear trend of increasing V% from fine to Coarse. But for the I-shaped weir this had nearly identical V% av for the Fine and Med at 20L/s and despite our repeated efforts the coarse at 40L/s had less V% than the fine and Med. We hope the additional clarification addressed this comment.

26. Figure 20: volume symbol is different from the one used in the text.

Corrected

27. Page 20, line 4: check the notation, BSF river or BSF River (as written in line 10)? Also in the conclusions…check the entire text to use a unform notation.

Corrected and fixed in multiple locations

28. Page 20, line 4: actually, you are not "replicating" the observed wood passage, as, as you state, the real weir were in very different conditions with respect to the laboratory ones. "Testing driftwood accumulation and passage…" is more appropriate.

We fully agree and apologize for the oversight. Corrected in the text.

29. Page 20, line 31: "the greatest greater effect"….greater or greatest?

Corrected.

30. Page 21, line 30: check the notation of the volume symbol.

Fixed, thank you again for these detailed comments.

2 Reviewer B:

The paper represents a novel contribution that could be very helpful for practitioners. I enjoyed reading it. Overall, the paper is well-written and clear, but the numbering of figures/tables and the text should be checked. I have only few minor comments. In particular, I invite authors to consider my comment 7.

Thank you Reviewer B for these comments. We have improved the paper due to your feedback. Point-by-point responses are included herein with tracked changes in the document.

Specific comments:

1) Page 2, lines 15-19: in principle, I may agree with authors' statement. But the "protective effect" of driftwood and large wood may depend on their location and orientation in the channel. For instance, depending on hydraulic conditions, when large woods are located close to the channel banks, a localized scour can occur in their proximity. Consequently, I would clarify this statement.

This is an important point and we have clarified the paragraph to include this clarification:

However, the success of such solutions is dependent upon hydraulic conditions and large wood location in combination with fluvial processes, as over time localized river conditions adjacent to a nature-like structure may shift.

2) it seems that figure numbering is not correct. For instance, at page 3 we have again Fig. 1. Please revise.

We had an auto-numbering that was incorrect for several figures. We have removed this and all figure and table numbering has been checked and corrected as needed.

3) Page 5: I believe that this should be Figure 4 not Figure 2.

Corrected

4) page 7, line 26: please clarify the unit of t.

Thank you. It is in minutes. Added.

5) Page 8, line 24: apparently, P is not defined. please check that all symbols are defined as soon as they appear.

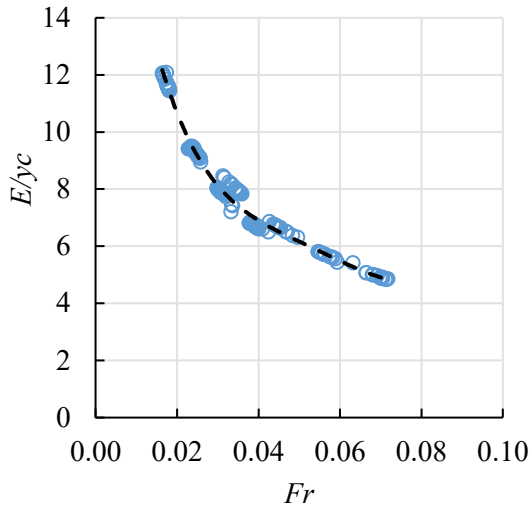
Thank you. The manuscript was carefully checked to make sure that all nomenclature is defined as soon as appearing in paper.

6) Page 11, lines 15 and 24. Please use capital D for driftwood.

Fixed for the two paragraphs starting with driftwood.

7) Eqs. (2) and (3): it is not clear to me why authors selected a polynomial function to interpolate data. As I can see from the figure in page 16, such type of function is not monotonically decreasing in the tested range of Fr (see for instance Eq. 2). May be an exponential function could avoid this problem.

Thank you for this observation. We had difficulty with the initial draft finding a good fit to the data if only using Fr as the independent. I again tried multiple equations and an exponential fit poorly to both, and a higher order polynomial unsurprisingly fit well but should not be used for extrapolation. The revised Eq. 2 is depicted below for your reference.



Recommendation: Revisions Required
