Manuscript EGUSPHERE-2024-414: Investigating the celerity of propagation for small perturbations and dispersive sediment aggradation under a supercritical flow
Hasan Eslami et al.

Response to Reviewers' and Editor's comments

March 1st, 2025

Dear Editor, we submit the R2 version of our manuscript. All the Reviewers' issues have been considered, and either accepted or rebutted. This letter contains detailed responses to all the comments and suggestions received.

Decision by Jens Turowski

Associate editor decision: Publish subject to minor revisions (review by editor)

Dear authors,
thanks for the thorough revisions. Both original reviewers have looked at the paper again and are happy with the changes in content. However, both of them commented on readibility, and sometimes confusing or difficult to follow writing (Reviewer #2 mentions this in his comment to the editor, rather than directly in the comment to the authors). Reviewer #1 makes some concrete suggestions for improvements.
I generally agree with the assessment and I return the paper to you for minor revisions, and ask you to go through the paper with a focus on language, clarity of argument, and structure. A lot of points I would make here are on style, and therefore somewhat a personal choice. However, premit me to make some general remarks on style (I leave it up to you in how far you want to take this up):
- Introduction: for me the introduction's point is to motivate the research and demonstrate its necessity. Generally, this moves from an undisputed, broad statement in the opening paragraph towards the specific research question, using the literature to support the arguments. The last paragraph of the introduction introduces the aim and objectives of the study, and the approach to tackle them. I would not refer to the study and its aims before.

> We have removed the mentions to the present study and its aims from the first paragraphs of the Introduction. Thus, in the revised manuscript, scope and aims of the present study are outlined only in the last paragraph.

- sentences like 'Figure X shows parameter A plotted vs. parameter B' are often inefficient and almost never necessary (a point also made by reviewer #1). Instead, state the message that the figure is meant to support and refer to it in parentheses.

> We have rephrased the presentation of the Figures in the cases where it streamlined the sentences.

- the discussion may benefit from some sub-structure. I generally aim for three separate parts / themes: a discussion / appraisal of the approach and methods, an interpretation of the results, and a placement into the body of previously existing knowledge.

> We have divided the Discussion into three sub-sections.

- the conclusion is often read before the bulk of the paper and it is often argued that it should be understandable on its own. It generally summarizes the findings in a paragraph and then provides the conclusions and wider implications.

> We have added a couple of sentences to the Conclusions section (at the beginning of the section), to make it stand-alone.

I hope this helps and I am looking forward to your revised paper.
All the best wishes, Jens Turowski

> Many thanks for handling the manuscript, the supportive decision and the useful suggestions.

Comments by Angel Monsalve (Reviewer 1)

Thank you for addressing my previous comments. I can clearly see that the article has improved significantly in its presentation, explanations, analysis, and discussion compared to the previous version. I appreciate the detailed manner in which my concerns were addressed. At this point, I only have a few minor comments that I believe are important to address before this paper is published.

Many thanks for recognizing our effort and for the additional suggestions.

1) I believe that associating celerity with eigenvalues is an excellent approach. However, for readers who are not entirely familiar with these concepts, I suggest including a schematic figure or cartoon that illustrates what the celerity of the bed surface represents. This should be Figure 1, as it would help all readers understand the phenomenon you are describing. I recommend showing a front moving downstream; even though this is more representative of subcritical conditions, it would provide a contextual framework for the entire paper.

We have added a Fig. 1 with sketches for translational and dispersive aggradation.

2) Abstract – Line 25: "Scatter plots indicate..." As mentioned in the first review, plots are tools used to analyze data, but they don't "indicate" something on their own. Rather, it is your interpretation of the plots that indicates a process. Consider revising this wording to more accurately reflect the relationship between data visualization and analysis.

We have changes “Scatter plots” into “Our results”.

3) Line 69: "prior investigations..." This sentence appears to be missing the word "only" to properly convey your intended meaning.

Added. In the revised manuscript, the statement has been moved to the last paragraph of the Introduction.

4) Line 125: The text mentions that Equation 1 is valid for a unit-width rectangular channel. While this is correct, this limitation—specifically the rectangular channel assumption— should be placed in context in the introduction and acknowledged there as well. As the article is currently presented, there is no mention of this constraint earlier in the paper. Furthermore, since engineering applications are mentioned in the abstract, it's important to note that natural channels may differ significantly from rectangular channels, which could affect the applicability of the findings.

Formulating the system of the Saint Venant and Exner equations in this way is functional to writing it in vector form and then determining the eigenvalues. We have added this explanation to the paragraph between eq. (1) and eq. (2).

5) "water ripples, mentioned above, ..." This reference is incorrect, as the discussion of water ripples appears in another section, not "above" this point in the text. Please modify this reference to accurately direct the reader to the appropriate section where the simple cases are discussed.

We have changed “above” into “in the Introduction”.

6) Line 178: "This finding is somehow consistent..." This statement is vague and imprecise. The authors should explicitly state in what specific ways the findings are consistent with previous research or expectations, rather than using the ambiguous term "somehow." Clear articulation of the relationship between current and previous findings would strengthen this discussion.

The paragraph just below eq. (12) has been rephrased to follow the Reviewer’s suggestion.

7) Line 261: "... under the assumption of uniform flow..." I question the validity of this assumption in the context of supercritical flow with rapidly varying bed elevation. This potential limitation should be explicitly discussed in the paper, as non-uniform flow conditions may significantly affect the applicability of the presented analysis in such dynamic environments.

In the revised manuscript, we have clarified that the use of the uniform-flow equation is just functional to quantify reference parameters of the experiment, where depth and velocity

continuously vary in space and time as aggradation proceeds. Text was revised just above Table 1.

8) Figure 2: Changes in water depth along the channel clearly shown in this figure demonstrate that this is not uniform flow. Please discuss the potential errors associated with the uniform flow assumption and provide appropriate justification for its use despite this visual evidence to the contrary. An assessment of how these errors might impact your results and conclusions would strengthen the validity of your analysis.

The previous reply should have clarified that the assumption of uniform flow is used to provide a reference value for the initial flow condition. Indeed, if we look at the 5-s profiles in Fig. 2, the uniform flow is reasonably approximated.

9) "as equal to 1 s and 1.8 cm..." Please explain how these specific values were determined or selected, and clarify what they represent in the context of your analysis. Providing the rationale behind these parameter choices would enhance the reproducibility of your study and help readers better understand your methodological approach.

Explanation has been added below eq. (20).

10) Line 367: "For the sake of ... of Fig 5 and 6" This sentence referencing Figure 4 is out of place and interrupts the flow of the paragraph. Please move it to where it logically belongs in the text to maintain coherence in your discussion.

Since the smoothed version of the color gradient map of the Froude number is not presented in the manuscript, we believe that this is the appropriate place for this statement.

11) Conclusion – Line 482: "(iv) The celerity..." Is this value (10^{-2} times the water velocity) the "rule of thumb" mentioned in the abstract? The origin of this value should be clearly explained. If I missed the derivation in the paper, please ensure it is explicitly presented, as this represents the engineering application mentioned in the abstract and would be particularly valuable for practitioners. This practical insight should be well-substantiated and clearly communicated given its prominence in the abstract.

At the end of the Discussion section we have added a reference to the Figs. 9 and 11 (new numbers after adding Fig. 1), to corroborate a statement that “C/u was less than 0.05”. Furthermore, we have mentioned this value explicitly in the abstract of the revised manuscript, and rephrased the last point of the Conclusions.

Comments by Reviewer 2

The authors did a good job in revising this manuscript. However, the language and presentation are not clear to convey the messages as well as deliver scientific insight to the audience. As a reader, I find it difficult to follow. For example, method and results are mixed up in section 4. Raw results should be moved to the result section.

Many thanks for recognizing our effort and for the additional suggestions.

While respecting the point of view of the Reviewer, we have finally resolved to leave the raw results in section 4. This is because the profiles of the bed elevation are useful to understand the application of eq. (20) that is crucial for the determination of the aggradation wave celerity. This is a recurring issue in papers, where a description of the methods without seeing any result remains, to our opinion, too abstract and difficult to follow. In order to clarify our intention, we have added (just below Table 1) a statement that raw results are presented in a method section to make following methods more easily understandable.

In the result section, several sentences start with “Figure presents/shows something” without giving much intuition about them.

We have rephrased the presentation of the Figures in the cases where it streamlined the sentences, as also suggested by the AE.

You can, for example, link the evolution of the celerity with changes in hydraulics during the experiments. You can also choose a specific location along the bed profile to show how the celerity of aggradation wave dynamically evolves with respect to the controlled hydraulics of the flume.

> The second comment would imply adding extra figures; a deeper phenomenological investigation of the celerity dynamics would surely be interesting, but beyond the scope of the paper and beyond the level of revision we were asked for. We have a further paper in our pipeline, that will be indeed focused on the celerity of the aggradation wave as a fundamental quantity for the process.

Several figures are in poor quality (e.g., figures 3, 4, 5 ,6, 7); the color map and color bar are difficult to visually discern.

> In the color gradient maps, we used multicolor scales instead of a single-band gradation that would have been harder to inspect. While we concur with the Reviewer that readability of color maps is generally an issue, all our maps have scatter-plot counterparts that are, instead, much more friendly for the human eye.

I think discussion is the weak section, as I do not see much interpretation of the celerity of small propagation as well as aggradation waves and implications for use cases. The first two paragraphs of the discussion are essentially results. Where should the reader find the discussion of the first type of correlation (Fr- lambda/u)?

> In order to account for this comment, some lines have been added to the first paragraph of section 6.2.

I could not quite follow the discussion until the last paragraph of the engineering point of view. Therefore, I highly recommend the author use simple and concise language, and a logical structure to display the results and discussion.

> We have divided the Discussion into three sub-sections to better guide the reader through it.

I have learned a usefully strategy that you generally can use the 4-step model to structure abstracts: 1) background and motivation, 2) research gap or question, 3) approach and method, 4) outcome and implications. Lines 20-23 appear to be redundant to me; what is the rationale for including supplementary information in the abstract? Line 25, perhaps, change “scatter plots” into “our results” which can be more compelling. Line 27, can you be more specific on mentioning the bulk value constrain? For instance, you might consider stating that $C/u < 0.05$ according to your results.

> The structure of our abstract follows the steps mentioned by the Reviewer, apart from declaring the manuscript scope in the very first line (which is an approach that others frequently recommend). Furthermore, in the revised manuscript we have followed the specific suggestions of the Reviewer.

There are several typos in the manuscript and misuse of language; kindly proofread and correct them again. For instance, it may be better to remove the word “for” on line 48; and on line 53, you might consider employing the term 'causes’; on line 432, I don’t understand the point here.

> We have accepted the first two suggestions and tried to improve the argument mentioned in the third comment. Furthermore, text has been polished at several places along the manuscript.