

Reply to Reviewers

Manuscript ID esurf-2021-46 entitled "The role of geological mouth islands on the morphodynamics of back-barrier tidal basins"

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Note to the Editor and Reviewers:

The comments and suggestions of the Editor and the reviewers are copied in *italic grey font*. The reply to each comment by the reviewers is written in normal font and appears just after the original comment or question. Thanks to the editors and reviewers for the constructive comments and useful suggestions, which has significantly raised the quality of the manuscript.

Review Editor

Following the recommendation of both reviewers, I recommend the paper to be published after the authors address their minor comments.

Reply: We wish to thank the editors for handling our submission and offering us an opportunity to be published. Each suggested revision and comment, brought forward by the reviewers is accurately incorporated and considered.

Reviewer #1

The authors adequately responded to all my comments except one: "Line 195 – "continue"?". Apparently, I was not clear enough. I was only wondering if "continue" is the right word here (To my understanding "continue" suggests a process in time). Among the authors, there are some native English-speaking senior experts, so I should not worry about this.

Reply: We gratefully appreciate the time and effort that the reviewer has dedicated to providing valuable feedback on our manuscript. We think all the comments are insightful and substantially help to result in a much better manuscript. After careful consideration, we have replaced "continue" with "further" in the revised manuscript.

Reviewer #3

The work by Wei et al. is an intriguing numerical study that seeks to quantify how the number and distribution of inlet mouth islands impact the morphologic evolution of semi-enclosed coastal basins. The results of this investigation easily spur multiple investigations for future study, and it is evident that the work presented here could form the foundation of a fruitful line of research. As such, I support the publication of this paper, while acknowledging that some editing is needed to clean up grammar/syntax and add additional context to underscore the importance of the results. To this end, please see my comments below. Please note that, with regards to grammar, I have not flagged every instance of awkward wording and instead focus mostly on language that could impact comprehensibility.

Reply: We wish to thank the reviewer for providing very constructive and detailed comments. We feel sorry for the confusion caused by some unclear wording in the manuscript. Following the

constructive comments, we have thoroughly modified our manuscript, rephrased many sentences, and made a clearer presentation of the model results.

General Notes:

The authors should consider being more upfront about the fact that the model uses ‘rocky’ fixed-dimension islands in their model experiments. This detail is not apparent until section 2.3, although it is hinted at in the abstract (“geological constraints”). Stating this clearly in the abstract will allow other researchers to connect with this topic more specifically. Additionally, the Introduction switches between citations of geologically constrained and unconstrained systems, which is somewhat confusing when presented with model investigations that focus only on rocky mouth islands. I think this confusion could be eliminated by concentrating more on embayed and drowned coasts in the Introduction, with references to sandy/alluvial-type systems as points of comparison and to make more general observations about how mouth islands have broadly been observed to function. To be clear, I am not proposing a total teardown and rebuild of the Introduction, but more of a rearrangement and rephrasing to present observations in a way that could better support the specific investigations undertaken in this study. This may also make it easier to project future work in the Discussion, simultaneously giving the reader an early understanding about the limitations of this study while suggesting the importance of this work for subsequent investigation.

Reply: Agreed. We have thoroughly revised and rephrased our abstract and introduction section to state ‘rocky’ islands much earlier. Further, we have rearranged our introduction section to concentrate more on embayed and drowned coasts.

Line Edits and Considerations:

Line 22 – ‘Hindering role’ in this sentence can probably remove to make the latter point in this sentence easier to understand. Recommend changing the dependent clause to “[...], while the presence of delta-side islands may increase relative sediment deposition in the basin.”—or something similar, assuming I have captured the concept correctly.

Reply: Yes, the reviewer is correct that the delta-side islands tend to increase relative sedimentation in the basin.

Line 35 – The last part of this sentence should read either ‘these types of coastal zones’ or ‘this type of coastal zone’ to keep consistent with pluralization or lack thereof.

Reply: Agreed and changed. We think ‘this type of coastal zone’ is better.

Line 42 – Consider swapping ‘changed landforms’ for just ‘landforms’ to better convey that this is a two-way exchange of influence.

Reply: Agreed and changed.

Line 44 – The sentence describing the finding of Otvos (1981) is ambiguous. Without looking to the reference, my first thought reading this line is that it is possibly referring to sediment being liberated from an antecedent high to begin early barrier formation during sea-level rise. Please clarify.

Reply: Yes, the reviewer is correct that Otvos (1981) explored the effects of sandbar drift on sandy island formation. Since this paper is more focused on rocky islands, we think it is better to remove this citation.

Line 48 – The ‘and’ here is being used as a conjunction. Add a comma after ‘systems.’

Reply: Agreed and modified.

Line 49 – Consider splitting this sentence after ‘tool’. ‘Virtual’ is also implied by numeral modeling, so not needed.

Reply: Agreed and modified accordingly.

Line 83 – The Massachusetts coast is heavily glacially-influenced, and bay islands are a mix of drowned uplands, glacial deposits, and alluvial features. To make the last part of the sentence more broadly accurate, could probably change to [...], which are probably formed from the drowning of topographic highs during sea-level rise in the post-glacial period.”

Reply: Agreed and changed accordingly.

Line 91 – When setting up the specific research questions, note that the number of islands is also being evaluated.

Reply: Yes, the reviewer is correct that this paper has been designed to explore the effects of the number of islands.

Line 143 – Merge with the previous paragraph.

Reply: Agreed and changed.

Line 152 – Suggest dropping ‘Besides’ from the beginning of the sentence. This line may also work better as the final sentence of the paragraph since it is a projection for future work, e.g. “In all cases, the same initial bathymetry is adopted so that the model results can be compared. Additionally, the islands in this initial study are non-erodible (rocky) and square (1 km x 1km). In the future, different sizes and shapes of islands will be investigated to determine how these parameters impact morphological outcomes.”

Reply: Agreed and modified accordingly.

Line 165 – Need a conjunction to link thoughts about where currents occur, something like... “Morphological evolution first occurs in the mouth zone where tidal currents are strongest, as the well as the river input zone due to fluvial input.”

Reply: Agreed and modified accordingly.

Line 173 – Add comma after ‘therein’.

Reply: Agreed and changed.

Line 182 – Need an article before ‘larger spatial scale’. Suggest ‘a larger spatial scale’.

Reply: Agreed and modified.

Line 183 – Consider changing ‘And more erosion occurs’ to ‘Also, more erosion occurs’ or something similar.

Reply: Agreed and changed.

Line 184 – Slight phrasing corrections are needed here. Suggesting the following: “Meanwhile, in the upstream zone, small differences are observed between the four cases, indicating that hydrodynamic effects on this area are relatively limited.”

Reply: Agreed and modified accordingly.

Figure 4: In the future, consider using a color palette that is more accessible to readers with color deficiencies. Again, not an issue here, but something to think about for the next study.

Reply: Thanks for the good suggestion. We will pay more attention to this issue in the next study.

Line 194 – I think “leading to more sediment suspended and transported, and forming a deeper inlet channel” could be rephrased more simply as just “leading to more suspended sediment transport and forming deeper inlet channels”.

Reply: Agreed and changed.

Line 199 – Reading this paragraph reminds of how much this setup mimics the processes that occur around bridge pilings, which seems to be what the modeled rocky islands act like. Could be a thought worth mentioning in the discussion.

Reply: We fully agree that the role of island chains at the marine scale looks somewhat similar to the role of bridge piles at the embayed scale. They both act as a converging and narrowing effect, thus resulting in higher water levels as well as stronger flows. We have mentioned this good idea in the discussion.

Line 213 – Slight phrasing corrections are needed here. Suggesting the following: “As the morphological evolution continues, the channel gradually develops into the upper intertidal area and forms a complex channel network.”

Reply: Agreed and changed accordingly.

Line 214 – Considering flipping the word order of ‘scenarios of inlet island (“IL”)’ to ‘inlet island scenarios’. This reordering would apply to similar phrasing throughout the paragraph.

Reply: Agreed. We have revised similar phrasing throughout the manuscript.

Line 219 – It is generally inadvisable to use contractions in a professional paper. Please change ‘that’s’ to, in this case, ‘This is’.

Reply: Thanks for the good suggestion. We will pay more attention to this issue.

Line 224 – Not sure what this is trying to say. Based on the previous sentence, this should say something about how morphology differs at CS3 with the longitudinal placement of the island, but as currently written there’s just a broad statement about where channels and deposition generally develop. Please elaborate further.

Reply: We feel sorry for the confusion caused by the unclear sentences. We have added more content to the revised manuscript to explain the different morphologies at CS3, as follows:

“In terms of ebb-delta area (CS3), the morphology is also significantly influenced by the longitudinal placement of the island. The inlet island scenario (“IL”) develops several tidal channels in the ebb-delta area due to the diversion created by the inlet island (Figure 6a). In the BS and DS cases, the ebb-delta area has a similar morphology, with extensive deposition developing in the middle of the ebb delta. However, larger sedimentation occurs in the BS case, suggesting that it produces more significant sediment transport (Figure 6k, 6l).”

Line 234 – “evolution a basin” should be “basin evolution”.

Reply: Agreed and modified.

Line 248 – In the final sentence of this paragraph, I think the last line should read “[...] indicating that hydrodynamics gradually adapts to basin morphology and a relative equilibrium state.” Please confirm if this is the correct meaning.

Reply: Yes, the reviewer is correct that hydrodynamics gradually develops towards a relative equilibrium state after 300 years. This sentence has modified accordingly.

Figure 8: This is my favorite figure in the paper!

Reply: Thanks!

Line 291 – “the ones gradually move the left side and become convex after 500 years” could be reworded to be more technically accurate. Perhaps something like “modeled hypsometric curves at 500 years become noticeably convex”.

Reply: Agreed and modified accordingly.

Line 294 – Check the wording on this paragraph—the topic sentence, especially, does not really explain the result. If I understand correctly, there are really only two points here: [1] During basin morphological evolution, the area of tidal flats grows slightly slower under the delta-side scenario and slightly faster under the basin-side scenario. [2] After 500 years, the magnitude of shoals and flats developed under all cases are similar. These two thoughts can probably be appended to the previous paragraph.

Reply: Yes, the reviewer is correct that these two points are really what we trying to make. We have rephrased this paragraph and appended it to the previous paragraph.

Figure 9: Both the 100-yr and 500-yr curves being dashed is slightly confusing to look at. Consider either making one set solid lines, or alternatively, changing the color shading between the sets. I am thinking something along the lines of dark blue and light blue for BS, dark green and light green for DS, etc.

Reply: Very good suggestion. We have modified the curve types and widths to make them easier to distinguish between cases. The new figure is shown below:

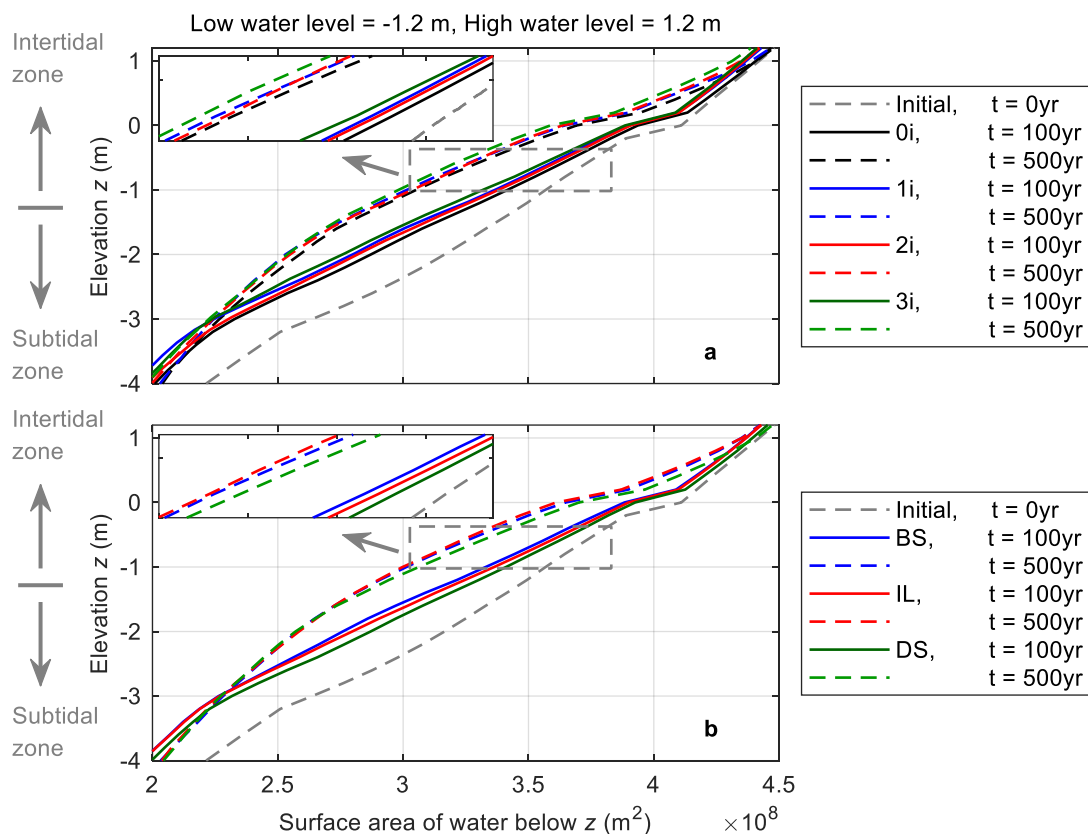


Figure 9: Hypsometry of the tidal basin for the simulations of different scenarios: (a) the scenarios of the different mouth island numbers; (b) the scenarios of different mouth island locations after 100 and 500 years respectively. The tidal amplitude in all cases is 1.2 m.

Line 335 – Suggest changing “the tidal basin tends to be stable showed a gradually stable tidal prism” to “the tidal basin tends to be stable, as shown by an increasingly stable tidal prism.”—or something similar.

Reply: Agreed and modified accordingly.

Line 405 – The second part of the last sentence in this paragraph does not really add anything to the discussion here. In light of the previous sentences in said paragraph, it reads almost contradictory, although I can see that is not the intent. Consider removing and/or elaborating.

Reply: Agreed. We have removed the sentence in the revised manuscript.

Section 4.2: This section could be better served in section 3, as it is effectively another result and could be easily discussed in the context of section 4.1. Consider rearranging—I think this would be fairly easy to implement and would improve the flow of the Discussion.

Reply: Agreed. We have rearranged section 4.2 into the results section and have appropriately discussed it in the discussion section.

Line 451 – In this first line of this section, remind the reader again that this is referring specifically to the basins in Massachusetts.

Reply: Agreed and modified accordingly.

Line 469 – I think it is possible these two paragraphs can be combined. The theme here is that the study does not fully capture the differences in the observed basins, which is probably a result of other geological constraints (particularly, initial bathymetry) that were not fully explored in this investigation. This could be used to set up a future sensitivity study to compare the relative magnitudes of morphological forcing from initial bathymetry and mouth island presence/placement.

Reply: Agreed and combined accordingly.

Line 475 – “while natural islands are often slowly eroded with time”—for the case of rocky islands specifically? Sandy mouth islands can be completely destroyed and reformed over decadal timescales. Might be worth adding some additional specificity.

Reply: Yes, we fully agree with the reviewer that it is necessary to add some specificity for rocky islands. The erosion rate varies between different types of islands. Sandy islands can be completely destroyed and reformed over decadal timescales (Vousdoukas et al., 2020). Rocky islands can be eroded in a range of 0.01-0.1 myr⁻¹, which largely depends on mechanical wave action and rock strength (Andriani and Walsh, 2007).

Section 4.3: Overall, in this section, I was expecting more focus on future work, since the authors mention in section 2.3 that they have designs for more study. In general, I feel like this section could be more optimistic about the model results—this is a topic that is largely unexplored, and the fact that the basins which inspired the study have some differences that are not easily explained speaks to the richness of possible investigations in this research area.

Reply: We highly appreciate this reviewer for the constructive and insightful comments. We feel all the comments substantially help to result in a much better manuscript, as well as benefit our next study. Aspects that are not well reproduced appear to relate to processes that have been omitted (e.g., initial bathymetry and sediment composition) and would merit further investigation.

Conclusions: Depending on if suggestions for more future work discussion/speculation are considered in section 4.3, consider adding a corresponding line or two here.

Reply: Agreed. We have added a corresponding line in this section.

References

Andriani, G. F. and Walsh, N.: Rocky coast geomorphology and erosional processes: a case study along the Murgia coastline South of Bari, Apulia—SE Italy, *Geomorphology*, 87, 224-238, <https://doi.org/10.5281/10.1016/j.geomorph.2006.03.033>, 2007.

Vousdoukas, M. I., Ranasinghe, R., Mentaschi, L., Plomaritis, T. A., Athanasiou, P., Luijendijk, A., and Feyen, L.: Sandy coastlines under threat of erosion, *Nature Climate Change*, 10, 260-263, <https://doi.org/10.1038/s41558-020-0697-0>, 2020.