Hydrodynamic Modelling Techniques for Bays and Estuaries: Simulation Methodology and Practical Application

Review Reports

General Comments:

- This is a very mathematical paper; and hence, I would love to see more derivations but in the appendix. Additionally, the authors compare against linear theory, whilst there is other simulation methodology which is available. Can I suggest the authors to compare against other simulation methodology as well.

Other specific comments are given below.

Specific Comments:

1. Abstract:
   General Comment:
   Good abstract

2. Introduction:
   General Comment:
   - Can you please include the structure of the paper at the end of the Introduction; to assist the reader.

3. Material and Methods

   General comment: May I suggest you include detailed derivations for some of these equations; so that they can be easily followed by most readers.

   Line 127-139: You gave a total of 8 assumptions in the study. Can you please justify the validity of each assumption on a real system and also provide references to other works which may have made the same assumptions for their work.
   Line 145: Can I suggest you start off with the general form of the equation for the momentum conservation equation, giving brief explanation/interpretation of the general equation, before going to the x-, y- and z-component form as given in equation 1a, b, and c. Please also specify that these are the x-, y- and z-momentum, respectively.

Equation 2: This is the mass conservation equation for a compressible fluid. Can you please give a brief explanation/physical interpretation of the equation, instead of just stating it there.

Line 153: Can you please state how equation (3) is obtained from equation (2), and please state explicitly that equation (3) is from equation (2).

Equation 6: what is ρ_0 at the denominator of equation (6).

Line 161: Can I also suggest you explicitly state from which equation from. Eg. "*The momentum equation in z direction of equation 1c can then be expressed as:*"

Line 164: You made an argument that the magnitude of the first order term in z is much greater compared to the advective term in z, to obtained equation (6) from equation 1c. However, not in deriving equations (7a) and (7b)? Also, there is duplication in equation (6) and (7c).

Line 168-169: Why are mean horizontal velocities expressed as U and V, but the surface velocity as $W(\eta)$? i.e. with η. What does η represents? Additionally, can you explicitly state which mass conservation equation i.e. which equation no. that you are using?

Line 177-181: Can I suggest you include supplementary materials to give more details on how these derivations are made? Equations 9a and 9b are from Equations 7a and 7b, whilst equation 9c are from equation 8. May I suggest you put Equation 9c as equation 10 (since they are from the momentum equations).

Line 201: Can I suggest you provide derivations of equation (12), but in the Supplementary information.

Line 207: An interpretation and descriptions of the main equation (13) may need to be provided for better understandings.

Line 229: Can you explain/highlight the difference between Figure 1 and 2 please? Is Figure 2 necessary; they relay almost the same information as figure 1.

Figure 3: Figure 3 is not even mentioned in the text; generally, if it is not important to be discussed, should not be put in the manuscript.

Line 275-276: I do not understand what you are trying to relay in Figure 4.

Line 338: I cannot find where Figure A.1 is? Similarly, Figure A.2a and Figure A.2b in line 341 and line 343, respectively? I also do not understand about the colours that you are referring to?

Line 346: Can you please provide some explanation/description of the flowchart.

4. Results

General Comments: Your proposed methodology performs well against the linear theory. What are the advantages of your method against the linear theory? Also, can you compare against other established simulation method?

Table 3: I am not sure what you are trying to convey with Table 2 and Table 3.

Line 396: Is there any reasons why you are focusing on position 1 and 10 only? Maybe can provide the whole data in supplementary information.

5. Discussions

   General comments:

   Line 446: Not sure what you mean? Need to discuss your results better! Maybe can determine R^2 as single metric to appraise results. Similarly on Figure 13 and 14?

   Line 517: Alternative to what? You need to compare the proposed methodology with

6. Conclusions

   General Comments:

   - Conclusions need to contain background, methodology, important hard results, and significance of work; your need to provide some background and some important hard results in your conclusion.

7. Appendix A

   Line 566: You need to introduce the appendix, provides explanation and context, by relating to the main text; at the moment, you are just dumping everything in Appendix A.