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Interactive comment on "Implementing a hydrodynamic model to complement water depth and flow velocity data for physical scale experiments of rivers and estuaries" *by* Steven A. H. Weisscher et al.

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This paper puts forward the use of a hydrodynamic model as a robust tool for reproducing flow depths and velocities from physical experiments conducted in the laboratory in compliment to the range of other measurement methods typically used (laser scans, photogrammetry, dye, point gauge, PIV). The authors compare and analyze results of a hydrodynamic model (Nays2D) with measurements conducted in two physical experiments (evolution of meandering and tidal influence on estuaries).

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Discussion paper

As a researcher with experience conducting physical experiments and more recently using hydrodynamic and morphodynamic models in field-based studies, I am familiar with the challenges, advantages, and limitations of these different approaches, and I proceeded to read this article with a keen interest in learning about the advantages offered by combining these approaches. I have several general suggestions for how I think this paper can be improved to be more in line with the main goal of this paper which is to demonstrate the advantages of using numerical models as a complimentary tool in experimental/physical studies.

To begin, I think the novelty of this work is a bit overstated and should be better framed within the context of other existing studies. Furthermore, the claim that there is a lack of studies combining experiments and models needs to be nuanced in order to provide more context about the novelty of this study. Classic hydraulic engineering studies based on physical models of fixed beds in combination with hydraulic numerical models have been used for decades and are not discussed. Meanwhile numerical morphodynamic models have been increasingly used in combination with physical models. Below is a very small sample of existing studies combining numerical models and physical experiments. I think that these or similar studies should be presented in the introduction and how this study clearly differs from / compliments / builds on these studies discussed.

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The work presented in this paper combines numerical models with physical models consisting of mobile beds that can evolve morphodynamically. I think this point should be presented and discussed much more explicitly, as it raises the question of the relevance and what insights are gained by using a hydraulic model with a fixed bed to

compare with experiments in which the bed is continuously evolving. How often do scans of the experiment need to be conducted and the model updated in order to be able to compare the evolution? Why not compare the experiments to morphodynamic models?

Beyond the direct comparison of the numerical and experimental data, which are interesting, I do not think the paper goes far enough in analyzing and "selling" the added benefits of using a hydrodynamic model and evaluating the cost-benefits in terms of the time investment and insights gained. In other words, I came away from the paper without a clear conviction that combining these approaches is worth the investment and that the gains from taking a combined approach surpass the results of using only one approach (numerical modeling or physical experiments). I think the authors can go further in their analyses and discussion to make a stronger case for what this paper argues for: that experimental data-model integration allows for experiments to be conducted in a manner requiring fewer measurements and less post-processing in a simple, affordable and labour-inexpensive manner. I think that part of the problem stems from the fact that the paper relies heavily on the details of physical experiments conducted and published previously. While I have no problem with the author's applying a numerical model to previously vetted and published experiments, the details of the experiments and the measurements presented here are insufficient to evaluate the steps and investment in acquiring them. The insights gained by applying a numerical study to experimental data that already exists from a previous study is not necessarily equivalent to the cost/benefits of designing new (future) experiments that integrate both methods at once. While the authors make a good argument for how these approaches and data sets compliment / complete each other, they do not go far enough in demonstrating that the combined approach yields results that are greater than the sum of its parts (i.e., results of two separate studies/approaches). Given that all studies are limited in time and resources this point seems very relevant when designing a study. I encourage the authors to be more creative in analyzing and presenting their results in order to make this argument more compelling by, for example, specifying the new

insights that were gained into how the system behaves/evolves by using a combined approach versus just one or another, and/or how using the numerical model cut down the need for measurements.

Finally, I recommend that the order of sections 2.2. and 2.1 either be reversed or that section 2.1. be moved to the methods so that the flow of the paper moves from the introduction and overview of techniques to the methods and specific setup of the experiments used in this study.

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