

Earth Surf. Dynam. Discuss., referee comment RC2
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Comment on esurf-2020-109

Anonymous Referee #2

Referee comment on "Dynamics of salt intrusion in the Mekong Delta: results of field observations and integrated coastal–inland modelling" by Sepehr Eslami et al., Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2020-109-RC2>, 2021

This manuscript describes the use of a 3D model—informed by field observations—to represent saltwater intrusion in surface water of the Vietnamese Mekong Delta. The authors argue that 3D models more adequately represent stratification and salinity dynamics compared to 1D and 2D methods. The authors show how bathymetric differences over time and offshore processes such as monsoon driven ocean surge influence salinity in the delta. The authors also point out that patterns of stratification and saltwater intrusion differ between connected and less connected channels.

Overall, the manuscript is sound and the use of the 3D model to show stratification with the channels is both interesting and impressive. I think this study will be a good contribution to the community. However, the manuscript can be improved by elaborating more on the field methods in the text. The overall readability of the manuscript can also be improved by addressing several minor changes related to sentence structures. I recommend this paper be accepted after the comments are addressed.

General Comments

The Field Campaign section could be expanded a bit more. In particular, the depth of salinity measurements and the conversion method from conductivity to PSU should be discussed. To improve readability, along with the citation, the moving boat measurement technique should be briefly highlighted in this section.

The phrases "saline water intrusion," "salt intrusion," and "SWI" are used seemingly interchangeably throughout the manuscript. Please use "saline water intrusion (SWI)" (or something similar) at the first occurrence of the phrase then only use SWI throughout the remainder of the paper to improve clarity. If saline water intrusion and salt intrusion are intended to highlight different processes highlight the difference.

To many people, saline water intrusion or saltwater intrusion refers to high salinity in groundwater aquifers as opposed to surface water (for example, Todd, 74; Bobba 2002; Michael et al 2013). Please point out early in the manuscript that the focus of this study is surface water processes. With that being said, information on groundwater salinity in the shallow aquifers of the delta could provide some valuable context to readers on potential groundwater endmembers. If such data is available, I recommend at least a mention of

the typical ranges of salinity in groundwater relative to surface water.

The authors suggest that 3D dimensional models perform better for the Mekong Delta compared to 1D and 2D models. This may be the case, but without any direct comparison of this impressive 3D model with simpler 1D or 2D models, readers are left to assume that this is indeed the case. I suggest comparing these results with at least 2D models if they are available.

Finally, are the authors modeling the whole continental shelf? If not, mention that only a portion of the shelf is being modeled.

Specific Comments

Line 33: Is the delta more vulnerable compared to other deltas or more vulnerable compared to past versions of the delta?

Lines 39-42: "Eslami et al., (2019b) showed that there has been increasing trends of salt intrusion and tidal amplification... that are being driven by bed level changes..." There seems to be enough room in the introduction to breakdown the link between SWI and bed level changes. Where are the bed level changes occurring? Are they occurring at the mouth, upstream, within the delta channels? Briefly point out how those changes affect tidal amplitude and SWI.

Line 68: Cite examples of some other deltas around the world. If relevant, perhaps cut the following line "There are a number of field measurements..." and add the citations to line 68-69

Line 85: Please elaborate on what is meant by "address estuarine variability." Do the authors mean to characterize 3D variability in salinity within the VMD?

Line 116: Here or earlier are good places to point out that this paper exclusively looks at surface water.

Lines 121: Please clarify how measuring SWI in 2016 gives insight into historical events.

Line 122: I think the paper would benefit from a brief summary of the moving boat measurements to supplement the references.

Line 126 What depth were the samples taken at?

Line 126: What equation/method was used to transform salinity?

Line 181: What was the SWI length in the Tran De channel and how did salinity near the mouth compare over spring and neap tide? These measurements for the Dinh An channel were compared but are not reported here for the Tran De channel.

Line 203: Why was the sample location not a fixed point? Was it possible to erect some sort of semi-permanent structure like a stake into the bed?

Line 204: Manual measurements of salinity? Using a probe, grab samples. Really briefly remind the readers here how you are collecting these samples so they do not have to go looking through the methods again.

Line 268: Higher to the field campaign (insert the date(s) of the field campaign here) to help with readability

Technical Corrections

Line 37: Perhaps not "the key to land use" but rather the key to *productive* land use.

Line 100: Point out the first split or remove "again."

Line 121: Consider something like "To interpret/estimate historical events we measured maximum"

Line 123: Keep consistent: Either Apr or April.

Line 123: Consider restructuring the sentence so that it reads something like "We simultaneously measured salinity structures and intrusion lengths along two channels over spring and neap tide (April 1 and 9, 2016, respectively)."

Line 125: Consider: "We sailed upstream from the estuary mouth along the thalweg at approximately 30 km."

Line 133: Fix punctuation

Line 182: "Figure 3a shows various environmental parameters during the 2016 dry season." This sentence does not add much to the results. It is probably better suited as part of a figure caption.

Line 182: Figure 3a shows... For this sentence and similar ones. Construct the sentence so that you point out the results and then put the figure number at the end in parentheses example (Figure 3a)

Line 190: remove "see" consider "(eg March)"

Line 251: remove "also"

Line 263: Define K1+O1. Also, define M2S2 in line 264.

Line 281: Replace "borrowing" with "using"

Line 282: Cut the second instance of "notation"

Lines 352-353: Consider the following sentence structure "Given recent advances in numerical methods and computational power, it has become possible to efficiently model the entire Mekong Delta in a combination 2DV and 3D."

355: Consider the following sentence structure "With this tool, 3D processes *were* fully represented, and salt transport mechanisms were modeled with 3-dimensional fidelity."

Line 359: forcings

Line 376: "... have a dominant role..." or "have dominant roles."

Line 391: No space before comma

Line 440: Remove "amongst others."

Figures

General suggestions: Many of the minor tick marks are not needed. Consider reducing the

number of minor tick marks to improve clarity in several of the figures (for example X axes on Figures 3, 4, 7, 8 and 9)

Figure 1 (b): Consider using a blue transect for Dinh An consistent with later figures.

Figure 2: Define HWS

Figure 3: Point out Period 1 and Period 2 directly on the figure.

Figure 4: Bring the key up a bit so that it does not cover parts of the "a" plot. Sort the figures in order so that all the WL, then all the salinity plots, and finally all the discharge plots are together

References

GHOSH BOBBA (2002) Numerical modelling of salt-water intrusion due to human activities and sea-level change in the Godavari Delta, India, *Hydrological Sciences Journal*, 47:sup1, S67-S80, DOI: 10.1080/02626660209493023

Michael, H. A., Russoniello, C. J., and Byron, L. A. (2013), Global assessment of vulnerability to sea-level rise in topography-limited and recharge-limited coastal groundwater systems, *Water Resour. Res.*, 49, 2228– 2240, doi:10.1002/wrcr.20213.

Todd, D.K. (1974), Salt Water Intrusion and Its Control. *Journal of the American Water Works Association*, 66: 180-187. <https://doi.org/10.1002/j.1551-8833.1974.tb01999.x>