“Flooding in the Mekong Delta: Impact of dyke systems on downstream hydrodynamics” by Vo Quoc Thanh et al.

Responses to Referee #1’s comments

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Dear Referee #1,

Thank you so much for taking time to review and comment. We will consider your comments to revising the manuscript. The following section is our responses to your comments.

The authors use a 1D/2D hydrodynamic model that covers the Mekong Delta including its rivers, major canals and extending into the continental shelf in the surrounding ocean, to investigate the impact of protecting agricultural areas with high-dykes on the river hydrodynamics. They found that (a) High dykes (particularly those in Long Xuyen Quadrangle (LXQ), Plains of Reeds (PoR)) have wide-spread impact on the flow downstream (b) has impact on inland tidal effects. Recent literature is well covered. Reasonably well-written introduction. Language use is generally adequate (though there are a number of technical issues that need correcting.) However, the paper is not easy to read as it is organized in such a way that a lot of (seemingly unnecessary) material is mixed with the main narrative of the paper.

Authors’ response: Thank you for the general comment on the paper. We will try to improve the paper structure to be easily readable.

1. What is the benefit of modelling the continental shelf? This is not an oceanographic/coastal engineering study. Your focus (as stated) was to investigate the impact of construction of high-dykes on the flow regime of the river system. You are also not considering highly dynamic ocean impacts like storm surge. What is the drawback of stopping the model at the river mouth and providing tidal boundary conditions with sea level there? You might have good reasons for this approach. If so, they need to be explained.

Authors’ response: Regarding the modelling grid, we extended the modelling grid, including the shelf, in order to completely contain the river plume. Although the objective of this study is to investigate the impact of high-dyke constructions, we analyse hydrodynamics of the stations at the river mouths. In fact, the river discharge has contribution to sea levels (Kuang et al., 2017). Therefore, we included the shelf to investigate the impact and presented in the Table 4. If the modelling domain is limited at the river mouths, this impact would be excluded. As another reason, this approach is suitable toward salinity and sediment transport modelling.

2. One year of simulation is a short period to obtain meaningful results. I think it is important to cover at least several years of flow data as such data for this case study is available. Is there a barrier to doing that?

Authors' response: We partly agree with you that one year is a short period. However, it includes seasonal variation which is one of the main characteristics of the annual floods in the Mekong Delta. The model was used to compute for the floods in 2000 and 2001, but we analysed the flood in 2000. It is possible to run a multiple year simulation, but it is quite difficult to select a suitable period. We selected the flood in 2000 because it is one of the most severe floods recently. The highest water levels of the flood in 2000 is used as a reference for construction of flood prevention. Thus selecting a severe flood to evaluate impacts of high dykes could determine the maximum possible impacts of these construction on downstream hydrodynamics. To define a suitable period, it should consist of a low water flow year (2008), a moderate water flow year (2004) and high water flow year (2000) based on water levels at Tan Chau station. Another approach could use the long-term average hydrograph (MRC, 2009) as the boundary conditions.

3. The point of departure (and justification for the methodology) of this paper seems to be the fact that previous studies could not able to predict the water level at the river mouth. If this is the sole justification to use a numerically expensive 2D model that includes continental shelf, the importance of obtaining those figures should be explained.

Authors' response: As we responded to the comment, the major reason to include the shelf is to investigate the possible changes of water levels at the river mouths. The previous studies are usually 1D models and their boundaries are defined at the river mouths so they are not able to calculate water level changes at the river mouth stations.

4. The point of doing a tidal harmonic analysis is unclear to me. Just testing the impact on the tidal range (amplitude) would have covered all the matter that is relevant to the central theme of the paper. Removing the tidal harmonic analysis part would shorten the paper - definitely would contribute to making it more readable and to the point.

Authors' response: Thanks for the suggestion to make the paper more readable. However, results of the tidal harmonic analysis are important because hydrodynamics in the Mekong Delta downstream are strongly influenced by tides. Thus amplitudes of the eight main tidal constituents are suitable indexes to indicate tidal propagation changes. Using these indexes can eliminate effects of the fluvial floods.

5. The authors should discuss the performance of the model. This is particularly important as many previous studies have used (much simpler) 1D modelling approach to arrive at similar results. How much is the computational effort? How does it compare with those reported in previous studies? What is the justification to use this modelling approach despite its expense (if that is the case)?

Authors' response: We will revise the "Model performance" section. The modelling approach in this study overcome a limitation of the previous 1D models. This can help to understand hydrodynamics at the river mouths where rivers and oceans interact. We will compare the performance of this model with the previous models, but the model performance should reach a reasonable level. The model performance determined by the Nash-Sutcliffe efficiency (NSE). We compared the NSE values to the previous studies (e.g. Dang et al., 2018; Tran et al., 2017; Triet et al., 2017). NSE values of this model are slightly lower than the mentioned studies, but it is generally in the *good* category based on (Moriasi et al., 2007) evaluation. The reason to use this modelling approach because its advantages, as mentioned in the comment 3's response.

6. So many figures and many descriptions on model validation performance. This is an important topic to cover, but it is overdone in this case. Just one paragraph on how the model performed during validation and if absolutely necessary, one map showing validation results. Much of this can be moved to an appendix. In fact, it's best that they are presented as an online supplement rather than an Appendix, so as to keep the paper succinct and to the point.

Authors' response: Thank you for your suggestion. We will take this comment to revise the paper.

7. Scenarios need a better explanation. For example how much is protected with high dykes in "Dyke VMD" scenario? What is the basis?

Authors' response: We will revise the paper with more details. The basic is the base scenario of the flood 2000, without high dykes. (Duong et al., 2016) found that there is no high dyke in the Vietnamese Mekong Delta before 2000.

8. Water balance diagrams and descriptions are hard to understand. Please check the literature for much clearer ways of presenting these.

Authors' response: Thank you for your suggestion.

9. Lastly, it is important to place the findings within the context of other changes. Are these significant for example impact of climate change on upstream Mekong flow, dam construction, sea-level rise etc.? Some discussion on such issues is warranted.

Authors' response: Thank you for comments.

Comments on the manuscript

Thanks for comments and suggestions on the manuscript. We will correct them.

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