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

Responses to Referee #3’s comments

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Dear Referee #3,

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 study aims at evaluating the impact of high dykes on the hydrodynamic behavior of the Mekong river. The analysis is based on a 1D-2D model that reproduces the topographic characteristics of the river, as well as different dyke ring configurations. The work does not infer specific research questions but it is aimed at increasing the knowledge of the river dynamics and its behavior in the light of the recent construction of a complex dyke system. The manuscript is in general well written, even if it results sometimes heavy and difficult to follow due to many details regarding the study area. I have some doubts concerning the scientific contributions of such kind of studies, even though the publication could be justified by the importance of the study area and the relevance of the river dynamics investigated. That said, the current manuscript fails in specifying what are the added knowledge provided compared to previous investigations performed in the same area, and with the same objective (see e.g. Tran et al., 2018). Hereafter some major and minor comments that need to be addressed before considering the manuscript for publication.

Authors’ response: Thank you for your comment. We will respond to your comments and revise the manuscript.

- One of the most relevant concern regarding the study is that it refers to only one year of data. The model has been calibrated and validated considering the 2000 and 2011 floods, respectively. After that, all the considerations regarding the river dynamics have been carried out referring to the event used for the calibration. However, Figure 5 clearly shows that the 2000 flood is different from the average condition. Thus, the question is: how representative is this event of the behaviors of the river network? The behavior of the different river branches and the way they interact depend on the specific contributions of the different basins. This to say that this analysis evaluates only a specific event, which might (is?) not be representative of the general river condition. As a matter of fact, previous studies investigating the same aspects (dyke effects) considered longer periods.

Authors’ response: Thank you for your comment. 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 are 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.

- The difference relative to the study of Tran et al. (2018) is sometimes cited in the document. However, the Authors should better specify the differences and the added knowledge ensured by this study. Also, are the results in line with previous findings? If not, how do you justify the difference? Does this study provide new information and knowledge relative to what was already known?

Authors' response: This study provides a new modelling approach for the Mekong Delta which can overcome the limitation of the existing 1D models in order to simulate hydrodynamics at the river mouths. In addition, this approach may consider effects of coastal processes (e.g. waves, storm surge). Compared to the study of Tran et al. (2018), we included impacts of high dykes in PoR and TransBassac and the results of this study show a similar increase of water levels. Besides, we found that the dyked floodplains in the LXQ and PoR not only influence water regimes on its directly linked Mekong' branch, but also on the other branches. Moreover, we investigated the impacts of high dykes on tidal propagation along the Mekong River.

- Differences in terms of water elevation are in most of cases very minimal and of the same magnitude of the error of the model. What is the representativeness of such results. How can you exclude that those limited variations obtained among different configurations do not depend on the model itself, or on the way it reproduces the interaction between river and dyke rings?

Authors' response: We found that the water volume stored in the Vietnamese Mekong Delta's floodplains is much smaller than the annual flood volume. Thus this causes the small changes among the cases. To avoid the errors, the model spin-up time covers the 1999 flood. By using the same model setup, except the high dyke configuration, we believe that the differences are caused by high dykes.

- The overall model description should be improved. The model structure covers a key role in the overall study and additional details should be reported. The distinction between high and small dykes is not clear unless you are familiar with the study area.

Please provide additional explanation about the model structure.

Authors' response: Thank you for your comment. We will revise it. We only consider impacts of high dykes and assume that low dykes and non-dykes allow floodplain inundation. This modelling approach of floodplains and canals is based on field observations, as presented in Figure 1 and Figure 2.

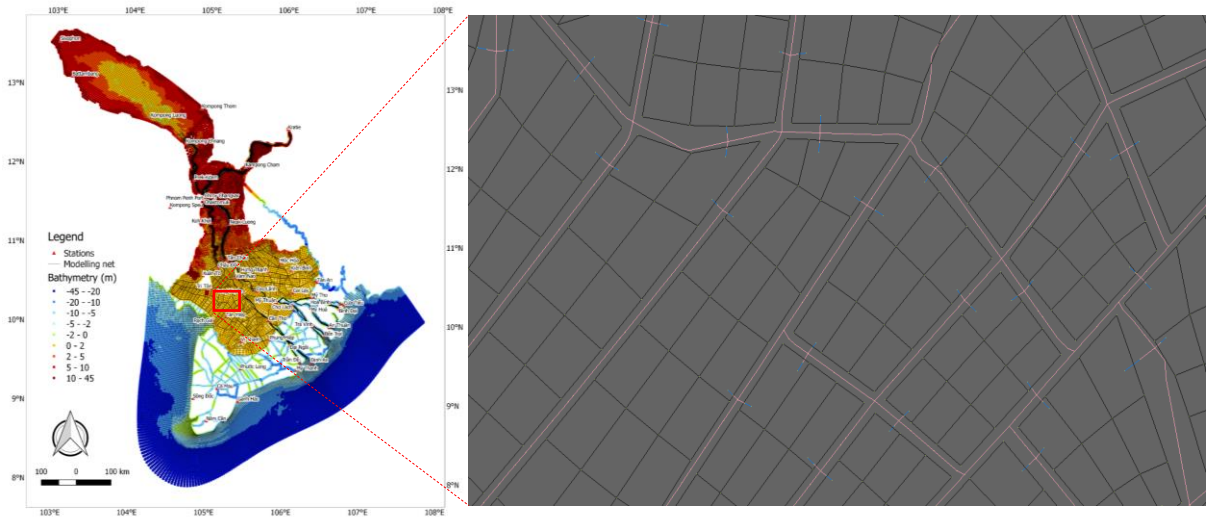

Figure 1. The modelling grid. The floodplains are defined as 2D grids (in black) and canals are defined as 1D networks (in pink). The connecting links of 1D network and 2D grids are in blue.

Figure 2. A high dyke and non/low dyke in An Giang province and their schematization in modelling. Photos by Vo Quoc Thanh 2012.

- Following all the hydrological details reported in the manuscript is sometimes difficult. Please always remind that a reader might not be familiar with the cited locations. All the cited locations should be identified within a Figure. For example, I would recommend adding a figure explaining the different geometric configurations and the dyke systems considered in the different cases. For example, what are the dyke system considered for the configuration LXQ, PoR, etc.?

Authors' response: Thank you for your suggestion. We will check the mentioned locations and locate in a map. We will revise the Section 2.3 *High dyke development scenarios* with more details.

- P2L9: which kind of hydraulic structures?

Authors' response: We introduced the hydraulic structures in general. The hydraulic structures are commonly high dykes in the flood-prone areas and sluice gates for salinity prevention in the coastal areas.

- P3L15: please put the figure in relation to their citation order. Figure 4 is cited in the text before figures 2 and 3.

Authors' response: We will correct it.

- P4L7-16: consider adding a scheme to better explain dykes interaction.

Authors' response: We will add it.

- Figure 2 and 3: why the number of dykes is significant? Probably reporting their overall length is more relevant.

Authors' response: In my opinion, the high dykes are separated by the canal system. Thus the mean areas of floodplain protected by high dykes can reflex flood water conveyance. For example, in the same area of floodplain protected by high dykes, the smaller mean area has higher water conveyed capacity.

- P7L24: I think here you should refer to "dike ring". How do you manage, within the model, areas partially protected with high dykes and partially not?

Authors' response: In the case of a flood compartment containing a high dyke and a non-dyke, we used a ratio of areas of floodplains protected by the high dyke and the non-dyke. The larger area of floodplains will define the type of dykes.

- Section 2.3: I would suggest using the term "configuration" instead of "scenario". Scenario is usually referred to identify different hydrological conditions (e.g. events of different return periods), while configuration sounds more appropriate for taking into account different topographic characteristics of the river network. Please make those locations clear using a map.

Authors' response: Thank you so much for your suggestion. The study of (Tran et al., 2018) which was published in the HESS journal also use "scenario", so we prefer to use "scenario" to make it consistent.

- Sometimes the structure of the paper is "heavy". Please consider to simplify it by removing some sub-subsections, such as 2.4.1, 2.4.2…etc.

Authors' response: We will edit them.

- P11L8: any discussion about the calibrated Manning coefficients: are they reasonable? Are they in agreement with those of previous studies?

Authors' response: As mentioned in the calibration method section, we started to calibrate the model with calibrated roughness values from Manh et al. (2014) and Van et al. (2012). Thus the

calibrated roughness values are in agreement with these studies. However, there are slight differences in the coastal areas.

- *P13L31: Is it relevant reporting a difference of 0.6 cm? How reliable is this estimation?*

See also my previous comment on that.

Authors' response: This increase is reasonable because this is yearly mean increase.

- *Figure 1: green areas should be reported as "high dyke protected areas". The same in Figure 4.*

Authors' response: Thank you for your suggestion. We will edit it.

- *Figure 7: check the unit of measure: m a.s.l. ?*

Authors' response: Thank you for your suggestion. We will edit it.

- *Figure 10-11: is the arrow dimension proportional to the flow? In case specify or add a legend.*

Authors' response: We will add a legend.

- *Figure 13: I was not able to find some of these stations in a map. Please add a reference to a map where those stations are visible.*

Authors' response: Thank you for your suggestion. We will add it.

References

Manh, N. V., Dung, N. V., Hung, N. N., Merz, B. and Apel, H.: Large-scale quantification of suspended sediment transport and deposition in the Mekong Delta, Hydrol. Earth Syst. Sci. Discuss., 18, 3033–3053, doi:10.5194/hessd-11-4311-2014, 2014.

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