Response to Referee's Comments from Ass. Prof. Assela Pathirana on

Has dyke development in the Vietnamese Mekong Delta shifted flood hazard downstream?

by Nguyen Van Khanh Triet

1. **The analytical work leading to the manuscript is rigorous. The authors employ proper statistical techniques and perform sensitivity and uncertainty analyses where appropriate. The model calibration and validation were done well. However, they should explain the basics of the model they employed in the manuscript. Just referring to the original source is not adequate here. At least explain the simplifications to the shallow water equation the model employs, solution scheme it uses etc. in the main text (and add an appendix explaining the model in a bit more detail if possible).**

AUTHORS' REPONSE: Thank you for the possitive comment, which was also raised by reviewer 1. The 1st paragraph of Sect. 2.4 Hydrodynamic modelling (p.6 – line 18) will be revised as following, as also stated in the reply to reviewer 1. For the further detailed information on the MIKE11 packages, the readers might refer to DHI website at the given link https://www.mikepoweredbydhi.com/products/mike-11.

To quantify the impact of the high-dyke development on flood hazard, a hydrodynamic model for the simulation of flood propagation in the MD was used. The model is a quasi-2D model based on the 1D hydrodynamic modelling suite MIKE 11. The MIKE 11 hydrodynamic (HD) module solves the vertically integrated equations of conservation of continuity and momentum (the 'Saint Venant´ equations). The solution of the equations of continuity (1) and momentum (2) is based on an implicit finite difference scheme developed by Abbott and Ionescu (1967). The model domain includes the CFP, the Tonle Sap Lake as well as the majority of the channels and hydraulic structures in the VMD. The model was initially developed by Dung et al. (2011) and refined by Manh et al. (2014). It explicitly takes the complex hydraulic system with intersecting channels and dyked floodplains of the VMD into account. A typical flood compartment, i.e. part of the floodplain encircled by channels and protected by dykes, is described by "virtual" channels with wide cross-sections connected to the channels by sluice gate model structures. These cross-sections were extracted from the available DEM (originally SRTM, now LiDAR DEM). The cross-section width is defined in such a way to preserve the flood compartment area. Dyke-lines of each flood compartment are described by four control structures right after the points where virtual and real channels are linked. These structures are introduced in the model as broad crest weirs. The crest levels of dyke-lines are presented as sill levels of these control structures (see Fig. 2). A comprehensive description of how floodplain compartments are introduced by the "virtual" channels and wide cross-sections can be found in Dung et al. (2011). The model has been calibrated by Dung et al. (2011) and Manh et al. (2014) with recent flood events in the VMD, encompassing the high floods of 2011, the medium floods in 2008 and 2009, and the extraordinary low flood in 2010.

$$\frac{\partial Q}{\partial x} + \frac{\partial A}{\partial t} = q \qquad (1)$$

$$\frac{\partial Q}{\partial t} + \frac{\partial (\alpha \frac{Q^2}{A})}{\partial x} + gA\frac{\partial h}{\partial x} + \frac{gQ|Q|}{C^2AR} = 0 \qquad (2)$$

where:

Q	discharge
A	flow area
q	lateral inflow
h	stage above datum
C	Chezy resistance coefficient
R	hydraulic or resistance radius
α	momentum distribution coefficient

2. While the manuscript is generally well written, there are some (minor) language and editorial issues that have to be addressed. Explain what are low-dykes and high-dykes in a way an international reader can readily understand (height limits?)

AUTHORS' REPONSE: Thank you for the comment. We have included in our manuscipt a description on height of high-dyke at page 4 and line 4: "crest levels of 4.0-6.0 m.a.s.l." We will additionally include the following text on height limits of low-dyke in the revised manuscipt (page 4 - line 2). "… with a total length of over 13,000 kilometers, of which 8,000 kilometers are low-dyke with crest levels vary from 1.5 – 4.0 m.a.s.l. …"

3. Some colors and patterns used in figure 1 are not clear (at least in the color I wonder whether all the tables included in the main text are really need to be there (why note move the likes of table 5 to an appendix or a supplement?).

AUTHORS' REPONSE: Thank you for pointing this out. We suppose it is the pattern which distinguishes the Long Xuyen Quadrangle and the Plain of Reeds that you are mentioning here. We will change the coressponding color and pattern in the revised manuscript (see figure below). Regarding table 5, we do think that it needs to remain in the main text. It presents the basis for our conclusion. Without it, the summarizing results and the conclusions cannot be followed.

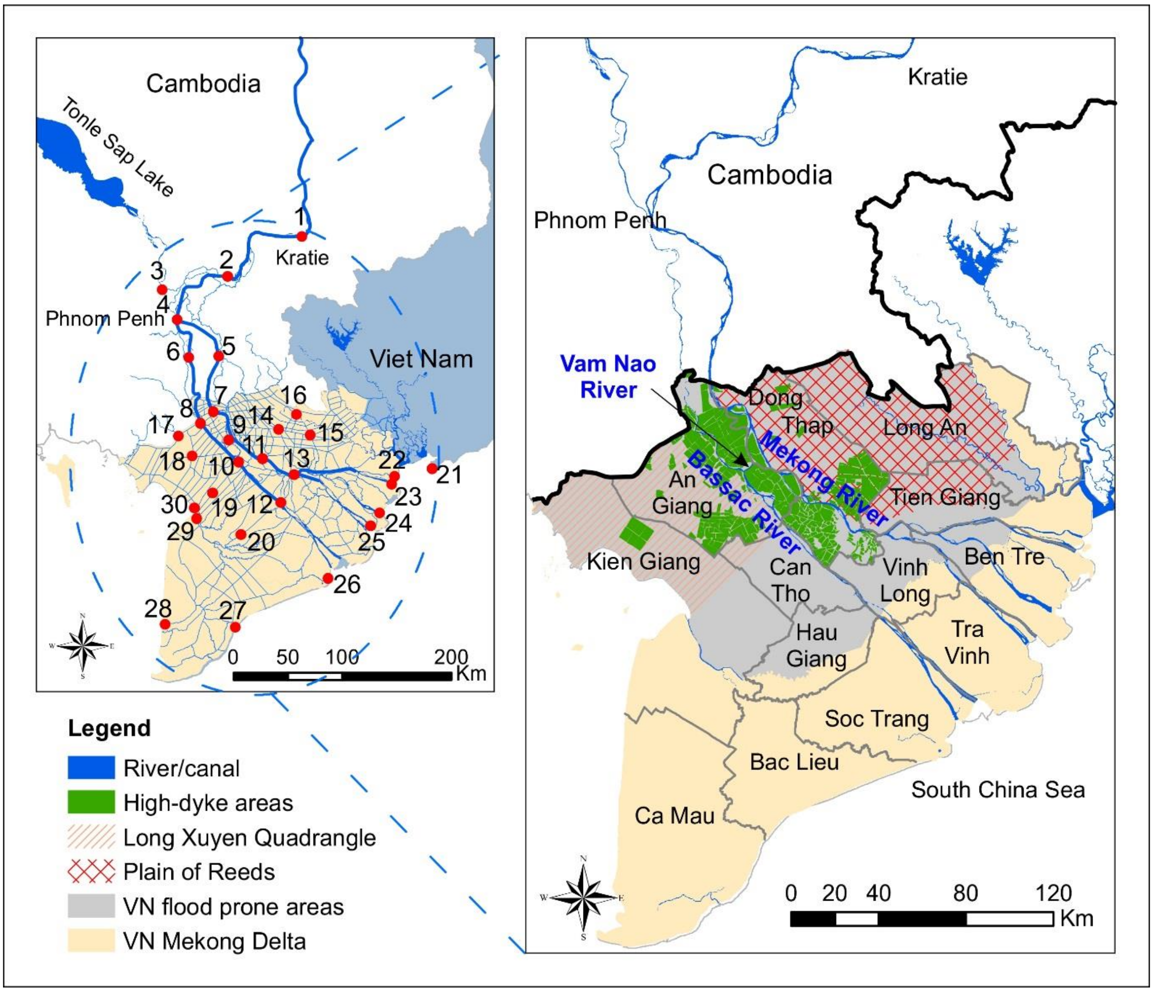

Figure 1. The Vietnamese Mekong Delta, its flood prone areas and location of measuring stations (red dots). The names in black indicate the provinces in the VMD.

4. I do not understand the basis for the last sentence (the recommendation) in the abstract!

AUTHORS' REPONSE: This recommendatiojn is base on the finding, that a reduction of 9–13 cm in flood peak might be achieveable if flood water is introducted to those fully protected flood compartments (i.e. areas encircle by high-dyke in the upper part of the delta). Therefor we recommend, analogously to flood management strategies applied in other countries, where Polder areas are deliberately opened for capping of flood peaks and reducing flood hazard downsteam, that flood risk management strategies in the VMD should use the high-dyke areas as retention zones to mitigate the flood hazard downstream.

References

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Manh, N. V., Dung, N. V., Hung, N. N., Merz, B., and Apel, H.: Large-scale suspended sediment transport and sediment deposition in the Mekong Delta, Hydrol. Earth Syst. Sci., 18, 3033-3053, 10.5194/hess-18-3033-2014, 2014.