

HESS-2017-141 – Review of “Assessing impacts of dike construction on the flood dynamics of the Mekong”

In this paper, the authors assess the hydrologic and hydraulic impacts of levee (dike) expansion on flooding within the Vietnamese portion of the Mekong Delta. The authors employ an existing Mike 11 model which uses a quasi-two-dimensional approach to assess changes in water-surface elevations (WSEs) and the water balance within the delta for four levee configuration scenarios. The result of the modeling showed levees increased WSEs upstream of the levee construction and their water balance analyses suggests a substantial amount of river discharge has been or will be diverted away from the wetlands of the Long Xuyen Quadrangle.

Overall, the paper is reasonably well written, and the manuscript should be considered for publication after a few minor issues are addressed. Please see my comments and suggestions below.

General Comments:

1. The most interesting finding in this study are the changes in the delta's water balance. The finding that levees impact WSEs upstream of the levee constriction is less interesting because it is: (1) predicted by hydraulic theory (e.g., Yen, 1995 and Akan, 2006); (2) has been documented in empirical studies (e.g., Hiene and Pinter, 2011); and (3) several modeling studies around the world. Focusing the paper on changes in the water balance and discussing the implications of these changes for river management would make this manuscript stronger.
2. Somewhere in the discussion section the authors should provide a relatively brief caveat about the limitations of their hydraulic model related to changes in the distribution of flow in the delta, the potential associated geometric channel changes, and the possible impact (i.e., uncertainty) on their model predictions of WSEs and water volume estimates.
3. Caveats about the limitations of their model should not be included in the abstract. Dialogue about the limitation of their models are best suited to the discussion section of the paper.

Specific Comments:

1. Abstract - Line 8 The term “river levels” is confusing in this context; Please specify you are talking about river discharges and not WSEs here.
2. Page 4 - Lines 8-10 The assertion that the change in WSEL for two floods is a “correlation” attributed to levee construction is not appropriate given the natural variability in the stage discharge relationship of a sand-bed and tidally-influenced river. I suggest using the word comparison verse correlation. Statistically speaking, you cannot make a correlation between to observations.
3. Page 5 – Lines 12-20 Please clarify what the authors mean by “floodwater regimes”.
4. Page 5 – Lines 21-24 The authors should include a sentence or two here why distribution analysis is essential. In addition, the authors should clarify what they mean by “distribution” analyses. Are distribution analyses the same thing as water balance analyses?
5. Page 6 – Line 10 and 11. The sentence starting with “This paper presents” is superfluous and should be removed.
6. Page 8 Within the modeling setup description more detail is needed about the quasi-two-dimensional cells. Specifically, how were the cell extents defined and what elevation data were used to define the cell volume?

7. Page 12 Please quantify what the authors mean by “high dikes”.
8. Page 19 – Line 1 Please use consistent terminology to describe the modeling scenarios (i.e., S1, S2, and S3)
9. Page 20 – Line 4 A space is needed between “(over) compensated”.
10. Page 21 – Lines 13-15 As worded, these discussion points seem in conflict with bullet point three in the conclusion section. Please specify **where** future levee expansion or heightening will have little to no impact on WSELs (i.e., downstream of the levee constriction). In addition, raising the elevation for dikes would likely increase the WSELs for floods which would have a large enough magnitude to overtop the current levees. Unless, the levee constricted flow resulted in substantial channel-bed scour and consequently increase the channel’s flood water carrying capacity resulting in no change or possibility a reduction in the WSEL.
11. Page 21 – Line 19 Would cubic kilometers be a more appropriate unit for the estimated flood volumes here?
12. Page 22 – Line 15 A comma is needed - “In part, this”
13. Page 23 – Line 2 Is the estimated increase of the WSEL at Can Tho based off the modeling performed in this study or the work of Hoa et al., 2007. Please specify the source for this estimate.
14. **Page 23** - Line 7 and 8 The relative stability of discharge in the lower reached of the Hau River may be the **likely** explanation for stability of WSELs at Can Tho. However, it is not the only explanation unless the authors have bathymetric data showing there was no substantial changes in channel geometry (i.e., scour) between the temporal points of comparison.
15. Page 24 – Line 22 I believe the authors mean **hydraulic**, not hydrologic impact.
16. Page 23 – Lines 18 and 19 I recommend using cubic kilometers instead of cubic meters.
17. Page 25 – Lines 1 and 2 Again, this finding is consistent with hydraulic theory and not unexpected.
18. Page 25 – Line 3 and 4 It is not clear to the reviewer how continued levee expansion will increase flood risk across the entire LQX. Does the estimated additional 100 cm of WSEL include just levee impacts or the cumulative effects of levees, sedimentation, and sea level rise? Based on the discussion in lines 8 to 16 on page 25, I believe the authors mean continued levee construction will “likely exacerbate flood risk”. As this sentence is currently worded, it seems the authors are attributing the entire 100 cm of the anticipated increase in WSELs within the LQX to future levee expansion.
19. Page 25 – lines 6 and 7 It is not clear what the authors are inferring here. Are the authors suggesting levees are increasing river discharges or are the differences in discharge attributable to model uncertainty? While it is possible for levees to increase river discharges by reducing static and transient water storage through the confinement of flood flows to a levee-defined floodway, such an assertion should be laid out in the discussion section stating how this is theoretically possible.
20. Page 25 – Line 14 – Do the authors mean hydraulic modeling perspective? Hydrological models are not commonly use to assess levee impacts on WSELs.
21. Figure 5 – Abbreviations such as LQX should be defined in the figure notes or caption.
22. Figures 6 and 7 The y-axis units are confusing and not consistent with Figure 8. I recommend putting the units in meters or centimeters in all three figures.

23. Figure 9 – Reporting the water balance scenario differences in percent change would make these changes appear more substantial and not “radical”.