

Review of manuscript: *“Flood risk assessment due to cyclone induced dike breaching on coastal areas of Bangladesh”.*

Overview:

The paper presents a method for Probabilistic Flood Mapping in a very interesting case study area, finding areas of high-risk within the polder, based on developed scenarios. Some of the methods to reach these results are somewhat simplified, but do give a good overview to the single-case study, and have the potential to be applied in other locations.

However, I find the conclusions out of scope, and not in-line with what has been done in the study. Multiple grammatical and formatting errors, ambiguous figures, and a very unclear methodology and message all make the manuscript difficult to read, and major revisions are suggested before this work can even be properly assessed.

A comprehensive rewrite by the authors would allow for a more thorough review, and would benefit the article itself. It should be noted however, that enhanced clarity in the methods used are likely to raise more questions from a reviewer.

General Comments:

The main issues I have with the paper are as follows;

- **Methodology:** The methods used for calibration, breaching analysis and scenario development are all unclear and open to debate, but the biggest problem is the 1D2D model used. It is not described clearly, and as I understand it, models the sea in the 1D component. If this is the case, it requires a much better explanation and/or figures.
- **Message:** I find the message of the paper ambiguous. The discussion and start of the conclusion mention the dynamics of the case-study, which make sense as discussion topics. However, conclusions about flood forecasting and early warning systems seem out of place. Perhaps the potential development of PFMs for other polders is better suited to be discussed in the conclusions. Lines such as ‘end the problem of poverty’ should certainly be reconsidered.
- **English:** Multiple mistakes are found which distract the reader and give the impression of a careless approach to the work. In the specific comments below, only the ones found in the introduction are listed, but many more exist throughout the manuscript.

Specific Comments:

Abstract

- P1, Line 22: Presumably this second smaller abstract is not meant to be part of the main abstract. This is perhaps a formatting error during the upload process.

Introduction

- P2, Line 7: "...to protect the land from flooding due to diurnal high tide". The English here is incorrect. Either 'high tides' or 'the diurnal high tide'. Also, do the polders not also protect from the heavy rainfall mentioned just before this sentence?
- P2, Line 14: "Rising the crest level...". English.
- P2, Line 16: "Effect of...". English
- P2, Line 16: "Moreover, non-structural flood mitigation measures such as (...) and (...) is currently unavailable for the coastal areas of Bangladesh". English.
- P2, Line 23: "Furthermore..". This sentence suggests that SLR is not an effect of climate change. Did Mendelsohn et al. include this in their study?
- P2, Line 31: I cannot find where the variables of breach width, height and propagation are analysed in the study
- P2, Line 31: Scenarios mentioned only previously in abstract. Authors could consider a minor revision here

Study Area

- P3, Fig. 1: Upazilla term used in figure, but not explained in text. Presumably it is a form of district
- P3, Fig. 1: Would it be possible to indicate the extent of the mangrove forests?
- P3, Line 7: Who has classified this? The authors or a governmental body?

Methodology

- P4, Line 18: "...simulated using discharge as the upstream boundary...". What discharge? Is it important? Is it correlated to the cyclonic rainfall? Is it negligible in relation to the water level.
- P4, Line 29-30: "...and the location furthest from the dike breach is most sensitive." Given we don't (yet) know the locations of the breach or in which direction from the breach you mean, this is very ambiguous. You presumably mean in areas of low flow.
- Side Note: I think the numbers should continue throughout the article, not restart after every page. Perhaps this is an article format, if so, please ignore this comment.
- P5, Line 3: This paragraph about data gathering seems out of place, considering that data gathering was described before the previous paragraph about sensitivity analysis.
- P5, Line 6: Perhaps you should mention that the flood extent data from MODIS data was (presumably) used for calibration.
- P5, Fig. 2. Please indicate the Khaprabhanga river on the map

- P5, Fig. 2. As I understand it, the 1D component of the model stretches right around the polder, from the start of the Khaprabhangra river into the foreshore. Can you indicate the extents on the map?
- P5, Line 12: “For the rivers, the surveyed cross...”. You are presumably referring to the Andharmanik and Galachipa rivers on the east and west sides of the polders, but the previous sentence mentions only river. Please clarify this.
- P5, Line 13: I find the use of 1D channels to simulate the foreshore very irregular, and feel it deserves more explanation or references of previous methods. Are these channels connected to the river channels? Is discharge a factor? It is not mentioned
- P5, Line 14: 13 control structures are mentioned here, which are presumably the ‘Sluice gates’ indicated on the map. If they are, please use the same term, and also, why are 13 not indicated?
- P5, Line 16: “Therefore, the canal network inside the polder was not included in the 1D model”. The canals will have no effect on the dynamics outside the polder, but once flooding occurs they almost certainly will. I understand the DEM resolution will be too coarse to capture them, but this fact should be mentioned.
- P5, Line 19: Surely the foreshore data has no average slope?
- P6, Line 13: Are these storm surge heights directly applied as boundary conditions to the 1D model at every 1D cross-section location on the foreshore. I find this very difficult to understand.
- P6, Line 16: This seems out of place, perhaps more suited to the literature review earlier.
- P6, Line 26: Where is this section? As mentioned it should be in the map
- P6, Line 30: It was previously indicated that the breach geometry and propagation were variable in the scenario make-up (Abstract and Introduction). However in the end they are dependent on the other variables. This should be made clear
- P7, Line 6: Why not call the scenarios east west and central for simplicity?
- P7, Table 1: The SLR variation is based on current conditions and a possible future rise in 2100. This raises the question as to which period the PFMs that have been developed correspond. Perhaps it makes more sense to vary SLR for a given future moment according to the RCP scenarios. Also, the 1/25yr surge height used for the cyclone is presumably for current conditions, but as you explain earlier, this is subject to change.
- P7, Line 9: I don’t understand this. If flooding results from the 3 worst case scenarios are available, it surely means breach locations are already selected. So how does this allow for a critical breach location to be selected? Is this flooding from overtopping of the dikes?
- P8, Line 3: “...depth-damage curves from elsewhere.” This is explained later, but at this point the sentence is very ambiguous.
- P9, Line 5: “The critical location of breaching...” Why is this included here? It adds to my existing confusion about how these locations are selected.
- P10, Line 2: “we have assumed that the probability of occurrence of the hazard and the probability of failure of dike as the same”. Can the authors estimate the accuracy of this assumption? Presumably no flooding occurs (from overflow) of the dike in the simulations without breaching, but perhaps wave overflow would occur?
- P10, Line 4: I don’t understand the relevance of this reference, as all scenarios used in the study have the (assumed) same probability.

- P10, Line15: "...comparing the observed and simulated water level and discharge". As mentioned previously, you have not mentioned what discharges are being simulated, or what you are calibrating them to. Also if the cyclone water levels are applied as boundary conditions, surely the calibration is trivial?
- P14, Figure 7: Can the authors explain why the damage decreases for larger flood depths?
- P15, Line 6: Ignoring depths less than 0.5m seems quite extreme, can the authors explain why this was done?
- P16, Line 22: "Figure 4 demonstrates that the depth of flooding gradually decreases as the water moves inland". This is not true, the figure only shows inundation extent. Perhaps the authors mean imply.
- P17, Line 18: "... (Fig. 8). Therefore, although canals play a crucial role in the economy and social life of the area, they also increase the risk of flooding". This is a strange, and in my view, inaccurate conclusion. Figure 8 shows the residential areas as high risk because they are more valuable. They happen to be situated beside canals.