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Review and rebuttal of the paper

A case for elevating coastal roads based on experiences from Hurricane Katrina and the Tohoku Tsunami

Bricker

Editor handling the paper: Miguel Esteban

The reviewers remain anonymous.

Reviewer A:

Comment. Thank you for this further analysis. As rightly noted, benefit–cost ratios should reflect the potential reduction in annual expected damages following implementation of the measure—in this case, raising the US90. While the analysis highlights that the potential benefits (i.e., the reduction in expected annual damages) are estimated to be an order of magnitude greater than the cost of the intervention, it does not sufficiently account for the fact that a significant share of insured damages may be attributed to wind and rainfall rather than coastal flooding. This should be acknowledged, even if a strong benefit–cost ratio may still be achievable.

Moreover, to complete the analysis, the benefits should be presented as the *net present value* of the reduction in annual expected damages, discounted over the expected lifetime of the embankment enhancement. This step is essential for a proper benefit–cost evaluation and should be discussed.

Response

The reviewer is correct that the $13.6billion cited includes both wind and flood damage, and data to separate these do not exist. The reviewer also has a good point that it would be helpful to further compare net present value of EAD to construction cost. If we assume a 50 year lifetime (common for large infrastructure projects) and a discount rate of 3% (this is the FY2025 accepted discount rate for USACE BCA's Annual EAD of $1.1 billion over 50 years leads to an NPV of $28billion damages avoided. This has been added to the Results section.

"Over an approximated 50-year design lifetime for the embankment, and applying the USACE FY2025 suggested discount rate of 3% (USACE, 2024), this EAD leads to a net present value of $28 billion in damages avoided, more than 2 orders of magnitude greater than the construction cost of the embankment. However, it is important to note that this value includes damages from both storm surge and wind, and represents the whole state, so an additional county-specific, flood-damage-only analysis is carried out in the Discussion section below. "

Comment: Fig. 5.

Maybe point out what area is landside and what area is seawardside?

Response: Done.

Comment: Ok. How many meters of foreshore is there? Could this be mentioned?

Response: Google Earth shows 50–100m of supratidal beach, plus 100–200m of sub/intertidal bars.

Reviewer B:

Appreciate the authors addressing my prior comments. I've also confirmed that the differences in momentum between storm surges and tsunamis were concisely stated in Page 7. These two mechanisms are not necessarily comparable.

Response: Thanks for confirming. Please let me know if you suggest further revisions.

Elevating 130 km for $196 million still strikes me as quite inexpensive. Assuming this only covers fill materials, embankment,, and culvert etc, the true cost, factoring in asphalt, detours, and temporary structures, would surely be orders of magnitude greater. The Discussion section also refers to the costs that weren't included. Therefore, the emphasis on this being under 1% of the insurance value feels slightly excessive. If this short paper is intended to raise expectations for road raising as a flood defense, based on quite a basic analysis using existing literature, precise figures may not be necessary. So it would be better to say 'a few percent' or 'several percent' instead of strictly '1% or 2%' in Abstract.

Response:

The reviewer is correct that the cost is that of embankment construction only, not asphalt, detours, and other road construction costs. For this reason, the cost is presented as the additional cost that would be required when rebuilding the road after its lifetime, which would have to be done at some point in any case, when costs of asphalt, detours would also have to be expended. Nonetheless, the reviewer is correct that unexpected costs always appear, and contingency funds are necessary for these. Therefore, I have reworded the abstract as they suggest. In addition, the Results section states

"This number excludes the cost of the asphalt road itself, along with its base and sub-base course, or any traffic detours or temporary structure needed for traffic continuity, thereby assuming these costs would need to be expended in any case during periodic maintenance and reconstruction"

Minor comments:

– For better understanding, the locations of the photographs shown in Figures 3–7 should be indicated on Figure 1 (or Figure 2)

Response: Done. Thanks for the suggestion.

– 2. Methodology: The FEMA FIRM viewer used in producing Figure 2 should be briefly clarified in the Methodology section.

Response: Done. The beginning of the Results section now states “Photographs taken by the author, as well as a desktop review of published reports and the FEMA National Flood Hazard Layer (FEMA, 2025, which is a GIS environment for FEMA Flood Insurance Rate Maps), are used to evaluate the effect of an at-grade highway and an elevated railway embankment on damage to coastal Mississippi during Hurricane Katrina.”

– A space is required between the numeral and the unit (e.g., 2km on L36, 6m on L47 in Page 2).

Response: Thank you for noticing these. They have been corrected.