

Review of paper by Sanuy et al.: “Linking source with consequences of coastal storm impacts for climate change and risk reduction scenarios for Mediterranean sandy beaches”

Introduction

This paper presents an approach to integrated risk assessment for coastal areas with regard to storm impact on beaches (*i.e.*, flooding and erosion), considering climate change. Two case studies are presented from the Mediterranean Sea, one from the northern Spanish coast and one from the Italian coast in the northwest part of the Adriatic Sea. The methodology employed involves simulation with deterministic models for a fixed number of storm scenarios, subsequently being generalized to involve a probabilistic approach using Bayesian statistics.

Overall Assessment

The paper presents an interesting and potentially useful methodology for estimating the risk associated with storm impact in coastal areas. It is in general clearly and well written; however, the paper is rather long and “wordy”, presenting a lot of detailed information not really needed. On the other hand, certain aspects of the study should be discussed and explained more.

In summary, the following weaknesses of the paper should be addressed: (1) reduce the length of the paper by eliminating detailed results from the study sites; (2) expand the discussion on how coastal managers may use the results of the proposed risk assessment in their work; (3) motivate the selection of models in the approach; (4) discuss the importance of other factors influencing long-term coastal evolution not considered in the approach; (5) clarify the discussion of the methodology and concepts used; (6) comment upon the effects of antecedent morphology and chronology of forcing; and (7) explain the description of beach response to sea level rise.

I recommend that the paper is accepted after major revisions.

The general comments are given in more detail below followed by comments to specific points in the paper.

General comments

The authors are requested to address the following comments of a more general nature:

1. **Reduce the length of the paper by eliminating detailed results from the study sites.** The paper is rather long and could be shortened by cutting some of the detailed results from the two study areas. The results from these areas are interesting mainly as an illustration of what the methodology can produce; the specific values are of little interest to the readers in general. Thus, many of the figures 10-18 can be eliminated without loss of information.

2. **Expand the discussion on how coastal managers may use the results of the proposed risk assessment in their work.** The discussion section is very good and informative, indicating strength and weaknesses of the methodology. However, I would like to see the authors present more of their thoughts on how managers can use the results coming out of the proposed risk assessment and advantages compared to how things are done presently. Also, are coastal managers ready to grasp this type of information, especially when it involves probabilistic concepts? In the end risk levels are presented in a qualitative manner through different categories. Would it be possible to be more quantitative?
3. **Motivate the selection of models in the approach.** The basis of the methodology is deterministic simulations that are employed in a probabilistic approach through the Bayesian model. What was the reasoning when selecting the present deterministic models, which are rather detailed and time-consuming to run? Could simpler models have been employed for which many more simulations could have been made? How was the balance selected between the deterministic and probabilistic parts of the approach?
4. **Discuss the importance of other factors influencing long-term coastal evolution not considered in the approach.** The approach focuses on the impact of storms, specifically flooding and erosion. However, storms are only one of the many factors controlling beach evolution. On some coasts storms will be the primary drivers of beach change, but quite often other processes, such longshore transport gradients, sediment input from rivers, and subsidence, must be included to determine how the beach evolves over longer time periods. Typically there is a coupling between longshore and cross-shore processes that needs to be taken into account in estimating beach evolution. Add some discussion.
5. **Clarify the discussion of the methodology and concepts used.** The paper is rather clear on the methodology, but sometimes it is a bit difficult to follow and the sentences become long and affected by jargon. I also have a bit of a problem with how the source-pathway-receptor model is translated to the storm case. The storm is the source and erosion/flooding is the pathway; this seems a bit different (and less logical) from the experience I have in looking at pollution transport. Anyway, maybe the writing about and motivation of the schematization could be made a bit clearer. Also, although abbreviations make things a bit easier, if there are too many it is difficult for the reader to remember all of them.
6. **Comment upon the effects of antecedent morphology and chronology of forcing.** Morphological response are very much a function of the antecedent conditions as well as the chronology of the forcing, especially when it comes to storms. For example, if a large storm is followed by a similar large storm the second one will cause much less erosion. Thus, looking a storm impact as individual events will cause some limitations in terms of the impact assessment. Please add some discussion on this.

- 7. Explain the description of beach response to sea level rise.** The response of a profile to sea level rise requires some assumption about the evolution of different morphological features, for example the dune (e.g., will the dune grow to its pre-SLR shape?). Some additional discussion on the assumptions made in this respect would be interesting.

Specific comments

In the following specific comments are given to the paper (L = Line number; P = page number).

P4, L14

“wave-induced run-up” Includes wave setup? Any consideration of duration with regard to having water at a certain location?

P5, L19

“thresholds” How sensitive are the methods to the selected thresholds? Were this selection based on impact or purely on the forcing properties (offshore wave conditions)? The probability of extreme events with regard to the former and the latter are typically different.

P8, L18

“XBeach model” How good was the calibration/validation?

P9, L14

“intersecting” Meaning in this context?

P11, L16

“footprint” What is this?

P12, L14

“a directional change” But the wind did not change, right (L3)? What is causing this.

P13, L14

“winter dune” What is this?

P18, L18

From here on some of the figure numbers are wrong. Please check.

P18

Some of the DRR measures taken seem to increase the risk. What is the explanation/logic behind this? Does it mean that the characterization of impact is not proper?