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Natural Hazards and Earth System Sciences
Discussions



# *Interactive comment on* "Probabilistic characterisation of coastal storm-induced risks using Bayesian Networks" *by* Marc Sanuy and Jose A. Jiménez

**Anonymous Referee #2**

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I have reviewed the manuscript entitles 'Probabilistic characterisation of coastal storm-induced risks using Bayesian Networks' by Sunay and Jimenez.

Overall the article is very well written and of high quality. It presents a new framework/approach using the SPRC framework to examine coastal vulnerability to erosion and inundation at an area within the Spanish coastline exposed to Mediterranean storms. The methodology uses Bayesian Networks to take the SPRC inputs/outputs to create a probabilistic outcome of risk assessment. I believe that the article is well within the journals scope and will be of interest to the readers. However, I believe some changes are needed and points clarified as detailed below.



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General comments: Unclear to me the reasoning behind running XBeach on the scenario cases for 5, 10, 20 years? As you've just done a linear retreat of the shoreline/profile and there is no account for changes in storminess or SLR [L482-485], are the results not just XBeach present day + retreat (Where a retreat is limited by hard structures such as seawalls)? I was a bit confused on how you did the retreat as well for the cases where structures were present. My general understanding is that a linear retreat (at all elevations) was done which essentially translated the profile intact. If the profile reached a structure, the landward translation stopped at that elevation, but the rest of the profile was allowed to continue to retreat? Or no? Figure 5 suggests that is not the case but it's not clear what was done? In reality, I think if it ran into a structure (like a seawall) the lower elevations would erode more than the linear trend as there would not be the sand from the land to compensate.

Data independence: I have several questions around data independence that I'd like to see addressed. First, while the data set is 60 years long, there are 179 independent storms (43 of these are multi-peak storms). It's not clear to me (from an erosion sense) why you'd split these 43 up into multiple storms to augment your data set to 237 storms (Which is still quite small in terms of BNs). Similarly, on L 155-160 it's again described about the multi-peak storms where a single multi-peak storm is run and the outputs from the cumulative are saved, but also those of the 'first peak' (but the cumulative output after each peak is saved?). Should (ii) not be the peak of each 'sub-peak' in a multi-peak storm and should the output not be the volume (for example) between the 2 peaks, rather than the cumulative over the full event? As an aside - Your wave height cutoffs (98 and 99.5%) are also quite high, so you could lower these and get more smaller storms (say the 95% level – see Masselink et al).

Second, my understanding is that inputs to the BNs are meant to be independent, so closely spaced receptors which are highly correlated shouldn't be included. I couldn't find details on the spacing of the receptors, but they don't look spatially independent to me (Eg. Fig 3). Beuzen et al. (2019 – JGR) I think discussed this and found

the alongshore spacing allowed where correlations dropped off (This would be site specific but in his case it was ~500m I think). So I suspect you've padded your BN with a bunch of data that's highly correlated which isn't best practice. Similarly, it's not best practice (And I think even discouraged) to augment your data by multiplying your synthetic cases by the number of storms that were in that bin (L144-146). I know it has been done in the past by others (including myself and I've learned from others this was incorrect) but that doesn't make it correct now. I appreciate you are wanting to keep the original distributions but I'm not sure there is a proper way to do this beyond running each case.

How probabilistic is your output? Your BNs (Fig 6 and 7) are quite complex and in some cases, highly discretised. This immensely increases the number of data points needed to ensure the priors are well represented. As the challenge is with much geophysical data, you look to have a lot of near empty bins in your outputs. How many of the relationships are really deterministic rather than probabilistic?

What's the difference between distance to public domain (Fig 7) and distance to beach (Fig 10-12)? I feel they must be similar if not the same so why not use the same classification and binning for the 2?

Specific Comments:

[L74]: 'were' should be 'where' in: "study area were"

[L204]: "Risk to life was also been" should be either 'Risk to live was also' or "Risk to life has also been"

Fig 5 - can you tell the reader what section these are in and the erosion rate used?

[L355] "affecter" should be 'affected'?

[L341] "front a of a" should be "front of a"

[L427] "relation" should be "relationship

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