RESPONSE TO REVIEWERS – *nhess-2019-159*

13 September 2019

Dear Editors –

We thank you and the two reviewers for your time, and for the opportunity to revise this submission. Here we offer detailed responses to the comments made by both reviewers (whose remarks are *italicised*).

Sincerely –

Eli Lazarus (E.D.Lazarus@soton.ac.uk)
Scott Armstrong

REVIEWER #2 (JLT) Comments

Page 4-Line31: . . . that tracks the vulnerability associated with beach width (Vbw) and beach nourishment (Vbn)...

Corrected.

Page 5-Lines 5-10: Equation (3) suggests that Vbw is equal to 1 when x=xo. Is 1 just an arbitrary value? If this is the case, I suggest the authors clarify this in the text. Additionally, the authors normalize Vbw by the min and max of Vbw (as we can see in Figure 3 and 6, for instance). Being this the case, would it be easier to write the normalized expression as Vbw = 1-x/xo?

We have corrected Eq. (3), and clarified that V_{bw} is a normalised value.

Page 5-Line 7: . . . in 1970 all counties had the same beach width (x). . .. The use of "x" in this case might be misleading. I believe "x" is the beach width at any point in time, not just in 1970.

Corrected (by deleting reference to *x*).

Line 15-20: I suggest the authors include the equation used to calculate Vbn. Including this expression will also help to better understand lines 20-32 in the results section (page 7).

We have added a new Eq. 4 (P5, L25) to show the expression we describe.

Additionally, I suggest the authors better explaining why as beach nourishment volume and frequency increases, the vulnerability of a coastal community increases. I can see why this is the case, but it might not be intuitive. Is it perhaps due to the community becoming dependent on such practices, which in turn depend on the availability of a limited resource?

Addressed with new text and citations at P7, L1.

The new text (in blue) reads:

"Like a ratchet, the cumulative beach-nourishment factor (V_{bn}) increases each time a county nourishes. This assumption represents the fact that nourishment projects for

shoreline protection (as opposed to reactionary projects for emergency storm response) are cyclical within multi-decadal programmes (NRC 1995, 2014). Nourishment at a given site rarely occurs only once. A community that initiates a nourishment programme will likely depend on periodic nourishment into the future. By comparison, the beach-width factor (V_{bw}) is more dynamic, reflecting the oscillatory behaviour of a nourishment cycle at multi-annual time scales by dropping to a minimum after a nourishment project (as the wide beach buffers property from hazard) and then increasing as the nourished beach erodes and coastal properties become more susceptible to hazard."

Page 7 – Line 15: Would it be useful to mention here that the shoreline erosion rate predicted by bathtub models often underestimates the natural rate of erosion? This is particularly the case in barrier island environments, which are quite common in the region of study included in this manuscript.

We have added this caveat and an appropriate reference at P4, L15, and at P7, L31:

Our estimation is effectively a "bathtub model" of change, controlled only by topography with no incorporation of wave-driven sediment transport or other shoreline dynamics. Bathtub models tend to underpredict shoreline erosion rates in wave-dominated, sandy barrier settings, such as those of the US Mid-Atlantic (Lorenzo-Trueba and Ashton, 2014; Wolinsky and Murray, 2009).

The alongshore mean rate derived from sea-level rise shows close agreement with the mean "recent" shoreline-change rate, suggesting that our simplified "bathtub" representation of hazard is a reasonable proxy on a multi-decadal time scale (Fig. 5), even though bathtub models tend to underestimate shoreline erosion rates along barrier coastlines (Lorenzo-Trueba and Ashton, 2014; Wolinsky and Murray, 2009).

Page 7 – Line 18: . . .we ranked each county by its risk. . .

Corrected.
