Earth Surf. Dynam. Discuss., 1, C675–C681, 2014
www.earth-surf-dynam-discuss.net/1/C675/2014/

Earth Surface Dynamics Discussions

Interactive comment on "Assessing the natural morphological sensitivity of a pinned, soft-cliff, sandy coast to a changing wave climate" *by* A. Barkwith et al.

A. Barkwith et al.

andr3@bgs.ac.uk

Received and published: 20 February 2014

The authors of the paper would like to begin their response by thanking the referees for taking the time to evaluate the article and for producing constructive comments and suggestions, it is very much appreciated.

We would also like to note that this paper is related to another paper recently submitted to the same journal (Barkwith et al., Earth Surf. Dynam. Discuss., 1, 1127-1149, 2013), where this study was extended to examine the influence of sea wall defences on coastal morphology. The difference between the two papers is in the questions which they are trying to address. This paper (without sea walls), studies the influences

of wave climate on a future, natural, evolved morphology, while the follow-up paper addresses the influence of engineered structures on this evolution. The authors would like to maintain the separation of the two studies into two separate papers; however, to highlight the link between these two papers we suggest an amendment to both of the paper titles (to be agreed by the appropriate editors):

Coastal vulnerability of a pinned, soft-cliff coastline, I: Assessing the natural sensitivity to wave climate [this paper]

Coastal vulnerability of a pinned, soft-cliff coastline, II: Assessing the influence of sea walls on future morphology [other paper]

The majority of this author response is aimed at addressing the concerns of the first reviewer (RC C397), however we will also incorporate the edits suggested by the second reviewer (RC C436) into the revised version of the manuscript. The specific reviewer comments, which together represent the major concern of reviewer 1 (RC C397), are broken down into sections and addressed individually.

---

1. "P858, L18–19 – "Previous work has shown that changing the distribution of wave approach angles can change the shape of a sandy coastline. . ." Are these the most appropriate / specific references for this statement? The Slott et al. (2006) reference makes sense, but the analysis in McNamara et al. (2011) involves a hazard-mitigation element that is irrelevant to the purposes of this paper. Use Ashton et al. 2006a instead?"

These references were selected to be the most appropriate for this statement, and although the McNamara et al. (2011) study involves a hazard-mitigation element that is not relevant to this study, their approach is still worth highlighting. A recently released paper, Moore et al. (2013), includes the same wave-climate and coastline-shape-response analyses as McNamara et al. (2011), but also features observational

support and no shoreline stabilisation. We suggest that this paper replaces the McNamara et al. (2011) study in the text.

Moore, L. J., McNamara, D. E., Brenner, O., and Murray, A.B., 2013. Observed changes in hurricane-driven waves explain the dynamics of modern cuspate shorelines, Geophys. Research Lett., 40, 5867–5871, doi:10.1002/2013GL057311.

———

2. “P861, L16 – "Due to uncertainty. . ." If there is so much uncertainty in predictions of what the North Sea wave climate will look like in the future, then why not use a longer (more inclusive) record of wave data? Similarly, at P865, L4–10, I’m not sure that two years of wave data is "a truer representation" of the wave climate just because the data are relatively recent. I suggest the authors clarify their justification for forcing the CEM with only two years of wave data. I suspect the answer has something to do with the fact that if these two years are generally representative of the North Sea wave climate – and are they? – then the data are sufficient for baseline probability distributions of wave height and incident direction, which the authors then manipulate anyway to create an ensemble of hypothetical future North Sea scenarios.”

The authors are currently working on alternative ways to generate long term synthetic wave climates from shorter periods of observed data, however this work is still in its infancy and therefore not suitable for this study. The two year record used was the longest offshore wave dataset available for this section of the UK coastline. We highlight the caveats of using such a short dataset as a baseline in section 6.4. By forcing the model with an observed dataset, as opposed to a synthetic dataset produced using a four bin PDF, a greater resolution in the incoming wave angles can be achieved, which allows the finer intricacies in the offshore wave climate to be captured. By increasing the number of PDF bins and extending the wave record back in time using an average North Sea wave climate, this finer scale may be captured; however, due to the basin characteristics, the North Sea has a highly heterogeneous distribution of wave

climates which will not be characteristic of the Holderness coastline. To address the comment, we will include these justifications at this point in the revised manuscript and remove the “Due to uncertainty” introduction to this sentence.

———

3. “P865, L11–18 – The final paragraph of the Methods section seems divorced from the discussion of wave climate in Sections 2.2 & 2.3, and is less clear by comparison. Merge or integrate these considerations of wave climate? Changes here may follow from the comment above.”

As these seem a little disconnected we shall integrate these considerations of wave climate into the revised manuscript.

———

4. “PP866–870 – This section, from the paragraph beginning with "Lithological and shoreline properties. . .", and the entire Results section that follows is especially unclear. The paragraph breaks do not seem natural, which usually means the weight-bearing topic sentences are buried elsewhere. Making the passive voice active might also help simplify the steps and logic throughout. (For example, consider the sentences framing P867, L13–14, ". . .changes to the coastal morphology and the sensitivity of coastline to change are appraised.") [.]”

We will restructure these sections as suggested by the reviewer, excavating the weight-bearing topic sentences, and making the passive voice active.

———

5. “The explanation for wave-climate permutations need to be cleaner for the results to make sense. I found the term "rotation" confusing. I understand that the authors are rotating their wave roses, but some mentions of rotation read like changes in wave-angle incidence related to refraction. This ambiguity should be moot, given that there is no explicit refraction in this model. On the other hand, refraction is implicit in the

arguments behind shadowing and the relative angle between shoreline orientation and incident waves. If the authors can be even more clear that it's the orientation of the entire wave climate that they're adjusting, I think that would help."

This point has been noted, and as a result we shall highlight that it is the orientation of the entire wave climate that we're adjusting during the progression of each simulation.

———

6. "Likewise, "relative erosion" – and what it illuminates that absolute erosion does not – needs to be clarified: "relative" with respect to what? The 2010 shoreline planform? I found this part of the calibration and results difficult to understand."

The relative erosion relates the erosion of each ensemble member to that of the baseline simulation. This is alluded to in PP868, L23-24, however we shall clarify this in the revised manuscript.

———

7. "PP871–874 – Much of the Discussion (Section 6) reads like Results (Section 5), perhaps with the exception of Section 6.2. Reorganise Section 6 in concert with the overhaul of Section 5?"

As with point 6, we will restructure these sections as suggested by the reviewer.

———

8. "P874, L3–9 – The effects of "heterogeneous" versus "homogeneous" in this paragraph are muddled. I think the authors mean that different (heterogeneous) rock types have different properties (e.g., erodibility), but units of a given rock type are internally homogeneous?"

These will be corrected in the revised manuscript.

———

9. "P875 – Conclusions have inherited all the confusing elements of the sections they draw upon. In revision, as the Results and Discussion change, amend the Conclusions in kind? I think it is especially important to clarify L21–23, which seems to me a punchline that deserves emphasis."

As with points 6 and 9, we will restructure these sections as suggested by the reviewer, adding greater emphasis and clarity to L21–23.

———

10. "P875, L24 – These implications-despite-caveats are unclear. Simplify?"

To simplify/clarify the statement, we will replace the aforementioned sentence with the following in the revised manuscript.

"It is recognised that representation of coastal defence structures within the simulation would alter the morphological characteristics."

———

11. "In general, the revision needs a careful proof. See "propergated" (P865, L12); tense agreement (P868, L5); erosional" (P869, L15); "lead" (P876, L10); and other examples. Verb tense. the work happened, but the experiment results still stand. This version of the manuscript includes a mix of present and past. Employing past tense in the conclusions to state that something "has been explained" in the preceding discussion is confusing."

Again, these will be corrected in the revised manuscript.

———

12. "I wonder if the authors would consider including a brief discussion of log-spiral bays, of which the coastline south of Flamborough Head is a neat example, and for which this CEM provides a neat explanation. (I'm aware of a Coastal Sediments '07 proceeding by Littlewood, Murray & Ashton: "An alternative explanation for the shape

of 'log-spiral' bays". These proceedings are available online via Google Books.) I think highlighting this connection to a classic morphology might help extend the relevance of these results to a wider range of coastal settings, and embed the work, despite its spatially explicit focus, in the context of fundamental research."

The CEM can, and has, been used to simulate a wide range of classic coastal morphologies. We will add a brief explanation of log-spiral bays into the manuscript, although not in great detail, as this study does not focus on millennial scale processes which created the log-spiral shape.

Interactive comment on Earth Surf. Dynam. Discuss., 1, 855, 2013.