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Earth Surface Dynamics Discussions
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# *Interactive comment on* "Complex coastlines responding to climate change: do shoreline shapes reflect present forcing or "remember" the distant past?" *by* Christopher W. Thomas et al.

**Christopher W. Thomas et al.**

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Reply to the anonymous review We are very grateful for the positive, helpful and insightful review. We have noted and corrected the typographical errors. We have addressed the specific points raised by the reviewer below. With regard to the responses to certain comments, the text has been amended in several places in the ms, so it is difficult to paste in revised text here. We hope that the responses address the points raised by the reviewer. We have appended revised versions of figures 3 & 6.

1. Characteristic timescales varying with the square of the aspect ratio

The proof of the scaling relationship is referred to in the third paragraph of section



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4.2. The results that show this relationship are given in Table S1 in the Supplementary information.

2. Confusion over the run lengths of the models in the caption to Figure 3. We have reviewed the caption to Figure 3 and have made some amendments to this and the text (Sections 3.3 and 4.1) which hopefully clear up any ambiguities. The spin up time is stated as 250 years (not 100 years). The second sentence in the caption states that the figures in the second panels (a.ii, b.ii) show the coastlines 200 years and 750 years after the wave climate was changed at 250 years. 750 years should be 500 years. We have amended Figure 3 accordingly.

3. Referring to gradients in fluxes: If we understand the reviewer's comment correctly, it is the gradients in the fluxes that are important here, and their direction, as these dictate where erosion and deposition take place – the divergences and convergences in flux are the gradients. If the sediment flux was uniform over some distance (i.e. no gradient), there would be no erosion or deposition over this distance, since there would be no local loss or gain of sediment. The gradients indicate how the flux changes alongshore and, therefore, how and where the coastal morphology will change. However, we have amended the text slightly hopefully to amplify/clarify this point.

4. '. . .timescale of many centuries. . .': We could have run models for longer, but in this paper, we wished to emphasise the marked difference in the timescales of morphological response of capes and spits. In addition, we ran the models over a sufficient time to help us explore characteristic timescales for change. Given the other variables that affect timescales (wave energy, shoreface depth, etc), to which the reviewer refers elsewhere, we did not feel it necessary to be more specific about the ultimate timescales over which a spit might be smoothed compared to a cape.

5. Equation 1: partial differential symbols: The reviewer is correct that these should be partial differentials, since y is f(x,t). In quoting the equation from Ashton & Murray (2006a) we had simply followed their style. We have amended Equation 1 to show

partial differential symbols. We have aimed to clarify y as the cross-shore position at long-shore position x at time t.

6. Line 22: net diffusivities: the text has been amended to clarify this.

7. Equation 3: we have amended the text to clarify that this equation was derived by Ashton & Murray in their 2006 a&b papers.

8. Timescale variations with wave height and shoreface depth: We feel that paragraph 3 of Section 5.2 acknowledges this point sufficiently.

9. Significant wave height is now explicitly stated.

10. Wording amended to clarify.

11. 'reconnected spits' changed to 'sand-waves' and reference made to the U,A phase space in Figure 2.c.

12. Page 8, line 22: corrected – this should have been net flux, Qs

13. 'The fluxes are proportional. . .': we have endeavoured to clarify this point in the text.

14. We have considered Figure 6 and reviewed at some length. We have revised the way we have plotted the data in this figure and added an extra panel which shows the gradient of the difference in the net fluxes generated by the two different wave climates, in order to emphasise the contrast in fluxes. This is augmented by additional explanatory text that hopefully clarifies the differences in the mechanistic responses of capes and spits to the changed wave climates.

15. See the comment above. It is the way the gradients in the fluxes vary over the critical parts of the spits and capes that is key to the difference in the response of the two morphologies, hence the additional panel in Figure 6. The caption has been amended accordingly.

16. The range in values in Figure 6b is necessary as the differences in the Q values do exceed 300.

17. It is not clear that any change is necessary here. Yes, a morphology could be in quasi/dynamic equilibrium with the current wave climate; this possibility is discussed earlier in the paper, where we note that the critical thing is the rate of rate of wave climate change compared to the 'ability' of a coastline morphology to respond. However, we simply re-state that this equilibrium should not be automatically assumed. This can now be tested to a first order, using the approaches we have outlined.

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Figure 3

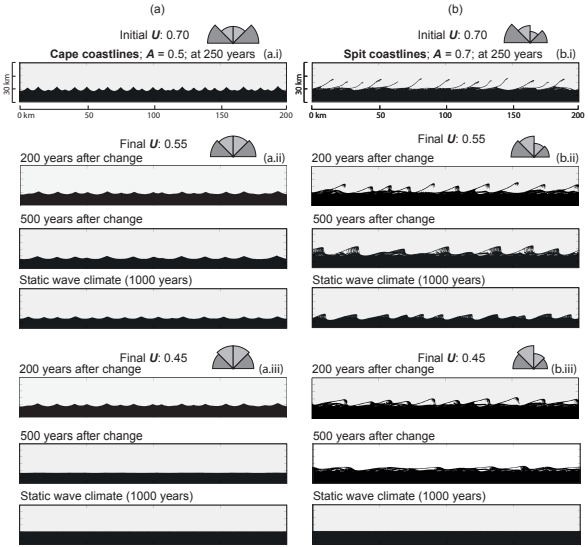


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**Fig. 1.**



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Figure 6

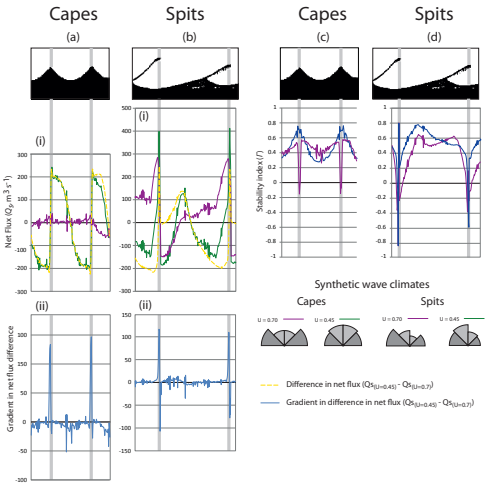




**Fig. 2.**



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