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Earth Surface Dynamics Discussions

Interactive comment on "Emerging crescentic patterns in modeled double sandbar systems" *by* Giovanni Coco et al.

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We thank Reviewer 1 for the constructive comments. Our reply to each comment is shown below.

* Abstract: The sentence "For intermediate differences between the two sandbars depths, patterns on both longshore bars appear to be fully coupled" was quite unclear to me before going through the manuscript, and it should therefore be slightly rephrased as by "fully coupled" the author mean something more like the 2 bar patterns grow at a similar rate.

-> Done. It now reads: "For intermediate differences between the two sandbars depths, patterns on both longshore bars appear to be fully coupled (similar growth rates and

strongly correlated pattern shape)"

* Introduction: This is a very nice section providing background on coupling patterns. I think, however, that the authors should make clearer that nothing has been done on the influence of the distance between the bars, and crest depth difference (although for the latter it is tentatively said), in other words, the authors may put more emphasis onto what is new in their contribution. I was not comfortable with the use of the word 'geometry' in this section. To me the sandbar geometry refers to the barline (2D horizontal) and does not include depth, I would rather talk about 3D morphology, but I am not English native so my comment may not be relevant.

-> The comment is relevant. We have changed "geometry" for "3D morphology". We have kept "geometry" when dealing with the 2D cross-shore profile only.

* The authors should also refer to the work of Garnier et al (2013, GRL) when dealing with bar straightening under obliquely incident waves.

-> We added a reference to Garnier et al (2013) in the sentence were we discuss the role of wave obliquity in sandbar straightening.

* I also recommend to indicate that the authors will stick to shore-normally incident waves in the last paragraph of the introduction section.

-> The text has been modified to state, in the last paragraph of the Introduction, that the hydrodynamics is forced by shore-normally incident waves.

* Numerical Model: Please double check all notations: for instance L142 zb is not the mean sea level (zs in eq (1)) but the mean seabed elevation, h in eq(12) is not defined it should be the bathymetric perturbation (deviation from the basic state). It would be nice to add a short paragraph with the equation of the perturbation and indication of how \tau is computed (why referred to as growth time rather than e-folding time in most papers?). I understand that this is given in earlier papers, but that would help the reader to have a standalone paper.

-> Motivated by the comments of the reviewer, we have rewritten the description of the variables at the beginning of the section and revised the rest of the notations. At the end of the section, the linear stability analysis is now also described very briefly.

* Results: * I encourage to modify Fig. 4 to improve readability of arrows and perturbation with for each mode the left-hand panels water depth with iso-contours and right-hand panels perturbation h (not contoured) with currents. Please also indicate the time at which the different bathymetries have been plotted.

-> The figure has been modified in line with the recommendations of the reviewer. Since this is a linear stability analysis, it is not proper to refer to a time in which the different magnitudes are plotted but to the amplitude of the disturbances. To facilitate the visualization of the modes, the plots have been made for an arbitrary bottom perturbation of 0.5m. The size of the velocity vectors has also been adjusted to facilitate the visualization. The maximum velocity is indicated for each of the graphs. Figure 4 and the corresponding figure caption, which provides information on the amplitude of the bottom perturbation, have been modified in the manuscript.

** L198: “When the coupling between sandbars is obvious” I guess that the authors used some kind of more or less objective threshold in terms of ratio of perturbation amplitude at the inner and outer bar to discriminate between “obvious” and more “subtle” couplings, please clarify.

-> In the submitted manuscript we used our judgment to indicate if a sandbar was dominant or if the pattern was coupled. Stimulated by the reviewer we have looked at perturbation amplitudes and realized that our “judgment” is extremely similar to a more objective criteria. If the amplitude of the perturbation of one of the sandbars is over 80% larger than the amplitude of that in the other sandbar, we consider that only the sandbar with largest perturbation amplitude will develop into a crescentic sandbar. If the amplitude of either the inner and outer sandbars is between 40% and 80% larger, that sandbar will dominate the coupling. If the difference in the amplitude perturbation

is below 40%, the two sandbars are considered to be fully coupled. Similarly, if the amplitude of the perturbation close to the shoreline is at least 20% of the largest amplitude, we consider that also the shoreline is unstable. Using the above approach, results (and figures in the manuscript) change only slightly. We have adopted the new approach, and modified the text and changed the figures (results are essentially unchanged). The approach is presented in lines 203-209 of Section 3.

** L200: the same applies here, did the authors use a some kind of threshold in term of perturbation near the shoreline, e.g. at a given basic state iso-contour ?

-> See reply above

*Discussion: * Dealing with the limitations of the study is half of the discussion, I advises lightly to shorten the limitations, which should start as a new paragraph L270, and/or extend the first part of the discussion

-> We would really like to keep all the limitations we discuss as many readers might not be familiar with linear stability analysis.

* In the limitations part, the authors may add a couple of sentences on the fact that coupling at half of the outer bar wavelength (Castelle et al., 2010b) cannot be reproduced here.

-> This has been added in the Discussion. The new text reads: “Since the present model is linear, the concept of coupling is limited to the initial morphological formation and, since linear stability analysis focuses on the fastest growing wavelength, coupling at half of the outer bar wavelength cannot occur.“

* My own ’empirical’ knowledge of double barred beaches I’ve been to along different coasts is that out-of-phase coupling is much more common than in-phase coupling, this also applies to shorelines and bar coupling along single barred beaches. The results here indicate the couplings are about equally distributed between in-phase and out-of-phase. I do not necessarily ask the authors to discuss this, because my qualitative

observations may be biased and they may not think the same, but I am curious to know what the authors think about the coupling type predominance and potential mismatch with model outputs.

-> The observation from the reviewer is certainly relevant. Figure 7 shows that, for mode 1, when the outer bar dominates over the inner bar the coupling is out of phase. It is only when the inner bar dominates that we observe in-phase coupling. To draw a conclusion about the predominant configuration, many more cross-shore profiles should be studied so that results can be more easily generalized.

* Technical corrections: * The authors may consider adding 'linear stability analysis' and/or 'under shore-normally incident waves' in their title.

-> The title now reads "Emerging crescentic patterns in modeled double sandbar systems under normally-incident waves"

* The paper is written in very good English, however there are a few typos here and there (L116 missing bracket, remove comma at the end of equation (6), add '.' before

-> Done

* 'Following' L147, uncapitalize 'X' of the 3 top \Delta X in Fig. 8, idem in Fig. 7, ...) and recommend a very last proofread.

-> Figures 5, 7, 8 and 9 have been modified so that only Delta x (lower case) appears throughout the manuscript.

* Remove or increase label size in Fig. 6 (cross-shore/longshore distance, isocontours)

-> The authors agree on the difficulty of reading both the labels and the arrows. For this reason only the isobaths are now shown in the figure.

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