

## ***Interactive comment on “The role of the reef-dune system in coastal protection Morelos (Mexico)” by Gemma L. Franklin et al.***

**Anonymous Referee #3**

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The manuscript presents a numerical study on the role that a reef-dune system plays in protecting a given coast from storms. The case study of Puerto Morelos, Mexico has been selected to this end. The study illustrates the importance of a holistic management of the coast (considering the reef and dunes as part of a single system) in order to maximise the protective service obtained from ecosystems, which is very relevant in the context of coastal developments, climate change and other factors that compromise the stability of such habitats. Therefore, the paper may potentially be very useful to policy makers, engineers and scientists concerned with a sustainable management of the coast. However, the study also presents some significant weaknesses that should be amended before publication of the manuscript is advised. Please find below a list of points –in decreasing order of importance- that should be addressed by

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the authors before I can recommend publication of the present paper in NHESS.

1. A good portion of the manuscript is devoted to the validation of the model (SWASH) against laboratory data, after which the authors conclude that such a validation justifies application of the model to the field case study. The problem with this line of reasoning should be evident and weakens the paper significantly. The numerical model SWASH has previously been validated (extensively) against laboratory experiments, so this section in itself does not add much to the present study. What one would expect instead is a calibration/validation of the model against field data from Puerto Morelos (the site selected for this research) before carrying out the rest of the study. If such data were not available, the manuscript should probably be reformulated as a more theoretical study and all necessary assumptions (e.g. on bed friction coefficients) should be justified.

2. The authors confess (e.g. page 9 line 30) that changes in reef roughness are important, but yet have not been considered in this study. Understandably, some assumptions need to be adopted (such as 1D approach, which may miss many important real 2D phenomena, but is a good first approximation), but variable reef roughness for degraded scenarios does not seem to be particularly cumbersome to include in the simulations. Hence, I would recommend that the authors either include variations in reef roughness for different degradations scenarios or justify why this has not been done.

3. In line with the previous point, study of the effect of a degraded sand dune, by means of a modified dune height, is an interesting aspect of this study. However, I wonder about the validity of the conclusions achieved regarding flooding (storm impact) when the sand dune has been reduced in height but considered non-erodible during the simulation. A discussion on how this assumption affects the conclusions would be valuable. Ideally, inclusion of morphological evolution of the dune/beach profile in the study of protective services provided by the reef-dune system would significantly strengthen the point made by this article (according to the authors themselves; page 9 line 28).

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4. The paper could be written in a more concise manner by avoiding excess of uninformative or non-relevant details all throughout the manuscript (especially true for Section 2).
5. No reference is given for the adopted projections of reef erosion (page 7 line 15).
6. I am not sure all figures are very useful or transmit their message in a clear way. For example, Fig 3 could be transformed into a statistical measure of the goodness of fit between model and experiments. Similarly, Fig 7 is not very informative – the y-axis could probably be presented as the percentage increase/decrease in Ru2% with respect to a reference case (e.g. current profile).
7. In general, the manuscript is well structured and written, but is not completely free from typos and grammatically confusing sentences. A general revision of the writing is recommended.

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