

Interactive comment on “Changes in beach shoreline due to sea level rise and waves under climate change scenarios: application to the Balearic Islands (Western Mediterranean)” by Alejandra R. Enríquez et al.

Anonymous Referee #2

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This study investigates hydrodynamic conditions for two beaches in the Balearic islands and estimates the evolution of a shoreline proxy under different sea-level rise and waves conditions. The hypothesis of the study are clearly exposed and the topic is important. In particular, the authors attempt to assess the impacts of sea-level rise and changing waves conditions, which are usually considered negligible in many studies. I think it is relevant for NHESS and could be published with moderate revisions.

Moderate comments:

The study is first of all an hydrodynamic study: it assumes that the nearshore

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bathymetry is unchanged over multi-decadal timescales, and estimates how the position of an hydrodynamic shoreline proxy evolves with changing offshore conditions. The authors provide a justification to this modeling strategy in their conclusion. However, in practice, assuming no change in the beach morphology as sea-level rises appears as a very optimistic assumption. Some references in the manuscript support this statement,. Other suggested references: e.g. Ranasinghe et al. 2012, Climatic Change; Davidson Arnott et al., 2002, Journal of Coastal Research.

To justify their modeling choice the authors could say that they assess a minimum impact to be expected from sea-level rise and changing waves conditions, with the assumption that the sedimentary budget over these two beaches remains in equilibrium. Assessing minimum impacts of sea-level rise is useful for decision makers as it defines the minimum adaptation needs. Data regarding the evolution of these beaches over the last decades would be useful for the reader to understand this sedimentary context. Do the authors have access to historical aerial photographs that would allow to appreciate how the two sites have evolved over these timescales?

This study would also benefit from better explanations regarding the uncertainties: in particular, there are some confusions regarding the $\pm 1 \sigma$ uncertainties around median sea-level rise values for scenarios RCP 4.5 and 8.5. The authors interpret them as minima / maxima, which is not true, as there are difficulties in defining boundaries in future sea-level rise (so-called high-end and low-end scenarios). I suggest to revise this aspect, especially page 8 (line 20: RCP85 $\pm 1 \sigma$ is not a worst case scenario).

Some detailed comments follow. I hope these comments are useful.

Details: -Abstract: please note that the coastline generally refers to a marker such as the dune toe. Here, the authors investigate changes in a shoreline proxy: the limit of the swash. I suggest to precise in the manuscript which shoreline proxy has been chosen and why it is relevant in the context of Mallorca. I guess that the beach width is especially important for tourism (?). To support this discussion, Boak and Turner

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2004 (Journal of Coastal Research) would be an appropriate reference.

Line 30 page 9: "The justification of constant beach shape is largely justified by the fact that there are no significant changes in the energy flux in wave projections that may force a change in the shape due to oceanic forcing." I strongly advise to revise this sentence: with higher sea-levels and identical hydrodynamic conditions, the beach profile is expected to translate or change. I advise the authors discuss the literature dedicated to beaches equilibrium profiles and beaches morphodynamics. Another paper that could be useful would be Stive et al 2002.

Figure 12: the scale of this figure is not adequate given the scale of the processes to be observed. I suggest to redo this figure

I suggest to avoid abbreviations when not necessary (e.g. std in the legend of figure 13)

Suggested references Boak, E. H., & Turner, I. L. (2005). Shoreline definition and detection: a review. *Journal of coastal research*, 688-703. Davidson-Arnott, R. G. (2005). Conceptual model of the effects of sea level rise on sandy coasts. *Journal of Coastal Research*, 1166-1172. Ranasinghe, R., Callaghan, D., & Stive, M. J. (2012). Estimating coastal recession due to sea level rise: beyond the Bruun rule. *Climatic Change*, 110(3), 561-574. Stive, M. J., Aarninkhof, S. G., Hamm, L., Hanson, H., Larson, M., Wijnberg, K. M., ... & Capobianco, M. (2002). Variability of shore and shoreline evolution. *Coastal Engineering*, 47(2), 211-235.

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