Response to Referee #1 comments:

"The role of morphodynamics in predicting coastal flooding from storms on a dissipative microtidal beach with SLR conditions: Cartagena de Indias (Colombia)" (nhess-2021-210) by Jairo E. Cueto Fonseca et al.

General Comments

- **[GC1] The main parameter presented as calibration variable is facua, which is accompanied in Table 4 by the Chezy coefficient. However, the Chezy coefficient is fix, directly related to the sediment grain size, and the reader must assume that the value is supported by previous calibrations for the site. Thus, it is recommended to include a comment on how the value of the Chezy parameter relates to the actual characteristics of the beach, and, as it is presented as a morphodynamic parameter, it is also recommended to include a comment on how results might be affected by changes in this parameter.**

  RESPONSE: The value of the Chezy coefficient was previously determined by Cueto and Otero (2020) at this site. Such clarification will be incorporated on the revised manuscript as follows:

  "The Chezy friction coefficient is directly related to the sediments' characteristics of the studied beach, which is mostly constituted by fine sands with grain sizes within the range of 0.08 and 0.42 mm (Conde *et al.*, 2017a; b). According to the tests conducted by Cueto and Otero (2020), an increase (decrease) in the bottom friction through the Chezy coefficient would cause greater (lower) dissipation of the incident waves energy, leading to an underestimation (overestimation) of on Bocagrande's morphology fluctuations."

- **[GC2] The discussion section should be further completed commenting on the limitations and/or assumptions of the adopted approach. One example is the limitation of Xbeach to properly calculate morphodynamic processes related to short (individual) waves. The model is presented in such a way that the reader understands that it is solving completely both components, while the model mainly uses the infragravity wave band to calculate morphodynamics, while it calculates morphodynamics related to the short waves by adding the contribution of the short waves to the infragravity waves. This means that, for instance, that the model has some limitations solving the diffraction processes taking place in study areas where processes are affected by the presence groins. Some notice about this is given in lines 342-346 and 348-356.Another example is that the study does not consider the beach long term response (given enough accommodation space) to SLR. The study compares scenarios based on the assumption of a given reference morphology.**

  RESPONSE: We thank the reviewer for pointing out to the need of discussing the model limitations. We agree that the surf beat model does not incorporate intra-wave processes that are particularly important in the swash zone. On the other hand, the beach morphology in the study area was assumed to remain the same under the future scenario, whereas in reality the submerged and subaerial beach is adjusted to such changes. Recent studies suggest that the gradual SLR and extreme storms allow the beach to migrate and mitigate adverse effects (e.g., Cooper et al., 2020; Harley et al., 2021). The discussion will be extended towards this direction.

Specific comments

- **SC1. (line 48) See G2. It is recommended to specify that the morphological processes and run-up are calculated with the infragravity wave band accounting indirectly for the contribution of the short waves band.**

  RESPONSE: The revised manuscript highlights that both morphological processes and runup are calculate while assuming that the ingravity energy dominates in the swash zone. Stockdon et al. (2006) shows that dissipative beaches are dominated by infragravity energy owing to the saturation of the short waves band. The latter suggests that the surfbeat mode of XBeach is suitable for accounting the impact of storms under highly energetic wave conditions (as in this research). The non-hydrostatic mode can solve individual waves, but this was not used in the present work due to a significant increase in the computation cost. Comment added but moved to the model description section (2.3.2).

- **SC2. (line 86) It is recommended to add also the usual surge range or magnitude of extreme surge, to give and idea about its relative contribution to the total water level at the beach.**

  RESPONSE: According to Andrade et al., 2013, the extreme surges are around the order of 0.2 m for the studied area. This information is now included in the manuscript.

- **SC3. (Table 1) To make information in the caption self-contained it is recommended to add the meaning of cases in italics.**

  RESPONSE: The selected cases are now in bold letters and the corresponding text has been included in Table 1 caption.

- **SC4. (Line 159 / Table 2) what is the offshore depth of the XBeach domain? Please consider adding this information in the manuscript.**

  RESPONSE: The offshore boundary for the XBeach and SWAN models are located at 6.5 m and 830 m, respectively. This information has been included in the revised manuscript (table and text).

- **SC5. (Table 2 and related text) Is the resolution the same in alongshore and crosshore directions? It is recommended to specify it in the manuscript.**

  RESPONSE: The resolution was specified in Table 2 for both models.

- **SC6. (line 176) See line 48. See G2. It is recommended to specify that the morphological and run-up processes are calculated with the infragravity wave band accounting indirectly for the contribution of the short waves band.**

  RESPONSE: See reply above (i.e., GC2)

- **SC7. (line 182) Consider defining non-linear shallow water equations: NLSWE.**

RESPONSE: The acronym NLSWE is now defined in the manuscript.

- **SC8. (table 5 and related text) In cases with multiple cold fronts, it is not clear whether the time between them is simulated or not. Also motivate in the text the intention behind scenarios A4, B4, and C4.**

  RESPONSE: The time between the cold fronts A, B and C of 2010 was simulated using the stationary mode of XBeach as wave conditions during those intervals were low-energetic (~0.7 – 0.8 m). This information has been now included in the text. The intention behind scenarios A4, B4 and C4 was explained.

- **SC9. (figure 7) Specify what (*) stands for in the figure caption.**

  RESPONSE: The * stands for high tide conditions (+0.25 m) in each case. The figure's caption has been revised accordingly.

- **SC10. (line 336-337) Add reference of other authors pointing in the same direction (importance of duration to the magnitude of erosion and inundation).**

  RESPONSE: Additional references (e.g., Ortiz-Royero et al. (2013), Bernal et al. (2016) and Otero et al. (2016)) have been included.