MS No: nhess-2021-210

Full title: The role of morphodynamics in predicting coastal flooding from storms on a dissipative microtidal beach with SLR conditions: Cartagena de Indias (Colombia)

General remarks

I read the m/s with great interest. Authors have investigated the extent of coastal flooding using previously calibrated two numerical models, SWAN and XBeach. Their main focus is to explore the flooding extend with and without morphodynamics in the simulations considering 5 scenarios (1 extreme event and 4 Cold front) together with sea level rise (SLR) and 3 scenarios with high tide. Approach and analyses support to derive their conclusions.

The content is interested for the NHESS readers. However, I found, the m/s needs careful improvements from abstract to conclusions. Therefore, I recommend moderate revision as suggested below before accepting for publication.

Major comments

1. Authors have simulated future scenarios representing 2025 and 2050 considering SLR only. It is not mentioned (ln 140 -145 or 2.3 Numerical Modelling), how SLR was implemented for the model water levels. Did you consider as water surface increase by SLR in both SWAN and XBeach models? Please state these clearly.
2. How reasonable to use the current condition of wave and wind for future scenarios of 2025 and 2050? This should be at least addressed in the discussion, we can not expect that wave and wind remain the same in future.
3. For identifying the events Lenny and Cold Front 2010 and 2017, authors have used wave time series from a virtual buoy based on the predicted WaveWatch3 NOAA data. It is not clear, which criterion was used to identify these events from the time series.
4. Under 2 Data and methods, it is more relevant to have 2.1 Study area and data and then 2.2 Approach or Methodology
5. Ln 133 when you mention ‘Both events were selected…’, it gives the impression that you have used only these two events to investigate the impacts of morphodynamics on coastal flooding, though you investigated in all selected scenarios. So remove this sentence and combine this paragraph with that of the below.
6. It is confusion using ‘switch-off and -on sediment transport’. If you want to investigate erosion, you should activate bed level change: morphodynamics. Sediment transport itself does not mean erosion or accretion in your domain unless you have activated morphodynamics. Please correct this term.
7. Ln 235 remove description of Fig 7 from 3.1 to 3.4 and present results for all scenarios together at the end of this section: this would be very convenient for readers. For Fig 3-6, could you present one plot rather than three sub plots, putting all coastlines together (e.g., A-1, A-2 and A-3), and also indicate the initial coastline in each figure. The background could be in gray-scale and lines are in colours for a better visualization. Use ‘present’ instead of ‘current conditions’.
8. At the end of the results section, I would recommend presenting one figure with results of all scenarios: x-axis, distance along the coast and y-axis: coastline position, that would give a better comparative impression of all scenarios than the values in Table 6.

9. In table 6, please provide measured retreat for the present conditions (A1, B1 and C1). This will definitely give an added value for your modelling approach.
10. From the text, it is not clear, why does the maximum erosion section change depending on the scenarios? For example, in Lenny, the max erosion occurred in section 3-4 and 4-5 with waves Hs=2.76m, Dr=316, but similar waves with cold front (B1-A: Hs 2.66 and Dr 357.24) max erosion occurs in section 2-3. Could please discuss this difference in Discussion?

Others comments

1. Please consider shortening the title: I find some words are not really necessary.
2. The first two sentences in Abstract do not fit for an abstract, but for Introduction. The terminology, '..the simultaneous and individual effects of erosion and flooding scenarios…': this is not correct. You have investigated simultaneous effect of erosion and flooding, and then only flooding without erosion, but not erosion only without flooding. This term needs to corrected throughout the m/s.
3. Ln 17 this study facilitates the construction of more precise models: do you want to develop precise models, or to accurate prediction of coastal flooding using numerical models?
4. Ln 20 those numerical models were calibrated using field campaigns data: in this study, you used already calibrated models.
5. Ln 20 'The results of this research indicate..' or you want to mention 'Results indicate..': short and sweet!
6. Ln 22 Could you provide here quantitative value to indicate the increase of erosion and flooding by SLR.
7. Ln 25 important or adverse
8. Ln 28 I would write 'residence and industries', and what do you mean by 'exposed elements'
9. Ln 40 How about increase in intensity and frequency of storm events as in recent IPCC report.
10. Ln 48 'This model solves…', this should go to the model description
11. Ln 51 Could you please use one terminology to indicate extreme events? You have used 'storms, extreme wave events, hurricane', is there a difference among these?
12. Ln 60 'serious erosion problems', are these related to storm events or chronical erosion?
13. Ln 63 after 50 meters include 'between January 2010 and January 2011'
14. Ln 67 no need 'it has been established that'
15. Ln 71 remove Per the above and I would write 'The main objective of the present work is..' Use 'morphodynamics' instead of 'morphodynamic changes', check throughout the m/s
16. Ln 77 how it is important for the management of irrigation?
17. Ln 80 remove this sentence
18. Ln 85 Could you extend Fig 1d and show these six groynes
19. Ln 85 breaker zone instead of the area of breakers
20. Ln 87 mention neap and spring tidal ranges and the max tide occurred during your analysis period. Why did you select 0.24 m (section 3.4) high tide though it is 0.30 m (ln 87)?
21. Ln 88 could you explain, how did you construct the model bathymetries based on what data
22. Ln 97 readers would interest to find wave and wind characteristics within your analysis period: average conditions
23. Please indicate in Fig 1 caption, what are S1 to S5 locations
24. Ln 115 simply explain, how this database was adjusted, and provide a reference for the next sentence.

25. Ln 124 briefly explain how did you integrate here
26. Ln 112 mention the depth of your virtual buoy
27. Ln 113 reanalysis or model predicted series from NOAA
28. In Table 1 caption, remove star and indicate selected events in bold letters
29. In Table 2 caption, Y nodes instead of And nodes, also provide offshore depth of each model
30. Ln 175 XBeach was originally developed as a collaboration research among IHE Delft, US Army and Deltares, see end of Roelvink et al (2009), so not only Delft University of Technology
31. Ln 177 what is 'Igrav', pleas explain
32. Ln 182 what is NLSWE?
33. 187 check km^2
34. Ln 189 please provide depth range of each model
35. Ln 198 correct appearance of unit
36. In Table 4, where are the location of these profile from A to D, indicate them on Fig 1?
37. Ln 205 Do you want to switch off sediment transport or bed level update to avoid erosion/accretion
38. In Table 5, caption it should be 'evaluation of flooding..', this table is not easy to understand. Case study A1-A4, B1-B4.. and so on, are they related to profile name in previous table, otherwise please use a different notation. Under storm, what is meant by A+B+C? please present in a way that you do not have to repeat wave conditions, also in durations. Note, it is enough to use one decimal place for hs and tp and no decimals for direction.
39. No need the first sentence in Results: we know that you going to explain results here
40. In the approach section, you should clearly mention your scenarios, SLR and high tide study cases
41. Ln 238 please explain in Approach, how did you estimate the flooding extent based on your model results.
42. Please use same terminology to indicate morphodynamics, Ln 259: non-static bottom, ln 291:erosiove processes, ln 292 sed-on etc
43. Ln 287 '..that comprise the XBeach computational domain,…', does this mean, you can evaluate even beyond your computational domain?
44. Captions Fig 3-6, should be in unique way, as only the scenarios are changed. Use 'with and without morphodynamics' instead of sediment transport module on and off. We interest in processes, but not the modules of these models.
45. In Fig 7, I would be very interested to see 'post-storm' measured profile in each subplot. Then, you want to mention the caption as, 'Simulate and measured beach retreats along….'
46. Again please change everywhere, with and without morphodynamics rather sed-on and sed-off: we interest in processes not models.
47. In Table 6, where is the reference line for maximum penetration in urban area, please mention those things in approach or under different section of analysis parameters
48. Ln 315 this sentence is not clear, rephrase it (two time of caused by)
49. Ln 317 'as far as the authors….', nice to say: Our novelty approach..
50. Ln 322 'erosion' or morphodynamics during flooding
51. Fig 8 easy to understand with colour lines
52. Ln 351 'invigorating' or 'exacerbate'
53. Ln 378 where did you get 15%, I did not find this earlier in your results
54. Please write conclusion focussing: approach, main findings, relevance and applicability for other study areas
55. Please use standard reference format for NHESS, eg,

Aagaard, T. and Greenwood, B.: Suspended sediment transport and the role of infragravity waves in a barred surf zone, Marine Geology, 118(1–2), 23–48, https://doi.org/10.1016/0025-3227(94)90111-2, 1994.
Andrade, C. A., Thomas, Y. F., Lerma, A. N., Durand, P., and Anselme, B.: Coastal Flooding Hazard Related to Swell Events in Cartagena de Indias, Colombia. Journal of Coastal Research, 290(5), 1126–1136, 390 https://doi.org/10.2112/JCOASTRES-D-12-00028.1, 2013
Beach, R.A. and Sternberg, R.W.: Infragravity Driven Suspended Sediment Transport in the Swash, Inner and Outer-Surf Zone. Proceedings Coastal Sediments, 91, New York, ASCE, pp. 114-128, 1991.