

Interactive comment on “The role of tidal modulation in coastal flooding on a micro-tidal coast during Central American Cold Surge events” by Wilmer Rey et al.

Anonymous Referee #1

Received and published: 18 May 2017

The paper deals with the assessment of coastal flooding in the Yucatan Peninsula (Mexico) and, particularly, within the Chelem lagoon, near the city of Progreso. The paper is an interesting case study, which reports an in-depth numerical analysis of the coastal dynamics that lead to coastal flooding in a given location.

The paper is quite long and not well organized. Mainly for this reason, and for the inadequate English, a substantial improvement is required to meet the standards of the Journal.

Major points

1) The English of the paper needs to be thoroughly revised. Many typos, awkward and

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incorrect sentences can be found in the text and should be fixed. The help of a native speaker could be beneficial.

2) The paper actually deals with coastal flooding in a specific location. It does not assess, in general terms, the role tidal modulation in coastal flooding. Please consider to revise the title, as tidal modulation is only one aspect of the overall process analyzed in the paper. I'm thinking of something as “Assessment of coastal flooding in the Yucatan coast during Central American Cold Surge Events”.

3) The presentation of the paper is very confused. Different type of data, validation of model results and of input data (i.e., water residuals and wind data), characterization of CACS events and analyses of the entire 30-years time series, etc. are mixed together. The Authors should re-order, and possibly shorten, the paper, which needs to be less dispersive to the reader attention. Rather than being a vast report of all the analyses carried out by the Authors, a scientific paper should lead the reader to clear conclusions.

4) The Introduction is too long; many specific information should be moved from Introduction to Section 2.

5) Although an interest topic per se, I do not understand the role of hydrogeology in coastal flooding. How can an aquifer discharge affect the sea level? This question needs to be clearly assessed (if aquifer discharge actually plays some roles), or otherwise, being not even mentioned in the paper.

6) The “References” section contains many typos and missing/wrong information (the formatting of conference proceedings and book chapter has problems with the conference/book title and with the number of pages). Please check carefully all the details of each bibliographic item.

Minor points

-Check for the presence of double consecutive spaces into text.

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-The use of acronyms and abbreviations should be limited, as it makes difficult to follow the text for those readers that are not already familiar with them. Finally, make sure that all the abbreviations are properly introduced when they first appear.

-Abstract: the reason why hindcast sea level time series was used (i.e., the lack of measurements) has to be stated. Rather than reporting specific numerical data, please specify the locations object of the study (Progreso and Chelem lagoon) and clearly outline the analyses carried out and the main results.

-page 1, line 11: an "... occurrence probability" can not be performed.

-p. 1, l. 16: "inlet" of what?

-p. 1, l. 17: "despite micro-tidal conditions" what does this means? What is the difference between the tide (mentioned just before) and these "micro-tidal conditions"?

-p. 1, l. 34: "passing over the GoM"

-p. 2, l. 4: "methodology" pertains to the "study of methods", use "method" instead. (see also p.6, l. 14)

-p. 2, l. 14: replace "induced by ... on the sea surface and" with "enhanced by"

-p. 2, l. 15: Shorten the sentence as "Consider that the effect of pressure field is relatively small during high-pressure atmospheric systems as CACS (Flather, 2001)."

-p. 2, l. 19: which currents?

-p. 2, l. 22: "... flood hazard is defined. ..."

-p. 2, l. 23: "... and period; it depends on ..."

-p. 2, l. 24: delete "However"

-p. 2, l. 25: The year is missing in the reference to Dorrestein

-p. 3, l. 13: delete "However"

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-p. 3, l. 28: "back-barrier lagoon of Chelem, behind Progreso"

-p. 3, l. 32: Start a new paragraph with "In terms of hydrogeology. ..." (see also major point n. 5)

-p. 3, l. 34: delete "in"

-p. 4, l. 17: units: remove periods from within units' expressions (e.g., m³s instead of m³.s). Please check throughout the text

-p. 4, l. 17: put a reference to Fig. 2 after "Holbox".

-p. 4, l. 22: please define "HD"

-p. 4, l. 23: "shallow water equations", not "shallow waters equations"

-p. 4, l. 25-26: awkward sentence

-Eq. (1), (2), and (3): What kind of discharge is S, whose units are 1/s? How are the components of the "lateral stress" evaluated? Are these Reynold/dispersion stresses?

-p. 5, l. 4: delete "studying". This sentence seems incomplete.

-p. 5, l. 10: After "wave action equation" please put a reference (bibliographic or to an equation reported in the paper).

-eq. (4) is correctly written?

-p. 5, l. 15: the sentence ": the directionally ... formulation" is duplicated

-p. 5, l. 18: "as described in"

-p. 5, l. 21: what's the meaning of "(10-10 km)"?

-p. 5, l. 22: "and both swell and combined. ... are not important"

-p. 5, l. 27: I don't see S in the equation

-p. 6, l. 9: "as reported"

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- p. 6, l. 14: Does the last sentence refer to the previously described treatment of the boundary condition? In this case, this sentence should be moved before the description of the boundary condition.
- p. 6, l. 19: “according to Arcement and Schneider (1989)”, “of the Yucatan sand”
- p. 6, l. 22: what is the result of the further calibration of Cd?
- p. 6, l. 37-ff: This paragraph should be reorganized. The risk of coastal flooding is only associated with the total sea level, not directly with the sea residual. Clearly, the analysis of the sea residual is crucial, e.g. in order to improve sea level forecasts, since the sea residual is affected by major uncertainties than the astronomical tide (e.g., Met et al., 2014).
- p. 7, l. 5-10: D1 and D2 are datasets, i.e. sets of data, but they are described as actions/procedures (“consisted in identifying”, “consisted in adding”). In D1 the astronomical tide is removed, in D2 is added again. . . Please make the description of the two datasets clearer.
- p. 6, l. 13: datasets have to be denoted with D1 and D2, not with (a) and (b).
- p. 6, l. 16: “selected and then analyzed”
- p. 6, l. 26: “At the peak”. Remove the comma after “were”
- p. 6, l. 31: “while” is a temporal expression, use “whereas for Event B. . .” instead. In addition, “closer to the normal to the coast”.
- p. 8, l. 15-16: It is not clear to me how this goal was pursued. By shifting the astronomical tide for the entire 30-years time series?
- p. 8, l. 27-ff: As for what I understand, a hypothetical scenario (TSSE) is compared with a measured (reanalyzed) wind field. Does this make sense?
- p. 9, l. 27 Figure 10, not Figure 9.

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- sect. 4 and sect. 5 are quite long. I suggest a sensibly shortening of these sections.
- p. 14, l. 11: “consist in using the. . . assuming that. . . and performing. . .”
- p. 14, l. 16: “events”
- p. 14, l. 23: A study can not perform anything. . .
- p. 14, l. 24: “to identify extreme water levels and characterize their probability of occurrence using. . .”
- p. 14, l. 27: “different”. “conditions”, not “configurations”.
- p. 14, l. 31: The fact that an area is more populated can not be a cause of more flooding. . . Rather, it can cause greater damages. . .
- p. 14, l. 33: “producing large set-up”; and waves? See, .e.g., Carniello et al. (2005).
- p. 14, l. 33: “Chelem lagoon”. “were” in place of “occurred”.
- p. 14, l. 34-35: “The passage of CACS, besides affecting water exchange with the sea and renewal dynamics inside the Chelem Lagoon (Viero & Defina, 2016a,b), is show to produce significant wind and wave set-up, characterized by nonlinear interactions between meteorological forcings and the astronomic tide.
- p. 15, l. 1: “Based on modeling results from. . .”
- p. 15, l. 2: “total flooded area”
- p. 15, l. 5: delete “is”
- p. 15, l. 6: awkward (and quite obvious) sentence.
- p. 15, l. 14: “storm surge, and set-up due to both wind and wave”.
- Figure 3: I suggest putting the text in magenta on a white box to improve readability.
- Figure 9, top panel: change the labels “Progreso” and “Progreso” with “Wind speed”

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and “Residual tide”.

-Figure 9, bottom panel: as for the top panel, labels should indicate the kind of data, not the location. “Reading (1992) method” is redundant here.

Additional references

Carniello L., Defina A., Fagherazzi S., D’Alpaos L., 2005. A combined wind wave-tidal model for the Venice lagoon, Italy. *Journal of Geophysical Research – Earth Surface*, 110, F04007, doi:10.1029/2004JF000232.

Mel R., Viero D.P., Carniello L., Defina A., D’Alpaos L., 2014. Simplified methods for real-time prediction of storm surge uncertainty: The city of Venice case study, *Advances in Water Resources* 71, 177-185, doi:10.1007/s00193-013-0452-9.

Vousdoukas M. I., Voukouvalas E., Mentaschi L., Dottori F., Giardino A., Bouziotas D., Bianchi A., Salamon P., Feyen L., 2016. Developments in large-scale coastal flood hazard mapping, *Natural Hazards and Earth System Sciences* 16(8), 1841-1853, doi:10.5194/nhess-16-1841-2016.

Viero D.P., Defina A., 2016. Water age, exposure time, and local flushing time in semi-enclosed, tidal basins with negligible freshwater inflow, *Journal of Marine Systems* 156, 16-29, doi:10.1016/j.jmarsys.2015.11.006.

Viero D.P., Defina A., 2016. Renewal time scales in tidal basins: climbing the Tower of Babel. In “Sustainable Hydraulics in the Era of Global Change”, Proceedings of the 4th IAHR Europe Congress, 27-29 July 2016, Eds: Erpicum et al., 338-345, Liege, Belgium.

Woodruff J. D., Irish J.L., and Camargo S.J., 2013. Coastal flooding by tropical cyclones and sea-level rise, *Nature* 504, 44-52, doi:10.1038/nature12855.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., doi:10.5194/nhess-2017-64, 2017.