

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1
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Comment on nhess-2021-259

Anonymous Referee #1

Referee comment on "Compound flood modeling framework for surface–subsurface water interactions" by Francisco Peña et al., Nat. Hazards Earth Syst. Sci. Discuss.,
<https://doi.org/10.5194/nhess-2021-259-RC1>, 2021

This manuscript introduces a coupled model to jointly simulate groundwater levels and surface flows to assess compound flooding in South Florida. The two models that are loosely coupled are FLO-2D and MODFLOW-2005. The modelling framework is applied for three past storm events to assess flood extent and depth and the role of the different flooding drivers. Validation opportunities are limited due to missing flood inundation information, but ancillary data is collected and used to assess the model performance. Overall, I think the manuscript is very interesting, timely, and generally well written. I have some general and several specific comments listed below which I think should be taken into consideration to improve the analysis/presentation.

General comments:

- I think the authors need to be clearer in how they define compound flooding for the purpose of their analysis, i.e. is a rainfall event that coincides with a high water table considered a compound event or do tides also have to contribute to escalate the flood depth/area to make it a compound event? From the introduction it appears that the key focus is on the combination of all three flooding drivers, rainfall, ground water, and coastal water levels, but the latter barely play a role in the events that were analyzed. I am not saying that the combination of rainfall and high water table could not be considered a compound event, but there was a bit of a mismatch of what I read in the introduction/methods and what was shown in the results. I think this can be fixed by changing the narrative and does not require additional analysis.
- I am not familiar with the exact models that were used for the analysis and hence I sometimes had a hard time understanding in the Methods section which parts of the modelling system were actually developed by the authors and which parts were already implemented. Much of it read like material I would expect in the technical manuals of the models. I would keep such information at a minimum and only provide the information necessary to understand the new aspects of the framework going beyond what was already there, and rather refer to the technical documentation for details of how these models work.

- The figure captions are all very short and often don't contain enough information to fully understand what is actually shown; this is particularly important since many of the figures are stitched together and contain a lot of information. See also specific comments below regarding figures/legends.

Specific comments:

19 "physics-based" might be better

22 "returns"

24 "that as" doesn't really work here I think

25 "result"

27 "damage of"

44 remove "field"?

50 there is a recent paper by Gori et al. (<https://doi.org/10.1029/2019WR026788>) which could be added to the list

73 "in that study"

165-171 Do I understand correctly that total still water levels (tide + surge) are considered? I was confused when I read later in the discussion/conclusion that storm surges were not included in the analysis. If still water levels were used but from "calm" periods where surge component was minimal that should be made clear.

199 would drainage systems be considered as sinks or explicitly modelled?

234 I would change to "solvers for matrix equations" to avoid repetition

329 "G&A" has not been defined; this is also an example where I wasn't sure if the authors had added new options/functionality or just selected one of different existing options already available in the model code

378 should it be "canal bed"?

382 "what is the CHD package feature"?

397 "responsible for"

393-416 This is where I started wondering what the actual role of the coastal water level will be in the analysis (after a lot was said about it before) since it is not mentioned at all, other than that the events had low storm surge levels. Was there a particular reason to not select any events where there was at least some storm surge to actually see the effect?

427 "karts environments"

435 I was confused here since it says Fig. 10 shows results for Leslie, but it also has results for other events.

437 How is "chronic flooding" defined here? It's a term often used when analyzing high tide flooding but that is different I think to what the authors refer to here. Please clarify.

441 should be "characterizes" I think

453 In Fig. 10b the water table actually goes above the terrain for all events at some point, should the reference be to "(Fig. 10c-f)"?

453 "consistent agreement" sounds a bit strange, maybe reword

455 do you mean SRL? I don't understand how any of the results presented here would show the effect of SLR (assuming that it stands for sea-level rise).

457 "account for 60%"

478 I think a better way to start the sentence is to use "Despite..." or something similar

512 the paper by Serafin et al. (<https://doi.org/10.5194/nhess-19-1415-2019>, 2019) could be added to the list

515 "on record"

517 here the authors use again "SLR" and I think this time it stands for sea-level rise, but it has not been defined anywhere

522 see comment above about using still water levels vs predicted tides as boundary conditions and the choice of picking three events where surge component was small

546 "coupled"

Figure 4: maybe consider switching "Stress Period I" and "Stress Period II" text as you start at the bottom with DT1 and T1 but they are linked to period II.

Figure 7: in the top what does "statistics" refer to? I didn't see anything about that in the text. In the caption it should be "base hydraulic model"

Figure 9: need to mention in the caption what the insets are and refer to the later figure where they are used.

Figure 10: This figure has a lot of information and is a little bit hard to read with 1,2,3 and a,b,c showing up multiple times. Maybe consider splitting the top part and the bottom part into separate figures. It's not clear what the markers (diamond, triangle, circle) represent

here. Similarly, the VGA Image and Area of Interest markers in the legend are confusing (and maybe not needed). The legend and associated text in the water table plots are way too small and impossible to read. Finally, what is meant with "other events"? I assume that relates to flood claims from events that were not Leslie or Andrea? At this point the reader has no clue about this information being even shown in the figure and it's not mentioned in the text or caption at all; it's only mentioned later when talking about Fig. 11, so maybe it shouldn't be shown in Fig. 10 to keep the reader focused on what matters.

Figure 11: why is the color yellow mentioned in the caption, are the black diamonds and red circles not representing SRL info? Please make sure that figures are 100% understandable when looking at them and reading the caption (one should not have to read the main text to understand the content of a figure).