Comment on nheess-2021-259
Anonymous Referee #2

Referee comment on "Compound flood modelling framework for rainfall-groundwater interactions" by Francisco Peña et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nheess-2021-259-RC2, 2021

General comments:

This manuscript develops an integrated modeling framework to simulate urban flooding caused by rainfall, tides, and groundwater using MODFLOW and FLO-2D. While the idea to combine a surface water model and a groundwater model is intriguing for flooding research, this manuscript suffers many writing and technical deficits.

1) The methodology is not well written and is vague. Details about coupling the FLO-2D model and MODFLOW-2005 model are not well explained. Also, Model setups, including boundary conditions and parameters, are not clear.

2) Although model calibration is mentioned in the Abstract, I don’t find descriptions of model calibration in the methodology, data, and results. If the model was not calibrated, then the results and analyses would not be convincing.

3) The title has the phrase “rainfall-groundwater interaction”, but the interactions are not discussed in the manuscript.

4) The manuscript fails to provide compelling evidence of interactions among rainfall, tides, and groundwater in the study area. Based on my reading, it seems that the rainfall and tides do not have strong interactions with groundwater in urban areas due to the imperviousness of pavements. High water tables in the study area may be caused by flow from other areas. If the interactions are not significant, then the integrated modeling framework is not useful to the study area.

5) Most figures have very poor readability. Some figures are too busy and confusing (e.g. Figures 1-3, 10-12); and some figures fail to convey meaningful information. Please see the specific comments for details.

6) The writing is redundant and irrelevant in many places. For example, it is not necessary to provide detailed information about the well-known models (MODFLOW and FLO-2D) in methodology section. Also, most of discussions are irrelevant to the modeling results. Please see the specific comments for details.

Based on these serious issues, the manuscript deserves a significant revision. I would not
recommend to accept this manuscript for publication.

Specific comments:

Line 23: I don’t find any methodology and results about model calibration throughout the manuscript.

Line 85: Please spell out the full name of MDC.

Line 129: Where is Miami? In section 2.2, it would be better to focus on the rainfall around the study area rather than in a large scale.

Line 190-225: A through introduction to FLO-2D is redundant in a scientific paper. Please condense.

Line 226-263: Again. Please condense the introduction to MODFLOW.

Line 311-321: Please be specific on how the FLO-2D and MODFLOW-2005 are integrated in the algorithm, which is one of the most important contributions in the manuscript. Currently, the descriptions and figures (Fig.4 and Fig.6) are not clear enough.

Line 357-390: Since this is a modeling study, the manuscript should include more details (statements and figures) about the model set-up. Currently, the boundary conditions and parameters of the model are not clear to readers.

Line 380-385: Based on my knowledge, MODFLOW is not able to directly simulate groundwater flow in karst aquifers. Please justify that the groundwater modeling in this study makes sense.

Line 381: The model is composed of one-layer...

Line 390: “Groundwater elevations” is not a clear term.

Line 396-416: Redundant. Please condense.

Line 429-430: Please provide the evidence to support that the water from rainfall and tides rapidly infiltrates. Based on my knowledge, infiltration in urban areas should not be significant. High groundwater table should be a result of flow from other regions.

Line 450-458: I can’t find those information in Figure 10 and 11.

Line 466-474: Figure 12 is too hard to read. I can’t follow the statements with the figure.

Line 485-496: The writing is irrelevant to the model results. It might be put in the introduction section.

Line 498-499: Please provide associating model results to support the statement.

Line 514-520: Irrelevant writing.

Line 528-535: Irrelevant writing.

Line 825: Figure 6 is confusing. Please clarify the meaning of T, DT, and dt.
Line 835: Groundwater table in Figure 3a is not influenced by rainfall and tides, compared to the other two figures. Please justify that the data in Figure 3a is correct.

Line 840: Caption of figure 9 is confusing.

Line 845: The caption of figure 10 does not match the figure. The color represents flood depth but only water surface elevation is mentioned in the caption. Also, only one storm event is mentioned in the caption but many events are included in the figure.