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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Measuring compound flood potential from river discharge and storm surge extremes at the global scale and its implications for flood hazard" *by* Anaïs Couasnon et al.

Anonymous Referee #2

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Authors explore the potential of compound flooding due to river flow and storm surge along the coast lines globally. They use numerical simulations forced by reanalysis dataset to extend our understanding about this phenomenon beyond previously reported regions with in-situ observational data. Characterization of compound flooding hazards is a very important problem in coastal regions worldwide and helps improving hazard prediction and effective resource allocation for flood risk management. The idea is interesting, study is robustly designed and manuscript is very well written. Given the fact that this is a significant contribution to the community of coastal hazard and it could

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Discussion paper

attain the readership of a broader community of natural hazard researchers, I recommend it for publication in NHESS after a minor revision. I am mainly concerned about the significance of conclusions made here, compared to previously reported patterns and results. Below, I provide more detailed comments and suggestions:

- In the abstract you mention ". We find many hotspot regions of compound flooding that could not be identified in previous global studies based on observations alone, such as: Madagascar..." and then further explore Madagascar as a case study. My question is that, given the fact that there is no observational record of discharge and storm surge in or at close proximity of Madagascar (Figures S1-S4), how reliable such compound hazard hotspot detection would be (seems among the hottest)? In other words, while with such limited information, estimation of individual extremes will be associated with significant uncertainty and errors associated with capturing the timing of extremes will add-up (Page 5), how conclusive your pattern detection would be? and why did not choose another location with more reliable record? I see you have thoroughly discussed the limitation of this work in pages 17 and 18, but still the audience needs to know the significance of results in Figure 3.

- Useful citation for Introduction Santiago-Collazo et al. (2019) A comprehensive review of compound inundation models in low-gradient coastal watersheds, Environmental Modelling & Software, Volume 119, Pages 166-181, https://doi.org/10.1016/j.envsoft.2019.06.002.

Tilloy et al. (2019) A review of quantification methodologies for multihazard interrelationships, Earth-Science Reviews, Volume 196, 102881, https://doi.org/10.1016/j.earscirev.2019.102881.

- P2:L17: I uspect the official death toll be close to 600 (https://www.unocha.org/southern-and-eastern-africa-rosea/cyclones-idai-and-kenneth). Please double check.

- P3:L15-19: A useful citation: Sadegh et al. (2018) Multihazard scenarios for analysis

of compound extreme events, Geophysical Research Letters 45 (11), 5470-5480, doi: 10.1029/2018GL077317.

- P10:L1: Please, clearly explain how you made this conclusion " This assumption seems reasonable based on visual observations..."

- P10:L3: "If no co-occurrences were measured (X=0), we select Pc = p", while from equation 5, if X -> 0 then Pc -> 0. There is mathematical inconsistency here.

- P10:L14: Not sure if a 5-yr event fits in the definition of compound "extremes" that has been used in the title.

- P10:L15: Many previous studies have found Archimidean copulas preferable in joint extreme analysis; and as you correctly mention in page 16, appropriate characterization of correlation structure can significantly affect the estimation of return period of compound extremes. Justify, why Gaussian Copulas used here?

Nice job!

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