

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC2
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Review of nhess-2021-50

Dominik Paprotny (Referee)

Referee comment on "Regional analysis of multivariate compound coastal flooding potential around Europe and environs: sensitivity analysis and spatial patterns" by Paula Camus et al., Nat. Hazards Earth Syst. Sci. Discuss.,
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This study on compound floods in Europe has two main aspects, one is investigating how sensitive are the compound flood estimates to the choice of method, and second is finding a synthetic measure of their severity. In both cases the paper provides meaningful results and I think will be an important work of reference. The manuscript is rather clear and concise, even though the presented findings are quite technical and not easy to synthesize. Overall I didn't really see any major issues with the study beyond those indicated by Referee #1.

The only thing I really found missing is that no reference is made to potential bias or overarching inaccuracy in the models in reproducing compound events, method used notwithstanding. As Ganguli et al. (2020) and Paprotny et al. (2020) have shown, the dependency between compound flood drivers produced by models differ considerably from dependencies computed from observations. For north-western Europe, where compound events are potentially most frequent and most severe there was a positive bias in the models used in the studies. I think the authors should comment on this aspect in the discussion in context of their calculation of the severity index and clusters.

Below I list a few minor textual points. I'm looking forward to the authors' revision of the paper.

Minor points:

L86: Paprotny et al. (2020) considered four drivers as well.

L180-185: I concur with reviewer #1 that this paragraph is very unclear as to how storm surge and waves are combined, and reading 3.1.4 doesn't help much, until actually reading the results. I suggest to use a single letter to define the combined surge-wave height (e.g. H or L) and then differentiate the two methods for computing the joint height as e.g. H1 and H2, so that the relevant pairs are referred as e.g. Q-H [H-Q].

L226: "between 1 and 10 days or 1 and 3 days". I think would be clearer to write "of ± 10 and ± 3 days".

L485 & L510: in "JQ(Q-P-SW)I" it should be "JO", I guess?

L540: the 'large' labels of the vertical axis, indicating the pairs do not clearly connect with their variants in smaller fonts, and further are not aligned with the caption which has some undefined abbreviations e.g. "Co". Please check that and synchronize the naming with the text.

Supplement: Figure S7's caption indicates that Kendall's correlation is used, yet the panels are labelled with "rho", suggesting Spearman's correlation. Please check what data is actually shown.

References:

Ganguli P., Paprotny D., Hasan M., Güntner A., Merz B. 2020. Projected changes in compound flood hazard from riverine and coastal floods in Northwestern Europe. *Earth's Future* 8(11):e2020EF001752, doi:10.1029/2020EF001752

Paprotny D., Vousdoukas M.I., Morales Nápoles O., Jonkman S.N., Feyen L. 2020. Pan-European hydrodynamic models and their ability to identify compound floods. *Natural Hazards*, 101(3), 933–957, doi:10.1007/s11069-020-03902-3