Interactive comment on "Multivariate Statistical Modelling of Compound Events via Pair-Copula Constructions: Analysis of Floods in Ravenna" *by* Emanuele Bevacqua et al.

Anonymous Referee #3

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The paper introduces a framework to assess compound flooding from storm surge and river discharge; the case study site is Ravenna in Italy where such an event caused major flooding in the recent past. The topic is a highly important one and falls into a very active research field. The authors propose a statistical modelling framework that exploits the copula theory by building pair copulas to model the 3 (in the stationary case) and 5 (including non-stationarity) dimensional problem at hand. The methods that are employed are state-of-the-art and in some places innovative. Bringing different types of statistical models together allows analyzing the complex problem of compound flooding under present-day, past, and future conditions paying particular attention to the uncertainties, which are often ignored in these kind of studies. I can see the conceptual

approach being adopted by other researchers and applied in different regions. I am in favor of publishing the manuscript with NHESS after some revision. I saw that the other reviewers already commented on two critical points, namely extending the cited literature and shifting text paragraphs around to better adhere to the structure that one would expect from the headers. Aside from that I list some comments below that should be addressed and are fairly minor. One thing that I was missing was the discussion of mean sea level rise, which is probably the most important driver for non-stationarity in the sea level component and as such in compound flood risk both over the past and in the future. I understand the model as it is would predict extreme events around the changing mean, this should be mentioned.

1-6 CE hasn't been defined

2-29 One typically cites those as Van den Hurk and Van den Brink (and puts them in the according place in the reference list)

5-28/29 Can you provide an example for that? It makes it easier for readers who are not experts on the different types of compound events.

8-25ff At this stage it was not clear to me how the selection was made for using this particular D-vine.

13-10ff Rivers flowing into the Adriatic are one contributor to the annual cycle that is not driven by barometric effects. Density changes due to temperature variations are probably also quite important.

15-5 Mention that this is not shown in the manuscript, at least I couldn't see it anywhere.

20-11 close bracket)

22-9 Merge Cooke (2001a, 2001b)

26-16 Repetition "depend on the dependence"

C3