Review #1

I want to thank the Authors for taking the time to carefully address the comments made during the first round of revision.

From my side, there is still one point about combining a vine-copula model with a co-occurring model that requires further clarification. The vine-copula approach is used to model the dependence between events so it should already include the concept of co-occurrence. However, here the Authors model the dependence between extremes sampled independently. What then does the correlation between extreme events sampled independently represent? From where does this correlation come? What does the vine-copula model represent in terms of dependence? For example, if the maximum discharge occurs in May and the maximum rainfall in October, what does the correlation between these two variables mean? I suggest that the Authors briefly justify the choice of using the combination of two models (and the meaning of the dependence observed between maximum events) versus modeling the observed dependence between events, e.g., extreme discharge and the associated precipitation event.

Thanks for your feedback and question. We indeed simulate the co-occurrence (empirical distribution) and dependence (Vine Copula) of annual maxima (AM) separately. Because the sample of co-occurring maxima is too small to assess the dependence between drivers, we assume that this dependence can be estimated based on all AM in the same hydrological year. In this case study, apart from the significant wave height AM, the AM of most drivers are within the same season or even month. Therefore, the correlation roughly captures the variability driven by seasonal climatological patterns, see figure A6 below. The benefit of this approach is that it provides information about both aspects of the "compoundness", co-occurrence and dependence, and it is easy to use with more than two drivers. In locations with fewer co-occurring AM or a less distinct wet season the approach might be less applicable.

To capture both the dependence and co-occurrence using a Vine Copula only, we would need to use a different sampling strategy where we sample events conditional to one driver being extreme. For multiple drivers this would require fitting multiple Vine Copulas, each conditioned to a different driver being extreme, and a method to account for co-occurring

extremes that occur in multiple samples. While this approach would also provide information on the magnitude of non-extreme events co-occurring with extremes, this information can currently also not be used in our hydrodynamic simulations because of computational limitations (we simulated all combinations of six extremes and one non-extreme design event for each driver).

We agree with the reviewer that it is important to compare our approach with alternatives, such as the one suggested, to understand under which conditions the assumptions taken are robust (see section 3.5).

We have added the figures to the supplementary information and the following text to section section 3.5 (Line 440):

"Here, we assume that the dependence can be estimated from all annual maxima. In our case study, where, apart from the significant wave height, the annual maxima of most drivers are within the same season, the correlation roughly captures the variability driven by seasonal climatological patterns, see Figure A6. In locations with fewer co-occurring annual maxima or a less distinct wet season the approach might be less applicable."

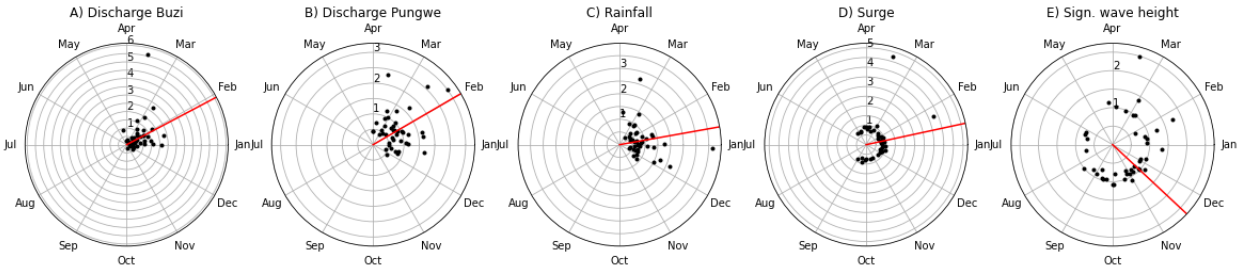

Figure A6: Day of the year (black dots) and mean day of the year (red line) of the annual maxima of all five drivers. The y-axis indicates the magnitude normalized by the mean annual maxima.