

Interactive comment on “Storm surge and extreme river discharge: a compound event analysis using ensemble impact modelling” by Sonu Khanal et al.

Anonymous Referee #1

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This paper investigates statistical dependency between extreme river discharge and coastal water level in Rhine river basin. While the authors mainly followed a methodology established by van den Hurk et al. 2015 and Klerk et al. 2015, this study provides a unique contribution in that they used a large set of ensemble model simulation results, not just observations. I think the authors have conducted substantial amount of work and critically analyzed their results, the paper is well written for readers to easily follow, and the findings are scientifically new and interesting. Therefore, I recommend this paper to go through minor revisions before publication. Minor comments are listed below.

P 2, L 10: Underestimation of what?

P 3, L 3 and after: Please use n-dash (–) not hyphen (-) to indicate certain range of
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values.

P 4, L 5: Add the full name before the abbreviation for TWL.

P 5, L 21: What is E-OBS?

P 6, L 3 and after: The³ in the unit m³/s should be superscript.

P 6, L4 and L 11: Both 'modeled' and 'modelled' are used throughout the paper, so use either of them.

P 6, L 20, 25–26 and 31–32: I agree with your rationale to use two hydrological models to assess model uncertainty as mentioned in P 4, L 8. However, as introduced here, SPHY is strongly biased in reproducing high discharges and HVB performs much better than SPHY. In the supplementary figure 4S, it is shown that SPHY's performance was better than HVB, but given that this paper's objective is to see the dependence between extreme values, it does not support the reason to use SPHY. I am not sure why the authors use such different models in terms of model types (i.e., SPHY is a conceptual model while HVB is a semi-distributed model) and the model physics (written in P 4, L 30–31) for comparison.

P 7, L 23–24: Why does SPHY have multiple maxima?

P 8, L 3–4: 'The broad shape of the distribution of both HBV and SPHY reflects the complex interaction of the climatic and hydrologic processes.' This sentence is too concise to understand the meaning. Why can you say that the broad distribution reflects the complexity in climatology-hydrology interactions? It would be helpful if you can add some more explanations.

P 8, L 8: Looking at Figure 4, the half of the data was located in the range -1–+1 in case of HVB, which does not seem so broad a distribution. P 9, L 3–4: Again, the SPHY results are strongly affected by the underestimation of river discharge. I am not sure whether the use of such a poorly biased model can provide meaningful indications.

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P 9, L 12–13: The word ‘tail’ is duplicated in the sentence ‘analyzing the tails of the tail of distributions’.

P 9, L 29: What does the width of the bands represent?

P 10, L 13–15: This analysis is interesting, but could you add some literature to support your reasoning about the hydrological characteristics of the target basin?

P 10, L 26: ‘in which the physical. . .’ maybe ‘physics’ not ‘physical’?

P 12, L 18: ‘still it’s not. . .’ The abbreviation should be avoided.

P 18, Figure 1 and after: Add the model names to each sub plot.

P 19, Figure 2: Maybe better to use ‘and’ instead of ‘&’.

P 19, Figure 3: What do the dotted lines in the right figure represent? Mean values?

P 22, Figure 6: In the scatter plots of the left figure, the blue dots represent events exceeding 99th quantile, but on the other hand, the black and blue lines in the left and right figures represent 95th and 50th quantiles, so the large/small relationship between gray and blue colors is inverse within the same figure. This is very confusing! In the right figures, what the triangular and the bands represent?

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