

Reviewer 1

I appreciate the authors' efforts in addressing my comments. I see the manuscript is clearer now. Here are my few follow up comments:

1. On the selection of the 18 dams: You may want to add a statement about future research on studying a larger number of dams but also point out to the data availability and potential confidentiality issues.

We have now included this point in the third paragraph of the discussion as follows:
“The feasibility of future studies that considers a larger sample size of dams will be dependent on the availability of data and confidentiality requirements related to dam operations.”.

2. Here is the full reference of Cho et al. (2025): Cho E, Ahmadisharaf E, Villarini G, AghaKouchak A (2025) Historical changes in overtopping probability of dams in the United States. *Nature Communications* 16(1), 6693.

Thank you, this reference has now been included.

3. The rainfall and soil moisture should be based on the entire upstream watershed of each dam as opposed to a single point—the watershed centroid. This can be at least discussed as a limitation for future research.

We do not use a single point to represent rainfall and soil moisture for the catchments upstream of the dam. The catchments are divided into sub areas ranging from 4-19 sub areas as described in section “2.2 Event-based modelling”. Rainfall is applied to the centroid of each sub area and rainfall excess is calculated at each sub area as described in Appendix A. The spatial distribution of rainfall can also be specified in the R²ORB model and we adopted the spatial weightings used by the dam owners.

4. Please also show the upstream watershed of each dam as a supplemental file (e.g., kmz) or map. It is unclear how large the upstream watershed of each dam was and why.

Table 1 shows the area of each catchment upstream of the dam and this provides clear information on the size of the catchment upstream of each dam.

We are unable to provide a map of the catchment upstream of each dam as this was not made available to us by the dam owners – we extracted the data we needed for our modelling purposes from their model files and ensured that our simulations agreed with their simulations. The most important point to note here is the area upstream of each dam, which we do provide in Table 1.

5. PMP was used as a baseline in your analyses. As I mentioned in my original comments, PMP can be estimated via different methods and changes your results. This was also acknowledged by the authors

in their response to my original comment. I think a sensitive analysis with respect to the selected method would add value to the paper results.

Our guiding principle with this study was to use methods and data sets that are consistent with accepted design practice in Australia – that is, these results are based on “real world” practice. While we accept that the results may be sensitive to various methodological aspects – the PMP method just being one – such an exercise would greatly expand upon the scope of the work. Hopefully this work will encourage researchers in other countries to explore the implications using different data sets and methods.

More specifically, we note that there is only one accepted method of estimating PMPs in Australia for each region, which we have used in this study (as stated in Section 2.3.1). But regardless, one reason we do not think the choice of PMP method is of great concern is that our focus is on the relative shift in overtopping probabilities over a range that lies between statistical estimates derived from the observed record and those inferred from PMP methods. Different PMP methods are associated with different exceedance probabilities, and thus while a different PMP estimate might shift the absolute estimate overtopping probability, there is no compelling reason to expect that it would influence the relative shift from one climate scenario to another.

6. Please present the temporal patterns of rainfall events as dimensionless time series showing the fraction of total rainfall as a supplement figure.

We have now included the figure that previously appeared in our response to the reviewer in the supplementary material.

7. I do not understand why adding a map of overtopping probability under historic and future conditions can be misleading. You present changes in the probability in the text as numbers. How can a map, which aggregates the same information in one figure, can be misleading?

We were unable to find any useful relationship between changes in overtopping flood risk under climate change and geographical location (as stated in the third paragraph of the discussion). We found that mapping the results has led audiences to propose the existence of a geographical influence, likely due to the spatial distribution of the case studies that are largely clustered in the south-east of Australia. However, this geographical influence is not statistically supported, which is our reason for demurring on the suggestion to present the results geographically.

Reviewer 2

I have carefully reviewed the revised version of the manuscript and am pleased to see that it has improved significantly.

I suggest some minor technical corrections:

- Lines 44-45: cite more recent works.

Thank you for the suggestion. We have added references to the works of Cho et al., 2025 and Rajabzadeh et al., 2023.

- Lines 140 and 421: "social, economic, and political factors"

The text has been revised as suggested.

- Line 199: replace "calculated" by "calculate"

The text has been revised as suggested.