Response to reviewer's comments after the re-submission of "Rain-on-wet-soil compound floods in lowlands: the combined effect of large rain events and shallow groundwater on discharge peaks in a changing climate" by Claudia Brauer, Ruben Imhoff and Remko Uijlenhoet, submitted to Hydrology and Earth System Sciences.

We thank both reviewers for reviewing the text again. In the text below we respond to each item in green.

Reviewer 1

This study investigates how initial groundwater depth interacts with rainfall to influence pluvial flood volumes in lowland catchments under current and future climates by using the WALRUS hydrological model. The authors have substantially improved the quality of the manuscript. They now present more robust results after discussing the limitations and adding additional supplementary information in the revised version. Although all results are based on modelled data due to data unavailability, the findings are now more convincing. Therefore, I recommend that the manuscript be accepted for publication after a few minor corrections.

Specific comments:

L383: Should it be 2085 instead of 2050?
Thank you for pointing this out! We fixed it.

Figure S25 is cited earlier in the manuscript than Figures S9–S24. I suggest moving Figure S25 to an earlier position in the supplementary materials and updating the numbering accordingly.
We agree. We changed the order of the supplementary figures and references to those figures in the main text.

Reviewer 2

I would like to thank the authors for addressing most of my comments. I know only have some minor remarks which should be addressed.

The authors did include the article by Berghuijs & Slater (2023) as recommended, however it seems that the article was included only as perfunctory citation. Since it is one of the few articles that analyses floods and groundwater, it should be discussed more in depth. I am not a co-author on the mentioned article and genuinely only mention it since I see it as relevant for the discussion. How do their results compare to yours in regard to lowland catchments, and trends in groundwater contribution to flood?
We reread the paper and agree that there are similarities with our study that we should point out more clearly. We summarized the most important findings and added three sentences to the manuscript: in the Introduction section (L. 18 and L. 49 in the revised manuscript with tracked changes) and in the Discussion section (L. 457).

The comparison against groundwater table depth is very helpful. One more question about the modelling, does the timing of model calibration influence the representation of climate change in the model parameters? Some of the early and late calibration times are 15 years apart (e.g. two in 1998 (with validation in 1991-1992, Vechte A and Dinkel), several other more in the early or mid-2010 (Hupsel Brook, Grote Waterleiding, Radewijkerbeek).

The choice of calibration year indeed has an effect on the resulting parameter values, just as the calibration technique and person performing the calibration. We expect that the 'age' of the calibration dataset is less important than the particular weather during that year (wet or dry year). In addition, as we explained (L. 229 in the revised manuscript with tracked changes), "The intention of our study was not to project the exact changes for each catchment separately, but rather to give a range of possible directions for lowland catchments."

L186: what do you mean by "since time series of observations are too short for robust statistical analyses". What statistical analysis are you referring to?
With "statistical analyses" we meant all the analyses we did in this paper. The long time series allowed us to compute average changes and discharges belonging to certain return periods. With many years of data which include a large variety of weather conditions, the results and conclusions are less sensitive to the specific situation in a particular year, and this allowed us to draw conclusions about rare events. To make this more clear, we changed all three occurrences of this phrase in the final resived manuscript (L 90, 145 and 179).

Figure 5 (and its match in the supplement) is missing a colour scale legend.
There is indeed no legend, but the contour lines are labeled, allowing the reader to estimate the values. We added 'Colours represent the same values as the contour lines and are added to make the figures easier to interpret.' to the captions.

Supplement Figure S5: What do you mean by "Since the exact land elevation at the measurement locations was unknown, this had to be estimated." Dinoloket provides metadata for each station including elevation of the surface.
Thank you for pointing that out! We retrieved the metadata and made the validation plot again with the observed land surfaces. We deleted the sentence "Since ... estimated" in the caption.

References

Berghuijs, W. R., & Slater, L. J. (2023). Groundwater shapes North American river floods. Environmental Research Letters, 18(3), 034043.