

Response to Referee Comment 2 on ‘Comparison of occurrence-bias-adjusting methods for hydrological impact modelling’ by J. Van de Velde et al.

Anonymous referee

We would like to thank the referee for the time spent reviewing our manuscript. Below, we give an overview of the comments, our responses and textual changes. For a detailed in-manuscript overview, we refer to the accompanying file.

General Comments

Comment: This paper compares different bias adjustment (BA) schemes for climate data as used in hydrological impact studies. With respect to precipitation, the originality resides in the fact that intensity and occurrence BA methods are used. Also, univariate and multivariate schemes are compared. The analysis is based on a high-quality climate data set, yet only a 20 year window is used to make the comparisons. For the comparison, precipitation amount, precipitation occurrence and discharge are evaluated. The results suggest that for the randomness inducing BA methods, performs worse than traditional methods. The results also show that the multi-variate methods lack robustness with respect to the modelling of precipitation occurrence and change the intrinsic structure of the time series in an unexplained way. The results suggest also that the performance of the current analysis is case specific and lacks generalization (the analysis should be repeated for climate series of other climate regions, and in the case of the multivariate method probably also with other climate variables). The paper is very detailed and uses state-of-the-art methods for implementing BA and for comparing novel BA approaches. The paper is also novel and original as it compares different BA methods for a specific climate region using a high-quality data set. Yet the paper lacks focus and is difficult to read. For instance, the BA is on climate data but the authors report also on the impact of climate data on modelled discharge. While this may be interesting to evaluate the impact of BA on final hydrological impact assessments, it does not add value to the comparison of the climate data in-se and only results in less focus of the manuscript. The final conclusions are also somehow disappointing: the addition of complexity in the BA did not result in better results. It is regretted that the reasons for these poor performances of more complex approaches are not explained. The reader is left with a feeling of : “So what? Why do the simple BA approaches outperform as compared to the more complex approaches”. No real answers on this question has been offered by the authors.

Response: We thank the referee for the suggestions and points raised. We would like to address them point by point. First, the referee discusses the lack of generalization. It is true that the paper is focused on one location, but this was an opportunity-based choice. This way, we could base our analysis on a high-quality observational dataset, instead of processed observations and/or simulations as is the case when using reanalysis datasets. Besides, the focus on one location allows us to zoom in and discuss some aspects that might get lost when averaging over a larger area. We have strengthened this perspective and added more generalization by rewriting the conclusion. It is now based on a few questions that could guide researchers or users in other areas in the assessment of occurrence-bias-adjusting methods. With this change, we wanted to also address a second point of the referee: the lack of focus. By rewriting the Discussion and Conclusions sections from a discharge perspective and generalizing this to raise a few questions with regards to the use of occurrence-bias-adjusting methods for climate change impact assessment, we hope to have a clearer and more cohesive ending of the paper, with a better link with the Introduction.

We decided not to remove the results and discussion on modelled discharge. Discharge is raised in many papers (as discussed in our introduction) as one of the most important reasons to adjust occurrence. Consequently, we decided that without discharge, the motivation for the article would be less clear and the result were harder to interpret. The focus on discharge is the reason as well

not to discuss other climate variables adjusted by the multivariate method. Precipitation is the most important driver for discharge, and the subject of all occurrence-bias-adjusting methods, thus we wanted to only focus on this variable. However, in an article in preparation, we will discuss the effect of multivariate bias-adjusting methods on other variables in a similar framework.

A last, and important point, is the 'so what'-feeling. This issue was also raised by the other referee, and based on his comments, we have largely expanded our discussion on the (interaction between the) methods. Whereas the text in the Section 3, on the methods themselves, has been expanded slightly, most additions have been made to the Results section, where we have tried to discuss in depth why certain issues have arisen and what their effects are. For more details, we refer to Referee Comment 1 and the adapted paper. This point also leads to the aforementioned changes to the Discussion and Conclusions: the reasons for certain methods performing well or poor, have been integrated into a series of questions that can be used as a decision tree for occurrence-bias-adjustment.

Specific Comments

Comment: Title: The title could be reformulated to focus on the climate data

Response: Given the reasoning in response to the general comments, we have not removed discharge from the paper. Therefore, we prefer to keep the title unchanged.

Comment: It is suggested to create a clear "material and methods" section.

Response: We have followed this suggestion. The new 'Data and methods' section bundles the former 'Data' and 'Bias-adjusting methods' sections.

Comment: Line 80 – 103. This section should be moved to a "material and methods" section.

Response: We have merged l. 92-103 with the relevant parts of the 'Data and methods' section, but the l. 80-91 felt relevant enough to be in the introduction, as it also included our motivation for using certain methods. This seemed to general for inclusion in the 'Data and methods' section.

Comment: Line 105 – 109 is not needed.

Response: These lines have been removed.

Comment: Line 310 -314. This section can be removed.

Response: As this is related to the discharge, these lines were not removed.

Comment: Table 1. Index 2 & 3 could be removed.

Response: As this is related to the discharge, these lines were not removed.

Comment: Line 321-328 could be removed.

Response: As this is related to the discharge, these lines were not removed.

Comment: Line 338-357. This section could be moved to a "material and methods section".

Response: This has been adjusted. These lines are now included in Section 2.3 'Evaluation', which is part of Section 2: Data and Methods.

Comment: Fig.5, Fig. 8. The quality of the symbols should be revised.

Response: This was a technical problem. The quality of these symbols and those of the other figures as well has been updated.