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**hess-2020-605**  
Responses to anonymous referee 3

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January 11, 2021

Dear Anonymous Reviewer 3,

thank you very much for reviewing our manuscript. We are very grateful for your comments and suggestions. In the following, we provide detailed responses to all your comments.

On behalf of all authors,

Sincerely,

Erwin Rottler

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## 1 General Comment

This paper analyses future changes in flood seasonality in the Rhine River Basin at three different global warming levels using the mesoscale Hydrological Model (mHM). The paper is well structured and written, considers earlier work quite well, and provides new insights in flood seasonality changes under climate change for the Rhine basin. Finally, the authors list some next steps to improve the modelling approach as including a glacier module or reservoir and lake functionality.

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Thank you for reviewing our manuscript. In the following, detailed responses to all your comments.

## 2 Specific comments

### 2.1 Comment 1

Data and Methods: suggest to include that the model does not include a glacier and lakes module. For the basin upstream Basel not including lakes can have quite some effect. Now, this becomes only clear at the end of the Conclusions section.

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We will include this information earlier, i.e., in the method section.

### 2.2 Comment 2

Page 3, line 15, please describe the downscale and bias correction in more detail. The sentence "adjusts the monthly mean and daily variability of simulated climate data to observations." does not describe how this was done.

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Thank you for pointing at this. We will extend this paragraph and provide additional information on the downscaling and bias correction.

## 2.3 Comment 3

Page 3, lines 22-25, The calibration procedure could be described in more detail. 1) For example why was the gauge Lobith also included in the calibration procedure? With MPR, one could have chosen for example three smaller sub-basins to find how well parameters are transferable to the larger basin scale. This makes the calibration more efficient, and would also provide an interesting result (although I understand this is not the focus of the paper, it is an important aspect of this study). 2) What were the specific DDS settings (e.g. number of function evaluations)? Please add these to the text. 3) Finally, how many model parameters were calibrated? At least this gives the reader some insight into the model complexity.

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We will provide more information on our multi-basin calibration approach and model parameters calibrated.

## 2.4 Comment 4

Page 14, line 5. Suggest to change "increased precipitation intensity" to amount, the analysis is about a monthly time scale, so probably better to use amount and not intensity.

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Yes, you are right. "Precipitation intensity" can be a bit misleading in our case. We will think of a better term focusing on the "amount" / "totals".

## 2.5 Comment 5

Page 15, line 10 and lines 13-14: Please add this reference as an example: <https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2019WR026807>, for a modelling approach also applied to the Rhine basin that already includes a glacier and lake module.

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We thank the Reviewer for this very interesting article! We are happy to include it into discussion of our manuscript.

### **3 Technical corrections**

#### **3.1 Comment 6**

Fig 7. change “elvation” to “elevation”

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Thank you, we will correct this typo.

#### **3.2 Comment 7**

Page 8, Table 2, change “ration” to “ratio”

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Thank you, we will correct this typo.