

## ***Interactive comment on “Projected changes in Rhine River flood seasonality under global warming” by Erwin Rottler et al.***

### **Anonymous Referee #1**

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The manuscript is much relevant both for science and practical water resources management. It helps to understand the complex runoff regime of the river Rhine and the effects of global warming on flood generation in large rivers. Furthermore it is a very helpful study for the planning of flood protection measures.

The title reflects the content of the paper very well. The results are sufficient to support the interpretations and the clearly presented conclusions. The figures are very clear and for the most part self-explanatory.

General comment:

Scientific terms and abbreviations should be the same in figures, tables and the text. E.g. in Fig 5 the term "discharge" is used but in the text "streamflow". in Fig 6 and

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its captions is written "melt magnitude" but in table 2 and the text the abbreviation Smax14. In table 2 Smax14 is singular, in the text sometimes plural. In the figures, tables and their captions should be checked if the same terms are used as in the text. I suggest to give the explanation of abbreviations in the method chapter, in table 2 and in the captions of the figures (but there only in brackets).

## Data and Methods:

The expression "sub-basin upstream gauge Basel" is quite complicate and, as I think, not necessary. I suggest to explain, that some of the investigated variables refer to the gauge and others to the basin. And then I would refer only to "gauge Basel" or "basin of gauge Basel"). Same for Cochem. Especially in the later chapters the long term of "sub-basin upstream gauge Basel" is a bit confusing.

P7, Fig3: Misspelling in the last point (elevation and solid precipitation)

P8, Table 2: the two last variables are not listed on P6, L11-L13. For me it is not clear what is meant with "melt elevation" especially when it comes to the units (see also Fig 6). For more clarity one could give the units in the table that also helps to understand if it is a value at a gauge or for a basin.

## Results:

It would be helpful, if the figures would be described more systematically. Sometimes exact values are given, sometimes not. Sometimes the results for Basel are described first, sometimes those for Cochem. It would be less confusing for the reader, wenn the order would be always like in the figures.

P8, L1: In my opinion the first two sentences contain already important results and therefore should be more precise and with more information. E.g. like this: "According to the model simulations the changes are largest at gauge Basel (Fig. 5a). Here, the median of discharge magnitude increases from 2500(?) m<sup>3</sup>/s in the historic period to 2700 (?) m<sup>3</sup>/s supposing a warming of 1.5 degree. Furthermore, the highest floods are

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higher than in the historic period. However, this increase in discharge is not linear with temperature rise....".

P8, L4: The results for Cochem and Cologne (Fig 5b and 5c) should be briefly mentioned already here (e.g. Cochem shows only very little increase of maximum discharge with increasing temperature).

P8, L5: The figure reference is not correct. Should be Fig. 5d to 5f.

P8, L8: I see a signal of change for Cochem: annual maxima seems to be a bit earlier (probably due to less solid fraction in the Vosges as proved in fig 6) .

P8, L13: Wrong word? "...runoff contribution of snowmelt of more the 20%..." should probably be "...runoff contribution of snowmelt of more than 20%...".

P8, L15: Here, Smax14 is plural and in the sentence before singular.

P8, L16: "solid Pmax5" is probably wrong, "total Pmax5" is probably meant as shown in the Figure and als logically (solid Pmax5 decreases with temperature rise).

P8, L22: Value of solid fraction should also be given for the historic period (80%), so that the reader do not have to look for it in the figure.

P11, L1: In think the information on highest ETmax14 is not relevant for the purpose of this study that is flood seasonality. This sentence should be deleted.

Discussion and Conclusion:

P12, L3: Delete sixth word "in".

P14, L32: Concerning precipitation intensity (see also Abstract): I think the study does not show, that the precipitation intensity increases. The rainfall intensity (or I would say "rainfall amount" because I associate intensity with shorter event of up to 72 h) increases due to higher fraction of liquid precipitation. Less snow, more rain... But is the total amount of precipitation increasing? If yes, I missed this result before.

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P15, L14: Here one could mention the lake of Constance, that has a considerable influence on the flood magnitude at gauge Basel. The lake of Constance is a big storage for the snow melt from the "Alpenrhein". By the way, the lake is not shown on the maps (and I wonder if it is part of the mHM). At least one should briefly mention the lake and its effect in general.

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