

## ***Interactive comment on “Flood risk along the upper Rhine since AD 1480” by I. Himmelsbach et al.***

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We, the authors, thank the reviewers for their constructive and detailed comments which helped improving the text. We hope that we were able to edit the passages in question in an acceptable manner. Please find our comments on the referee’s suggestions in the text below.

Anonymous Referee #1 Received and published: 13 February 2015

"[. . .] My principal remark relies on the main scientific objectives of the paper: these objectives should (in my opinion) figure more clearly, starting from the abstract and the introduction. Some parts of the article suffer then from a lack of connection between them, which contributes to reduce the organization and the coherence of your

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results. For instance, the link between underlying the meteorological causes and the risk management analysis should be developed and argued."

Response: Those points had been addressed by the referee in greater detail in the sections below. Please find our comments there.

"The general visibility of the Figures has to be improved (use a bigger font, localize the examples on your studied area by adding a small map in a corner of the figure, use a more contrasted colour for the "natural flood plain" of the Rhine river)."

Response: We generally revised the figures, changed font size and some color and added information (e.g. in form of a general map) where necessary.

"Some general remarks for each section: The title of the paper may be judged as too neutral and doesn't point totally out your approach. Maybe consider to change it for a more relevant one."

Response: We agree with the point made by the referee and changed the title to "Flood events and flood risk of French and German tributaries of the Rhine and the Rhine itself along the upper Rhine since AD 1480".

"The abstract is too short, and doesn't seem to represent all the objectives of your study. You should maybe give more details on your methodology and your results in order to incite the reader. Insist more on the originality of the studied area and of the solicited approach in a such way to promote the scientific interest of the paper. During the introduction you point out the interest of studying small catchments area but don't develop this aspect anymore in the rest of the paper, and especially in the conclusion. As in the abstract, the main purpose of the study should clearly figure and be developed within the introduction (historical analysis of floods events and relation between floods risk and vulnerability, flood risk management?)."

Response: We agree with the referee and revised the abstract.

"Concerning the methodology and the data set, the paper makes reference of the sev-

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eral classifications schemes used in historical climatology and seems especially based on the works of Glaser. It firstly would be necessary to develop the main criteria used and show the main limits of each class. For instance, we don't know exactly the difference between the class "average damage" and the class "severous damage" without looking at the referenced articles. It would be a good idea to represent these limits inside the Table 1 (?)."

Response: We added the requested class limits to table 1 as suggested.

"Secondly, the uncertainties about dealing with historical information are not mentioned. These uncertainties are yet a significant parameter to point out in order to criticize the methodology (especially for quantitative data such as return periods or economic values). For instance, comparing economic value of disasters from different temporal and spatial scales raises many questions such as the data availability through centuries."

Response: In general we agree with the referee. Uncertainties are always an important aspect when dealing with (historical) data. As far as our methodology comparing economic loss between two flood events from different centuries goes, we however feel to have addressed that issue by normalizing the damages. We have not claimed that the database we use will cover the entire losses of both events. Neither can that be archived nor is it necessary for our approach. However we feel that the comparison we made – based on the available data – is sound. We added a paragraph hinting to the likely incomplete dataset.

"The analysis of the evolution of meteorological causes triggering to floods points out some interesting points. It should however be relevant to bring some conclusions at the end of this part and link this part with the vulnerability analysis."

Response: We edited the passage in question and added information in the text.

"I would be more critic about this second part of your results. In fact, you mainly com-

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pare the vulnerability face to flood taking mainly into account the inundated area and the damages and don't really take into account the land-use evolution (except for the case study of Mulhouse which is more detailed and quite clear). It would be interesting to link more the land use and flood risk management evolutions in consideration for the two first case studies. The second needs in that way to be more developed (it doesn't seem very useful in comparison with the others which are more detailed)."

Response: We added information and revised the text in order to better document our approach, so we feel confident, that it provides additional information to our text pointing to the fact, that not only land use changes affect flood events, but also the condition of structures like bridges.

"We don't know of which part of the studied area you make reference within this part (it is the same for Fig. 15). The studied of trans-boundary aspects should be more linked to the rest of the study. You mention many interesting points but the text should be related to the precedent points developed in the paper (Why the study of local flood risk management is interesting and influence or is influenced by the floods chronology?)"

Response: We commented on the trans-boundary aspect in depth in paragraph 6. We have revised that paragraph thoroughly.

"Maybe the title of this part should be review and focusing more on rivers and flood risk management? You could also post section 6 before section 5, in order to explain the administrative differences between France and Germany."

Response: We discussed the suggestion of the referee to reorganize the text and found that idea helpful. We decided to print paragraph 6 before paragraph 5.3.

"Finally within the conclusions, some on the main results should be resumed and more developed in order to illustrate why this paper can be considered as an original article and is relevant for improving flood risk analysis (or depending from you initial objectives). The conclusions given are not substantial and need to be revised. Some

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perspectives should also appear."

Response: We agree with the referee and substantially revised the conclusions.

Specific remarks:

P178, L21-26: "You give some examples about flood risk management on small catchment area in France. How is this management in Germany?"

Response: We added the requested information.

P179: "Maybe insist on the historical context of the studied area. How this historical context significant in your analysis? For instance you didn't mention that Alsace was attached to the German government for almost 50 years. I would suggest to also insisting on the originality of the studied area: a local context marked by the presence of a significant river (the Rhine) and a cross-border location. Concerning the meteorological aspects, maybe a map could illustrate the annual rainfall on the studied area in order to shed the light on the rainfall characteristics? You indicate the presence of numerous stakes inside the region: are they spread over the territory in a homogenous way? (I especially think about the little tributary of the Ill River)?"

Response: We added a small map of the spatial distribution of precipitation. However we feel that this topic was conclusively dealt with during the REKLIP project and we therefor want to refer to their web-page.

P180, L19: "You wrote 15 tributaries instead of 14 mentioned on the page 179."

Response: We apologize for the typo and corrected the passage in question.

P180, L24: "The sentence "Had as of yet" seems incorrect. I suggest "Had yet been conducted"?"

Response: We edited the passage in question.

P181, L1: "The dash for "Flood-risk-management" seems unnecessary."

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Response: We apologize for the typo and corrected the passage in question.

P181: "The data should be more detailed as well as it limits (cf. General remarks)."

P181: "I disagree with your affirmation indicating that most of the floods events in France can be found before the 19th century. According to the table, it seems that there are 402 events from the 15th to the 18th and 799 events from the 19th to the 21th century right? Next sentence: does the figure 2 only points out the gauge data or is it also about written sources? (cf. remarks on methodology)."

Response: We substantially edited the passage in question and added information in the text.

P182: "It would be better to give the number of the Figure after the date of the concerned flood instead of at the beginning of the section."

Response: We discussed that point. However we decided to maintain our system.

P182, L15: "What is the general meteorological pattern responsible for this kind of flood? I know it is located outside of the studied area but I would be interesting to notice it from the literature."

Response: We edited the passage in question and added some information.

P182: "End of 5.1 section, Remark: A table similar to the table 2 and including the number of floods within each group (and associated with the class of severity) would be interesting to create in order to go further in the analysis."

Response: We agree with the referee. However the organization of our dataset would make that task time consuming, so that we unfortunately will go without that table.

P183, L15-17: "Why is it important to collect data on timing and meteorological causes? It would be necessary to affirm the aim of this information and link it to the objective of your analysis."

Response: We edited the passage in question and added information in the text.

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P184, L2: "Are the changes in Fig. 7 statistically significant or simply due to sampling variability?"

Response: We edited the passage in question and substituted the word 'significant'.

P185, L11: "Syntax problem: A link word seems missing between "modern" and "the hydrological budget."

Response: We corrected the passage in question.

P185: "I think the term of "vulnerability analysis" has to be taken with precaution. Maybe give more examples of how useful can be your work for studying flood vulnerability? In the same order, you may mention your methodology clearly: comparing the inundated area from different floods on a same territory and analysing the damage location in order to see the changes and the possible influence of risk management policies and land use?"

Response: We substantially edited the passage in question and added information in the text.

P186, L6: FIG. 14: "You need to locate the village mentioned in the text on the map, unless we cannot verify your point."

Response: We added a general map providing that information.

P186, L13: "The pattern of this region has not changed very much between 1896 and 1991" seems in contradiction with you last paragraph explaining the changes. Maybe that's an assessment to do at the beginning of the section?"

Response: We revised the paragraph and figure in question in that manner that we hope, our point became clearer now.

P185, L20: "Established" without the "c".

Response: We apologize for the typo and corrected the passage in question.

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P186, L25: Spelling mistake: “an analysis”

Response: We apologize for the typo and corrected the passage in question.

P. 186: “After 1991” isn’t supposed to be “After 1896”? We cannot judge of the situation after 1991 from the map? What is the return period of these two events according to your analysis (I think it has to be indicated)? What are the differences on damages between these two floods?”

Response: We indeed meant “after 1991”. The passage in question gives additional information which exceeds the information given in the maps. We substantially edited the passage in question and added information in the text.

P186, section 5.3. "As suggested on general remarks, I would suggest developing or deleting this point. The merits of this case study are not clearly shown from your comments."

Response: We substantially edited the passage in question and added information in the text.

FIG. 15: "We don't know exactly where the area is located. You need to put another map on the left high corner in order to locate this region in you study area. We don't know which river this point is focusing on: is it still on the Dreisam River or is it one of its tributary?"

Response: We added a general map providing that information.

P187, L1: "I suggest to date the last major flood event (1924 according to the figure)."

Response: We added that information in the text.

P187, L25: "Maybe indicate the subject of your comparison: “flood risk management?” or “rivers management”? On” the research area instead “of” seems better."

Response: We edited the passage in question.

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P188: "The older example of prevention cited is 1716, but the study is starting in 1480: What was the situation before ? In a general way, how can you link this part with the first ones and with the scientific interest of your study?"

Response: We substantially edited the passage in question and added information in the text.

P188, L22; P189, L14; P189, L24: after ":" do not start with a capital letter.

Response: We apologize for the typos and corrected the passage in question.

P190: "Your conclusions are short. I suggest developing briefly the main results coming from your research (changes in flood chronology, evolution in vulnerability (or nonevolution)?). You need to bring some new perspectives and highlights why the Transrisk project contributed to improve the methodology on flood risk analysis. Do these results can be used for Flood Directive?"

Response: We agree with the referee and substantially revised the conclusions.

M. Ertsen (Referee #2) Received and published: 27 February 2015

"[. . .] Basically, what I argue is that the paper should include more detail on the source material, including the type, certainty, and socio-political context."

Response: In general we do totally agree with the point taken by the referee. However we feel this discussion, covering the region of the upper Rhine with its eventful history and an actual count of nearly 3000 described floods way overshoots the possibilities even of a long paragraph in this article, but would be perfectly suitable for a paper of its own.

"The introduction stands rather brief as is, . . . (comment continued below)"

Response: We agree that the introduction was too short and revised the paragraph. See comments to referee#1.

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(comment continued) "... and suggests that "small" and "large" can be compared as "weak" and "strong". Even if this were to be correct for the cases to be discussed, it would still need to be shown."

Response: We feel that we never implied that "small" could be compared to "weak" and "large" could be compared to "strong". We did not use the latter categories in the text, but only referred to the physical size of the catchment areas researched. We apologize for a possible misunderstanding of our text.

"In addition, the introduction could be used to position this study within the larger scholarly context of historical hydrology."

Response: We discussed the point taken by the referee. However we feel, that the topic of our text points in a slightly different direction as aspects of historical hydrology are only slightly mentioned in the example comparing flooded areas of two past flood events of the river Dreisam with inundation areas legally labeled by the administration.

"The paragraphs 3 and 4 as they are now, are hardly informative and could apply to any study - even on those about very different topics."

Response: We edited parts of paragraph 3 and substantially edited and added information in paragraph 4.

"The interesting remark in 4 about the difference between France and Germany suggests that the database is shaped through differential data sets. This is obviously well-known in history: the surviving data are usually the data of the winners and at least of those who could write. In order to be able to judge the validity of the hydrological argument, I would suggest that much more emphasis on the historical argument is needed. What do the different types of data mean?"

Response: We agree with the referee that our dataset on flood events in the upper Rhine region (covering nearly 3000 different events as of now) originates from a large variety of sources covering different administrations and different political and social

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systems since 1480. This lies in the nature of things. However we argue that information about floods are mostly free of value. Furthermore the method of critical source analysis requires multiple hints to a single event to be regarded as “true” information. Therefore we feel that our data is – at large – reliable.

"Why are certain data sources better represented or not?"

Response: See comment to the point taken by referee#1 to p181.

"Similar debates have been held within studies on fisheries, with historians suggesting that treating historical material as neutral raw data is problematic, as these data (like the actual catch and processes on board of ships) were at least partially manipulated within the existing political economy."

Response: We argue that concerning the motivation to edit / falsify data there is a large difference between economic data giving information about trade value and the descriptions about flood events used in our text.

"Especially the transboundary aspects of the case in the paper would allow for a critical analysis on the source material. This would improve the paper even further."

Response: We substantially edited the passage in question and added information in the text.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 177, 2015.

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