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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Flood history of the Bavarian Alpine Foreland since the late Middle Ages in the context of internal and external climate forcing factors" *by* O. Böhm et al.

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General evaluation: This paper presents an analysis and interpretation of the documentary sources on floods for Bavarian Alps foreland. Whereas in Bavaria, the systematic records of flood levels go back to 1821, using the documentary sources, authors succeeded in extension of the flood analysis to the 13th century. I consider the paper as very interesting and valuable. Specific comments and points to be addressed: 1. I strongly suggest the authors to include the overall summary of used data. How many flood events (without specifica- C5228 tion of locality) were recorded during the examined period? Answer: In the database "IBT" are more than 18.000 records organized.

For the investigation area above 1800 single records could be collected. All other records are temporal linked to Bavarian Foreland flood events as a European climatic frame to understand meteorological and climatological geneses for floods into the investigation area. The database of this paper resp. for Fig. 3 are above 1600 different flood records which could be assigned to 584 independent flood events 584. Please compare see page 7412 l. 16, Discussion Paper. Changes: The time series "Bavarian Foreland", depicted in Fig. 3 is derived from above 1600 different flood records in total. The single records could be sophisticated into 399 level 3, 746 level 2 and 779 level 1 events. I mean the flood event asspecified on example of flood event of 1501 (7418/ pp. 10–15). 2. The authors should stress in how many sites (profiles – being either hydrological sites or sites mentioned in chronicles) were the flood events recorded in the IBT database. It is not clear if these are the 9 sites presented by Fig. 1 (Kempten (Iller), Augsburg, Landsberg- (river Lech), Munich, Landshut (Isar), Innsbruck, Wasserburg (Inn), Salzburg, Burghausen (Salzach)? Answer: Fig. 1 depicts the most important historical sites concerning historical records. The sites are also depicted to express the spatial location of the investigation area. For the time series Bavarian Foreland written evidences of the middle reaches and tail waters have been consulted. For the EIP only one gauge was considered. For EIP please compare p. 7414, line 4 following, Discussion Paper. Changes: Due to the beneath described approach all written evidences of the middle reaches and tail waters have been considered. If it is the case, it should be explicitly mentioned in the text. Or are these above mentioned sites just the most important places were the floods were mentioned, or are these just places with water gauges? Answer: Beside the historical importance, all sites are historical/recent gauge stations. But only one representative gauge station per river was used for the time series. Please compare p. 7415 l. 5, Discussion Paper. Changes: Text beneath caption of Fig. 1 has been rephrased Fig. 1: Investigation area. The Bavarian Foreland is bordered by the rivers Iller, Danube, Inn/Salzach and the Alpine border (dashed line). Red spots are locating outstanding historical locations and gauges.

This should be clarified in the text. If there are more important places relevant for the

topic, they should be described and adequately marked in Fig. 1. 3. The authors should provide more detailed information on the documentary data on floods at disposal for the above profiles – particularly interesting is the time span of the data and count of the documentary sources. Answer: Please compare Chapter 3 “Database”. This chapter encloses a brief description of the used data. Main aim of the current paper was not a detailed discussion of the used data but the flood vulnerability of a superordinate spatial unite as function of climatic parameters. 4. Bohm (2006) provided the analysis of flood frequencies separately for Munich and Augsburg, similarly Schmocker et al. (2010) analysed the flood series separately for Switzerland. In this paper, in contrast, the data is merged and analysed jointly. Why? What is the reason? Answer: The aim was a superordinate spatial unite based on recent administrative borders under consideration of climatic parameters. The merging of the single time series should reveal the flood-vulnerability of the investigation area. Is there any benefit for merging the data? And how about the limitations? With respect to the point 1. of my review, it is desirable to clarify what are these flood events presented in the graphs showing 31-year standardized frequency. How were the flood events selected – what criteria did the authors select – please, specify in the text. Answer: On page 7416 line 7 following (Discussion Paper), the selection criteria are justified with an approach called NCA. In general the selection criteria is based on damage reports.

Changes:

. . . have been merged for one overall time series. The merging of the single time series should reveal the flood-vulnerability of a superordinate spatial unite based on recent administrative borders under consideration of climatic parameters. Single flood events as well as quantifications of flood events do not stand in the limelight of the current paper. The timeline of the flood history . . .

5. The authors should explain the acronym “EIP” time series. Answer: EIP means early instrumental period. Please compare page 7412 line 9 6. I suggest the authors to compare their results with the results of similar analyses published for Switzerland,

and particularly for the Czech Republic, where significant similarity in flood frequency can be anticipated. Changes:

The flood frequencies of the Bavarian Foreland in confrontation with selected flood frequencies of Central Europe This confrontation is limited to the period between 1500 and 1900. The limitation is founded due to weak data density in general before 1500 and due to a multitude of anthropogenic overprints of the river systems around the beginning of the 20th century. The comparison will be limited to the Lower Rhine and Middle Rhine (cf. Glaser 2008) and Vlatva (an Elbe tributary) and the Czech Elbe itself (cf. Brazdil 1998). The confrontation is depicted in table 4. Due to the decadal visualization beginnings and endings of the marked periods underlie a certain blur. Similarities for all time series can be particularly highlighted for the second half of the 16th century. In general an unexpected similarity can be stranded between the time series Bavarian Foreland and the Lower Rhine, except the years 1790 until 1819. Good accordance between the Bavarian Foreland can be revealed for the first and seventh and eighth decade of the 16th century. During the 17th century only the sixth decade shows good accordance. Again good accordance can be highlighted for the end of the 18th and beginning of the 19th century. Reasons for this variable behavior are founded in the variability of general synopsis and resulting weather conditions. In that context the above mentioned NAO is playing a vital role. For a further understanding of the variability between the confronted time series meteorological aspects must be consulted. Table 4. Confrontation of selected flood frequencies. Lower Rhine (RHl), Middle Rhine (RHm), Czech Elbe (ELBcz), Vlatava (VLA) and Bavarian Foreland (BF). Due to the decadal visualization beginnings and endings of the marked periods underlie a certain blur. Data altered according to Glaser (2008) and Brazdil (1998).

7. The authors should clearly denote the flood rich periods (the area above the polynomial function) in Fig. 3 – some appropriate tool for accentuation of the area should be used (shades of grey, #1-#9, colour). Chnages: Flood rich periods according to the grey boxes in Fig. 4 supplemented, see below:

Fig. 3: 31-year running flood frequencies of the Bavarian Foreland. Right ordinate: black columns show the annual flood frequencies, grey bars label flood-rich periods #1 to #9

Minor corrections â c Fig. 2 a, b – monthly maxima should rather be presented by the bar chart – it would be more transparent â c Fig. 3 – the x-axis should begin in the year of 1250, the polynomial approximation is pointless â ÌĄc 7416 - Fig. 4a – do the C5229 authors mean Fig. 2a? â c 7425 com-pared

Answer: Minor have been fixed for final revised paper

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 7409, 2014.

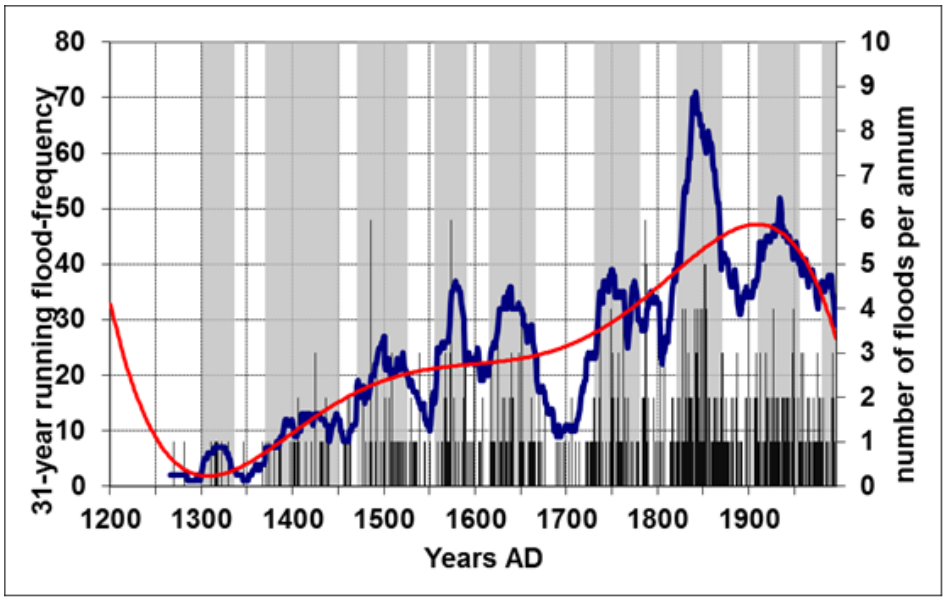

Fig. 1. Fig. 3

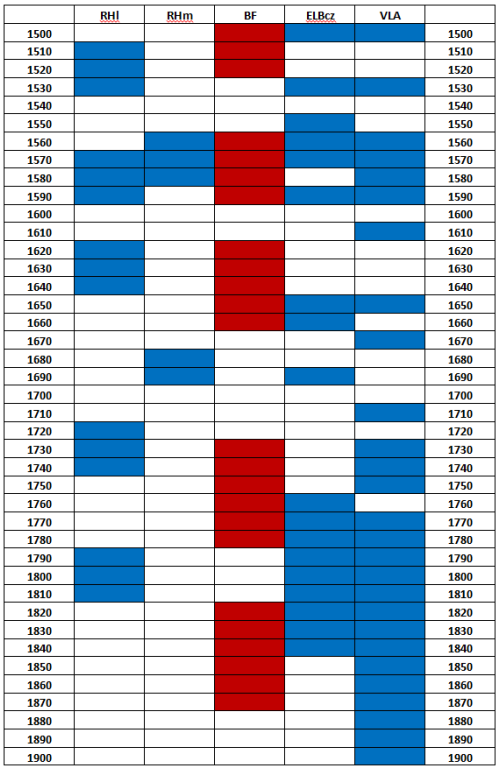
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Fig. 2. Tab. 4