

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 COMMENTS This manuscript is produced in a framework of European research on historical floods. Past years of systematic efforts of data collection are producing first exploratory results. Present manuscript show a primary overview about different climatic forcing factors explaining variability on flood frequency and seasonality. One of objectives is a better characterization of present uncertainty in central Europe on this natural risk. Historical climatology is presented as a right opportunity to collect historical information on that, generating and analyzing data (qualitative, quantitative, instrumental), obtaining results to improve knowledge of climatic and risk

C6722

temporal patterns of low frequency. Results are very interesting. Considering floods as a complex phenomena, with different factors at different time scale, including human factors, regional detailed approaches give us to scientific community partial but solid results to reduce uncertainties on this matter. Many techniques or methods for historical information treatment results new and interesting to be applied in other researches. Classification by indices is more or less usual, but corrections of variation on river bed depth result a concept very important for a better management of historical information of "context" when historical floods must be reconstructed more carefully as possible.

SPECIFIC COMMENTS – Section 1. Introduction. P. 7412. Lines 5-10... Authors give details of documentary sources researched for flood database. One question about it: for region under study, there are documentary sources available from local authorities (City Councils or similar)?

Answer: The database is divided. Descriptive data have been investigated in archives, chronicles, libraries, compilations and already existing databases like the HISKLID (ger.: Historische Klimadatenbank Deutschland by Rüdiger Glaser). The data of the EIP (early instrumental Period) from 1826 on could be investigated, maybe saved at the former archive of the former Bavarian Water Authority. Data basis of the EIP are worksheets with water level details in daily resolution.

From my experience, these sources are enough correct and reliable to obtain information on flood events in historical time. Any comment about this potential documentary source would be appreciated.

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 unit as function of climatic parameters.

– Section 3. Database. Authors mention clearly origin of information (biblio. references, databases...) collected for flood database. But is not easy to appreciate what

C6723

is dimension and general characteristics of information available about flood events. Not all public know these details for alpine region or central Europe. Authors should describe basic characteristics of flood database used for development of work into manuscript: number of flood chronologies, extreme years of flood data series available, total amount of flood events by spatial units (subregions, valleys, basins, cities.... as authors consider). Temporal distribution of flood events available is also illustrative. One figure with evolution of raw data, flood events before treatment and adjustment would be wellcome (by basins or cumulated).

Answer: Please compare p. 7415, line 17 following, there a brief characterization of flood database is given. Due to bidden brevity on a detailed listing of the characteristics of the single catchment areas was waived. For temporal distribution please compare Tab. 2

Changes: In Table 3 all flood events used for the merged time series "flood frequencies of the Bavarian Foreland" (cf. fig. 3) are listed. The time series is derived from 1825 different flood records in total which could be assigned to 584 independent flood events.

Table 3. Synoptic table of data basis 'flood frequencies Bavarian Foreland'. Columns a-c contains all outer alpine flood events of documentary evidences until 1880 segmented after intensity levels. Columns d-e contains all floods derived from instrumental periods until 2008 for one representative gauge per river. EIP = Early Instrumental Period, MIP = Modern Instrumental Period.

It could give opportunity to compare with similar approaches from other regions or basins.

– P. 7417. Lines 5-20. Organization of information about flood events is excellent. This is not a criticism, but this comment is needed to be highlighted. At present, with improvement and increasing information on historical floods, researchers involved can work with criteria suggested by authors: all information must be organized in flood events, considering all flood records or cases. One flood record can be unique to know

C6724

about one flood event. But other flood events may consist of a large number of flood records. A detailed analysis is needed to identify flood events, avoiding biases or wrong interpretations of data.

Answer: Due to the data base IBT meteorological perimeters for the flood events under consideration of recent distribution of precipitation and weather conditions have been considered to identify "one" flood event. In the database are more than 18.000 flood 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.

– P. 7424. Lines 3-5. Authors find good coherence between solar sunspots and flood frequency variability. It seems evident that cold periods record higher frequency of flood events. At least for any specific cases. I recognize for example for my study area strong coincidence for Wolf Minimum, not for Maunder Minimum. Considering complexity of climatic system, and having data for other similar period at historical scale, authors could give any comment about relation between this forcing factor and flood events? For example, both processes don't show temporal inercy or delete. How could affect so quickly solar sunspot to flood frequencies? Or any atmospheric mechanism is producing any direct effect?

Answer: The question about the physical links between flood frequencies and the variation of sunspot resp. the transfer through the atmospheric layers can't be answered at the moment. The author is working on a DFG proposal (German Research Foundation) which will contribute to solve this question.

– P. 7425. Lines 8-9. Description of NAO climatic pattern. For public not focused on climatology, more detailed description of NAO pattern would be grateful. This is a journal of hydrology. For example, details about regions affected by NAO patterns, seasonality, atmospheric processes involved. Any basic reference on NAO pattern

C6725

would be also positive to make easy access to more details.

Changes:

Due to oscillations of barometric pressure between the so called Island cyclone and Azores anticyclone weather conditions of the investigated area can be affected in various manners.

– P. 7438. Figure 5. All flood chronologies are plotted as an unique flood data series. It means a regional indices is created. Please, authors must define how this index is created. Is weighted? It use all events?, only level 3? all series? Please, more information is needed.

Answer: The aim of the current paper is a superordinate spatial unite based on recent administrative borders under consideration of climatic parameters. Only the flood events of the middle reaches and tail waters have been consulted. Due to the created approach NCA all events have been considered.

Modification: Chapter 3 Database and Chapter 4 Methods have been supplemented.

TECHNICAL CORRECTIONS – P. 7416. Line 24. Reference to "Figure 4a" has a ny problem. It's not available as a figure. May be "Figure 2a" ?? – P. 7425. Line 6. "com-pared" by "compared" – P. 7435. Figure 2a and 2b. Style of this figure must be changed. Saturation o f black dots produce too visual noise for a correct comprehension of figure.

Answer: Technical corrections have been fixed for final revised paper

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C6726

| River | a) Level 1 | b) Level 2 | c) Level 3 | d) EIP/MIP level 2 | e) EIP/MIP level 3 |
|----------------|-------------------|-------------------|-------------------|---------------------------|---------------------------|
| Iller | 32 | 53 | 15 | 45 | 13 |
| Wertach | 37 | 79 | 20 | 66 | 16 |
| Ledh | 101 | 159 | 80 | 78 | 38 |
| Isar | 88 | 101 | 29 | 55 | 18 |
| Salzach | 154 | 113 | 78 | 56 | 22 |
| Inn | 79 | 82 | 63 | 48 | 7 |

Fig. 1. Tab. 3

C6727