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Designing an ‘expert knowledge‘ based approach for the quantification of historical floods – the case study of the Kinzig catchment in Southwest Germany

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Future estimations of flood hazard and risk for developing optimal coping and adaption strategies inevitably include considerations of the frequency and magnitude of past events. Methods of historical climatology represent one way of assessing flood occurrences beyond the period of instrumental measurements and can thereby substantially help to extend the view into the past and to improve modern risk analysis. Such historical information can be of additional value and has been used in statistical approaches like Bayesian flood frequency analyses during recent years. However, the derivation of quantitative values from vague descriptive information of historical sources remains a crucial challenge. We explored possibilities of parametrization of descriptive flood related data specifically for the assessment of historical floods in a framework that combines a hermeneutical approach with mathematical and statistical methods.

This study forms part of the transnational, Franco-German research project TRANSRISK2 (2014 - 2017), funded by ANR and DFG, with the focus on exploring the floods history of the last 300 years for the regions of Upper and Middle Rhine. A broad data base of flood events had been compiled, dating back to AD 1500. The events had been classified based on hermeneutical methods, depending on intensity, spatial dimension, temporal structure, damages and mitigation measures associated with the specific events. This indexed database allowed the exploration of a link between descriptive data and quantitative information for the overlapping time period of classified floods and instrumental measurements since the end of the 19th century. Thereby, flood peak discharges as a quantitative measure of the severity of a flood were used to assess the discharge intervals for flood classes (upper and lower thresholds) within different time intervals for validating the flood classification, as well as examining the trend in the perception threshold over time. Furthermore, within a suitable time period, flood classes and other quantifiable indicators of flood intensity (number of damaged locations mentioned in historical sources, general availability of reports associated with a specific event) were combined with available peak discharges measurements. We argue that this information can be considered as ‘expert knowledge’ and used it to develop a fuzzy rule based model for deriving peak discharge estimates of pre-instrumental events that can finally be introduced into a flood frequency analysis.