



## **Reconstructing peak discharges of historic flood levels in urban areas**

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For historic settlement areas numerous flood level descriptions from times before the installation of river gauges are passed on, most of them are even dated. Typically, these written descriptions are qualitative such as “the water level peaked at 2 feet above the floor of the church” or “the water level topped the bridge before it failed”. Furthermore, historic flood water levels are frequently marked at buildings and constructions. Such descriptions of flood water levels are used to determine periods of increased flood frequencies but are rarely transferred into palaeodischarge numbers due to methodological problems. One major problem is the estimation of the cross section area due to missing information on the topography and hydraulic roughness of the floodplain and the river channel in historic times.

For the historic flood level records from the cities of Cologne (River Rhine) and Prague (River Vltava) an approach to estimate peak discharge is developed. Based on historic etchings, paintings and descriptions it is possible to reconstruct the characteristics of the river channel and floodplains to estimate cross-section areas during flood events. The reconstruction made use of all available data and estimations regarding channel incision as well as anthropogenic modification of the river and its floodplain. The mean flow velocity at the time of the historic flood events is estimated by the Manning-equation, based on the reconstructed river channel and floodplains. The slope of the water level is assumed to be comparable to recent values, while the estimation of the hydraulic roughness is a challenge as no studies on the hydraulic roughness of settled floodplains have been carried out so far. Sensitivity studies with different  $n$ -values within a reliable range of values are made to estimate the influence of this uncertainty. Finally, the reconstructed data are tested by estimating peak discharges of recent floods by the application of the described method and comparing the results with measured discharge data from the gauges located at Cologne and Prague.

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