



## Fuzzyfication of historical flooding data: case study of the city of Passau, Germany

Jose Luis Salinas, Andrea Kiss, and Guenter Bloeschl

Vienna University of Technology, Institute of Hydraulic Engineering and Water Resources Management, Centre for Water Resource Systems, Vienna, Austria (salinas@hydro.tuwien.ac.at)

Hydrological information comes from a variety of sources, which do not necessarily coincide. In particular, this is an important issue for the available information on water stages during historical floods. An accurate estimation of the water level profile, together with an elevation model of the riverbed and floodplain areas is fundamental for the hydraulic reconstruction of historical flood events, allowing the back calculation of flood peak discharges, velocity and erosion fields, damages, among others.

A set of historical floodmarks was recently collected during a field campaign (Salinas and Kiss, 2013) in the German city of Passau. For the greatest floods during the last 500 years, the water levels at different location in the old city centre were read out from stone markings and similar, and the numeric values were not always identical for the same events. One possible way of modelling the inherent unpreciseness of these historical water levels is with the arithmetics of fuzzy numbers (Zadeh, 1965), described by their membership functions, in a similar fashion as the probability density function describes the uncertainty of a random variable. Additional to the in-site collected water stages from floodmarks and other documentary evidence (e.g. preserved in narratives and newspaper flood reports) are prone to be modeled in a fuzzy way.

This study presents a formal approach on the use of fuzzy logic to transform historical information from different sources, in this case of flood water stages, into membership functions with the aim to perform further hydraulic and statistical analyses in the framework of fuzzy numbers algebra.

Salinas, J. L., and A. Kiss (2013), Hydraulic reconstruction of historical floods at the Danube-Carpathian basin, Geophysical Research Abstracts, Vol. 15, EGU2013-14036, 2013

Zadeh, L. A. (1965), Fuzzy sets, *Information and Control*, Vol. 8, pp 338-353.