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Analysis and propagation of uncertainties due to stage discharge relationship

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River flood discharges are seldom directly measured and usually derived from a single valued stage discharge relationship. However, discharge values typically scatter with respect to stages and the use of single valued relationship leads to uncertainties. The paper considers the fuzzy extension principle based methods for the analysis and propagation of uncertainties due to a scattered relationship. The uncertainty analysis involves the application of fuzzy regression methods considering the parameters of the relationship as fuzzy numbers. Both the linear and nonlinear fuzzy regression methods are used, which defines the upper and the lower uncertainty bounds of the relationship. The analysis produces membership functions of discharges corresponding to any measured stages. The discharge membership function of a flood peak is used for the propagation of uncertainties in river channels and floodplains. This involves the application of fuzzy extension principle based alpha cut method together with an one dimensional hydrodynamic numerical model. The results are combined with a digital terrain model for the depiction of uncertainties in the inundation areas. The methods are demonstrated using the data from the Lauffen gauging station in the Neckar River, Germany.