Imprecise probabilities to specify hydrological loads for flood risk management

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It is widely accepted that complete safety in flood management cannot be ensured by technical means. Assessments of the performance and the risk of failures of complex technical flood retention systems demand the specification of hydrological loads under a wide range of possible circumstances. However the outcome of risk assessments depends on pre-assumptions about these hazards. Design flood events which are characterizing "most expected" flood conditions under simplified basic assumptions are insufficient. This becomes evident if we compare the possible range of extreme events which could happen in relationship with the available information about observed floods. The existing gap of information demands new approaches to characterize uncertainties. The widely used application of more or less complex hydrological models to specify these loads should be combined with a consideration of the inherent imprecision in expressing probabilities in such a way. As it is more and more recognized that the concept of uncertainty is too broad to be captured by probability theory alone, the application of imprecise probabilities can be useful in this context. In a case study a wide range of possible flood events was specified by hydrological models which combine stochastic and deterministic components. The simulation results were analyzed by multivariate statistics. With acceptance of the uncertainties of simulations the characterization of loads was combined with a fuzzy-based specification of their plausibility. This plausibility was handled afterwards in a Decision Support System as basic characteristic of impact assessments of future planning decisions.