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# Opportunities of probabilistic flood loss models

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Oftentimes, traditional uni-variate damage models as for instance depth-damage curves fail to reproduce the variability of observed flood damage. However, reliable flood damage models are a prerequisite for the practical usefulness of the model results. Innovative multi-variate probabilistic modelling approaches are promising to capture and quantify the uncertainty involved and thus to improve the basis for decision making.
In this study we compare the predictive capability of two probabilistic modelling approaches, namely Bagging Decision Trees and Bayesian Networks and traditional stage damage functions. For model evaluation we use empirical damage data which are available from computer aided telephone interviews that were respectively compiled after the floods in 2002, 2005, 2006 and 2013 in the Elbe and Danube catchments in Germany. We carry out a split sample test by sub-setting the damage records. One sub-set is used to derive the models and the remaining records are used to evaluate the predictive performance of the model. Further we stratify the sample according to catchments which allows studying model performance in a spatial transfer context. Flood damage estimation is carried out on the scale of the individual buildings in terms of relative damage. The predictive performance of the models is assessed in terms of systematic deviations (mean bias), precision (mean absolute error) as well as in terms of sharpness of the predictions the reliability which is represented by the proportion of the number of observations that fall within the 95-quantile and 5-quantile predictive interval.
The comparison of the uni-variable Stage damage function and the multivariable model approach emphasises the importance to quantify predictive uncertainty. With each explanatory variable, the multi-variable model reveals an additional source of uncertainty.
However, the predictive performance in terms of precision (mbe), accuracy (mae) and reliability (HR) is clearly improved in comparison to uni-variable Stage damage function. Overall, Probabilistic models provide quantitative information about prediction uncertainty which is crucial to assess the reliability of model predictions and improves the usefulness of model results.