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Testing the cross-country transfer of multi-variable flood damage models

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Flood damage assessment is often done with damage curves based on a single hazard variable, most often water depth, using depth-damage functions. Since damage models are often transferred in space and time, from country to country, and from one flood event to another, uncertainties in these depth-damage functions propagate into damage assessments. Validation has shown that depth-damage curve estimates are associated with high uncertainties, particularly when applied in regions outside the area or country where the data for the damage curves was collected. In this study we compare multi-variable probabilistic models using Bayesian Networks and Random Forests. These models were developed on the basis of flood damage datasets from either Germany or The Netherlands. The variables in the datasets were harmonized, so that the models could be validated on each other's datasets. Using several criteria, the performance of the models was tested on a validation sub-set of the country's data. The models are also updated with data from the other country and then tested again. We present and analyse the quantitative results of these steps.
The results show that the German models (BN and RF-FLEMOps) perform better in the Netherlands than the Dutch models (BN and RF-Meuse) perform in Germany. This is because the FLEMOps models are based on more heterogeneous data than the Meuse models. The German data covers multiple flood events from multiple locations, representing a wider variety of damaging events and processes, compared to the Dutch dataset that covers a single event in a single location. The FLEMOps models, therefore, are better able to capture damages from other events and in other locations. The key conclusion is thus that multi-variable flood damage models perform better when transferred if they are based on heterogeneous data. We therefore hypothesise that flood damage data collection efforts over several years and different event locations provide more relevant information for improving quantitative risk analysis than an in-depth study for a single event.