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Assessing flood risk based on long-term continuous simulation with a coupled model chain

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A novel approach for assessing flood risk in river catchments in a spatially consistent way is presented. The complete flood risk chain is represented by coupling different models. This chain includes a multisite, multivariate weather generator, a hydrological model, a coupled 1D-2D hydrodynamic model and a flood damage model. For the example of the Mulde catchment in Germany, 10,000 years of meteorological fields at daily resolution are generated and used as input to the subsequent models. This results in 10,000 years of spatially consistent river discharge, inundation patterns and damage values. Flood risk is directly estimated by the simulated damage. The benefits of this approach are: (1) In contrast to traditional flood risk assessments, where homogenous return periods are assumed for the entire catchment, it yields spatially heterogeneous patterns of precipitation, discharge, inundation and damage which respect to the spatial correlations of the different processes and their spatial interactions. (2) Catchment and floodplain processes are represented in a holistic way, since the complete chain of flood processes is represented by the coupled models. (3) In contrast to the traditional approach where the discharge probability is used as proxy for the probability of damage, flood risk is directly derived from damage yielding a more realistic representation of risk.