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Assessing the potential of adapted land use to mitigate climate change effects on hydrological extremes in central Europe

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Climate change severely impacts the hydro-ecological conditions in central European watersheds. This study evaluates the capacities of adjusted land use management to mitigate the adverse eff̆ects of climate change on hydrological extremes. The understanding of driving forces of hydroň loŏgical extremes, the characterization of process interaction and the development of reliable methods of prognosis must be based on process-oriented, spatially distributed and (largely) un-calibrated modelling schemes.

The presented study comprises the setup of a physically-based modelling system, the preparation of a scaling procedure ("Geocomplexes") to maintain scale-invariant model certainties and the 30-year-validation of the spatio-temporal dynamics of water balance and flood risk in the Altmuňehl watershed (A=1.400 km^2) in central Bavaria. A stochastical procedure based on long time-series of station recordings is introduced to provide high resolution climate change scenario data.

Ensemble simulations are performed to predict the impacts of climate change on the runoff regiňme, indicating a significant increase of winter floods and strong drying during summer months, leading to increased water stress and drought frequency and adverse effects on the environmental flow requirements in the river. These changing boundary conditions are likely to create distinct conflicts between water resources managers with ecological or engineering backgrounds. Several land use scenarios from different perspectives are investigated to analyze the effects of non-structural planning measures to mediate water balance and river runoff extremes.

It is shown, that land use adaptations have significant but only limited potential to miti-

gate the hydro-ecological impacts caused by climate change. It is discussed, how these findings may be incorporated in an integrated and sustainable watershed management strategy.