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Spatially quantitative models for vulnerability analyses and resilience measures in flood risk management: Case study Rafina, Greece

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We will address spatially quantitative models for vulnerability analyses in flood risk management in the catchment of Rafina, 25 km east of Athens, Greece; and potential measures to reduce damage costs. The evaluation of flood damage losses is relatively advanced. Nevertheless, major problems arise since there are no market prices for the evaluation process available. Moreover, there is particular gap in quantifying the damages and necessary expenditures for the implementation of mitigation measures with respect to flash floods. The key issue is to develop prototypes for assessing flood losses and the impact of mitigation measures on flood resilience by adjusting a vulnerability model and to further develop the method in a Mediterranean region influenced by both, mountain and coastal characteristics of land development.
The objective of this study is to create a spatial and temporal analysis of the vulnerability factors based on a method combining spatially explicit loss data, data on the value of exposed elements at risk, and data on flood intensities. In this contribution, a methodology for the development of a flood damage assessment as a function of the process intensity and the degree of loss is presented. It is shown that (1) such relationships for defined object categories are dependent on site-specific and process-specific characteristics, but there is a correlation between process types that have similar characteristics; (2) existing semi-quantitative approaches of vulnerability assessment for elements at risk can be improved based on the proposed quantitative method; and (3) the concept of risk can be enhanced with respect to a standardised and comprehensive implementation by applying the vulnerability functions to be developed within the proposed research. Therefore, loss data were collected from responsible administrative bodies and analysed on an object level.
The used model is based on a basin scale approach as well as data on elements at risk exposed, and data on flash flood intensities. The model is composed of three basic parts: (1) the quantification of flood hazard via hydrologic and hydraulic calculations and the evaluation of flood intensity for various flood scenarios, (2) the determination of exposure to flood hazard using a semi-quantitative method for the determination of the hazard level, which serves the purpose for the spatial evaluation of corresponding quantities and (3) to show potential resilience measures to protect individual households.
The aim of the study is to provide a modified framework for quantitative assessment of vulnerability of building damages and to show potential resilience measures to protect individual households.