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A Fuzzy Formative Scenario Analysis modelling framework for knowledge integration in natural hazard management

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Hydrological hazards occurring in alpine regions during the last decades have clearly shown a variety of functional chains leading to floodplain inundation, such as morphological changes due to increased local erosion and deposition phenomena, and clogging of critical flow sections due to woody debris deposits. Simulation models are only partially capable to predict complex systems behaviours and the subsequently designed and implemented protection strategies are not able to mitigate the full spectrum of risk consequences.
The proposed Fuzzy Formative Scenario Analysis framework is based on a methodology of knowledge integration from various stakeholders involved in the risk management process. Based on a participative assessment, input parameters are defined to gain a deepened insight into particular system loading configurations at (1) hydraulically critical cross-sections and (2) longitudinal sections of torrents and river segments susceptible to geomorphic changes. Furthermore, potential system developments are deduced and consistent and reliable scenarios are constructed in a rigorously systematic manner. These scenarios are fundamental to assure quality during the planning process and are an essential prerequisite for the realisation of efficient protection systems.
Fuzzy set theory has proven to be a powerful modelling framework for the necessary qualitative and quantitative knowledge integration and for coping with the underlying uncertainties, which were considered to be a key element in natural hazards risk assessment.