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Integrated assessment of fluvial and pluvial flood hazards in the city of Salzburg, Austria

Korbinian Breinl
Paris-Lodron University of Salzburg, Department of Geoinformatics (Z_GIS), Austria (korbinian.breinl@sbg.ac.at)

Urban flooding can have various sources including floods from a river ('fluvial flooding'), from heavy rainfall usually from convective storms ('pluvial flooding') or from high tides ('storm surge'). Although awareness of pluvial flooding in the scientific community and among policymakers has been increasing, the term 'flooding' is still often seen as a phenomenon explicitly related to a river. Previous research primarily focused on fluvial flooding, with only very recent literature dealing with pluvial flooding. As a result, there are established methods to assess the hazards from fluvial floods, and a smaller number focusing on pluvial floods. Much less work has been conducted on integrated flood hazard assessment taking into account various types of flood hazards. In this work, an integrative, probabilistic modelling framework was developed to assess the urban flood hazard from fluvial and pluvial flooding in the city of Salzburg (Austria). The framework consists of a stochastic multi-site weather generator, which provides input for the hydrological model HBV. In the city of Salzburg, a kNN algorithm converts the simulated mean discharge into peak discharge as well as daily into sub-daily precipitation. The time series generated in this way make the identification of fluvial events (peak discharge) and pluvial events (sub-daily precipitation) possible. The kNN algorithm inherently considers weather situations to ensure a reasonable disaggregation of daily precipitation. Critical thresholds of pluvial flood events are empirically derived from damage data provided by a local insurer as well as action plans from the local fire service. The modelling framework is then applied to examine the probability of the two single flood hazards, as well as the probability of simultaneous pluvial-fluvial flood events.