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Strengthening community resilience against impacts of urban flash floods

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Urban flash floods (UFF) are caused by short-term intense precipitation events (STIPE), exacerbated by urban land use changes, namely surface sealing. STIPE last from several minutes to a few hours at a given location. They mainly occur during the warm season and originate from individual or clusters of cumulonimbus clouds. Observed and projected temperature increase enhances the water-holding capacity of those clouds by up to 14% per degree of warming (super-Clausius-Clayperon-relation), intensifying the risk of UFF.

Many communities are not sensitised and prepared for the massive surface runoff and subsequent flooding following STIPE. Valley locations canalise the water and particularly increase the risk of UFF. Critical factors shaping the impact of STIPE are, among others, slope gradients, the degree of surface sealing, vegetation structure, soil type and pre-event soil moisture. Consequently, most communities possess no appropriate overview of potentially flooded areas by small streams and laminar water flow during STIPE, and their resulting vulnerability.

The contribution introduces a framework empowering local communities within the central-German federal state of Hesse to strengthen their resilience against impacts of UFF. The project consists of two parts:

1) Data analysis: information on observed heavy precipitation events and their changes (by gauges and radar), STIPE emergency management data, topographic aspects and erosion risk maps are mapped into integrated state-wide "heavy precipitation reference maps" with a resolution of about 1 km^2. Communities profit from a general UFF vulnerability estimation, supporting larger-scale communal spatial planning.

2) Support part for hydrological engineers: will improve the data foundation for hydrological applications by providing

a) routines to easily implement radar precipitation data into hydrological applications,

b) preprocessed radar sample data sets of observed STIPE to be used in originally affected areas, but also locations with similar spatial characteristics, and

c) more realistic equations for laminar water flow and STIPE runoff potential.

All of these aspects support communities in improving their resilience with respect to STIPE. As a practical example, high-resolution (<1 m^2) exemplary "heavy precipitation hazard risk maps" will be produced for two local communities in Hesse.

Communicating highly complex, subject-specific scientific results of different sources to public decision makers in mostly small to medium-sized communities is a specific necessity within the presented framework. We focus on three challenges: to efficiently 1) increase the awareness of decision makers towards the municipalities' existing vulnerability to UFF, 2) convey the benefits of precaution measures, 3) sample and distribute best-practice examples in disaster control and precaution measures.