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Pluvial flooding in urban areas: Parsimonious hazard mapping for a case study in Berlin, Germany

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Urban pluvial floods are increasingly recognized as a ubiquitous hazard. They are caused by short and intense rainfall, followed by rapid runoff concentration. But while flood hazard maps for rivers have been widely implemented under the EU Flood Directive, corresponding efforts for pluvial flooding are rare, yet: pluvial floods are not to the existence of a river channel. They could occur anywhere, subject to the existence of minimal areas for surface runoff generation and concentration. That concentration could be dominated by small features of urban landscapes, which makes identification of flow paths uncertain even with highly-resolved digital elevation models (DEM) and full hydrodynamic simulations (which are computationally expensive). At the same time, sub-surface sewer and drainage systems – an additional complication in an already complex environment – will typically be subject to overcharge for extremely heavy rainfall events. That, however, allows us to focus on the surface in order to assess the hazard from such events. In the present study, we present a low-(computational)-cost approach to identify areas at risk of pluvial flooding. Common GIS operations are used to detect flood-prone depressions from a high-resolution 1m x 1m DEM, identify contributing watersheds, and represent runoff concentration by a fill-spill-merge approach. The approach is applied to a study area in Berlin, which has been repeatedly subject to pluvial flooding in the past years.