Towards identification of critical rainfall thresholds for urban pluvial flooding prediction by crowdsourced flood observations

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The identification of critical rainfall thresholds beyond which urban floods are likely to be triggered can provide valuable input for urban flood management and climate resilience strategies. In this study, the potential of crowd-sourced data and open spatial data is investigated to predict urban pluvial floods. Citizens' flood complaints and reports for the city of Rotterdam are correlated with radar rainfall estimates and sewage pump flows from 2010 to 2016 to study the link between rainfall amounts and hydrological response at variable temporal and spatial scales. A robust change point analysis technique is used to derive critical thresholds of rainfall amounts and imperviousness above which the occurrence of flooding starts to increase. Surprisingly, the identified rainfall thresholds equated to only half of the drainage system design capacity. Furthermore, results indicated a significant imperviousness threshold of 0.7, above which the probability of pluvial floods increases. Antecedent rainfall depth does not seem to be a significant predictor for urban pluvial floods. We found that the spatial analysis is strongly sensitive to the aggregation scale. Our study implies that crowdsourced data and open spatial data have a considerable value, additional to the conventional hydrological analysis of urban water systems.