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Impact-based early warning for pluvial floods

Viktor Rözer[1,2], Aaron Peche[3], Simon Berkhahn[3], Yu Feng[4], Lothar Fuchs[5], Thomas Graf[3], Uwe Haberlandt[6], Heidi Kreibich[2], Robert Sämann[3], Monika Sester[4], Bora Shehu[6], Julian Wahl[5], and Insa Neuweiler[3]

[1]Grantham Research Institute on Climate Change and the Environment, London School of Economics, London, United Kingdom (v.roezer@lse.ac.uk)

[2]Section Hydrology, Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences, Potsdam, Germany

[3]Institute of Fluid Mechanics and Environmental Physics in Civil Engineering, Leibniz Universität, Hannover, Hannover, Germany

[4]Institute of Cartography and Geoinformatics, Leibniz Universität, Hannover, Hannover, Germany

[5]Institute for Technical and Scientific Hydrology (itwh) GmbH, Hannover, Germany

[6]Institute of Hydrology and Water Resources Management, Leibniz Universität, Hannover, Hannover, Germany

Pluvial floods in urban areas are caused by local, fast storm events with very high rainfall rates, which lead to inundation of streets and buildings before the storm water reaches a watercourse. An increase in frequency and intensity of heavy rainfall events and an on-going urbanization may further increase the risk of pluvial flooding in many urban areas. Current early warning systems for pluvial floods are limited to rainfall predictions with fixed thresholds for rainfall duration and intensity and often do not provide the necessary information to effectively protect people and goods. We present a proof-of-concept for an impact-based early warning system for pluvial floods.

Using a model chain consisting of a rainfall forecast, an inundation, a contaminant transport and a damage model, we are able to provide predictions for the expected rainfall, the inundated areas, spreading of potential contamination and the expected damage to residential buildings. We use a neural network-based inundation model, which significantly reduces the computation time of the model chain. To demonstrate the feasibility, we perform a hindcast of a recent pluvial flood event in an urban area in Germany. The required spatio-temporal accuracy of rainfall forecasts is still a major challenge, but our results show that reliable impact-based warnings can be issued up to 5 minutes before the peak of an extreme rainfall event. To effectively disseminate the warnings issued by the model chain we propose a two-way mobile warning application that allows for the collection of real-time validation data.