Geophysical Research Abstracts
Vol. 21, EGU2019-5104, 2019
EGU General Assembly 2019

Simulation of heavy precipitation in urban areas: a multi-level approach

Sebastian Gürke, Jens Bender, and Jürgen Jensen
Research Institute for Water and Environment, University of Siegen, Siegen, Germany (sebastian.guerke@uni-siegen.de)

In recent years, numerous heavy rainfall events have led to severe flooding with considerable property damages and also fatalities worldwide. The city of Siegen (115 km^2), located in the southeast of North Rhine-Westphalia (Germany), has been affected by heavy rainfall events (pluvial) as well as fluvial floods several times in the past. Due to its low mountain range topography it has an increased flood risk potential. The majority of the urban areas of Siegen are located in a valley surrounded by steep slopes, from which numerous side valleys branch off. The altitudes within the city range from 215 to 500 m a.s.l., whereby 45 % of the area has slopes of more than 20 %. With a mean annual precipitation height of about 1,200 mm/a, Siegen is one of the cities with the largest precipitation rates throughout Germany. Against this background, the research project “Simulation of heavy precipitation in the city of Siegen" (SiSSi) was recently launched. The project is a cooperation of the Research Institute for Water and Environment of the University of Siegen and the local waste management company. In addition to the determination of the areas and infrastructures in the urban area at risk and the estimation of potential damages, the project aims at developing a methodical framework to consider physical as well as statistical dependencies of pluvial and fluvial flooding processes.

In a first step we conducted a topographical analysis of the entire urban area based on a digital elevation model (i. e. determination of potential flow directions and accumulations as well as terrain sinks). Currently, detailed hydrodynamic numerical models are set up consisting of a one-dimensional sewer network model and a two-dimensional surface model. Using a bidirectional coupled model, model flows from the surface to the sewer and vice versa can be modelled. Since the sewer system drains excess storm water into nearby rivers, it is also necessary to model the interactions between the sewer system and the riverine water bodies. In order to take this into account the watercourses are incorporated into the surface model in detail. In this way, the physical interaction of these three elements is modelled realistically and the resulting flow depths and velocities are calculated. In this contribution we will present an overview of the research project SiSSi including first results and the current state of the hydrodynamic numerical models.