Geophysical Research Abstracts
Vol. 21, EGU2019-15509, 2019
EGU General Assembly 2019

Hydrodynamic simulation of the flash flood events in Baiersdorf and Simbach (Bavaria) – A model comparison

Thomas Pflugbeil, Karl Broich, and Markus Disse

Technical University of Munich, Chair of Hydrology and River Basin Management, Department of Civil, Geo and Environmental Engineering, Germany (thomas.pflugbeil@tum.de)

Flash flood events have caused enormous damage in recent years. The risk of flash floods has been shown to increase with climate change and a forecast for heavy rain is not possible in the medium term. Therefore, the effects of flash floods can only be mitigated by precautionary measures and insurance cover. For both, the exact knowledge of the local shape of a potential flash flood is necessary. This knowledge can be obtained by an analysis of the topographical conditions or with greater accuracy by hydrodynamic simulation. The focus is on the study of urban space.
There are several models available that are able to calculate flash floods. A selection of four models will be examined. The models HYDRO_AS-2D (Hydrotec, [1]), TELEMAC-2D (open source, supervised by developer consortium [2]), FloodArea (geomer, [3]) and P-DWave ([4]) compared with each other. In order to evaluate the general suitability for the calculation of flash floods, five benchmark tests have been carried out and evaluated [5]. Based on two case studies, the programs will be tested for their suitability for operational use. For the model comparison, the flash flood events from Baiersdorf (2007) and Simbach a. Inn (2016) are selected.
The comparison is done for two different scenarios. First a scenario A is considered, in which all channels are continuous. In a second scenario B, it is assumed that the channels are mostly clogged. In both cases, a grid 2x2 m is used in the city area. The hydraulic input is defined by the effective precipitation in the calculation area and the inflows at the boundary of the area. The effective precipitation is generated temporally and spatially from the YW-RADOLAN product (about 1 km^2 and 5 min resolution) of the German Weather Service DWD and the SCS-CN method. The inflows are calculated by a preceding hydrodynamic calculation with coarser discretization (about 5 m) for the entire catchment area. For both, the program TELEMAC-2D is used. The input data thus determined is transferred to the other models. Thus, the calculations for Simbach a. Inn and Baiersdorf can be carried out consistently for all models. Calculated water levels and outflows are compared with observed discharge and high-water marks during the events.

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