Geophysical Research Abstracts
Vol. 18, EGU2016-17022, 2016
EGU General Assembly 2016

Heavy rainfall induced flash flood management

Markus Weiler, Andreas Steinbrich, Michael Stölzle, and Hannes Leistert
University of Freiburg, Hydrology, Freiburg, Germany (markus.weiler@hydrology.uni-freiburg.de)

Heavy rain induced flash floods are still a serious hazard. In context of climate change even a rise of threat potential of flash flood must be suspected. To improve prediction of endangered areas hydraulic models was developed in the past that implement topography information in heigh resolution, gathered by laser scan applications. To run such models it is crucial to estimate the runoff input spatial distributed. However, this information is usually derived with relatively simple models lacking the process rigour that is required for prediction in engaged basins. Though available rain runoff models are able to model runoff response integral for measured catchments they do not indicate the spatial distribution of processes. Moreover they are commonly calibrated to measured runoff data and not applicable in other environments. Since runoff generation is commonly not measured, a calibration on it is hardly possible. In this study, we present a new approach for quantification of runoff generation in height spatial and temporal resolution. A suited model needs to work without calibration in every given environment under any given conditions. It is possible to develop such a model by combining spatial distributed input data of land surface properties (e.g. soil, geology, land use, ...) with worldwide findings of runoff generation research. We developed such a model for the state of Baden-Württemberg, what has an extensive pool of spatial data. E.g. a digital elevation model of 1*1m^2 resolution, degree of sealing of the earth surface in 1*1m^2 resolution, soil properties (1:50.000) and geology (1:200.000). Within the state of Baden-Württemberg different regions are situated, with distinct environmental characteristics concerning as well climate, soil properties, land use, topography and geology.
The model was tested and validated by modelling 36 observed flood events in 13 mesoscale catchments representing the different regions of Baden-Württemberg as well as by modelling 7 large area (70 m^2) sprinkler experiments on 5 different plots in different regions of Switzerland. It was found, that the model was able to reproduce the temporal runoff dynamics as well as the peak discharge and the runoff volume in both, mesoscale catchments and 70 m^2 plots. It works in every given environment under every given conditions as antecedent moisture and precipitation characteristics. Since it works well under given different conditions in different regions and on different scales without any calibration, it is predestinated for the purpose of quantification of runoff generation for flash floods while heavy rain events in the different regions of Baden-Württemberg. Therefore we have it applied on the whole area of Baden-Württemberg on a spatial resolution of 5*5m^2 to model the runoff generation for one hour precipitation events of the return period 50, 100 and 1000 years and different antecedent moisture conditions. The pattern and effects are studied in detail as well as other interesting features.