Geophysical Research Abstracts
Vol. 20, EGU2018-4845, 2018
EGU General Assembly 2018

Controls of flash flood peak discharge in Mediterranean basins and the special role of runoff contributing area

Yair Rinat, Francesco Marra, Davide Zoccatelli, and Efrat Morin

The Fredy & Nadine Herrmann Institute of Earth Sciences, Hydrology and Water Resources, Hebrew University of Jerusalem, Jerusalem, Israel (yair.rinat@mail.huji.ac.il)

The complex dynamic interactions between spatiotemporal rainfall rain fields and heterogeneous basin properties drive the outlet discharge. In particular, different portions of the basin actively contribute discharge in different moments, so that runoff on hillslopes and streams varies both in space and time. The presented research aims at improving our understanding of the runoff contributing area (RCA, i.e. area of all hillslope sections from which water flow, reach the stream network, and consequently the basin outlet at a given time) and at examining its relations with flash flood peak discharge in events of different magnitudes, thus, leading to a better understanding of intra-basin processes.

To achieve this, we developed a distributed hydrological model operating at high spatiotemporal resolution that describes hillslope and stream runoff formation, with re-infiltration over hillslopes, and enables RCA and peak discharge computation. The model was applied to four medium sized catchments (18-69 km^2) in Mediterranean climate and 59 flash flood events were analyzed. Validation proves that the model is suited for flood simulations in this kind of environment.

Results show that the correlation between the observed peak discharge and the multiplication of the basin area and basin maximal averaged rain rate over the time of concentration, i.e., the rational equation method, is poor (R^2=0.16). However, a new index describing the volume of rain over the RCA during a characteristic time resulted in a higher correlation with observed peak discharge (R^2=0.64) across a wide range of flood magnitudes. In addition, RCA and basin properties for moderate, large, and extreme peak discharges were studied. It was found that pre-storm soil moisture content is similar for all flood magnitudes. However, higher flood peaks were found to be associated with higher basin rain depth and higher soil moisture values, and in addition with higher rain coverage, higher convective rain coverage, and higher RCA at the time just preceding the peak discharge. Finally, areas characterized by low runoff potential, such as forested areas, plantation, and uncultivated fields, were found to contribute mainly during large and extreme events.