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Flash flood prediction using an un-calibrated hydrological model and radar rainfall data in a Mediterranean watershed under changing hydrological conditions

Shahar Rozalis (1), Efrat Morin (2), Yoav Yair (3), and Colin Price (4)

(1) Porter School of Environmental Studies, Tel Aviv University, Israel, (2) Hebrew University of Jerusalem, Geography, Jerusalem, Israel (msmorin@mscc.huji.ac.il), (3) Department of Life and Natural Sciences , The Open University, Israel, (4) Geophysics and Planetary Sciences Department, Tel Aviv University, Israel

Flash floods are one of the most severe natural disasters in Europe in general and in Mediterranean areas in particular. They can cause severe damage to property, infrastructures and loss of human life. The complexity of flash-flood generation processes and their dependency on different factors related to watershed properties and rainfall characteristics make flash flood prediction a difficult task. In this study, as a part of the EU-FLASH project, we use an un-calibrated hydrological model to simulate flow events in a 27 km2 Mediterranean watershed in Israel and to analyze and better understand the various factors affecting them. The model is based on the well-known SCS Curve Number method for rainfall-runoff calculations and on the kinematic wave method for flow routing. Existing data available from maps, GIS and field studies have been used to define model parameters, and no further calibration has been conducted to get a better fit between computed and observed flow data. The model rainfall input was obtained from the high temporal and spatial resolution radar data adjusted to rain gauges. 20 flow events which occurred within the study area along a 15 years period have all been analyzed. The model shows a generally good prediction capability (e.g., r2=0.7 for peak discharge) which is mainly due to the high performance in predicting flash-floods generated by intense, short-lived convective storm events (r2=0.9). A better performance is achieved when considering the flood level; then the model is able to predict all events defined as high level flood events. The degree of urban development was found to have a large effect on runoff amount and peak discharge with higher sensitivity of moderate and low flow events relative to high flows. Flash-flood generation was also found to be very sensitive to the temporal distribution of rain intensity within the specific storm event.