Plinius Conference Abstracts
Vol. 16, Plinius16-60, 2018
16th Plinius Conference on Mediterranean Risks

Hydrometeorological processes and characteristics of flash floods in arid climate

Efrat Morin, Idit Belachsen, Davide Zocatelli, Francesco Marra, and Moshe Armon

The Fredy and Nadine Herrmann Institute of Earth Sciences, The Hebrew University of Jerusalem, The Edmond J. Safra Campus, Givat Ram, Jerusalem 9190401, Israel

More than a quarter of the earth land area is under arid climate regime and population size in such regions is steadily increasing. Rainfall in arid areas is scarce and meager, but rain intensities can be high. Falling on bare soil or exposed rock surfaces, covered by only a sparse vegetation, runoff generation is fast, and may lead to large flash floods. In this presentation we discuss flash flood characteristics and hydrometeorological processes in arid environment, demonstrated for the region of the Eastern Mediterranean.

Rainfall, as the major forcing, is first considered. We show that although storm rain depth is much lower in arid areas, as compared to more humid regions, local rain intensities of short durations and long recurrence intervals are typically higher. Rain storms are often composed of convective rain cells of only few km radius and short life span. We present climatological analysis of space-time properties of convective rain cells in arid areas, derived from a long, high resolution, radar rainfall data record.

Next, sensitivity of flash flood magnitude to rainfall properties is considered. In arid areas, this sensitivity is amplified due to the relatively minor role of antecedent conditions and soil moisture content, and the major role of rain intensities, for flash flood generation. In fact, large flash floods can be produced by a single convective rain cell. We present the dependency of flash flood magnitude on rain cell properties such as intensity, area, location, direction and speed, both from a statistical point of view and using hydrological models.

In the last part, we discuss how the above unique relationships are manifested in flash flood characteristics. Specifically, we consider flood peak discharge and envelop curves, hydrograph shapes, lag times, runoff to rainfall ratios and more. We also discuss the effect of catchment size on flash flood magnitude, considering rain storm size and the additional effect of transmission losses that can be dominant in arid catchments.