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Hydro-Geomorphic Connectivity in Arid Watershed: Anthropogenic Effects and Extreme Flash flood

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Arid watersheds are excellent settings to study water and sediment connectivity because of spars vegetation and the possibility to make clearer links between climate parameters and topographical changes. However different flood event magnitudes may result in different degrees of connectivity. This even gets more complicated when man made modifications to the drainage system are done without considering the outcomes in terms of the potential of flood damage and risks, i.e. in the case of extreme flash floods.
Herein we report on the results from two studies conducted in two different small catchments along the dead sea rift: Wadi A Dalia and Wadi Ras Moakif. The studies conducted as part of a larger project aimed at investigating the floods and damages triggered by a rare storm event occurred at the end of October 2015. This storm event covered all of Israel and characterized with rare rainfall depths and intensities as well as floods with rare pick discharges. Observations and field measurements of bed material, river cross sections and water elevation markers were done and statistical analysis has been performed to estimate the exceed probability of the different measured and estimated hydro-climatic values. In Wadi-A-Dalia the coupling of rare rainfall depths over the watershed area which itself was bare due to over grazing result in a major flood. The severe damage caused by this flood was intensified due to the increase of structural hydrologic connectivity, i.e. flood protection canal discharged higher volumes of water collected from small Wadi systems at the same time. In Wadi Ras Moakif the rainfall cells did not produced rare rainfall, but still a major flood occurred over a very short distance of the main channel transporting huge amount of bed material deposited and blocked the main road along the dead sea western coast. In this case the cause was similar - a modification to the drainage system result in increase structural hydrologic connectivity lead to runoff concentration and higher stream power value.
The results suggest that in arid watersheds flood protection measures that involve modifications to the drainage system such that the structural hydrologic connectivity improves with the aim to conduit the volume of water away may fail to provide the protection planned and may cause higher damage to infrastructures. Therefore, hydrologic connectivity should become a parameter in flood control design. Moreover, studying hydrologic connectivity in natural landscapes may provide valid solutions for flood control design projects.