Flash flood modeling in semiarid regions - NE Lebanon as a case study

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Hydrological models are an important basis of flash flood forecasting and early warning systems. They provide significant data on hydrological risks. Flash floods, on the other hand, occur periodically in Lebanon; especially in the semi-arid region of the country, due to the thunderstorms that usually hit the area during the summer and autumn periods. The frequency of these events seems to be following an increasing trend in the last few decades, as a result of the global warming phenomenon. The aim of this paper is to develop a flood model for catchments in semiarid regions. The catchment that witnessed the night of September 25, 2011 a flash flood located NE Bekaa valley of Lebanon was chosen as our case study. The model consists of a rainfall-runoff model that converts excess precipitation to direct runoff using the SCS curve number method, and of a hydraulic model that compute the unsteady state flow in the main channel based on the hydrological model (rainfall-runoff model) derived hydrographs, using the kinematic wave method. The rainfall data used as input for the hydrological model was derived from recently implemented rain gauge station in the catchment, while the basin parameters were extracted from the available 10 m Digital Elevation Model, soil and land use maps for the catchment area. The hydrological model was calibrated using a post flood measurements of the maximum water level observed at some control cross sections and by investigating with local eye witnesses since the catchment is missing a stream gauging network. The calibrated hydrological model was simulated for flash floods of different return periods, to estimates the maximum peak discharge possible in the catchment for a 20, 50 70, and 100 years flood. The different obtained recurrence flood models was simulated with proposed dams, detention ponds, and other water retention structures in different location to attenuate the peak discharge at the basin outlet. The designed model represents a tool for flash flood prediction and can be of great aid for flood damages prevention in an area that suffered from flash floods for a long period of time.