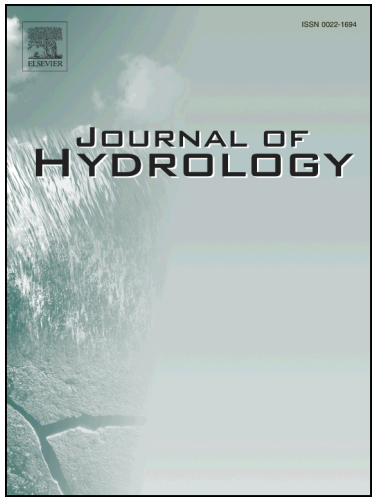

Research papers

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

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Abstract

During the complex dynamic interactions between rainfall and basin properties, different portions of the basin produce runoff at different moments. Capturing this spatiotemporal variability is important for flood analysis, but knowledge of this subject is limited. The presented research aims at improving the understanding of runoff-contributing areas (RCA; hillslope sections from which water flows, reaches the stream network, and consequently the basin outlet) and at examining their relationship with the magnitude of a flash flood's peak discharge. A distributed hydrological model (GB-HYDRA) that enables computing RCA and flood discharge was developed. The model was applied to four medium-size basins (18–69 km^2) in a Mediterranean climate and 59 flash flood events were analyzed. The correlation between basin input flux (basin area multiplied by the basin maximal rain intensity averaged over the time of concentration) and output flux (observed peak discharge) was poor (R^2 =0.16). However, using a newly developed index, termed IRCA, to calculate the input flux accounting only for the RCA extent and rainfall intensity over it, resulted in a substantially higher correlation (R^2 = 0.64) across a wide range of flood magnitudes. The highest correlation was found using a 50-min time window, which is shorter than the time of concentration. Flood events were categorized