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Controls of flash flood peak discharge in Mediterranean basins 1

and the special role of runoff-contributing areas 2

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Abstract 5

During the complex dynamic interactions between rainfall and basin properties, 6
different portions of the basin produce runoff at different moments. Capturing this 7
spatiotemporal variability is important for flood analysis, but knowledge of this 8
subject is limited. The presented research aims at improving the understanding of 9
runoff-contributing areas (RCA; hillslope sections from which water flows, reaches 10
the stream network, and consequently the basin outlet) and at examining their 11
relationship with the magnitude of a flash flood's peak discharge. A distributed 12
hydrological model (GB-HYDRA) that enables computing RCA and flood discharge 13
was developed. The model was applied to four medium-size basins (18–69 km²) in a 14
Mediterranean climate and 59 flash flood events were analyzed. The correlation 15
between basin input flux (basin area multiplied by the basin maximal rain intensity 16
averaged over the time of concentration) and output flux (observed peak discharge) 17
was poor ($R^2=0.16$). However, using a newly developed index, termed IRCA, to 18
calculate the input flux accounting only for the RCA extent and rainfall intensity over 19
it, resulted in a substantially higher correlation ($R^2 = 0.64$) across a wide range of 20
flood magnitudes. The highest correlation was found using a 50-min time window, 21
which is shorter than the time of concentration. Flood events were categorized 22

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