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Effect of rainfall spatial variability on runoff modelling in a semiarid catchment

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Theoretical and field studies have revealed that the spatial generation of runoff is strongly non-uniform In semiarid and arid areas, this non-uniformity of runoff generation is mainly controlled by rainfall characteristics and the surface physical and chemical properties. In addition, some Mediterranean catchments are suffering a deep urbanization process with the corresponding development of impervious areas, which increases the volume of runoff and the size of the flood peak resulting from each storm, and reduces the lag period between rainfall and peak flow. Consequently, a deeper knowledge of the hydrological response of semiarid, urbanized, Mediterranean watersheds would be useful for assessing flood risks and planning flood mitigation works. In this sense, distributed rainfall-runoff modelling is a necessary tool for predicting floods.

A number of studies are focused on estimation of areal precipitation fields including meteorological radar and point measurements of precipitation such as are provided by a network of rain gauges. Others study the rainfall –runoff model sensitivity to rainfall temporal and spatial variability, including radar data.

We analyse here the sensitivity of runoff response to lumping or redistribution of precipitation in a large semiarid catchment with urbanized areas, by the use of a physically based rainfall-runoff model, with explicit kinematic wave routing. The model accounts for our perceptual, in the sense of Beven (2001), hydrological processes of these specific environments. The Rambla del Albujón watershed is a 500 km^2 semiarid watershed in a Mediterranean coastal area with high agricultural and urban pressures: Runoff events are commonly produced by large precipitation events with irregular spa-

tial distribution. Incorporation of radar data in comparison with the common Inverse Distance Weighted (IDW) used method for interpolation of areal fields, and with conservation of mean rainfall throughout the watershed, had a striking effect on simulated peak runoff values and the hydrograph shape. For a specific parameterisation of the model, peak simulated values increased from 17 m^2s^{-1} to 103 m^2s^{-1}, by using IDW or radar, respectively, for redistribution of total estimated rainfall. For similar average rainfall intensity in every time step, the calibration process for a specific event would lead to a very different model parameterisation, depending on the spatial rainfall distribution input. These different sets of calibrated parameter values would lead to high changes in model predictions for future rainfall events. Hence, a proper estimation of areal precipitation fields, aided by radar data, is necessary to allow rainfall-runoff models accurately predict new events in semiarid watersheds with high spatially variable properties and non-uniform rainfall events.