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Linking precipitation structural elements and catchment hydrological response.

It is well known that catchment hydrological response is highly sensitive to space-time patterns of precipitation fields. These patterns are not arbitrary but they are organized in some typical structures that are related to the climatic regime and the meteorological conditions. We believe that a better and more generalized understanding of catchment hydrological response can be achieved by the direct linkage of this response to the precipitation space-time structures. Our research has focused so far in the dry climate regimes of the Eastern Mediterranean where convective rain cells are the main precipitating element. The space-time patterns of these cells were investigated using meteorological radar data and a rain cell model was fitted to the data. The rain cell model was linked to a hydrological model and the interactions between the space-time characteristics of convective rain cells and the catchment hydrological response were investigated. As a demonstration, we tested an extreme storm event over a semi-arid catchment in southern Israel. It was found that the catchment is very sensitive to the rain cell's location, speed and direction and that relatively small changes of these properties may increase the flash flood peak discharge by three-fold. From this understating and from distributions of space-time characteristics of convective rain cells derived for the regions, we generalize and suggest catchment-meteorological conditions under which extreme flash floods are generated in the desert catchments of this region. On-going research studies using this suggested approach are currently conducted to: 1) extend the analyses to Mediterranean climate regions, and, 2) to better understand and represent within-catchment hydrological processes. We believe that utilizing the suggested approach, where the precipitation structural elements are explicitly represented in the hydrological model, a better understanding and prediction of the catchment hydrological response can be achieved.