Assessing the role of spatial rainfall variability on watershed response based on weather radar data (a case study of the gard region, France)

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Abstrak

Rainfall is the primary input into rainfall-runoff modeling. Previous work indicates that the accurate representation of rainfall in time and space is important due to its influence on the hydrological response. The objective of this study is to evaluate the relevance of theoretical indices of spatial rainfall variability and the theoretical criteria of the hydrological response proposed by Emmanuel et al. (2015) in a real case study. The distributed model CINECAR has been chosen to accommodate the spatial discretization of hydrological data. The production function of the model adopts the Soil Conservation Service-Curve Number method, while the transfer function is based on a kinematic wave model. The simulations used weather radar data and also their average over the watershed, with a data resolution of 1×1 km2. They were conducted on the basis of 13 watersheds in the Gard region and four events in 2008 for each watershed. The difference between the distributed and averaged hydrographs obtained from the CINECAR model were calculated using two criteria, namely the difference in peak discharge (LQ) and the difference in peak time (TQ). The values of LQ and TQ represent the influence of spatial rainfall variability on the hydrological response. The spatially distributed rainfall was analyzed based on the values of its maximum Horizontal and Vertical Gab (HG and VG) to watershed centroid acting as indices, as proposed by Emmanuel. The analysis of the influence of spatial rainfall variability on the watershed response was conducted by quantification of the averaged and distributed hydrographs using the proposed indices and criteria. The results show that value of LQ rises by more than 50% for some events, and that TQ shows different times to peak between the average and distributed hydrographs. The values of the HG and VG indices accurately describe the rainfall distribution in the watershed. Therefore, these criteria and indices are effective in quantifying the influence of spatial rainfall variability on the hydrological modeling in particular events which are affected by rainfall distribution.