THE INFLUENCE OF STORM CHARACTERISTICS ON RUNOFF GENERATION AND CONNECTIVITY ON SEMI-ARID HILLSLOPES

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Much attention has been given to the surface controls on the generation and transmission of runoff in semi-arid areas. However, the surface controls form only part of the system and hence it is important to consider the effect that the characteristics of the storm event has on the generation of runoff and the transmission of flow across the slope. The impact of the different storm characteristics has been investigated using the Connectivity of Runoff Model (CRUM). This is a distributed, dynamic hydrology model which considers the hydrological processes relevant for a semi-arid environment at the temporal scale of a single storm event. The key storm characteristics that have been investigated are the storm duration, rainfall intensity, rainfall variability and temporal structure. This has been achieved through the use of a series of defined storm hydrographs and stochastic rainfall.

It has been found that the temporal fragmentation of high intensity rainfall is important for determining the travel distances of overland flow and hence the amount of runoff which leaves the slope as discharge. If the high intensity rainfall is fragmented, the runoff will be infiltrated a short distance down slope. Longer periods of high intensity rainfall allows the runoff to travel further and hence become discharge. Therefore, storms may have the same amount of high intensity rainfall but produce vastly different amounts of discharge.

The response of the hydrological system to changes in the rainfall characteristics can be explained using a four stage model of the runoff generation process. These stages are: 1, all water infiltrating, 2, the surface depression store filling or emptying without runoff occurring, 3, the generation and transmission of runoff and 4, the transmission
of runoff without new runoff being generated. The storm event will move the system between the four stages and the nature of the rainfall required to move between the stages is determined by the surface characteristics. This research shows the importance of the variable intensity rainfall when modelling semi-arid runoff generation. The amount of discharge may be greater or less than the amount that would have been produced if constant rainfall intensity is used in the model.