Geophysical Research Abstracts, Vol. 9, 07507, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07507
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Experimental study of surface runoff under simulated rainfall: effects of rain intensity variations.

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An experimental study was carried out with the aim to improve our understanding of runoff generation within watersheds. A well known scale effect is the decrease of specific discharge with watershed area which implies re-infiltration processes before runoff water reaches the river. Though, re-infiltration is poorly documented in field datasets and thus, difficult to quantify. Using a new rainfall simulator of variable length, runoff was measured at the outlet of experimental parcels for different lengths (1, 2, 4 and 8 m) and for two soil cover types (with and without aerial vegetation). Rain was applied with various intensities and durations. The greater time before runoff appears for grassed soil could be explained in a large part by the initial state drier than that of bare soil. Grassed soil have a greater available superficial detention for a given runoff amount than bare soil. However, as the weeding was done shortly before the experiments, no soil cover influence could be observed on the quasi-steady runoff regime for a continuous rain what was attributed to the presence of root macropores. Likewise, no length effect on this steady regime was observed. To study rain dynamics influence on runoff, non continuous rain application was tested. The results showed that: (1) The runoff deficit for a non continuous rain for which the flow is interrupted every 10 minutes could induce 15 % to 25 % loss as compared to a continuous rainfall of the same amount and maximal intensity. (2) The mean runoff for a non continuous rainfall alternating 10-minute peaks and voids was approximately equal to the runoff for the continuous rainfall of the same mean intensity.

We conclude that rain intermittence and intensity variations might be a dominant factor of re-infiltration within watersheds especially with spatially homogeneous soils.