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GERALDINE QUÉNÉHERVÉ (*), FELIX BACHOFER (**) & MICHAEL MAERKER (*,**)

EXPERIMENTAL ASSESSMENT OF RUNOFF GENERATION PROCESSES ON HILLSLOPE SCALE IN A SEMIARID REGION IN NORTHERN TANZANIA

ABSTRACT - QUÉNÉHERVÉ G., BACHOFER F., & MAERKER M., *Experimental Assessment of Runoff Generation Processes on Hillslope Scale in a Semiarid Region in Northern Tanzania.* (IT ISSN 0391-9838, 2015).

In runoff modelling often saturated conductivities or infiltration rates for saturated surfaces are used to calculate the soil water balance and subsequently surface runoff. These infiltration rates are often too high and thus no or very little runoff is generated. However, after long dry periods even with small precipitation events surface runoff is observed. In this study we focus on the infiltration rates at different tensions to study their effect on surface runoff generation on a typical soil catena of northern Tanzania. The area is characterized by very little information on surface runoff and soil characteristics. Therefore, we measured soil infiltration and texture at the surface as well as overland flow volumes for individual rainfall events between October 10, 2010 and December 6, 2010 using a simple experimental setting. We examined rough water balance quantities for single rainfall events. A simplistic hydrological modelling of the surface runoff and accumulation was performed and compared to measured surface runoff. The study shows that infiltration at 0 water tension clearly overestimates infiltration quantities. However, even when soil characteristics like crusting of sealing are not considered, our simple approach yield much better surface runoff volumes using infiltration rates at higher soil water tensions instead of saturated infiltration conditions. The interaction between rainfall and soil surface conditions is relevant for understanding the hydrology of semiarid savannas with gentle slopes. However, we show that our approach integrating simple field measurements and basic hydrological budget models yield much better results than conventional approaches.

KEY WORDS: Surface Runoff; Hydrological Modelling; Rainfall-Runoff; Hillslope Scale; Tanzania; Surface Runoff Detectors.

INTRODUCTION

Runoff generation in direct response to a precipitation event triggers soil particle detachment and accordingly soil erosion phenomena which are a major threat in sparsely vegetated regions. The factors affecting runoff for event-based analyses are i) rainfall characteristics and climatic conditions (rainfall intensity, duration and distribution), ii) the soil type (soil evaporation, infiltrability, hydraulic conductivity, antecedent condition of the soil moisture, water repellent characteristics, bulk density, surface crusting and surface roughness), iii) vegetation (vegetation cover, organic matter, macropores and root systems), and iv) the catchment area (slope steepness, slope length, landscape position) (after Critchley & Siegert, 1991; Borselli & *alii*, 2001; Bracken & Croke, 2007; Ritter & *alii*, 2011).

However, for a detailed surface runoff assessment especially the soil parameters are often not available or only hardly obtainable requiring sophisticated instruments, trained personnel and the economic resources to measure them. Particularly, semiarid areas around the globe are often characterized by scarce infrastructure and rural environments with no or sparse information on the spatial distribution of soils or related parameters on institutional levels. Moreover, semiarid regions generally show low precipitation that is highly variable (Sala & Lauenroth, 1982; Mualem & Assouline, 1996). Hence, simple low budget approaches are needed to overcome these problems.

In order to assess surface runoff processes in semiarid areas, precipitation events have to be addressed as pulses,

(*) *Institute of Geography, University of Tübingen, Ruemelinstr. 19-23, 72070 Tuebingen, Germany.*

(**) *Heidelberg Academy of Sciences and Humanities, c/o University of Tübingen, Ruemelinstr. 23, 72070 Tübingen, Germany.*

(***) *Dipartimento di Scienze della Terra, Università di Firenze, Italia.*

Corresponding author: Geraldine Quénéhervé, Tel.: +49 7071 2972131. E-Mail address: geraldine.queneherve@uni-tuebingen.de

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