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Temporal and spatial patterns of soil moisture in semiarid badlands of SE Spain

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Abstract

Temporal and spatial patterns of soil water content (θ) have been studied in badlands in Tabernas (Almería, SE Spain). θ was measured on a detailed time scale for 18 months under different conditions of soil surface cover, soil properties and topography. θ was found to be highly spatially heterogeneous within small areas, controlled primarily by soil surface cover and soil properties. The role of lichen crusts in θ conservation has been demonstrated even when the properties of the soil beneath do not favour water storage. Differences in soil moisture regimes have been found below inter-shrub (open) areas and below shrubs. The influence of most terrain attributes (slope gradient and aspect, specific catchment area, slope curvature, wetness index, slope length factor and distance to channels) on θ is masked by the influence of soil cover properties. The simultaneous monitoring of rainfall, soil moisture and runoff at short intervals shows the different responses of soil surfaces to rainfall and the influence of rainfall partitioning on soil moisture patterns. This work contributes to an understanding of several aspects of spatial and temporal variability of θ in semiarid areas and the factors controlling it, and provides key information for their management.

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1. Introduction

One of the major challenges for hydrology and bioclimatology is the assessment of the temporal and spatial distribution of soil surface water content. In recent decades, there has been a considerable number of papers reporting the main factors governing the spatial and temporal variability of soil water content

in the top layers of the soil: (a) soil properties (Beckett and Webster, 1971; Zhang and Berndtsson, 1988; Fitzjohn et al., 1998); (b) topography (Burt and Butcher, 1985; Moore et al., 1988; Crave and Gascuel-Odoux, 1997; Western et al., 1999; Gomez-Plaza et al., 2001) and (c) vegetation (Yair and Danin, 1980; Sharma et al., 1980; Hawley et al., 1983; Francis et al., 1986; Seghieri et al., 1997; Bromley et al., 1997; Rodriguez-Iturbe et al., 1999). However, it is difficult to identify the relative importance of these factors because of their mutual and multiple

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