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Using a 3-D coupled overland-subsurface flow model for evaluating the efficiency of runoff harvesting techniques

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In arid and semi-arid zones runoff harvesting techniques are often applied to increase the water retention and infiltration on steep slopes. Additionally, they act as an erosion control measure to reduce land degradation hazards. Both in literature and in the field, a large variety of runoff collecting systems are found, as well as large variations in design and dimensions. Therefore, detailed measurements were performed on a semi-arid slope in central Chile to identify the effect of a simple water harvesting technique on soil water availability. For this purpose, twenty two TDR probes were installed and monitored continuously during and after a simulated rainfall event. These data were used to investigate coupled overland-subsurface flow processes using the 3D distributed flow model HydroGeoSphere. Runoff components and soil water retention as influenced by the water harvesting technique were assessed, both under simulated and natural rainfall conditions.
Preliminary results show important design flaws of the water harvesting technique, which do not take into account local soil and climatic conditions adequately, resulting in a low water harvesting efficiency.
The proposed methodology can be used to improve the design of water harvesting techniques and optimally apply scarce financial sources in order to obtain maximal efficiency from runoff harvesting techniques in semi-arid regions.