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EVALUATING A RUNOFF HARVESTING TECHNIQUE USING A 3D COUPLED SURFACE-SUBSURFACE HYDROLOGICAL MODEL

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Summary. 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, but a rigorous evaluation of their efficiency is lacking. Therefore, detailed measurements were performed on a semi-arid slope in central Chile to allow identification of the effect of a simple water harvesting technique on soil water availability. For this purpose, twenty two TDR-probes were installed and were monitored continuously during and after a simulated rainfall event. These data were used to calibrate the 3D distributed flow model HydroGeoSphere (HGS), to assess the surface runoff components and the subsurface soil water redistribution simultaneously as influenced by the water harvesting technique, both under simulated and natural rainfall conditions.

The first part of the study evaluates the datasets required for optimal model calibration in an inverse modeling approach and for model well-posedness, using a parameter sensitivity analysis and response surface analysis. In a second part, sensitive parameters were allowed to optimize, coupling a Parameter ESTimation software to HGS, resulting in high correlations between observed and simulated water content and runoff values. When running scenario analyses, results show a clear advantage of the harvesting technique in terms of additional water storage in the soil profile, but also indicate that correct design of these techniques under various soil physical and climatic conditions is needed to improve water harvesting efficiency.