Geophysical Research Abstracts
Vol. 13, EGU2011-11709-1, 2011
EGU General Assembly 2011

Developing a framework for efficient runoff harvesting using a high resolution measurement-modelling approach

Koen Verbist (1,3), Wim M. Cornelis (1), Rob McLaren (2), and Donald Gabriels (1)

(1) University Ghent, International Centre for Eremology (ICE), Department of Soil Management, Belgium (koen.verbist@ugent.be), (3) UNESCO Water Centre for Arid and Semiarid Zones of Latin America and the Caribbean (CAZALAC), Chile, (2) Department of Earth Sciences, University of Waterloo, Canada.

In arid and semi-arid zones runoff harvesting techniques are often applied to increase the water retention and infiltration on steep slopes. 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, multiple TDR-probes were installed and were monitored continuously during and after a simulated rainfall event. These data, together with detailed field and laboratory analysis of soil hydrophysical properties, were used to calibrate the 3D coupled surface-subsurface distributed flow model HydroGeoSphere, to assess the runoff components and soil water retention as influenced by the water harvesting technique, both under simulated and natural rainfall conditions. In a first step, a sensitivity analysis identified essential parameters in the model optimization process, evaluating parameter influences on the subsurface and surface processes individually. Model well-posedness was investigated in step two, using model response surfaces, and allowed identifying parameter correlations and the measurement data sets required for model calibration. Based on parameter sensitivities and correlations, an effective model calibration was performed and the best fit was retained. The parameter combination was then evaluated for parameter non-uniqueness by searching other combinations of parameters that result in the same goodness of fit to observed data, and uncertainty of model output after calibration was hence assessed. The final model was then used to evaluate water retention in the trench compared to a non-intervened parcel under natural rainfall conditions in dry and wet years. The model was then upscaled to the hill slope level (1.15 ha) to represent the larger scale field conditions with complex interactions of multiple water harvesting techniques acting together. The proposed methodology was then finally used to improve the design of water harvesting techniques under the most common climatic conditions.