Geophysical Research Abstracts, Vol. 8, 02520, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02520

A time-continuous monitoring system for surface runoff and sediment delivery on a hillslope

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With most existing measurement devices at the hillslope scale, erosion and sediment transport is measured in an integrative manner over a selected time period (e.g. be sticks or collection tanks) or monitored continuously by taking aliquots of suspended sediment. Monitoring of suspended sediment, however, is not useful to assess to sediment delivery if coarse substrate is involved, which is transported as bed load at the rill bottom. For the detailed investigation of erosion and sediment transport processes, a time-continuous measurement of the sediment delivery together with the runoff rate is required. In this talk, a measuring system is presented to quantify continuously in time the sediment delivery from a small catchment where the transported soil material is dominated by coarse sand. Runoff is measured at the outlet of the small catchment by a continuously logging tipping bucket device. The transported sediment is caught by a weighing device that retains the sediment while the water is passed through a sieve. The sediment transport can be monitored continuously by registering the actual weight of the sieve with a fixed time step for logging of 5 minutes. Water content of the collected sediment is assumed to be at saturation. The drainage time of the water is determined by lab and field experiments. The monitoring system is installed on a hillslope and comprises a small catchment of 300 sqm in size, situated in a former surface coal mining area of Lower Liusatia (East Germany). The substrate was artificially refilled in 2001 with tertiary, coarse sand. Episodic surface runoff occurs on crusted and hydrophobic sandy soil surfaces free of vegetation. This leads to high erosion rates, forming a complex network of rills within a short period. These conditions, together with low annual rainfall volumes, make the test site a valuable pilot study area for the development of monitoring and modeling approaches to assess erosion and land degradation processes in dryland areas. The presentation shows the functionality and

the results of the monitoring system. Problems and limitations of the approach are discussed. Based on the observations, a theoretical model for the runoff generation on the investigated hillslope has been developed. It could be shown that soil water repellency is a governing factor for runoff generation.