Geophysical Research Abstracts, Vol. 9, 10682, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10682

Estimates of subsurface storm flow intensity

Peter Kienzler and Felix Naef
ETH Zurich

In studies of runoff generation at hillslopes, subsurface storm flow (SSF) in lateral preferential flow paths has been observed to be an important contributor to stream flow in many headwater basins. Information on existence and geometry of lateral preferential flow paths are required for reliable estimates of SSF intensity. However, these flow paths are not visible and show high spatial variability. Therefore, to predict SSF intensity on a larger scale, it is necessary to resort to easily observable parameters as a substitute for direct observations. Here, a better understanding of the influence and relevance of soil parameters and topography would help to assess SSF intensities and to model SSF more reliably.

To this purpose, combined sprinkling and tracer experiments were conducted at four test slopes with different soils and geology, where shallow impermeable bedrock, high density of macropores and sloping terrain indicated potential for the occurrence of SSF. SSF response was monitored as well as soil moisture changes, flow velocities and event and pre-event water fractions in different flow components.

Different forms of SSF were observed at the four sites. SSF intensity depended on whether SSF was fed directly from precipitation or indirectly from saturated parts of the soil. A comparison of the four slopes showed that the degree of direct or indirect feeding can be explained partially with "easily observable" parameters like the layering of the soil and the hydraulic permeability of the soil matrix. On the other hand, the results showed the large influence of individual flow path geometry on SSF intensity.

Besides, the influence of temporally variable preconditions on SSF was investigated. Here, lateral preferential flow prevented saturation of the soil profile at the test slopes due to quick drainage of the soils. Therefore, different initial conditions during follow-up experiments had only minor importance for SSF response. Different precipitation intensities led to large differences in relevance of SSF.

Based on these results, possibilities and limitations are discussed of SSF intensity estimates with easily observable parameters or parameters contained in maps of soil, geology and topography.