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Analysis of subsurface runoff processes and their role for the catchment response in low mountain ranges (Sauerland, Germany)

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In the small catchments "Obere Brachtpe" (2,5 km^2) and "Bohläse" (0,7 km^2), Sauerland, central west Germany, runoff generation processes have been investigated since 2000 with a hydrometric, hydrochemical and soil physical approach. The experimental investigations have been focused on the analysis of the influence of relief, soil and soil moisture dynamics on the discharge processes at the plot and hillslope scale.

Therefore four soil hydrology measurement locations and fourteen piezometers are installed in the catchment "Obere Brachtpe". The measurement locations are arranged in a gently convergent slope ranging from the upper slope to the riparian zone. They are equipped with several tensiometers installed in different depths (20 to 200 cm). The water suction is registered automatically every 10 minutes. Moreover the precipitation and the runoff are measured at the catchment outlet in a 10 min- respectively 15 min-interval. The groundwater gauges are fitted with pressure heads and dataloggers (10 min-interval) and arranged in two sections vertical to the valley. The first section is installed in a gently convergent slope, the second at the foodslope of a divergent slope. In the catchment "Bohläse" there are three soil hydrology measurement loca-

tions installed arranged at the upperslope and at the foodslope. Also the precipitation, the throughfall and the runoff are measured in a 10 min-interval.

In a next step, the aim of the study is to analyse the subsurface flow processes in the point scale and their effect on the catchment response. The analysis of temporally high-dissolved data of the groundwater dynamics in relation to the discharge of the receiving stream during several rainfall/runoff events shows the influence of the flat „riparian zone“ on the runoff processes. Caused by the small slope inclination the velocity of water flow is reduced and groundwater from the slope is transported to the channel with a time lag. Due to this delayed groundwater flow the runoff in the receiving stream also shows a delayed increase. But the transforming reaction of the riparian zone between slope and receiving stream isn‘t always the same it rather depends on the topical moisture conditions, which are represented by the groundwater level and the soil moisture. Summarized, the laged increase of runoff at the catchment outlet can be explained by the groundwater dynamics at the convergent hillslope. Moreover the analysis of temporally high-dissolved measuring data of the groundwater dynamics contributes to a deeper understanding of the influence of relief on the runoff processes and the interactions between upslope zone, riparian zone and the runoff.

Based on studies at different scales, runoff processes in the catchment “Bohläse” (Sauerland, Germany) were analysed during several rainfall-runoff-events. Using hydrological tracers and hydrometric methods, the influence of periglacial cover beds was determined for runoff at the catchment scale and for soil water flux at the point scale. The results show that the influence of the base layer depends on the current water content. If the water content in the base layer is low, vertical water movement is impeded. On the other hand, if the water content is high, the base layer becomes a preferential flow path for interflow. Due to the spatial variability of the soil physical properties, the base layer functions as a preferential flow path for interflow only if the bulk density is low. The results confirm the importance of periglacial cover beds for runoff processes in low mountain regions and represent an experimental basis for hydrological regionalisation depending on the spatial distribution of periglacial cover beds (Chifflard et al. 2008).

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