Geophysical Research Abstracts,
Vol. 11, EGU2009-6167, 2009
EGU General Assembly 2009

Local scale analyses of hillslope-channel coupling in the cuesta landscape of the Swabian Alb, S-W Germany

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In upland fluvial systems hillslope and channel processes are often closely connected. While the influence of fluvial erosion on hillslope stability received much attention in the past, the influence of hillslope processes on the fluvial system has less comprehensively been investigated. Especially landslides can have a profound impact on the fluvial system, by either altering channel morphology, diverting the channel course or, in some cases, by blocking the entire valley resulting in a landslide dammed lake. The disturbance of a river system by landslides often causes a marked knickpoint in the channel's longitudinal profile. Adjustment of the longitudinal profile depends on sediment input and erosivity of the material delivered to the channel, but also on the human impact on the system. In case of erosive landslide material a fast adjustment to disturbance is assumed.

The main aim of this study is to analyse the impact of landslides on channel morphology in the Fils and the Schlichem catchments. Both catchments are located in the Swabian Alb (SW Germany), a cuesta landscape where hillslope processes are dominated by landslide processes.

Within these catchments, bank failures, small slump failures and valley cross-sections for local river reaches are mapped and taken as a proxy for the activity of the coupled area. River longitudinal profiles are calculated from high resolution digital elevation models. Additionally, the thickness of alluvial sediment upstream and downstream of the disturbed areas is determined in the field in order to identify the effects of landslides on the alluvial sedimentation. Besides the geomorphological evidence, historical sources on channel pattern changes and landslide impacts are analysed.

Preliminary results show that the impact of landslides on the river longitudinal profile can be detected in the longitudinal profiles on a local scale. The higher frequency of small slump failures within the disturbed area compared to undisturbed river reaches indicates the ongoing adaption of the fluvial system to the landslide impact. In the upper Fils valley ERT soundings and small drillings indicate a higher alluvial sedimentation in the downstream area of the landslide, accounting for the increased sediment input through the landslide. In the case of the upper Schlichem valley alluvial sediments are thicker in the upstream positions of the obstruction, supporting the idea of a former blockage of the valley by a landslide. This finding is confirmed by historical sources indicating that blockage of the valley by a landslide and the subsequent formation of a lake in the upstream area of the obstruction happened three times during the late 18th century. In 1787 and 1789 the landslide dam was removed with shovels by the local population to prevent a catastrophic failure of the landslide-dammed lake, which profoundly shortened the relaxation time of the natural fluvial system.