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Quantification and modelling of bedload discharge from small channels on hillslopes in alpine catchments

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The activity of geomorphic processes in densely populated high mountains can lead to extensive damages. Torrents which are connected to the densely populated valleys pose a major threat. The hazard potential of such torrents is controlled by the availability of sediment in the channel which is supplied by the geomorphic processes in their catchments. Hillslope channels play a major role, because they connect the torrents to sediment sources (e.g. storages) in the upper parts of the catchments.

Within the DFG founded SEDAG Project, the fluvial bedload discharge from such hillslope channels was measured weekly by means of 28 sediment traps in two catchments in the northern Calcareous Alps/Germany between 2000 and 2006. These data, in combination with geospatial and statistical analyses, made it possible to identify those parameters that govern the fluvial bedload discharge. The spatial variability of the mean annual fluvial bedload discharge can be statistically explained by the size of the sediment contributing area. This is derived by a rule based approach which includes vegetation cover, distance to channel and slope. Based on these results, a statistical model for the Lahnenwiesgraben catchment was developed to predict mean annual bed load using the relation with the respective sediment contributing area. This model was also applied to the second catchment (Reintal) in order to validate it with the measured bed load discharge. The model predicted the annual bed load discharge in the second catchment very well. So by using the model it is not only possible to identify channels with very high sediment output but also to calculate the sum of mean annual bed load input to the main channel for both catchments.

Because coverage of vegetation in the sediment contributing area is an important part of the model, the effect of a change in vegetation cover can be estimated e.g. due to changing climatic conditions or damages by wind or fire. This was done for two scenarios. In a worst case scenario the whole vegetation cover was “removed” and in a best case scenario the whole catchment was totally covered by vegetation. The results of these scenarios were analysed on the basis of two subcatchments and on the basis of the bed load input into the main channel of the Lahnenwiesgraben.