Geophysical Research Abstracts
Vol. 18, EGU2016-1400, 2016
EGU General Assembly 2016

Postglacial sediment evacuation from the tributaries of the Upper Rhone, Switzerland

Anna Schoch (1), Günther Prasicek (2), Jan Blöthe (1), Thomas Hoffmann (3,1), Jürgen Mey (4), and Lothar Schrott (1)

(1) Department of Geography, University of Bonn, Germany (anna.schoch@uni-bonn.de), (2) Department of Geography and Geology, University of Salzburg, Austria, (3) German Federal Institute of Hydrology (BfG), Koblenz, Germany, (4) Institute of Earth and Environmental Science, University of Potsdam, Germany

The paraglacial concept implies that most of the sediment from the last glaciation at the end of the Pleistocene should be evacuated from the headwaters and currently be stored further downstream. However, the location and spatial distribution of sediment storages (e.g. valley fills, debris cones, talus slopes) in alpine regions has mainly been addressed in small-scale sediment budget studies (catchments up to 10^2 km^2). Our study tests the assumptions of the paraglacial concept by assessing the rate of Postglacial sediment evacuation from the large-scale Upper Rhone basin (URB, c. 5400 km^2) based on the mapping of Postglacial sediment storages, knickpoints and valley fills as well as estimates of valley fill volumes.

We investigate the distribution of sediment storage in the URB, how sediment storage changes with increasing drainage area and how this is related to Pleistocene glacial imprint, the morphometry of the tributaries as well as the location of knickpoints in the river network. Therefore, we examine whether the areal extent of sediment coverage varies with the degree of glacial imprint and if knickpoints control the location of valley fills.

Bedrock and sediment storage was mapped in five sub-regions of the URB (Goms, Lötschen valley, Val d'Illiez, Vallée de la Liène, Turtmann valley) in the field as well as from high-resolution remote sensing imagery. Using a high-resolution digital elevation model (2 m, SwissALTI3D by swisstopo) and Landsat imagery, we derived 23 parameters characterizing topography, surface characteristics, and vegetation cover. Subsequently, we applied a principal component analysis (PCA) and used the uncorrelated PCs with the highest explanatory power as predictors in a stepwise logistic regression model to predict the spatial distribution of bedrock and sediment storage for the whole URB. Model performance was tested with odds ratios and receiver operating characteristic (ROC) curves. The morphometric analysis of the tributaries to identify the degree of glacial imprint includes different attributes such as the glaciality index (GI), slope, geophysical relief and the location of knickpoints. The thickness and volumes of valley fills were estimated based on the bedrock topography below valley fills within the URB and its tributaries. The bedrock topography is derived from the geometric properties of the landscape using artificial neural networks.

Results from mapping show that 17-36% of the sub-regions are covered with bedrock. The ROC analysis implies that the logistic regression model using principal components as input parameters is well suited to model the spatial distribution of bedrock. Through the PCA the number of input variables for the model could be reduced to 7 (starting with 23 parameters). Preliminary results indicate that a significant portion of the headwaters of the URB is covered by sediment. In contrast, sediment is evacuated from the lower reaches of the tributaries which are often characterized by fluvial incision (V-shaped valleys) following deglaciation. Valley fills are generally located above the location of prominent knickpoints in the tributaries where headward fluvial incision has not yet overprinted glacial topograpy.