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Semi-automatic landform mapping in 3D – Applications for rapid, high-accurate hazard zonation in high mountain terrain using high resolution DEM data.

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Digital landform mapping on air photos and digital elevation models (DEM) is commonly performed manually on a plane two dimensional dataset. To enhance the identification of landforms on a two dimensional image several derivates of the base data (slope-, aspect-, curvature maps, image classification) can be used. However, the potential of high resolution DEM data as a resource for land surface characteristics is limited to the calculation of these derivates. Our natural three dimensional perception of the world is disabled by the restriction of digitization tools using 2-dimensional visualisation techniques. We introduce a new semi-automatic tool for 3-dimensional landform mapping. The tool is integrated into a real-time 3D visualisation engine, which allows interactive exploration of a virtual terrain based on air photo and high resolution DEM data. The user is enabled to perform the mapping directly in this 3D virtual terrain. In addition to the 3D capabilities the tool assists the user by specifying geomorphological objects quickly and accurately by using simple gesture motions with a mouse. This is realised by the utilisation of digital image segmentation techniques applied to the air photo, the DEM and its derivatives. In contrast to tedious and time consuming manual segmentation user input is minimized without sacrificing accuracy.

We present the performance of the semi-automatic tool by mapping meso-scale geomorphologic landforms in high mountain terrain. Using high resolution terrain data

(HRSC: 1m DEM and high resolution air photos), visualised in a 3D environment, we asses the applicability, accuracy and mapping efficiency of the new mapping tool with special focus on applications in hazard zonation studies. We consider the new approach a highly accurate, efficient and unbiased tool for landform and process mapping especially in inaccessible rugged mountain terrain.