Semi-automated geomorphological map through multiple-point geostatistics

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Traditional geomorphological maps are usually developed by mapping features on the field or directly in Geographic Information Systems from orthoimages and topographic data. This approach is time-consuming and is therefore only suitable for mapping small areas. For the mapping of larger areas, automatic procedures are needed, but to be efficient those need to be guided by geomorphological expertise.

To this end, we developed an approach that performs semi-automated geomorphological mapping (SAGM) guided by an already classified map from an analogue area. The algorithm used is the Direct Sampling (DS), part of the multiple-point geostatistics framework that simulates a random variable (here the geomorphological categories) based on a training image. The training image is composed of an existing geomorphological map of a site with analogue geomorphological features, along with topoclimatic attributes including slope, aspect, curvature, roughness, flow accumulation, solar radiation and an orthophoto. All these attributes, except the geomorphological categories, are also known in the target area to be classified. The DS algorithms then generate geomorphological categories in the target area, based on correspondences found in the training image.

The SAGM framework is first tested on a focus site located in the Western Swiss Alps and characterized by high geomorphological heterogeneity. Here a traditional geomorphological map is available for validation, allowing to test the methodology. Then, the SAGM is extended to other alpine areas.