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Characterization of artificial and natural roughness present in DTMs derived from Airborne Laser Scanning data

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Characterization of a real surface geometry is an important task in interpreting and modeling a geomorphological process. However, processes usually shape the surface in a very complex way, making the characterization very difficult. This surface complexity will be termed here natural roughness. On the other hand, data pre-processing and the selected acquisition technique may add artificial roughness which will complicate further the characterization. Our contribution presents and approach which allow us to identify different geomorphological features and to localize this artificial roughness.

Airborne laser scanning data of a typical alpine slope is used to test the robustness of the method. The area is located in the federal state of Vorarlberg, a mountainous area in the western part of Austria. Some parts of the area are covered by forest and buildings that requires robust data filtering for removal of non-ground points. As a consequence, the procedure had some misclassified points which are together with the selected interpolation technique and the complexity of terrain make extreme conditions for the method testing.

Several openness maps and their derivatives are used as a base for the roughness characterization. The openness map is generally represents well the surface concavity and therefore it is highly related to the present morphology. We assume that surface concavity differs significantly in the neighborhood of a rough feature and therefore an openness variation map is calculated. Those modified openness information are used to calculate three roughness classes. As an interpretation of this preliminary result we found that those three classes showed high correlation to erosional features, zones of sliding material and smooth, relatively stable areas, respectively. In addition, the artifacts present in the DTM are also recognized as regions of the extreme roughness. The method also showed high robustness over the whole area.