Geophysical Research Abstracts
Vol. 14, EGU2012-13722, 2012
EGU General Assembly 2012

The influence of control parameter estimation on large scale geomorphological interpretation of pointclouds

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In recent years, laser scanning, also referred to as LiDAR, has proved to be an important tool for topographic data acquisition. Basically, laser scanning acquires a more or less homogeneously distributed point cloud. These points represent all natural objects like terrain and vegetation as well as man-made objects such as buildings, streets, powerlines, or other constructions.

Due to the enormous amount of data provided by current scanning systems capturing up to several hundred thousands of points per second, the immediate application of such point clouds for large scale interpretation and analysis is often prohibitive due to restrictions of the hard- and software infrastructure. To overcome this, numerous methods for the determination of derived products do exist.

Commonly, Digital Terrain Models (DTM) or Digital Surface Models (DSM) are derived to represent the topography using a regular grid as datastructure. The obvious advantages are a significant reduction of the amount of data and the introduction of an implicit neighborhood topology enabling the application of efficient post processing methods. The major disadvantages are the loss of 3D information (i.e. overhangs) as well as the loss of information due to the interpolation approach used.

We introduced a segmentation approach enabling the determination of planar structures within a given point cloud. It was originally developed for the purpose of building modeling but has proven to be well suited for large scale geomorphological analysis as well. The result is an assignment of the original points to a set of planes. Each plane is represented by its plane parameters. Additionally, numerous quality and quantity parameters are determined (e.g. aspect, slope, local roughness, etc.).

In this contribution, we investigate the influence of the control parameters required for the plane segmentation on the geomorphological interpretation of the derived product. The respective control parameters may be determined either automatically (i.e. estimated of the given data) or manually (i.e. supervised parameter estimation). Additionally, the result might be influenced if data processing is performed locally (i.e. using tiles) or globally. Local processing of the data has the advantages of generally performing faster, having less hardware requirements, and enabling the determination of more detailed information. By contrast, especially in geomorphological interpretation, a global data processing enables determining large scale relations within the dataset analyzed.

We investigated the influence of control parameter settings on the geomorphological interpretation on airborne and terrestrial laser scanning data sets of the landslide at Doren (Vorarlberg, Austria), on airborne laser scanning data of the western cordilleras of the central Andes, and on HRSC terrain data of the Mars surface. Topics discussed are the suitability of automated versus manual determination of control parameters, the influence of the definition of the area of interest (local versus global application) as well as computational performance.