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Determination of surface roughness of a proglacial floodplain using TLS data. What to consider!

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The determination of surface roughness of channel reaches and floodplains is a part of geomorphologic studies since decades. Usually, the grain roughness determination requires knowledge about the grain size distribution of the study site. However, in some cases this approach is impractical, especially when investigating large areas (when form roughness is more important) or even impossible due to inaccessibility. In addition, the particles within the channel are usually covered by other particles or incorporated into finer sediment. Removing the particles from the channel bottom already means a disturbance of the system under investigation and thus possible falsification of the results.
Here, the application of terrestrial laser scanning (TLS) offers new possibilities. The indirect recording of the surface leads to a significant reduction of the workload in the field. Furthermore, form roughness and burial/imbrication are taken into account. However, there are numerous factors which may influence the results. Therefore, this study focuses on the following questions:

1) Is the application of several filter techniques influencing the calculation of the roughness height?
2) How crucial is the point density of the point cloud?

The roughness height is determined by standard deviation of the height values (Z) within a grid cell. Due to this the third question is:

3) How does the grid cell size influence the roughness height?

To answer these questions a floodplain in the proglacial zone of the Gepatschferner glacier, Austria was surveyed using the terrestrial laser scanner ILRIS-36D. The floodplain was scanned from two different directions and with three different resolutions (20 mm, 50 mm, and 100 mm). When processing the raw data different filters were used. The influence of the cell size was examined by using different grid cell sizes (10 mm, 50 mm, 100 mm, 250 mm, 430 mm, 690 mm, and 1085 mm) when calculating the roughness height. A pebble count was carried out to compare the TLS data with the c axis values of the grains on the floodplain.
First results show that the application of different filter techniques alters the results of the roughness calculation. Point density becomes more important when small cell sizes are chosen for determining surface roughness. At least grid cell size is also important for roughness calculation. With increasing cell size, the roughness values are greater.