Geophysical Research Abstracts
Vol. 18, EGU2016-8514, 2016
EGU General Assembly 2016

3D granulometry: grain-scale shape and size distribution from point cloud dataset of river environments

Philippe Steer, Dimitri Lague, Aurélie Gourdon, Thomas Croissant, and Alain Crave
Université Rennes 1, Geosciences Rennes - UMR 6118, Rennes, France (philippe.steer@gmail.com)

The grain-scale morphology of river sediments and their size distribution are important factors controlling the efficiency of fluvial erosion and transport. In turn, constraining the spatial evolution of these two metrics offer deep insights on the dynamics of river erosion and sediment transport from hillslopes to the sea. However, the size distribution of river sediments is generally assessed using statistically-biased field measurements and determining the grain-scale shape of river sediments remains a real challenge in geomorphology. Here we determine, with new methodological approaches based on the segmentation and geomorphological fitting of 3D point cloud dataset, the size distribution and grain-scale shape of sediments located in river environments. Point cloud segmentation is performed using either machine-learning algorithms or geometrical criterion, such as local plan fitting or curvature analysis. Once the grains are individualized into several sub-clouds, each grain-scale morphology is determined using a 3D geometrical fitting algorithm applied on the sub-cloud. If different geometrical models can be conceived and tested, only ellipsoidal models were used in this study. A phase of results checking is then performed to remove grains showing a best-fitting model with a low level of confidence. The main benefits of this automatic method are that it provides 1) an un-biased estimate of grain-size distribution on a large range of scales, from centimeter to tens of meters; 2) access to a very large number of data, only limited by the number of grains in the point-cloud dataset; 3) access to the 3D morphology of grains, in turn allowing to develop new metrics characterizing the size and shape of grains. The main limit of this method is that it is only able to detect grains with a characteristic size greater than the resolution of the point cloud. This new 3D granulometric method is then applied to river terraces both in the Poerua catchment in New-Zealand and along the Laonong river in Taiwan, which point clouds were obtained using both terrestrial lidar scanning and structure from motion photogrammetry.