Supervision and granulometric analysis of photo-optical underwater-sampling of river beds

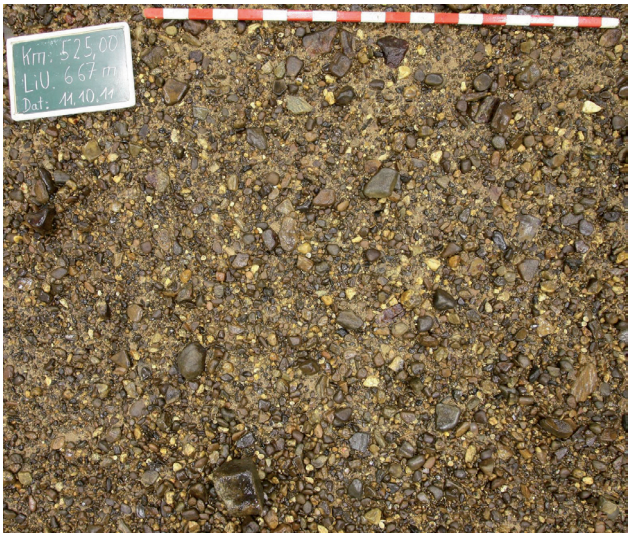

Figure 1: Underwater bed of River Rhine, photograph taken in a diver bell before volume sampling

Within this project a procedure is developed to classify the grain-sizes of a river bed by contact-free measurements at underwater conditions. A VAW in-house MATLAB code for automatic object detection to estimate the quasi-grain size distribution from top-view photographs of dry and free accessable alpine and prealpine river banks is adapted to be used in this project.

Customary methods to analyze the grain structure of a river bed need either extensive extraction, transport and laboratory sieving of the bed material or time consuming in-situ counting of single grains (e.g., line-by-number or grid-by-number sampling). These methods need free access to the bed, i.e. the river bed should not be overflowed. Otherwise the sampling is impossible in most of the cases. For larger rivers like the River Rhine, the access to the bed along the thalweg can be given by diver bells from special ships, e.g. the MV Carl-Straat. Beside the high technical efforts, an essential disadvantage of this method is that the water in the diver bell needs to be the blown out before entering it, which leads to an unspecified loss of fines. Furthermore the maximal volume per sample is limited to a few liters. Consequently, the representativity of the taken sample cannot be confirmed. Another technical device used by BAW to monitor the subaquaeous bed is a video-optical scanner consisting of an underwater camera mounted in a streamlined housing. The construction, called 'fish', is lowered to the river bed by a heaver. However, due to the low recording quality the data sets obtained up to know are not adequate enough for a systematic analysis of the grain size distributions of the river bed materials.

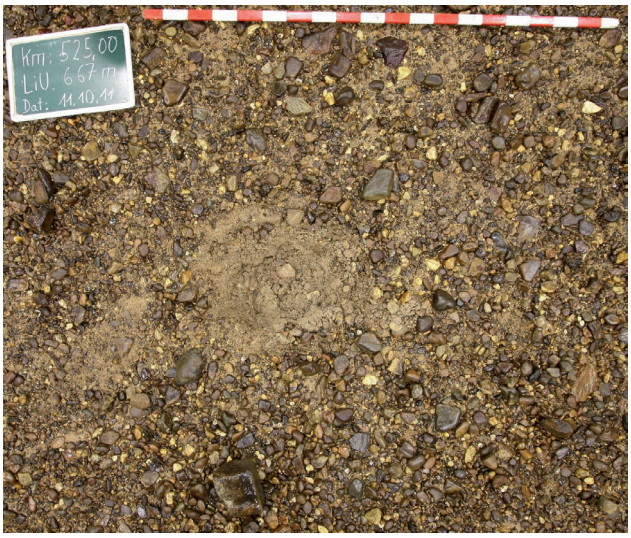

Figure 2: Underwater bed of River Rhine, photograph taken in a diver bell after volume sampling

In 2010, an advanced change was done to initialize this self dynamization more effectively (fig. 2). This project has a pilot character for initiate self dynamization of rivers by a small scale intervention – in opposite to so far performed fluvial revitalizations realized by intensive mechanical operations to reform a whole river reach. Therefore, the VAW supervises this project scientifically and monitors the development of bed material composition, hydraulics, sediment transport and bed morphology. Special focus is given to grain size analyzing by image processing and the use of hydro-numerical means for predicting morphodynamic aspects. In the end, guidelines to initiate the self dynamization of rivers will be given to increase the effectiveness in design and performance of comparable river vitalization projects.

Keywords:	object detection, grain size distribution, Rhine, river bed, image analysis
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