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Grain size on gravel bed rivers: results of a simple method used to collect photographic samples

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The characterisation of the particle size distribution along a river is an hard task and usually involves the work of many experienced operators. Although that, it is very difficult to obtain a clear description of the different granulometric patches constituting, for instance, a big gravel bar. This is the result of the chosen spatial sampling schemes and of the used method for collecting samples. Pebble count (grid or transect line) methods, frequently used in gravel and cobble riverbeds, are time consuming procedures to perform and give results concerning the spread area where the samples were collected. Photographic methods can improve the quality and the resolution of the sampling efforts because they allow the collection of large samples (hundred of stones) over little areas (the dimension of the picture). The paper shows the results of a field study finalised to define criterion and method to collect photographic samples. A field survey was carried out concerning the collection of grid-by-number, transect-line and photographic samples. The large number of data has allowed to compare the results of the different methods. In particular we decided to concentrate our efforts to define criteria to collect pictures. Obviously, this is strictly related to the method we used to automatically obtain the granulometric data from the photo. The chosen method, along with the results of other researches, is the thresholding of the grey scale image and the segmentation of the obtained one. It seems, in fact, that this method, compared to other more complex, can give the best results (Butler et al. 2001; Sime & Ferguson, 2003). However, we noted that many different variables can influence the results of the automatic image analysis, as, for instance, the light (it depends on the height of the sun), the colour of the stones and overall, the dimensions of the pebbles in the picture. This, in turn, depends on some parameters: the characteristics of the camera (focal length, dimension of the picture), the size of the clasts and the shot height. Looking into this problem we have empirically obtained a relationship

between accuracy (capacity of the automatic procedure to recognise the clasts appearing on the picture and to give correct values for grain size distribution) and shot height (after defined the value for the parameters previously described). The obtained values of accuracy, obtained manually digitising clasts and verifying the agreement with the automatic analysis results, have shown that it is possible to define an interval of distances to the ground from where the picture have to be acquired. This range, varying accordingly to median pebble dimensions, seems to guarantee the best performance of the digital image analysis and is limited only by the characteristics of the camera and by the height of the operator collecting pictures. A big value of accuracy is the premised for a good concordance between automatic analysis results and pebble count data. We observed that pictures collected from distances comprised into the right range give granulometric curves that, after performing the conversion from area-by-number to grid-by-number, are really similar to the manual collected data. The percentiles obtained using the two methods seems to aligns, on a graph, along the 1:1 line.