Geophysical Research Abstracts
Vol. 15, EGU2013-9947, 2013
EGU General Assembly 2013

Quantifying fluvial gravel surface and sub-surface topography using photogrammetry

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Quantifying the structure of river beds is important for many aspects of fluvial geomorphology, including understanding small scale sediment transport/entrainment processes and the functionality of aquatic habitats. Close range photogrammetry can be used to obtain high resolution representations of the river bed structure. However, previous work has been limited to 2D (and a maximum of 2.5D) digital elevation models. This study aims to quantify the 3D structure of fluvial gravels using close range photogrammetry. This will provide knowledge of both the surface topography and additionally the sub-surface gravel structure. The 3D structure will be obtained by taking digital photographs of the gravel surface, before then incrementally removing the surface layer and repeating the process. The sequential photographs are then analysed using PhotoModeller software and the modelled DEM's extracted for further analysis. Obtaining a 3D structure will allow important properties such as grain size, shape, porosity, intra-gravel pore connectivity to be extracted.

This technique will have applications in studies concerning salmonid spawning habitat, where our understanding of the egg incubation zone (also called a redd) is minimal, with only bulk properties known. This approach will allow a greater insight and understanding of the sub-surface intra-gravel habitat and processes that occur. Another application of this approach could be investigating the impact of flood flows on sub-surface gravel structure. Surface imbrication of the river bed gravels results from high flows, but it is unknown whether there is any sub-surface distinction between gravels that have been water-worked and ones that have not.