



## 4D photogrammetric technique to study free surface water in open channels

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Characteristics of three-dimensional surface water are considered as the most valuable information to understand hydrodynamic phenomena in open channel flow. An accurate and coherent description of the free water surface morphology improves the accuracy of hydraulic models which study river processes. However, amongst existing techniques to measure three-dimensional surface, stereo-photogrammetry is clearly the most effective technique to obtain an instantaneous and high accurate 3D free water surface and it's suitable to both flume and field condition. Our study aims at developing this technique in two controlled channels, one in interior with glass borders (length: 6 m, width: 0.3 m and depth: 0.5 m) and one outside with cement borders (length: 13 m, width: 0.7 m and depth: 0.4 m). A system consisting in three NIKON-D3200 cameras, mounted to an adjustable tripod head, which is fixed to an inverted aluminium T-bar with the center camera higher than the two side cameras. Each camera is fitted with a 28 mm lens and cameras are synchronized using a Phottix(R) system. The system was mounted at a downstream position from the channel with an oblique configuration. A series of pictures taken at a 3 s interval during the water weight bearing were reported and analyzed using the Photoscan Pro(R) software for image matching. Validation procedure of the technique was realized using an orthophotography of the lateral border of the interior channel to delimit the line of water surface, and using a video capture of a slide fixed inside the outside channel. A high resolution and dynamic elevation map of the surface water was constructed. Our study give encouraging results, with a good capture of water surface morphology and a limited occlusion issues. The confrontation of the results with the validation dataset highlight limitations that need to be discussed with the audience.