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www.elsevier.com/locate/ijsrc

PII: S1001-6279(18)30035-0
DOI: https://doi.org/10.1016/j.ijsrc.2018.02.001
Reference: IJSRC162

To appear in: *International Journal of Sediment Research*

Received date: 31 August 2016
Revised date: 30 November 2017
Accepted date: 5 February 2018

Cite this article as: M. Detert, L. Kadinski and V. Weitbrecht, On the way to airborne gravelometry based on 3D spatial data derived from images, *International Journal of Sediment Research,* https://doi.org/10.1016/j.ijsrc.2018.02.001

On the way to airborne gravelometry based on 3D spatial data derived from images

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ABSTRACT: This paper presents basic tests to develop an airborne photogrammetric methodology that derives grain size characteristics of gravel bed rivers. The data acquisition was done using a lightweight action cam and a hand-held digital single lens reflex camera. Image processing comprised the structure from motion technique and multiview-stereo algorithms to obtain digital elevation models of non-cohesive gravel beds. Laboratory results indicate that the method accuracy is about four to six times lower than laser-scan data when based on action cam data. The accuracy of digital elevation models computed via photos taken by the reflex camera is almost of the same range as the laser data. Field experiments were done to test the performance of image based gravelometry against manual surface sampling. For this application the action cam was mounted to a low-cost quadrocopter, while the reflex camera was operated by hand. Results indicate that this combination has a high potential to generate data from which characteristic grain size parameters can be estimated.

KEYWORDS: Airborne photogrammetry, Grain size distribution, Gravel bed, Field work, Gravelometry, Image analysis, Laboratory experiments, Structure from motion, Surface sampling

Introduction

1.1. *Recent developments in river bed surveying*

More than one decade ago developments in medical applications made laser scanning technology also attractive to be used in the area of surveying dry river beds. For instance, Smart et al. (2004) and Heritage and Milan (2009) in the field and Aberle and Nikora (2006) in the laboratory successfully tested the applicability of a terrestrial laser scanner to derive statistical properties of gravel beds on patches of a few square meters. Brasington et al. (2012) expanded this approach to map spatial patterns of particle sizes even on a reach length scale. However, the costs of laser scanners are high (typically between 30–100 k€) and, during field work, the instrument has to be moved to several scanner loca-