Super-resolution mapping of gravel bed surface roughness using terrestrial laser scanning and airborne laser scanning

Guo-Hao Huang [a] *and Chi-Kuei Wang* [*b]

[a] *Postdoctoral Fellow, Department of Geomatics, National Cheng-Kung University, No.1, University Road, Tainan City 701, Taiwan; Tel: + 886-6-2757505#63825; E-mail: guohao.huang@gmail.com*

[b] *Associate Professor , Department of Geomatics, National Cheng-Kung University, No.1, University Road, Tainan City 701, Taiwan; Tel: + 886-6-2757505#63809; E-mail: chikuei@mail.ncku.edu.tw*

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ABSTRACT:

The aim of this study is to derive the scaling behavior of gravel-bed roughness of terrestrial laser scanning (TLS) from airborne laser scanning (ALS). We use the fractal dimension, which can be estimated from the slope of log-log variogram of laser scanning data, to represent gravel bed roughness. The study area is located near the confluence of the Nan-Shih River and Pei-Shih River, northern Taiwan. Six gravel-bed sites with the extent of 6m × 6m were acquired by FARO photon 80, and then in-situ digital surface models (DSMs) were generated with 1 cm × 1cm resolution. ALS survey was conducted by an Optech ALTM 3070 at the density of 100 points/m^2. The point cloud data were collected by ALS, which showed smoothed surface of TLS counterparts. Because the gravel-bed surface exhibits the anisotropic property, two-dimensional variogram surfaces were employed to determine the anisotropic directions. Previous studies found that anisotropic directions exhibited in ALS data were similar as their respective TLS-derived DSMs. In this study, we used the deconvolution method to derive the variograms of TLS-derived DSM from the variograms of ALS footprint in the direction of maximum and minimum continuity. The results will lead a better understanding of gravel-bed roughness using ALS data for the large-scale areas.