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# Capturing and modelling high-complex alluvial topography with UAS-borne laser scanning

Gottfried Mandlburger (1), Martin Wieser (1), and Martin Pfennigbauer (2)

(1) Department of Geodesy and Geoinformation, Vienna University of Technology, Vienna, Austria (gottfried.mandlburger@geo.tuwien.ac.at), (2) Riegl Laser Mesurement Systems, Horn, Austria

Due to fluvial activity alluvial forests are zones of highest complexity and relief energy. Alluvial forests are dominated by new and pristine channels in consequence of current and historic flood events. Apart from topographic features, the vegetation structure is typically very complex featuring, both, dense under story as well as high trees. Furthermore, deadwood and debris carried from upstream during periods of high discharge within the river channel are deposited in these areas. Therefore, precise modelling of the micro relief of alluvial forests using standard tools like Airborne Laser Scanning (ALS) is hardly feasible. Terrestrial Laser Scanning (TLS), in turn, is very time consuming for capturing larger areas as many scan positions are necessary for obtaining complete coverage due to view occlusions in the forest. In the recent past, the technological development of Unmanned Arial Systems (UAS) has reached a level that light-weight survey-grade laser scanners can be operated from these platforms. For capturing alluvial topography this could bridge the gap between ALS and TLS in terms of providing a very detailed description of the topography and the vegetation structure due to the achievable very high point density of >100 points per m2.

In our contribution we demonstrate the feasibility to apply UAS-borne laser scanning for capturing and modelling the complex topography of the study area Neubacher Au, an alluvial forest at the pre-alpine River Pielach (Lower Austria). The area was captured with Riegl's VUX-1 compact time-of-flight laser scanner mounted on a RiCopter (X-8 array octocopter). The scanner features an effective scan rate of 500 kHz and was flown in 50-100 m above ground. At this flying height the laser footprint is 25-50 mm allowing mapping of very small surface details. Furthermore, online waveform processing of the backscattered laser energy enables the retrieval of multiple targets for single laser shots resulting in a dense point cloud of, both, the ground surface and the alluvial vegetation. From the acquired point cloud the following products could be derived: (i) a very high resolution Digital Terrain Model (10 cm raster), (ii) a high resolution model of the water surface of the River Pielach (especially useful for validation of topo-bathymetry LiDAR data) and (iii) a detailed description of the complex vegetation structure.