36. Influence of UAV-Borne LiDAR Scanning Modes on Ground-Point Sampling and DTM Completeness: A Preliminary Evaluation of the DJI Zenmuse L3

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Recent advances in miniaturization and integration of commercial airborne Light Detection and Ranging (LiDAR) have enabled their deployment on Unmanned Aerial Vehicle (UAV) platforms. Compared with conventional crewed-aircraft systems, UAV-borne LiDAR offers greater operational flexibility for high-resolution survey and is adopted in geomatics applications, including 3D surveying, infrastructure inspection, environmental monitoring and forestry, where vegetation penetration offers advantages over passive sensing techniques. Commercial UAV-borne LiDAR systems often operate as black-box solutions, where acquisition settings directly determine the resulting point cloud. Independent evaluations are therefore needed to understand how scanning configurations affect point distribution and terrain sampling. This study presents a preliminary evaluation of the DJI Zenmuse L3, focusing on the influence of scanning mode and pulse repetition frequency on groundpoint sampling and Digital Terrain Model (DTM) completeness in a forested test area. Three scanning modes (Linear, Star-shaped and Non-repetitive) were compared at 100 kHz under equivalent flight conditions, while an additional Starshaped acquisition at 350 kHz explored the effect of increased pulse rate. Ground-classified point clouds were analysed considering spatial distribution, point density, grid completeness and sampling redundancy at grid steps of 0.05, 0.10 and 0.20 m. At 100 kHz, Linear scanning provided the highest ground-point density and completeness at 0.05 m, whereas Star-shaped scanning achieved slightly higher completeness at 0.10 m. At 0.20 m, all modes approached complete spatial coverage. Increasing the pulse rate to 350 kHz improved groundpoint availability, finer-resolution completeness and sampling redundancy. Overall, DTM support depended on scanning geometry, pulse rate and target raster resolution.