

# 森林内部における3次元構造評価のためのUAV-Lidarによる点群取得手法の検討

A study of point cloud acquisition method by UAV-Lidar for evaluation of 3D structure of forests

KP16

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無人航空機 (UAV) によるレーザ測量 (Lidar) を用いて、樹木の幹形状や下層植生など、森林内部の3次元構造を高精細に取得するためには、適切な飛行計画を設定する必要がある。そのための効果的な現地観測の設定を検証し、得られた点群解析の方法を検討した。

In order to obtain high-definition 3D structures of the forest interior structure, including tree trunk shapes and understory vegetation, using laser scanning (Lidar) by unmanned aerial vehicle (UAV), it is necessary to set up an appropriate flight plan. We will assess the effective settings of field observation for the flight of UAV-Lidar and examine the method of analysis of the obtained point cloud.

## UAV-Lidar: DJI Matrice 300 RTK / Zenmuse L1



**Low-cost UAV-Lidar**

- Lidar (Livox Avia), RGB sensor, IMU
- 1-2 km<sup>2</sup> coverage by one flight (about 30-40 minutes)
- accuracies: 5 cm (v); 10 cm (h)
- frequency: 240,000 pts/sec
- triple returns
- scan range: 190 m (10% reflectance, 100 kb)
- IP54 waterproof
- two scan modes: non-repetitive / repetitive



**GNSS base station: D-RTK2**

tentative positions: post-processed (static correction) using adjacent GSI base station observation data

- 35.622870916° (UTM 441546.672 m)
- 140.354502019° (UTM 3942312.427 m)
- 84.80 m (HAE) ct, geoid height: 33.89 m



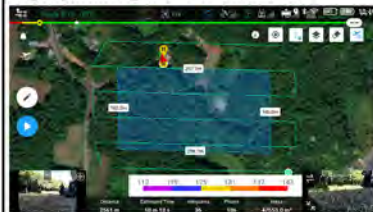
飛行機運用 <https://www.dji.com/ja/matrice-300-rtk>  
 必要装置



**Live view of point cloud and image acquisitions**

- map view / onboard camera / Zenmuse L1 sensors
- flight plan mission status

## flight planning (#1-#4) & results



**common settings**

- height above ground: 50 m
- terrain-following flight mode (using DEM108 by GSI)
- side overlap: 20%
- coverage area: ca. 520 m x 380 m [20 ha]

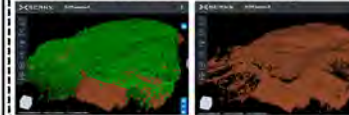
**varied settings (four plans)**

- lidar scan mode: repetitive (#1, #3, #4), non-repetitive (#2)
- flight path: east-west (#1, #2, #4), north-south (#3)
- flight speed: 5 m/s (#1, #2, #3), 2.5 m/s (#4)

### remarks

- non-repetitive scan mode is better to capture details of the internal structure, rather than the slow flight with repetitive mode
- crossing flight paths may increase the visibility of tree trunk shapes

## cf. point cloud classification (trees and ground) from point clouds all combined (#1-#4)



further ecological/geomorphological analysis

