

Simulating Photogrammetry of Bird Flight Height to Assess its Accuracy: Through Drone Flight and Computer-Generated Imagery

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RELEVANCE

- Tall structures (inc. *green energy*) threaten birds
 - Barotrauma/collision with wind turbines^[1-3]
 - Heat injury/collision with Utility Scale Solar Energy towers^[4-5]
 - Collision with overhead cables between transmission towers^[6]
- Flight height data critical for species risk assessment^[7-8]
- Developed 3-D photogrammetry of bird flight height^[9]
 - Precision: stationary structures and flying subjects
 - Accuracy: stationary structures
- Accuracy on flying subjects?



MAPPING



The application and limitations of a low-cost UAV platform and open-source software combination for ecological mapping and monitoring

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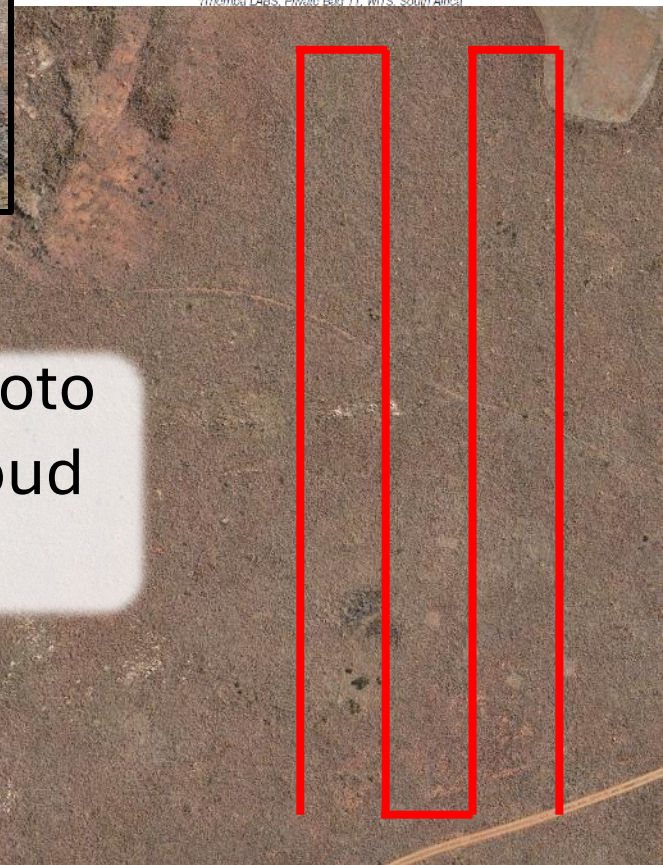
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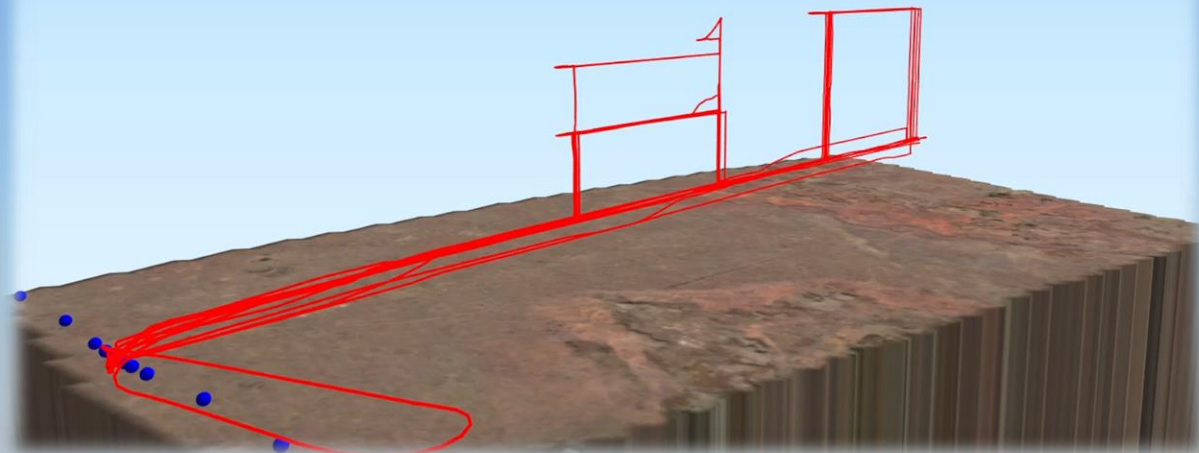
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- Orthophoto
- Point cloud
- DEM





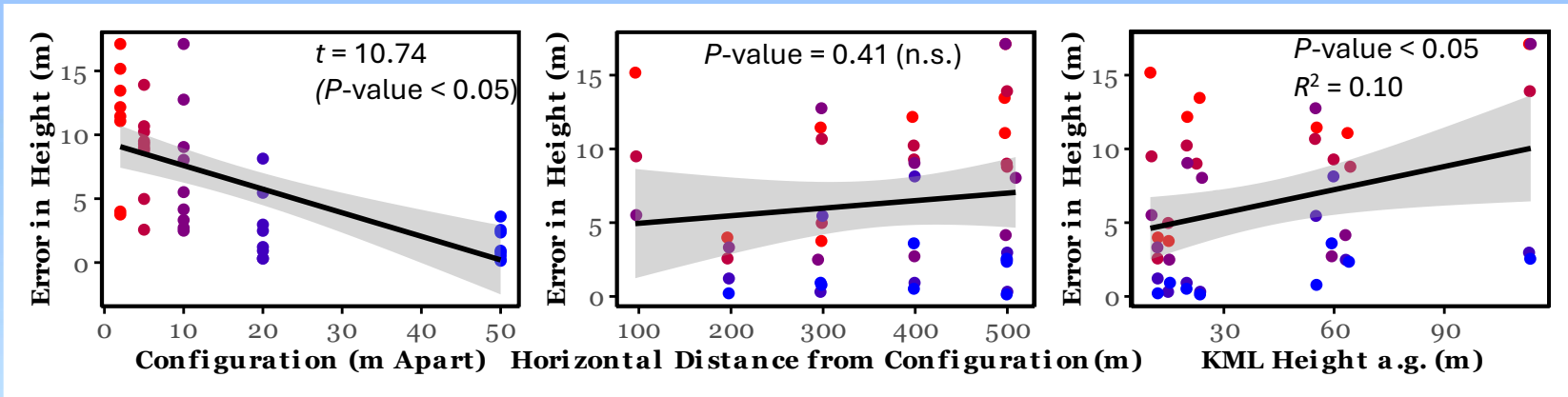
$$FH = Alt_{Drone} - Alt_{DEM\downarrow}$$

Yongnuo remote trigger



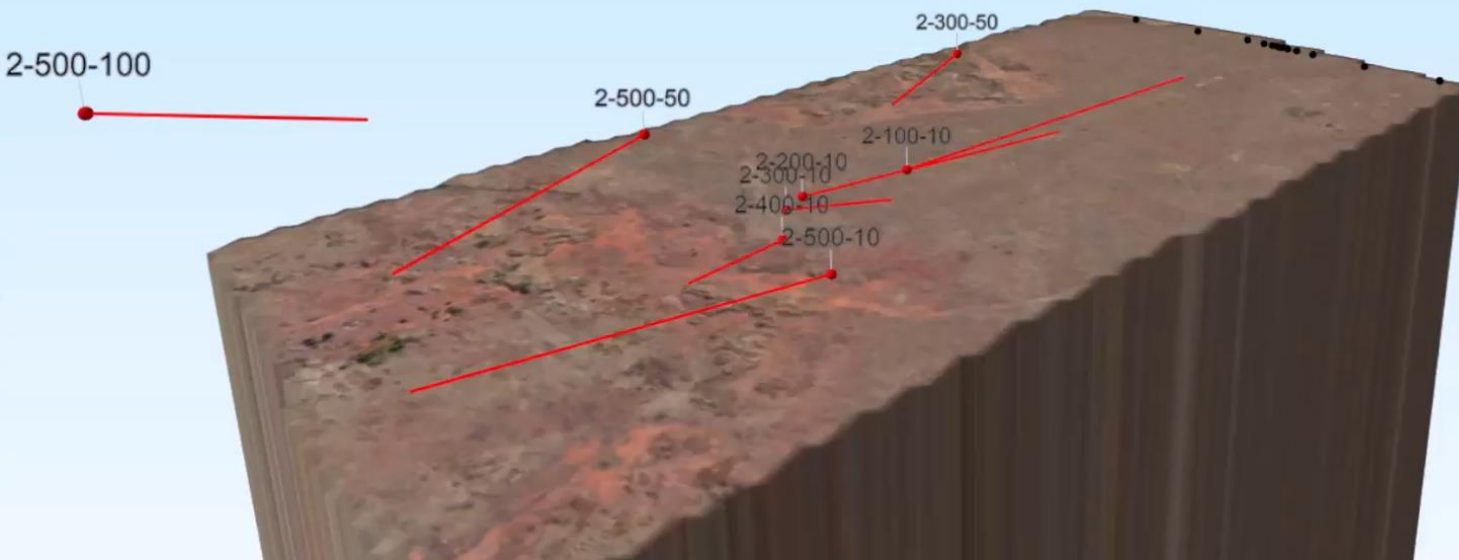
Canon EOS1300D

Photogrammetric Accuracy



rlm

← *gvlma accepted (lm)* →



IMPORTANT INSIGHTS

Method	Accuracy Statement	Details
Surveyors	Prone to underestimation Assignment to broad height bands	Relies on imprecise observer estimation, affected by experience, visibility, distance, fatigue and lack of reference heights. Used for general observations [1-3].
Laser-based range-finding	±1 m up to 100 m away and 50 m high [2,4]	Accuracy decreases with distance and is affected by atmospheric conditions and bird reflectivity. Best for large, consistently and slow-moving birds [2-6].
Fixed-beam radars & thermal imaging	±5 to 10 m [7]	Expensive and cumbersome. Accuracy dependent on beam width, signal processing, and bird size. Useful for fixed area monitoring [4,8-9].
LiDAR	±1 m up to 150 m away [10]	Most accurate method but costly.
Perpendicular radar system	±1 to 5 m at intersecting beams on a 1.5 km radius	Expensive, complex and may not identify species [11-13].
GPS-loggers and/or altimeters (bird tracking devices)	±2–7 m [14]	Despite continuous data, limited to large birds, short-lived, costly, and invasive capture and recapture, which limits sample sizes and may affect bird behaviour [6,15-17].
Stereophotogrammetry*	±2 m up to 500 m away and 100 m high	Calibrated area improves the accuracy. Sufficiently spaced camera configuration (50 m apart).

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