

INTISARI

ANALISIS *QUALITY CONTROL* DAN AKURASI DATA LiDAR PADA VARIASI KETINGGIAN TERBANG BERBASIS DATA *TOTAL STATION*

Oleh

Zayyan Fadhillah
22/503453/PA/21638

Pemetaan topografi menggunakan LiDAR semakin banyak diterapkan dalam kajian ilmu kebumihantoran, namun kualitas akurasi dalam penentuan posisi sangat dipengaruhi oleh parameter akuisisi, khususnya ketinggian terbang. Penelitian ini bertujuan menganalisis akurasi geometrik dan resolusi spasial data LiDAR pada tiga variasi ketinggian terbang (100 m, 200 m, dan 300 m) di atas permukaan tanah menggunakan data acuan hasil pengukuran terestris *Total Station* di Lapangan Sidomoyo, Kabupaten Sleman, DIY. Evaluasi akurasi dilakukan pada 28–30 titik uji independen menggunakan parameter *mean error*, standar deviasi, dan *Root Mean Square Error* (RMSE), yang selanjutnya dikonversi ke nilai CE90 dan LE90 sesuai Perka BIG No. 15 Tahun 2014. Analisis resolusi spasial dilakukan melalui evaluasi distribusi kerapatan titik menggunakan metode interpolasi IDW.

Hasil menunjukkan bahwa apabila dievaluasi pada skala acuan yang sama yaitu 1:2.500 sesuai standar Kelas 1 BIG dengan batas toleransi $CE90 \leq 0,5$ m dan $LE90 \leq 0,5$ m, ketinggian 100 m menghasilkan akurasi terbaik dengan $RMSE\ H = 0,0751$ m dan $RMSE\ V = 0,0546$ m, serta ketinggian 200 m dengan $RMSE\ H = 0,1830$ m dan $RMSE\ V = 0,0572$ m, keduanya memenuhi standar Kelas 1 pada komponen horizontal maupun vertikal. Ketinggian 300 m menunjukkan bias vertikal sistematis sebesar 1,6527 m dengan $RMSE\ V = 1,6546$ m yang tidak memenuhi standar ketelitian vertikal BIG, meskipun komponen horizontalnya masih memenuhi Kelas 1. Kerapatan titik menurun secara signifikan seiring bertambahnya ketinggian terbang. Berdasarkan keseimbangan antara akurasi, resolusi spasial, dan efisiensi survei, ketinggian 200 m direkomendasikan untuk survei geofisika pada area luas, sedangkan ketinggian 100 m lebih sesuai untuk survei detail pada area terbatas.

Kata kunci: LiDAR, *quality control*, akurasi posisi, ketinggian terbang, RMSE, *Total Station*, Perka BIG

ABSTRACT

ANALYSIS OF QUALITY CONTROL AND ACCURACY OF LIDAR DATA AT DIFFERENT FLIGHT ALTITUDES BASED ON TOTAL STATION DATA

by

Zayyan Fadhillah
22/503453/PA/21638

High resolution topographic mapping using LiDAR has been increasingly applied in geosciences; however, its positional accuracy is strongly influenced by acquisition parameters, particularly flight altitude. This study aims to analyze the positional accuracy and spatial resolution of LiDAR data at three flight altitude variations (100 m, 200 m, and 300 m) above ground level, using terrestrial Total Station measurements as reference data at Sidomoyo Field, Sleman Regency, Special Region of Yogyakarta. Accuracy evaluation was conducted on 28-30 independent check points using mean error, standard deviation, and Root mean square Error (RMSE), which were subsequently converted to CE90 and LE90 values in accordance with BIG Regulation No. 15 of 2014. Spatial resolution analysis was performed through the evaluation of point density distribution using the Inverse Distance Weighting (IDW) interpolation method.

The results show that when evaluated against a common reference scale of 1:2,500 according to BIG Class 1 standards with tolerance limits of $CE90 \leq 0.5$ m and $LE90 \leq 0.5$ m, a flight altitude of 100 m yielded the best accuracy with $RMSE H = 0.0751$ m and $RMSE V = 0.0546$ m, while a flight altitude of 200 m produced $RMSE H = 0.1830$ m and $RMSE V = 0.0572$ m, both meeting Class 1 standards for both horizontal and vertical components. A flight altitude of 300 m exhibited a systematic vertical bias of 1.6527 m with $RMSE V = 1.6546$ m, which does not meet BIG vertical accuracy standards at any map scale, although its horizontal component still satisfies Class 1. Point density decreased significantly as flight altitude increased. Based on the balance between accuracy, spatial resolution, and survey efficiency, a flight altitude of 200 m is recommended for geophysical surveys over large areas, while 100 m is more suitable for detailed surveys over limited areas.

Keywords: *LiDAR, quality control, positional accuracy, flight altitude, RMSE, Total Station, BIG Regulation*