

RADIOMETRIC CALIBRATION OF FULL-WAVEFORM AIRBORNE LASER SCANNING DATA BASED ON NATURAL SURFACES

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Technical Commission VII Symposium 2010

KEY WORDS: Radiometry, Calibration, LIDAR, Laser scanning, Radiometric

ABSTRACT:

Airborne laser scanning (ALS) has become a commercially available and therefore widely used technique for obtaining the geometric structure of the earth's surface. For many ALS applications it is beneficial or even essential to classify the 3D point cloud into different categories (e.g. ground, vegetation, building). So far, most classification techniques use the geometry of the 3D point cloud or parameters which can be gained from analyzing the geometry or the number of echoes per emitted laser shot. Decomposing the echo waveform of full-waveform laser scanners provides in addition to the 3D position of each echo its amplitude and width. These physical observables are influenced by many different factors (e.g. range, angle of incidence, surface characteristics, atmosphere, etc.). Therefore, these attributes can hardly be used without radiometric calibration. In this paper the theory of the radar equation will be used to transform amplitude and echo width into backscatter cross section values. For this aim, external reference targets with known backscatter characteristics are necessary for the absolute radiometric calibration. In contrast to other approaches, this paper presents the usage of natural surfaces for this calibration task. These surfaces are observed in order to determine their backscatter characteristics independently from the ALS flight mission by a RIEGL reflectometer. Based on these observations the data from the ALS flight can be calibrated. Calibration results of data acquired by a RIEGL LMS-Q560 sensor are presented and discussed. Next to a strip wise analysis, the radiometric calibration results of different strips in the overlapping region are studied. In this way, the accuracy of the calibration is analyzed (1) relatively by analyzing these overlapping regions and (2) absolutely by the comparison of the calibrated ALS data in respect to further available radiometric control surfaces.

TOPIC: Lidar and laser scanning

ALTERNATIVE TOPIC: Physical modeling and signatures