Radiometric Analysis of Mulit-Wavelength Airborne Laser Scanning Data of Different Case Study

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Abstract

Airborne laser scanning (ALS) is widely used for the acquisition of urban and rural areas. Nowadays a wide range of ALS sensors with different technical specifications can be found. One key parameter is the laser wavelength which determines the instrument's relative ranging capabilities due to the wavelength-dependent backscatter characteristic of the sensed surfaces. Next to the geometric information (i.e. the location in space) current ALS sensors usually record amplitude information for each echo. In order to utilize this information for the study of the backscatter characteristics of the sensed surface, radiometric calibration is essential. This paper focuses on the radiometric calibration of multi-wavelength ALS data as opposed to conventional monochromatic (single-wavelength) ALS data. After a short introduction theory and practice of the radiometric calibration of ALS data based on in-situ reference surfaces is presented. Based on individual monochromatic radiometric reflectance readings a calibrated multi-wavelength reflectance image can be generated. It is important to note that this image is not influenced by shadows (due to the active illumination of the sensed surface) and from a geometric viewpoint the position of the objects on top of the terrain surface is not altered (true orthophoto). Within this paper the approach is demonstrated for two projects both comprising three different single-wavelength ALS data acquisitions (532nm, 1064nm, and 1550nm). One project covers the area of the city of Horn in Austria and the other covers a rural area near Horn containing woods, fields, open grass land, a small lake, and a small village.
The practical results presented here show the applicability of calibrating multi-wavelength radiometric imagery from ALS data and provide an insight into the challenges of radiometric processing and exploitation of multi-wavelength ALS data. Based on the resulting multi-wavelength reflectance information spectral analysis of the radiometric behavior of the sensed surfaces at the three different wavelengths is possible. Furthermore, the analysis of the ALS data focuses on the point clouds obtained with the three different laser scanners with respect to point density, multi-target resolution, scan alignment, vegetation penetration, and water surface and ground caption.