Comparison and Evaluation of Image Matching and Airborne Laser Scanning Point Clouds for Generating Canopy Height Model

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SUMMARY

Accurate knowledge of the condition of forests allows for rational forest management. The use of aerial images and airborne laser scanning point clouds is on the rise for this purpose. It will enable to study individual trees and conduct precision forestry. Because photogrammetric data are freely available on the geoportal for the entire area of Poland, there are opportunities to use them on a broader scale in rational forest management. The experiment aimed to evaluate the possibility of using the aerial data to generate the Canopy Height Model. Aerial photos and LiDAR point clouds were used. The data covered the area of the Biebrza National Park. They were obtained as part of the HabitARS project: The innovative approach supporting monitoring of non-forest Natura 2000 habitats, using remote sensing methods. The project was carried out in 2016–2019 as part of the BIOSTRATEG II program and funded by The National Centre for Research and Development in Poland.

The generated Canopy Height Models based on image matching point clouds were compared with those from airborne laser scanning. Canopy Height Model based on airborne laser scanning data proved to be better quality. It maps the shape of the canopies more accurately. The boundaries between tree canopies are more clearly marked on the CHM generated from LiDAR data. Single trees and groups of trees on LiDAR CHM are more distinguishable than CHM based on image matching. Moreover, the boundaries of individual canopies are fuzzy on the CHM generated from image matching point clouds. Many details are smoothed out and indistinct. The most significant differences in height values between models occur on the edges of the forest stand and in the free spaces between trees. The great advantage of LiDAR data is the ability of the laser beam to penetrate through the vegetation. It enables to get more detailed stand characteristics and information about the ground under the vegetation. The image matching point cloud has different characteristics. Vegetation is often a source of errors in matching images. Errors in height appear

mainly on the edges of the canopies and shaded areas. However, image matching point clouds can be used in multi-time analyses when LiDAR data is unavailable.