



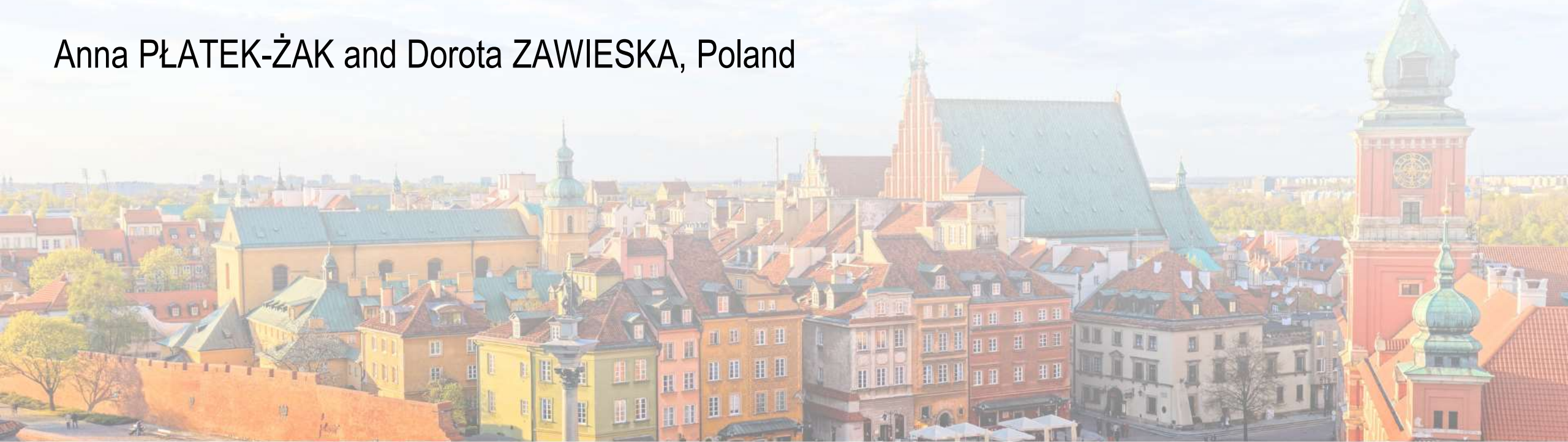
XXVII FIG CONGRESS

11-15 SEPTEMBER 2022
Warsaw, Poland

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

Anna PŁATEK-ŻAK and Dorota ZAWIESKA, Poland



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Introduction

- Photogrammetric data and products are used in forest management to determine many forest characteristics.
- **The aim of this study is to compare point clouds from image matching with point clouds from airborne laser scanning in generating Canopy Height Models.**
- The generation of Canopy Height Model is still a current research problem.
- In many countries ALS data is the main source for generating CHM, but there are places where ALS point cloud is not acquired often.
- In such situations, the possible solution is to use aerial images which are acquired more often and regularly.

Area of interest and data

Podlaskie voivodeship



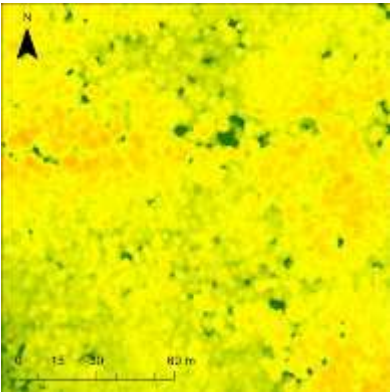
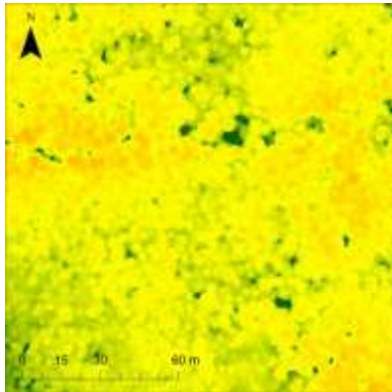
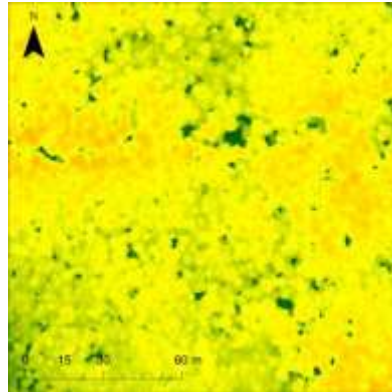
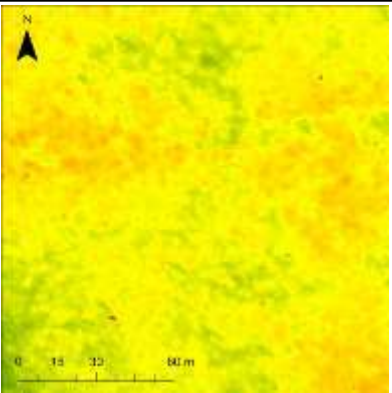
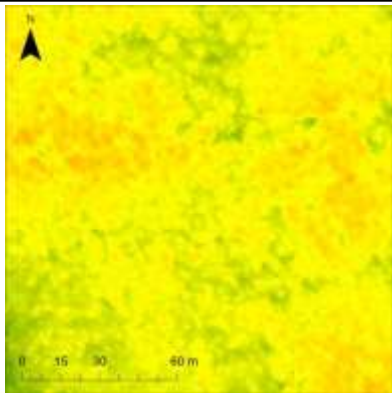
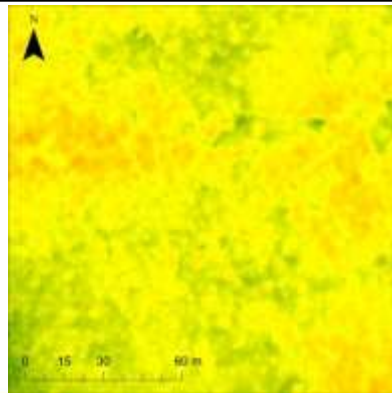
The district of Mońki



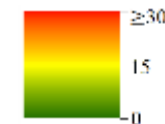
- Biebrza National Park
- Aerial images and ALS point clouds
- Three data acquisition missions:
 - 04-05 June 2016,
 - 28 August 2016,
 - 15 September 2016.
- The data was acquired as part of the HabitARS project: The innovative approach supporting monitoring of non-forest Natura 2000 habitats, using 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.

Location of the area of interest according to the administrative division

Canopy Height Model generation

Data acquisition date	04-05 June 2016	28 August 2016	15 September 2016
ALS point cloud			
Image matching point cloud			

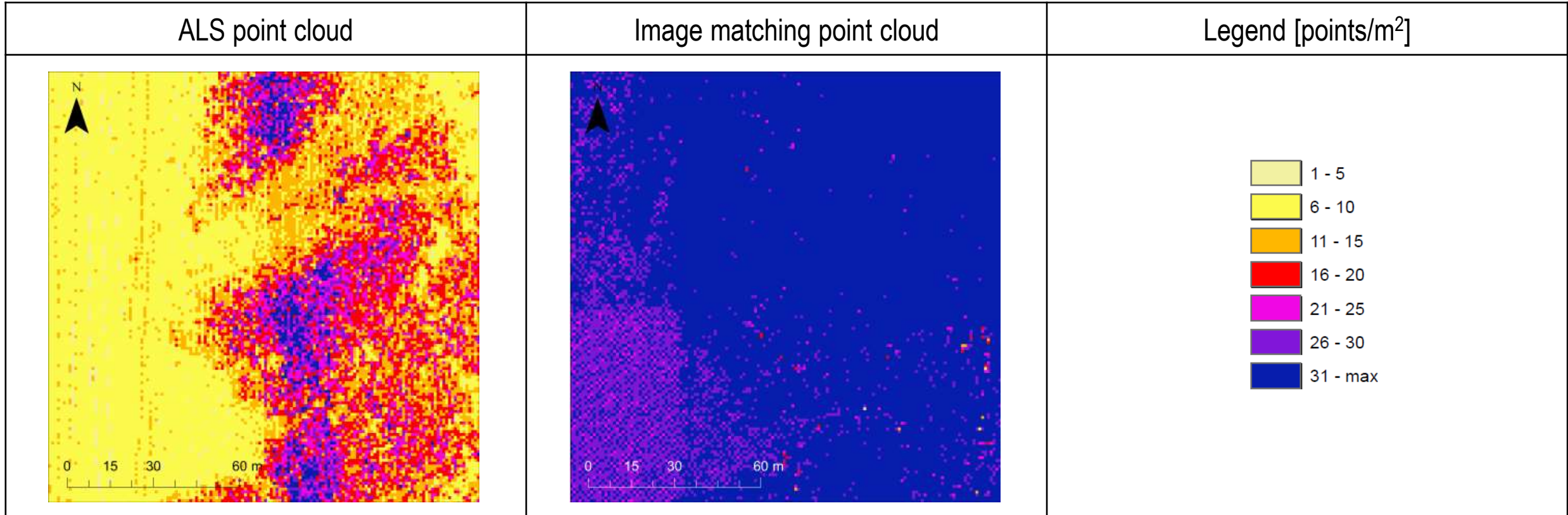
Forest stand height [m]



Results - Height values comparison

Data acquisition date	04-05 June 2016	28 August 2016	15 September 2016
Height differences values 			
Mean value of absolute height differences [m]	0,41	0,68	0,23
RMS values [m]	0,52	0,47	0,50

Results - Point cloud density comparison



Results - Terrain profile comparison

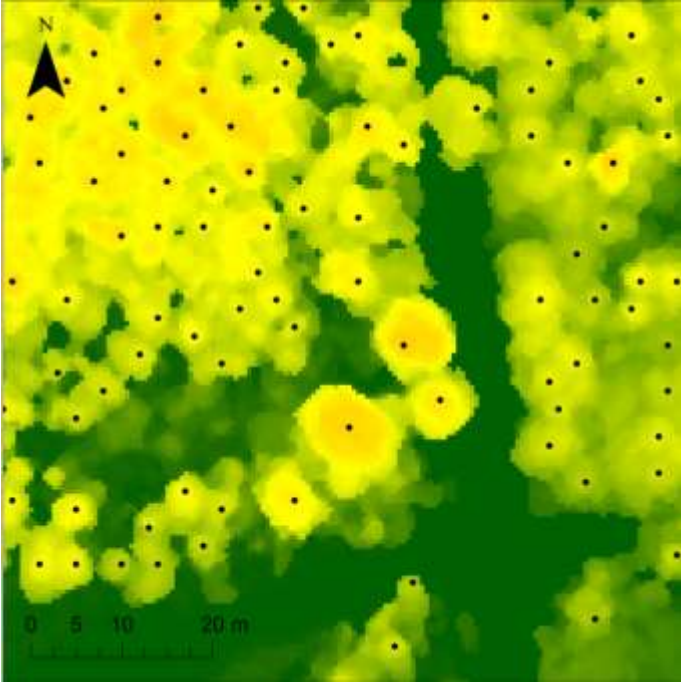
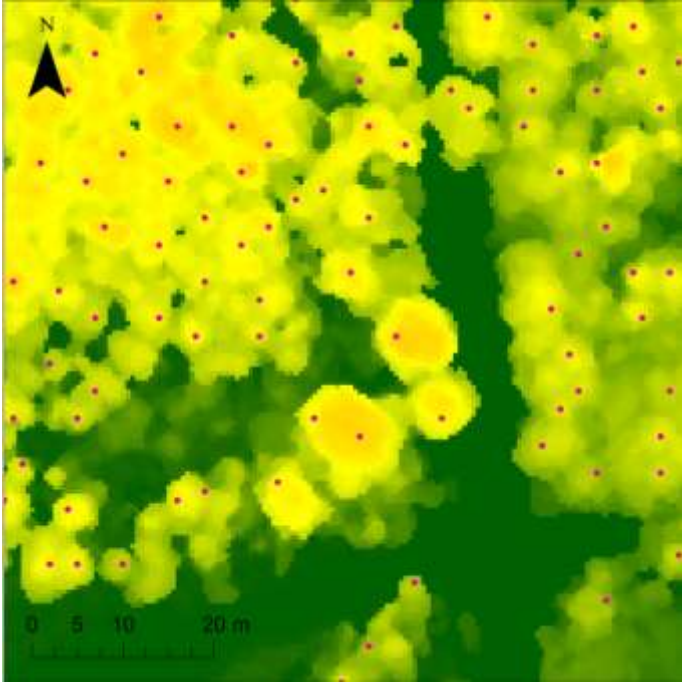
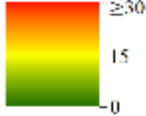
Profile of area with road
and roadside group of
trees for ALS data from
04-05 June 2016



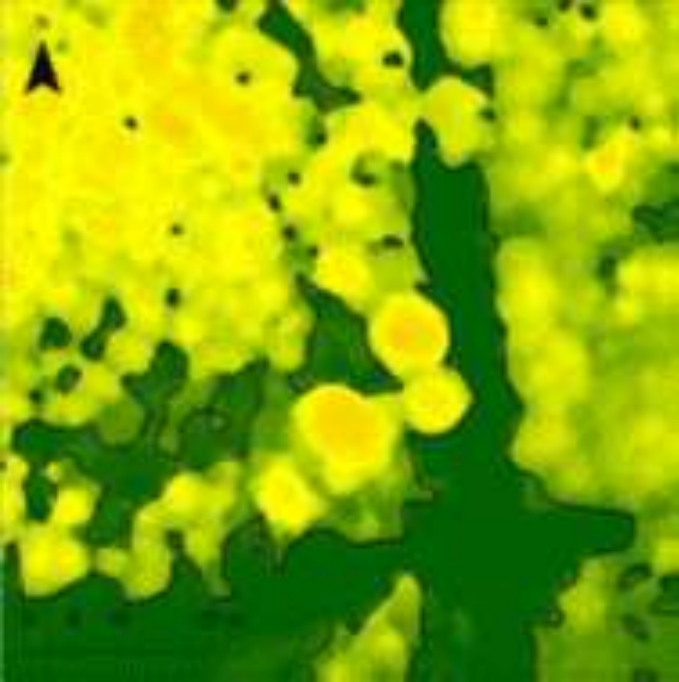
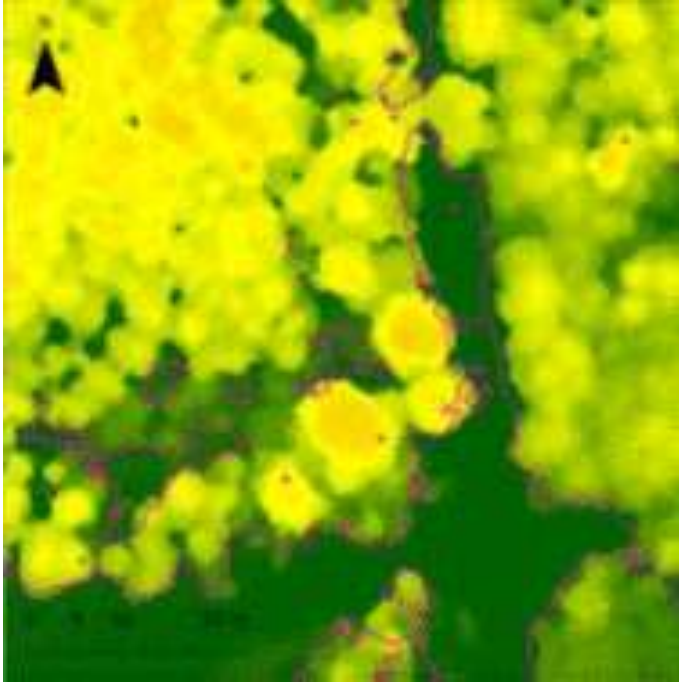
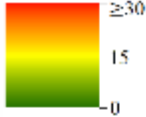
Profile of area with road
and roadside group of
trees for image matching
point cloud from 04-05
June 2016



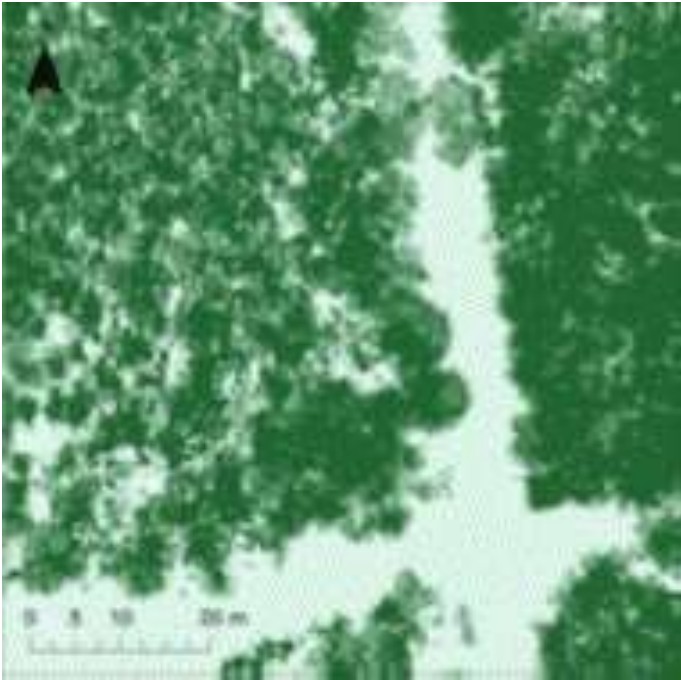
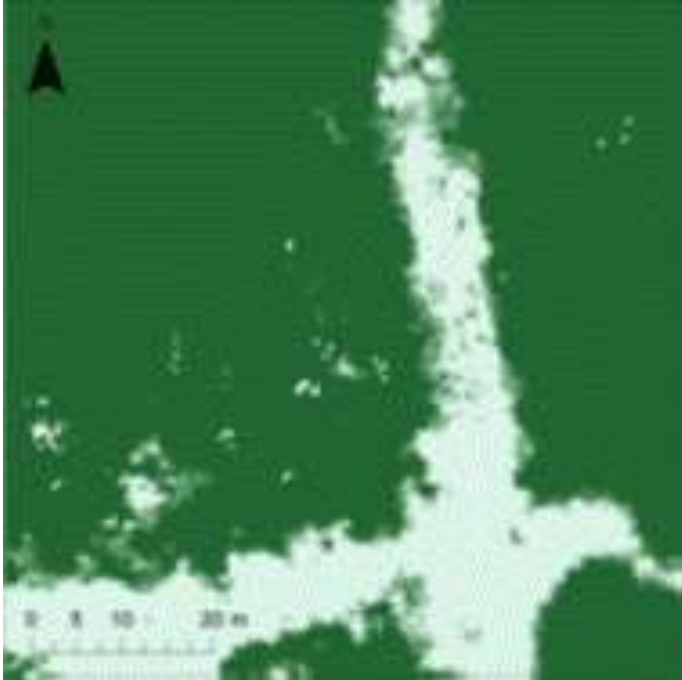
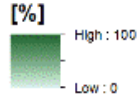
Results - Individual tree tops

ALS point cloud	Image matching point cloud	Legend
		<p>Forest stand height [m]:</p>  <p>Tree tops based on ALS data: ●</p> <p>Tree tops based on image matching point clouds: ●</p>

Results - Forest stand boundaries

ALS point cloud	Image matching point cloud	Legend
		<p>Forest stand height [m]:</p>  <p>Forest stand boundaries based on ALS data: —</p> <p>Forest stand boundaries based on image matching point clouds: —</p>

Results - Forest stand cover

ALS point cloud	Image matching point cloud	Legend [points/m ²]
		<p>Forest stand height [m]:</p>  <p>High : 100 Low : 0</p>

Conclusion

- ALS data and image matching point clouds are useful for Canopy Height Model generation.
- The image-matching point cloud has completely different characteristics than the ALS point cloud. It is not possible to obtain information about the land under the surface of the forest stand. Vegetation is a source of errors in image matching. This is due to the similar texture and repeating elements. Errors in height occur mostly on the edges of the crowns and the entire stand, as well as in places of shade.
- To develop the Canopy Height Model, it is better to use data from airborne laser scanning. It more accurately reflects the shape of the crowns. It presents details of objects and have an adequate point density. The ability of the laser beam to penetrate through the vegetation is a great advantage. It is possible to get more detailed characteristics of the stand and information about the ground under the vegetation.

Thank you for your attention

Anna Płatek-Żak, BEng, MSc

- Email: anna.platek@pw.edu.pl

Dorota Zawieska, BEng, PhD, DSc

- Email: dorota.zawieska@pw.edu.pl

Warsaw University of Technology, Faculty of Geodesy and Cartography,
Department of Photogrammetry, Remote Sensing and Spatial Information Systems
Pl. Politechniki 1
00-661 Warsaw
POLAND