Abstract template for the conference "A century of national forest inventories – informing past, present and future decisions"

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Abstract title:		The influence of outliers in image matching point clouds on canopy height models and growing stock estimations
Take-home message:		*Filtering of outliers improves the quality of forest related information derived from photogrammetric point clouds.*
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General topic, see website: (please double click on the check box and activate the relevant one)	☐	Improving future NFIs by learning from the past
	☐	NFIs today and in the future
	x	Cutting edge and futuristic inventory techniques and technologies
Preferred presentation form:	x	Oral presentation
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The influence of outliers in image matching point clouds on canopy height models and growing stock estimations

Christian Aufreiter & Stefan Schöttl

Introduction:

Due to the nationwide availability of aerial images and latest developments in information technology, photogrammetric point clouds have recently gained popularity among National Forest Inventories of many European countries. Beside other technical reasons, image matching point clouds contain outliers in z-dimension especially in areas of low colour information. The total number of outliers in relation to non outlier points is relatively low. Nevertheless, they can have a local influence on the tree height estimation. Consequently the aggregation of per point object heights to canopy height models and derived products such as growing stock maps might be affected. Automatic outlier detection in high density point clouds is challenging. In literature, relatively simple methods, e.g. the statistical outlier removal method (Rusu et al., 2008) as well as more sophisticated ones, e.g. supervised outlier detection (Stucker et al., 2018) can be found.

Materials and methods:

The data for this study is derived from nationwide Austrian aerial image and ALS flight campaigns. The image matching process is performed by Trimble Inpho MATCH-T DSM. In-house written Python code is used for the calculation of canopy heights per point, the detection and removal of outliers, the grid aggregation to canopy height models as well as for the estimation of growing stock. In this study we introduce a two-pass procedure to reduce the amount of outliers based on height thresholding, DBSCSAN clustering (Ester et al., 1996) and distance thresholding. The workflow is tested on 33 NFI-plots in different landscapes of Austria that are likely to be affected. Growing stock estimations based on raw, simply filtered and two-pass filtered point clouds are compared.

Results:

The overall share of outliers in the point cloud is very low. Different types of outliers can be identified. Our results show that canopy heights vary depending on the applied filter method. Consequently outliers lead to an overestimation of the growing stock of 1.3 percent in average compared to filtered data and 4.8 percent at maximum.

Conclusion:

We conclude that it is worth to remove outliers already at the point cloud data level before calculating canopy height models, estimating growing stock or deriving further forest related structures. This is especially true for small scale studies in which no further aggregation will be performed.

References:

Ester et al., 1996, Proceedings of the 2nd International Conference on Knowledge Discovery and Data Mining, 226-231

Rusu et al., 2008, Towards 3D Point Cloud Based Object Maps for Household Environments Robotics and Autonomous Systems Journal (Special Issue on Semantic Knowledge)

Stucker et al., 2018, ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences, Volume IV-2, 263-270

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