Abstract of the "3D Tree Models for Forest Dynamics", 9th - 10th January 2020 Helsinki, Finland

Impacts of acquisition patterns on the robustness and accuracy of tree models derived from UAV LiDAR for forest dynamic studies

Moritz Bruggisser[1], Markus Hollaus[1], Lukas Winiwarter[2], Johannes Otepka[1], Di Wang[3], Bernhard Höfle[2] and Norbert Pfeifer[1]

(1) Department of Geodesy and Geoinformation, TU Wien, Vienna, Austria
(2) 3D Geospatial Data Processing Group, Institute of Geography, Heidelberg University, Germany
(3) Department of Built Environment, Aalto University, Finland

High-resolution point clouds acquired by laser scanning sensors mounted on unmanned aerial vehicles (ULS) facilitate the 3D modelling of individual trees on regional extents. In previous studies, we demonstrated the feasibility to accurately model the diameters at breast height (DBH) from a Riegl VUX-1 and from a miniVUX-1DL ULS system with respective median absolute deviations to field references of 0.1 – 0.5 cm (0.1 – 1.1% relative error) and 0.2 – 1.3 cm (0.7 - 3.8% relative error) and with completeness values of up to 67% and 91%, respectively. In our current study, we investigate the accuracy of the derived DBHs as a function of the stem coverage (the number of points on the stem). We found that the median absolute deviations to the reference were increased (0.1 – 1.5 cm for VUX-1; 0.2 – 2.2 cm for miniVUX-1DL) if the pulse repetition frequency (PRF) was artificially reduced to one half of the initial PRF. We furthermore investigated the influence of a horizontal translation of the flight trajectory on the results in order to test the robustness and the intercomparability of the results from different ULS acquisitions. From our results we can deduce requirements for future ULS campaigns, which will enable the accurate modelling and, in particular, the intercomparability of the derived tree parameters. ULS acquisitions which enable the robust derivation of tree parameters are a prerequisite for studies on forest dynamics. We also gain insight on the temporal resolution at which dynamics of tree parameters can still be detected and distinguished from measurement noise.