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Derivation of tree height and crown closure from airborne Lidar imagery

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In recent years, airborne laser scanning (ALS, LiDAR) has emerged as a powerful tool for the remote sensing of forest structure. To estimate parameters like timber volume or carbon storage, tree height and crown closure are key variables. Several methods of estimating these structural forest parameters from airborne laser scanner data have been tested. The area of study is the Idarforest in south-western Germany; a forest containing different species (primarily Norway spruce, Douglas fir, beech, and oak) in different age classes on a small area. In September 2005, laser scanner data was acquired using a Riegl LiteMapper 5600 flown aboard a helicopter. Tree height, stem density, LAI, crown height and width, stem diameter at breast height und crown coverage were measured during a field campaign in 28 stands, complementing field measurements in earlier years. To increase the laser scanner data's accuracy, absolute heights of several flat areas like sports fields in the area were measured using differential GPS and theodolite measurements. Tree heights were derived from the ALS data for the whole area by applying a moving window approach that uses percentiles of the data distribution. To prevent small roads from being overlapped by neighbouring stands an adaptive moving window was applied. Crown closure was derived from crown to ground point density ratios. The results were compared with findings from the field measurements. Tree height could be assessed with high accuracy; crown closure was estimated with good accuracy in spruce stands but with low accuracy in beech stands.