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Estimation of terracing characteristics from airborne laser scanning data

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Agricultural terraces are a fundamental morphological form of the Slovenian landscape. They are present in all of its diverse geographical regions, from Mediterranean and Dinaric hills and plateaus, Alpine mountains and plains, to Pannonian hills. New systematic research based on mapping aerial orthophotos and historical maps revealed previously unrecorded distribution and extent of terracing. However, the extensive overgrowing of the Slovenian countryside in the past century, when forest cover has grown from 40% to more than 60%, hid many of the terraces under a thick forest canopy. This is especially true for the higher and more remote areas where unfavourable natural conditions have coupled with depopulation processes. In such conditions, the only reasonable technique to observe cultural terraces and other remains of past human activities over large areas is airborne laser scanning. With the country-wide airborne lidar data becoming available, many new possibilities for discovery as well as quantitative analyses are becoming available. We explored manual and semiautomatic approaches to obtain terracing characteristics around representative villages of diverse landscape types. Individual terraces can be described with several attributes, such as riser slope gradient, riser height, tread area, length and width, ratio of length and width, altitude, location of the terrace in the thermal band, distance to the settlement, number and type of trees, distance between trees, and number of vineyard rows.
Such characteristics can be derived manually, which can be painstakingly slow, but with relative precisions reaching the order of centimetres and decimetres, or semiautomatically, which is much faster, but with worse precision levels, mainly due to various outliers and errors in processing. The success of attribute derivation is highly dependent on raw lidar data acquisition parameters and processing. Manual interpretation has a distinct advantage of the possibility to explore and manipulate the raw data, i.e. the lidar point cloud, where relevant features that could be removed in the filtering process can still be traced and their exact extents discernible. However, this is only possible for specific and very detailed analyses, while much more of the work has to be done with already processed raster elevation data. Processing has to be tailored specifically with terracing in mind, otherwise typical characteristics, such as riser slope gradient and thread edges can be distorted. We also investigated the role different elevation model visualizations have on the manual interpretation of terraced landscapes and which visualizations can benefit semiautomatic processing.