Mapping the height of heterogeneous vegetation from UAV-borne visible images and DSM

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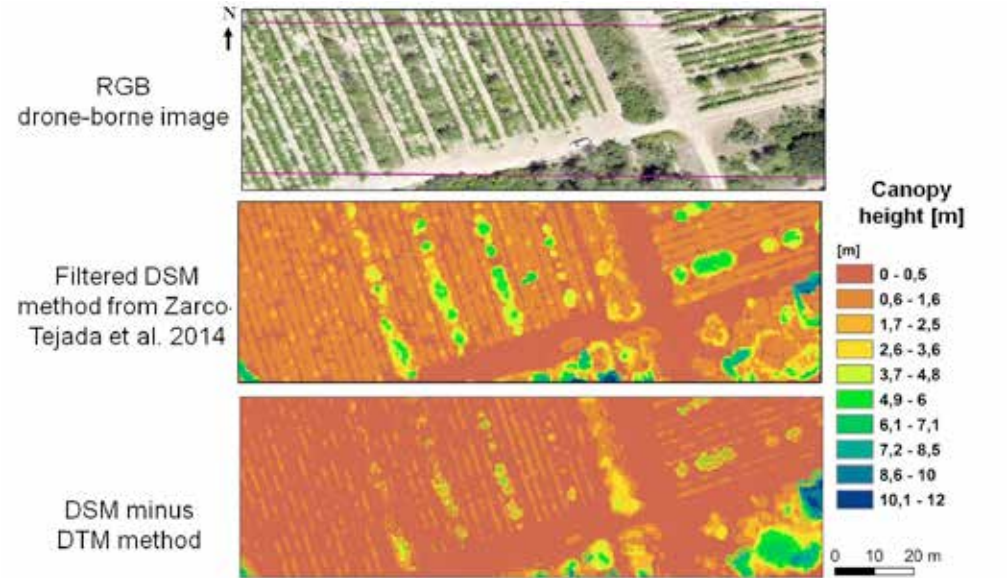
Assessing vegetation structure is essential for studying light distribution and air flow regime within agroforestry plots. Canopy heights and foliage density notably stand as key variables and should be described at both the internal and at the landscape scale of the vegetation. Based on this knowledge, a two-step generic methodology is proposed for describing vegetation structure of agroforestry plots using very high resolution stereoscopic RGB images acquired through UAV flights. It consists first in mapping the land cover and second in mapping the height of vegetation canopy. Both steps were tested using images of three different agroforestry vineyards located in Southern-France. For the first step, using a Random Forest [1] supervised classification approach showed important confusion between grapevine and tree classes unless post-processing masks were applied. For the second step, the 'filtered DSM' method proposed by Zarco-Tejada et al. [2] was compared with a 'DSM minus DTM' approach.

For most of the tree species standing as individual trees at the study sites, this new method showed a higher overall accuracy for estimating their heights based on laser-meter measures of reference. In the particular case of very small leaved canopies, no conclusion could be drawn due to experimental bias. The 'DSM minus DTM' method also revealed several promising methodological advantages: it preserves vegetation borderlines and it allows pixel at pixel applications.



RGB image and top canopy heights of the agroforestry vineyards at Domaine of Restinclières, France

Keywords: UAV, Digital Surface Model, Digital terrain Model, supervised classification, top canopy height.

References:

1. Breiman L (2001) Machine learning 45:5–32
2. Zarco-Tejada PJ, Diaz-Varela R, Angileri V, Loudjani P (2014) European Journal of Agronomy 55:89–99