

ID: W2980571983

TITLE: Estimating aboveground biomass of the mangrove forests on northeast Hainan Island in China using an upscaling method from field plots, UAV-LiDAR data and Sentinel-2 imagery

AUTHOR: ['Dezhi Wang', 'Bo Wan', 'Jing Liu', 'YanJun Su', 'Qinghua Guo', 'Penghua Qiu', 'Xia Wu']

ABSTRACT:

The mangrove forests of northeast Hainan Island are the most species diverse forests in China and consist of the Dongzhai National Nature Reserve and the Qinglan Provincial Nature Reserve. The former reserve is the first Chinese national nature reserve for mangroves and the latter has the most abundant mangrove species in China. However, to date the aboveground biomass (AGB) of this mangrove region has not been quantified due to the high species diversity and the difficulty of extensive field sampling in mangrove habitat. Although three-dimensional point clouds can capture the forest vertical structure, their application to large areas is hindered by the logistics, costs and data volumes involved. To fill the gap and address this issue, this study proposed a novel upscaling method for mangrove AGB estimation using field plots, UAV-LiDAR strip data and Sentinel-2 imagery (named G⁺LiDAR⁺S2 model) based on a point-line-polygon framework. In this model, the partial-coverage UAV-LiDAR data were used as a linear bridge to link ground measurements to the wall-to-wall coverage Sentinel-2 data. The results showed that northeast Hainan Island has a total mangrove AGB of 312,806.29 Mg with a mean AGB of 119.26 Mg ha⁻¹. The results also indicated that at the regional scale, the proposed UAV-LiDAR linear bridge method (i.e., G⁺LiDAR⁺S2 model) performed better than the traditional approach, which directly relates field plots to Sentinel-2 data (named the G⁺S2 model) ($R^2 = 0.62 > 0.52$, RMSE = 50.36 Mg ha⁻¹ < 56.63 Mg ha⁻¹). Through a trend extrapolation method, this study inferred that the G⁺LiDAR⁺S2 model could decrease the number of field samples required by approximately 37% in comparison with those required by the G⁺S2 model in the study area. Regarding the UAV-LiDAR sampling intensity, compared with the original number of LiDAR plots, 20% of original linear bridges could produce an acceptable accuracy ($R^2 = 0.62$, RMSE = 51.03 Mg ha⁻¹). Consequently, this study presents the first investigation of AGB for the mangrove forests on northeast Hainan Island in China and verifies the feasibility of using this mangrove AGB upscaling method for diverse mangrove forests.

SOURCE: International journal of applied earth observation and geoinformation

PDF URL: None

CITED BY COUNT: 93

PUBLICATION YEAR: 2020

TYPE: article

CONCEPTS: ['Mangrove', 'Lidar', 'Biomass (ecology)', 'Environmental science', 'Geography', 'Remote sensing', 'Sampling (signal processing)', 'Forestry', 'Physical geography', 'Ecology', 'Biology', 'Filter (signal processing)', 'Computer science', 'Computer vision']