|  |
| --- |
| **Individual Tree Level AGB Model for Different Tree Species based on UAV LiDAR** |
| **Introduction/Aim:**  Accurate forest AGB estimation is the primary approach to quantify carbon stocks and sequestration rates. LiDAR signals can penetrate the forest canopy to obtain three-dimensional structural information from the top to the bottom of the forest, which benefit to understand the carbon sequestration capacity of forest ecosystems. Traditional forest AGB inversion methods based on LiDAR technology often requires setting up a large number of field sample plots, and it is difficult to obtain AGB results at the individual tree level. The LiDAR Biomass Index (LBI) has been proved to be able to complete accurate AGB estimation at individual tree level based on the crown size and tree height parameters obtained from terrestrial and airborne laser scanning data. More importantly, only a small number of sample trees were required to achieve model calibration of a certain tree species.  **Methods:**  Unmanned Aerial Vehicle (UAV) LiDAR technology has the advantages of high accuracy, portability, and low cost, and has gradually become a commonly used data acquisition method in forest survey. This study aims to construct individual tree level AGB models for different tree species and tree species groups based on UAV LiDAR data, and verify their accuracy for further application. Firstly, 10 major coniferous and broad-leaved tree species around worldwide are selected, and the UAV LiDAR data of these tree species are acquired or collected. Secondly, the LiDAR data are segmented into individual trees and matched with field measurement data. Based on the matching results, a small number (≥30) of sample trees with different diameter classes for each tree species were selected. The LBI and tree height parameters of the sample trees are calculated based on the LiDAR data, and the AGB models for different tree species at individual tree level are constructed and verified in combination with the measured AGB. Then, the transferability between biomass models of similar tree species was evaluated and high-precision modelling methods for tree species groups are explored combine with the geometric characteristics of tree species.  **Results:**  The results indicate that LBI calculated from UAV LiDAR data can be used to construct the individual tree level AGB models for the 10 tree species (The R2 of AGB models for different tree species range from 0.82 to 0.90). When selected individual trees to validate the accuracy of each model, the values of R2 are between 0.72 and 0.88 and RMSE are between 45.32 kg and 282.90 kg for different tree species. Meanwhile, the biomass models have a certain degree of universality among tree species with similar geometric features, thereby obtaining acceptable modelling accuracy for tree species groups.  **Conclusion:**  The results of this study demonstrate the high accuracy and stability of LBI obtained from UAV LiDAR for individual tree level biomass calculation of different tree species, which providing a new method for biomass calculation. |