Estimating logged-over lowland rainforest aboveground biomass in Sabah, Malaysia using airborne LiDAR data

Abstract

Unprecedented deforestation and forest degradation in recent decades have severely depleted the carbon storage in Borneo. Estimating aboveground biomass (AGB) with high accuracy is crucial to quantifying carbon stocks for Reducing Emissions from Deforestation and Forest Degradation-plus implementation (REDD+). Airborne Light Detection and Ranging (LiDAR) is a promising remote sensing technology that provides fine-scale forest structure variability data. This paper highlights the use of airborne LiDAR data for estimating the AGB of a logged-over tropical forest in Sabah, Malaysia. The LiDAR data was acquired using an Optech Orion C200 sensor onboard a fixed wing aircraft. The canopy height of each LiDAR point was calculated from the height difference between the first returns and the Digital Terrain Model (DTM) constructed from the ground points. Among the obtained LiDAR height metrics, the mean canopy height produced the strongest relationship with the observed AGB. This single-variable model had a root mean squared error (RMSE) of 80.02 t ha-1 or 22.31% of the mean AGB, which performed exceptionally when compared with recent tropical rainforest studies. Overall, airborne LiDAR did provide fine-scale canopy height measurements for accurately and reliably estimating the AGB in a logged-over forest in Sabah, thus supporting the state's effort in realizing the REDD+ mechanism.