Regional applicability of forest height and aboveground biomass models for the Geoscience Laser Altimeter System

Dirk Pflugmacher[1*], Warren B. Cohen[2], Robert E. Kennedy[2], Michael A. Lefsky[3]

[1]Oregon State University, Department of Forest Science, 321 Richardson Hall, Corvallis, OR 97331, United States
[2]USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331, United States
[3]Center for Ecological Analysis of Lidar, Department of Natural Resources, Colorado State University, 131 Forestry Building, Fort Collins, CO 80523-1472, United States

Abstract

Accurate estimates of forest aboveground biomass are needed to reduce uncertainties in global and regional terrestrial carbon fluxes. The Geoscience Laser Altimeter System (GLAS) onboard the Ice, Cloud and land Elevation Satellite is the first spaceborne lidar sensor that will provide global estimates of forest height useful estimating forest biomass. In this study we investigated the utility of GLAS for large-scale biomass inventories. We compared accuracy and regional variability of GLAS height estimates in two eco-regions in the Eastern and Western United States using data from the U.S. Forest Service Inventory and Analysis (FIA) program and found that current GLAS algorithms provided generally accurate estimates of height. GLAS heights were at average 2-3 m lower than FIA estimates. To translate GLAS-estimated heights into forest biomass will require general allometric equations. Analyzes of the regional variability of forest height–biomass relationships using FIA field data indicated that general non-species specific equations are applicable without a significant loss of prediction accuracy. We developed height-biomass models from FIA data and applied them to the GLAS-estimated heights. Regional estimates of forest biomass from GLAS differed between 39.7 – 58.2 Mg ha-1 when compared to FIA.