A COMPARISON OF FOREST BIOPHYSICAL PARAMETERS ASSESSED WITH LIDAR DATA ON THREE PLATFORMS: GROUND, AIRBORNE, AND SATELLITE

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Abstract

Lidar remote sensing from three platforms – ground, airborne, and spaceborne – has the capability to acquire direct three-dimensional measurements of the forest canopy that are useful for estimating a variety of forest inventory parameters, including tree height, volume, and biomass, and also for deriving useful information for characterizing wildlife habitat or forest fuels.

The overall goal of this paper was to compare biomass estimates and forest structure metrics obtained by processing ICESat waveform data and spatially coincident discrete-return airborne lidar and ground-based data over varied terrain conditions. For mostly flat-terrain conditions, we investigated lidar data over forests in east Texas, which are characteristics for most of the south-eastern United States, thus allowing terrain to be largely excluded as a source of error. For sloped-terrain, we used lidar data over forests in Oregon. With biomass estimates derived from waveform height metrics, we also compared ground elevation measurements and canopy parameters. Specific objectives were to: compare ground elevations and canopy height parameters derived from ICESat and airborne lidar; (2) investigate above ground biomass estimates; (3) develop a 3D ray-tracing model to simulate lidar waveforms over forests with sloped terrain; and (4) test model performance with real lidar data over terrain with varied topography. Over flat terrain, results indicated a very strong correlation for terrain elevations between ICESat and airborne lidar, with R-square values of 0.98 and sub-meter RMSE. ICESat height

variables were able to explain 80% of the variance associated with the reference biomass derived from airborne lidar, with an RMSE of 37.7 Mg/ha. Most of the models for height metrics had R-square values above 0.9. Results from ongoing investigations for sloped-terrain are expected to establish practical procedures for improving analysis of waveform data in vegetation studies.