An Analysis of Expected Biomass Errors GEDI, ICESat-2 and NISAR in High Biomass Forests

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Background

The total carbon content stored in Earth's forests remains unknown, with the largest uncertainties in carbon rich, old growth forests. GEDI, ICESat-2 and NISAR will provide novel data streams for biomass mapping, and this paper used simulations of these three instruments for Sonoma County to determine their potential utility in high biomass forests.

Analysis

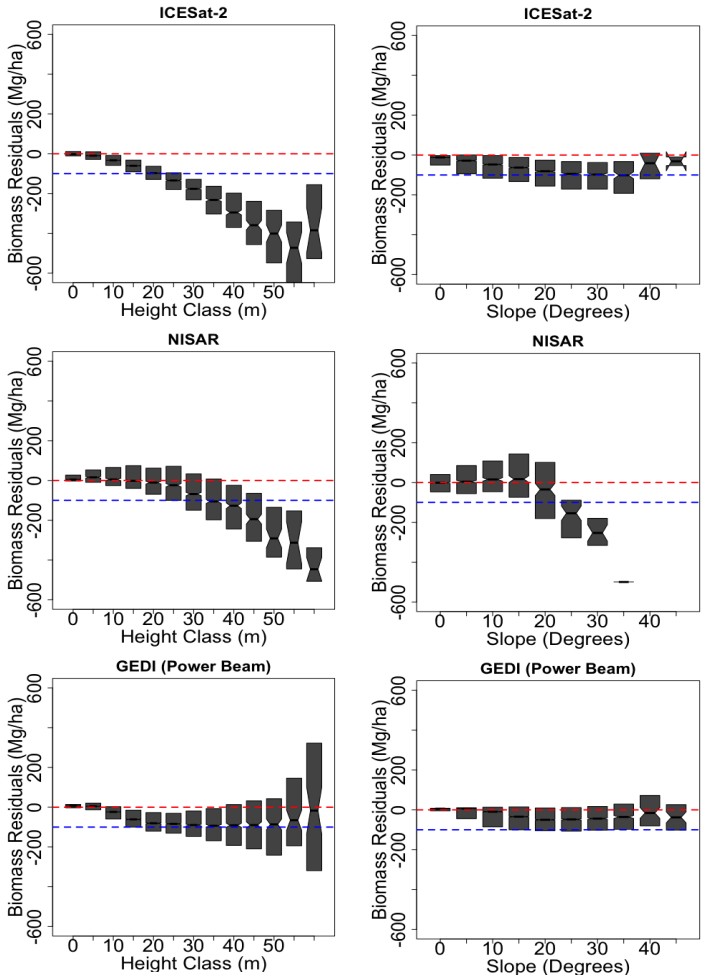
Simulations of GEDI, ICESat-2 and NISAR are compared to a reference airborne lidar biomass map. GEDI's biomass models are tested in Sonoma and applied to ICESat-2 data. L-band backscatter models are tested across gradients of height, cover and slope.

Results

Tall, dense forests over steep slopes have the highest errors (as expected). GEDI's biomass algorithms transferred well to ICESat-2. ICESat-2's utility for biomass estimation depends on the photon return rate. Backscatter-based estimates underestimated biomass over steep slopes.

Significance

ICESat-2 could successfully estimate biomass with GEDI's biomass algorithms, and all three missions will be useful for making improved biomass maps through sensor fusion in carbon rich ecosystems.



Biomass residuals plotted against forest height and slope. All errors increase with height, and for NISAR with slope. GEDI's power beam has the best performance (least biased residuals) in high biomass forests.