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From monitoring to modeling: using biomass observation for benchmarking terrestrial carbon cycle models

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Biomass is a key ecosystem property linking biogeochemical fluxes with the accumulation of carbon in terrestrial ecosystems. The spatial and temporal distribution of aboveground biomass has implications for climate stability and other ecosystem services, including timber supplies. Globally, terrestrial forest ecosystems store $\sim$380 Pg C in aboveground biomass, which is about 45% compared to the amount of carbon in the atmosphere as CO_2. Model-data comparisons of aboveground biomass have so far been limited because of a lack of wall-to-wall coverage of observations, which has recently been resolved from satellite remote sensing and an intensification of forest inventory networks. Here, we compare aboveground biomass estimates among an ensemble of terrestrial carbon cycle models, and benchmark these estimates with inventory and satellite-based estimates. We then use the distribution of biomass estimates to evaluate bias in net ecosystem exchange caused by uncertainty from carbon turnover rates. By identifying model structure and the parameters linked to carbon turnover, improvements can be made to more realistically simulate aboveground biomass.