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Global forest biomass mapping from multiple datasets

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Forest biomass is identified as a crucial variable for understanding the net carbon dioxide exchange between the land surface and the atmosphere, and also one of the largest uncertainties in the global carbon cycle and climate change scenarios. Accurate estimation of forest biomass with spatially explicit details is critically needed. Although recent studies have attempted to integrate field measurements with LiDAR as well as optical and radar remotely sensed data using advanced methods to provide reliable forest biomass maps, substantial uncertainties still existed in the current biomass maps. Different studies produced quite different biomass estimates covering the same geographical area, on both the magnitude and the spatial distribution. Harmonization of current datasets could help improve the accuracy of forest biomass estimates on a global scale. In this study, we aim to integrate diverse biomass maps currently available to generate the global forest biomass maps with greater accuracy and better spatial coverage than each of the individual biomass datasets. We used the most extensive field biomass data that we could assemble globally to calibrate the gridded forest biomass datasets. Ancillary datasets closely related to forest biomass such as leaf area index, forest canopy height, and forest cover fraction, were also incorporated into the harmonization procedure to ensure the spatial consistence of the generated forest biomass map. Integration of these datasets was implemented under the spatial statistical data fusion framework, which was suitable for processing massive datasets with diverse spatial resolutions. The estimated biomass results were validated with field references and inter-compared with datasets from other sources. The final global forest biomass map will be available and freely downloaded from the web.