National Aeronautics and Space Administration

NASA Carbon Monitoring System

UNIVERSITY OF MARYLAND

Spatial heterogeneity of global forest aboveground carbon stocks and fluxes constrained by spaceborne lidar data and mechanistic modeling

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Science Questions

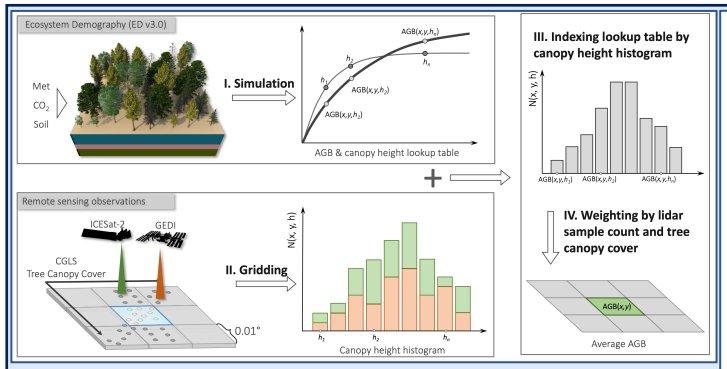
- What is the spatial heterogeneity of forest structure and carbon dynamics at a fine scale?
- How can global carbon cycle modeling be improved by using novel spaceborne lidar observations?

Method

- Gridded 3.77 billion lidar samples from GEDI and ICESat-2 into canopy height histogram at 0.01 °.
- Initialized a global Ecosystem Demography (ED v3.0) model by lidar data and then estimated AGB stocks and fluxes.
- Evaluated against a comprehensive reference datasets, including forest inventory, national statistics, remote sensing products and ecosystem modeling.

Result/Significance

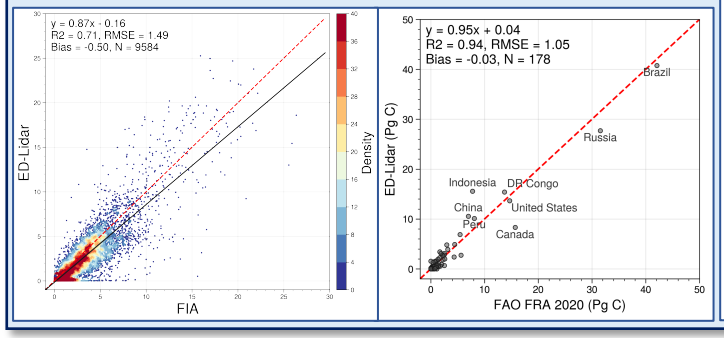
- Lidar observations enabled a qualitative increase in the spatial resolution of model estimates achievable previously (from 0.25° to 0.01°).
- Now process-based models can capture detailed spatial patterns of forest structure and carbon dynamics, resulting from natural and anthropogenic disturbance and recovery.
- This work is a key step to the development of a global forest carbon monitoring and modeling system.

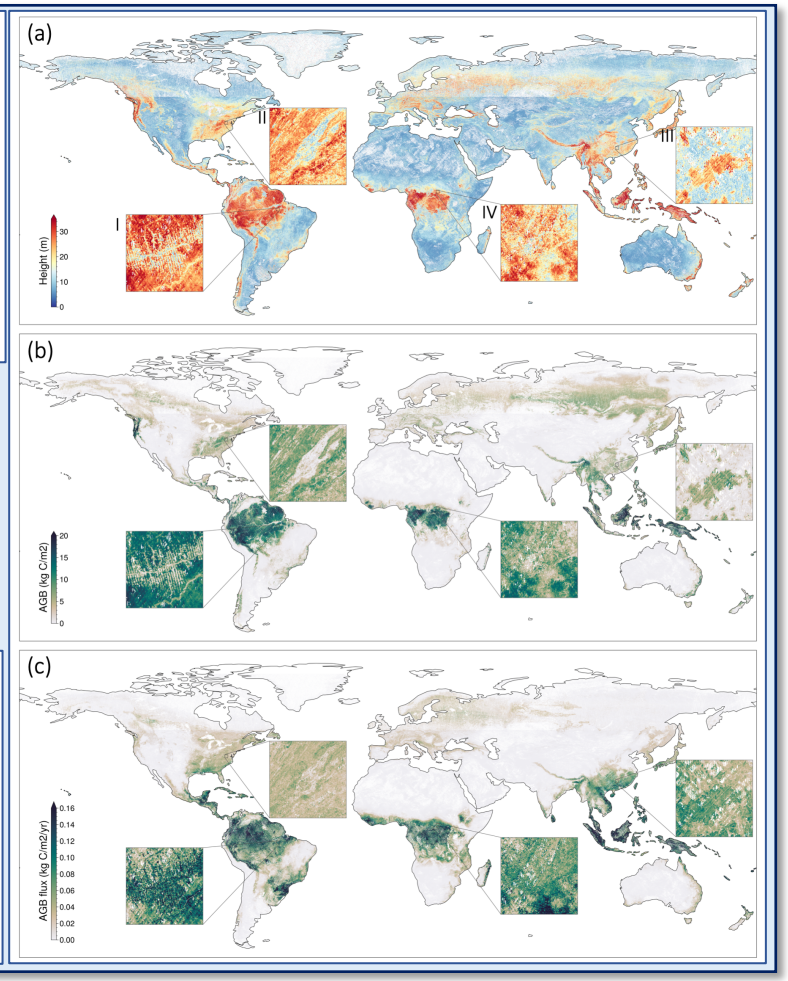


Top: illustration of ED-Lidar initialization using inputs of canopy height histogram and tree canopy.

Right: (a) gridded lidar canopy height; (b) and (c) are ED-Lidar estimated AGB stocks and fluxes.

Bottom: evaluations against USFS FIA over CONUS and FAO over globe.





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