Supplementary Information


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S1. List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>ASRL</td>
<td>Allometric Scaling and Resource Limitations</td>
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<td>ASTER</td>
<td>Advanced Spaceborne Thermal Emission and Reflection Radiometer</td>
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<td>CMDSSS</td>
<td>China Meteorological Data Sharing Service System</td>
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<td>CONNA</td>
<td>Continental China</td>
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<tr>
<td>DEM</td>
<td>Digital Elevation Model</td>
</tr>
<tr>
<td>DBH</td>
<td>Diameter at Breast Height</td>
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<tr>
<td>GDEM</td>
<td>Global Digital Elevation Map</td>
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<td>GLA14</td>
<td>GLAS Level-2 Land Surface Altimetry</td>
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</table>
GLAS  Geoscience Laser Altimeter System
$H_{ASRL}$  Predicted Height from optimized ASRL model
$H_{GLAS}$  Measured Height from valid GLAS waveform data
$H_{NFI}$  Measured Height from NFI
LC  Land Cover
MODIS  Moderate Resolution Imaging Spectroradiometer
MRE  Mean Relative Error
NFI  National Forest Inventory
SD  Standard Deviation
SFA  State Forestry Administration
VCF  Vegetation Continuous Fields

S2. Figures S1–S5

**Figure S1.** Geographical distribution of meteorological stations used for climatic variable construction ($n = 754$; in red color) and site-specific evaluation ($n = 14$; in blue color). The CMDSSS provides meteorological observations from these stations for a temporal period of 1951–2007. Forested lands are depicted in green color.
**Figure S2.** Distribution of maximum tree heights derived from (a) the valid GLAS shots and (b) the NFI dataset at a 1km spatial resolution. The GLAS altimetry was generated after filtering invalid GLAS shots and correcting topographic effects [S1]. The NFI tree heights were estimated using the allometric relationships between field-measured DBH and height (surveyed by the SFA [S2–S4]). Note that the NFI map is limited over the northeastern regions of CONNA since we considered the forested lands over the effective climate zones.
Figure S3. Distribution of relative errors for site-specific simulations of the optimized ASRL model: (a) two-fold cross validation and (b) bootstrapping validation. The MRE (dotted line) and SD of relative errors are notated in each plot.

Figure S4. Distribution of relative errors for continental-scale simulations of the optimized ASRL model: (a) two-fold cross validation with GLAS observations and (b) one-to-one validation with field measurements. The MRE (dotted line) and SD of relative error are notated in each plot.
**Figure S5.** Spatial distribution of prediction errors of the optimized ASRL model: comparisons against (a) test GLAS dataset \( (H_{\text{ASRL}} - H_{\text{GLAS}}) \), and (b) field measurements \( (H_{\text{ASRL}} - H_{\text{NFI}}) \). Note that the NFI map is limited over the northeastern regions of CONNA since we considered the forested lands over the effective climate zones.
S3. Table S1

Table S1. List of datasets to derive the valid GLAS tree heights. Ancillary data (LC, VCF, DEM, and slope) were used to filter invalid GLAS shots and to correct topographic effects.

<table>
<thead>
<tr>
<th>Data</th>
<th>Source</th>
<th>Spatial Resolution</th>
<th>Acquisition Year</th>
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<tbody>
<tr>
<td>GLAS</td>
<td>GLA14 [S5]</td>
<td>70 m (Circular footprint)</td>
<td>2003–2006 (Only in May–October)</td>
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<tr>
<td>LC</td>
<td>MODIS MCD12Q1 [S6]</td>
<td>500 m</td>
<td>2005</td>
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<tr>
<td>VCF</td>
<td>MODIS MOD44B [S6]</td>
<td>250 m</td>
<td>2005</td>
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<td>DEM</td>
<td>ASTER GDEM V2 [S6]</td>
<td>30 m</td>
<td>2011</td>
</tr>
<tr>
<td>Slope</td>
<td>Derived from ASTER GDEM V2 [S7]</td>
<td>30 m</td>
<td>2011</td>
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Reference


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