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| **Intergovernmental Panel on Climate Change (IPCC) Tier 1 forest biomass estimates from Earth Observation** |
| **Introduction/Aim:** Aboveground dry woody Biomass Density (AGBD) maps produced with Earth Observation (EO) data have a large potential to periodically provide a transparent, consistent and replicable picture of the state of the world’s forests. They can comply with the standards mandated by the UNFCCC, but are yet to formally adopted in international policy guidance. Our research provides the first compilation of AGBD estimates in the format of Intergovernmental Panel on Climate Change (IPCC) Tier 1 values for natural forests1, sourced from NASA’s GEDI and IceSAT-2 missions, and ESA's Climate Change Initiative (CCI). It also provides the underlying classification of global forests by ecozones, continents and status (primary, young (≤20 years) and old secondary (>20 years)). **Methods:** Our approach is based on a Boolean compilation of various EO-derived datasets, which leverages the strengths of layers of satellite-derived forest tree cover, height, age and land use classifications. In summary, first, layers that identify a potential forest status/condition class (e.g. primary forests) are merged, and second, layers that identify sources of disagreement (e.g. presence of plantations or deforestation detected in the delineated primary forests) are used to remove areas of potential commission errors. The classification is run on the collaborative open-science could-computing system, the ESA-NASA Multi-mission analysis and algorithm platform (<https://scimaap.net/>). MAAP has capabilities to host relevant data, processing algorithms, and computing capabilities in a common cloud environment, linked to public GitLab/GitHub repositories, ensuring the transparency of our methods. Upon classification, mean estimates of AGBD (and their associated errors) are sourced from the GEDI’s hybrid inference estimators2, High northern latitude estimates from IceSAT-23 and the ESA CCI Biomass map of 20204. **Results:** Across the world's natural forests (excluding planted forests), approximately 1678 Mha of primary forests, 1265 Mha of old secondary forests and 316 Mha of young secondary forests were identified. The trends in EO-derived AGBD estimates across these classes are captured well by the EO-datasets; like the IPCC values, the GEDI/ICESat-2 dataset estimates that primary Asian tropical rainforests and mountain systems harbour some of the highest AGBD globally, while the CCI dataset estimates that primary African rainforests harbour the highest AGBD. Model results show that there isn't sufficient evidence to indicate that GEDI/ICESat-2 estimates exhibit significant systematic differences to the IPCC values over all forest classes globally, although systematic differences are observed for the CCI estimates. **Conclusion:** The results of this article are a pioneering international effort from CEOS, presenting AGBD maps in a format practical for policy and adoptable, upon review, in the IPCC Emissions Factors Database.  |

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