

CCI BIOMASS

PRODUCT FACT SHEET

VERSION 7.0

Creation date: 21 January 2026

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The aim of the Climate Change Initiative (CCI) Programme is to advance scientific understanding of the climate system and climate change by producing long-term datasets that meet climate data quality conditions (IPCC, 2003) and that can be readily linked to climate models. The above-ground biomass (AGB) is crucial to understand both the source and sink terms in the global carbon cycle. AGB is here defined as the mass, expressed as oven-dry weight of the woody parts (stem, bark, branches and twigs), of all living trees excluding stump and roots, per unit area (unit: Mg/ha or tons/ha). The CCI BIOMASS project currently aims to a) generate annual global estimates of AGB density in woody vegetation for several epochs between 2005 and 2024, and b) quantify AGB density changes between epochs. An approximate value for the corresponding carbon density (unit: MgC/ha) can be obtained by scaling with a factor of 0.5.

The current release of the CCI BIOMASS data products (v7) consists of global maps of

- AGB for each of the years 2005-2012 and 2015-2024, together with per-pixel standard deviation with a pixel size of 1 ha, i.e., for a 100 m x 100 m large area.
- Examples of AGB change expressed as the difference of AGB maps for two consecutive years (2020-2019) and for a decade (2020-2010), together with an estimate of their standard deviation and a quality flag map, detailing the level of reliability of the AGB change estimate¹. **Because of the different types of remote sensing data available for each year, the AGB change maps may be affected by substantial biases. We strongly encourage referring to the quality flag layer to ensure that the data are used correctly**
- Spatial averages of the AGB and AGB change maps, including corresponding maps of standard deviation and quality flag for the change (pixel sizes: 1 km, 10 km, 25 km and 50 km).
- A python tool that allows the generation of AGB change map products for any pair of AGB maps included in this release.

The current release of the CCI BIOMASS data products is version 7, available through the CCI Open Data Portal (<https://climate.esa.int/en/odp/#/dashboard>). Older versions are superseded. Datasets available on other platforms may be older or unofficial versions of the most recent official release.

¹ Legend of the quality flag layer

0: AGB=0 in both maps; 1: AGB loss; 2: Potential AGB loss; 3: Improbable change; 4: Potential AGB gain, 5: AGB gain

Usage and release notes

AGB maps

- The AGB and AGB change maps are not masked for forest area. Users wishing to derive statistics for forest land are advised to apply an own forest/non-forest dataset to the CCI BIOMASS data products
- A pixel with a value equal to 0 means that the AGB is equal to 0 Mg/ha.
- The AGB and AGB change values are representative of the pixel area, i.e., they do not account for partial or total forest cover within the area of the pixel. The biomass stock in a pixel is obtained from the AGB value multiplied by the area of the pixel (NOTE: the area of the pixel changes with latitude)
- AGB refers to the aboveground LIVE dry biomass. However, given that AGB is derived from radar backscatter observations, which are sensitive to the density of stems and branches on the ground, it is likely that values larger than 0 Mg ha⁻¹ occur in correspondence of dead standing wood.
- Non-woody vegetation is in principle not accounted for. All AGB estimates were obtained with a retrieval model tailored to relate the radar backscatter to the biomass of woody vegetation.
- Biomass of understory and lianas is not accounted for because it is assumed that the remote sensing data used to estimate biomass does not contain sufficient signal scattered from layers below the top canopy.
- Use of the AGB estimates of individual full resolution pixels should be avoided.
- The maps have a global scope and may, therefore, be biased at regional level. Users intending to adopt the CCI BIOMASS data product for national or sub-national studies are advised to check the quality of the CCI product by comparing with local data (e.g., from own field survey, National Forest Inventory, airborne datasets etc.).
- The CCI BIOMASS datasets have not been cross-checked with other CCI datasets.
- The AGB in each annual map corresponds to an average value for the corresponding year. Consequently, the AGB value in correspondence of areas that have been affected by changes within a given year, may not be representative of the AGB either before or after the change.
- The annual maps are equally reliable and replace any previous release if existing.
- The 2010 dataset is an improved version of older releases and of the GlobBiomass AGB dataset (<http://globbiomass.org>), which is superseded.
- The pre-2015 datasets may present AGB > 0 in contrast to AGB = 0 in more recent years in correspondence of non-forest areas. This is due to the lower quality of the EO data used to estimate AGB before 2015. Users are advised to mask out non-forest areas to avoid incorrect interpretation of temporal trends.
- Fluctuations of the AGB values from one year to the next may occur in correspondence of mixed landscapes, cropland and arid land due to the inter-annual variability of the number of radar observations.
- Trends in the time series of AGB maps have not been analyzed in detail and may therefore need to be critically investigated, in particular when comparing pre- and post-2015 AGB maps due to the different set of EO observations.

AGB change maps

- AGB change products (AGB difference, standard deviation of the AGB change value and a quality flag to interpret the reliability of the change value) are provided for a one-year case (2020-2019) and a decade (2020-2010).
- Users interested in an AGB change map between two years need to download the AGB maps for the two years of interest and compute the change products with the Python tool provided with this release.
- AGB change maps should be interpreted carefully. It is strongly advised to use the quality flag layer to understand the reliability of the AGB change values. AGB change values in correspondence of pixels labelled as “improbable change” may be unrealistic. AGB change values in correspondence of pixels labelled as “gain” or “loss” are realistic although the standard deviation layer of the AGB change map should be accounted for as well.
- Be extremely cautious when using the CCI BIOMASS maps to assess AGB changes. We strongly advise to validate changes before further analysis of the data.

Spatially averaged AGB and AGB change products

- All notes for the data products at full resolution apply
- Spatial averaging increases the precision of the dataset
- The magnitude of changes is more reliable at coarser resolution

Version update (v6 to v7)

V7 consists of an update of the maps of AGB released in v6 (years 2007, 2010, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022). To the time series, AGB maps for 2005, 2006, 2008, 2009, 2011, 2012, 2023 and 2024 have been added. The provision of AGB change maps is now restricted to an example for an annual interval (2020-2019) and for a decadal interval (2020-2010). The change products based on any two years of AGB maps can be obtained with the new Python tool included in this release.

The retrieval models were further revised to remove biases revealed by the validation of v6.

This version offers an update of the spatially averaged estimates of AGB and AGB change at 1 km, 10 km, 25 km and 50 km.

Data access and policy

The CCI BIOMASS datasets have been processed by the CCI BIOMASS consortium led by the University of Aberystwyth (U.K.). They are made available to the public by ESA and the consortium. You may use one or several CCI BIOMASS products for educational and/or scientific purposes, without any fee on the condition that you credit the ESA Climate Change Initiative and in particular its BIOMASS project as the source of the data:

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Any scientific publication on the results of research activities based on CCI BIOMASS data products should acknowledge the ESA CCI BIOMASS project in the text of the publication and provide the project with an electronic copy of the publication (see <https://climate.esa.int/en/projects/biomass/> for contacts).

If CCI BIOMASS data products are to be used in advertising or commercial promotion, the ESA CCI BIOMASS project should be acknowledged and the layout should be submitted to the project for approval beforehand (see <https://climate.esa.int/en/projects/biomass/> for contacts).