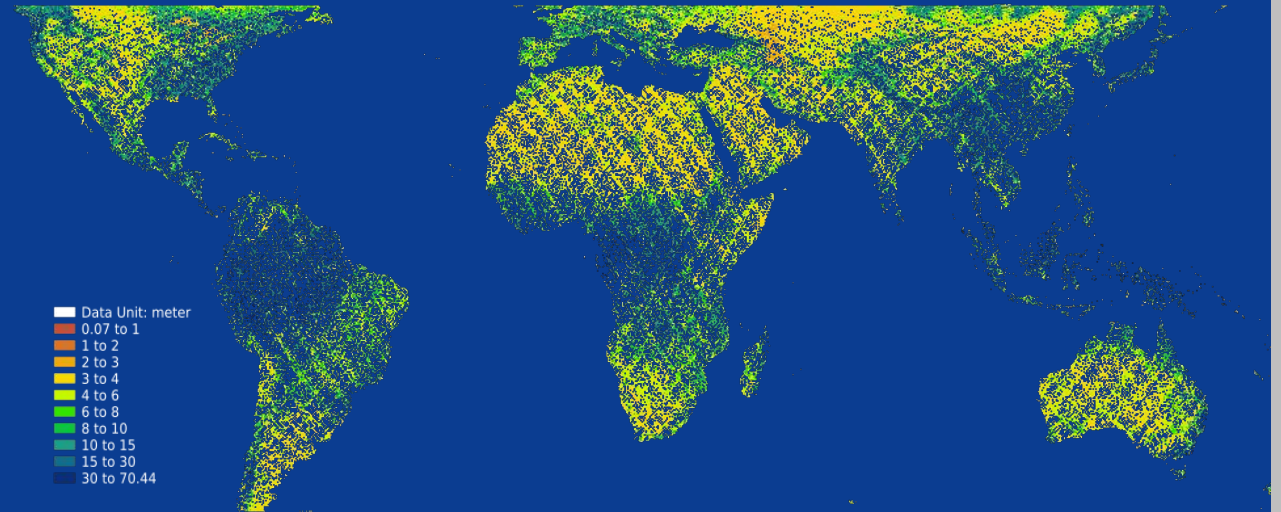


GEDI Level 3 and 4 Datasets at ORNL DAAC

Rupesh Shrestha

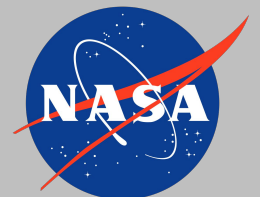
*GEDI Science Team Meeting
College Park, MD
October 17-19, 2023*



The Oak Ridge National Laboratory Distributed Active Archive Center for Biogeochemical Dynamics operates under an interagency agreement between NASA and the U.S. Department of Energy



**U.S. DEPARTMENT OF
ENERGY**



About ORNL DAAC

- Mission
 - Assemble, distribute, and provide data services for a comprehensive archive of terrestrial biogeochemistry and ecological dynamics observations and models to facilitate research, education, and decision-making in support of NASA's Earth Science.



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GEDI L4B Gridded Aboveground Biomass Density
Level 4B (L4B) Gridded Aboveground Biomass Density data now available from the Global Ecosystems Dynamic Investigation.

Field Campaigns
1233 Datasets in
16 Projects

Land Validation
31 Datasets in
8 Projects

Regional/Global
434 Datasets in
12 Projects

Model Archive
15 Models in
1 Project

News

Daymet V4 Revision 1 Released November 1, 2022
On November 1, 2022 the ORNL DAAC transitioned Daymet V4 distribution to a V4 Revision 1 (V4 R1) distribution.

NASA Disaster Assessment Webinar Series
A 3-part training, in English and in Spanish, on using SAR to assess areas prone to disaster in October.

2022 ASCI Survey closed, Thanks for your feedback
The 2022 Customer Satisfaction Survey for the NASA DAACs has closed and results are now being compiled.

Aboveground Vegetation Structure for Herbaceous Wetlands across MRD
Mean stem diameter, mean height, dominant species, hydrogeomorphic zone, and stem density for vegetation in herbaceous wetlands collected in southeastern coastal Louisiana.

The ORNL DAAC mission is to assemble, distribute, and provide data services for a comprehensive archive of terrestrial biogeochemistry and ecological dynamics observations and models to facilitate research, education, and decision-making in support of NASA's Earth science. [Read more about the ORNL DAAC.](#)

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Tools MODIS THREDDS SDAT Daymet Airborne Data Visualizer Soil Moisture Visualizer Land - Water Checker

Resources Learning Data Management News Earthdata Forum

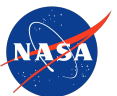
Contact Us

Status of GEDI Datasets at ORNL DAAC

Dataset	Version	Published	DOI	Temporal Extent	# Granules	Size (TB)
GEDI Level 3 Gridded Land Surface Metrics	1.0	2021-03-15	10.3334/ORNLDAAAC/1865	MW 19-70	5	0.003
	2.0	2021-11-23	<u>10.3334/ORNLDAAAC/1952</u>	MW 19-223	25	0.013
GEDI Level 4A Footprint Level Aboveground Biomass Density	1.0	2021-08-19	10.3334/ORNLDAAAC/1907	MW 19-90	6,742	5.601
	1.0 (GW)	2022-02-14	<u>10.3334/ORNLDAAAC/2028</u>	MW 19,32,34,38	386	0.318
	2.0	2021-12-15	10.3334/ORNLDAAAC/1986	MW 19-138	44,095	8.447
	2.1	2022-03-17	<u>10.3334/ORNLDAAAC/2056</u>	MW 19-223	74,860	14.266
GEDI Level 4B Gridded Aboveground Biomass Density	2.0	2022-03-29	<u>10.3334/ORNLDAAAC/2017</u>	MW 19-138	10	0.003
	2.1	2023-11-XX	<u>10.3334/ORNLDAAAC/2299</u>	MW 19-223	10	0.003

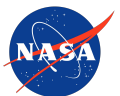
MW=Mission Week; GW=Golden Week; TB=Terabytes;

<https://daac.ornl.gov/gedi>



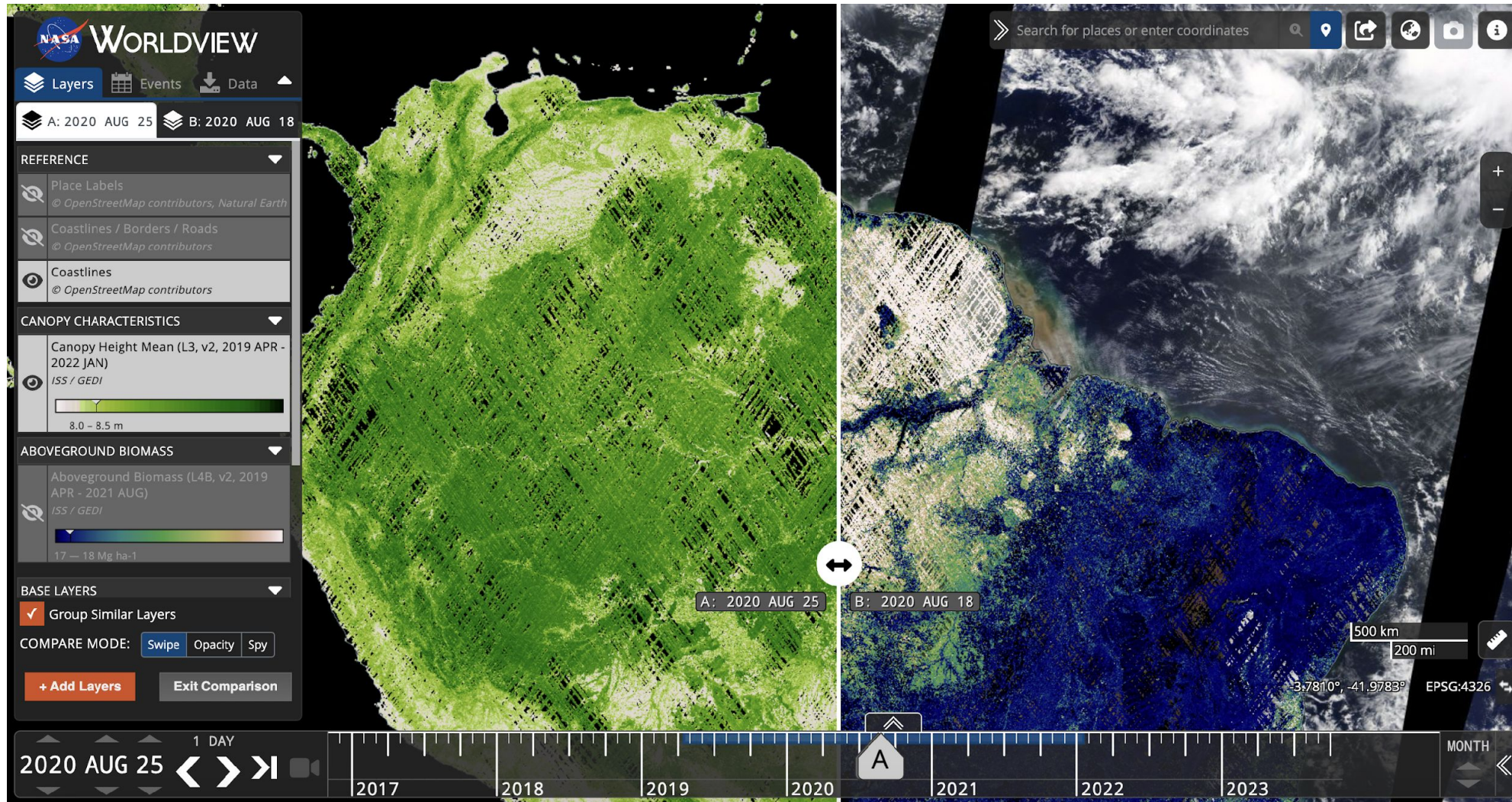
Data Tools and Services for GEDI L3, L4A, and L4B

Tools/Services	GEDI L3	GEDI L4B	GEDI L4A
NASA Earthdata Cloud (including direct S3 access)	✓	✓	✓
NASA Earthdata Search/Common Metadata Repository (CMR) API	✓	✓	✓
NASA Earthdata Search Subscription Service	✓	✓	✓
NASA Harmony API			✓
NASA WorldView / GIBS API	✓	✓	
NASA OPeNDAP for Cloud (Hyrax)			✓
Open Geospatial Consortium Web Mapping Service (OGC WMS)	✓	✓	
Open Geospatial Consortium Web Coverage Service (OGC WCS)	✓	✓	
ORNL DAAC's Spatial Data Access Tool (SDAT)	✓	✓	
ORNL DAAC's Shopping Cart	✓	✓	✓
ORNL DAAC's Terrestrial Ecology Subsetting and Visualization (TESViS)	✓	✓	✓
ORNL DAAC's Quick Order	✓	✓	



https://github.com/ornl-daac/gedi_tutorials/blob/main/services.md

GEDI L3 and L4B on NASA WorldView/GIBS API



<https://go.nasa.gov/45PAR0x>

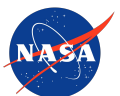
- <https://worldview.earthdata.nasa.gov/> (user interface)
- <https://www.earthdata.nasa.gov/engage/open-data-services-and-software/api/gibs-api> (API)

Customized L4A Download via Harmony

The screenshot displays the EarthData Search web interface. On the left, a sidebar shows the project details: "Untitled Project", "40.6k Granules", "1 Collection", and "6.3 TB". The selected dataset is "GEDI L4A Footprint Level Aboveground Biomass Density, Version 2.1". The main panel is titled "Edit Options" and contains two sections:

- 1 Select a data access method**
 - ☒ **Customize** Harmony: Select options like variables, transformations, and output formats for in-region cloud access. More Info
 - ☐ **Direct Download**: Direct download of all data associated with the selected granules. More Info
- 2 Configure data customization options**
 - Temporal Subsetting**: When enabled, temporal subsetting will trim the data to the selected temporal range.
 - ☒ Trim output granules to the selected temporal constraint
 - Selected Range:** 2020-02-01 00:00:00 to 2022-02-28 23:59:59
 - Variables**: Use science keywords to subset your collection granules by measurements and variables.
 - 2 variables selected
 - [Edit Variables](#)

At the bottom left, there is a "Download Data" button. At the bottom right, it says "Collection 1 of 1" and a "Done" button. The background of the interface is a world map with green lines indicating data coverage. The bottom of the page shows a timeline for the month of June 2023 and footer information including "v1.182.2", "Search Time: 1.5s", and "NASA Official: Stephen Berrick".



- <https://search.earthdata.nasa.gov/search/> (user interface)
- https://github.com/ornl-daac/gedi-tutorials/blob/main/gedi_l4a_harmony.ipynb (API tutorial)

Download L4A via OpenDAP for Cloud (Hyrax)

dataset: GEDI04_A_2020009160947_O06097_02_T00100_02_002_02_V002.h5

Actions Download Encoding: Get Data...

Data URL https://opendap.earthdata.nasa.gov/collections/C2237824918-ORNL_CLOUD/granules/GEDI_L4A_AGB_Density_V2_1.GEDI04_A_2020009160947_O06097_02_T00100_02_002_02_V002.h5
Copy encoded Data URL Copy raw Data URL

Global Attributes

Global Dimensions

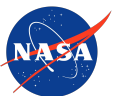
Variables

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- ☐ BEAM0101 (Type is Group)
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- ☐ BEAM0110 (Type is Group)
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 - ☐ member variables
- ☐ BEAM1000 (Type is Group)
 - ☒ attributes
 - ☐ member variables
- ☐ BEAM1011 (Type is Group)
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 - ☐ member variables
- ☐ METADATA (Type is Group)
no attributes
 - ☐ member variables

☐ debug

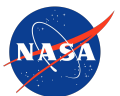
OPeNDAP Hyrax (1.16.8-94)
[Documentation](#)

- https://opendap.earthdata.nasa.gov/collections/C2237824918-ORNL_CLOUD/granules/GEDI_L4A_AGB_Density_V2_1.GEDI04_A_2020009160947_O06097_02_T00100_02_002_02_V002.h5.dmr.html (DMR++ page)
- https://github.com/ornl-daac/gedi_tutorials/blob/main/access_gedi_l4a_hyrax.ipynb (tutorial)



Usage Metrics of GEDI Datasets at ORNL DAAC

Dataset	Total Downloads	No. of unique users	Download Volume (TB)
GEDI Level 3 Gridded Land Surface Metrics	103,164	9,784	11.3
GEDI Level 4A Footprint Level Aboveground Biomass Density	4,220,926	2,432	744.4
GEDI Level 4B Gridded Aboveground Biomass Density	99,863	9,497	6.8

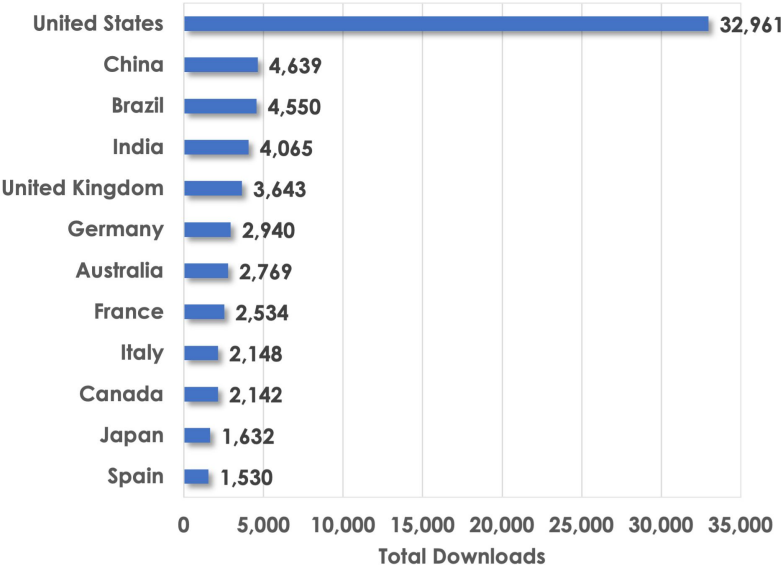


Note: The usage metrics do not include direct S3 access

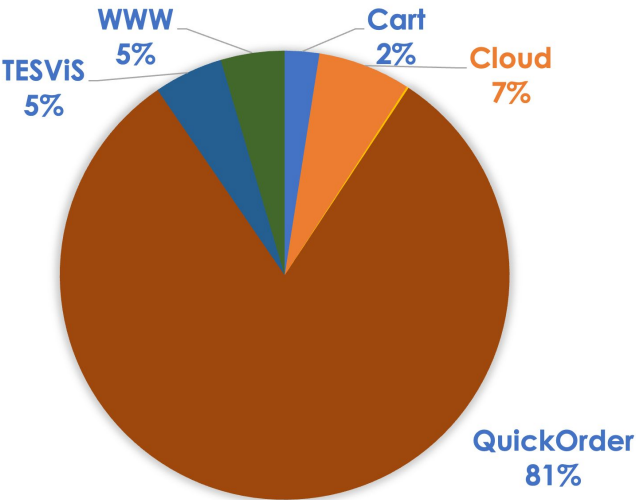
GEDI L3 Usage Metrics



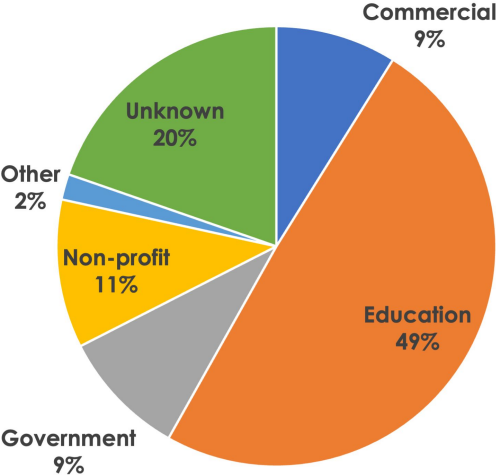
Downloads by Country



Data Access Methods (percent volume)

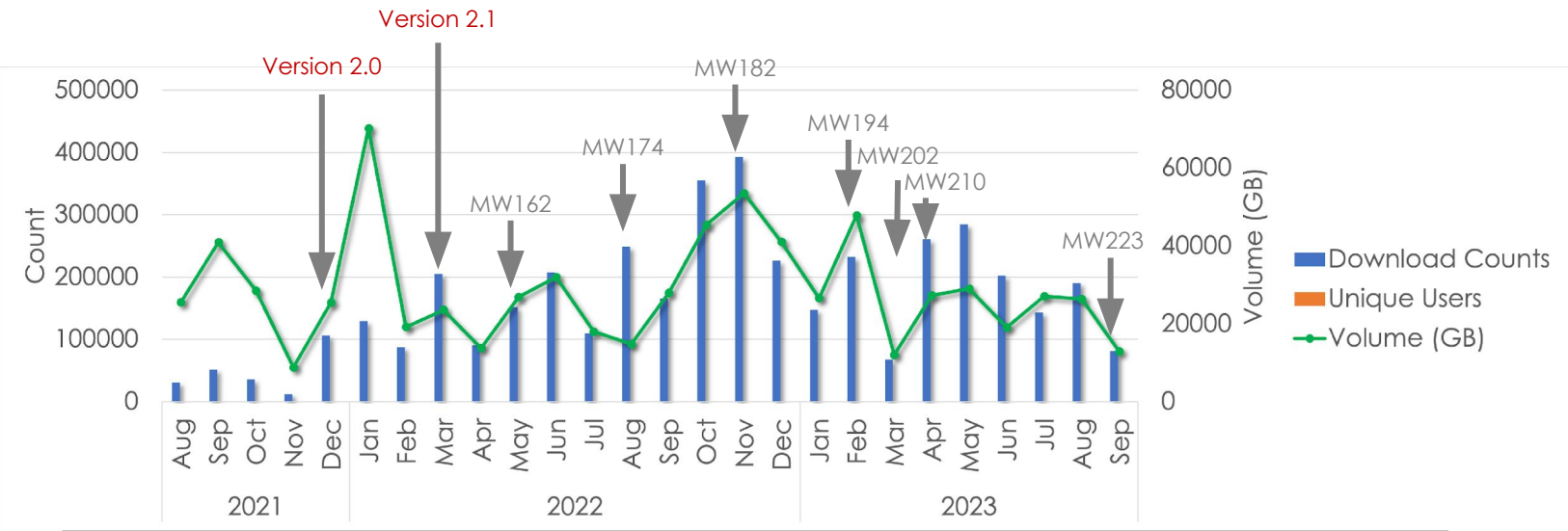


Affiliations (percent volume)

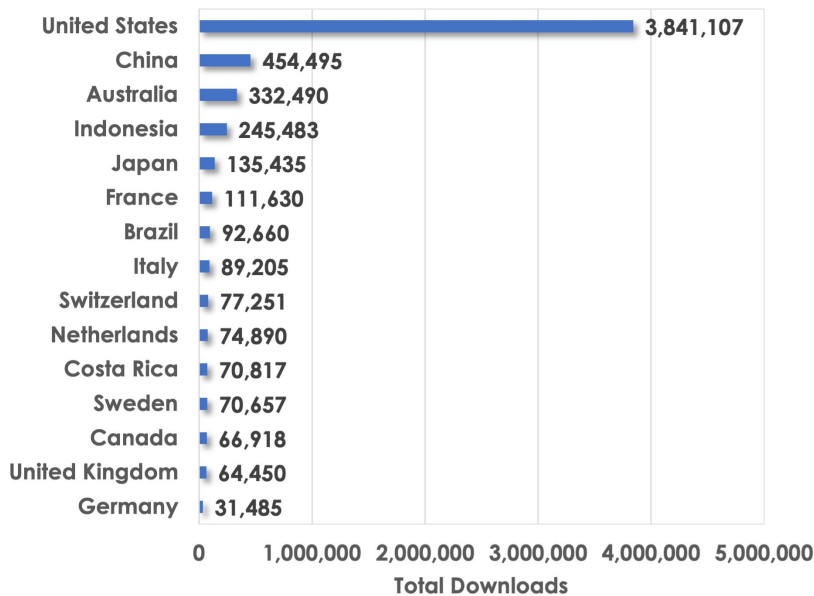


Note: The usage metrics do not include direct S3 access

GEDI L4A Usage Metrics

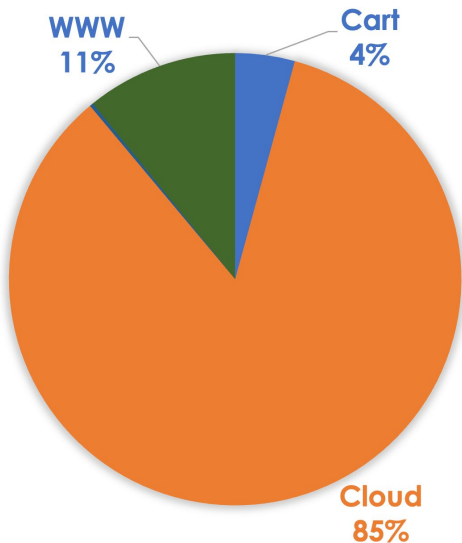


Downloads by Country

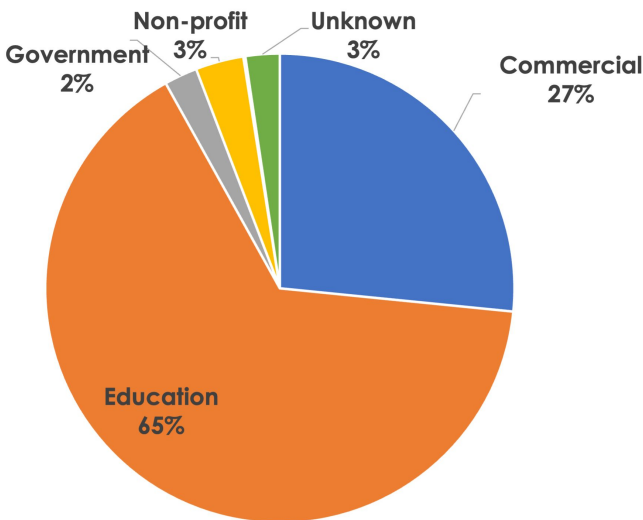


Note: The usage metrics do not include direct S3 access

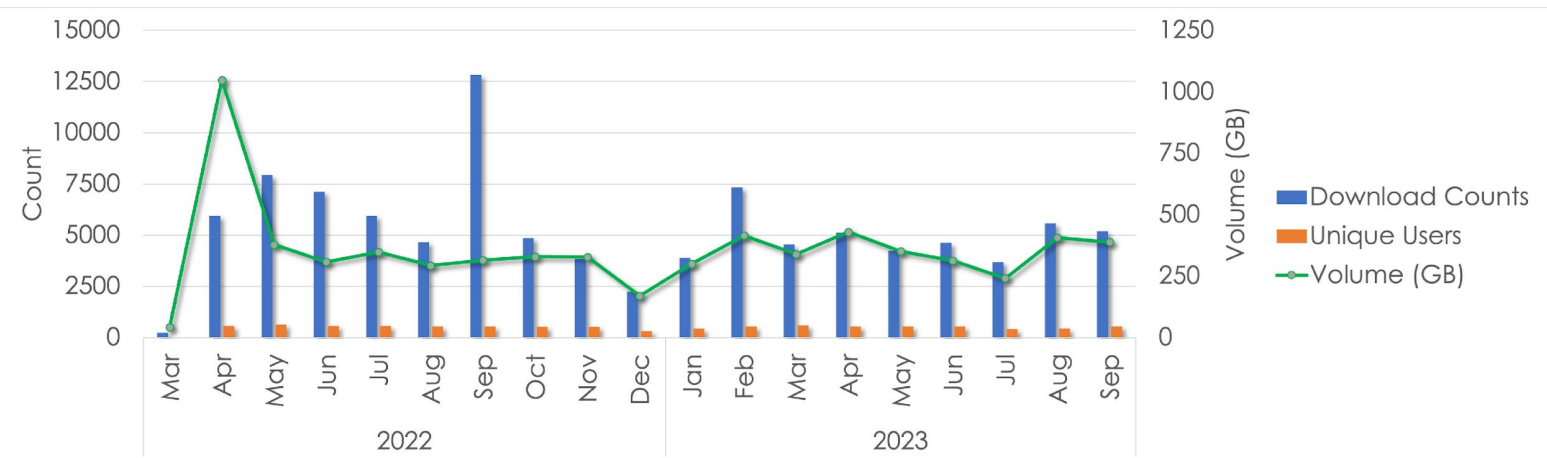
Data Access Methods (percent volume)



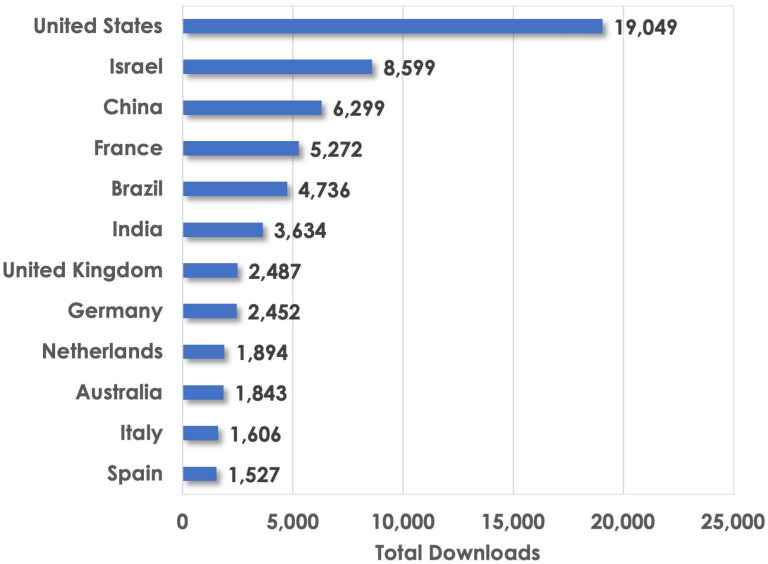
Affiliations (percent volume)



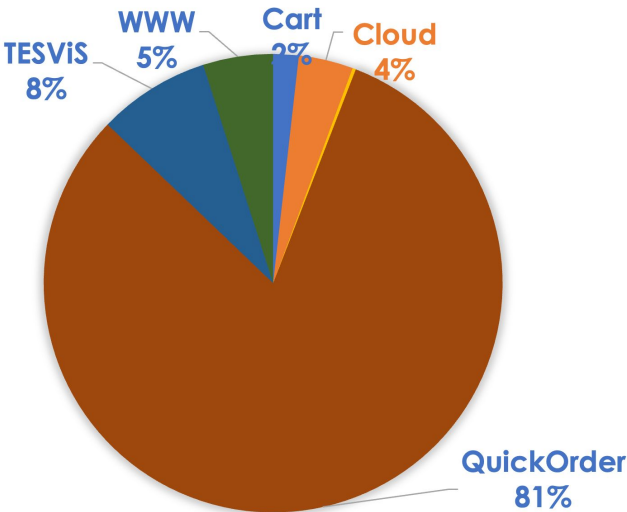
GEDI L4B Usage Metrics



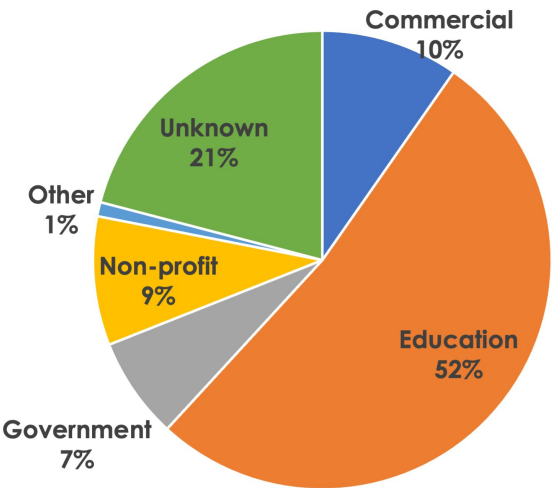
Downloads by Country



Data Access Methods (percent volume)



Affiliations (percent volume)



Note: The usage metrics do not include direct S3 access

Dataset Citations





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Publications Citing Global Ecosystem Dynamics Investigation (GEDI)

The following 69 publications cited the Global Ecosystem Dynamics Investigation (GEDI) project.

Show 10 entries

Filter:

Year	Citation	Dataset or Project
2023	Bullock, E.L., S.P. Healey, Z. Yang, R. Acosta, H. Villalba, K.P. Insfrán, J.B. Melo, S. Wilson, L. Duncanson, E. Næsset, J. Armston, S. Saarela, G. Ståhl, P.L. Patterson, and R. Dubayah. 2023. Estimating aboveground biomass density using hybrid statistical inference with GEDI lidar data and Paraguay's national forest inventory. Environmental Research Letters. 18(8):085001. https://doi.org/10.1088/1748-9326/acd0f3	GEDI L4A Footprint Level Aboveground Biomass Density, Version 2.1
2023	Choi, C., M. Pardini, J. Armston, and K.P. Papathanassiou. 2023. Forest Biomass Mapping Using Continuous InSAR and Discrete Waveform Lidar Measurements: A TanDEM-X/GEDI Test Study. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing. 16:7675-7689. https://doi.org/10.1109/JSTARS.2023.3302026	GEDI L4A Footprint Level Aboveground Biomass Density, Version 1
2023	Farrant, D.N., D.A. Roberts, C.M. D'Antonio, and A.E. Larsen. 2023. What follows follow? Assessing revegetation patterns on abandoned sugarcane land in Hawaii?. Agriculture, Ecosystems & Environment. 355:108603. https://doi.org/10.1016/j.agee.2023.108603	GEDI L4B Gridded Aboveground Biomass Density, Version 2
2023	Geremew, T., A. Gonsamo, W. Zewdie, and P. Polikka. 2023. Extrapolation of canopy height and cover metrics of GEDI LIDAR in tropical montane forest ecosystem. African Geographical Review. 1-17. https://doi.org/10.1080/19376812.2023.2164865	GEDI L3 Gridded Land Surface Metrics, Version 2
2023	Hoffrén, R., M.T. Lamelas, J. de la Riva, D. Domingo, A.L. Montealegre, A. García-Martín, and S. Revilla. 2023. Assessing GEDI-NASA system for forest fuels classification using machine learning techniques. International Journal of Applied Earth Observation and Geoinformation. 116:103175. https://doi.org/10.1016/j.jag.2022.103175	GEDI L4A Footprint Level Aboveground Biomass Density, Version 2.1
2023	Li, W., W. Guo, M. Pasgaard, Z. Niu, L. Wang, F. Chen, Y. Qin, and J. Svenning. 2023. Human fingerprint on structural density of forests globally. Nature Sustainability. 6(4):368-379. https://doi.org/10.1038/s41893-022-01020-5	GEDI L3 Gridded Land Surface Metrics, Version 2
2023	Liang, M., L. Duncanson, J.A. Silva, and F. Sedano. 2023. Quantifying aboveground biomass dynamics from charcoal degradation in Mozambique using GEDI Lidar and Landsat. Remote Sensing of Environment. 284:113367. https://doi.org/10.1016/j.rse.2022.113367	GEDI L4A Footprint Level Aboveground Biomass Density, Version 1
2023	May, P., K.S. McConville, G.G. Moisen, J. Bruening, and R. Dubayah. 2023. A spatially varying model for small area estimates of biomass density across the contiguous United States. Remote Sensing of Environment. 286:113420. https://doi.org/10.1016/j.rse.2022.113420	GEDI L4B Gridded Aboveground Biomass Density, Version 2
2023	Padalia, H., A. Prakash, and T. Watham. 2023. Modelling aboveground biomass of a multistage managed forest through synergistic use of Landsat-OLI, ALOS-2 L-band SAR and GEDI metrics. Ecological Informatics. 77:102234. https://doi.org/10.1016/j.ecoinf.2023.102234	GEDI L4B Gridded Aboveground Biomass Density, Version 2
2023	Pascual, A., J. Guerra-Hernández, J. Armston, D.M. Minor, L.I. Duncanson, P.B. May, J.R. Kellner, and R. Dubayah. 2023. Assessing the performance of NASA's GEDI L4A footprint aboveground biomass density models using National Forest Inventory and airborne laser scanning data in Mediterranean forest ecosystems. Forest Ecology and Management. 538:120975. https://doi.org/10.1016/j.foreco.2023.120975	GEDI L4A Footprint Level Aboveground Biomass Density, Version 2.1

https://daac.ornl.gov/cgi-bin/project_citations.pl?pr=40

GEDI Data Tutorial at AEOIP Applications Workshop

A joint LP/ORNL DAAC GEDI Data tutorial:

USFS - NASA Joint Applications Workshop

“Addressing Land & Water Monitoring Needs Using Remote Sensing Data”

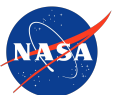
April 25 – 27, 2023
Salt Lake City, UT



**Applied Earth Observations
Innovation Partnership (AEOIP)**

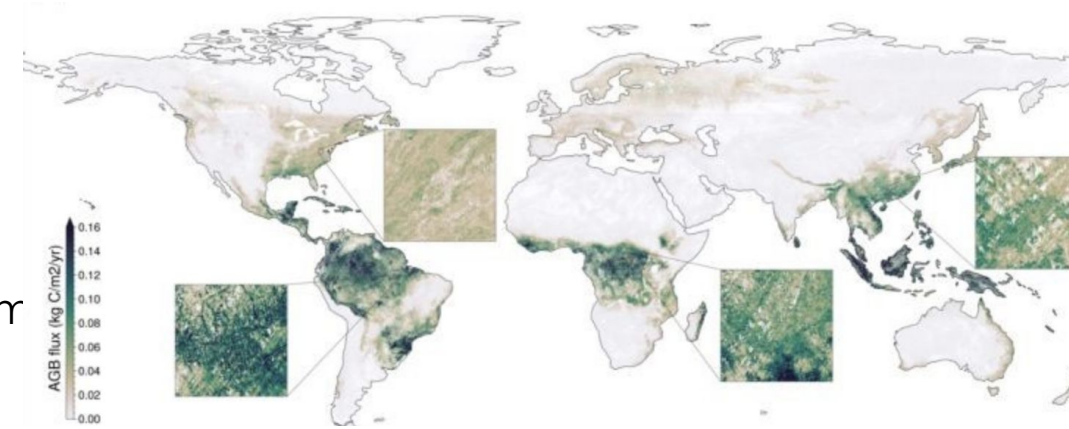


<https://www.aeoip.com>

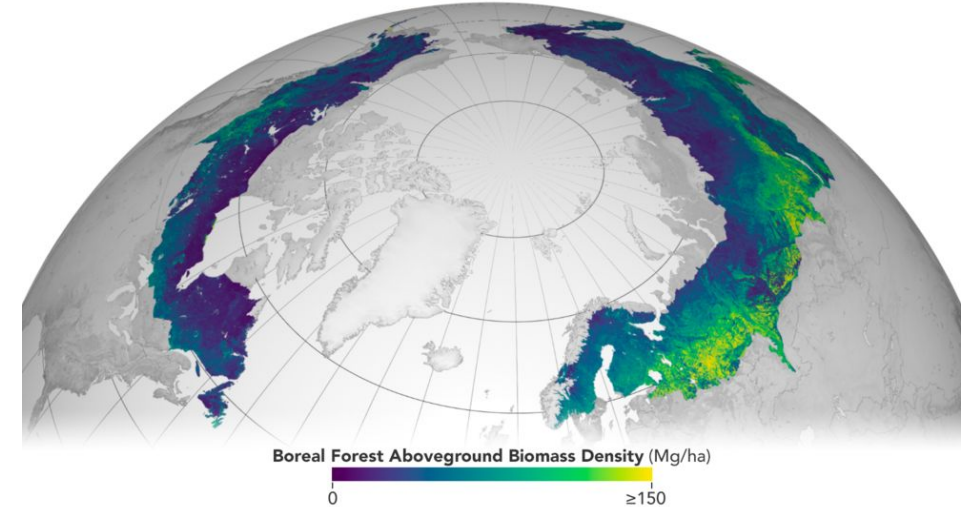


Other Datasets

- Published community and related datasets:
 - Global Forest Aboveground Carbon Stocks and Fluxes from GEDI and ICESat-2, 2018-2021 (L. Ma)
<https://doi.org/10.3334/ORNLDAAAC/2180>
 - Aboveground Biomass Density for High Latitude Forests from ICESat-2, 2020 (L. Duncanson)
<https://doi.org/10.3334/ORNLDAAAC/2186>
- Datasets in pipeline:
 - GEDI-Fusion Structure Metrics Western US, 2016-2020 (J. Vogeler) ([Pre-print](#))
 - Pantropical Forest Height and Biomass from GEDI and TanDEM-X Data Fusion (gridded high-resolution product) (W. Qi) ([Pre-print](#))
 - ICESat-2 derived relative height metrics intercalibrated with GEDI Predicted relative height metrics (S. Favrichon)



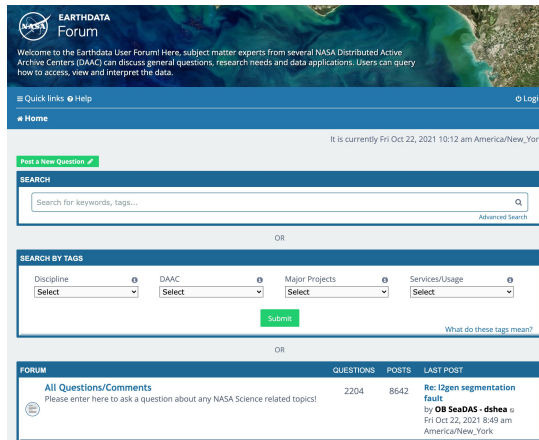
Aboveground carbon flux estimated using Ecosystem Demography model using inputs from both GEDI and ICESat-2:
<https://doi.org/10.3334/ORNLDAAAC/2180>



Aboveground biomass density for boreal forest:
<https://doi.org/10.3334/ORNLDAAAC/2186>

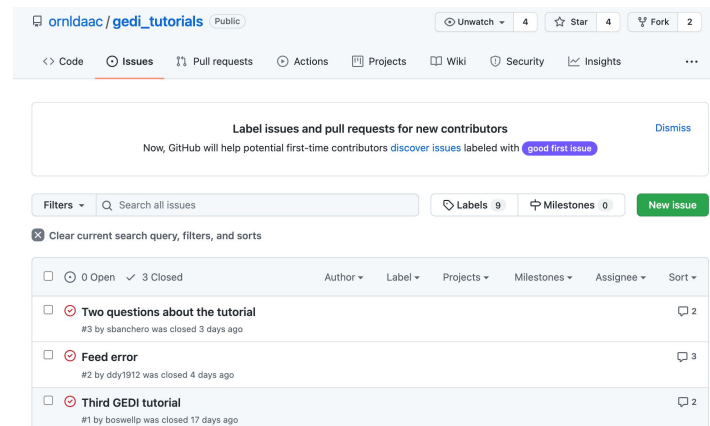
User Support

Earthdata Forum



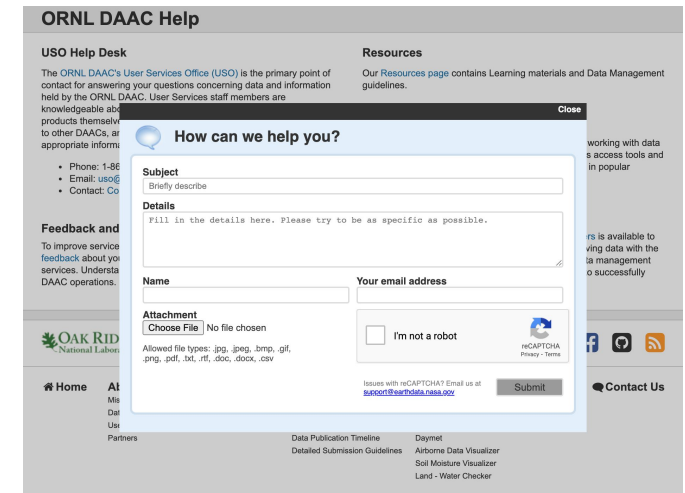
<https://forum.earthdata.nasa.gov/>

Github Issues



https://github.com/ornldaac/gedi_tutorials

USO Support



uso@daac.ornl.gov
<https://daac.ornl.gov/help/>

