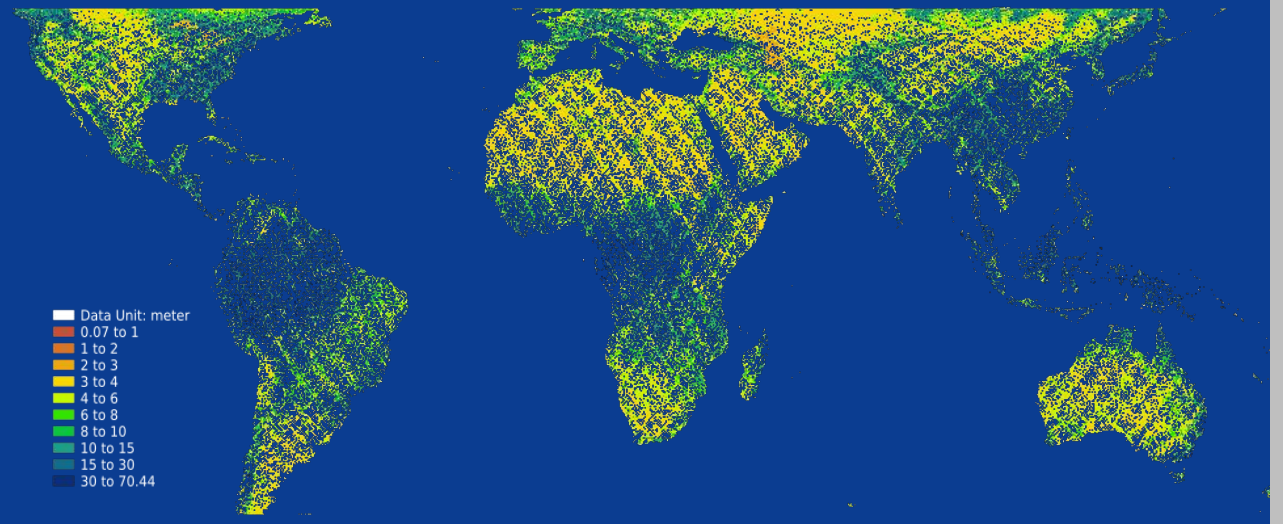
GEDI Level 3 and 4 Datasets at ORNL DAAC

Rupesh Shrestha

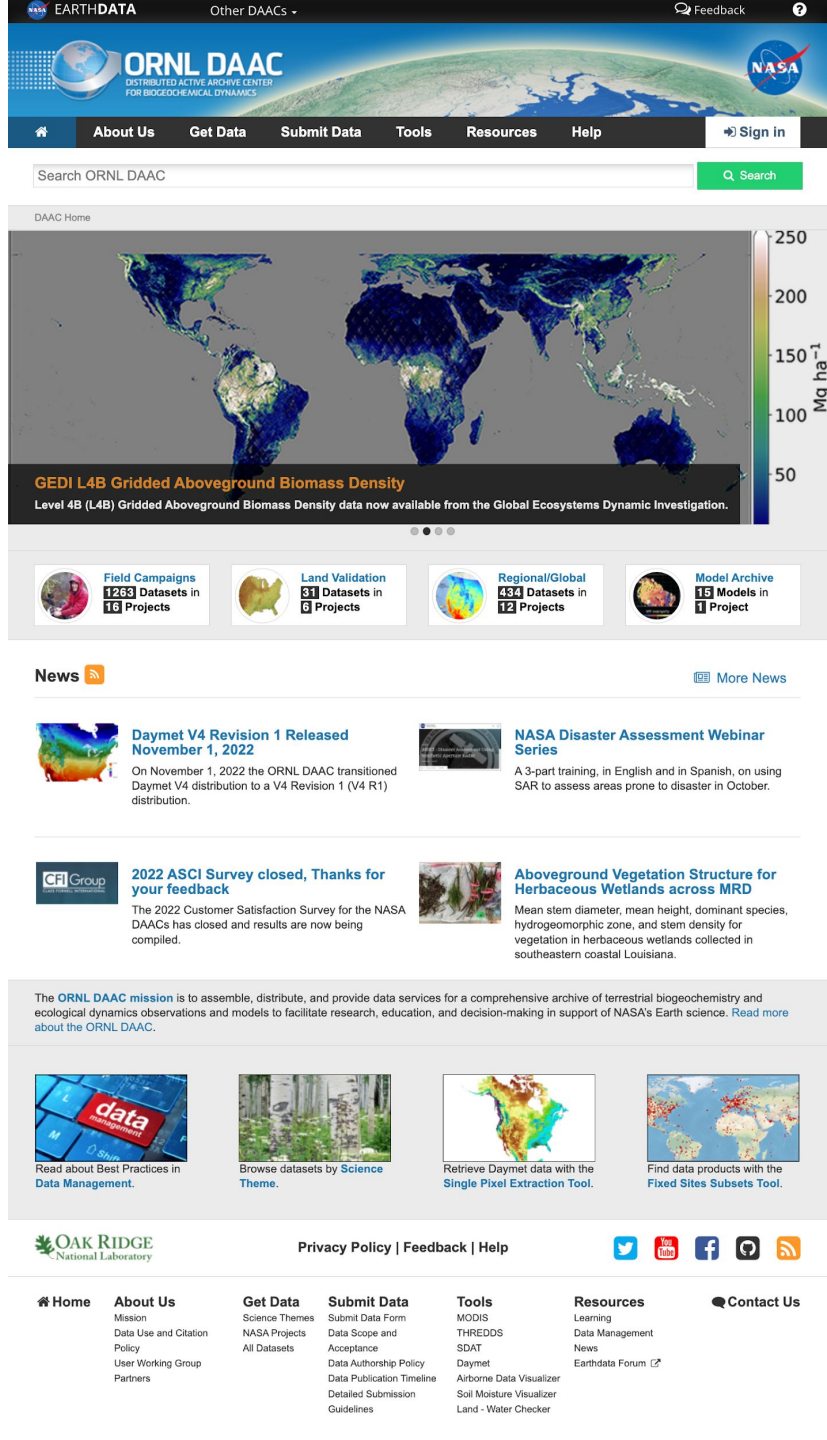
GEDI Science Team Meeting
College Park, MD
October 17-19, 2023



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

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.



https://daac.ornl.gov

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/ORNLDAAC/1865	MW 19-70	5	0.003
	2.0	**2021-11-23**	**10.3334/ORNLDAAC/1952**	**MW 19-223**	**25**	**0.013**
GEDI Level 4A Footprint Level Aboveground Biomass Density	1.0	2021-08-19	10.3334/ORNLDAAC/1907	MW 19-90	6,742	5.601
	1.0 (GW)	**2022-02-14**	**10.3334/ORNLDAAC/2028**	**MW 19,32,34,38**	**386**	**0.318**
	2.0	2021-12-15	10.3334/ORNLDAAC/1986	MW 19-138	44,095	8.447
	2.1	**2022-03-17**	**10.3334/ORNLDAAC/2056**	**MW 19-223**	**74,860**	**14.266**
GEDI Level 4B Gridded Aboveground Biomass Density	**2.0**	**2022-03-29**	**10.3334/ORNLDAAC/2017**	**MW 19-138**	**10**	**0.003**
	2.1	2023-11-XX	10.3334/ORNLDAAC/2299	MW 19-223	10	0.003

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

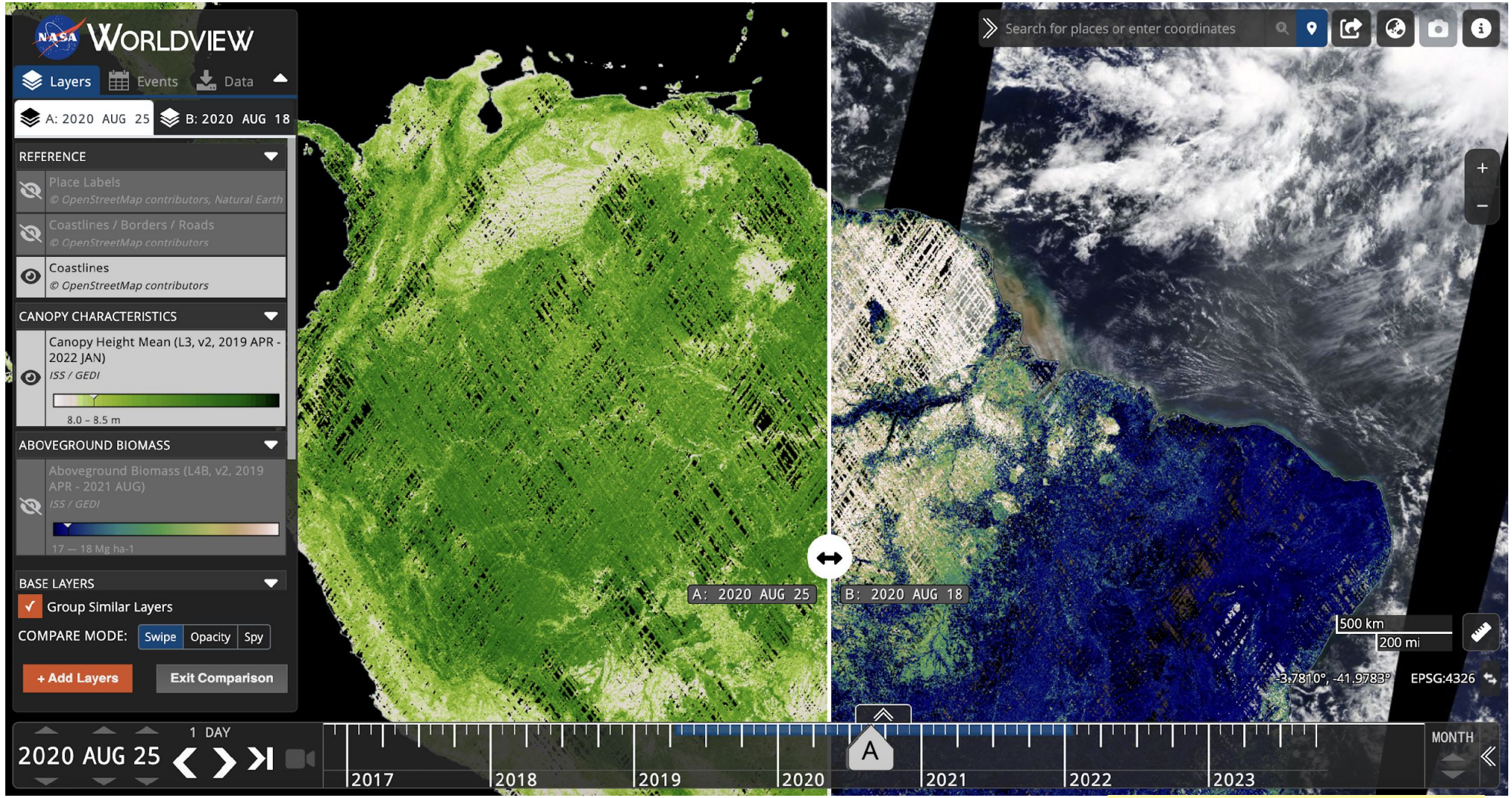
https://daac.ornl.gov/gedi

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/ornldaac/gedi_tutorials/blob/main/services.md

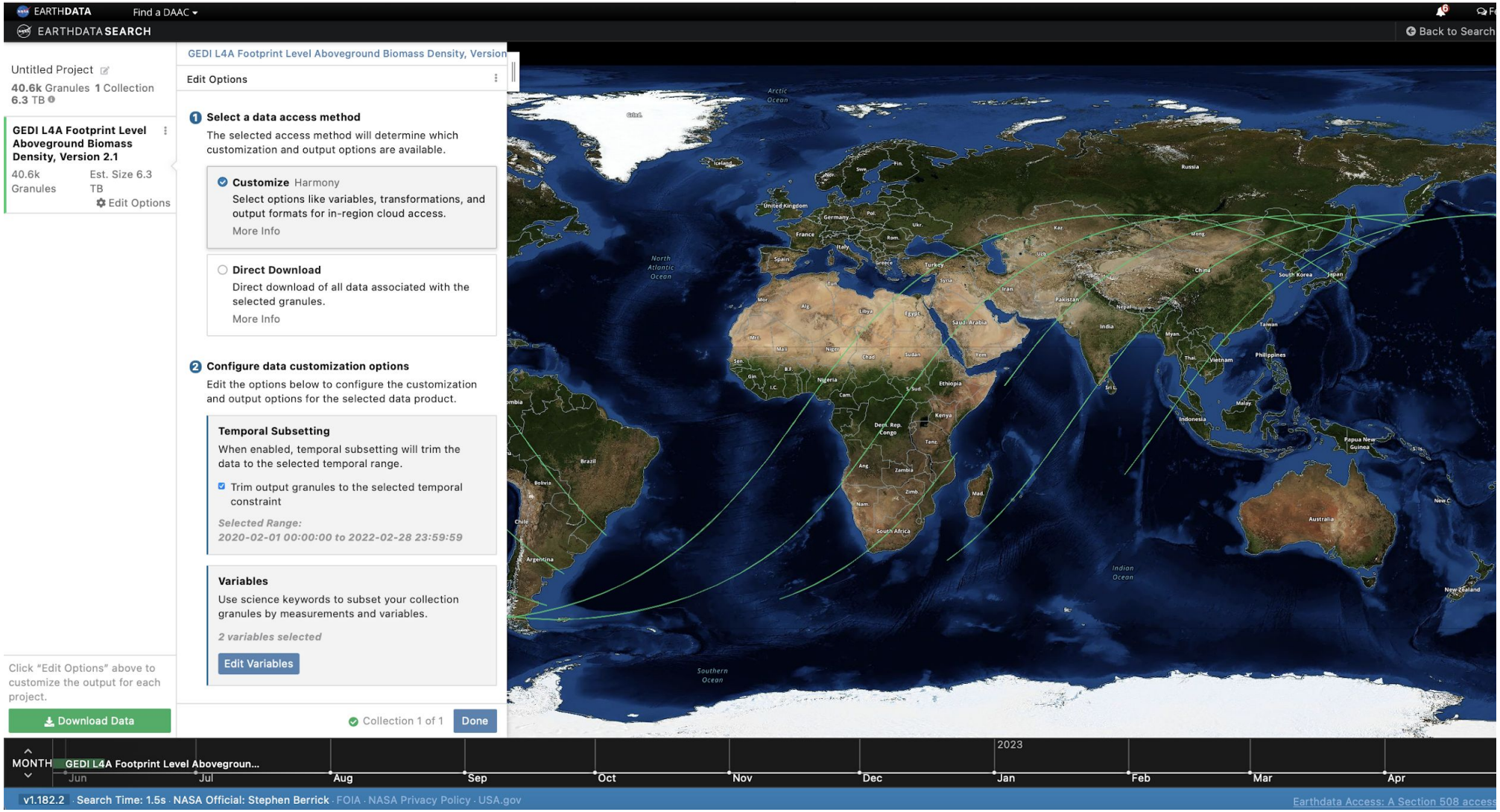
GEDI L3 and L4B on NASA WorldView/GIBS API



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

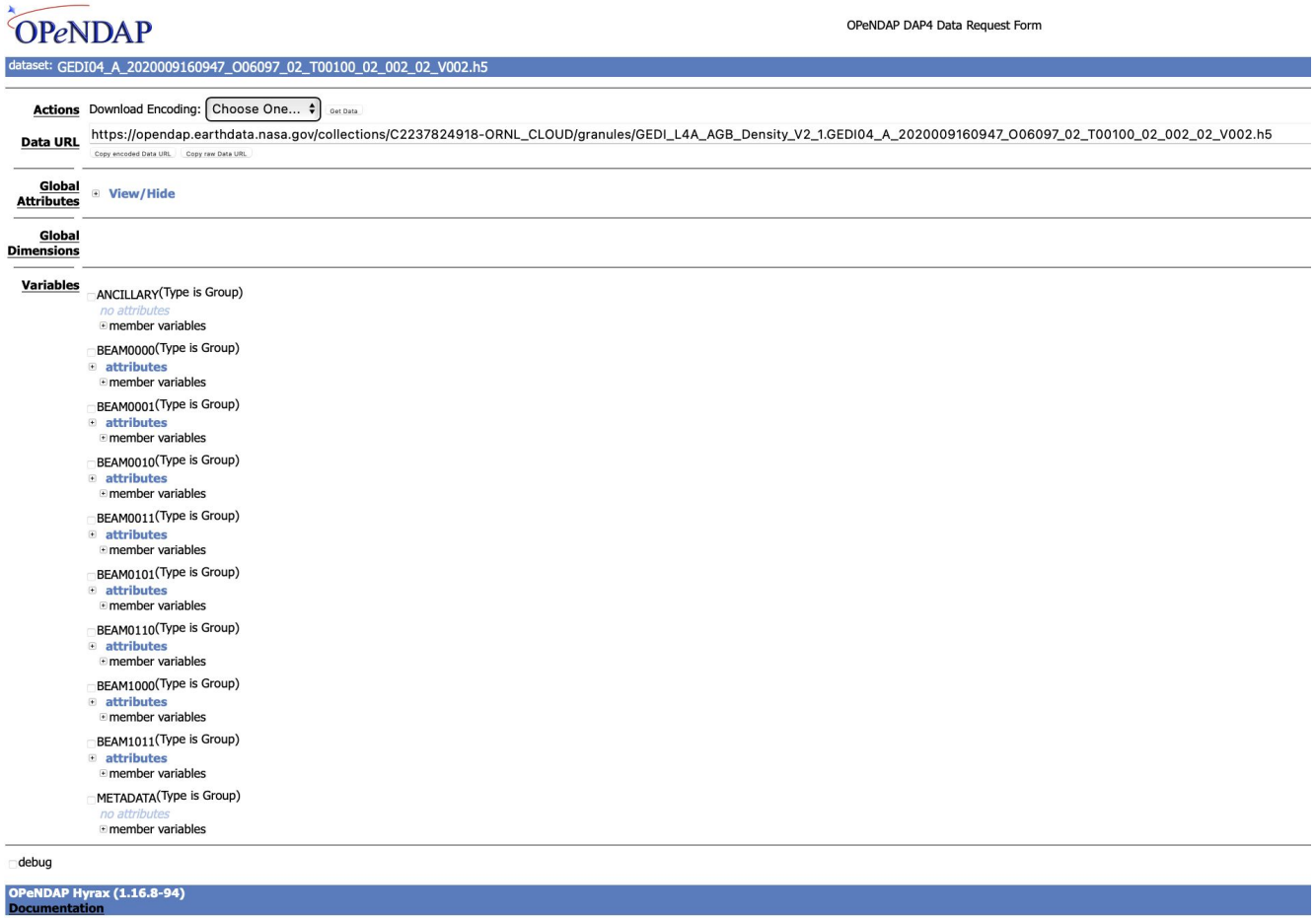
- https://worldview.earthdata.nasa.gov/ (user interface)
- https://www.earthdata.nasa.gov/engage/open-data-services-and-software/api/gibs-api (API)

Customized L4A Download via Harmony



- https://search.earthdata.nasa.gov/search/ (user interface)
- https://github.com/ornldaac/gedi_tutorials/blob/main/gedi_l4a_harmony.ipynb (API tutorial)

Download L4A via OpenDAP for Cloud (Hyrax)



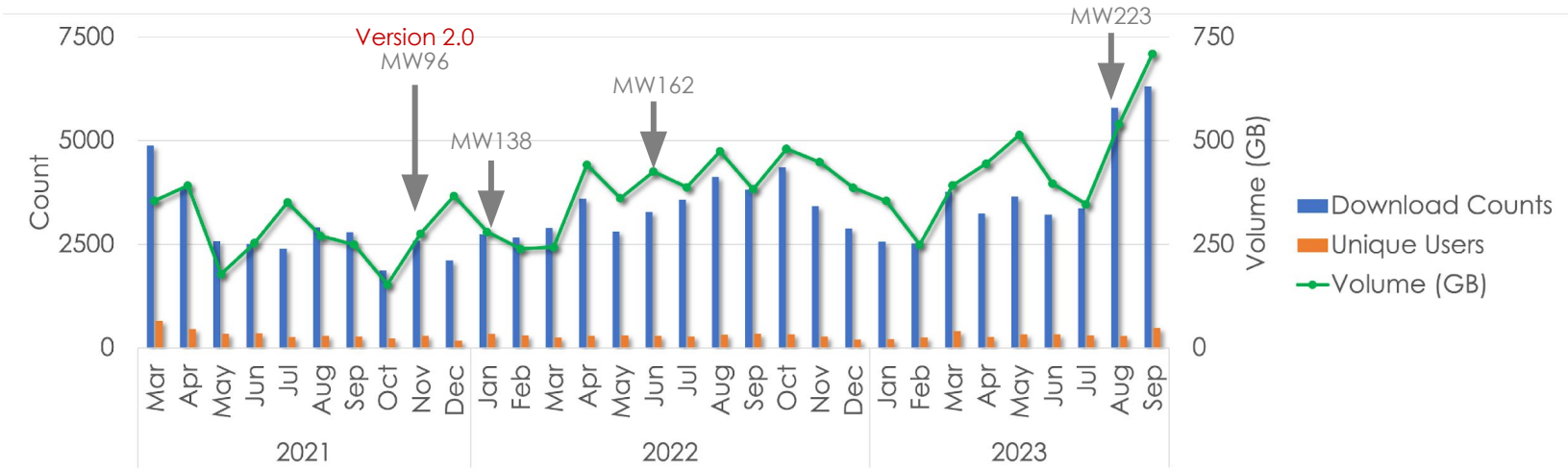
- https://opendap.earthdata.nasa.gov/collections/C2237824918-ORNL_CLOUD/granules/GEDI_L4A_AGB_Density_V2_1.GEDI04_A_2020009160947_O06097_02_T00100_02_002_02_V002.h5.dmr.html (DMR++ page)
- https://github.com/ornldaac/gedi_tutorials/blob/main/access_gedi_l4a_hyrax.ipynb (tutorial)

Usage Metrics of GEDI Datasets at ORNL DAAC

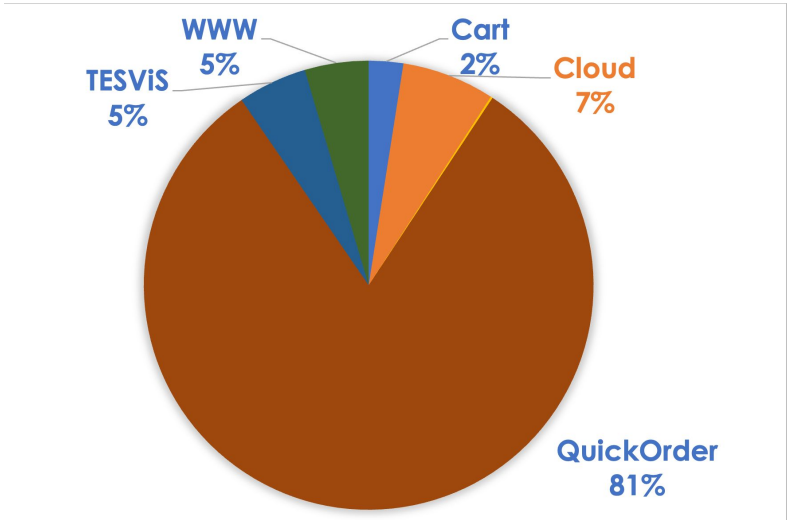
Dataset	Total Downloads	No. of unique users	Download Volume (TB)
GEDI Level 3 Gridded Land Surface Metrics	**103,164**	**9,784**	**11.3**
GEDI Level 4A Footprint Level Aboveground Biomass Density	**4,220,926**	**2,432**	**744.4**
GEDI Level 4B Gridded Aboveground Biomass Density	**99,863**	**9,497**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

Note: The usage metrics do not include direct S3 access

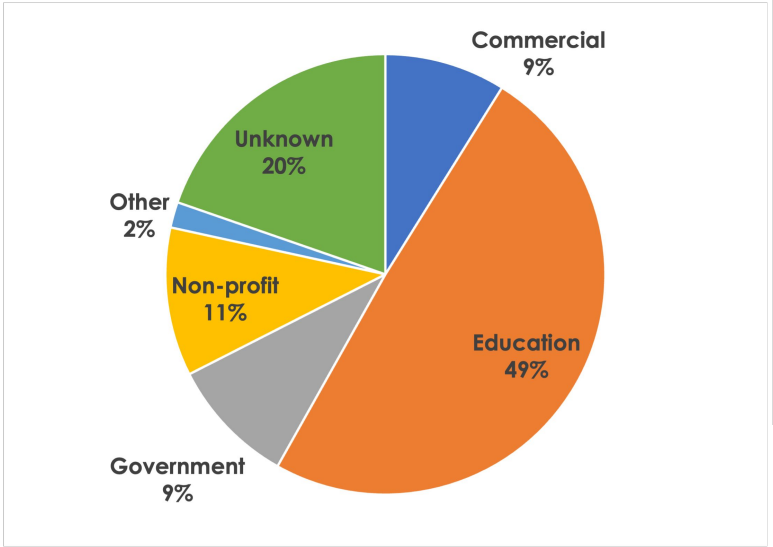
GEDI L3 Usage Metrics



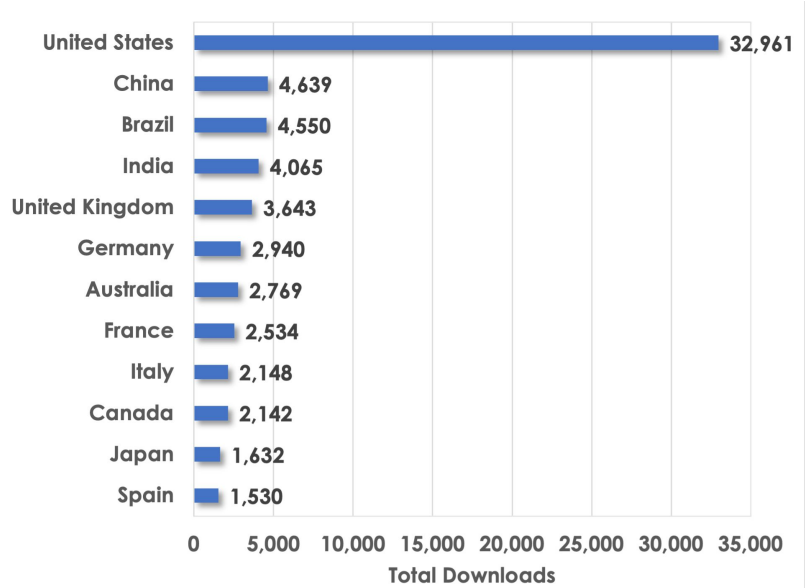
Data Access Methods (percent volume)



Affiliations (percent volume)

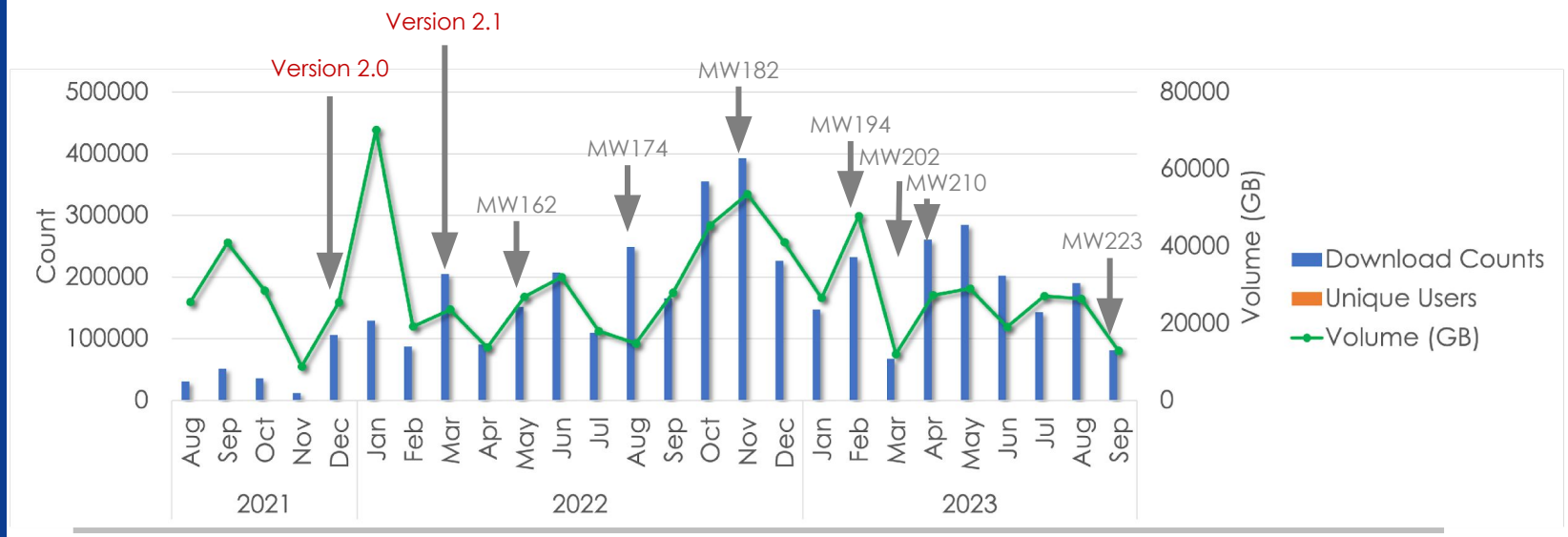


Downloads by Country

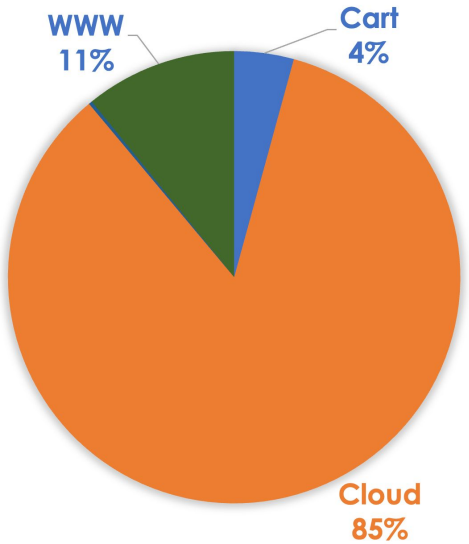


Note: The usage metrics do not include direct S3 access

GEDI L4A Usage Metrics



Data Access Methods (percent volume)



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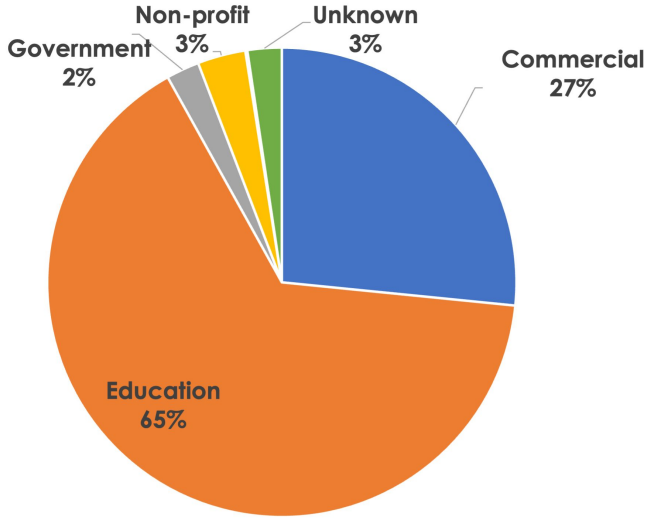
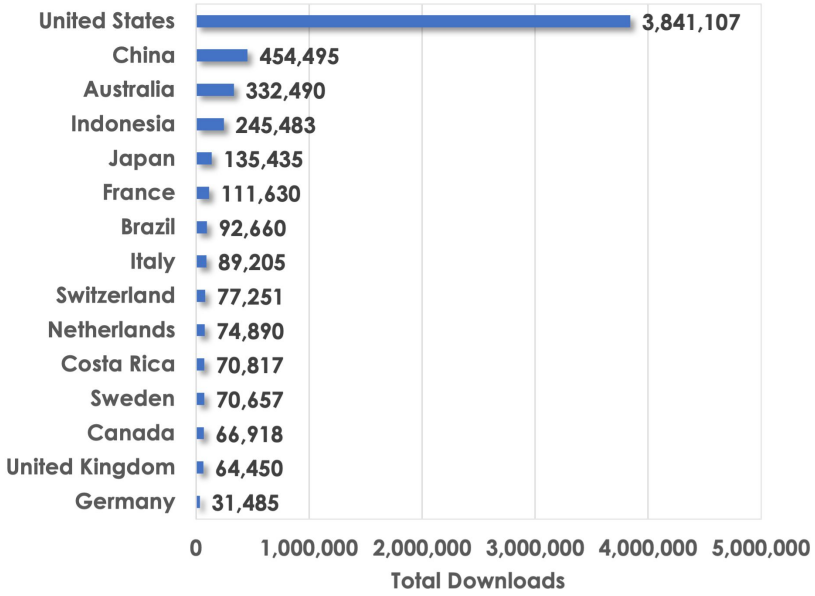
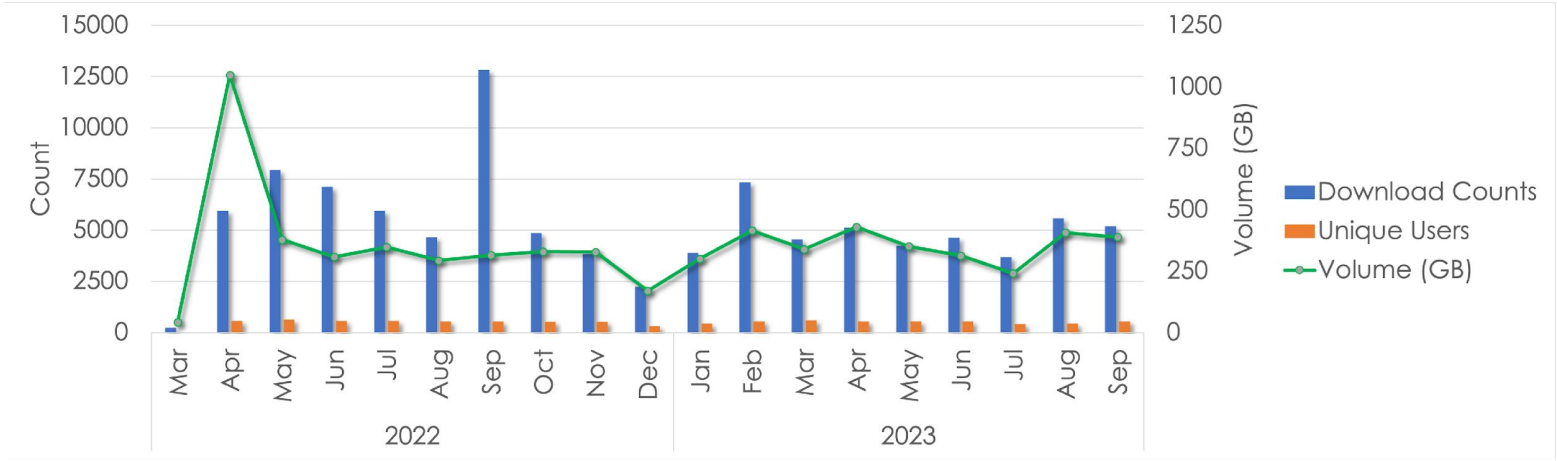


Downloads by Country

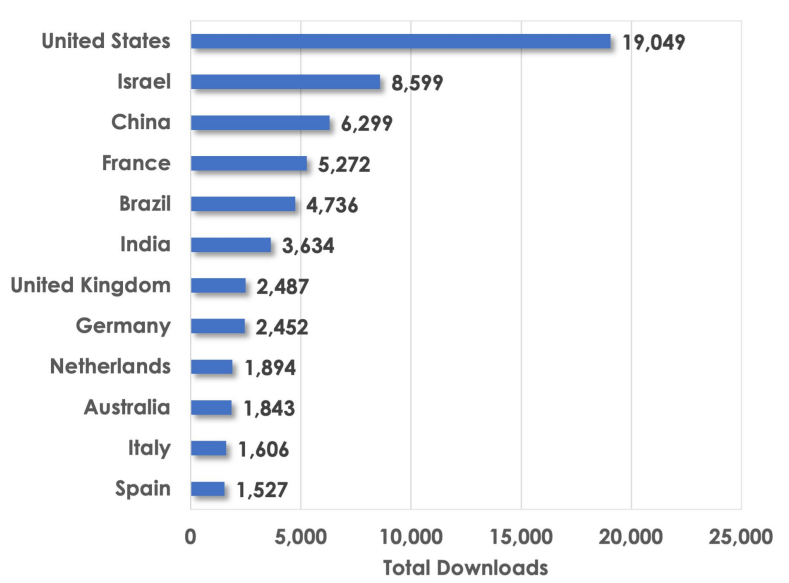


Note: The usage metrics do not include direct S3 access

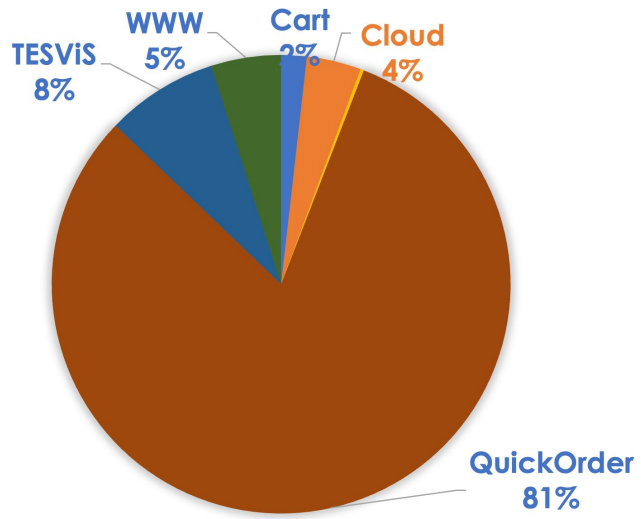
GEDI L4B Usage Metrics



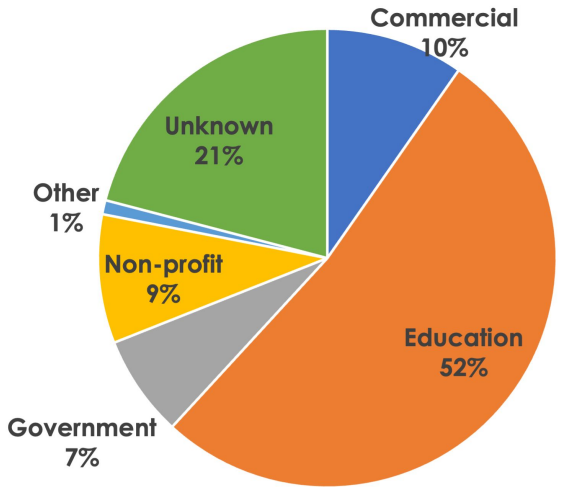
Downloads by Country



Data Access Methods (percent volume)

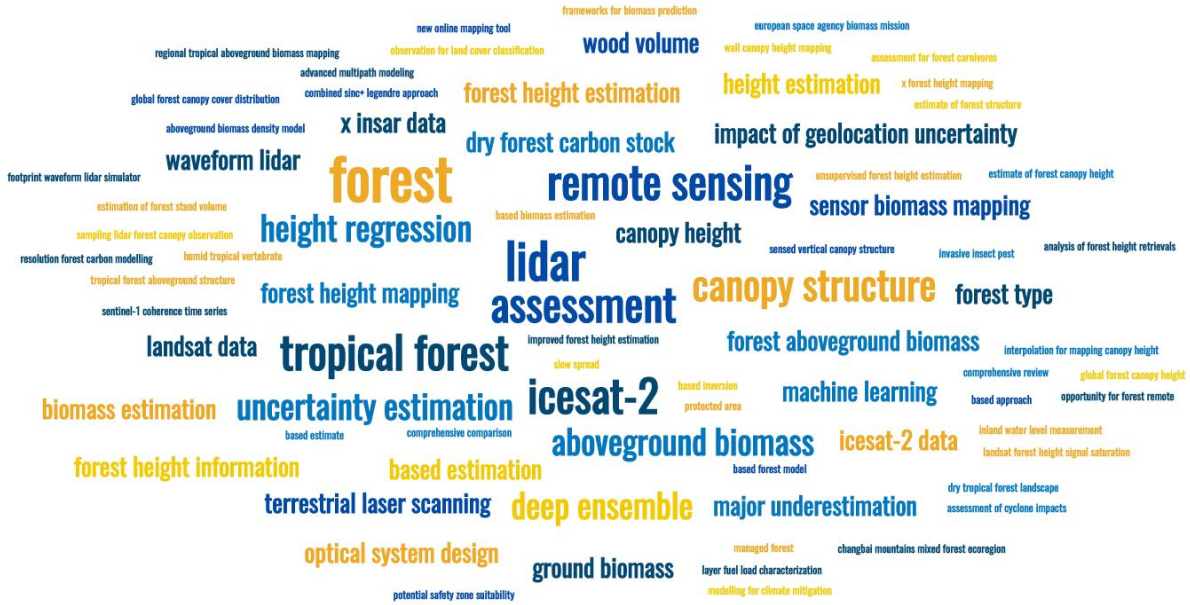


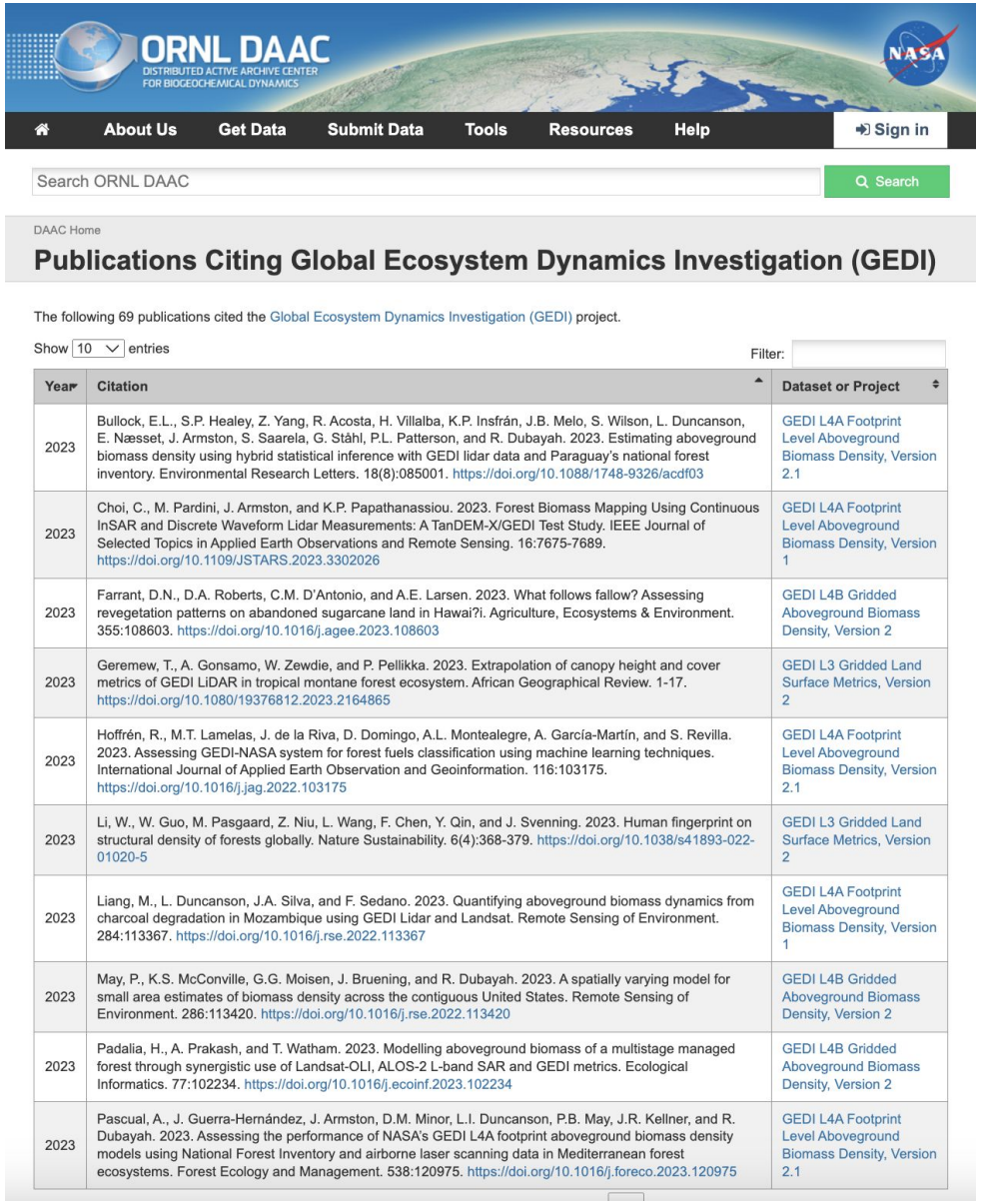
Affiliations (percent volume)



Note: The usage metrics do not include direct S3 access

Dataset Citations





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/acdf03	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 fallow? Assessing revegetation patterns on abandoned sugarcane land in Hawai?i. 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. Pellikka. 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"

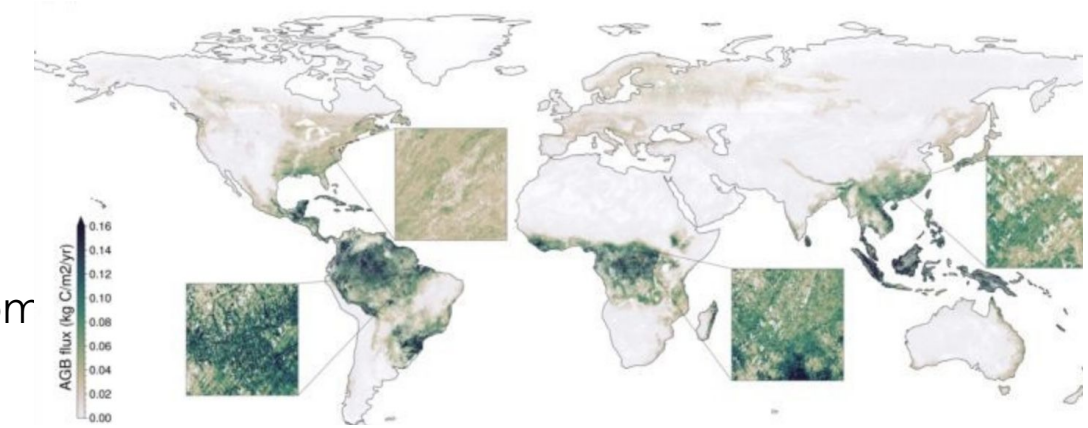
April 25 – 27, 2023
Salt Lake City, UT

Applied Earth Observations Innovation Partnership (AEOIP)

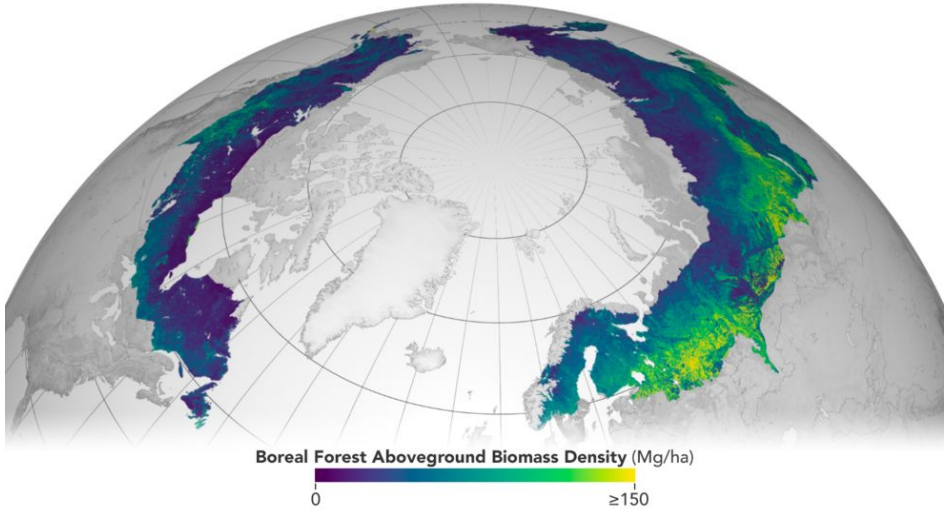
https://www.aeoip.com

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/ORNLDAAC/2180
  - Aboveground Biomass Density for High Latitude Forests from ICESat-2, 2020 (L. Duncanson) https://doi.org/10.3334/ORNLDAAC/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)



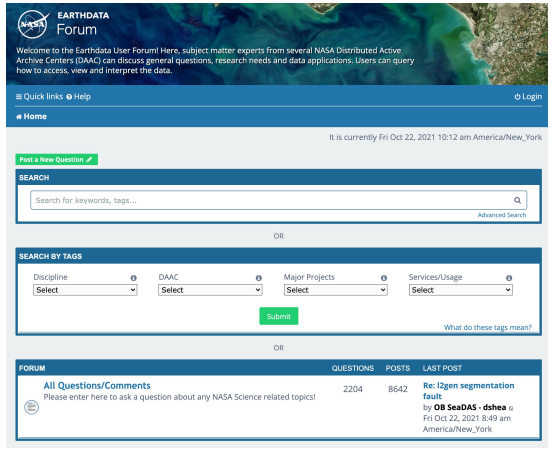
Aboveground carbon flux estimated using Ecosystem Demography model using inputs from both GEDI and ICESat-2: https://doi.org/10.3334/ORNLDAAC/2180



Aboveground biomass density for boreal forest: https://doi.org/10.3334/ORNLDAAC/2186

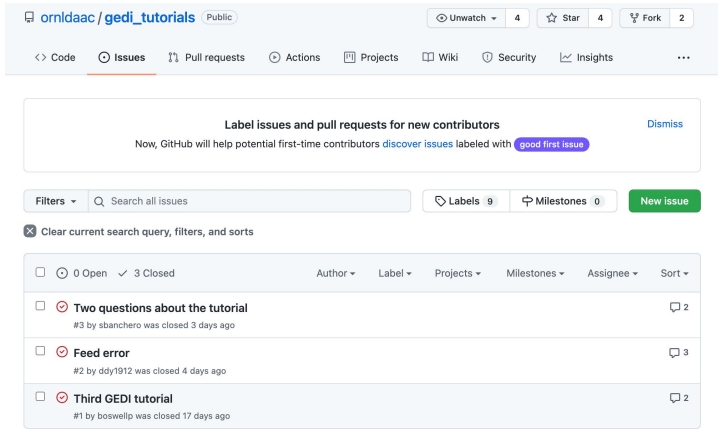
User Support

Earthdata Forum



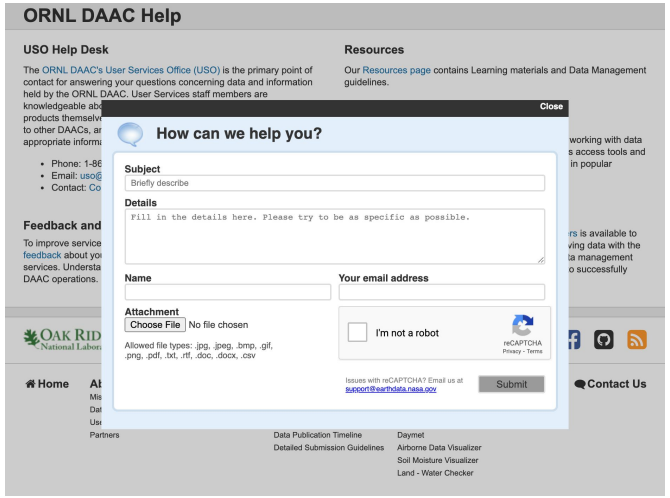
https://forum.earthdata.nasa.gov/

Github Issues



https://github.com/ornldaac/gedi_tutorials

USO Support



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https://daac.ornl.gov/help/