Land Product Validation (LPV) Sub-group Quarterly Meeting

Fabrizio Niro – (ESA/ESRIN) –Chair

Subgroup Quarterly Meeting
2nd July 2026

Outline

- Feedback from WGCV
- CEOS-FRM concept and FRM WS
- Protocol status
- FA leads
- Validation stage
- Collaboration and events

Feedback from WGCV#56 (USGS, EROS, 20-24 Apr 2026)

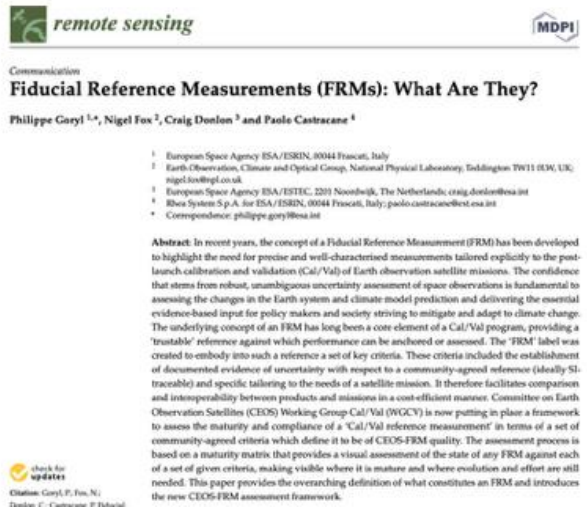
- CEOS-FRM
  - 2nd round of assessment
  - Discussion about CEOS-FRM concept
- Future CEOS-ARD
  - Include more explicit quality requirements into future ARD PFS
  - LPV contribution to future land ARD
- Supersite discussion
  - LPV supersite as an example
  - Shall we move to WCV supersite definition
- Future collaboration:
  - Biodiversity group
  - Wildfire LSI-VC group





CEOS-FRM definition

- FRM mandatory characteristics:
  - **Traceability -** documented evidence of traceability to a community reference, ideally to SI.
  - **Independence** - FRMs are independent from the satellite (under-comparison)
  - **Uncertainty budget -** A comprehensive uncertainty budget for all instruments used in deriving FRM
  - **Documented protocols -** FRM protocols, procedures and community-wide quality management practices defined, published and adhered to
  - **Accessibility -** FRM data, including metadata and documentation, are accessible to other researchers allowing independent verification
  - **Representativeness-** degree of representativeness of the FRM to that of the satellite observation and/or associated retrieval needs to be documented and the uncertainty assessed.


remote sensing

MDPI

Communication

Fiducial Reference Measurements (FRMs): What Are They?

Philippe Goryl [1,*], Nigel Fox [2], Craig Donlon [3] and Paolo Castracane [4]

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* Correspondence: philippe.goryl@esa.int

Abstract: In recent years, the concept of a Fiducial Reference Measurement (FRM) has been developed to highlight the need for precise and well-characterised measurements tailored explicitly to the post-launch calibration and validation (Cal/Val) of Earth observation satellite missions. The confidence that stems from robust, unambiguous uncertainty assessment of space observations is fundamental to assessing the changes in the Earth system and climate model prediction and delivering the essential evidence-based input for policy makers and society striving to mitigate and adapt to climate change. The underlying concept of an FRM has long been a core element of a Cal/Val program, providing a 'trustable' reference against which performance can be anchored or assessed. The 'FRM' label was created to embody into such a reference a set of key criteria. These criteria included the establishment of documented evidence of uncertainty with respect to a community-agreed reference (ideally SI-traceable) and specific tailoring to the needs of a satellite mission. It therefore facilitates comparison and interoperability between products and missions in a cost-efficient manner. Committee on Earth Observation Satellites (CEOS) Working Group Cal/Val (WGCV) is now putting in place a framework to assess the maturity and compliance of a 'Cal/Val reference measurement' in terms of a set of community-agreed criteria which define it to be of CEOS-FRM quality. The assessment process is based on a maturity matrix that provides a visual assessment of the state of any FRM against each of a set of given criteria, making visible where it is mature and where evolution and effort are still needed. This paper provides the overarching definition of what constitutes an FRM and introduces the new CEOS-FRM assessment framework.

check for updates

Citation: Goryl, P.; Fox, N.;

*Goryl et al, 2023, "**Fiducial reference measurements (FRMs): What are they?**", MDPI RS*



CEOS-FRM assessment framework

FRM assessment



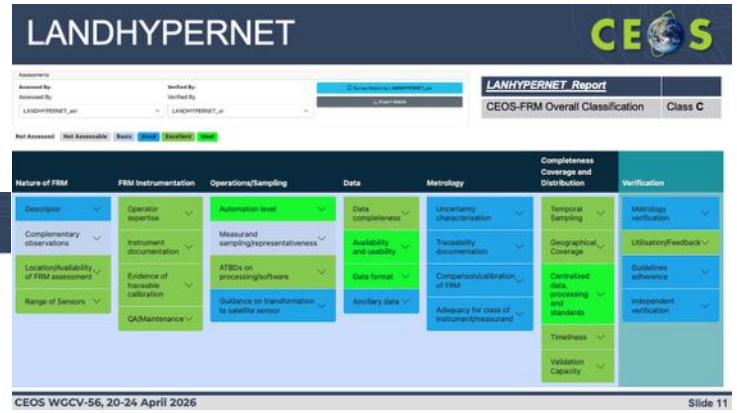
Self-Assessment						Independent Assessor
Nature of FRM	FRM Instrumentation	Operations/ Sampling (single instrument)	Data	Metrology	Completeness, coverage and distribution	Verification
Descriptor	Instrument documentation	Automation level	Data completeness	Uncertainty characterisation	Validation capacity	Guidelines adherence
Location/ availability of FRM	Evidence of traceable calibration	Measurand sampling/ representativeness	Availability and Usability	Traceability documentation	Geographical coverage Temporal sampling	Utilisation/ Feedback
Range of sensors	QA Maintenance	ATBDs on processing/software	Data format	Comparison/ calibration of FRM	Centralized data, processing, quality assessment and adherence to community standards	Metrology verification
Complementary observations	Operator expertise	Guidelines on transformation to satellite sensor	Ancillary data	Adequacy for class of instrument/ measurand	Timeliness	Independent verification
					FRM CLASSIFICATION	A B C D

Class A – Where the measurement fully meets all the criteria necessary to be considered an FRM for a particular class of instrument and measurand.
Class B – Where the measurement meets many of the key criteria and has a path towards meeting the Class A status in the near term.
Class C – Meets or has some clear path towards achieving the criteria needed to reach a higher class and provides some clear value to the validation of a class of satellite instruments/measurands.
Class D – Is a relatively basic adherence to the FRM criteria but there is a strategy and aspiration to progress towards a higher class. This can be considered an entry level class for those starting out on developing an FRM.

Grade
Not Assessed
Not Assessable
Basic
Good
Excellent
Ideal
Not Public







FRM Workshop

- 18-20 May, hosted by NPL, UK
- Gathering the EU Cal/Val community, 60+ participants in person
- Reviewing status and plans for current and planned ESA-funded FRM projects
  - In the land domain: FRM4VEG, FRM4SR, FRM4Fire, RadCalNet, HYPERNETS
- Discuss on CEOS-FRM assessment framework and results
- Gather user feedback about FRM concept:
  - What is missing
  - Data and knowledge gaps
  - How we move forward

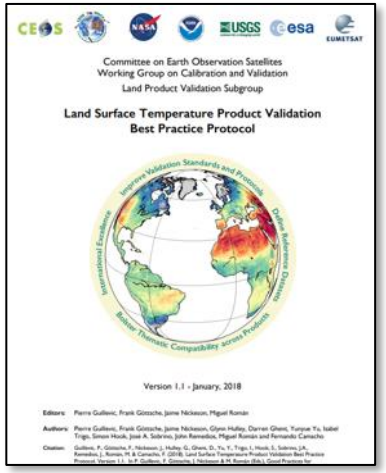


Protocols Status

FA	Status	Planned date
Biophysical	LAI(2014) Draft paper under review	**Q4 2026 (paper)**
Fire/Burn Area	BA: draft on-going AF, FRP on-going FRM4FRP	**BA (2026)** FRP (2027)
Phenology	Consolidated draft 90% ready	**Q4 2026**
VI	Consolidated draft ready	**Q4 2026**
Land Cover	Endorsed at CEOS-SIT	2025
Snow Cover	Draft on-going	
Surface Radiation	Albedo (2019) – Review planned to start in 2027 Downward Radiation (TBC)	**Albedo update 2028**
Soil Moisture	SM (2020) – Update on-going	**Update 2027**
LST and LSE	LST (2019) – Update planned	**Update 2028**
AGB	AGB (2021)	
ET	Draft July 2026	**Q3 2027**
GPP/NPP	Planned 1st draft 2027	



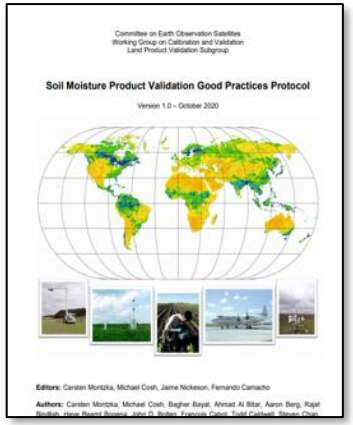
2014 - LAI



2018 - LST



2019 - Albedo



2020 - SM



2021 - AGB



2025 - LC

FA leads

	First Name	Last Name	Institution	Country	End of Term
Admin	Fabrizio	Niro	ESA	Italy	Apr 2028
	Vacant				
	Jaime	Nickeson	GSFC	USA	
Land Cover	Alexandra	Tyukavina	University of Maryland	USA	Mar 2027 (2nd term)
	Nandika	Tsendbazar	Wageningen University	Netherlands	April 2027 (1st term)
	Sophie	Bontemps	Université Catholique de Louvain	Belgium	**ex-officio**
Biophysical	Richard	Fernandes	Natural Resources Canada	Canada	Apr 2027 (one term)
	Hao	Teng	University of Maryland	USA	April 2027 (1st term)
	Luke	Brown	University of Salford	UK	Jan 2026 (1st term)
Fire/Burn Area	Louis	Giglio	University of Maryland	USA	Sep 2026 (2nd term)
	Bernardo	Mota	National Physical Lab	UK	Jan 2026 (1st term)
Surface Rad	Zhuosen	Wang	GSFC	USA	**ex-officio**
	Angela	Erb	Leidos	USA	Jan 2026 (1st term)
	Jorge	Sanchez-Zapero	EOLab	Spain	Jan 2026 (1st term)
Soil Moisture	John	Bolten	NASA GSFC	USA	Apr 2026 (2nd term)
	Alexander	Gruber	TU Wien	Austria	Oct 2026 (1st term)
LST	Thomas	Holmes	NASA/GSFC	USA	Dec 2028 (1st term)
	Lluis	Perez Planells	Karlsruhe Institute of Technology	Germany	Sept 2026 (1st term)
Phenology	Joshua	Gray	North Carolina State University	USA	Jan 2025 (2nd term)
	Victor	Rodríguez-Galiano	University of Seville	Spain	Aug 2025 (2nd term)
	Qiaoyun	Xie	The University Of Western Australia	Australia	Sep 2028 (1st term)
Snow Cover	Carrie	Vuyovich	NASA GSFC	USA	Jan 2026 (1st term)
	Juha	Lemmetyinen	Finnish Meteorologial Inst.	Finland	Sep 2026 (1st term)
Veg Index	Tomoaki	Miura	University of Hawai'i	USA	**ex-officio**
	Simon	Kraatz	USDA	USA	Apr 2027 (1st term)
	Sarah	Gebruers	VITO	Belgium	Sep 2028 (1st term)
Biomass	Laura	Duncanson	UMD/GSFC	USA	**ex-officio**
	Kim	Calders	Ghent University	Belgium	Feb 2026 (1st term)
	Mikhail	Urbazaev	GFZ	Germany	Jan 2029 (1st term)
	KC	Cushman	ORNL	USA	Jan 2029 (1st term)
ET	Yun	Yang	Cornell University	USA	Jan 2027 (1st term)
	Carmelo	Cammalleri	Politecnico di Milano	Italy	Jan 2027 (1st term)
GPP/NPP	Arthur	Endsley	University of Montana	USA	Sept 2027 (1st term)
	Álvaro	Moreno	University of Valencia	Spain	Nov 2027 (1st term)

NEW co-lead in **Phenology**
Dr. Qiaoyun Xie
The University Of Western Australia

NEW co-lead in **Biomass**
Dr. Mikhail Urbazaev
GFZ
Germany

NEW co-lead in **Biomass**
Dr KC Cushman
ORNL
USA

Still vacant:
- Vice-chair
- LSP co-chair

Validation Stages

LAI recently moved to Stage 3, update of OLIVE tool for reaching Stage 4on-going (ESA project starting now, initially focusing on coarse resolution products)

ET recently assessed at Stage 2, need to review status for GPP/NPP

	Validation Stages - Definition and Current State	Variable
0	No validation. Product accuracy has not been assessed. Product considered beta.	
1	Product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in situ or other suitable reference data.	**Snow** **Fire Radiative Power**
2	Product accuracy is estimated over a significant (typically > 30) set of locations and time periods by comparison with reference in situ or other suitable reference data. Spatial and temporal consistency of the product, and its consistency with similar products, has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.	**fAPAR** **Phenology** **Biomass** **Evapotranspiration**
3	Uncertainties in the product and its associated structure are well quantified over a significant (typically > 30) set of locations and time periods representing global conditions by comparison with reference in situ or other suitable reference data. Validation procedures follow community-agreed-upon good practices. Spatial and temporal consistency of the product, and its consistency with similar products, has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.	**LAI** **LST & Emissivity** **Active Fire** **Burned Area** **Vegetation Indices**
4	Validation results for stage 3 are systematically updated when new product versions are released or as the interannual time series expands. When appropriate for the product, uncertainties in the product are quantified using fiducial reference measurements over a global network of sites and time periods (if available).	**Land Cover** **Albedo** **Soil Moisture**

Collaboration and events

Collaboration with GEOGLAM on ET

- First meeting with GEOGLAM held on Dec 2025, follow-up emails/TCs to define scope and agenda of ET Validation WS, Joint meeting postponed to Nov/Dec 2026 at FAO (Rome)
- Draft LPV ET protocol first presented/discussed with GEOGLAM community to prepare the WS

Future events

- **Land Product Validation and Evolution (LPVE) WS#4 in ESA/ESRIN (8-10 June 2027) !!!**
- **LPV 2027 Plenary** will be held after the LPVE WS: **11 June 2027 @ESRIN**

Past LPV Plenary Meetings

- June 2025, ESA LPS, Vienna, Austria
- **June 2023, 3rd ESA LPVE, Frascati, Italy**
- Sep 2022 Virtual
- May 2021, Virtual
- April 2019, ESA LPS, Milan Italy
- **March 2018, 2nd ESA LPVE, Frascati, Italy**
- **January 2014, 1st ESA LPVE, Frascati, Italy**





CEOS WORKING GROUP ON CALIBRATION & VALIDATION

Land Cover Focus Area



Alexandra (Sasha) Tyukavina (U. Maryland, USA)
Nandika Tsendbazar (Wageningen University, Netherlands)

LPV telecon – July 2, 2026

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Land Cover (1/4)

Land Cover validation guidelines were presented at CEOS SIT-41 meeting in Irvine, CA (15-16 April, 2026) by Sasha Tyukavina, and **endorsed by CEOS SIT!**



DECISION 05	CEOS SIT endorsed the WGCV Land Product Validation (LPV) Subgroup Land Cover and Change Map Accuracy Assessment and Area Estimation Good Practices Protocol.
	Rationale: The good practices protocol recommends that map accuracy assessments be prioritised, planned, and sufficiently resourced as a core aspect of research projects and products.

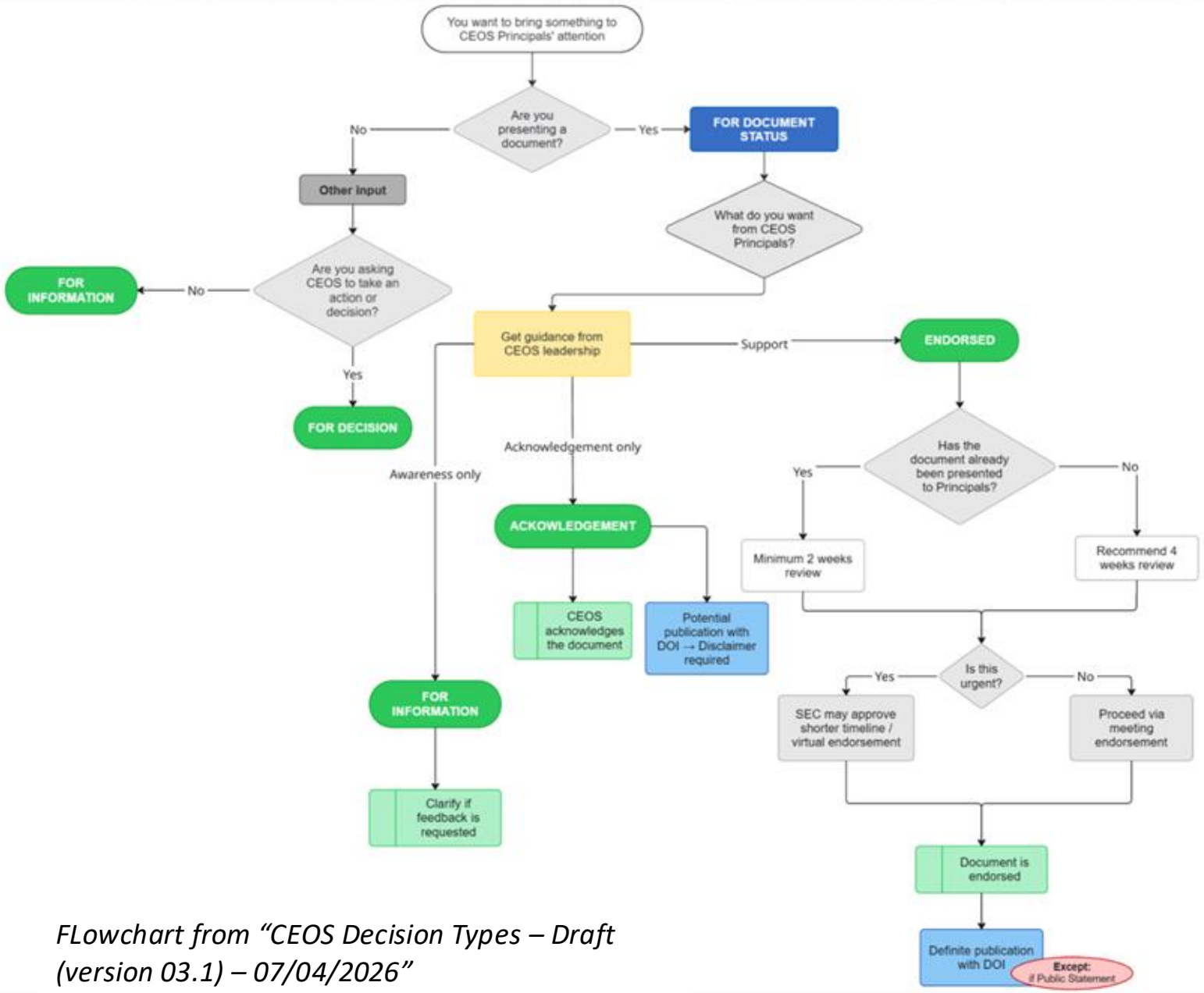
Land Cover (2/4)

CEOS will follow-up regarding **standardized cover and DOI** for CEOS-endorsed documents -> something that might need to be considered pre-publication for the future guidelines (see SIT-41 Actions 2 and 15 below).

SIT-41-02	SEO to prepare a near final draft of the DOI Process Paper for discussion at the 2026 SIT Technical Workshop, with a view to endorsement at the 2026 CEOS Plenary.	**SIT TW 2026**
	Rationale: The document clarifies the technical and governance process for CEOS documentation to receive a DOI. A next to final draft will be presented at the 2026 SIT Technical Workshop and be finalised for endorsement at the 2026 CEOS Plenary.	

SIT-41-15	As part of the DOI process paper work, SEO to consider a means for consistently distinguishing (visually) CEOS documents, considering alignment with the needs of the in progress CEOS Document Status and Handling Framework.	**SIT TW 2026**
	Rationale: It would be helpful to have a simple and flexible standardised branding for CEOS outputs. However, this should not be at the expense of visual variety.	

Land Cover (3/4)



FLowchart from "CEOS Decision Types – Draft (version 03.1) – 07/04/2026"

Important! Proposed changes to CEOS endorsement process: long technical documents like Guidelines will be suggested for **Acknowledgement only**, not Endorsement (see the flowchart).

<u>The new process will be finalized at the 2026 CEOS Plenary.</u>

If **Endorsement** is requested, a minimum of 2 weeks (4 weeks recommended) will be required for document review by the CEOS Principals.

Acknowledged documents may still be published with CEOS DOI (and cover?) with the Disclaimer stating that this Acknowledgement, and not Endorsement.

Land Cover Guidelines were Endorsed (grandfathered in, because the new process was not yet established).

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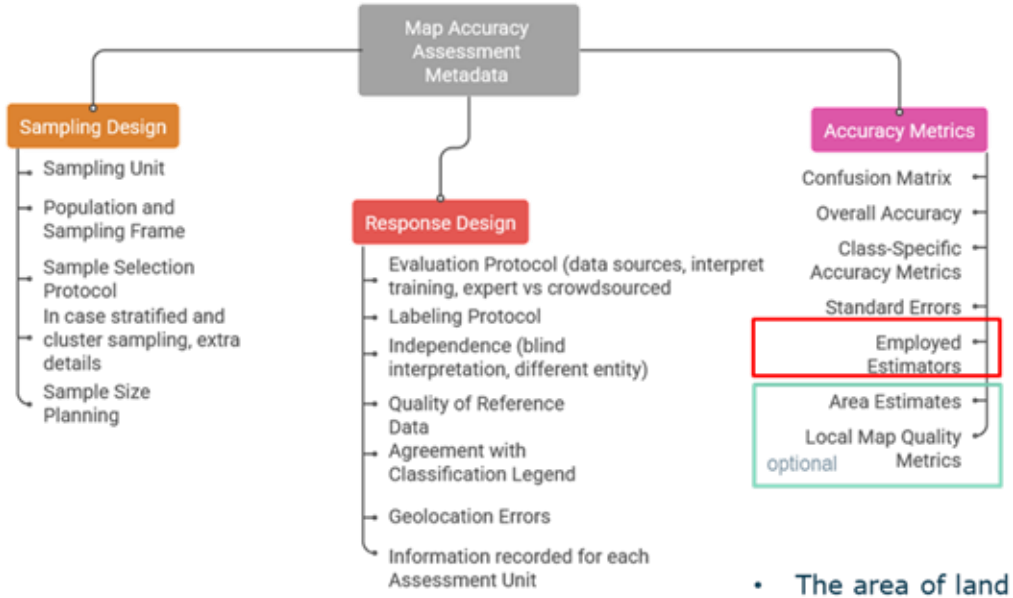
Land Cover (4/4)

StatEO26 update

~ 300 participants - EO applications, quality assessments and uncertainty estimation

- **Strong focus on reference, ground truth data**
- **Challenges in linking various expertise and domains**



- Reference data uncertainty needs to be quantified, minimized, or incorporated in the estimates. Quality outweighs quantity.

- The area of land cover class should be estimated from the reference sample, not derived via pixel counting.
- Area estimation is a simple extension of accuracy assessment.

Land Surface Phenology

ONGOING REVIEWS/ARTICLES RELATED TO THE PROTOCOLS:

- The **LSP validation protocol** is now at a very advanced stage, **approximately 90% complete**. Most of the core sections have already been drafted and reviewed. The remaining work mainly concerns the conclusions and the annexes, which will include practical validation examples at different spatial resolutions and using different types of auxiliary/reference data, including in situ observations, phenocams, and flux tower data.
- We have also contacted additional auxiliary data networks that could support validation activities, in particular the **Japanese Meteorological Agency (JMA) Phenological Network** and the **Chinese Phenological Observation Network (CPON)**.
- If progress continues as expected, the protocol could be ready for a **first review phase in September**.
- The protocol has involved contributions from a broad group of authors, with responsibilities distributed across the main sections:
  - Introduction, definitions, validation metrics, satellite LSP products, and overall validation strategy: mainly led by Víctor Rodríguez-Galiano, with contributions from Lars Eklundh, José Antonio Caparrós-Santiago, Xiaoyang Zhang, and others.
  - Spatial and geometrical aspects of validation: led by Elias Berra, with contributions from Magdalena Smigaj and Dominic Fawcett.
  - In situ human phenological observations and direct validation examples: led by Víctor Rodríguez-Galiano, with contributions from Guilhem Jeannet and Theresa Crimmins.
  - Ground-based imaging, phenocams, continuous spectral measurements, flux towers, and indirect validation examples: led by Getachew Mulualem, Jadu Dash, and Qiaoyun Xie.
  - UAV-based reference data: led by Elias Berra and Víctor Rodríguez-Galiano, with additional contributions from Magdalena Smigaj, Dominic Fawcett and other co-authors.

CEOS WORKING GROUP ON CALIBRATION & VALIDATION

Land Surface Phenology

	Section	Author
1	INTRODUCTION	Rodríguez-Galiano, V.
1.1.	Importance of Land Surface Phenology	Rodríguez-Galiano, V.
1.2.	The Role of CEOS WGCV	
1.3.	Goal of this Document	Rodríguez-Galiano, V.
2	DEFINITIONS	Rodríguez-Galiano, V.
2.1.	Definitions of phenology and Land Surface Phenology	Rodríguez-Galiano, V.
2.2.	Definitions of Associated Biological Parameters	Rodríguez-Galiano, V.
2.2.1.	Phenophase	Rodríguez-Galiano, V.
2.2.2.	Phenophase status	Rodríguez-Galiano, V.
2.3.	Definition of Spatial and Geometrical Aspects	Berra, E., Smigag, M., Fawcett, D.
2.3.1.	Elementary Sampling Unit (ESU)	Berra, E., Berra, E., Smigag, M., Fawcett, D.
2.3.2.	Local Horizontal Datum	Berra, E., Berra, E., Smigag, M., Fawcett, D.
2.3.3.	Projected Instantaneous Field of View (PIFOV) of Measurement	Berra, E., Berra, E., Smigag, M., Fawcett, D.
2.3.4.	Effective Projected Instantaneous Field of View (EPIFOV) of Measurement	Berra, E., Berra, E., Smigag, M., Fawcett, D.
2.3.5.	Satellite Measurement Geolocation Uncertainty	Berra, E., Berra, E., Smigag, M., Fawcett, D.
2.3.6.	Mapping Unit	Berra, E.,Berra, E., Smigag, M., Fawcett, D.
2.4.	Definition of Validation Metrics	Rodríguez-Galiano, V.
2.4.1.	Error (of measurement)	Rodríguez-Galiano, V.
2.4.2.	Uncertainty	Rodríguez-Galiano, V.
2.4.3.	Accuracy	Rodríguez-Galiano, V.
2.4.4.	Precision or repeatability (of results of measurements)	Rodríguez-Galiano, V.
2.4.5.	Completeness	Rodríguez-Galiano, V.

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Land Surface Phenology

3	GENERAL CONSIDERATIONS FOR SATELLITE LSP PRODUCTS	
3.1.	LSP estimation methods	Caparros-Santiago, J.A.
3.2.	Current Satellite-based LSP products	Rodríguez-Galiano, V., Eklundh, L.
3.2.1.	High Resolution Vegetation Phenology and Productivity (HR-VPP)	Rodríguez-Galiano, V., Eklundh, L.
3.2.2.	MODIS Land Cover Dynamics (MCD12Q2)	Rodríguez-Galiano, V.
3.2.3.	VIIRS Land Surface Phenology (VNP22Q2 & VNP22C2)	Rodríguez-Galiano, V., Zhang, X.
3.2.4.	S-NPP 375-m eVIIRS (VIIRS)	Rodríguez-Galiano, V.
3.2.5.	OLCI LSP (Sentinel-3)	Rodríguez-Galiano, V., Eklundh, L.
3.2.6.	MR-VPP (MODIS)	Rodríguez-Galiano, V., Eklundh, L.
3.3.	General considerations for in situ references	Rodríguez-Galiano, V.
3.3.1.	In situ human phenological observations	Rodríguez-Galiano, V., Jeannet, G., Crimmins, T.
3.3.2.	Ground-based imaging/continuous spectral measurements	Mulualem, G., Dash, J., Xie, Q.
3.3.3.	Eddy covariance flux towers	Mulualem, G., Dash, J., Xie, Q.
3.3.4.	Unmaned Aerial Vehicles Images (UAVs)	Berra, E. Rodriguez-Galiano, V., et al.
3.3.5.	Uncertainties related to input data	Rodríguez-Galiano, V. Caparros-Santiago, J.A.

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Land Surface Phenology

4	GENERAL STRATEGY FOR VALIDATION OF LSP PRODUCTS	
4.1.	CEOS Validation Stages	
4.2.	Status of Current Validation Capacity and Methods	Rodriguez-Galiano, V.
4.2.1.	Ground-based validation	Rodriguez-Galiano, V.
4.2.2.	Satellite Product Inter-Comparison	Rodriguez-Galiano, V.
4.3.	Validation strategy	Rodriguez-Galiano, V.
4.3.1.	Direct validation using species-specific phenological observations	Rodriguez-Galiano, V.
4.3.2.	Indirect Validation using flux towers and Phenocams	Mulualem, G., Dash, J., Xie, Q.
5	CONCLUSSIONS	
6	APPENDIX A: EXAMPLE OF DIRECT VALIDATION USING SPECIES-SPECIFIC	Rodriguez-Galiano, V., Jeannet, G.
6.1.	Workflow	Rodriguez-Galiano, V., Jeannet, G.
6.2.	Pseudocode	Rodriguez-Galiano, V., Jeannet, G.
7	APPENDIX B: EXAMPLE OF DIRECT VALIDATION USING FLUX TOWERS AND	Mulualem, G., Dash, J., Xie, Q.
8	REFERENCES	

CEOS WORKING GROUP ON CALIBRATION & VALIDATION

Evapotranspiration(1/2)

Workshop - **TWO SOURCE THERMAL REMOTE SENSING FOR THE MANAGEMENT OF AGRICULTURAL SYSTEMS**

Portici (Italy), May 27-29 2026

Discussions on a multi-model intercomparison study on a common framework (guidelines)



Evapotranspiration(2/2)

Good Practices Protocol

- Document structure (almost) finalized
- Chapter leaders and key contributors are at work on the first draft
- **July 9:** next chapter leaders meeting (deadline for first draft)

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GPP/NPP updates (02-7-2026)

- List of state of the art GPP products and models checked and updated to be shared with the community.

- Mailing list also ready

- Relevant sessions in AGU 2026 related with GPP/NPP modelling and cal/val activities:
  - B001 - Advances in Land Carbon Cycle Modeling
  - B004 Advances in Modeling of Terrestrial Ecosystem Carbon and Water Fluxes
  - B074 - Remote Sensing of Biodiversity–Flux Relationships Across Scales: From Traits to Ecosystem Function

FLUXNET Shuttle: What's New

From rare releases to continuous data

- Replaces infrequent major releases (e.g. FLUXNET2015) with continuously updated data.
- Shared responsibility across regional hubs, not a few individuals.

Unprecedented global coverage

- 700+ sites (3× more than FLUXNET2015) ~6,000 site-years.
- Reduces geographic bias in global flux analyses.

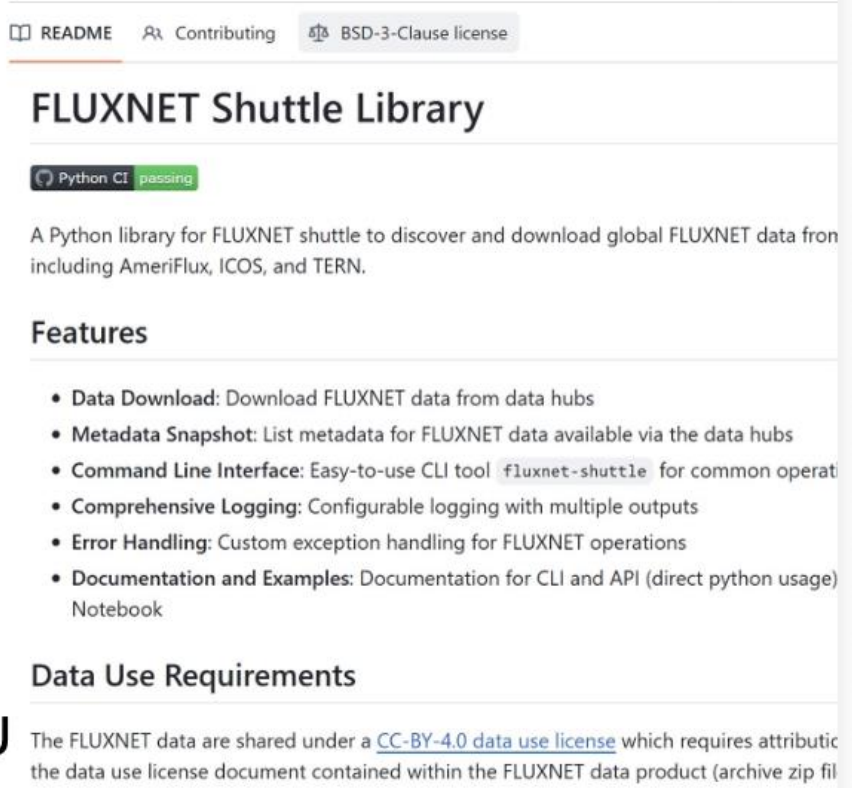
Open licensing and citation

- Data shared under CC-BY.
- Ready-made citations credit each contributing network.

Built with the global flux community

- Led by AmeriFlux, ICOS, TERN; data prep by ChinaFLUX, EU Fluxes DB, KoFlux, JapanFlux, SAEON.
- More sites and upgrades coming.
- Library of functions and GUI to facilitate easy access to the data

https://data.fluxnet.org/


README Contributing BSD-3-Clause license

FLUXNET Shuttle Library

Python CI passing

A Python library for FLUXNET shuttle to discover and download global FLUXNET data fron including AmeriFlux, ICOS, and TERN.

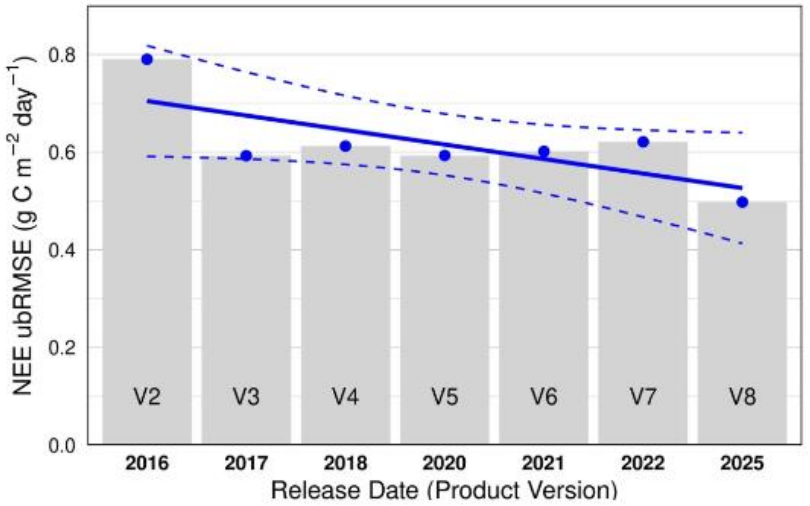
Features

- **Data Download**: Download FLUXNET data from data hubs
- **Metadata Snapshot**: List metadata for FLUXNET data available via the data hubs
- **Command Line Interface**: Easy-to-use CLI tool `fluxnet-shuttle` for common operati
- **Comprehensive Logging**: Configurable logging with multiple outputs
- **Error Handling**: Custom exception handling for FLUXNET operations
- **Documentation and Examples**: Documentation for CLI and API (direct python usage) Notebook

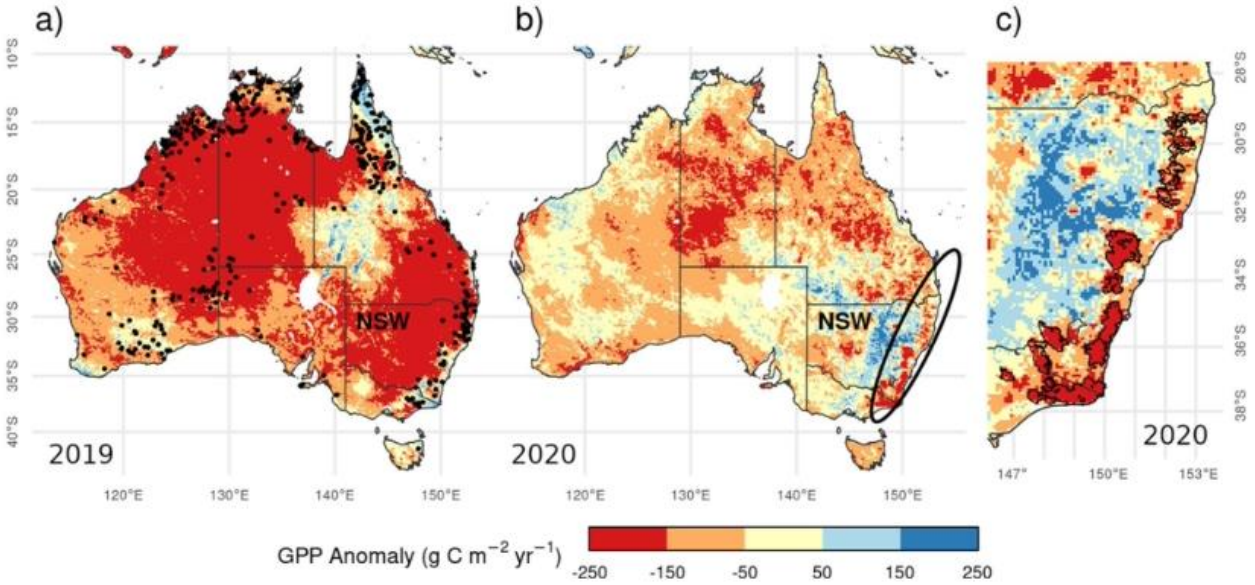
Data Use Requirements

The FLUXNET data are shared under a CC-BY-4.0 data use license which requires attributic the data use license document contained within the FLUXNET data product (archive zip fil

SMAP Level 4 Carbon (L4_C) Version 8: 10+ years of GPP constrained by soil moisture



- 10+ years of SMAP L-band radiometer measurements
- Stable algorithm performance since 2015
- **L4_C GPP measurements meet or exceed performance of FLUXCOM-X,** compared over their joint calibration towers



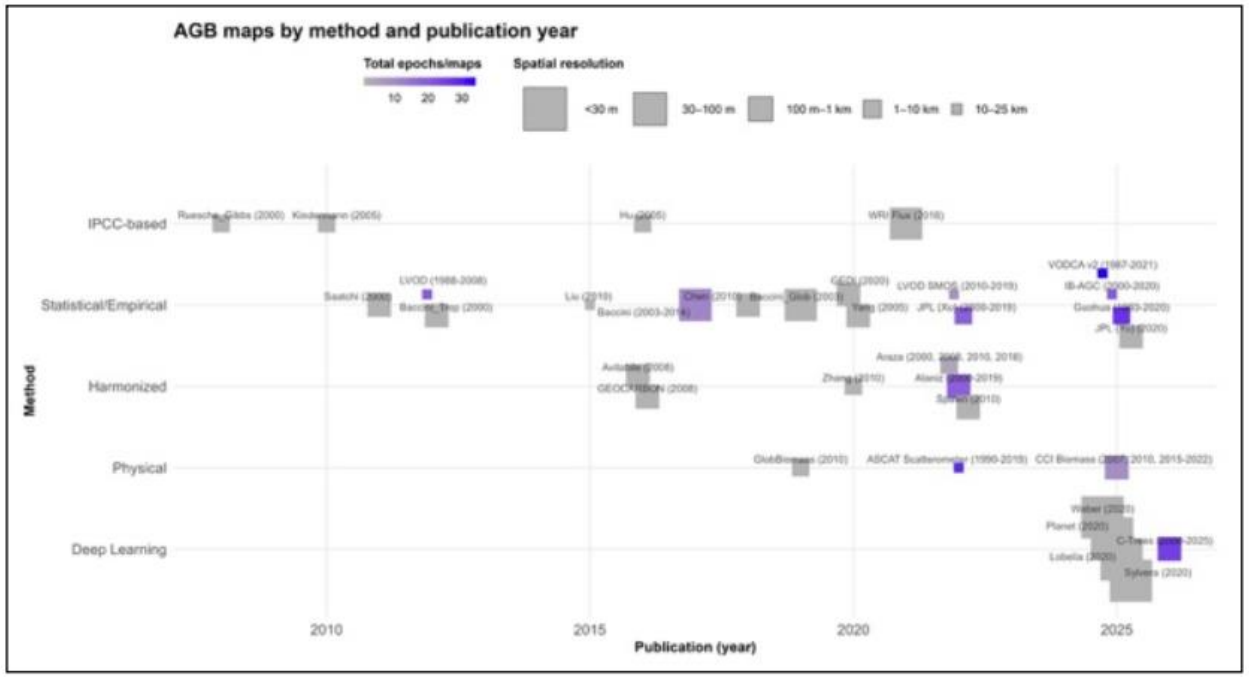
- Resolves drought, burn scars and impacts on GPP (e.g., Australia's 2019 "Black Summer")

Endsley et al. (2026, *JGR: Biogeosciences*)
https://doi.org/10.1029/2025JG009588

Biomass (1/3)

Current Biomass Activities

- On-going study on global comparative analysis of published aboveground biomass (AGB) products

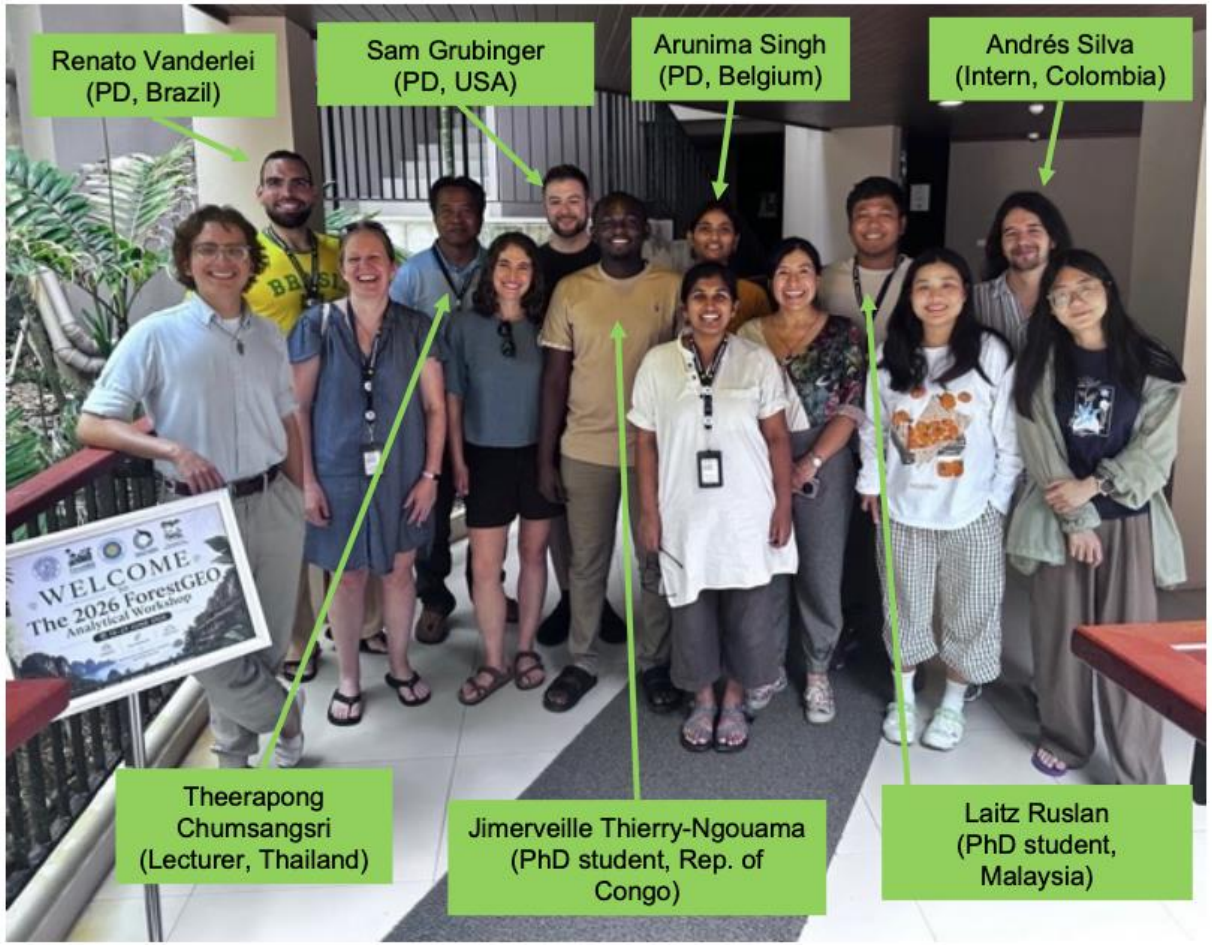


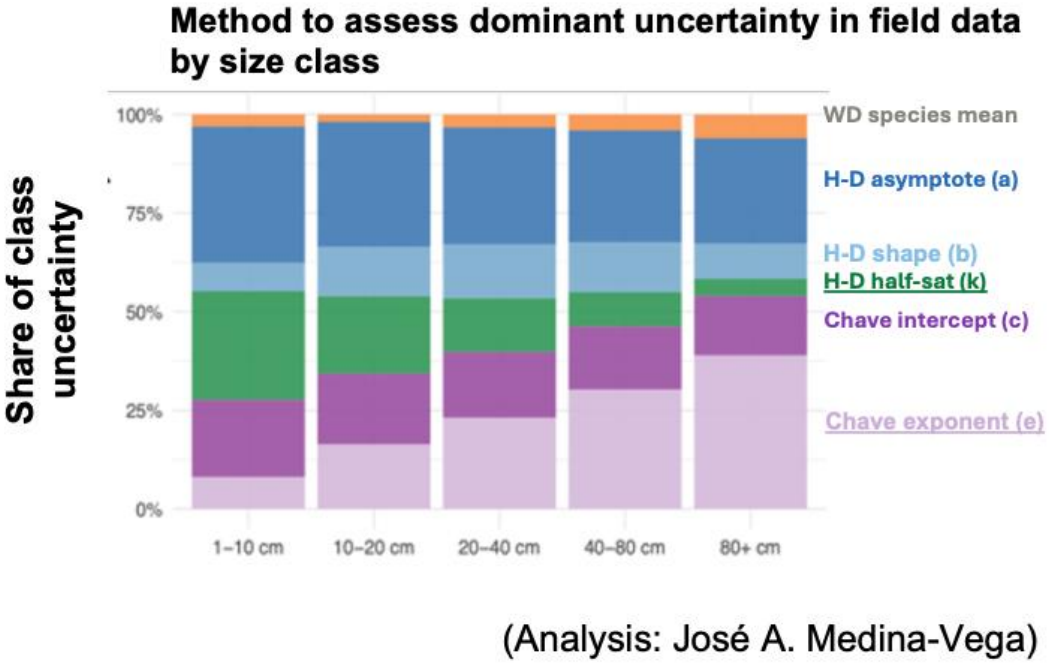
- A new project extending the Copernicus Climate Change Service ECV portfolio (https://climate.copernicus.eu) with operational time-series of global biomass maps at 100 m and 0.25° resolution
- Preparation for a TLS field campaign in Gabon (GFZ, August-September 2026, 6-ha) to support ESA-BIOMASS and GEO-TREES activities

Biomass (2/3)

Current Biomass Activities

- GEO-TREES Biomass participants at the Smithsonian Forest Global Earth Observatory Workshop in Thailand June 13-26





(Analysis: José A. Medina-Vega)