WGCV-55

Land Product Validation (LPV) sub-group report

Committee on Earth Observation Satellites

Fabrizio Niro (Serco/ESA)

Agenda Item 2.2, WGCV-55

Hyderabad, India, 8-10 July 2025

Outline

- LPV internal structure and team
- ECVs and EBVs requirements
- LPV Validation Framework
- LPV protocols, datasets and tools
- LPV Supersites Update
- Reports from LPV Focus Areas
- Summary and Outlook

LPV Structure and Team

	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)
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)
	Vacant				
Biomass	Laura	Duncanson	UMD/GSFC	USA	**ex-officio**
	Kim	Calders	Ghent University	Belgium	Feb 2026 (1st term)
	Neha	Hunka	ESA/ESRIN	Italy	Feb 2026 (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)

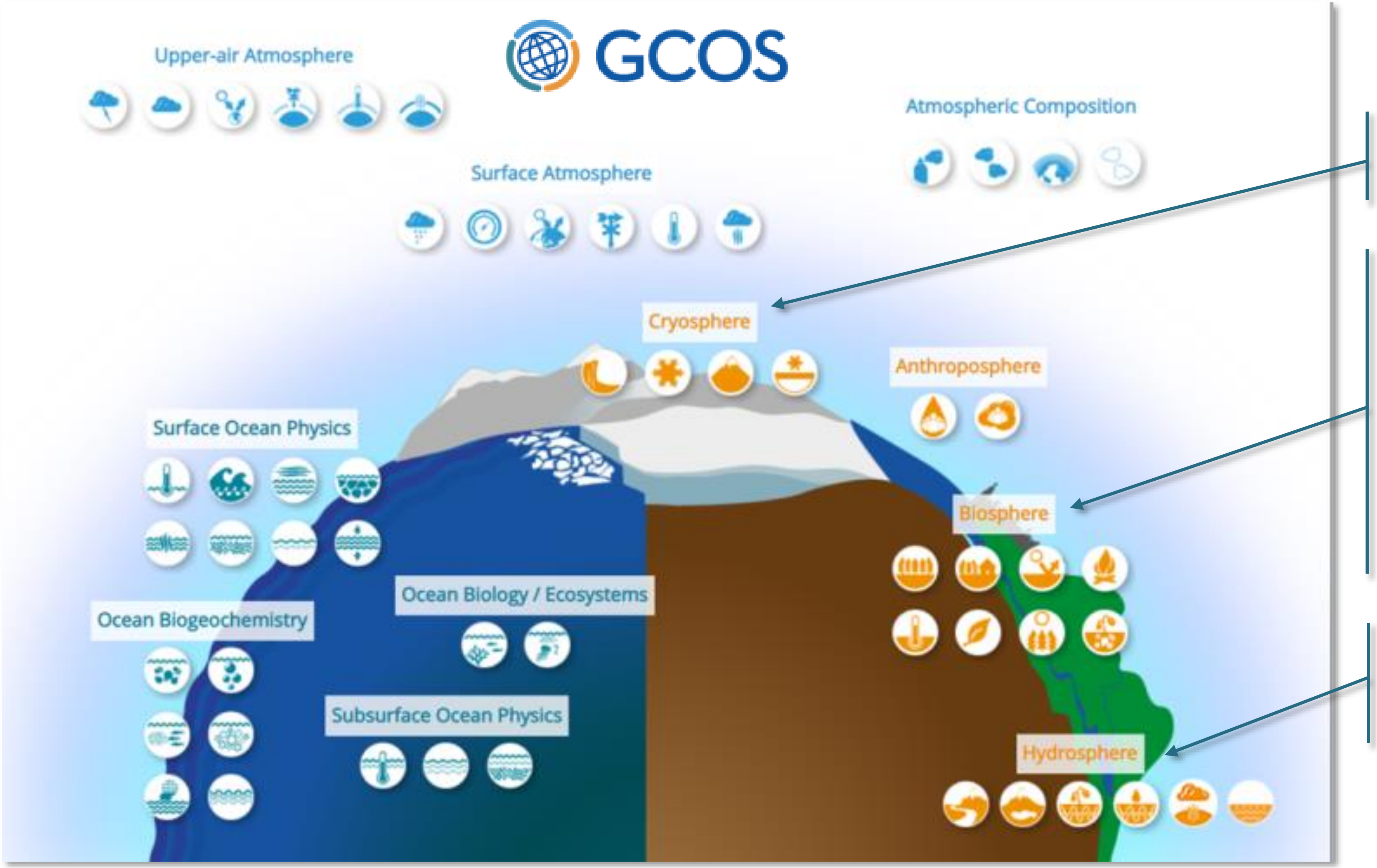
New

ex-officio

end of term approaching

Vacant or beyond end of term

ECVs addressed by LPV

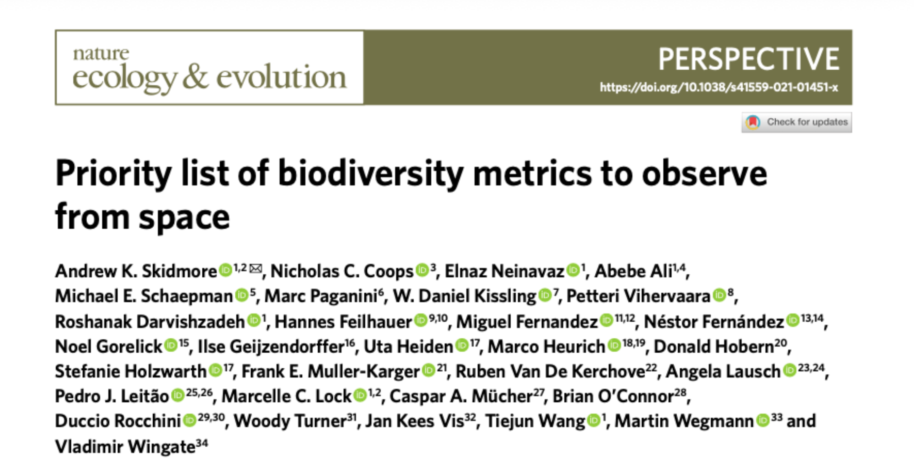


- Snow (SCE, SWE)

- Biomass (AGB)
- Albedo
- Fire (FRP, BA)
- fAPAR
- Land Cover
- LST
- Leaf Area Index

- Land Evaporation
- Soil Moisture

Biodiversity metrics covered by LPV



nature ecology & evolution

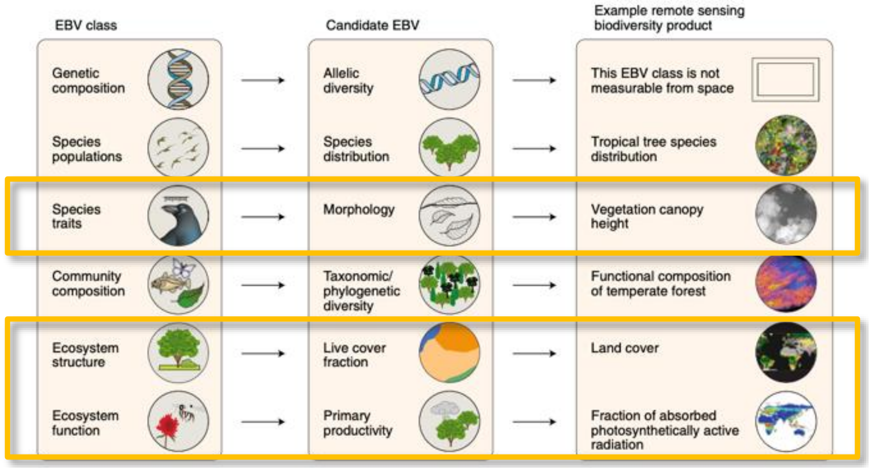
PERSPECTIVE

https://doi.org/10.1038/s41559-021-01451-x

Check for updates

Priority list of biodiversity metrics to observe from space

Andrew K. Skidmore[1,2]✉, Nicholas C. Coops[3], Elnaz Neinavaz[1], Abebe Ali[1,4], Michael E. Schaepman[5], Marc Paganini[6], W. Daniel Kissling[7], Petteri Vihervaara[8], Roshanak Darvishzadeh[1], Hannes Feilhauer[9,10], Miguel Fernandez[11,12], Néstor Fernández[13,14], Noel Gorelick[15], Ilse Geijzendorffer[16], Uta Heiden[17], Marco Heurich[18,19], Donald Hobern[20], Stefanie Holzwarth[17], Frank E. Muller-Karger[21], Ruben Van De Kerchove[22], Angela Lausch[23,24], Pedro J. Leitão[25,26], Marcelle C. Lock[1,2], Caspar A. Mücher[27], Brian O'Connor[28], Duccio Rocchini[29,30], Woody Turner[31], Jan Kees Vis[32], Tiejun Wang[1], Martin Wegmann[33] and Vladimir Wingate[34]



Skidmore et al 2021, Nature ecology and evolution

PERSPECTIVE NATURE ECOLOGY & EVOLUTION

Table 2 | The 30 remote sensing biodiversity products with the highest rankings

Number	Remote sensing biodiversity product	Remote sensing-enabled biodiversity variable	EBV class	Rank within EBV class	Rank across all EBV classes
1	Biological effects of fire disturbance (direction, duration, abruptness, magnitude, extent and frequency)	Ecosystem disturbance	Ecosystem function	1	1
		Habitat structure	Ecosystem structure	1	1
2	Biological effects of irregular inundation	Ecosystem disturbance	Ecosystem function	1	1
		Habitat structure	Ecosystem structure	1	1
3	LAI	Ecosystem physiology	Ecosystem function	3	5
		Habitat structure	Ecosystem structure	3	5
		Species physiology	Species traits	1	21
4	Land cover (vegetation type)	Habitat structure	Ecosystem structure	3	5
5	Ice cover habitat	Habitat structure	Ecosystem structure	5	8
6	Above-ground biomass	Habitat structure	Ecosystem structure	6	9
7	Foliar N/P/K content	Ecosystem physiology	Ecosystem function	4	9
		Species physiology	Species traits	2	28
8	Net primary productivity	Ecosystem physiology	Ecosystem function	5	11
		Species physiology	Species traits	2	28
9	Gross primary productivity	Ecosystem physiology	Ecosystem function	5	11
		Species physiology	Species traits	2	28
10	Fraction of absorbed photosynthetically active radiation	Ecosystem physiology	Ecosystem function	5	11
11	Ecosystem fragmentation	Spatial configuration	Ecosystem structure	7	11
12	Ecosystem structural variance	Spatial configuration	Ecosystem structure	7	11
13	Urban habitat	Habitat structure	Ecosystem structure	7	11
14	Vegetation height	Habitat structure	Ecosystem structure	7	11
15	Plant area index profile (canopy cover)	Habitat structure	Ecosystem structure	7	11
16	Habitat structure	Habitat structure	Ecosystem structure	7	11
17	Fraction of vegetation cover	Habitat structure	Ecosystem structure	7	11
18	Specific leaf area	Ecosystem physiology	Ecosystem function	8	22
		Species morphology	Species traits	2	28
19	Chlorophyll content and flux	Ecosystem physiology	Ecosystem function	8	22
		Species physiology	Species traits	2	28
20	Land surface peak (maximum of season)	Ecosystem phenology	Ecosystem function	8	22
	Land surface green-up (start of season)	Ecosystem phenology	Ecosystem function	8	22
	Land surface senescence (end of season)	Ecosystem phenology	Ecosystem function	8	22
21	Carbon cycle (above-ground biomass)	Ecosystem physiology	Ecosystem function	8	22
22	Peak season (maximum of season)	Species phenology	Species traits	2	28
23	Green-up (start of season)	Species phenology	Species traits	2	28
24	Senescence (end of season)	Species phenology	Species traits	2	28
25	Leaf dry matter content	Species morphology	Species traits	2	28
26	Ecosystem soil moisture	Ecosystem physiology	Ecosystem function	14	28
27	Functional diversity	Community diversity	Community composition	1	38
28	Species abundance	Population abundance	Species population	1	46
29	Relative species abundance	Population abundance	Species population	1	46
30	Population density	Population structure by age/size class	Species population	1	46

- AGB
- Fire
- fAPAR
- Land Cover
- Leaf Area Index
- Soil Moisture

- Fraction Vegetation Cover
- Phenology
- Net Primary Production
- Gross Primary Production

ECVs and EBVs requirements

- GCOS **ECVs requirements**, e.g., temporal and spatial resolution, stability and uncertainty
- More stringent requirements in **2022 edition** for several ECVs
- These are the main drivers for developing **LPV protocols**
- **No mature** requirements yet for **biodiversity** metrics, work is ongoing to fill this gap

The 2022 GCOS ECVs Requirements

ГЛОБАЛЬНАЯ СИСТЕМА НАБЛЮДЕНИЙ ЗА КЛИМАТОМ

SYSTÈME MONDIAL D'OBSERVATION DU CLIMAT

النظام العالمي لرصد المناخ

全球气候观测系统

SISTEMA MUNDIAL DE OBSERVACIÓN DEL CLIMA

GLOBAL CLIMATE OBSERVING SYSTEM

GCOS – 245

GLOBAL CLIMATE OBSERVING SYSTEM

2022 GCOS ECVs Requirements

9.2 ECV: Albedo

9.2.1 ECV Product: Spectral and Broadband (Visible, Near Infrared and Shortwave) DHR & BHR[1] with Associated Spectral Bidirectional Reflectance Distribution Function (BRDF) Parameters

Name	**Spectral and Broadband (visible, near infrared and shortwave) DHR & BHR with Associated Spectral Bidirectional Reflectance Distribution Function (BRDF) parameters (required to derive albedo from reflectance)**				
Definition	The land surface albedo is the ratio of the radiant flux reflected from Earth's surface to the incident flux. Each spectral/broadband value depends on natural variations and is highly variable in space and time as a result of terrestrial properties changes, and with illumination conditions.				
Unit	Dimensionless				
Note	Length of record: Threshold: 20 years; Target: > 40 years				
Requirements					
Item needed	**Unit**	**Metric**	**[1]**	**Value**	**Notes**
Horizontal Resolution	m		G	10	Due to the heterogeneous nature of terrestrial surfaces, having surface albedo at such scale will increase accuracy for further assimilation of local/regional climate model.
			B		
			T	250	Enable assimilation in earth/climate model.
Vertical Resolution			G	-	N/A
			B	-	
			T	-	
Temporal Resolution	day		G	1	For climate change services. Multi-angular instruments (including geostationary) and/or accumulation of daily data for BRDF parameters retrieval.
			B		
			T	10	For assimilation in earth/climate model. Same as above as mono-angular
Timeliness	day		G	1	For climate change services.
			B		
			T	5	For NRT reanalysis.
Required Measurement Uncertainty	%	1 standard deviation or error covariance matrix, with associated PDF shape (functional form of estimated error distribution for the term)	G	3% for values ≥0.05; 0.0015 (absolute value) for smaller values	"A change of 1% to the Earth's albedo has a radiative effect of 3.4 W/m²" Over snow-free and snow-covered land, climate, biogeochemical, hydrological, and weather forecast models require this uncertainty.
			B		
			T	5% for values ≥0.05; 0.0025 for smaller values	See Ohring, et al. 2005
Stability	% / decade	A factor of uncertainties to demonstrate that the 'error' of the product remains constant over the period, typically a decade or more	G	< 1 %	Rate of change of surface albedo over the available time period (per decade). The required stability is some fraction of the expected signal' (see Ohring, et al. 2005)
			B		
			T	< 1.5 %	
	Boussetta S., Balsamo G., Dutra E., Beljaars A., Albergel C. (2015). Assimilation of surface albedo and vegetation states from satellite observations and their impact on numerical weather prediction, Remote Sensing of Environment, pp. 111-126. DOI:10.1016/j.rse.2015.03.009 Ohring, G., Wielicki, B., Spencer, R., Emery, B., & Datla, R. (2005). Satellite instrument calibration for measuring global climate change: Report of a workshop. Bulletin of the American Meteorological Society, 86(9), 1303-1314.				

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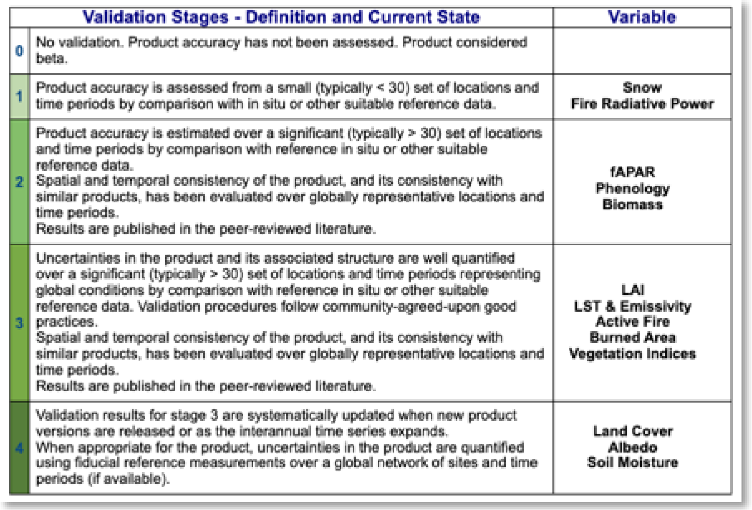
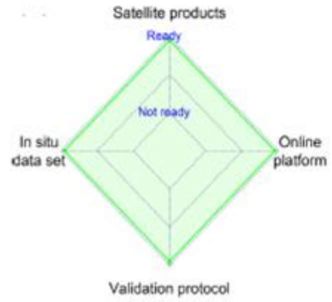
[1] DHR: Directional Hemispheric Reflectance; BHR: Bidirectional Hemispheric Reflectance.

LPV Validation Framework

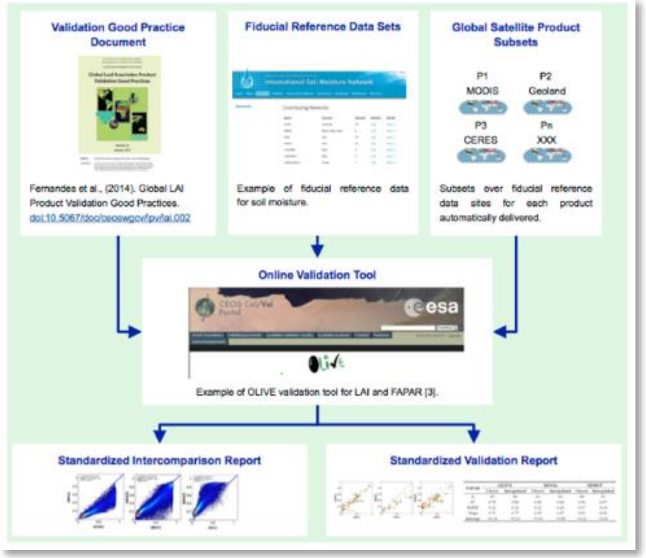
- ❖ LPV **maturity** concept / framework to ensure common approaches to the validation of terrestrial ECVs
- ❖ LPV framework basic **elements**:
    - Fiducial Reference Data
    - Validation Good Practices
    - Reference satellite products
    - On-line validation tools
- ❖ Availability of on-line validation **tool** prerequisite to reach **Stage “4”**



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**
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**



Bayat et al. 2020



Validation Good Practice Document

Fernandes et al., (2014). Global LAI Product Validation Good Practices. doi:10.5067/doc/ceoswgcv/lpv/lai.002

Fiducial Reference Data Sets

Example of fiducial reference data for soil moisture.

Global Satellite Product Subsets

Subsets over fiducial reference data sites for each product automatically delivered.

Online Validation Tool

Example of OLIVE validation tool for LAI and FAPAR [3].

Standardized Intercomparison Report

Standardized Validation Report

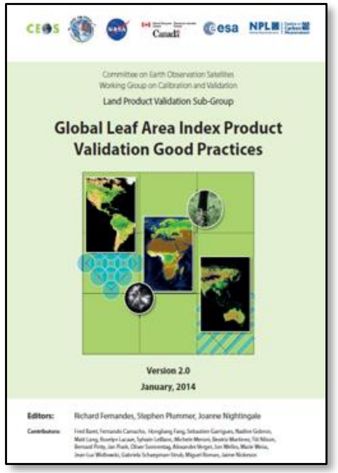
LPV Protocols

- ❖ **LC protocol** being finalised to be endorsed at WGCV / CEOS level !
- ❖ **LAI protocol** review: adding **fCover, fAPAR,** higher resolution data (**<100m**), RSE paper
- ❖ First draft **VI protocol**

Summary - Annual Downloads

Year	AGB	SM	Albedo	LST	LAI*
2016					53
2017				17	58
2018				104	142
2019			126	79	95
2020		102	122	106	134
2021	445	126	90	81	129
2022	188	55	48	52	93
2023	239	77	60	79	104
2024	328	69	58	105	136
2025^	92	49	13	21	24
Totals	**1292**	**478**	**517**	**644**	**968**

*LAI missing stats from Aug2014 - Jun2016, ^thru May



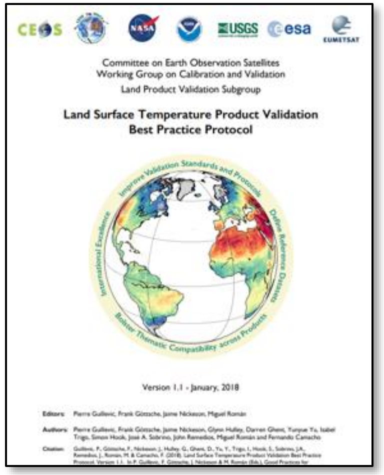
Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Sub-Group

Global Leaf Area Index Product Validation Good Practices

Version 2.0
January, 2014

Editors: Richard Fernandes, Stephen Plummer, Joanne Nightingale

2014 - LAI



Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Subgroup

Land Surface Temperature Product Validation Best Practice Protocol

Version 1.1 - January, 2018

Editors: Pierre Guillevic, Frank Göttsche, Jaime Nickeson, Miguel Román

Authors: Pierre Guillevic, Frank Göttsche, Jaime Nickeson, Glynn Hulley, Darren Ghent, Yunyue Yu, Isabel Trigo, Simon Hook, José A. Sobrino, John Remedios, Miguel Román and Fernando Camacho

2018 - LST

Committee on Earth Observation Satellites

Working Group on Calibration and Validation

Land Product Validation Subgroup

Global Surface Albedo Product Validation Best Practices Protocol

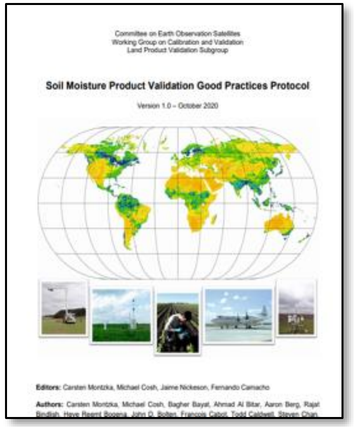
Version 1.0 – 2018

Editors: Zhuosen Wang, Jaime Nickeson, Miguel Román

Authors: Zhuosen Wang, Crystal Schaaf, Alessio Lattanzio, Dominique Carrer, Ian Grant, Miguel Román, Fernando Camacho, Yunyue Yu, Jorge Sánchez-Zapero, Jaime Nickeson

Citation: Wang, Z., Schaaf, C., Lattanzio, A., Carrer, D., Grant, I., Román, M., Camacho, F., Yu, Y., Sánchez-Zapero, J. & Nickeson, J. (2019). Global Surface Albedo Product Validation Best Practices Protocol. Version 1.0. In Z. Wang, J. Nickeson & M. Román (Eds.), Good Practices for Satellite Derived Land Product Validation (p. 45): Land Product Validation

2019 - Albedo



Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Subgroup

Soil Moisture Product Validation Good Practices Protocol

Version 1.0 – October 2020

Editors: Carsten Montzka, Michael Cosh, Jaime Nickeson, Fernando Camacho

Authors: Carsten Montzka, Michael Cosh, Bagher Bayat, Ahmad Al Bitar, Aaron Berg, Rajat Bindlish, Heye Reemt Bogena, John D. Bolten, François Cabot, Todd Caldwell, Steven Chan

2020 - SM

Committee on Earth Observation Satellites

Working Group on Calibration and Validation
Land Product Validation Subgroup

Aboveground Woody Biomass Product Validation

Good Practices Protocol

Version 1.0 – 2021

Editors: Laura Duncanson, Mat Disney, John Armston, Jaime Nickeson, David Minor, Fernando Camacho

2021 - AGB

Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Subgroup
Land Cover Focus Area

Land Cover and Change Map Accuracy Assessment and Area Estimation Good Practices Protocol

Version 0.1 - 2024

Editors: Alexandra Tyukavina, Sophie Bontemps, Giles Foody, Stephen V. Stehman, Anna Komarova, Jaime Nickeson

Chapter leads: Alexandra Tyukavina (Chapters 1 - 5), Sophie Bontemps (Chapters 1, 2, Appendix), Pontus Olofsson (Chapters 3, 5), Giles Foody and Julien Radoux (Chapter 4), Linda See and Bryant Serre (Chapter 6), Xiao-Peng Song (Chapter 7)

2025 - LC

LPV Datasets and Tools

- Available in Cal/Val portal:
  - **LPV Direct 2.1 dataset** for LAI, fAPAR, fCover coarse resolution
  - **SALVAL Tool** for broadband albedo coarse resolution using ground-based data and reference satellite products
  - **OLIVE Tool** for LAI/fAPAR outdated, long-standing open **action** → ESA project to update this tool, start 2026 (TBC)

LPV DIRECT V2.1 DB

CEOS WGCV LPV DIRECT V2.1 database

Ground references of high quality are needed to validate satellite-based products. The DIRECT V2.1 database compiles Leaf Area Index (LAI), fraction of absorbed photosynthetically active radiation (FAPAR) and fraction of vegetation cover (FCover) averaged values over a 3 km x 3 km area. The ground data was upscaled using high spatial resolution imagery following CEOS WGCV LPV LAI good practices to properly account for the spatial heterogeneity of the site. Ground measurements including in the first version (DIRECT) were resulting from several international activities including VALERI, BigFoot, SAFARI-2000, CCRS, Boston University and ESA campaigns compiled by S. Garrigues (Garrigues et al., 2008), and later ingested in the CEOS WGCV LPV OLIVE tool (Weiss et al., 2014) for accuracy assessment. F. Camacho reviewed DIRECT to remove those sites without understory measurements (Camacho et al., 2013) and after that expanded the database with ImagineS sites (Camacho et al., 2021). DIRECT V2.1 is the last update including 44 new sites from China (Fang et al., 2019; Song et al., 2021) and 2 sites from ESA FRM4Veg (Brown et al., 2021).

The CEOS WGCV LPV DIRECT V2.1 database constitutes a major effort of the international community to

SALVAL

The overall aim of SALVAL is to **bring together validation good practices protocols, ground data and satellite products** to provide users with **traceable** (i.e. reproducible) **validation results** allowing reaching **CEOS WGCV LPV validation Stage 4**.

OLIVE Description - OLIVE

OLIVE Main Description

OLIVE PAPER WAS PUBLISHED IN MAY 2014 IN OPEN ACCESS:

Weiss, M.; Baret, F.; Block, T.; Koetz, B.; Burini, A.; Scholze, B.; Lecharpentier, P.; Brockmann, C.; Fernandes, R.; Plummer, S.; Myneni, R.; Gobron, N.; Nightingale, J.; Schaepman-Strub, G.; Camacho, F.; Sanchez-Azofeifa, A. On Line Validation Exercise (OLIVE): A Web Based Service for the Validation of Medium Resolution Land Products. Application to FAPAR Products. *Remote Sens.* **2014**, *6*, 4190-4216. URL

OLIVE (On Line Interactive Validation Exercise) system provides three main functionalities:

Information to the scientific community, including:

- Description of the main functionalities of the OLIVE Matlab Validation Core Code (MVCC) used to generate the validation exercise report.
- List of publically available products to run a validation exercise
- Dataset description (BELMANIP2 and DIRECT, please note that the updated version DIRECT 2.0 is also available)
- Publically available validation results

Validation exercise:

- The user can run a validation exercise by choosing the products and the time period he requires to validate them
- The user can make his results available to the OLIVE community or keep them private
- A brief description, as well as a more complete user guide is provided to use OLIVE MVCC

LPV communications

- ❖ Annual Newsletters (email)
- ❖ Quarterly telecons (Web)
- ❖ Yearly **tag up** meetings with each FA (VI/Phenology and ET already done)
- ❖ Up-to-date Web / list of products / key references
- ❖ Workshops or special sessions per variable (every 2-3 years)
- ❖ Plenary LPV meeting (every 1 or 2 years)

https://lpvs.gsfc.nasa.gov/

National Aeronautics and Space Administration
Goddard Space Flight Center

CEOS Working Group on Calibration and Validation

Land Product Validation Subgroup

LPV Focus Areas

- Biophysical
- Fire/Burn Area
- Phenology
- Vegetation Index
- Land Cover
- Snow Cover
- Surface Radiation
- Soil Moisture
- LST and Emissivity
- Aboveground Biomass
- Evapotranspiration

LPV Supersites

LPV Meetings and Telecons

The mission of the CEOS Land Product Validation (LPV) subgroup is to coordinate the quantitative validation of satellite-derived products. The focus lies on standardized intercomparison and validation across products from different satellite, algorithms, and agency sources.

The sub-group consists of 12 Focus Areas, with 2 or 3 co-leads responsible for each land surface variable (essential climate and biodiversity variables).

CEOS VALIDATION HIERARCHY

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

LPV Plenary 2025

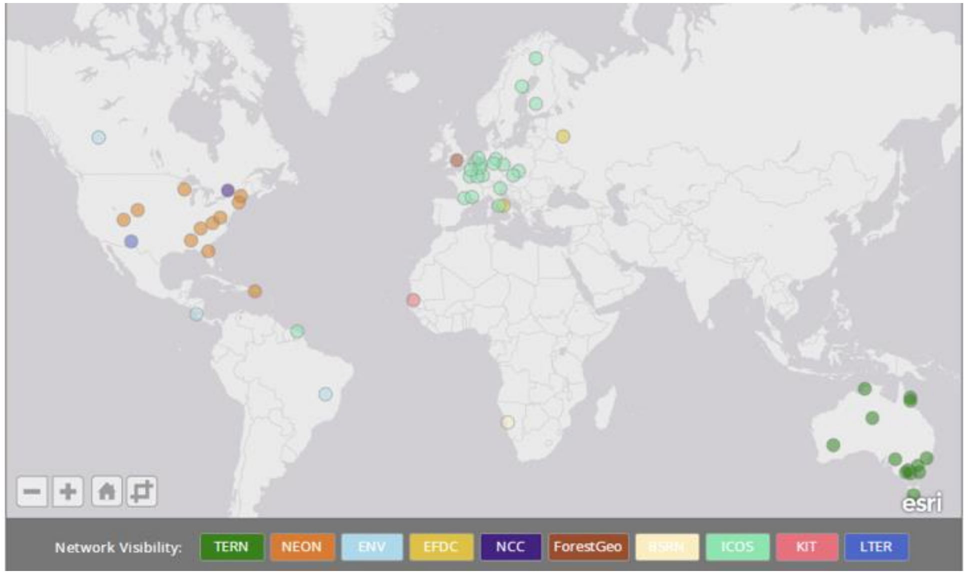
- Half-day LPV plenary organised during the **LPS25** week
- **Reports** from all FA leads covering all variables
- Large number of input and **recommendations** gathered
- Basis for **LPV Action Plan** for the 2025-28 period
- Content in this presentation extracted from the plenary

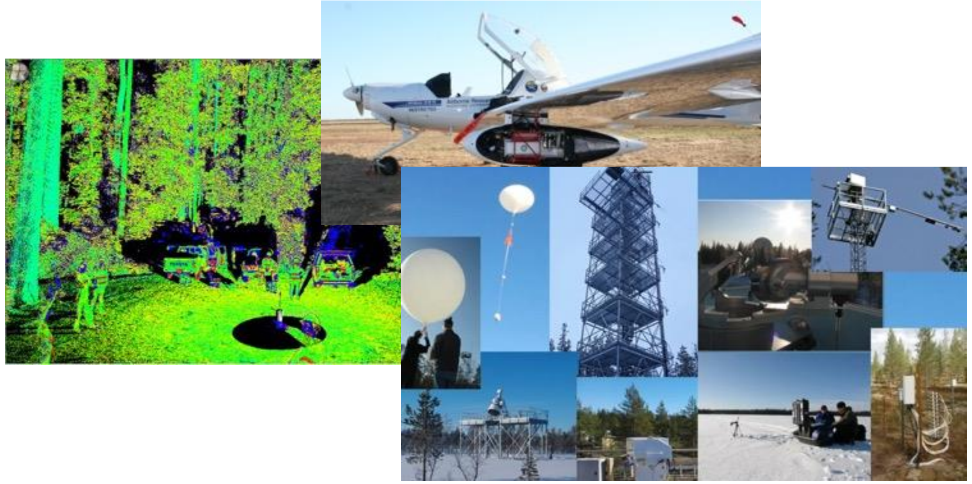
Thursday 26th June 2025

14:00	Start meeting	
Introduction		
14:00 – 14:15	CEOS-LPV status and plans, updates on ESA Ca/Val projects	Fabrizio Niro (Serco/ESA), Jaime Nickeson (GSFC/NASA)
14:15 – 14:30	LPV Supersites update	Fernando Camacho (EOLab) – In person
FA updates		
14:30 – 14:45	Land Cover	Sasha Tyukavina (UMD), Nandika Tsendbazar (WUR) – In person
14:45 – 15:00	Biophysical	Luke Brown (Salford University), Richard Fernandes (NRC) – In person
15:00 – 15:15	Fire	Bernardo Mota (NPL) – In person
15:15 – 15:30	Soil Moisture	Alexander Gruber (TUW) – In person
15:30 – 16:00	Coffee break	
16:00 – 16:15	Snow Cover	Juha Lemmetyinnen (FMI), Carrie Vuyovich (NASA) – Slides presented by FN
16:15 – 16:30	Above Ground Biomass	Kim Calders (U. Ghent), Neha Hunka (ESA/ESRIN) – Slides presented by FN
16:30 – 16:45	Land Surface Temperature	Lluis Perez Plannels (IMK) – In person
16:45 – 17:00	GPP/NPP	Alvaro Moreno (UV) – In person
17:00 – 17:15	Phenology	Victor Rodriguez Galiano (U. Seville) – In person
17:15 – 17:30	Surface Radiation	Jorge Sanchez Zapero (EOLab), Angela Erb (Leidos), Zhuosen Wang (NASA) – Remote
17:30 – 17:45	Evapotranspiration	Yun Yang (Cornell University) – Remote
17:45 – 18:00	Vegetation Indices	Simon Kraatz (USDA), Tomoaki Miura (U. Hawaii) – Remote
18:00 – 18:15	Wrap up and Closing remarks	F. Niro, J. Nickeson
18:15	End of Meeting	

LPV Supersites

- ❖ In **2016**, LPV **supersites** (55) defined to address CEOS CV-12 action :
  - Well characterised site canopy structure for **RTM-based** validation
  - Useful for validating at least **3 ECVs**
  - Long term **operations**, part of established networks (e.g., ICOS, NEON, TERN)
  - Community-agreed **protocols**
  - Ideally supported by airborne / Lidar
- ❖ Since 2016, landscape **evolved**:
  - New sites/networks, new variables, advanced sensors (UAV), new missions





LPV Supersites update

- Review **definition**
  - Expand variables: SR, **ET**, **GPP/NPP**, **SIF**
  - For validation of at least **3 FA groups**
  - Assess spatial **representativeness**
  - Adherence (ideal) to **CEOS-FRM** concept
  - Adding **UAV-LiDAR** as ideal component
- Sites selection (220+ candidate)
  - Review ecosystem **networks** for recent protocol updates (e.g., ICOS fAPAR)
  - Include **recent** networks /sites
  - **Ranking:** ancillary data, priority to under-sampled biomes/regions
  - List (**Q4 2025**) for WGCV endorsement

FA status report

▨ Biophysical	⬜ Fires	⬜ Phenology	🟦 Vegetation Index
🟩 Land Cover	⬜ Snow	▨ Surface Radiation	▨ Soil Moisture
🟩 LST / LSE	🟩 Biomass	⬜ Evapotranspiration	⬜ GPP/NPP

🟩 Protocol Ready

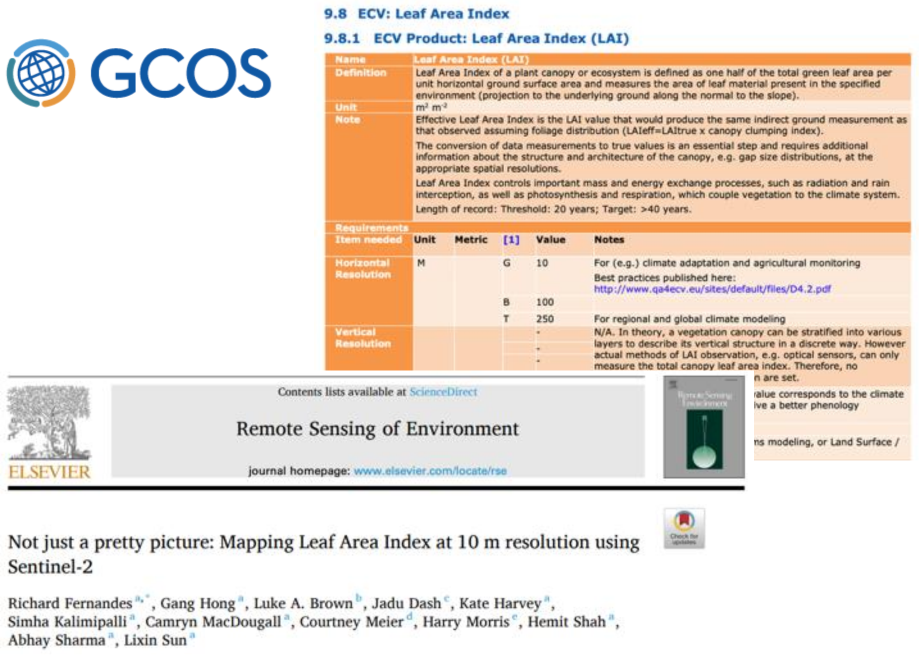
▨ Update on going / planned

🟦 Draft ready

⬜ Draft on going

Biophysical

- ❖ LAI 2014 protocol revision
  - More stringent **GCOS** requirements
  - Add new variable: **FCover**, **fAPAR**
  - High-resolution products (**<100 m**)
  - Focus on uncertainty (**FRM4VEG**)
  - Technological **advances** (automated sensors, UAV-based)
- ❖ Status of protocol update
  - **RSE paper** (draft) as initial step
  - First call to community gathering sent



GCOS

9.8 ECV: Leaf Area Index

9.8.1 ECV Product: Leaf Area Index (LAI)

Name	Leaf Area Index (LAI)				
Definition	Leaf Area Index of a plant canopy or ecosystem is defined as one half of the total green leaf area per unit horizontal ground surface area and measures the area of leaf material present in the specified environment (projection to the underlying ground along the normal to the slope).				
Unit	$m^2 m^{-2}$				
Note	Effective Leaf Area Index is the LAI value that would produce the same indirect ground measurement as that observed assuming foliage distribution (LAIeff=LAItrue x canopy clumping index). The conversion of data measurements to true values is an essential step and requires additional information about the structure and architecture of the canopy, e.g. gap size distributions, at the appropriate spatial resolutions. Leaf Area Index controls important mass and energy exchange processes, such as radiation and rain interception, as well as photosynthesis and respiration, which couple vegetation to the climate system. Length of record: Threshold: 20 years; Target: >40 years.				
Requirements					
Item needed	Unit	Metric	[1]	Value	Notes
Horizontal Resolution	M		G	10	For (e.g.) climate adaptation and agricultural monitoring Best practices published here: http://www.qa4ecv.eu/sites/default/files/D4.2.pdf
			B	100	
			T	250	For regional and global climate modeling
Vertical Resolution				-	N/A. In theory, a vegetation canopy can be stratified into various layers to describe its vertical structure in a discrete way. However actual methods of LAI observation, e.g. optical sensors, can only measure the total canopy leaf area index. Therefore, no
				-	n are set.
				-	
					value corresponds to the climate ive a better phenology
					ns modeling, or Land Surface /

ELSEVIER

Contents lists available at ScienceDirect

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

Not just a pretty picture: Mapping Leaf Area Index at 10 m resolution using Sentinel-2

Richard Fernandes[a,*], Gang Hong[a], Luke A. Brown[b], Jadu Dash[c], Kate Harvey[a], Simha Kalimipalli[a], Camryn MacDougall[a], Courtney Meier[d], Harry Morris[e], Hemit Shah[a], Abhay Sharma[a], Lixin Sun[a]

Fernandes et al. 2025

Biophysical

- ❖ **GROUNDED EO** database
  - 81 NEON, ICOS & TERN sites (2013-2022)
  - > 16,000 FRM (**LAI, FAPAR, FCOVER**)
  - Provided at **ESU** scale (10 m to 100 m)
  - **Uncertainties** following FRM4VEG
  - Available on **Zenodo**, **Cal/Val portal**
- ❖ Recent **updates**
  - **ICOS** LAI/fAPAR **protocols** being updated align to FRM4VEG and LPV protocols
  - Tackling long standing action: **improving** use of ICOS for Cal/Val (NUBICOS EU)

Contents lists available at ScienceDirect

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

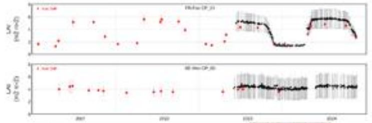
GROUNDED EO: Data-driven Sentinel-2 LAI and FAPAR retrieval using Gaussian processes trained with extensive fiducial reference measurements

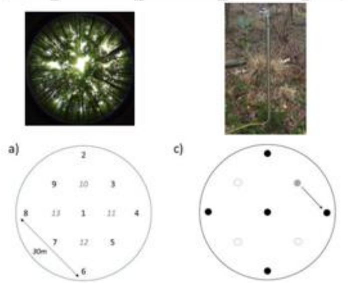
Luke A. Brown[a,*], Richard Fernandes[b], Jochem Verrelst[c], Harry
Pablo Reyes-Muñoz[c], Dávid D.Kovács[c], Courtney Meier[e]

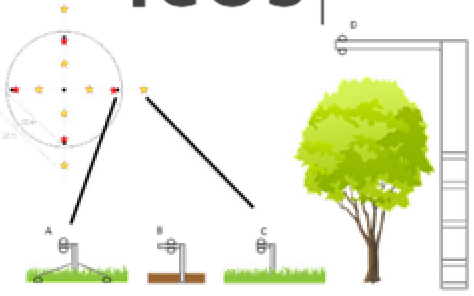
Brown et al. 2025

CEOS Cal/Val Portal

Cal/Val Data Access

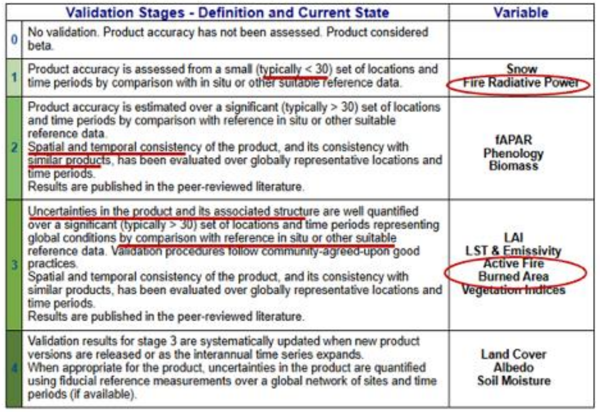






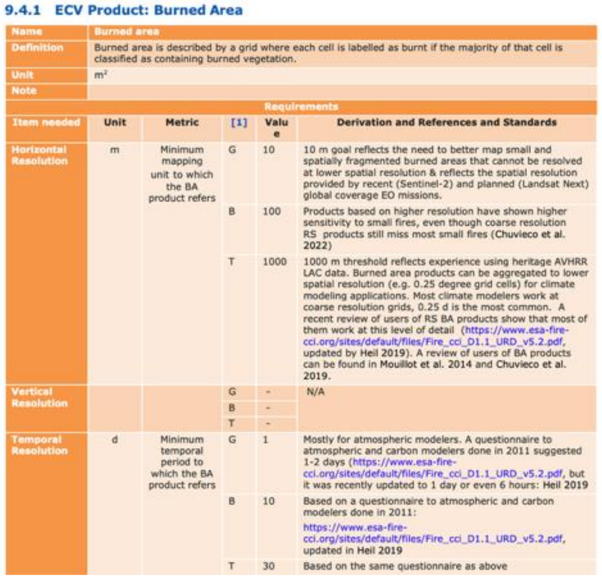
Fires

- Gaps / challenges (BA, AF, FRP)
  - Lack of community **protocols**
  - Focus on **higher resolution** (<100m)
  - Lack of **uncertainties** / traceability (BA)
  - Ephemerality of the phenomenon (**FRP**): challenges in **spatiotemporal** comparison
  - **Scarcity** of field campaigns data
- Yet, growing **interest**
  - Emerging **commercial** data providers
  - Relevance for **biodiversity** monitoring, climate adaptation and mitigation



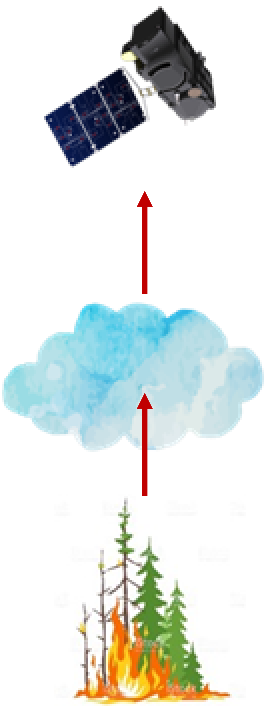
Validation Stages - Definition and Current State		Variable
0	No validation. Product accuracy has not been assessed. Product considered beta.	
1	Product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in situ or other suitable reference data.	Snow 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
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

GCOS



9.4.1 ECV Product: Burned Area

Name	Burned area				
Definition	Burned area is described by a grid where each cell is labelled as burnt if the majority of that cell is classified as containing burned vegetation.				
Unit	m²				
Note					
Requirements					
Item needed	Unit	Metric	[1]	Value	Derivation and References and Standards
Horizontal Resolution	m	Minimum mapping unit to which the BA product refers	G	10	10 m goal reflects the need to better map small and spatially fragmented burned areas that cannot be resolved at lower spatial resolution & reflects the spatial resolution provided by recent (Sentinel-2) and planned (Landsat Next) global coverage EO missions.
			B	100	Products based on higher resolution have shown higher sensitivity to small fires, even though coarse resolution RS products still miss most small fires (Chuvieco et al. 2022)
			T	1000	1000 m threshold reflects experience using heritage AVHRR LAC data. Burned area products can be aggregated to lower spatial resolution (e.g. 0.25 degree grid cells) for climate modeling applications. Most climate modelers work at coarse resolution grids, 0.25 d is the most common. A recent review of users of RS BA products show that most of them work at this level of detail (https://www.esa-fire-cci.org/sites/default/files/Fire_cci_D1.1_URD_v5.2.pdf, updated by Heil 2019). A review of users of BA products can be found in Mouillot et al. 2014 and Chuvieco et al. 2019.
Vertical Resolution			G	-	N/A
			B	-	
			T	-	
Temporal Resolution	d	Minimum temporal period to which the BA product refers	G	1	Mostly for atmospheric modelers. A questionnaire to atmospheric and carbon modelers done in 2011 suggested 1-2 days (https://www.esa-fire-cci.org/sites/default/files/Fire_cci_D1.1_URD_v5.2.pdf, but it was recently updated to 1 day or even 6 hours: Heil 2019
			B	10	Based on a questionnaire to atmospheric and carbon modelers done in 2011: https://www.esa-fire-cci.org/sites/default/files/Fire_cci_D1.1_URD_v5.2.pdf, updated in Heil 2019
			T	30	Based on the same questionnaire as above



Fires

❖ BA

- **Draft** being prepared (Q4 2025)
- Still some **disagreement** for sample sizes, metrics and collocation criteria
- Final **discussion** at upcoming GOFC

❖ FRP

- Relying on **airborne** campaigns: limit to stage 2 (< 30 sites): review **LPV stage** ?
- FRP airborne Vs satellite **comparison** challenge: temporal and spatial scale
- **FRM4Fire** traceability chain/uncertainty for FRP → Protocol draft (2026)

Contents lists available at ScienceDirect

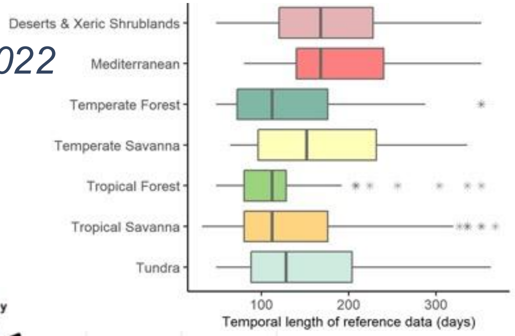
Remote Sensing of Environment

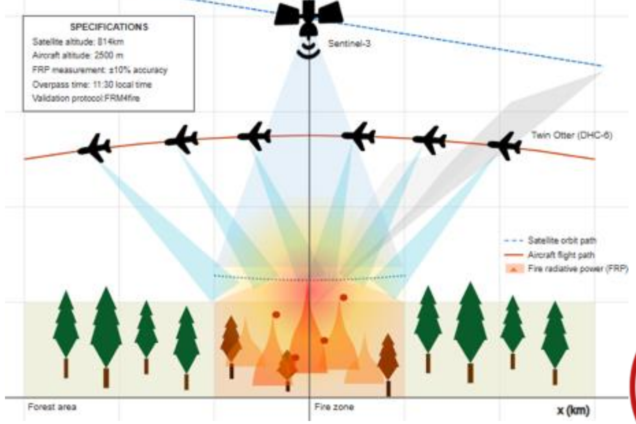
journal homepage: www.elsevier.com/locate/rse

Using long temporal reference units to assess the spatial accuracy of global satellite-derived burned area products

Magí Franquesa[a,*], Joshua Lizundia-Loiola[a], Stephen V. Stehman[b], Emilio Chuvieco[a]

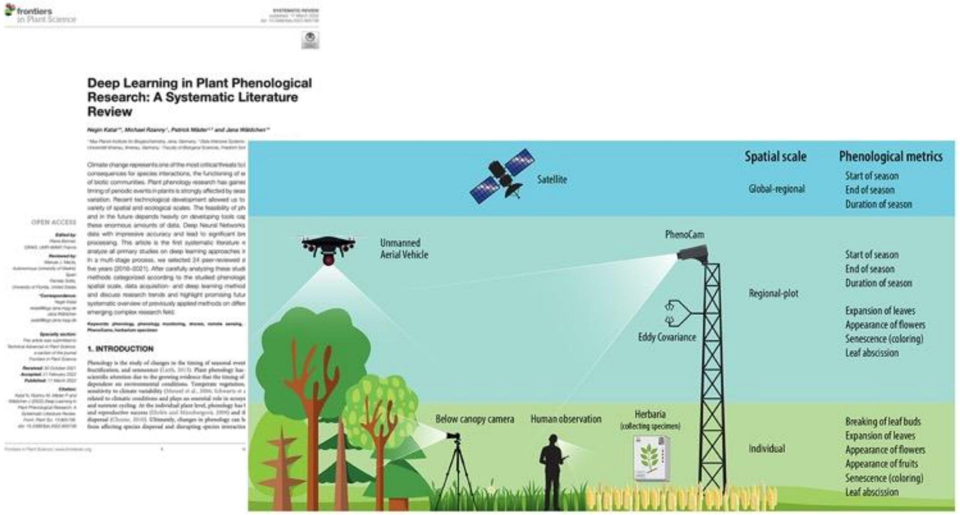
Franquesa et al. 2022





Phenology and VI

- **LSP protocol** being drafted
    - Large **variety** of Cal/Val sources different spatiotemporal scale
    - Emerging use of **UAV**: review paper being prepared
    - Focus on **HR**, Copernicus HR-VPP Phenology products (10m)
    - Ground-based networks (PhenoCam, national networks, Flux Towers)
- **VI draft protocol** under revision, Q4 2025 for release

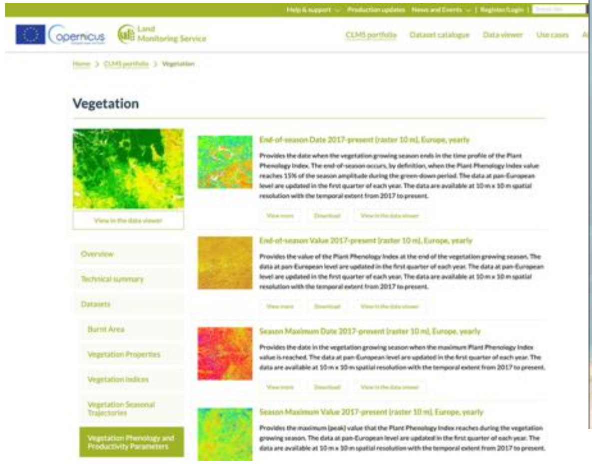


frontiers in Plant Science

Deep Learning in Plant Phenological Research: A Systematic Literature Review

1. INTRODUCTION

Katal et al. 2022



Vegetation

End-of-season Date 2017-present (raster 10 m), Europe, yearly

Provides the date when the vegetation growing season ends in the time profile of the Plant Phenology Index. The end-of-season occurs, by definition, when the Plant Phenology Index value reaches 15% of the season amplitude during the green-down period. The data at pan-European level are updated in the first quarter of each year. The data are available at 10 m x 10 m spatial resolution with the temporal extent from 2017 to present.

End-of-season Value 2017-present (raster 10 m), Europe, yearly

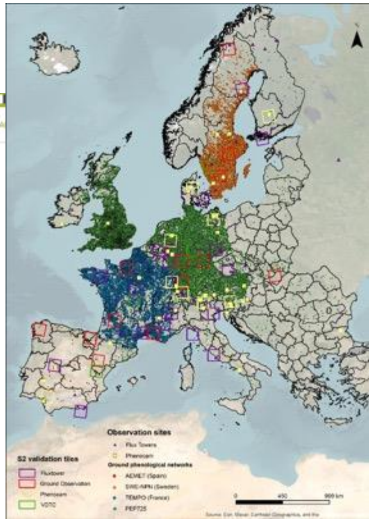
Provides the value of the Plant Phenology Index at the end of the vegetation growing season. The data at pan-European level are updated in the first quarter of each year. The data at pan-European level are updated in the first quarter of each year. The data are available at 10 m x 10 m spatial resolution with the temporal extent from 2017 to present.

Season Maximum Date 2017-present (raster 10 m), Europe, yearly

Provides the date in the vegetation growing season when the maximum Plant Phenology Index value is reached. The data at pan-European level are updated in the first quarter of each year. The data are available at 10 m x 10 m spatial resolution with the temporal extent from 2017 to present.

Season Maximum Value 2017-present (raster 10 m), Europe, yearly

Provides the maximum (peak) value that the Plant Phenology Index reaches during the vegetation growing season. The data at pan-European level are updated in the first quarter of each year. The data are available at 10 m x 10 m spatial resolution with the temporal extent from 2017 to present.



Land Cover

❖ Status and Challenges

- Ever **increasing** number of HR maps
- Accuracy estimate not **comparable**
- HR not always more **spatial details**
- Accuracy vary per **continent**

❖ Way forward

- Ensemble validation datasets to ease **comparability**
- Need **community protocol** for producers, users, and agencies

Contents lists available at ScienceDirect

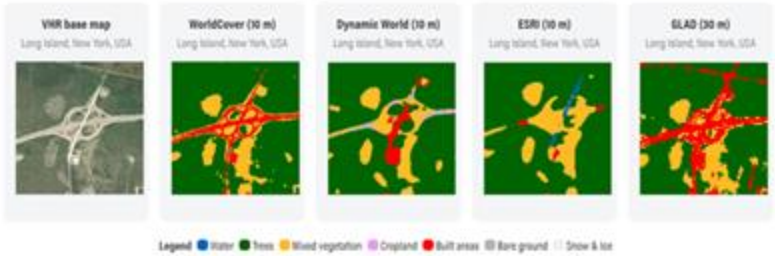
Remote Sensing of Environment

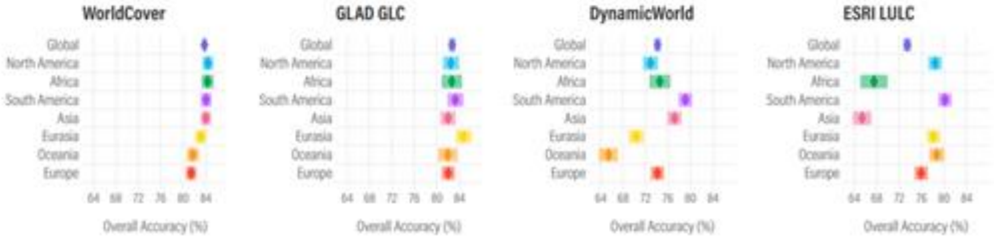
journal homepage: www.elsevier.com/locate/rse

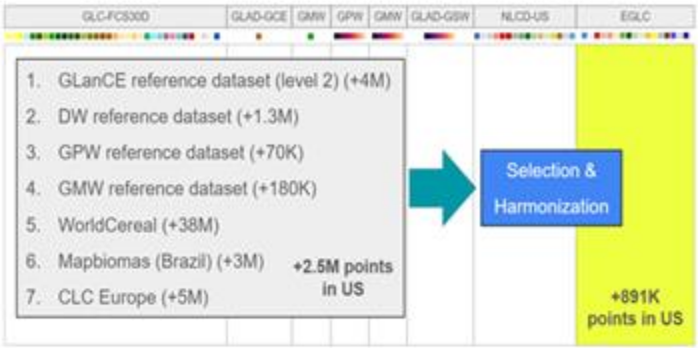
Comparative validation of recent 10 m-resolution global land cover maps

Panpan Xu[a], Nandin-Erdene Tsendbazar[a,*], Martin Herold[a,b], Sytze de Bruin[a], Myke Koopmans[a], Tanya Birch[c], Sarah Carter[d], Steffen Fritz[e], Myroslava Lesiv[e], Elise Mazur[d], Amy Pickens[f], Peter Potapov[f], Fred Stolle[d], Alexandra Tyukavina[f], Ruben Van De Kerchove[g], Daniele Zanaga[g]

Xu et al. 2024







1. GLanCE reference dataset (level 2) (+4M)
2. DW reference dataset (+1.3M)
3. GPW reference dataset (+70K)
4. GMW reference dataset (+180K)
5. WorldCereal (+38M)
6. Mapbiomas (Brazil) (+3M)
7. CLC Europe (+5M)

Land Cover

❖ LC Protocol

- **V0.1** comments from 12 reviewers: Europe (6), USA (4), China (1), Brazil (1)
- Overall feedback overwhelmingly **positive**, strong interest
- New sections on Definitions, **GCOS** requirements and **FRM** concept
- **V1.0** Q3 2025 for endorsement at WGCV and CEOS level
- **Reference** guidelines for current and upcoming new HR LC maps

Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Subgroup
Land Cover Focus Area

Land Cover and Change Map Accuracy Assessment and Area Estimation Good Practices Protocol

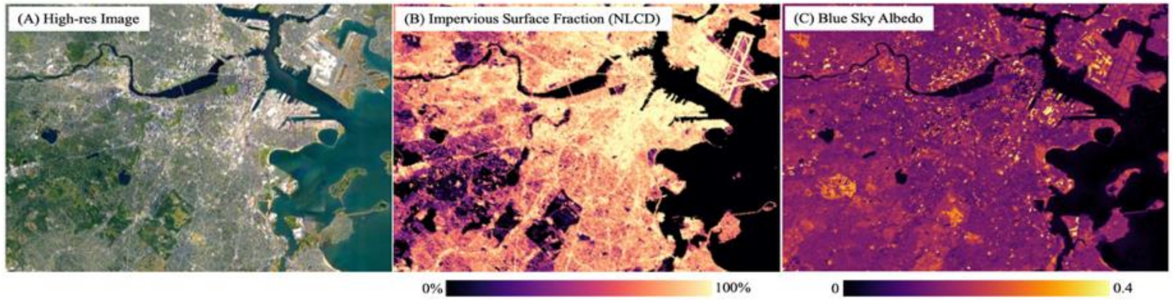
Version 0.1 - 2024

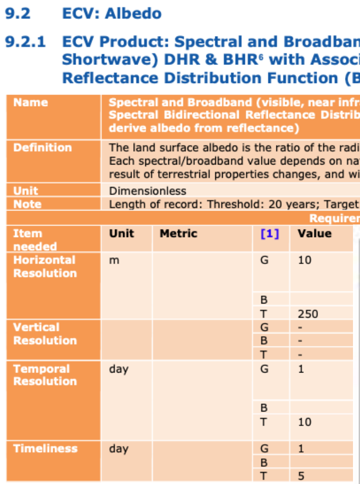
Editors: Alexandra Tyukavina, Sophie Bontemps, Giles Foody, Stephen V. Stehman, Anna Komarova, Jaime Nickeson

Chapter leads: Alexandra Tyukavina (Chapters 1 - 5), Sophie Bontemps (Chapters 1, 2, Appendix), Pontus Olofsson (Chapters 3, 5), Giles Foody and Julien Radoux (Chapter 4), Linda See and Bryant Serre (Chapter 6), Xiao-Peng Song (Chapter 7)

Surface Radiation

- ❖ Emerging focus on **HR** data (<100m) for **urban** climate
- ❖ GCOS 2022 updates
  - **Higher** spatiotemporal resolution
  - Added **BRDF** parameters, **spectral** albedo (DHR, BHR)
- ❖ Status within LPV
  - Existing protocol / tool focus on **coarse** resolution broadband using tower-based + intercomparison
  - Need practices / reference for **BRDF** and **spectral albedo** validation





9.2 ECV: Albedo

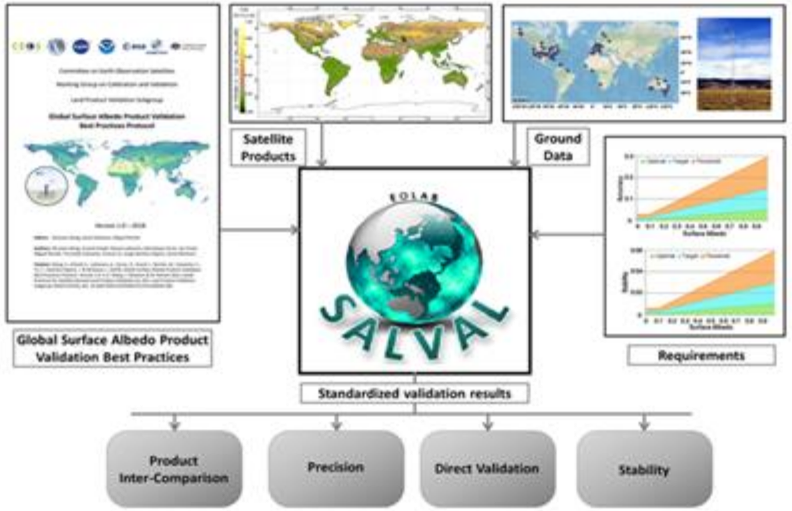
9.2.1 ECV Product: Spectral and Broadband (Visible, Near Infrared and Shortwave) DHR & BHR[6] with Associated Spectral Bidirectional Reflectance Distribution Function (BRDF) Parameters

Name	**Spectral and Broadband (visible, near infrared and shortwave) DHR & BHR with Associated Spectral Bidirectional Reflectance Distribution Function (BRDF) parameters (required to derive albedo from reflectance)**
Definition	The land surface albedo is the ratio of the radiant flux reflected from Earth's surface to the incident flux. Each spectral/broadband value depends on natural variations and is highly variable in space and time as a result of terrestrial properties changes, and with illumination conditions.
Unit	Dimensionless
Note	Length of record: Threshold: 20 years; Target: > 40 years

Requirements

Item needed	**Unit**	**Metric**	[1]	**Value**
Horizontal Resolution	m		G	10
			B	
			T	250
Vertical Resolution			G	-
			B	-
			T	-
Temporal Resolution	day		G	1
			B	
			T	10
Timeliness	day		G	1
			B	
			T	5

https://eolab.es/salval/

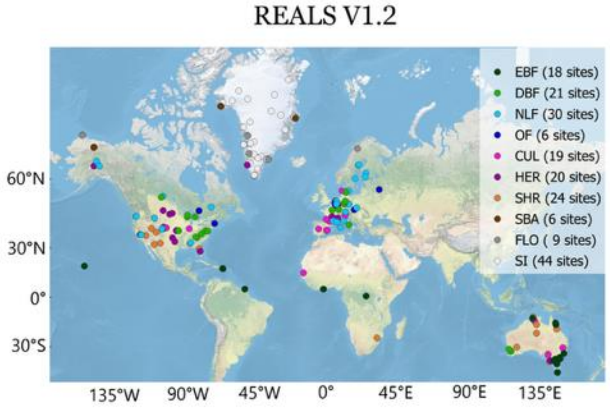


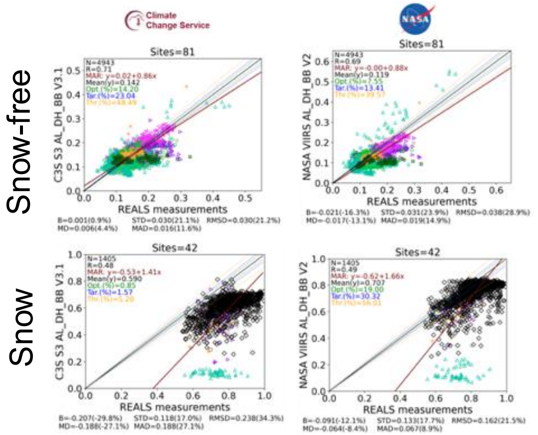
Surface Radiation

- ❖ Update of protocol:
  - Response to **GCOS updates**
  - Best practices for **BRDF** and **spectral albedo** validation
  - Finalize Global **Downward Radiation** Protocol (draft)
- ❖ SALVAL tool update
  - Annual **maintenance**
  - **Expand REALS** tower-based data from 99 to ~200 sites
  - Improve **sampling** LANDVAL V2

Representativeness-Evaluated ALbedo Stations (REALS)

A unique high quality-controlled sub-set of **in situ measurements** selected from tower-based stations (e.g., FLUXNET, BSRN, SURFRAD) that meet the CEOS LPV validation protocol (including spatial representativeness). Recent inclusion of PROMICE **snow/ice** sites in Greenland.



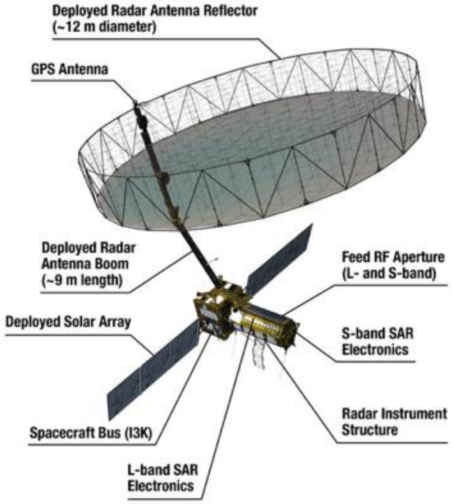


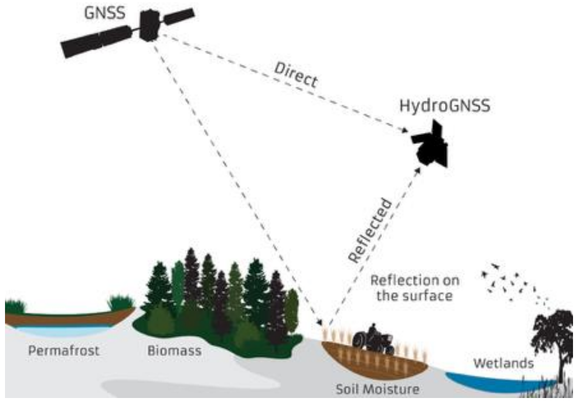
LANDVAL V2

Improve sampling scheme from LANDVAL V1 to V2 global sampling for product intercomparison → from 720 to 2000 sites

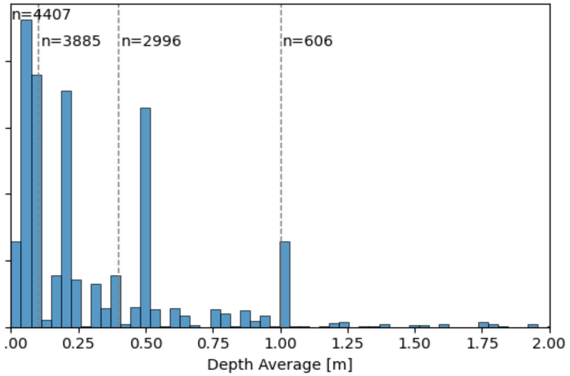
Soil Moisture

- ❖ Emerging focus on **HR** (<1km)
  - New technology (GNSS-R) and new missions (NISAR, CIMR)
  - Downscaling and ML approaches
- ❖ New interest for **root-zone** SM
  - Crucial for **agriculture**, drought monitoring, hydrology
  - Satellites provide surface SM need **models** for RZSM
  - Reference data (**ISMN**) vertical resolution ill defined





ISMN measuring depths



https://ismn.earth/en/

Major data updates for **SCAN** and **SNOTEL** networks, please check our News section for more information!!!

Welcome to the International Soil Moisture Network

The **International Soil Moisture Network (ISMN)** is a collaborative initiative aimed at establishing and maintaining a global in situ soil moisture database. This database serves as a vital resource for validating and enhancing global satellite products, as well as improving land surface, climate and hydrological models.

Soil moisture, which is the water stored in the upper soil layer, plays a pivotal role in numerous processes and applications. These include numerical weather prediction, flood forecasting, agricultural drought assessment, water resource management, greenhouse gas accounting, civil protection, and epidemiological modeling of water-borne diseases. The societal benefits of the ISMN are therefore extensive.

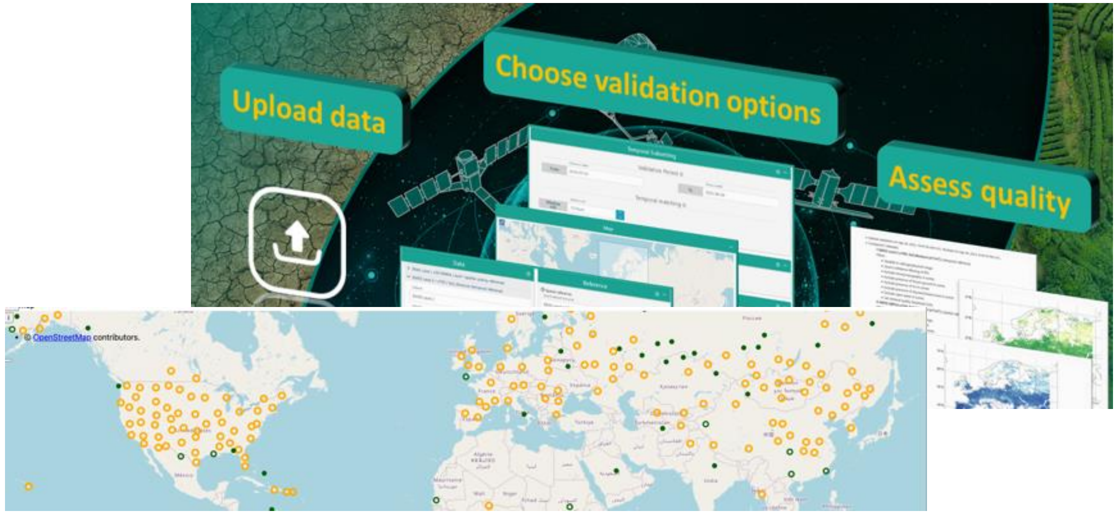
The ISMN was initially developed by the **TU Wien (Vienna University of Technology) Department of Geodesy and Geoinformation - Climate and Environmental Remote Sensing Research Unit** (CLIMERS). Since 2022, it has been jointly hosted and managed by the **International Centre for Water Resources and Global Change** (ICWRGC) and the **Federal Institute of Hydrology** (BfG) in Germany.

The ISMN represents a collaborative effort supported by multiple international organisations, including the **Global Energy and Water Exchanges Project** (GEWEX), the **Committee on Earth Observation Satellites** (CEOS), the **Global Climate Observing System - Terrestrial Observation Panel for Climate** (GCOS-TOPC), the **Group of Earth Observation** (GEO), and the **Global Terrestrial Network on Hydrology** (GTN-H). Its establishment and operation was made possible through financial support of the Earth Observation Programme of the **European Space Agency** (ESA) and the many voluntary contributions of scientists and networks worldwide.

Soil Moisture

- Need to update protocols, reference data and tool:
  - **Maintain** and improve ISMN database and QA4SM tool
  - Address the need for **higher spatial resolution** products
  - Address the needs for **RZSM** validation
  - Assess adherence to **CEOS-FRM** as part of ESA **FRM4SM**
  - Aiming at first release in 2026

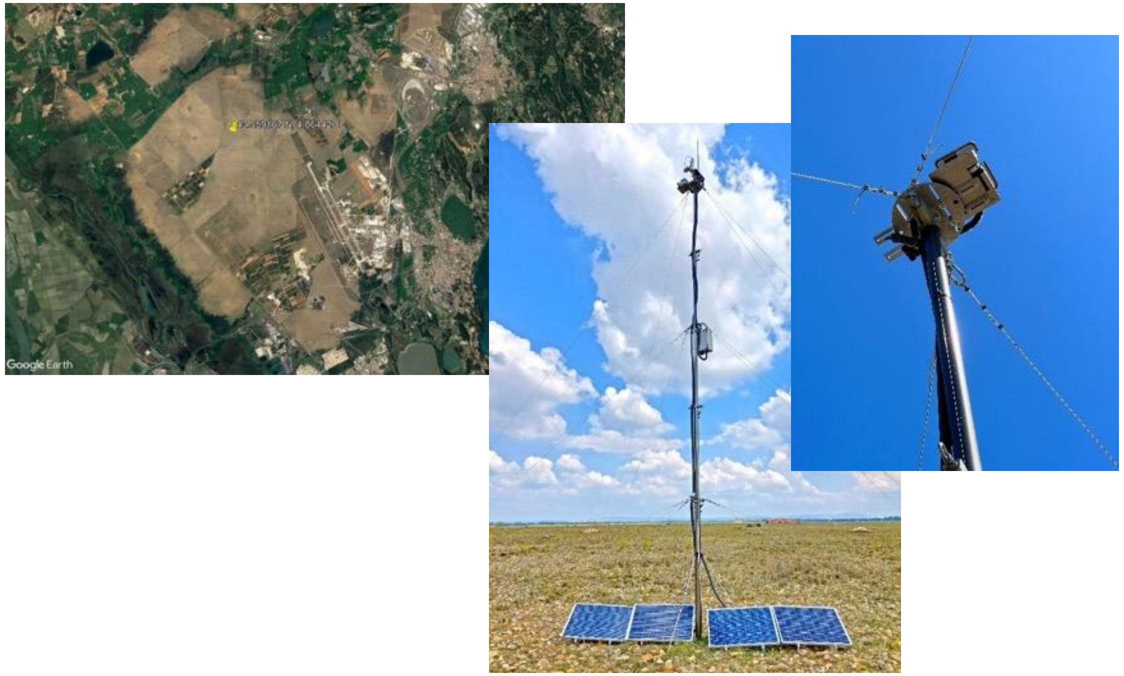
https://qa4sm.eu/



LST / LSE

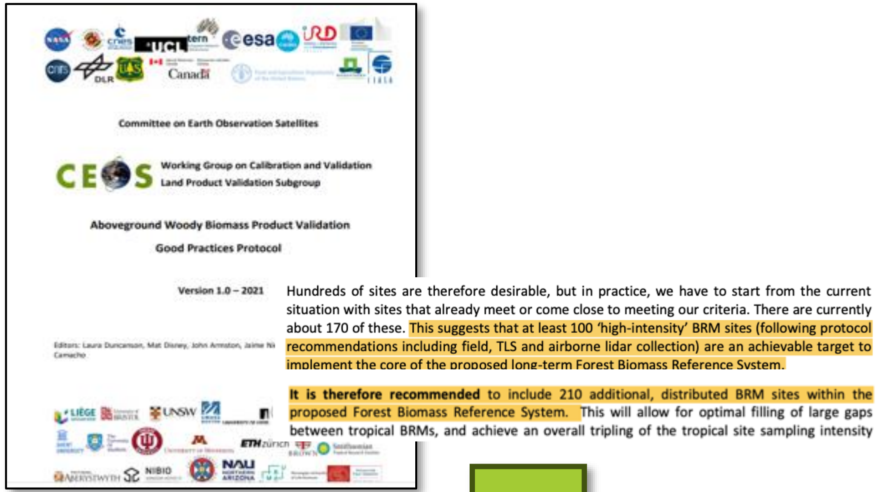
❖ Contribute to TIRCalNet

- Towards operational RadCalNet-like network for **TOA radiance** validation
- Cooperation ESA, CNES, JPL, Uni. Leicester, **KIT**, RAL
- Define instrument / algorithms, characterise **uncertainties**
- Radiometers installed at **La Crau** to perform initial testing
- **Emissivity** estimation remain primary source of uncertainty
- In-situ **comparison** of TIR radiometers (JPL and KIT) at lake Costance



Biomass

- ❖ **GEO-TREES**: a Global Forest Biomass Reference System
  - Stems from recommendations from the **LPV AGB protocol**
  - Global **coverage** with highest sampling in the critical carbon-rich tropics
  - **Open data** policy and long-term commitment
- ❖ Long-term vision
  - 100 **core** sites (60 Tropical, 40 Temperate)
  - 200 **supplementary**, lower-cost sites



Committee on Earth Observation Satellites

CEOS Working Group on Calibration and Validation
Land Product Validation Subgroup

Aboveground Woody Biomass Product Validation
Good Practices Protocol

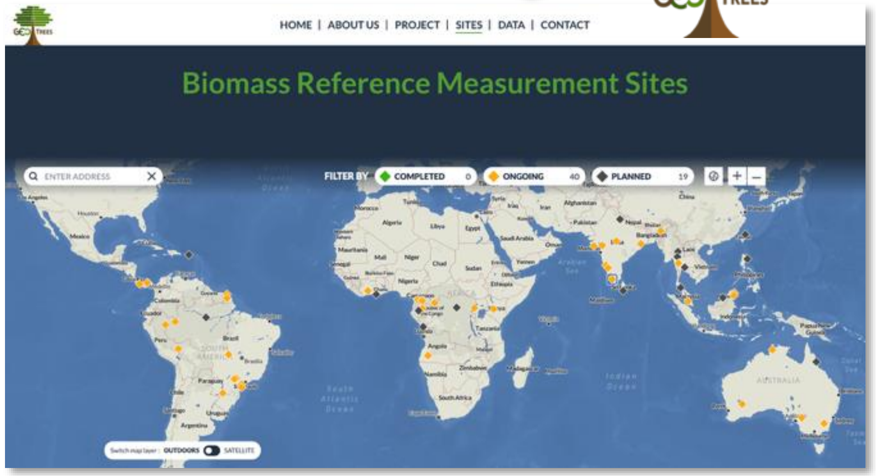
Version 1.0 – 2021

Editors: Laura Duncanson, Mat Disney, John Armston, Jaime Ni
Camacho

Hundreds of sites are therefore desirable, but in practice, we have to start from the current situation with sites that already meet or come close to meeting our criteria. There are currently about 170 of these. This suggests that at least 100 'high-intensity' BRM sites (following protocol recommendations including field, TLS and airborne lidar collection) are an achievable target to implement the core of the proposed long-term Forest Biomass Reference System.

It is therefore recommended to include 210 additional, distributed BRM sites within the proposed Forest Biomass Reference System. This will allow for optimal filling of large gaps between tropical BRMs, and achieve an overall tripling of the tropical site sampling intensity

https://geo-trees.org/



Biomass Reference Measurement Sites

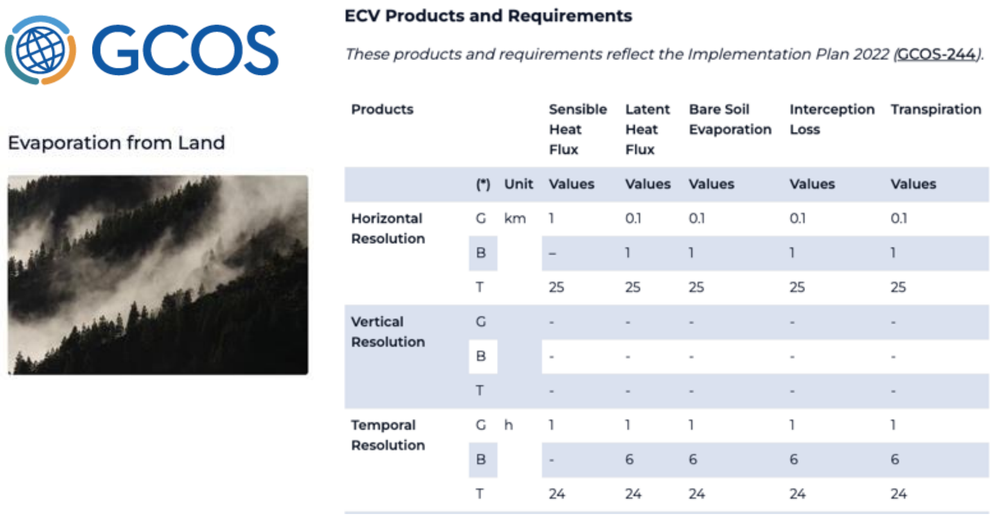
FILTER BY: ◆ COMPLETED 0 ◆ ONGOING 40 ◆ PLANNED 19

Biomass

- ❖ **Multi-scale** approach
  - High-quality AGB at **0.25 ha** plot scale with local **allometric** model
  - Survey at **3 ha** scale using **TLS**
  - **Airborne** Laser Scanning of canopy height covering **100+ ha** per site
- ❖ GEO-TREES looking **forward**
  - Secure **resources** to reach the long-term vision of BRM sites (100 / 200)
  - Build links **across disciplines** for forest, biodiversity monitoring

Evapotranspiration

- Status and challenges (New FA)
  - Relevance for **applications**: agriculture, water management, …
  - Growing number of **ET products** (institutional / commercial)
  - Large **variety** of models / input data (e.g., satellite, meteorological)
  - GCOS **definition** slightly differs from ET used in RS community
  - Need **consensus** on definition, models, validation practices



GCOS

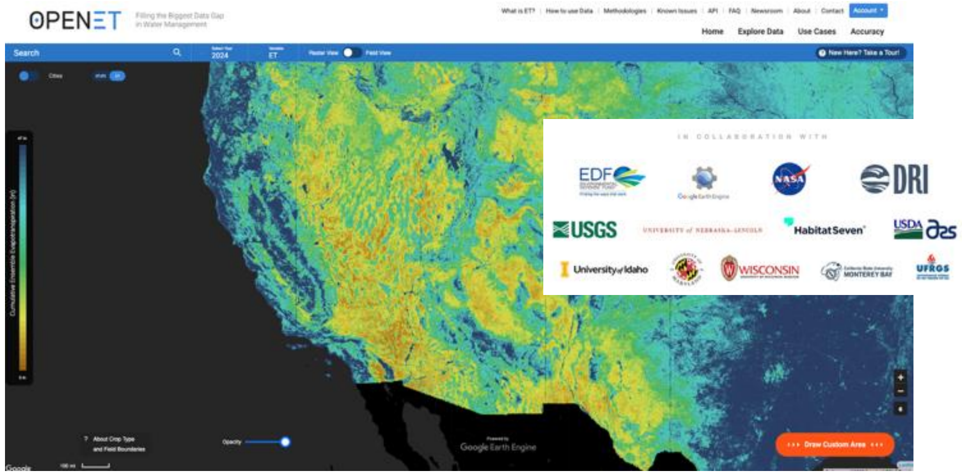
Evaporation from Land

ECV Products and Requirements

These products and requirements reflect the Implementation Plan 2022 (GCOS-244).

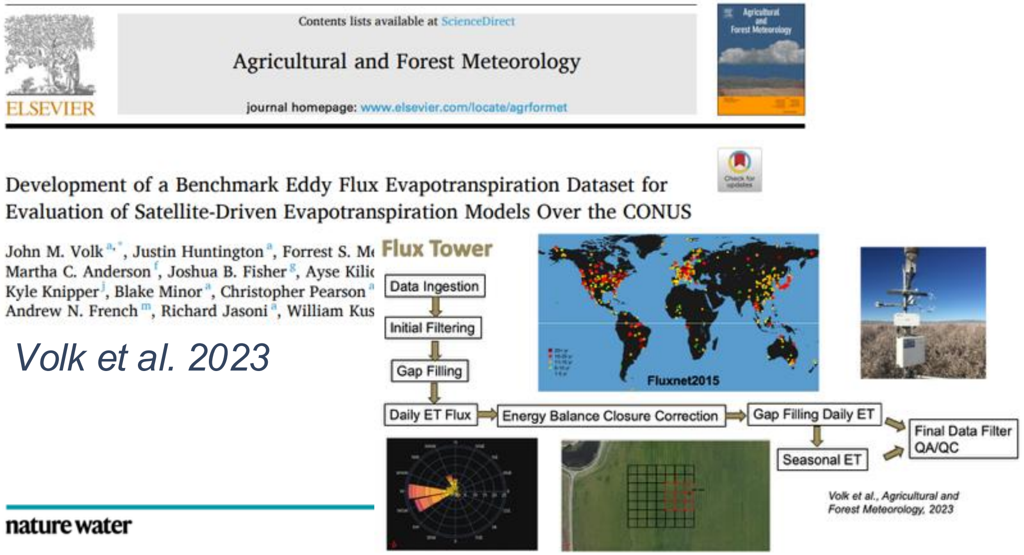
Products			Sensible Heat Flux	Latent Heat Flux	Bare Soil Evaporation	Interception Loss	Transpiration
	(*)	Unit	Values	Values	Values	Values	Values
Horizontal Resolution	G	km	1	0.1	0.1	0.1	0.1
	B		–	1	1	1	1
	T		25	25	25	25	25
Vertical Resolution	G		-	-	-	-	-
	B		-	-	-	-	-
	T		-	-	-	-	-
Temporal Resolution	G	h	1	1	1	1	1
	B		-	6	6	6	6
	T		24	24	24	24	24

https://etdata.org/



Evapotranspiration

- ❖ Way forward
  - Review existing **products**, group them: models, input data, coverage
  - Review of existing Cal/Val **practices**
  - Identify data and knowledge **gaps**
  - Gather **community** in conferences / meeting (AGU24/ EGU25)
  - Draft protocol **outline** (Q3 2025) and ask feedback
  - Convene a **WS** by end of 2025



Contents lists available at ScienceDirect

Agricultural and Forest Meteorology

journal homepage: www.elsevier.com/locate/agrformet

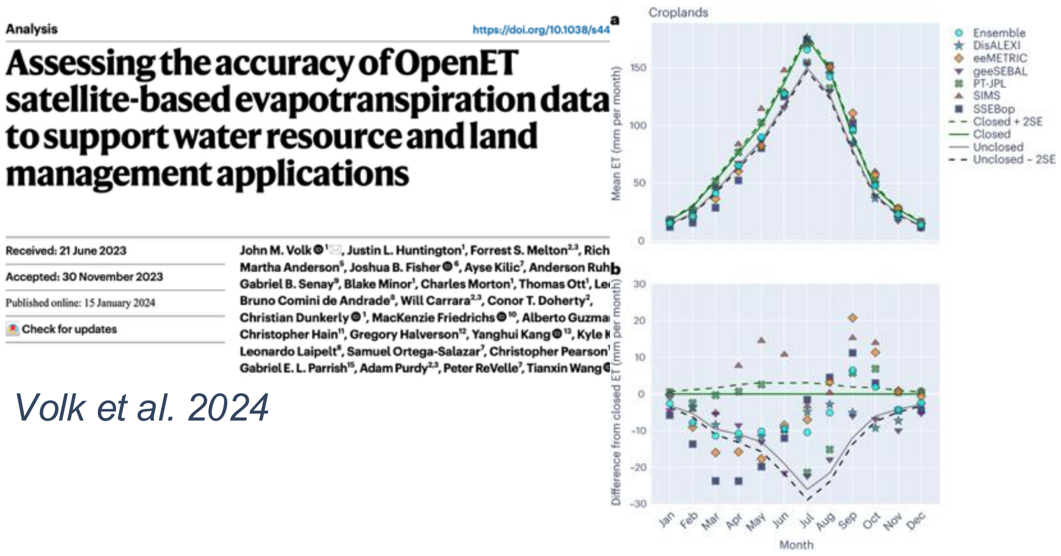
Development of a Benchmark Eddy Flux Evapotranspiration Dataset for Evaluation of Satellite-Driven Evapotranspiration Models Over the CONUS

John M. Volk[a,*], Justin Huntington[a], Forrest S. Me
Martha C. Anderson[f], Joshua B. Fisher[g], Ayse Kilic
Kyle Knipper[j], Blake Minor[a], Christopher Pearson[a]
Andrew N. French[m], Richard Jasoni[a], William Kus

Volk et al. 2023

Volk et al., Agricultural and Forest Meteorology, 2023

nature water



Analysis https://doi.org/10.1038/s44

Assessing the accuracy of OpenET satellite-based evapotranspiration data to support water resource and land management applications

Received: 21 June 2023

Accepted: 30 November 2023

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Check for updates

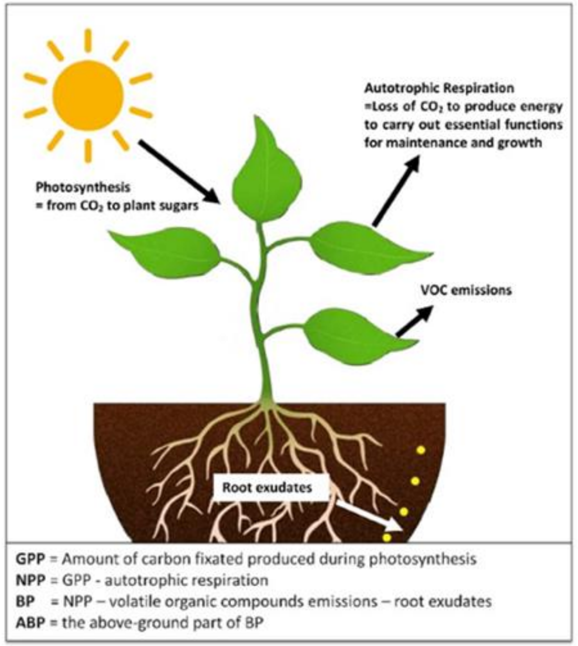
John M. Volk[1], Justin L. Huntington[1], Forrest S. Melton[2,3], Rich
Martha Anderson[5], Joshua B. Fisher[6], Ayse Kilic[7], Anderson Ruh
Gabriel B. Senay[9], Blake Minor[1], Charles Morton[1], Thomas Ott[1], Le
Bruno Comini de Andrade[8], Will Carrara[2,3], Conor T. Doherty[2],
Christian Dunkerly[1], MacKenzie Friedrichs[10], Alberto Guzma
Christopher Hain[11], Gregory Halverson[12], Yanghui Kang[13], Kyle K
Leonardo Laipelt[8], Samuel Ortega-Salazar[7], Christopher Pearson
Gabriel E. L. Parrish[15], Adam Purdy[2,3], Peter ReVelle[7], Tianxin Wang

Volk et al. 2024

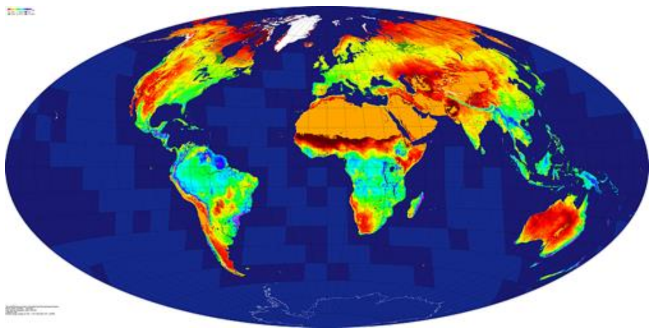
Volk et al., 2024

GPP / NPP

- Status and challenges (new FA)
  - Not yet ECV, though identified as part of **biodiversity** metrics
  - Growing **interest** and **availability** of GPP/NPP satellite products
  - **Variety** of models, inconsistencies across products
- Way forward
  - **Review** of existing models/products
  - Gather the **community** (FluxNET)
  - Propose protocol **outline**
  - Discuss in a dedicated WS



GPP = Amount of carbon fixated produced during photosynthesis
NPP = GPP - autotrophic respiration
BP = NPP – volatile organic compounds emissions – root exudates
ABP = the above-ground part of BP



NASA Global VIIRS 500m GPP/NPP for terrestrial ecosystems

Summary

- Highlights
  - LC protocol being issued: very positive feedback from community
  - Review of LPV Supersites definition and list
  - Updates of protocols on-going: Biophysical, Albedo, SM
  - Strong interest in the upcoming ET and GPP/NPP protocol filling a well recognised data / knowledge gap
- Way forward
  - Compile Action Plan for next 3 years
  - Work towards filling long-standing gaps: OLIVE, ICOS for Cal/Val
  - Enhance readiness to upcoming missions (hyperspectral)
  - Strengthen collaboration with GEO-BON, GEO-TREES, GEO-GLAM

Thank You!

CEOS
Committee on
Earth Observation Satellites