WGCV-54 Land Product Validation Subgroup

Michael Cosh

Agenda Item 2.9

WGCV-54, USGS, Sioux Falls, SD USA

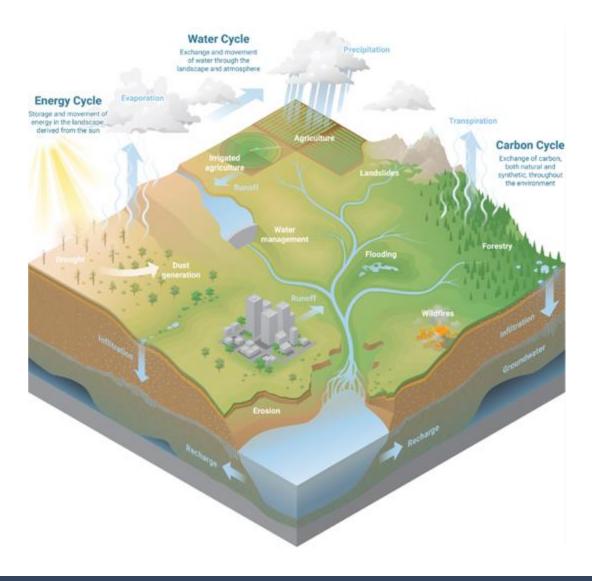
October 15-18, 2024



Earth Observation Satellites

Focus Areas

Focus Area Biophysical Fire/Burn Area Phenology Vegetation Index Land Cover Snow Cover 12 Surface Radiation Soil Moisture LST and Emissivity Aboveground Biomass Evapotranspiration **GPP/NPP**



Focus Area Leads



MicheleCeñaUSAAUSAApr.2025AdminFabrizioNiroESALialyApr.2025 (pr.conolio to Chair)AlexandraNickesonGSF CUSAAlexandraTsendbaaraWageningen University of MarylandUSAAlexandraTsendbaaraWageningen UniversityMetherlandsApr.2027 (2**1em)SophieEncompsUniversity of MarylandUSAApr.2027 (2**1em)BiophysicalHaoFarandesNatural Revources CanadaCanadaApr.2027 (1*term)LickeBrownUniversity of MarylandUSASep.2022 (2*1em)BiophysicalHaoGigl OUniversity of MarylandUSASep.2022 (2*1em)BernardoMolaNatural Revources CanadaUSASep.2022 (2*1em)BernardoMolaNatoral Physical LabUKASep.2026 (2*1em)AngelaErioUniversity of MarylandUSASep.2026 (2*1em)AngelaErioUMass BostonUSAsep.2026 (2*1em)JohnBotenNASA GSFCUSAapr.2026 (2*1em)JohnBotenNASA GSFCUSAJap.2026 (1*1em)ListOrandGrayer CallenoUniversity of SevilleUSAJap.2025 (2*4em)JohnBotenNASA GSFCUSAJap.2025 (2*4em)ListOrandeMarset Instructer TechnologyUSAJap.2025 (2*4em)ListOrandeMarset Instructer TechnologyUSAJap.2025 (2*4em)ListOrandeMarset		First Name	Last Name	Institution	Institution	End of Term
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Alvaro Moreno Martinez University of Valencia Spain Oct 2027 (1 st term)	GPP/NPP	Arthur	Endsley	University of Montana	USA	Sept 2027 (1 st term)
	Grijivir	Alvaro	Moreno Martinez	University of Valencia	Spain	Oct 2027 (1 st term)

WGCV-54, 15-18 October 2024

LPV Validation Stage Status



Γ	Validation Stages - Definition and Current State	Variable
	No validation. Product accuracy has not been assessed. Product considered beta.	
	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
	 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
	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.	Vegetation Indicies LST & Emissivity Active Fire Burned Area
	 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

Focus Area Protocols Update



Focus Area	Protocol
Biophysical	LAI(2014)
Fire/Burn Area	Burned Area Targeting 2025 Active Fire next
Phenology	Targeting end of 2024
Vegetation Index	Targeting end of 2024
Land Cover	Revision of first public comment -> WGCV 55
Snow Cover	
Surface Radiation	Albedo(2019) Global Downward Radiation Product Validation Best
Soil Moisture	SM(2020)
LST and Emissivity	LST (2019)
Aboveground Biomass	AGWB(2021)
Evapotranspiration	
GPP/NPP	

Biophysical



- Definitions:
 - 3 Geomatics Canada Open Files (version controlled DOI labelled)
 - Revised LAI, FAPAR to conform with current GCOS definitions.
 - Added FCOVER corresponding to FAO definition.
 - Added definition of "Related Quantities" to each definition to increase clarity in community.
- Revised Product List
 - Deleted 20 (mainly different resolutions of same products)
 - Added new products: 6 LAI, 8 FAPAR, 8 FCOVER; including 7 <100m resolution continental products.
- CEOS Validation Stage Assessment
 - Assessed validation stage by continent.
 - Geomatics Canada Open File summarizing findings
 - A total of 22 LAI products, 17 fAPAR products and 8 fCOVER products were identified and evaluated in terms of continental scale CEOS validation stage.
 - Stage 3 validated products are currently available for Europe and North America at >=250m resolution and for regions of North America above 40degrees at 20m resolution. Stage 2 validated >250m resolution products are also available for Africa and Asia and it is likely these will soon achieve Stage 3. Stage 1 validate products are available for South America and Australia/Oceania.
 - Up to LPV to decide how to update product validation stage table suggest it be uniform across variables.
- Outline of new good practice document for medium resolution products including fCOVER.

Biophysical



Good Practices Update

- Discussions on proposed new sections
 - Revise Definitions
 - inclusion of FAPAR, FCOVER
 - Revise In Situ Reference Estimates
 - include new sensor and tech development (e.g. terrestrial laser scanner)
 - Add new section on high resolution data products
 - high resolution vs. ESU
 - Add new section on 3D data products
 - lidar

Fire/Burn Area

CESS

Validation Protocol Status		
 Update of 11-page 2010 draft 	DRAFT Committee on Earth Observation Satellites	Satellie-Darived Gibbal Burned Area Product Weldelon Beat Practices Protocol
burned area validation protocol	Working Group on Calibration and Validation Land Product Validation Subgroup	Table of Contents Acronyms and Nomenclature
ongoingCurrently 34 pages	Satellite-Derived Global Burned Area Product Validation Best Practices Protocol	1.1. Earth Observation burned area products 5 1.2. CEOS validation stages 6 1.3. Limitations and challenges 8 2. Production and Standardization of reference data for validation purposes 10 2.1. Reference data 10 2.2. Criteria for the selection of reference data 11
 Engaged additional section authors 	Version 10.0 – June 2024	2.3. Thematic content of the reference data 13 2.4. Format of the reference data 14 2.5. Quality assessment of the reference data 14 2.6. Special considerations for burned area reference data 16 3. General strategies for the validation of global burned area products 17
 Discussion-ready draft for GOFC Fire Implementation Team meeting (17-18 Sep.) and 13th EARSeL Workshop on Forest Fires (19-20 Sep.) in 	Editors: * Authors: B. Mota, L. Giglio, L. Boschetti, D. P. Roy, S. V. Stehman, J. V. Hall, M. Humber, K. Vadrevu, M. Padilla, M. Zubkova. Citation: *, 2024, Satellite-Derived Global Burned Area Product Validation Best Practices Protocol	3.1. Sampling design using data
 Milan Active Fire protocol to follow 		2

Phenology



- Copernicus Land Monitoring Service (CLMS) has signed a new contract for the continuation and evolution of the High-Resolution Vegetation Phenology and Productivity (HR-VPP) product suite:
 - Consortium comprises VITO, in partnership with Lund University, Joanneum Research, and Space4Environment.
 - Calibration report to be published in autumn 2025
- Review paper: Gong et al. Satellite remote sensing of vegetation phenology: Progress, challenges, and opportunities. ISPRS J. Photo. Rem. Sens.
- Special Issue in the journal "Forest": Vegetation and Remote Sensing Phenology in Deciduous Forests.
 - Deadline for manuscript submissions: 31 October 2025

Vegetation Indices

Protocol Development

- Formed a small group of VI experts to review the outline (November 2022)
 - Carolien Toté (VITO, Belgium)
 - Kamel Didan (University of Arizona, USA)
 - Molly Brown (University of Maryland, USA)
 - . Kazuhito Ichii (Chiba University, Japan)
- Held a kick-off meeting with the expert group (December 15, 2022)
- Held a 2nd meeting to the group's review comments/suggestions (Jan 2023)
- Revised the outline and shared the revised outline with them (March 2023)
- Completed the first complete draft (December 3, 2023)
- Had the group review one more time (December 2023 January 2024)
- Reviewed and updated the VI listserv list (May 2024)
- Plan to send the draft protocol document for the community feedback (August 2024)



Land Cover

Guideline document update:

Version 0.1 is ready, sent out for community review on August 30th, 2024

Next steps:

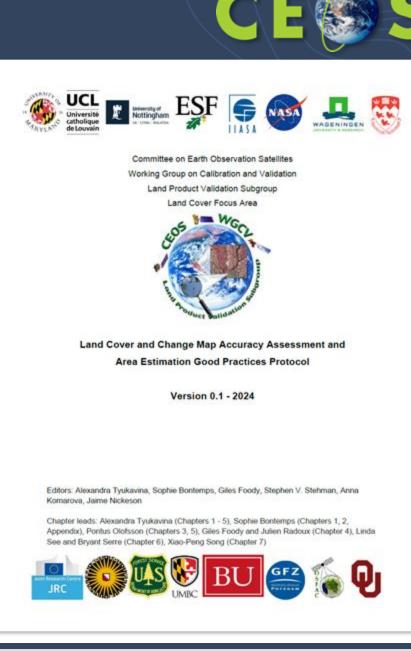
Revisions due on October 1st, 2024

Expected completion of Version 1.0: Winter 2024 – 2025

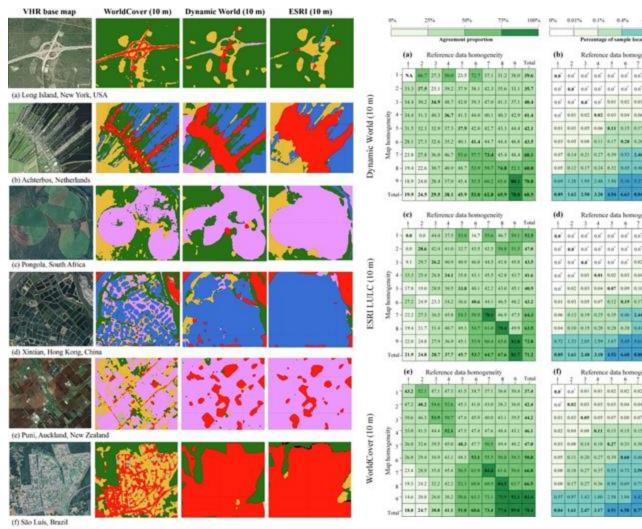
Editors and chapter leads will address reviewers' comments

One round of revisions is planned (no re-review) Authors: Tyukavina, A.¹, Bontemps, S.², Foody, G.³, Stephen V, Stehman⁴, See, L.⁵, Olofsson, P.⁶, Tsendbazar, N.⁷, Radoux, J.², Komarova, A.¹, Serre, B.⁸, Song, X-P.¹, d'Andrimont, R.⁹, Koren, G.¹⁰, Potapov, P.¹, Bullock, E.¹¹, Campbell, P.^{12,13}, de Bruin, S.⁷, Defourny, P.², Friedl., M.A.⁴⁴, Fritz., S.⁵, Hansen, M.¹, Herold, M.^{7,15}, Lamarche, C.², Lesiv, M.⁵, Mané, L.¹⁶, Meroni, M.⁹, Nickeson, J.¹², Pelletier, F.⁸, Pickens, A.¹, Reiche, J.⁷, Shchepashchenko, D.⁵, Tarrio, K.¹⁴, Verhegghen, A.⁹, Woodcock, C.¹⁴, Xiao, X.¹⁷

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- ¹⁷ Department of Microbiology and Plant Biology, Center for Earth Observation and Modeling, University of Oklahoma, Norman, OK, USA



Land Cover



Water Mixed vegetation Cropland Built areas Bare ground Snow & Ice

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Remote Sensing of Environment Volume 311, 1 September 2024, 114316

Comparative validation of recent 10mresolution global land cover maps

Panpan Xu °, Nandin-Erdene Tsendbazar ° 🎗 🛱 , Martin Herold ° b, Sytze de Bruin °, Myke Koopmans¹⁰, Tanya Birch¹⁰, Sarah Carter¹⁰, Steffen Fritz¹⁰, Myroslava Lesiv¹⁰, Elise Mazur¹⁰ Amy Pickens ¹, Peter Potapov ¹, Fred Stolle ⁴, Alexandro Tyukavina ¹, Ruben Van De Kerchove ¹¹, Daniele Zanago 9

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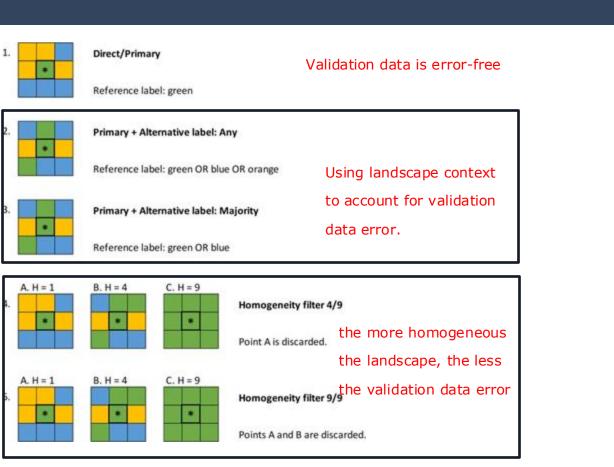
https://doi.org/10.1016/j.rse.2024.114316 # Under a Creative Commons license >

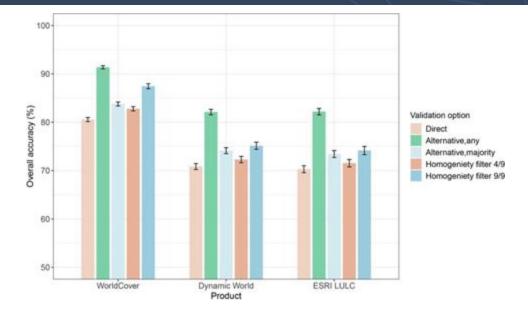
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- Comparative validation of recent high-resolution global land cover maps
- * Accuracy comparison – global, continental, and for 47 countries
- Assessing spatial details
- Integrating reference data $\mathbf{\mathbf{x}}$ uncertainty to map validation

Land Cover





- Comparative validation of recent highresolution global land cover maps
- Accuracy comparison global, ** continental and for 47 countries
- Assessing spatial details $\overset{\bullet}{}$

Integrating reference data uncertainty to map validation







NASA Snow Community Meeting

August 14-15, 2024, Boulder, CO

Objective: To cohesively summarize existing and ongoing snowpack monitoring efforts and identify remaining knowledge gaps and next steps for the snow community, specifically through recognition of the completion of NASA SnowEx multi-year field experiment and recent Earth System Explorers satellite mission proposals

- 1. Toward consensus across snow community
 - Community building
 - Snow mission requirements
 - Science questions
 - Applications
 - Next steps
- 2. Summarize the current state of snow sensing, modeling, and technologies
- 3. Outline white paper concepts for the next decadal survey

- Approximately 200 inperson and virtual attendees
- Summary report in prep now

Snow Cover



Global Climate Observing System program (GCOS)

- Current Essential Climate Variable (ECV) guidance for snow is being reviewed over the next ~6 months
- These requirements mainly focused on data requirements that are not currently met by any satellite mission
- The GCOS snow group has reached out to the snow community for input in the development of the requirements.

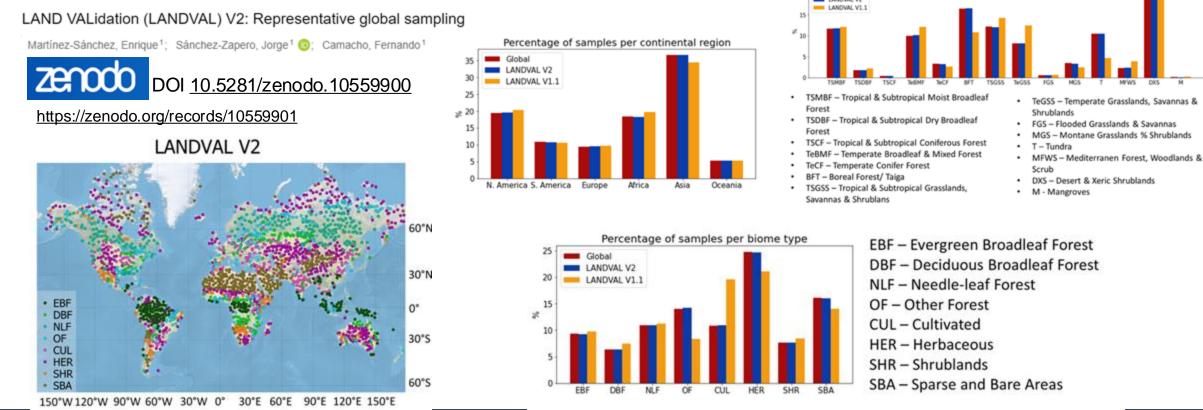
Update on process:

- Meeting July 5 to discuss review:
 - Plan to focus on the three existing snow ECV products (variables/quantities) Area Covered by Snow, Snow Depth, Snow Water Equivalent.
 - As this is a GCOS initiative, it will concentrate on the GCOS requirements which are intended for <u>climate</u> monitoring
- Preliminary requirements drafted
- Next meeting to discuss will be scheduled for late Sept/early Oct
- We will work with this group to develop a validation protocol once the requirements are in place
- In the meantime the CEOS LPV Snow will point to the protocols developed by the SnowPEx satellite snow product intercomparison and evaluation exercise which focuses on existing SCE and SWE products

Surface Radiation

CESS

- SALVAL:
 - 2024 annual update has started (inclusion updated values for ground data and satellite products).
 - New sampling LANDVAL-V2 for product intercomparison will be tested in the tool: from 720 to 2000 samples.



Surface Radiation



LP DAAC to Release Gap Filled MODIS Version 6.1 Albedo, BRDF, and NBAR Data Product

- Expected in Fall 2024
- The LP DAAC will announce the availability of the Terra+Aqua Combined MODIS Version 6.1 Bidirectional Reflectance Distribution Function and Albedo (BRDF/Albedo) Gap-Filled Snow-Free Daily L3 Global 30ArcSec Climate Modelling Grid (CMG) data product (MCD43GF).
- The data product includes Albedo, Bidirectional Reflectance Distribution Function (BRDF), and Nadir BRDF-Adjusted Reflectance (NBAR) data. Currently, the collection only contains data from 2013 through 2021. The remaining historic data will be added at a later date.
- The older MCD43GF Version 6 data product will remain available until the complete MCD43GF Version 6.1 data record is available.

Soil Moisture



Relevant projects:

- Fiducial Reference Measurements for Soil Moisture (FRM4SM)
 - Direct negotiations w. ESA for a Phase 2 (2025-2026)
 - Dedicated budget to update the CEOS LPV validation good practice protocol
 - Exchange w. Copernicus Evaluation and Quality Control (EQC) framework to integrate QA4SM activities
- ESA Climate Change Initiative (CCI)
 - New satellite-only root zone soil moisture products provided in the next release
 - Proposal for new CCI AWU in preparation, important open questions regarding the validation of high-res soil moisture
 - Proposal for new CCI ET in discussion, joint forces w. ESA CCI soil moisture team
 - Potential of expanding QA4SM to validate other variables
- EURAMET Green Deal Call 2024
 - Proposal in development: "Metrology for ground-based reference measurements for satellite soil moisture validation"
 - ~3 M€ project, led by the German National Metrology Institute (Miroslav Zboril)
 - Focus: Development of soil moisture "super sites", transferring SI-traceability from the lab into the field, aiming to get long-term funding for the operation via meteorological institutes, WMO, etc

Soil Moisture



Upcoming workshops:

- BIPM-WMO Metrology for Climate Action Workshop 2024
 - 16-18 September @ BIPM headquarters, Sevres, France.
 - Free online attendance possible: <u>https://bipm-cenv2024.org/</u>
- EGU General Assembly 2025
 - 27 April-2 May, Vienna, Austria
 - Several Cal/Val sessions proposed (incl. Soil Moisture)
- ESA Living Planet Symposium 2025
 - 23-27 June, Vienna, Austria
 - Several Cal/Val sessions proposed (incl. Soil Moisture)

LST and E



Upcoming Conferences

- 7th International Symposium on Recent Advances in Quantitative Remote Sensing (RAQRS'VII), Valencia, Sep 23-27
- EUMETSAT Meteorological Satellite Conference 2024. Würzburg, Germany, 30 Sep 4 Oct.
- ECOSTRESS Science and Applications Team meeting, Pasadena, CA, 30 Sep 2 Oct.
- EARSeL Thermal Remote Sensing Workshop. 2-4 December 2024, Leicester, UK.
- LST CCI 2024 User Workshop. 5-6 December 2024, Leicester, UK.

Project news

- TIRCALNet preparation study, coordination meeting in June 2024.
- Validation of ECOSTRESS Collection 2 LSTE products is underway.
- Analyses of thermal camera in situ measurement intercomparison campaign available.
- International science workshop on High resolution Thermal remote sensing expected in India during November 2024

LST and E

TIRCalNet Preparation Study

- Goal: Prepare the roadmap for the TIRCalNet operations.
- Cooperation between TIRCalNet Preparation Study team (Uni. Leicester, KIT, RAL Space), CNES and JPL.
- Study at La Crau site:
 - Characterization of site uncertainties: Emissivity measurements + drone flights.
 - Characterization of instruments uncertainties.
 - Characterization of atmospheric propagation approach: common methodology.







Above Ground Biomass





Committee on Earth Observation Satellites Working Group on Calibration and Validation

Land Product Validation Subgroup

Global Aboveground Biomass Product Validation

Best Practice Protocol



Version 2.0 - 2025

Editors: Kim Calders, Neha Hunka, Laura Duncanson, David Minor, Mat Disney, John Armston, Jaime Nickeson

Protocol Update Status

- V2.0 is currently being drafted
- Some authors have provided revisions to chapters.

Above Ground Biomass



Two papers that use NASA GEDI and ESA CCI forest biomass estimates are currently in review

National Forest Biomass Assessments Enhanced with Earth Observation to Aid Climate Policy Needs

 Hunka, Neha and May, Paul and Babcock, Chad and Armando Alanís de la Rosa, José and de los Ángeles Soriano-Luna, Maria and Mayorga Saucedo, Rafael and Armston, John and Santoro, Maurizio and Requena Suarez, Daniela and Herold, Martin and Málaga, Natalia and Healey, Sean P. and Kennedy, Robert and Hudak, Andrew and Duncanson, Laura. Available at SSRN: <u>https://ssrn.com/abstract=4910141</u>

Intergovernmental Panel on Climate Change (IPCC) Tier 1 forest biomass estimates from Earth Observation

- Neha Hunka, Laura Duncanson, John Armston, et al. Authorea. March 04, 2024.
 DOI: <u>10.22541/au.170958900.06861359/v1</u>
- Results to be submitted to the IPCC Emission Factors Database in October 2024





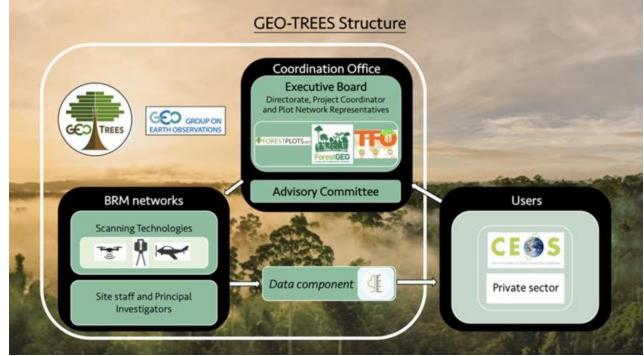
CARB-21-03



Forest Biomass Reference Network (GEO-TREES) (CARB-21-03) In Progress...The project office is up and running via funding from the French government. <u>https://geo-trees.org</u> and is actively soliciting funding, with various opportunities in the pipeline.

Nothing concrete as yet in terms of actual funding for data collection, but likely in the near future

future.



Evapotranspiration

Workshops:

- AGU Chapman conference:
 - The Energy Balance Closure Problem: Causes, Corrections, and Implications (Sep 14-19, 2025 Boulder)
- International Science Workshop on High-Resolution Thermal Earth Observation (Nov. 19-21, 2024 India, abstract and registration due 9/30)
- ECOSTRESS Science Team meeting (Sep 30-Oct 2, 2024 Pasadena, LA)

Publications (large regional or continental product):

- Evapotranspiration and surface energy fluxes across Europe, Africa and Eastern South America throughout the operational life of the Meteosat second generation satellite (<u>https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/gdj3.235</u>)
- A brief history of the thermal IR-based Two-Source Energy Balance (TSEB) model diagnosing evapotranspiration from plant to global scales (<u>https://www.sciencedirect.com/science/article/pii/S0168192324000662</u>)
- Spatial-temporal patterns of land surface evapotranspiration from global products (<u>https://www.sciencedirect.com/science/article/pii/S0034425724000774#f0060</u>)

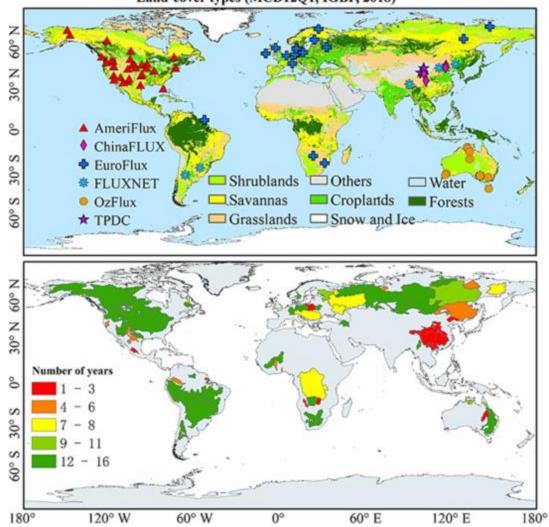
Evapotranspiration

Tang et al., 2024 RSE

https://www.sciencedirect.com/science/article/pii/S0034425 724000774#f0010

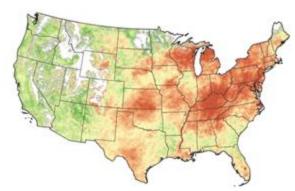
Category	Name	Time Coverage	Spatial Resolution	
	EB-ET	2000-2007	5km/day	
	SSEBop	2003-now	1km/month	
	3T	2001-2020	0.25°/day	
	GLEAM	1980-2022	0.25°/day	
	PT-JPLsm	2002-2017	36km/month	
Remote Sensing-based	ET-Monitor	2001-2019	1km/month	
	MOD16A2	2001-now	500m/8-day	
	NTSG	1983-2018	0.25°/month	
	BESS	2001-2015	1km/8-day	
	PML-V2	2000-2020	500m/8-day	
	PEW	1982-2018	0.1°/month	
	CFSR	1979-2010	0.3°/sub-daily	
	CFSV2	2011-now	0.2°/sub-daily	
	ERA5-Land	1950-now	0.1°/sub-daily	
Reanalysis-based	GLDAS V2.1	2000-2023	0.25°/sub-daily	
	JRA-55	1958-now	0.56°/sub-daily	
	MERRA-2	1980-now	0.5,0.625°/sub-daily	
	NCEP-R2	1979-now	1.9°/sub-daily	
	DOLCE	1980-2018	0.25°/month	
Hybrid-based	GLASS	1982-2018	1km/8-day	
	REA	1980-2017	0.25°/day	
	SGAN	1982-2019	1km/month	
Machine Learning-based	DLBH	2003-2019	0.25°/daily	
	FLUXCOM	2001-2015	0.083°/month	
Water balance-based	WB-MTE	2001-2013	0.5°/month	
water balance-based	TerraClimate	1958-2015	4km/month	

Land-cover types (MCD12Q1, IGBP, 2018)

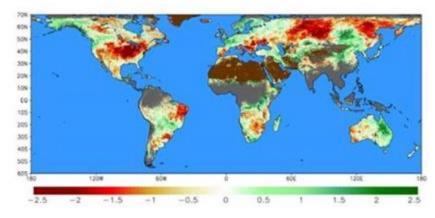




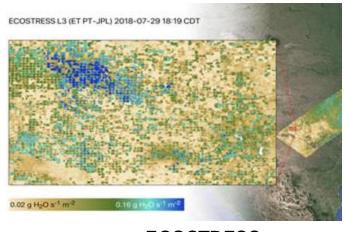
Evapotranspiration



Evaporative Stress Index



SERVIR Global ESI



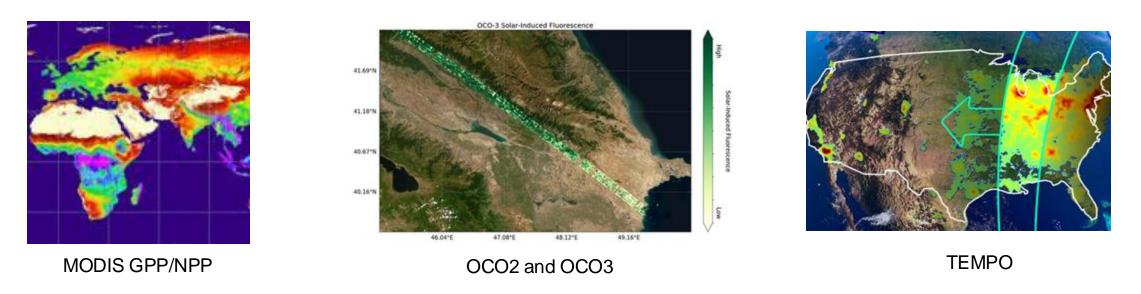
ECOSTRESS

GPP/NPP

CESS

♦ WGCV to consider potential for GPP/NPP land product Focus Area within LPV

MODIS GPP/NPP uses FPAR, Land Cover, modelled products (LST), etc. New missions as well with GPP/NPP implications



GPP/NPP - Gross Primary Production/Net Primary Production

Earth Observation Assessment

2023 EARTH OBSERVATIONS ASSESSMENT REPORT: AGRICULTURE & FORESTRY

Product of the SUBCOMMITTEE ON U.S. EARTH OBSERVATION COMMITTEE ON ENVIRONMENT

July 2024

About the Subcommittee on the United States Group on Earth Observations

The United States Group on Earth Observations (USGEO) is chartered as a Subcommittee of the NSTC Committee on Environment. The Subcommittee's purpose is to plan, assess, and coordinate Federal Earth observations, research, and activities; foster improved Earth system data management and interoperability; identify high-priority user needs for Earth observations data; and engage international stakeholders by formulating the United States' position for, and coordinating U.S. participation in, the intergovernmental Group on Earth Observations (GEO).

Agriculture and Forestry Climate Agriculture and Forestry Climate ...

2023:

2024:

2025:

2026:

2027:

2028:

2029:



Earth Observation Assessment

EOA 2023 - Agriculture & Forestry

	A summary of statistics for Agriculture & Forestry	Value Tree Explorer	Earth Observation Input Impacts - SBA Level	Earth Observation Input Impacts - Sub- Area Level	Value Tree Performance	Earth Observation Input Breadth	Earth Observation Input Support of KPSOs	
<								>

Agriculture & Forestry	Impact Highest					
Earth Observation Input	Agriculture & Forestry 🛛 🖻	Enhance Food Supply	Maximize Productivity and Conservation of Ecosystem Condition	Improve Resilience to Disasters and Disturbance Events	Support Regulatory Requirements and Evidence-Based Decision-Making	Very High High Moderate Contributas Supplemental Does Not Contribute
Aqua Moderate Resolution Imaging Spectroradiometer (MODIS)	Highest	Highest	Highest	Highest	Highest	Filter by Earth
Terra Moderate Resolution Imaging Spectroradiometer (MODIS)	Highest	Highest	Highest	Highest	Highest	Observation Input (AII)
Field Work - Visual Surveys/Lab Samples Collection	Highest	Highest	Highest	Very High	Very High	✓ 1-Minute Refresh
Landsat Operational Land Imager (OLI)	Highest	Highest	Highest	Highest	Highest	SD Hydrography Program (SDHP)
JPSS Polar Constellation Visible Infrared Imaging Radiometer Suite	Highest	Very High	Very High	Highest	Highest	✓ 5-Minute Refresh ✓ 10km OSISAF Global Daily Sea Ice Conc
Digital Elevation Models Output - Shuttle Radar Topography Mission (USGS)	Highest	Highest	Very High	Highest	Highest	✓ 2011-2020 Real Time Mesoscale Analys
Sentinal-2 Multi-Spectral Imager [ESA]	Highest	Very High	Very High	Highest	Very High	2015 North American Land Change Mo
National Agriculture Imagery Program (NAIP)	Highest	Highest	Very High	Very High	Highest	 Active Mine Locations ADCIRC Western and Eastern Tidal Dat
Landsat Thermal Infrared Sensor (TIRS)	Very High	Very High	Very High	Very High	Very High	Advanced Land Observing Satellite-2 (A
Global Positioning System (GPS)	Very High	High	Very High	High	Highest	Advancec National Seismic System (AN
National Elevation Dataset (NED)	Very High	Highest	Very High	Very High	Very High	 Advanced Spaceborne Thermal Emissio Ag Conservation Practice Type and Acr
Field Work - Ground Surveys, Field Measurements	Very High	Moderate	Very High	High	Highest	Ag Economic Data (crop prices, econ re
State/Local Parcel Data	Very High	Moderate	Very High	High	Highest	 Agriculture and Agri-Food Canada (AAF Agrimet (USBR, Pac NW Agricultural Sf
Landsat archives	Very High	High	Very High	Very High	Highest	 Air Quality System (AQS)
Commercial Airborne Lidar	Very High	Highest	High	Very High	Very High	Air Resources Lab Observing Capabilities
Global Land Survey Digital Elevation Model (GLSDEM)	Very High	Very High	Very High	Very High	Very High	✓ Air Resources Lab Observing Capabiliti ✓ Air Resources Lab Observing Capabiliti
Citizen Reporting - Phenology	Very High	Moderate	Very High	Moderate		Air-Launched Autonomous Micro Obser
USGS Topographic Maps	Very High	Moderate	High	High	Highest	Airborne Gamma Ray Surveys
SNOwpack TELemetry (SNOTEL)	Very High	Very High	Moderate	Very High	High	Airborne High-Resolution Visible Image Airborne Obs USCG
GOS Basic Surface Synoptic Network	Very High	Moderate	Contributes	Highest	High	Airborne Synthetic Aperture Radar (SA
Field Work - Visual Surveys	High	Very High	Moderate	High	Highest	Aircraft Meteorological DAta Relay (A

https://usgeo.gov/eoa/

LPV Contributing Satellites Review

There is a need for a review on satellites which contribute to LPV development, not just in primary, but in ancillary datasets, both public and commercial

Challenges:

Moving Target: Aqua, Terra Decommissioning cycles, GEDI, ECOSTRESS Commercial transparency Interdependencies of products on multiple satellites Constellations



Discussions

