Land Product Validation (LPV) Sub-group Meeting

Michael Cosh – (USDA) –Chair
Fabrizio Niro – (ESA/ESRIN) – Vice Chair

Subgroup meeting
07 Feb 2023

NEXT LPV TELECON April 4, 2023

Attendance

Participants

Michael Cosh
Fabrizio Niro
Jaime Nickeson
Zhuosen Wang
Frank Göttsche
Joshua Gray
John Bolten
Tomoaki Miura
Else Swinnen
Sylvain Leblanc
Joshua Gray
Louis Giglio
Mat Disney
Angela Erb
Bernardo Mota
Jorge Sanchez-Zapero
Carrie Vuyovich
Luke Brown

Unavailable

Victor Rodríguez-Galiano
John Armston
Carsten Montzka
Glynn Hulley
Sasha Tyukavina
Laura Duncanson
Sophie Bontemps
Marie Weiss
Carsten Montzka
Gareth Roberts

Validation Status

Validation Stage - 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** **Biomass**
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** **LAI**
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.	**Vegetation Indicies** **Albedo** **Soil Moisture** **LST & Emissivity** **Active Fire** **Burned Area**
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**

Protocol Progress

Focus Area	Protocol
Biophysical	LAI(2014)
Fire/Burn Area	Targeting summer 2023
Phenology	Targeting summer 2023
Vegetation Index	Targeting summer 2023
Land Cover	Targeting spring 2023
Snow Cover	
Surface Radiation	Albedo (2019)
Soil Moisture	SM(2020)
LST and Emissivity	LST (2019)
Aboveground Biomass	AGWB (2021)

2022 Focus Area Leads

	First Name	Last Name	Institution	Location	End of Term
Main	Michael	Cosh	USDA	USA	Apr 2025 (final)
Main	Fabrizio	Niro	ESA	Italy	Apr 2025(promotion to Chair)
Main	Jaime	Nickeson	GSFC	USA	never
Land Cover	Alexandra	Tyukavina	University of Maryland	USA	March 2024 (1st term)
Land Cover	Sophie	Bontemps	Université Catholique de Louvain	Belgium	Oct 2023 (2nd term)
Biophysical	Marie	Weiss	INRA	France	Sep 2023 (2nd term)
Biophysical	Sylvain	Leblanc	Natural Resources Canada	Canada	Sept 2023 (2nd term)
Biophysical	Hongliang	Fang	CAS	China	Dec 2022 (2nd term)
Fire/Burn Area	Louis	Giglio	University of Maryland	USA	Sep 2023 (1st term)
Fire/Burn Are	Gareth	Roberts	University of Southampton	UK	Dec 2022 (2nd term)
Surface Rad	Zhuosen	Wang	UMD/GSFC	USA	Dec 2022 (2nd term)
Surface Rad	Dominique	Carrer	Météo-France	France	Sept 2022 (1.5 term)
Soil Moisture	John	Bolten	NASA GSFC	USA	Apr 2023 (1st term)
Soil Moisture	Carsten	Montzka	Jülich Research Centre	Germany	Sept 2023 (2nd term)
LST	Glynn	Hulley	NASA/JPL	USA	July 2024 (2nd term)
LST	Frank	Goettsche	Karlsruhe Institute of Technology	Germany	Dec 2022 (2nd term)
Phenology	Joshua	Gray	North Carolina State University	USA	Jan 2025 (2nd term)
Phenology	Victor	Rodríguez-Galiano	University of Seville	Spain	Aug 2025 (2nd term)
~~**Snow Cover**~~	~~Simon~~	~~Gascon~~	~~cesbio~~	~~France~~	~~May 2023 (1st term)~~
Snow Cover	Chris	Crawford	USGS	USA	May 2023 (1st term)
Veg Index	Tomoaki	Miura	University of Hawai'i	USA	Dec 2022 (2nd term)
Veg Index	Else	Swinnen	VITO	Belgium	Apr 2023 (2nd term)
Biomass	Laura	Duncanson	UMD/GSFC	USA	Dec 2022 (2nd term)
Biomass	John	Armston	UMD/GSFC	USA	Dec 2022 (2nd term)
Biomass	Mat	Disney	UCL	UK	Dec 2022 (2nd term)

2023 Focus Area Leads

	First Name	Last Name	Institution	Location	End of Term
Admin	Michael	Cosh	USDA	USA	Apr 2025
Admin	Fabrizio	Niro	ESA	Italy	Apr 2025(promotion to Chair)
Admin	Jaime	Nickeson	GSFC	USA	never
Land Cover	Alexandra	Tyukavina	University of Maryland	USA	March 2024 (1st term)
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Biophysical	Marie	Weiss	INRA	France	**Sep 2023 (2nd term)**
Biophysical	Sylvain	Leblanc	Natural Resources Canada	Canada	**Sept 2023 (2nd term)**
Biophysical	Luke	Brown	Salford	UK	Jan 2026 (1st term)
Fire/Burn Area	Louis	Giglio	University of Maryland	USA	Sep 2023 (1st term)
Fire/Burn Area	Bernardo	Mota	National Physical Lab	UK	Jan 2026 (1st term)
Surface Rad	Angel	Erb	Umass Boston	USA	Jan 2026 (1st term)
Surface Rad	Jorge	Sanchez-Zapero	EOLab	Spain	Jan 2026 (1st term)
Soil Moisture	John	Bolten	NASA GSFC	USA	Apr 2023 (1st term)
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Snow Cover	Vacant				
Snow Cover	Carrie	Vuyovich	NASA GSFC	USA	Jan 2026 (1st term)
Veg Index	Tomoaki	Miura	University of Hawai'i	USA	Dec 2022 (2nd term)
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Biomass	Mat	Disney	UCL	UK	Dec 2022 (2nd term)

Open Questions

- Large turnover of FA leads, 5 positions still open.
- Where does Solar Induced Flourescence fall within LPV hierarchy?
- Where does Evapotranspiration fall within LPV hierarchy?
- Interaction with ICOS for updating of protocols for supersites and LPV products.
- Discussion with IVOS on TOA calibration of LST
- What does Stage 4 validation look like for LPV products?

LPV Plenary 2023

Past LPV Plenary Meetings

- March 2018, Frascati, Italy
- April 2019, Milan Italy
- May 2021, Virtual
- Sep 2022 Virtual

Upcoming WGCV Plenary

- *WGCV 5-9 June 2023 ESRIN, Frascati, Italy*

LPVE Meeting – Frascati, June – Proposed LPV Plenary following

- **Land Product Validation and Evolution, June 12-14, 2023 ESRIN, Frascati, Italy**
- **Land Production Validation Plenary, June 15, 2023 ESRIN, Frascati, Italy**
- Propose 2024 LPV Plenary, US – Potential Venues?

FA Web Status

Focus Area	Home Page	Product table	Collaboration Page	References	Listserv	Letters to Community
Land Cover	May 2021	Sept 2022	May 2021	Sep 2021	Sep 2022	Oct 2022
Biophysical LAI/Fpar	Nov 2021	Nov 2021	Nov 2021	Aug 2022	Oct 2019	Sept 2019
Surface Rad/Albedo	Mar 2021	Jan 2023	Mar 2021	Oct 2022	May 2020	May 2020
LST/Emissivity	Mar 2021	Nov 2021	Mar 2021	April 2019	April 2019	
Fire/Burn Area	May 2021	Aug 2022	Mar 2020	Aug 2022	Mar 2020	
Soil Moisture	Mar 2021	Feb 2019	Mar 2021	Sep 2022	Dec 2020	Dec 2020
Phenology	Apr 2021	July 2020	Apr 2021	Oct 2022		
Snow Cover	Oct 2021	Jan 2021	Oct 2021	Oct 2021	Oct 2019	
Vegetation Index	May 2021	Nov 2021	May 2021	May 2021	May 2019	
Biomass	Apr 2021	Oct 2021	Apr 2021	Apr 2021	Sep 2020	Sept 2020

Focus Area Reports

- Phenology
- Soil Moisture
- Vegetation Indices
- Land Cover
- Biophysical (LAI/FAPAR)
- Fire/Disturbance
- LST&E
- Surface Radiation
- Biomass
- Snow

Land Surface Phenology (1/6)

Updates

- Completed a manuscript documenting model fitting variation across a wide swath of different phenology products and independent validation data: MCD12Q2, MSLSP30NA, PEP725, and ground observations at Harvard Forest and Hubbard Brook.
- We have also generated 35 years of 30 m phenology for 200 North American sites.

- Special Issues in **Remote Sensing:**
  - Advances in Detecting and Understanding Land Surface Phenology
    - **Special Issue Editors : Dr. Jianmin Wang and Dr. Xiaoyang Zhang** (South Dakota State University)

      Deadline for manuscript submissions: **31 August 2023**
  - Remote Sensing for Vegetation Phenology in a Changing Environment
    - **Special Issue Guest Editors: Dr. Dr. Mei Yu (**University of Puerto Rico), **Dr. Yuyu Zhou (**Iowa State University)

      Deadline for manuscript submissions: **30 June 2023**

Land Surface Phenology (2/6)

ISPRS Journal of Photogrammetry and Remote Sensing 194 (2022) 74–90

Contents lists available at ScienceDirect

ISPRS Journal of Photogrammetry and Remote Sensing

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

An optimal method for validating satellite-derived land surface phenology using in-situ observations from national phenology networks

Yongchang Ye [a], Xiaoyang Zhang [a,*], Yu Shen [a], Jianmin Wang [a], Theresa Crimmins [b], Helfried Scheifinger [c]

[a] Geospatial Sciences Center of Excellence, Department of Geography, South Dakota State University, Brookings, SD 57007, USA
[b] School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721, USA
[c] Zentralanstalt für Meteorologie und Geodynamik, 1190 Vienna, Austria

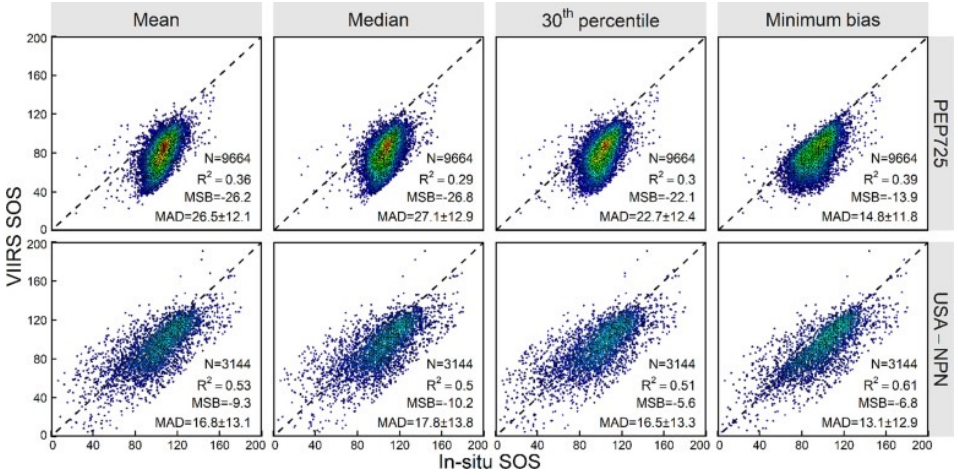


Figure 1. VIIRS SOS and in-situ SOS at all site-years (2013–2020) in Europe (top) and the USA (bottom). Colors indicate density of sample number (blue = low; red = high). MAD: mean absolute difference; MSB: mean systematic bias.

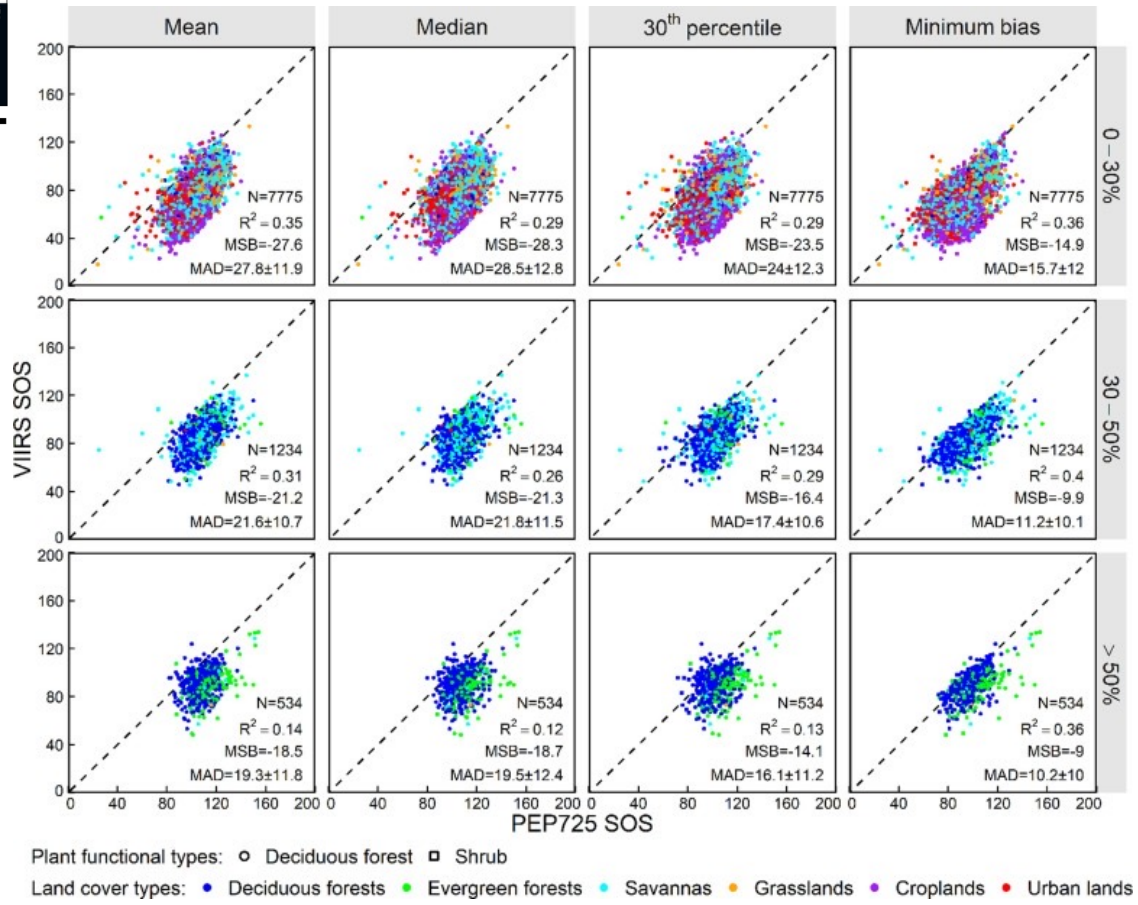


Figure 2. Comparison between VIIRS SOS and in-situ SOS at all site-years (2013–2020) in Europe under four aggregation methods and three tree cover categories (0–30%, 30–50%, and >50%). MAD: mean absolute difference; MSB: mean systematic bias.

Land Surface Phenology (3/6)

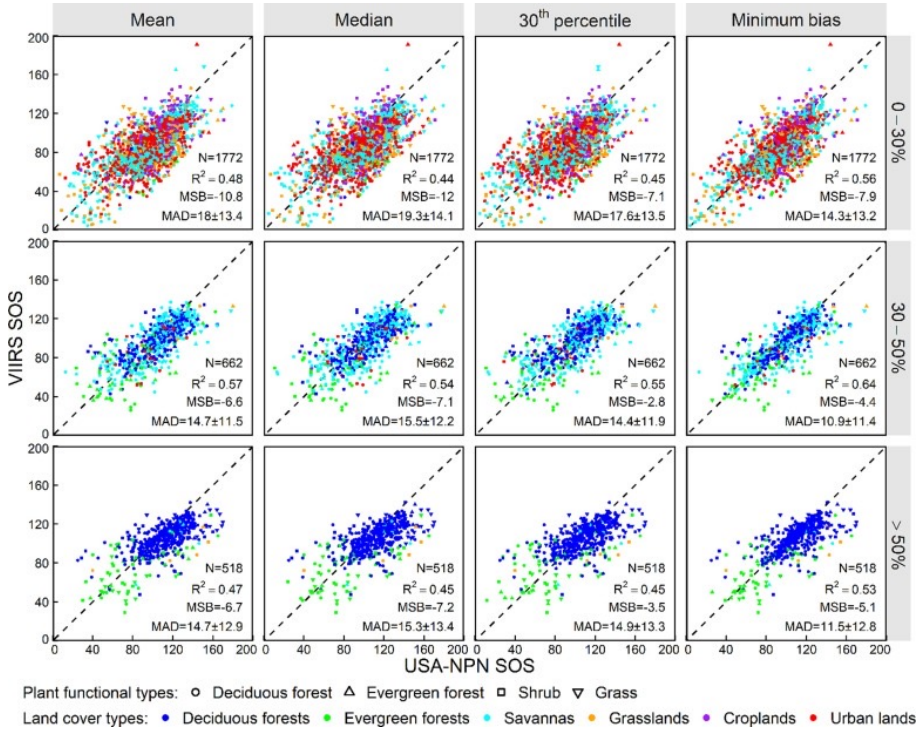


Figure 3. Comparison between VIIRS SOS and in-situ SOS at all site-years (2013–2020) in the USA under four upscaling methods and three tree cover categories (0–30%, 30–50%, and >50%). MAD: mean absolute difference; MSB: mean systematic bias.

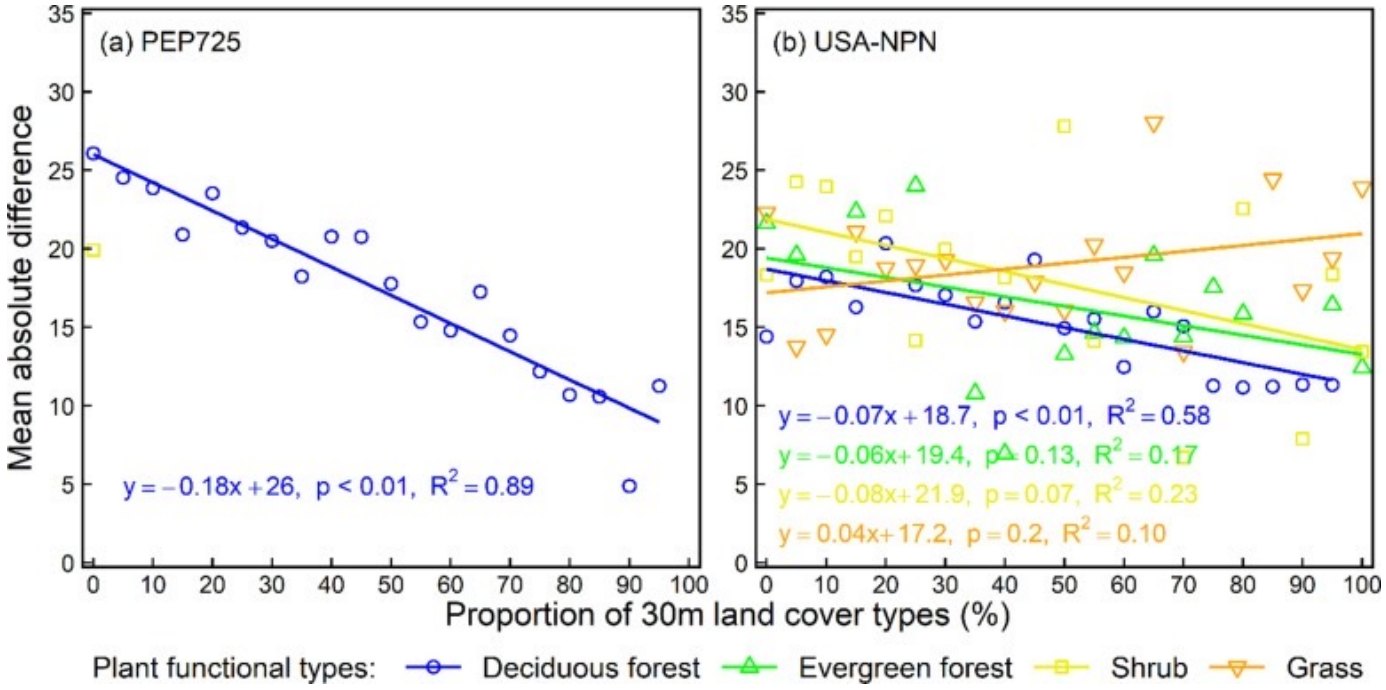


Figure 4. Variation in mean absolute difference between VIIR SOS and in-situ SOS for different in-situ plant functional types against the proportion of same vegetation types calculated from 30 m land cover product at all site-years (2013–2020). The in-situ observations were aggregated using the 30th percentile method.

Land Surface Phenology (4/6)

scientific data

Check for updates

OPEN

DATA DESCRIPTOR

A high spatial resolution land surface phenology dataset for AmeriFlux and NEON sites

Minkyu Moon[1✉], Andrew D. Richardson[2,3], Thomas Milliman[4] & Mark A. Friedl[1]

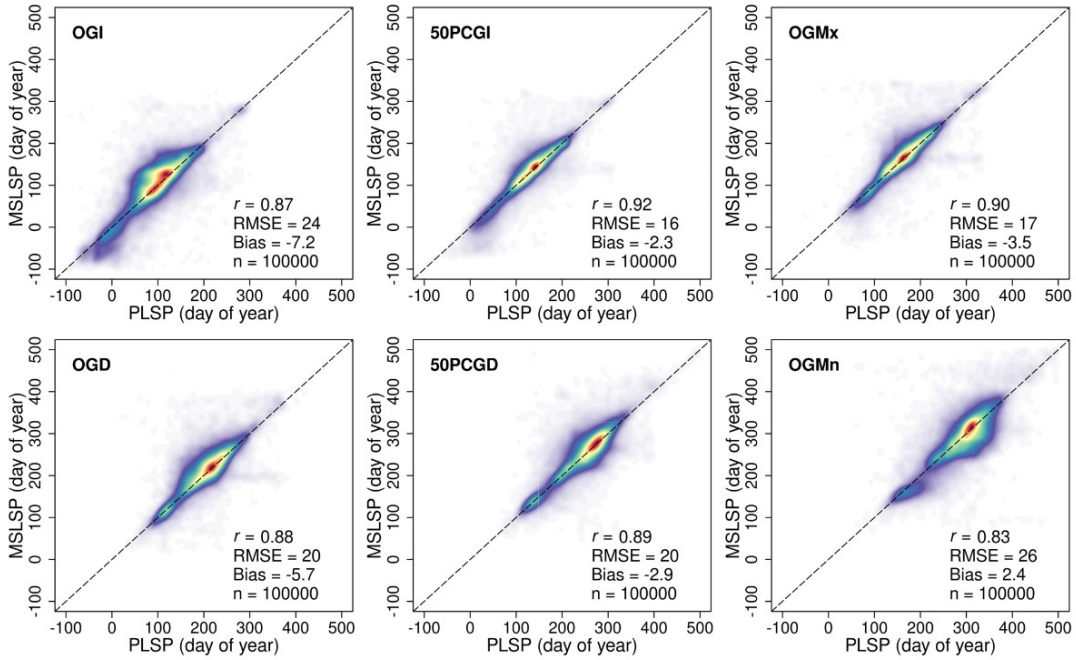


Figure 1. Comparison of PLSP and MSLSP metrics. Each plot compares average values for randomly selected 3 × 3 pixel windows in the MSLSP dataset against average values for co-located 30 × 30 pixel windows from the PLSP dataset (i.e., 90 by 90 m windows).

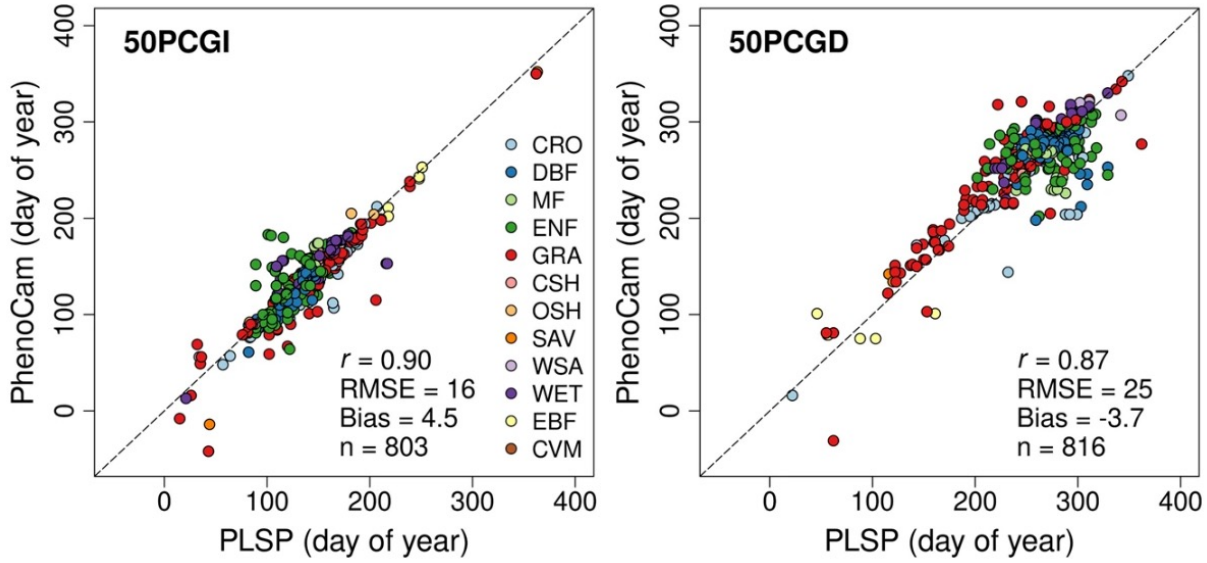


Figure 2. Comparison between PLSP and PhenoCam phenometrics. The comparison is based on average values for 5 × 5 pixel windows from PLSP images centred over each PhenoCam (i.e., 15 by 15 m). Colors indicate the IGBP land cover class assigned to each site by AmeriFlux or NEON.

Land Surface Phenology (5/6)

Contents lists available at ScienceDirect

Remote Sensing of Environment

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

A novel algorithm for the generation of gap-free time series by fusing harmonized Landsat 8 and Sentinel-2 observations with PhenoCam time series for detecting land surface phenology

Khuong H. Tran, Xiaoyang Zhang *, Alexander R. Ketchpaw, Jianmin Wang, Yongchang Ye, Yu Shen

Geospatial Science Center of Excellence, Department of Geography and Geospatial Sciences, South Dakota State University, Brookings, SD 57007, USA

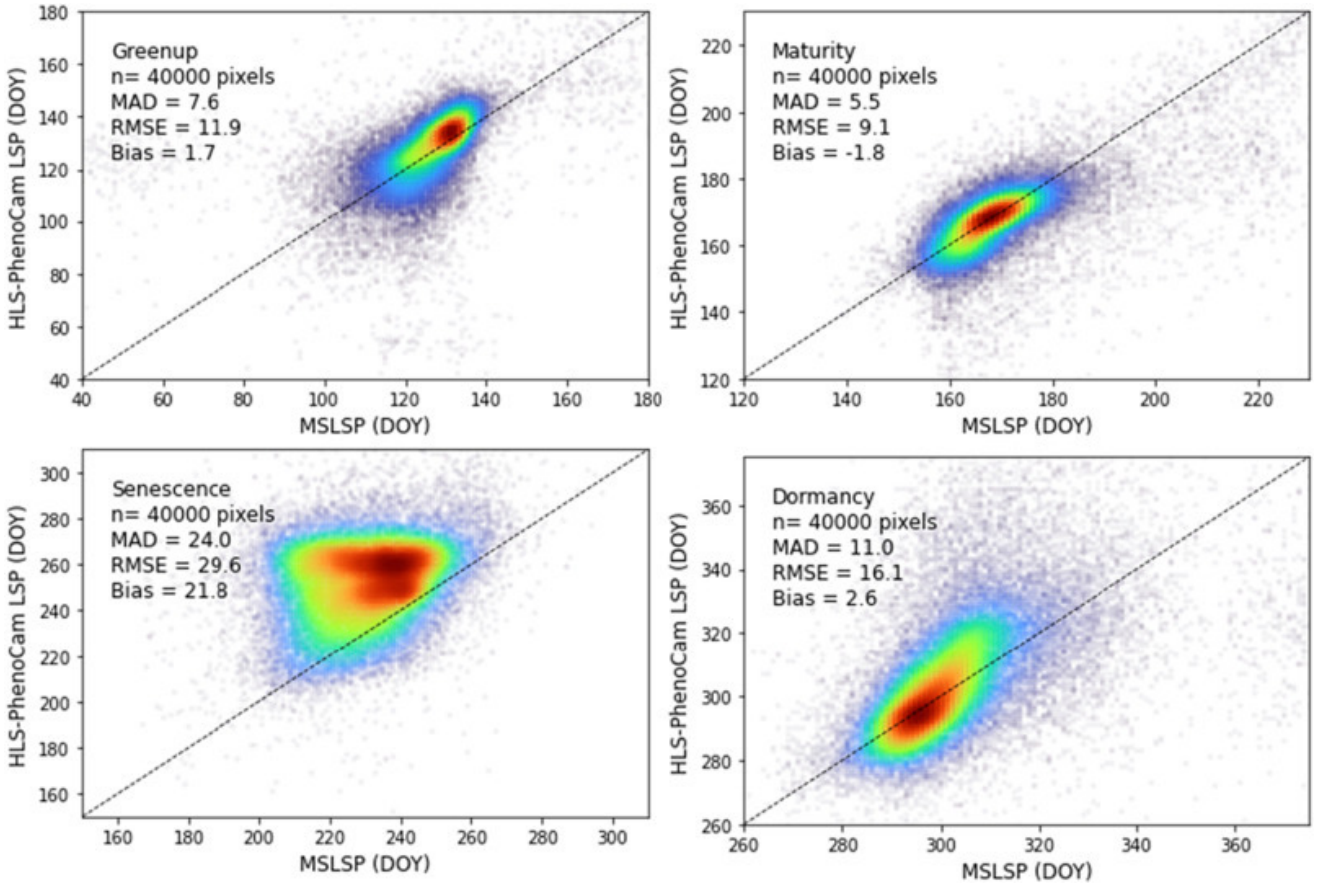


Figure 1. The phenometrics comparison between HLS-PhenoCam LSP with the MSLSP product for the year 2019. 20,000 pixels were randomly selected from the New England study area and 20,000 pixels from the Wisconsin-Michigan study area for this comparison.

Land Surface Phenology (6/6)

International Journal of Applied Earth Observations and Geoinformation 116 (2023) 103148

Contents lists available at ScienceDirect

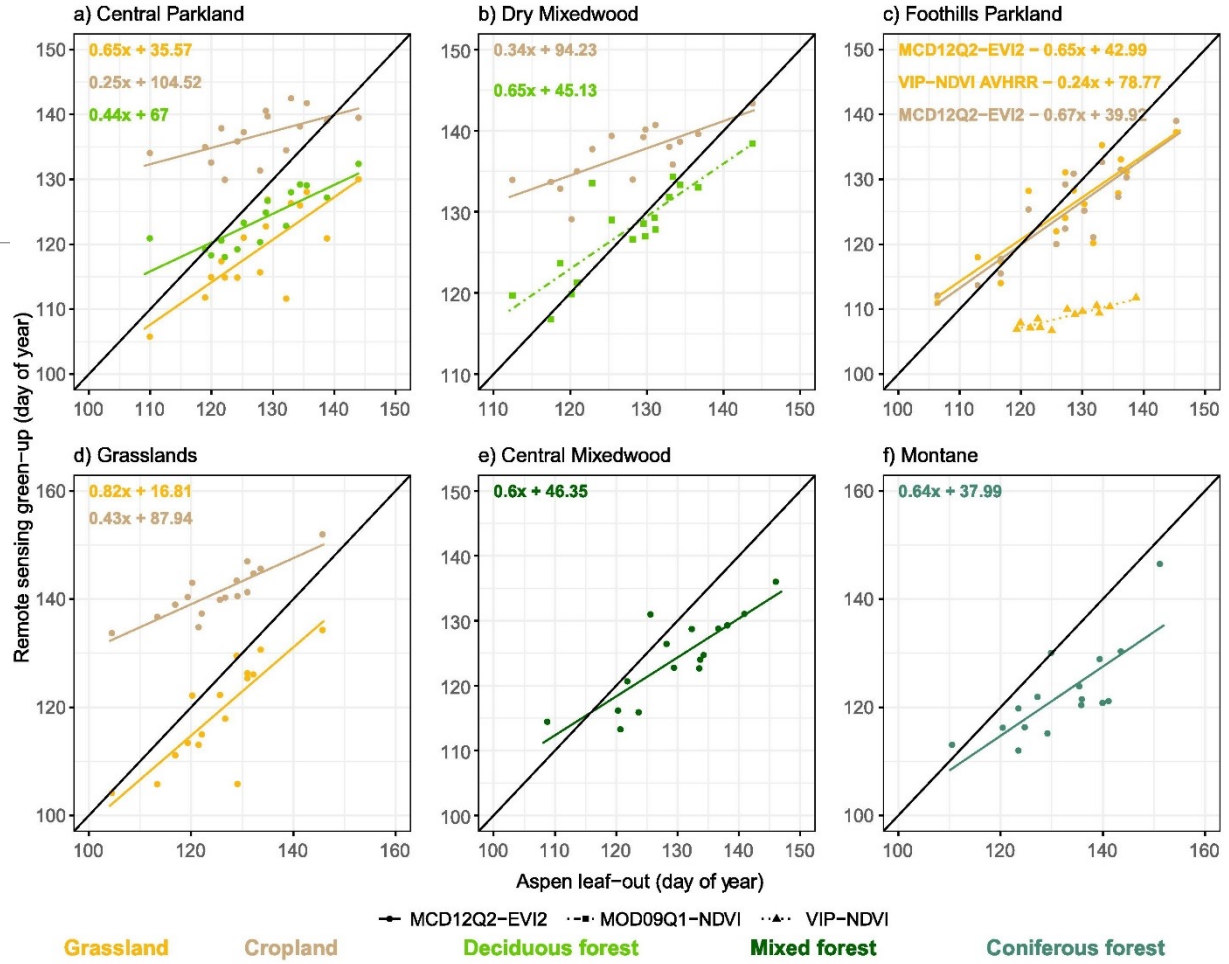
International Journal of Applied Earth Observations and Geoinformation

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

Validating remotely sensed land surface phenology with leaf out records from a citizen science network

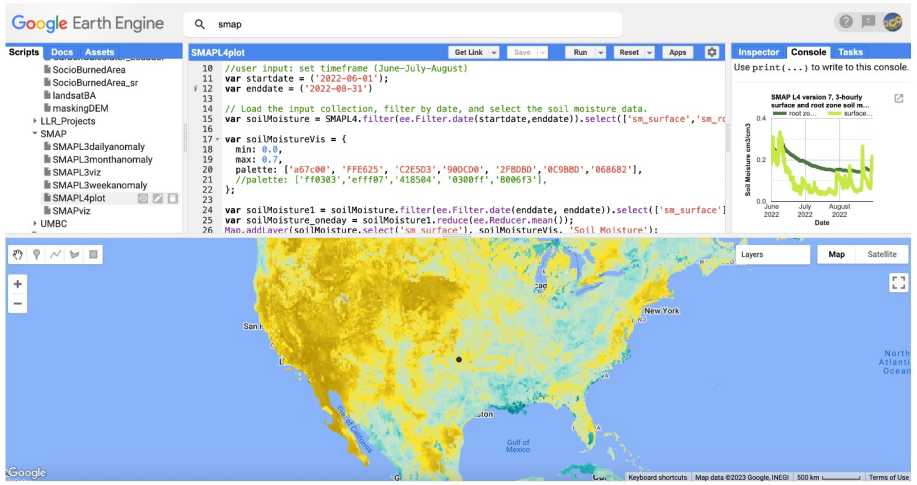
Logan M. Purdy *, Zihaohan Sang, Elisabeth Beaubien, Andreas Hamann

Department of Renewable Resources, University of Alberta, 751, General Services Building, Edmonton, AB T6G 2H1, Canada



Soil Moisture

News: NASA SMAP Level 3 and Level 4 data now available on Google Earth Engine



Workshops:

- 7th Satellite Soil Moisture Validation and Application Workshop, Fall 2024?, New Orleans, USA?
- SMAPVEX Workshop 2023 at Mt. Ida Campus of UMass Amherst in Boston, MA, on April 18-20, 2023
- National Soil Moisture Workshop, August 14-17, 2023
  - Aug 14: Soil Moisture Field School: A hands-on session on soil moisture installation & operation conducted at the nearby USDA ARS field site.
  - Aug 15-16: National Soil Moisture Workshop: The workshop will include a roundtable discussion to gain feedback on the draft Data Quality Guidance White Paper.
  - Aug 17: Forest Soil Moisture Monitoring Special Session

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)
  - Michele Meroni (JRC, Italy)
  - Kazuhito Ichii (Chiba University, Japan)

- Held a kick-off meeting with the expert group (December 15, 2022)
  - Group members charged to review the outline and provide feedback

- Held a 2nd meeting to review comments/suggestions from the expert group (31-Jan)
  - Co-leads charged to revise the outline and incorporate the comments

- Plan to hold another meeting for another review (during the last week of February or the first week of March)

Land Cover

Both Leads are unavailable today

Protocol update:

- We are continuing to gather first draft contributions for the chapters of the guidelines, maybe 60-70% there.

Workshop

- The cropland workshop with Geoglam has been pushed back to the Fall due to delayed funding from NASA and then a conflict with a WRI meeting in June that many cropland folks will be attending.

Biophysical (1/3)

- New Co-lead: Luke Brown (University of Salford)

  - Lecturer in GIS & Remote Sensing and ESA Living Planet Fellow (project is called GROUNDED EO)
  - Previous experience under S3MPC, GBOV & FRM4VEG projects whilst at University of Southampton (with some involvement maintained)

- GBOV 2022 release available since December, review has been performed by CLMS (October 2022)

  - 25 vegetation sites + 6 vegetation sites + 1 site in Japan to come
  - Automated DHP
  - Implementation of a NRT and consolidated mode
  - Upscaling function for bare soil/shrublands/grassland to be improved
  - Emphasis on LST, Soil Moisture

Biophysical (2/3)

- Workshops
  - ESA LPVE Workshop (June 2023)
  - IGARSS 2023, Special session led by R. Fernandes

    CCS.54: From Need to Product: Recent Advances in Mapping and Validation of Vegetation Biophysical Parameters at Regional to Global Extents

- TBD in 2023
  - Newsletter
  - Protocol Update (LAI/fAPAR)

Recent Publications

Martínez-Ferrer, L., Moreno-Martínez, Á., Campos-Taberner, M., García-Haro, F.J., Muñoz-Marí, J., Running, S.W., Kimball, J., Clinton, N., & Camps-Valls, G. (2022). Quantifying uncertainty in high resolution biophysical variable retrieval with machine learning. *Remote Sensing of Environment, 280, 113199, https://doi.org/10.1016/j.rse.2022.113199*

Xu, M., Liu, R., Chen, J.M., Liu, Y., Wolanin, A., Croft, H., He, L., Shang, R., Ju, W., Zhang, Y., He, Y., & Wang, R. (2022). A 21-Year Time Series of Global Leaf Chlorophyll Content Maps From MODIS Imagery. *IEEE transactions on geoscience and remote sensing, 60, 1-13, 10.1109/TGRS.2022.3204185*

Xiao, Z., Song, J., Yang, H., Sun, R., & Li, J. (2022). A 250 m resolution global leaf area index product derived from MODIS surface reflectance data. International Journal of Remote Sensing, 43, 1409-1429, 10.1080/01431161.2022.2039415

Fire Disturbance

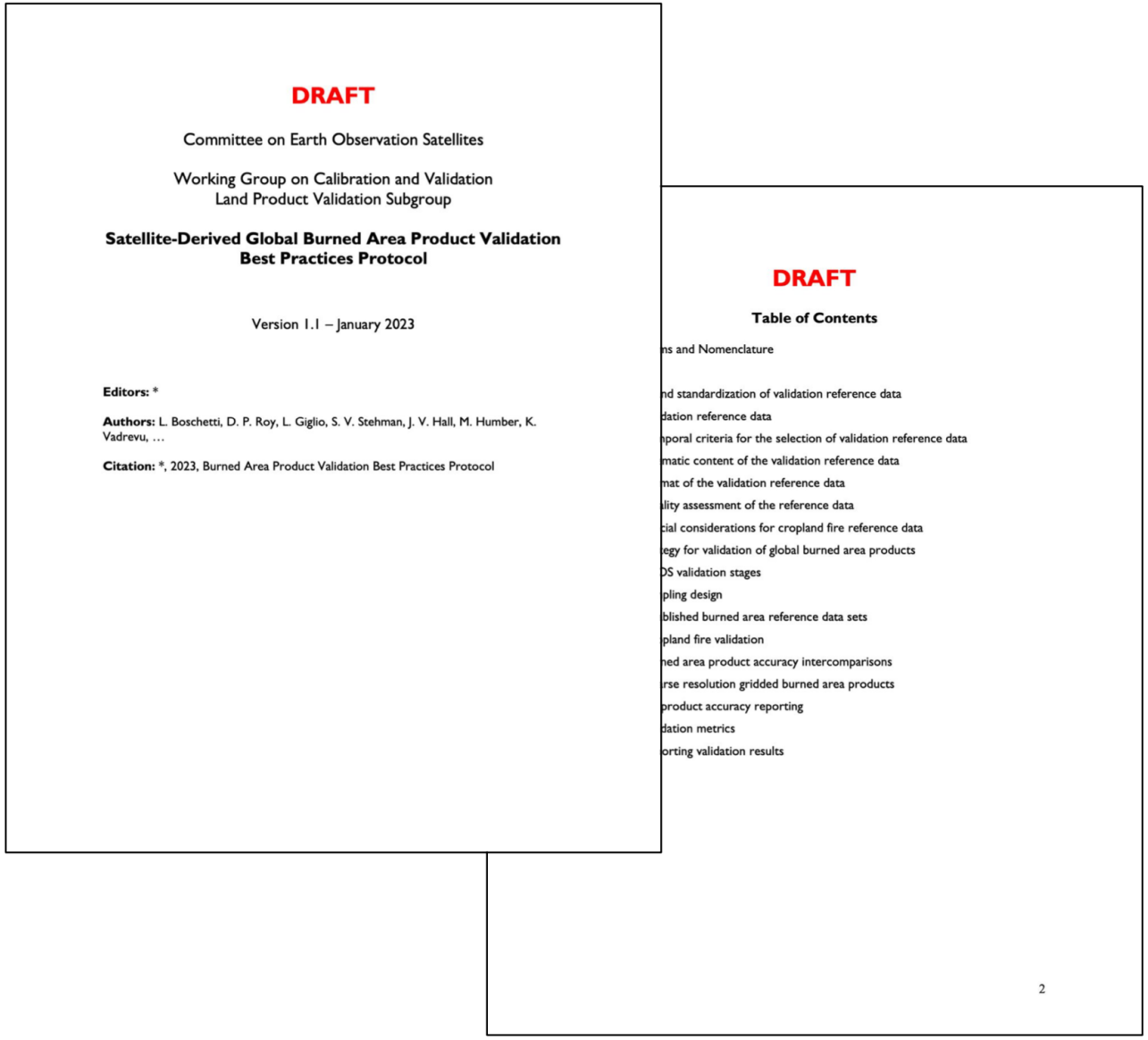
Validation Protocol Status

- Solicited assistance with Burned Area and Active Fire validation protocols at June 2022 GOFC Fire IT meeting
- Update of 2010 draft burned area validation protocol began in August
- Discuss + circulate full draft at next Fire IT meeting in Oct. 2023
- Active Fire protocol to follow

New Co-Lead

Bernardo Mota

National Physical Laboratory (UK)



DRAFT

Committee on Earth Observation Satellites

Working Group on Calibration and Validation
Land Product Validation Subgroup

Satellite-Derived Global Burned Area Product Validation Best Practices Protocol

Version 1.1 – January 2023

Editors: *

Authors: L. Boschetti, D. P. Roy, L. Giglio, S. V. Stehman, J. V. Hall, M. Humber, K. Vadrevu, …

Citation: *, 2023, Burned Area Product Validation Best Practices Protocol

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Table of Contents

ns and Nomenclature

nd standardization of validation reference data
dation reference data
nporal criteria for the selection of validation reference data
matic content of the validation reference data
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lity assessment of the reference data
cial considerations for cropland fire reference data
egy for validation of global burned area products
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pland fire validation
ned area product accuracy intercomparisons
rse resolution gridded burned area products
product accuracy reporting
dation metrics
orting validation results

2

LST & Emissivity (1/3)

Conferences / Workshops

- Int. High Resolution Thermal Workshop, ESRIN, Italy, 10-12 May 2023
  - Preparatory activities for the upcoming High-resolution thermal missions such as TRISHNA, SBG and LSTM
- LPVE23 - Workshop on LPV & Evolution, ESRIN, Italy, 12-14 June 2023

Project news

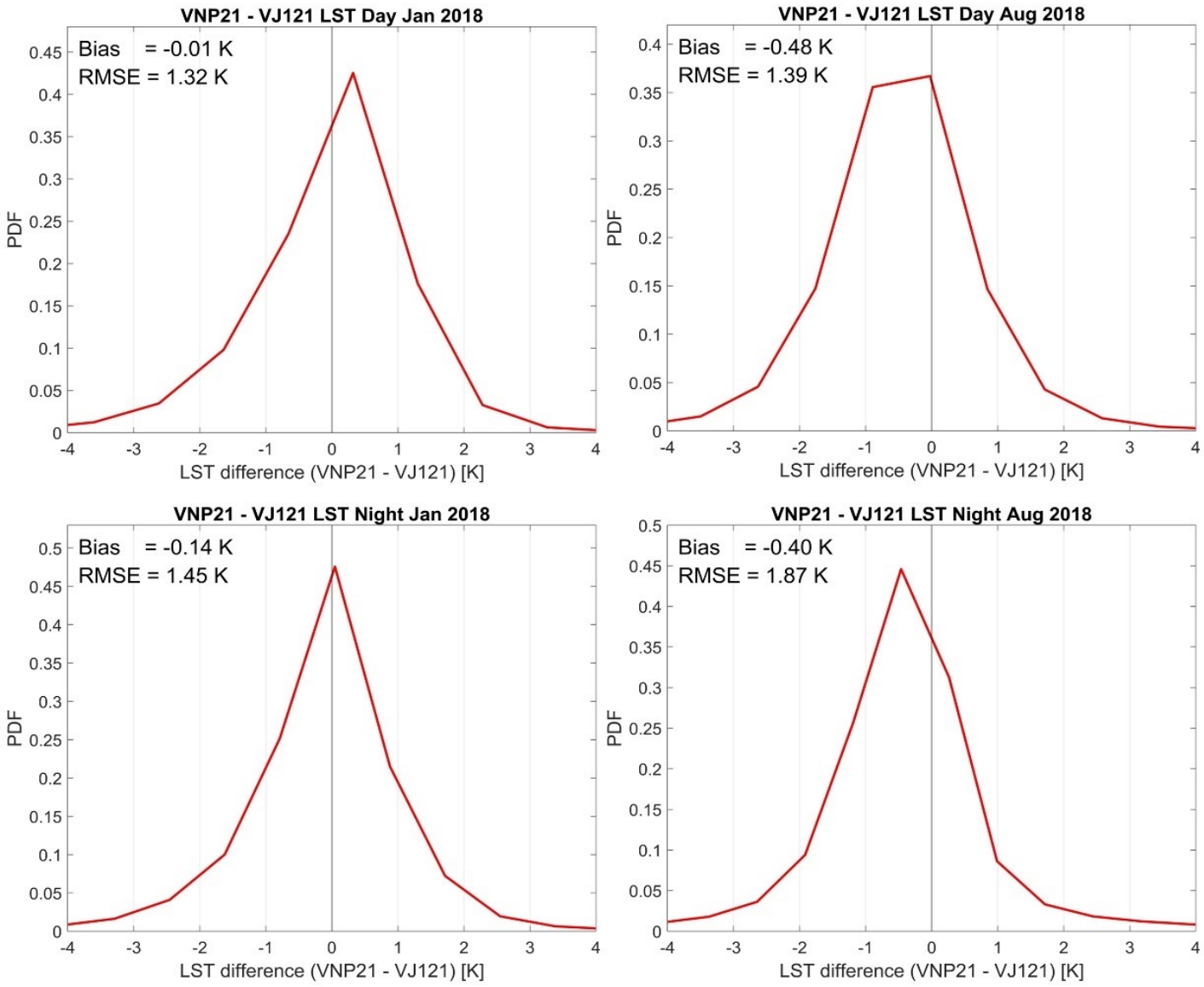
- LST validation stations of Copernicus LAW will be continued within the Optical Mission Performance Cluster (OPT-MPC) for Sentinel 2 & 3
- ECOSTRESS collection 2 LST&E and cloud products available in forward processing – reprocessing of archive to begin March 2022
- New VIIRS 375-m near real time LST product currently in testing and will be available in Spring 2022
- Release of VIIRS collection 2 LST&E expected soon at LPAAC

LST & Emissivity (2/3)

VNP21 (SNPP) and VJ121 (NOAA-20) LST continuity

- The VIIRS TES algorithm for SNPP (since 2011) was successfully adapted and used to generate LST&E products with VIIRS data from JPSS-1/NOAA-20 (since 2018)

- Differences are <0.5 K on average and can be attributed to different overpass time (up to an hour) and cloud mask differences



LST & Emissivity (3/3)

Recent LST&E publications

- Wang et al. (2023), Evaluation of Three Land Surface Temperature Products From Landsat Series Using in Situ Measurements. IEEE Transactions on Geoscience and Remote Sensing, doi: 10.1109/TGRS.2022.3232624.

- Rains et al. (2022), High-resolution all-sky land surface temperature and net radiation over Europe. Earth System Science Data, doi: 10.5194/essd-2022-302 (preprint).

- Galve et al. (2022), Assessment of Land Surface Temperature Estimates from Landsat 8-TIRS in A High-Contrast Semiarid Agroecosystem. Algorithms Intercomparison. Remote Sensing, doi: 10.3390/rs14081843.

- Göttsche et al. (2022), Validation of Satellite-Retrieved Land Surface Temperature (LST) Products at Gobabeb, Namibia. Journal Namibia Scientific Society, vol. 69, ISSN: 1018-7677.

Surface Radiation (1/4)

Welcome to our new co-leads

- Jorge Sánchez-Zapero from EOLAB, Valencia, Spain
- Angela Erb from University of Massachusetts, Boston

New downward shortwave radiation products

- GeoNEX DSR and PAR derived from HIMAWARI-8 AHI and GOES16 ABI.

Status of Copernicus validation activities

SALVAL updates

Surface Radiation (2/4)

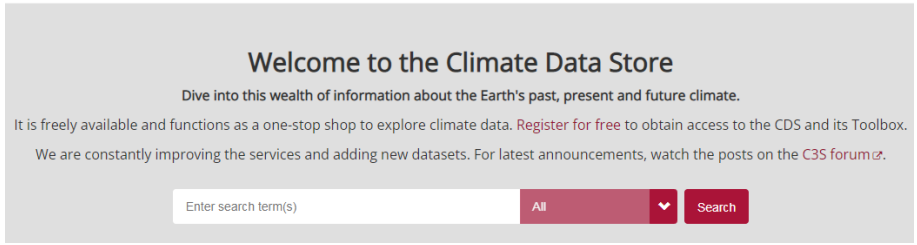
Status of Copernicus validation activities

Copernicus Global Land Service (CGLS):

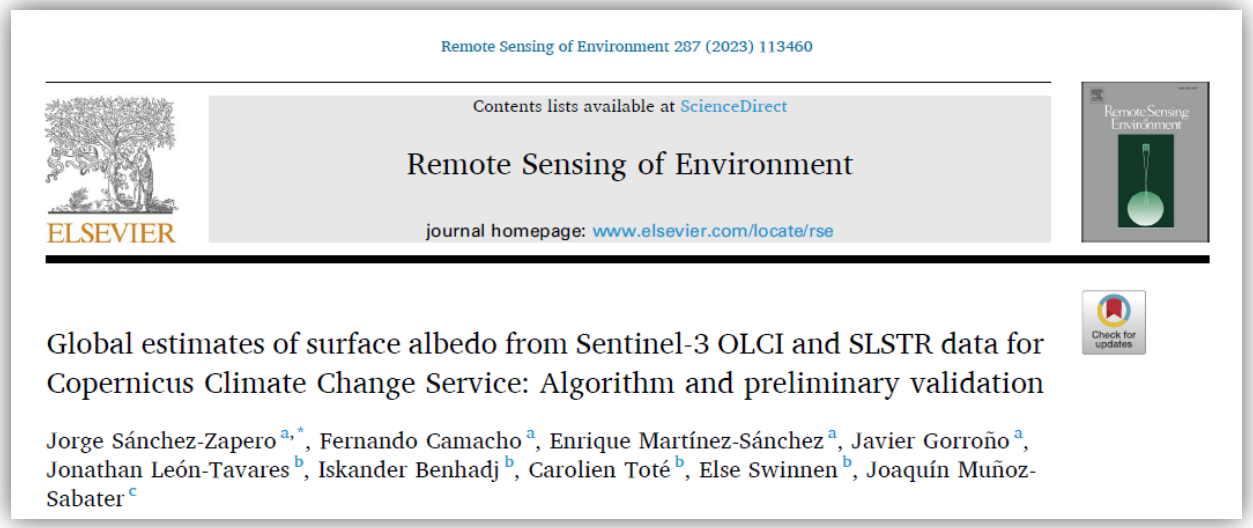
- Working on validation of Surface Reflectance Sentinel-3 products → internal product (not disseminated to users).
- Use of RadCalNet as reference data.

Copernicus Climate Change Service (C3S):

- Development and validation of Surface albedo product based on Sentinel-3 → input from CGLS
- Demonstration pre-operational dataset (July 2018–April 2019).
- It is expected to extend the dataset in an operational context to provide continuity to existing CDR.



Availabe at Copernicus Climate Data Store



Surface Radiation (3/4)

SALVAL updates

- **Publication under review** in Remote Sensing. Recent Advances in Satellite Derived Global Land Product Validation: Part II"

remote sensing

MDPI

Article

Surface Albedo VALidation (SALVAL) platform: towards CEOS LPV validation stage 4. Application to three global albedo climate data records

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- **SATELLITE DATASETS:** Currently several products are included (up to 2021 year):
  - MCD43A3 C6.1
  - C3S (V1, multi-sensor V2)
  - GLASS
  - GlobAlbedo

→ **OBJECTIVE:** to extend the time series up to the present and to include new products (C3S S3 V3, LSA SAF, VIIRS).

Surface Radiation (4/4)

SALVAL updates, con't

- **GROUND DATA:** Representativeness-Evaluated ALbedo Stations **(REALS)** is used as a **reference ground dataset.**
  - A total of 99 sites (data availability for 2000-2020 period) are included.
  - Spatial representativeness is evaluated using CEOS LPV albedo protocol standards.

  → **OBJECTIVE:** to extend the ground data up to the present and to include new products sites.

- **NEW VALIDATION ACTIVITIES ?**

  → **Validation of C3S Sentinel-3 albedo products using SALVAL.**

Aboveground Biomass

Latest Updates

- We have invited two new co-leads! Kim Calders (Ghent University) on the EU side, and Neha Hunka (University of Maryland) on the US side.
  - The initial focus for the new co-leads will be on adding a biomass change chapter to the protocol as well as continuing the biomass harmonization activities that Neha is currently leading.
- ALSO, big announcement - GEDI has been recommended for an extension through 2029! Some ISS issues remain, but they are being worked. GEDI will take a break from next month through the end of 2024, but we expect it to be back on for 2025-2029.
- The GEOTREES initiative effort continues, with a push for funding from private-sector stakeholders and partners – Website: https://geo-trees.org/
- Publication – Biomass FRM
  - Toward a forest biomass reference measurement system for remote sensing applications (https://onlinelibrary.wiley.com/doi/10.1111/gcb.16497)

Snow

Welcome to Carrie Vuyovich, a research scientist within the Hydrological Science Laboratory at NASA Goddard Space Flight Center.

Appreciate your acceptance of the nomination to lead our Snow Focus Area and we will continue in our efforts to seek out an additional co-lead for you!