Land Product Validation (LPV) Sub-group Meeting

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

Subgroup meeting
04 Feb 2025

NEXT LPV TELECON Apr 1, 2025

LPV Working Group Updates (1 of 2)

At end of Term:

Michael Cosh – next call will see Fabrizio as the Chair and leading our teleconferences.
We have a couple of candidates, to consider, one still on the fence and another still considering and checking on funding situation.

Glynn Hulley – time has flown and somehow Glynn has already served 2 3-year terms as co-lead of LST!   Thank you for your community service!!

In need of candidates: Phenology
Josh Gray – also has reached the end of his two-term mark, and his co-lead Victor is not far behind later this summer. It would be good if one could stay on while we search for replacements…. Hopefully today is not goodbye quite yet.

LPV Working Group Updates (con't)

And on brighter note, we have introductions for

****NEW** Focus area leads joining us ;)**

Thomas Holmes – NASA/GSFC will be taking Glynn's place on LST

And for our other new focus area, **GPP/NPP,** we now have two new leads:

Arthur Endsley – University of Montana
Álvaro Moreno Martínez – University of Valencia

	First Name	Last Name	Institution	Country	End of Term
Admin	Michael	Cosh	USDA	USA	Apr 2025
	Fabrizio	Niro	ESA	Italy	Apr 2025 (becomes Chair)
	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	UMD?	USA	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)

LAI has been moved to Stage 3

Will need to consider where the ET and GPP/NPP products are…

	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**

Protocols Status – Updates or Still on Track?

Focus Area	Protocol
Biophysical	LAI(2014)
Fire/Burn Area	Burned Area Targeting (2025?) Active Fire next
Phenology	Targeting (?%)
Vegetation Index	Targeting 2025 (final revision)
Land Cover	Targeting 2025 (175pp, 50 pp)
Snow Cover	
Surface Radiation	Albedo(2019) Global Downward Radiation Product Validation Best Practices (80%)
Soil Moisture	SM (2020)
LST and Emissivity	LST (2019)
Aboveground Biomass	AGWB (2021) Update for Biomass Change (?)
Evapotranspiration	
GPP/NPP	

CEOS WORKING GROUP ON CALIBRATION & VALIDATION

FA Web Status

The **Home** and **Collaboration** page content is on GoogleDrive folder ready for markup.

Updates can be made at any time, just edit your GD files w track changes on (**suggestion mode**) and notify me.

Veg Index and Phenology need to get out of the red!

Focus Area	Home Page	Product table	Collaboration Page	References	Listserv	Letters to Community
Land Cover	May 2024	Dec 2023	May 2024	May 2024	Sep 2024	Nov 2024
Biophysical LAI/Fpar	Nov 2024	Nov 2024	Nov 2024	Aug 2022	Nov 2024	Sept 2019
Surface Rad/Albedo	Jan 2024	Jan 2023	Mar 2021	Oct 2022	Dec 2023	Jan 2024?
LST/Emissivity	Jan 2024	Mar 2024	Mar 2024	Jan 2024	Aug 2024	
Fire/Burn Area	May 2021	Feb 2024	Mar 2020	Aug 2022	Dec 2023	
Soil Moisture	Apr 2024	Feb 2019	Apr 2024	Sep 2022	Dec 2020	Dec 2020
Phenology	Apr 2021	Feb 2025	Apr 2021	Oct 2022	Feb 2025	
Snow Cover	May 2024	Jan 2021	May 2024	Oct 2021	Oct 2019	
Vegetation Index	Sep 2024	Sep 2024	Oct 2024	May 2021	Sep 2024	Nov 2024
Biomass	Mar 2024	Oct 2021	Mar 2024	Dec 2023	Dec 2023	Sept 2020

Focus Area Reports

- LST&E
- Land Cover
- Fire/Disturbance
- Surface Radiation
- Evapotranspiration
- Land Surface Phenology
- Snow
- Biomass
- Soil Moisture
- Vegetation Indices
- Biophysical (LAI/FAPAR)
- GPP/NPP next time!

LST & E (1/3)

Upcoming Conferences

- ESA Living Planet Symposium. 23 – 27 June 2025, Vienna, Austria.
  - **A.02.01** Land Surface Temperature and Emissivity Data for Research and Applications
  - **C.06.02** Advances in Calibration and Product Validation for Optical Sensors
  - C.06.04 New Space Missions Data Quality & Cal/Val
  - C.05.04 Landsat Program and Science Applications

Project news

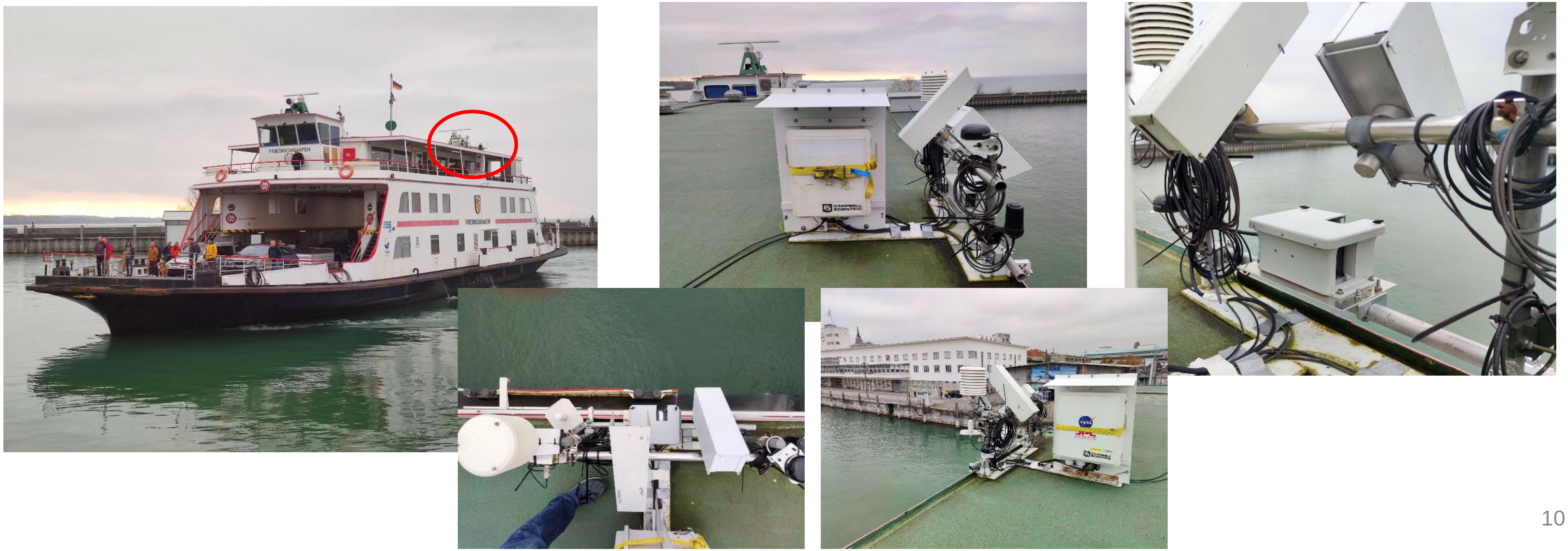
- TIRCALNet preparation study, coordination meeting in February 2025.
- LST_cci, internal validation of recently reprocessed datasets.
- ECOSTRESS forward processing and reprocessing for Collection 2 higher level products (ET, ESI, WUE) has begun

LST & E (2/3)

In-situ comparison of TIR radiometers at Lake Constance

- JPL Radiometer (JPL Network)
  - Wavelength range: 8-14 µm
  - Field of view: 44°
  - Accuracy: 0.08 K
  - Self-calibrated with internal blackbody

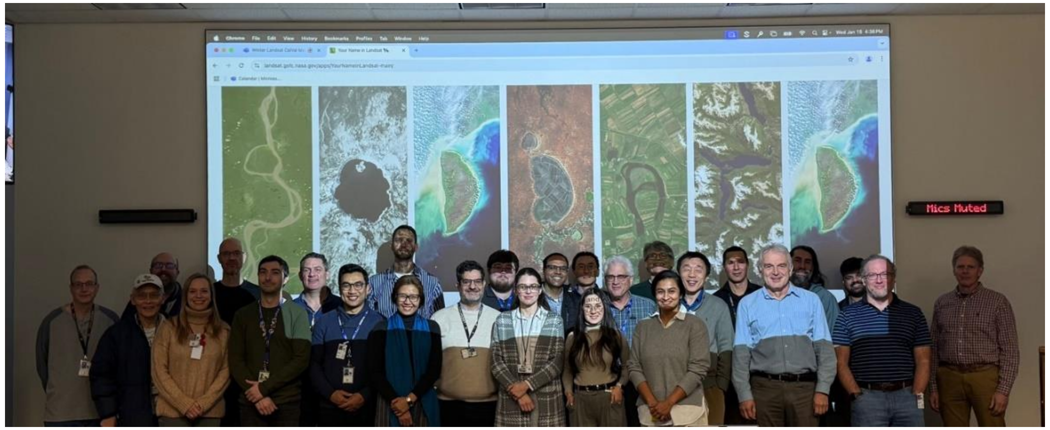
- HEITRONICS KT15.85 (KIT Network)
  - Wavelength range: 9.6-11.5 µm
  - Field of view: 44°
  - Accuracy: 0.3 K
  - High long-term stability: <0.1 % per year



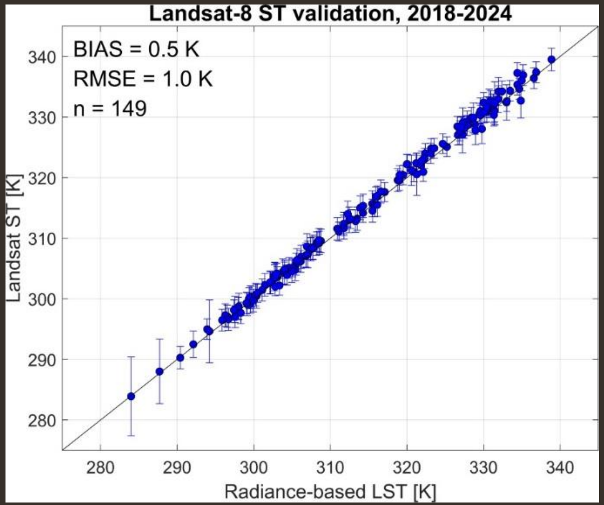
LST & E (3/3)

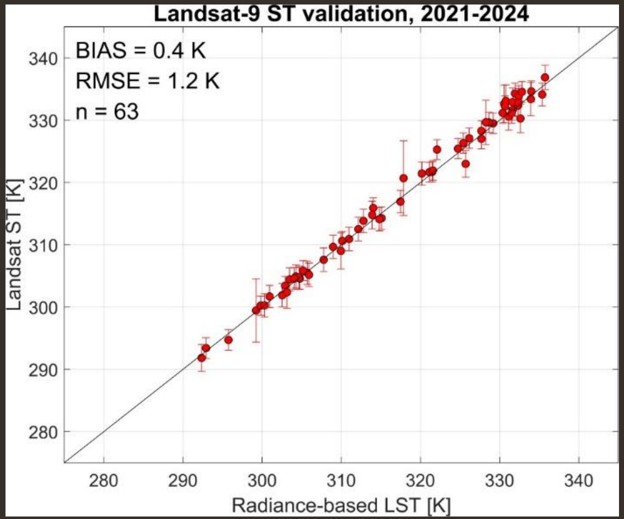
Landsat Cal/Val Meeting was held at NASA GSFC, January 14-16, 2025.

Topics included L7 retrospective, status and validation of L8/L9, and look forward to LNext.



L2 Surface Temperature (ST) validation at pseudo-invariant sand sites shows accuracies <1 K and total uncertainties between 1 – 1.5 K (nominal and as expected)
Credit: Glynn Hulley/JPL





Algodones Dunes, CA
Composition: quartz

Land Cover (1/1)

Guidelines progress update:

Editors working on revisions in response to reviewers' comments.

New "Definitions" section is almost ready.

Other edits pending…

Goal:

Finalize version 1.0 by the end of Spring 2025


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)

Fire Disturbance (1/2)

Validation Protocol Status

- Update of 11-page 2010 draft burned area validation protocol ongoing
- Currently 35 pages
- Engaged additional section authors
- Points of contention
    - FireCCI “long” validation units
    - NASA et al. coarse resolution (~3–6 km) regression

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 10.0 – June 2024

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

Satellite-Derived Global Burned Area Product Validation Best Practices Protocol
Draft v10.1 – June 2024

Table of Contents

2

Fire Disturbance (2/2)

Active Fire Protocol Status

- Finally started!
- Detection + fire radiative power (FRP) retrieval

DRAFT

Committee on Earth Observation Satellites

Working Group on Calibration and Validation
Land Product Validation Subgroup

Satellite-Derived Global Active Fire Product Validation Best Practices Protocol

Version 1.0 – January 2025

Editors: *

Authors: B. Mota, L. Giglio, ...

Citation: *, 2025, Satellite-Derived Global Active Fire Product Validation Best Practices Protocol

Table of Contents

WORKING GROUP ON CALIBRATION & VALIDATION

CEOS

Surface Radiation (1/2)

New publication

remote sensing

Retrieval and Evaluation of Global Surface Albedo Based on AVHRR GAC Data of the Last 40 Years

by Shaopeng Li [1,2,*], Xiongxin Xiao [1,2], Christoph Neuhaus [1,2] and Stefan Wunderle [1,2]

1 Institute of Geography, University of Bern, CH-3012 Bern, Switzerland

2 Oeschger Centre for Climate Change Research, University of Bern, CH-3012 Bern, Switzerland

* Author to whom correspondence should be addressed.

Remote Sens. **2025**, *17*(1), 117; https://doi.org/10.3390/rs17010117

Submission received: 28 November 2024 / Revised: 27 December 2024 / Accepted: 29 December 2024 / Published: 1 January 2025

(This article belongs to the Special Issue State-of-the-Art Remote Sensing Technologies for Environmental Monitoring)

- Global land surface albedo GAC43: 1979 period using AVHRR (NOAA+MetOp). Grid size of 5 km × 5 km.
- Validation and intercomparison using CLARA-A3, C3S and MODIS MCD43.
  - GAC43 best stability (CLARA-A3 noise and C3S biases due to change of sensors).
  - GAC43 similar accuracy (19 FLUXNET + 6 SURFRADd sites) than C3S (RMSE ~ 0,03). MCD43 RMSE ~ 0,023 and CLARA-A3 ~ 0,042.
  - GAC43 and C3S show similar distribution and slight positive bias compared with MCD43. CLARA-A3 shows positive bias with all satellite products.

Surface Radiation (2/2)

Status of Copernicus validation activities

Land Monitoring Service

- New version of **Sentinel-3 OLCI+SLSTR TOC-r V2.3**:
    - Improved OLCI & SLSTR co-registration.
    - Updated Idepix pre-processing (v2.3.2).
    - OLCI & SLSTR calibration coefficients & uncertainties.
    - **Sentinel-3 TOC V2.3 will be included in NRT processing since March 2025 and disseminated to users.**
    - **Direct validation vs. RadCalNet** showed **accuracy < ±1.5% for most channels**

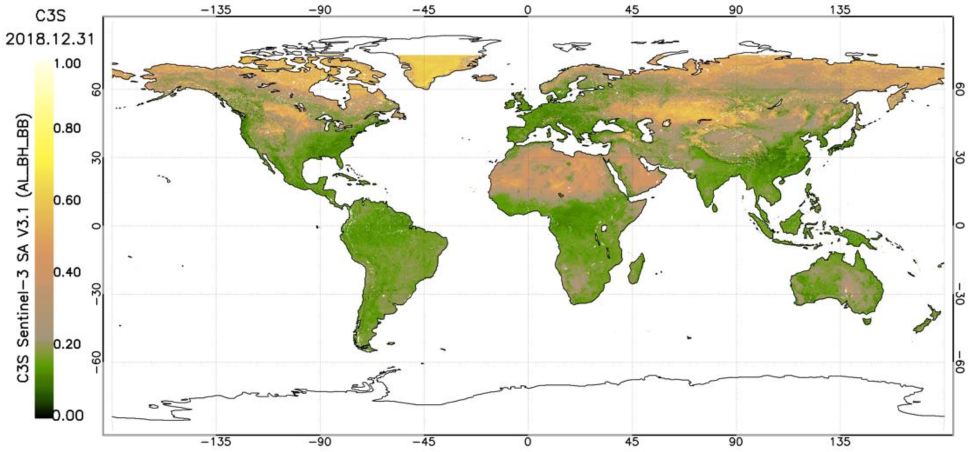
Band	Central wavelength (nm)	FWHM (nm)	Corrected
Oa01	399.9	14.0	no
Oa02	411.8	9.8	yes
Oa03	442.9	9.9	yes
Oa04	490.4	9.9	yes
Oa05	510.4	9.9	yes
Oa06	560.4	9.9	yes
Oa07	620.4	9.9	yes
Oa08	665.2	9.9	yes
Oa09	674.0	7.4	yes
Oa10	681.6	7.4	yes
Oa11	709.1	9.9	yes
Oa12	754.2	7.4	yes
Oa13	761.7	2.5	no [1]
Oa14	764.8	3.7	no [1]
Oa15	767.9	2.5	no [1]
Oa16	779.2	15.0	yes
Oa17	865.6	19.8	yes
Oa18	884.4	9.9	yes
Oa19	899.4	9.9	no [2]
Oa20	939.3	19.7	no [2]
Oa21	1012.9	26.9	yes

[1] This band is highly contaminated by oxygen absorption (O_2)

[2] This band is highly contaminated by Water Vapour (WV)

Climate Change Service

- Global reprocessing ongoing using TOC-r V2.3 for **July 2018 – present**: **C3S SA V3.1**



SLSTR

Band	Central wavelength (nm)	FWHM (nm)	Corrected
S1	554.3	19.2	yes
S2	659.5	19.2	yes
S3	868.0	20.6	yes
S4	1374.8	20.4	No [1]
S5	1613.4	66.4	yes
S6	2255.5	51.0	yes

[1] This band is used for the detection of cirrus.

Evapotranspiration (1/1)

Workshops:

- EGU, 27 April – 2 May, 2025, Vienna, Austria (Carmelo will give an oral presentation)
  - Carmelo Cammalleri will give an oral presentation about ET
- CSBE/ASABE 2025 Annual International Meeting, July 13-16, 2025, Toronto, Canada
  - Has an ecosystem ET session
- The Chapman Conference, Energy Balance Closure Problem, September 15-19 2025, Boulder, Colorado

LPV Subgroup Website:

- We are working on the reference list and Collaboration.

Land Surface Phenology (1/1)

- LSP products and email list updated (Feb 2025).

- New edition of book: Schwartz, M. D. (2024). Phenology : an integrative environmental science. Springer. ISBN 978-3-031-75026-7.
  - Book chapter: Henebry, G.M., de Beurs, K.M. (2024). Remote Sensing of Land Surface Phenology: Progress, Challenges, Prospects. In: Schwartz, M.D. (eds) Phenology: An Integrative Environmental Science. Springer, Cham. https://doi.org/10.1007/978-3-031-75027-4_19
  - Book chapter: de Beurs, K.M., Driscoll, E., Henebry, G.M. (2024). Land Surface Phenology in Global Change Studies. In: Schwartz, M.D. (eds) Phenology: An Integrative Environmental Science. Springer, Cham. https://doi.org/10.1007/978-3-031-75027-4_22

- Special Issue in the journal “Forest”: Forest Phenology Dynamics and Response to Climate Change

  Deadline for manuscript submissions: 16 June 2025

WORKING GROUP ON CALIBRATION & VALIDATION

CEOS

Snow (1/1)

Community Meeting

Snow CCI User Workshop, 23 January 2025

Environment Climate Change Canada (ECCC) hosted the 3rd Snow Climate Change Initiative Workshop to

- Present status and development plans for Snow CCI products
- Gather feedback on climate analysis use cases and requirements from ongoing snow initiatives
- Address key questions on user requirements to inform planning of future CCI product versions

Summary:
Snow CCI is an ESA initiative which produces several long-term satellite-based global SWE and snow cover fraction datasets aiming to meet the GCOS requirements for climate data.
Several new snow CCI products were recently released as version 3: Climate Data Packages, Version 3, including:

- Global daily Snow Cover Fraction on Ground (SCFG) products from MODIS (2000 - 2022), 1 km pixel spacing
- Global daily Snow Cover Fraction Viewable (SCFV) products from MODIS (2000 - 2022), 1 km pixel spacing
- Global daily Snow Cover Fraction on Ground (SCFG) products from AVHRR (1979 - 2022), 5 km pixel spacing
- Global daily Snow Cover Fraction Viewable (SCFV) products from AVHRR (1979 - 2022), 5 km pixel spacing
- Global daily Snow Water Equivalent (SWE) products (1979 - 2022), 10 km pixel spacing

The updated GCOS requirements were also presented which are expected to be formally adopted soon.

Biomass (1/1)

Current Biomass activities:

- Published a letter in Science on spatial resolution
- Planning to work on an expanded piece as a Primer for One Earth that will present the protocol recommendations in a user friendly format (like a text book). Currently just an outline; partnering with private sector partners for this, and trying to make a definition of transparency levels for products
- Neha moving to ESRIN to lead their forest applications research
- NISAR and BIOMASS still likely to launch around April, will allow for some some interesting fusion work
- GEDI version 3 products expected in spring 2025 including post hibernation which should enable changes
- GEOTREES meeting in Paris this week focused on African biomass cal/val; validation tool for biomass using GEOTREES data in preparation at UMD
- GEOTREES data collections ongoing across the tropics, data curation will be through MAAP and following LPV guidelines

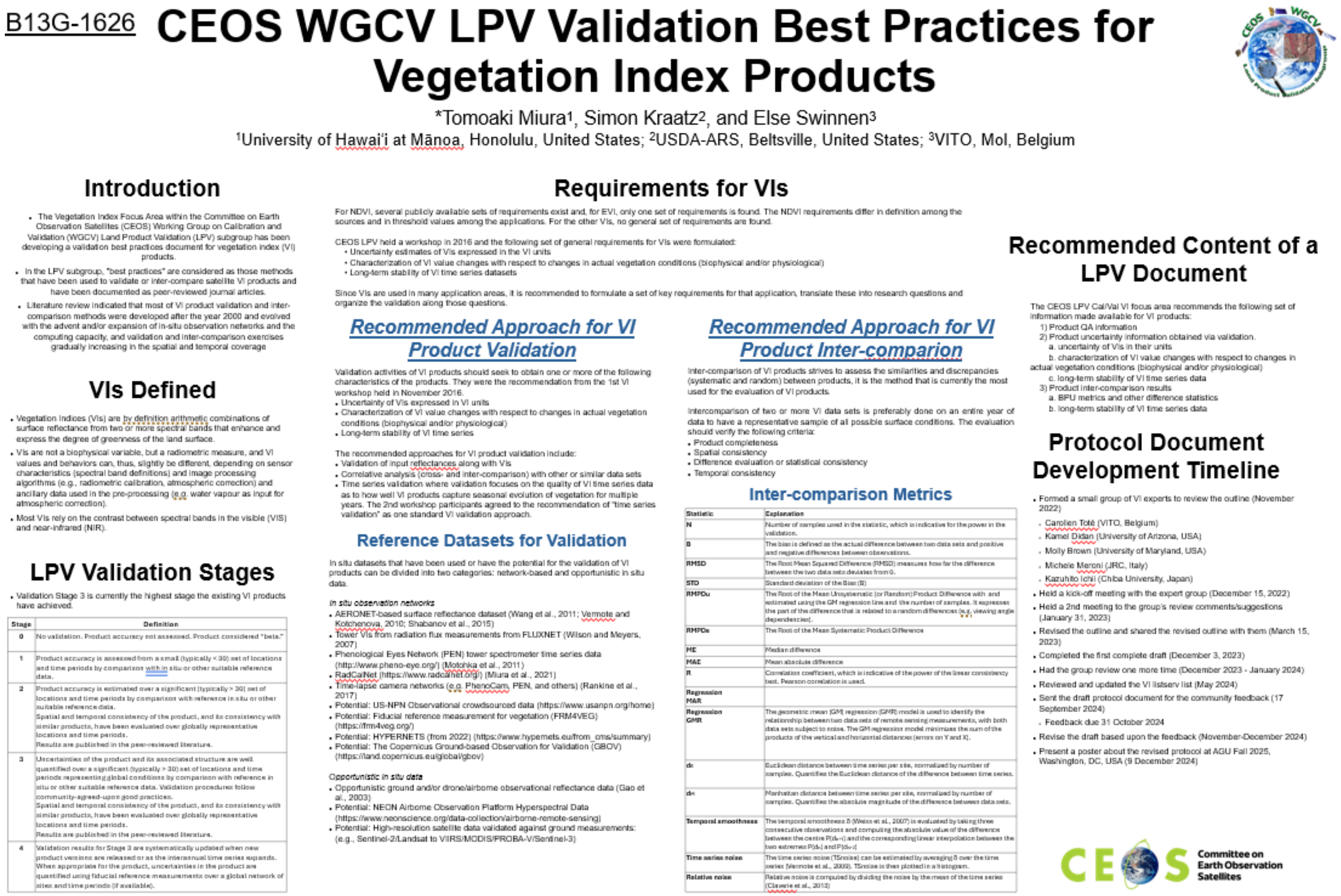
Vegetation Indices (1/3)

Protocol Development

- Still need to revise the draft based upon the feedback (November 2024)

- The idea is to link the website updates with the protocol document updates, so that their contents will be consistent.

- We presented a poster about the revised protocol at AGU Fall 2025, Washington, DC, USA (9 December 2024)



Soil Moisture (1/4)

Relevant Updates:

1. LPV Updated Products Table - we are getting close to an updated version of the products table.
2. LPV Reference List – New references added. Will upload soon.
3. New guidance documents of the National Coordinated Soil Moisture Monitoring Network (NCSMMN) have been released (to be found here)
    1. Soil Moisture Data Quality Guidance
    2. Soil Moisture Metadata Guidance
4. A revision of Soil Moisture Measurement Chapter of "WMO Nr 8 Guide to Instruments and Methods of Observation" is currently in preparation, led by Simone Bircher from MeteoSwiss

Soil Moisture (2/4)

Upcoming workshops:

- EGU General Assembly 2025
  - 27 April-2 May, Vienna, Austria
  - Several Cal/Val sessions proposed (incl. Soil Moisture)
  1. HS 6.1: Remote Sensing of Soil Moisture (30 abstracts)
  2. HS 8.3.2: Advancing the monitoring, maintenance and utilization of in situ soil moisture (10 abstracts)

- ESA Living Planet Symposium 2025
  - 23-27 June, Vienna, Austria
  - Several Cal/Val sessions proposed (incl. Soil Moisture)
  - Quality Assurance for Soil Moisture (QA4SM) User tutorial will be organized
  - CEOS LPV plenary & 25th anniversary planned during LPS, (likely) hosted @ TU Wien

Soil Moisture (3/4)

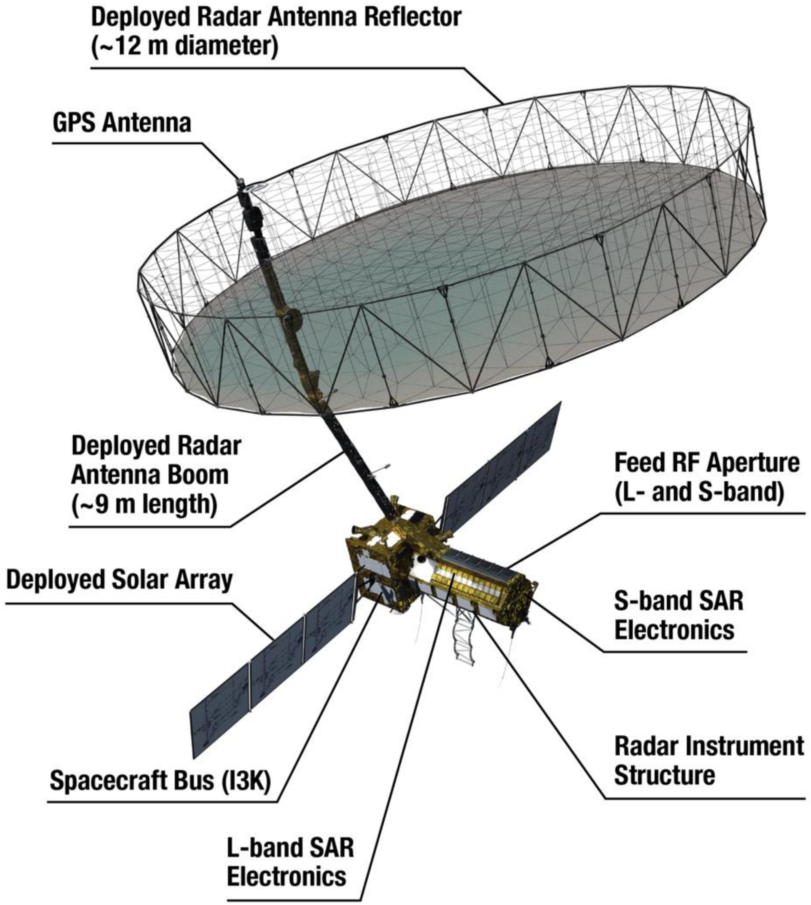
Projects:

- Proposal for FRM4SM Phase 2 (2025-2027) formally accepted by ESA, focus on revising CEOS Validation Good Practice protocol (e.g., develop good practices for validating high-resolution and root-zone soil moisture products)

Soil Moisture (4/4)

NISAR Mission

- NASA – ISRO Synthetic Aperture Radar Mission
- Integration and Testing is completed.
- Projected launch in Spring, 2025. (April)
- Commissioning for three months
- First data available after commissioning
- Soil moisture product will 200 m resolution
- Global 6 day repeat (asc/desc)



Vegetation Indices (2/3)

- Focus Area Web Status updates.

Home Page	VI_home.docx updated
Product Table	NDVI_products_20111102.xlsx updated
Collaboration Page	Checked: October 2024
References	Need to be updated
Listserv	Updated: September 2024
Letters to Community	Invitation Email: September 2024

communications earth & environment — Article
https://doi.org/10.1038/s43247-024-01712-0

Temporal dynamics in vertical leaf angles can confound vegetation indices widely used in Earth observations

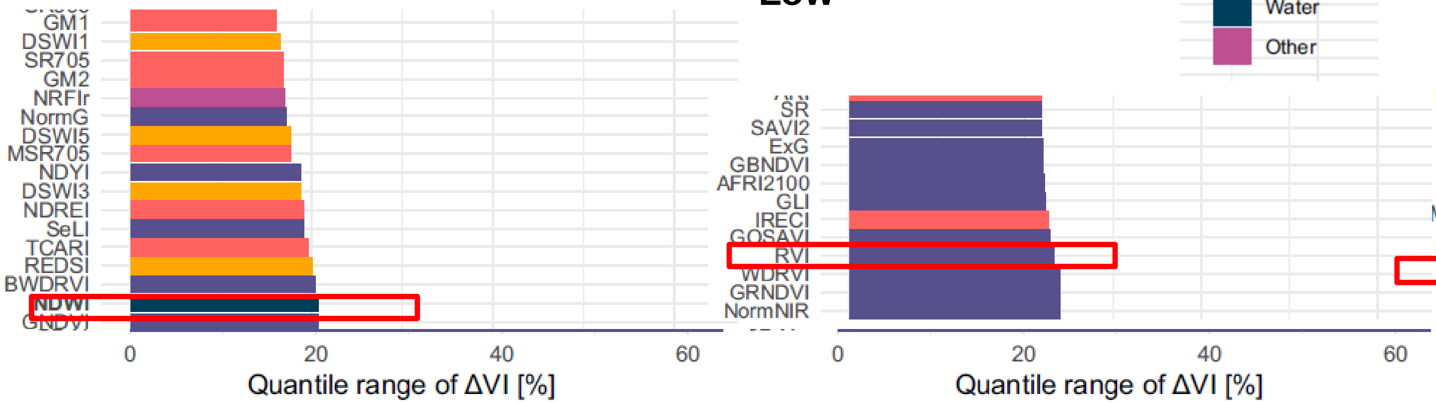
Teja Kattenborn[1,2,3], Sebastian Wieneke[2,3], David Montero[2,3], Miguel D. Mahecha, Ronny Richter[3,5], Claudia Guimarães-Steinicke[2,3], Christian Wirth[3,5], Olga Ferlian[3,6], Hannes Feilhauer[2,3,4], Lena Sachsenmaier[3,5], Nico Eisenhauer[3,6] & Benjamin Dechant

Animation of the AngleCam input (image frames) and output (leaf angle estimates) for a Acer pseudoplatanus crown. Note that here the output (leaf angle distribution) is for simplicity integrated to average leaf angles. ***The animation shows that during a sunny day Tilia cordata tends to oscilate its leaf angles.*** *The estimates show a* ***relatively high variance, mostly caused by small changes in leaf orientation due to wind****. Despite considerable variation in illumination conditions,* ***the predictions show a relatively stable course during the day****.*

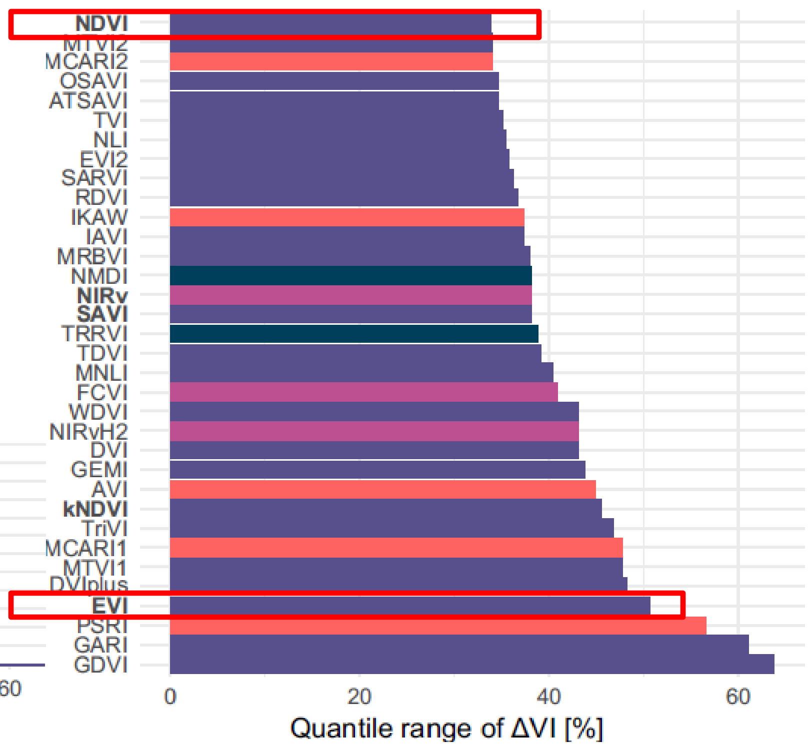
- **temporal dynamics in vertical leaf angles can strongly alter reflectance signals and, hence, vegetation indices.**
- **they show that leaf angle dynamics systematically confound widely applied vegetation indices**
- **these effects are not random but tightly linked to abiotic environmental conditions.**
  - ➢ **implications for monitoring plant properties, biodiversity, and ecosystem functional properties.**

[tejakattenborn/AngleCAM: A deep learning based method to infer leaf angle variation from photographs.]

Low



High



Biophysical

- The team is working on a major revision of the outline for the Protocol Update. It will be expanded to include:
  - Additional biophysical variables other than LAI (i.e. fAPAR and fCOVER)
  - Emerging products and their validation requirements (e.g. decametric products)
  - New in situ data collection approaches and considerations (e.g. active sensors, automated sensors, sources of bias and approaches to corrections)
  - Uncertainty estimation and fiducial reference measurements
- Planning to share the outline with a focused list of reviewers for feedback and then share with the listserv.
- Worked on revised definitions for LAI, FAPAR, FCOVER
- Preparing a resource list of validation Reference Datasets and Tools for the web site.
- Updated the listserv Contact List

GPP/NPP

- Next time!