



CEOS/WGCV/LPV Update

Miguel Román (NASA) Miguel.O.Roman@nasa.gov

Tomoaki Miura (University of Hawaii at Manoa) <u>TomoakiM@hawaii.edu</u>

CEOS-LPV Structure and Agency Programs



NASA	POC: Hank Margolis (LPV Chair + 5 Focus Areas)

POC: Ferran Gascon (WGCV-ACIX; 4 Focus Areas)



POC: Alessio Lattanzio (3 Focus Areas)



POC: John Dwyer (LSI-VC; WG-Climate; 1 Focus Area)

esa

POC: Ivan Csiszar (4 Focus Areas)





POC: Hongliang Fang (1 Focus Area)

JRC

EUROPEAN COMMISSION

POC: Nadine Gobron (GCOS-TOPC; 1 Focus Area)

Group	First Name	Surname	Country	Supporting Agency / Program	Institution
Chair	Miguel	Román	USA	NASA	NASA
Vice Chair	Fernando	Camacho	Spain	ESA	EOLab
Secretariat	Jaime	Nickeson	USA	NASA	GSFC
	Martin	Herold	The Netherlands	GOFC-GOLD/ESA	Wageningen University
Land Use/Cover	Pontus	Olofsson	USA	NASA	Boston University
	Hongliang	Fang	China	CAS	CAS
LAI	Oliver	Sonnentag	Canada	IAI/NSERC	University of Montreal
Fanar	Nadine	Gobron	Italy	JRC	Joint Research Centre
rapar	Arturo	Sanchez	Canada	IAI/NSERC	Univ. of Alberta
	Gareth	Roberts	UK	EUMETSAT	Univ. of Southampton
Active Fire - Burn Area	Andrew	Edwards	Australia	DCBR/B&NHCRC	Charles Darwin University
	Luigi	Boschetti	USA	USGS/NASA	University of Idaho
	Zhuosen	Wang	USA	NOAA/NASA	UMD/NASA GSFC
BRDF/Albedo	Alessio	Lattanzio	Germany	EUMETSAT	EUMETSAT
Coll Majotura	VACANT				
Soli Moisture	Michael	Cosh	USA	USDA	USDA ARS
LST &	Pierre	Guillevic	USA	NOAA/NASA	UMD/NASA GSFC
Emmisivity	Frank	Goettsche	Germany	EUMETSAT	KIT
Dhanalasu	Jadu	Dash	UK	ESA	Univ. of Southampton
Phenology	Matt	Jones	USA	NASA	University of Montana
Vegetation Indices	Tomoaki	Miura	USA	NOAA	University of Hawai'i
	Swinnen	Else	Belgium	VITO	VITO
				VACANT	
Snow Cover	Thomas	Nagler	Austria	ESA	ENVEO
	Laura	Duncanson	USA	NASA	UMD/NASA GSFC
Biomass	John	Armston	USA	NASA	University of Maryland
	Mathias	Disney	UK	ESA	University College London



NOAA Contributions to LPV

- LPV focus area leads funded by NOAA Vegetation Indices, Land Surface Temperature
- Creates operational NDVI, Fire, Snow products
- NOAA PIs on the VIIRS Land Science team are developing and validating VIIRS Environmental Data Records (EDRs)

EUMETSAT Contributions to LPV

- CEOS leadership vice-chair of WG Climate
- Albedo focus area lead supported by EUMETSAT
- Sustained, Coordinated Processing of Environmental Satellite Data for Climate Monitoring – SCOPE-CM – retrieval of satellite albedo from geostationary satellites from various agencies









Area and accuracy estimation of land change Pontus Olofsson (Boston University)



- Image classification errors can greatly biased mapped areas of land change also, "pixel-counting" in maps is incompliant with IPCC criteria reporting of land change.

- CEOS-LPV is providing guidance to implement protocols for unbiased estimation of area and accuracy.

- NASA and other agencies support development and implementation of estimation protocols.



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

Making better use of accuracy data in land change studies: Estimating accuracy and area and quantifying uncertainty using stratified estimation

Pontus Olofsson ^{a,*}, Giles M. Foody ^b, Stephen V. Stehman ^c, Curtis E. Woodcock ^a

Department of Earth and Environment, Boston University, 675 Commonwealth Avenue, Boston, MA 02215, USA ^b School of Geography, University of Nottingham, University Park, Nottingham NG7 2RD, UK Department of Forest and Natural Resources Management, State University of New York, 1 Forestry Drive, Syracuse, NY 13210, USA





Integration of remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests













Spatial and temporal sampling for global burned area validation

Luigi Boschetti (U Idaho, CEOS Land Product Validation Subgroup) David P. Roy (South Dakota State) Stephen V. Stehman (SUNY-ESF)









Rigorous design-based validation of global burned area products, in which reference data are selected via a probability sampling design, is effective in reducing the standard errors of accuracy and area estimators compared to simple random sampling.





https://viirsland.gsfc.nasa.gov/Campaigns.html

S



Multi AngLe Imaging BRDF Unmanned aerial system



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95

SuperSwift Platform with: (1) Soil moisture radiometer, (2) Volcano payload, (3) MALIBU



MALIBU Campaign Status

- Ortho-rectified imagery @ BSRN Table Mountain (Nov 30, 16.)
- FAA approvals went through without a hitch from flight request, to approval, to deployment in < 2 weeks!
 in situ









Time Series plot from:

https://www.esrl.noaa.gov/gmd/grad/meetings/BSRN_talks/P2_3_Crystal_Schaaf_BSRN_validation_2016_v0.8.pdf





3.2 Progress on the implementation of the CEOS Strategy for Carbon Observations from Space

CARB-19: Land	Q4 2017	Summarize current list of validated	WGCV
product validation		land data products relevant to Carbon	
listing and framework		Strategy.	
		Document validation framework and	
		protocols	
	Contraction of the local division of the loc	Provide guidance for online platform for	
	A Sur	intercomparison of terrestrial carbon	
	- The second	products.	
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CARB-19: Land product validation listing



 CEOS/WGCV/LPV has completed listing of 11 carbon-focused variables, totaling 138 land products from 11 CEOS Agencies.

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

- 9 product categories are listed as GCOS Essential Climate Variables (ECVs*)
- 2 product categories are listed as **GEOBON Essential Biodiversity** Variables (EBVs*).

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Biomass

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LST

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> Select Focus Area 🔻 Subscribe me!

Announcing...

reference data LST & Emissivity Fire Radiative Power Product accuracy is estimated over a significant set of locations and time periods by comparison with reference in situ or other suitable Leaf Area Index reference data. Spatial and temporal consistency of the product and consistency with similar products has been evaluated over globally Burned Area representative locations and time periods. Results are published in the peer-reviewed literature Uncertainties in the product and its associated structure are well guantified from comparison with reference in situ or other suitable reference data. Uncertainties are characterized in a statistically rigorous Land Cover way over multiple locations and time periods representing global Albedo conditions. Spatial and temporal consistency of the product and with Soil Moisture similar products has been evaluated over globally representative locations and periods. Results are published in the peer-reviewed literature. Validation results for stage 3 are systematically updated when new

product versions are released and as the time-series expands.



CARB-19: Land product validation listing (Example #3)



CEOS-LPV Validation Reports – Land Surface Temperature & Emissivity Focus Area







3.2 Progress on the implementation of the CEOS Strategy for Carbon Observations from Space

CARB-19: Land	Q4 2017	Summarize current list of validated	WGCV
listing and framework		Strategy.	
		Document validation framework and protocols Provide guidance for online platform for intercomparison of terrestrial carbon products.	

CARB-19: CEOS Land Validation Framework



- Multiple agencies are coordinating five actionable tasks:
- 1. [NASA] Developing best practice validation protocols, where validation methods are sent through rigorous peer-review (Q4-2018).
- 2. [NOAA/ESA/EUMETSAT] Ensuring access to processed fiducial reference data (ongoing).
- 3. [USGS/NOAA] Supporting automated subsets of global satellite products (LPCS; Q2-2017.)
- 4. [NASA] Implementing data analysis tools (Q2-2018).
- [NASA/ESA] Delivering standardized intercomparison and validation reports (Q4-2018)

Schaepman-Strub et al., (2017) submitted





CARB-19: Land Validation Protocol -Land Surface Temperature (LST) (Q4-2017)

Protocol Status: LST validation protocol document is complete and undergoing peer-review. The protocol will present recommendations on internationally accepted validation good practices.

Overarching Goal: To ensure thematic compatibility across products, reference datasets, and methods. CEOS agency deliverables include:



Support product development, validation, and interconsistency efforts (ROSES, MEaSUREs), maintain the On Line Interactive Validation Exercise (OLIVE) platform to assess global satellite products (LAI, Albedo, LST).



Maintain observational networks in the US (BSRN/SURFRAD, USCRN) used for routine validation of LST.



Develop and maintain the online Land Product Characterization System (<u>https://landsat.usgs.gov/lpcs</u>) to facilitate the characterization and validation of multi-satellite products using in-situ data .



Provide users with multi-mission LST data (**GlobTemperature**). Engage with the user community through the **International LST and Emissivity Working Group** (<u>http://ilste-wg.org</u>)



Maintain ground-based LST reference networks in Portugal and Africa for satellite land products validation (Satellite Application Facilities, <u>http://landsaf.ipma.pt</u>)



Editors: Pierre Guillevic, Frank Goettsche, Jamie Nickeson, Miguel Román

Contributors: Fermando Camacho, Darren Ghent, Yunyue Yu, Simon Hook, Glynn Hulley, John Remedios, José Sobrino

> Version 0.1 March, 2017



CEOS LPV Supersites



CV-12 WGCV action: Evaluation of validation supersites and new validation approaches

Evaluation of well-characterized supersites with data continuity prospects for validation purposes that allow for testing of products, algorithms, and validation strategies through radiative transfer modeling.

LPV Supersite Definition

> A Supersite should be fully characterized (3D canopy structure, plus key land variables) to allow a RT model parameterization, whereas a core site refers typically to the same variable.

>A Supersite should be useful for the validation of several land products (>3).

Candidates Networks:

- TERN Australian Super Sites
- ICOS Ecosystem network
- > NEON
- Sites proposed by LPV members

NEON Network





Contact: ≻ Shelley Petroy

National Ecological Observatory Network (NEON)

Continental-scale ecological observation facility sponsored by the National Science Foundation to gather and synthesize data on the impacts of climate change, land use change and invasive species on natural resources and biodiversity

Strategically locates sites across the U.S. to capture variability in ecological and climatological conditions (terrestrial and aquatic stations)

>Coordinates local measurements in the field with high-resolution airborne remote sensing.

➢Provide resources for the ecological community to integrate observations and datasets independently, such as collection and processing protocols.

➢NEON network includes core and relocatable terrestrial sites across the U.S. (including Alaska, Hawaii and Puerto Rico). Core sites (20) are fixed, collect data for a minimum of 30 years and are designed to represent and capture wildland conditions. Relocatable sites (27) move through time to capture environmental gradients not captured at core sites

Open access to sites data is provided through the NEON data portal (http://data.neonscience.org/home).

source: http://www.neonscience.org/science-design/field-sites http://www.neonscience.org/science-design/spatiotemporal-design



Candidates Selection Status

Overall, 61 Supersites selected out of:

TERN : 18 nodes in 10 Supersites
ICOS: 71 sites
NEON: 47 sites
LPV : 13 sites

> The networks referred previously have been investigated to select the candidate sites. Two major criteria were first applied:

□ **Availability of data**: the station is active.

□ **Spatial representativeness**: to guarantee the highest level of homogeneity and to minimize issues associated with spatial representativeness in the point-to-pixel comparison.

■ Using high resolution satellite images (available via Google Earth[™]), to identify those matching the requirement of homogeneity in the area surrounding the measurement tower

Only visually homogeneous sites at 3x3 km and 1x1 km are considered.



Vegetation Index Focus Area



- Sep 2016: Officially established
- Nov 2016: Held a VI & LSP workshop (Fort Collins, CO)
 - 1) Initiate the development of validation protocols for Vegetation Indices and Land Surface Phenology products.
 - 2) Develop a strategy to advance the validation stage of one or more operational Land Surface Phenology Products and one or more Vegetation Index Products
 - To learn the current validation status of VI products
 - To exchange validation methodologies used for VI products
 - To discuss and develop a list of action items and a strategic plan



LPV Vegetation Index & Land Surface Phenology Workshop





Vegetation Index Focus Area



VI & LSP Workshop Fort Collins, CO, USA, November 9-10, 2016

- Three components of VI validation needed to define and characterize VI uncertainties and to satisfy the user needs:
 - 1) Uncertainty of VIs in their units (e.g.,
 NDVI)
 - 2) VI sensitivity to vegetation biophysical/physiological conditions
 - 3) Long-term stability of VI time series data
- Potential data sources for VI validation were identified:
 - NEON airborne hyperspectral data
 - AERONET-based surface reflectance data
 - Ground-/drone-observational reflectance data
 - FLUXNET data

*Each participant volunteered to look into one or more of these datasets and to begin evaluating their VI products of interest



Vegetation Index Focus Area



- Mar 2017:
 - Else Swinnen (VITO) appointed as co-lead
 - Invitation to participate in the VI focus area was sent (127 potential participants)
- July 2017:the VI focus are website launched and completed (https://lpvs.gsfc.nasa.gov/NDVI/VI_home.html)
 - Updated VI product list
 - Updated VI validation references



Biomass

LINKS



Vegetation Index Focus Area

- Action Items:
 - Preliminary validation exercises using the identified validation data sources
 - Selection of a globally representative set of sites for inter-comparison
 - Inter-comparison exercise
 - Reconvening in a year or 1.5 years





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