

Coordination of Validation Efforts of Satellite Derived Land Surface Products – Role and Recent Achievements of the CEOS LPV Subgroup



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LPV Focus Area Leads

Land Product Validation (LPV)
Working Group on Calibration and Validation (WGCV)
Committee on Earth Observation Satellites (CEOS)

LPVE, 28-30 January, 2014, Frascati, Rome

LPV Structure - Focus Areas

* ECV

Snow cover (T5)*, Ice	(Dorothy Hall) (NASA GSFC)	Tao Che (Chinese Academy of Sciences)
Surface radiation (Reflectance, BRDF, Albedo (T8)*)	Crystal Schaaf (U. Massachusetts)	Xavier Ceamanos (Meteo France)
Land cover (T9)*	Pontus Olofsson (Boston University)	Martin Herold (Wageningen University, NL)
FAPAR (T10)*	Arturo Sanchez-Azofeifa (U. Alberta)	Nadine Gobron (JRC, IT)
Leaf area index (T11)*	Oliver Sonnentag (Richard Fernandes)	Stephen Plummer (Harwell, UK)
Fire (T13)* (Active Fire, Burned Area)	Luigi Boschetti (University of Maryland)	Kevin Tansey (University of Leicester, UK)
Land surface temperature*	Simon Hook (NASA JPL)	Jose Sobrino (University of Valencia, SP)
Soil moisture*	Tom Jackson (USDA)	Wolfgang Wagner (Vienna Uni of Technology, AT)
Land surface phenology	Matt Jones (U of Montana)	Jadu Dash (University of Southampton, UK)

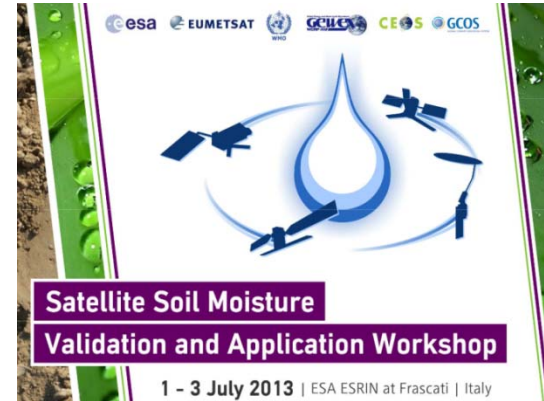
Supported by Jaime Nickeson, NASA GSFC

CEOS LPV Objectives and Goals

1. To foster and coordinate quantitative validation of higher level global land products derived from remotely sensed data, in a traceable way, and to relay results so they are relevant to users.
2. To increase the quality and efficiency of global satellite product validation by developing and promoting international standards and protocols for
 - Field sampling
 - Scaling techniques
 - Accuracy reporting
 - Data and information exchange
3. To provide feedback to international structures for
 - Requirements on product accuracy and quality assurance
 - Terrestrial ECV measurement standards
 - Definitions for future missions

1. Foster and Coordinate Quantitative Validation...

- Focus Areas – product specific validation workshops
 - Phenology – Sept & Dec. 2012
 - Soil Moisture – July 2013
 - Land cover and Fire – April 2013
 - Soil moisture – July 2013
 - FAPAR – January 2014
- LPV sub-group level coordination
 - Telecon every 2nd month to exchange information within LPV and with agencies (NASA, ESA, USGS).
 - LPV meetings (this week)
- Reporting to CEOS WGCV plenaries
- Internationally – chairs and focus area co-leads actively involved in projects, workshops, international activities.



... and Relay Results to Users

- International meetings to communicate to users
 - General idea – alternating sessions at EGU and AGU
 - AGU 2012 - 2 oral, 1 poster session on validation
 - Watch out for validation session at AGU 2014!!
- Emailing lists to distribute news to community
- LPV website <http://lpvs.gsfc.nasa.gov/>
 - Validation events
 - Overview of activities per focus area
 - Contact of focus area leads
 - Available products

<http://lpvs.gsfc.nasa.gov/>



GODDARD SPACE FLIGHT CENTER

[+ NASA Homepage](#)

CEOS Working Group on Calibration and Validation



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Land Product Validation Subgroup

Focus Areas

- [Biophysical](#)
- [Fire/Burn Area](#)
- [Land Cover](#)
- [LST/Emissivity](#)
- [Phenology](#)
- [Snow Cover](#)
- [Soil Moisture](#)
- [SurfRad/Albedo](#)

Announcing...

[2014 Recent Advances in Quantitative Remote Sensing](#), 22 - 26 Sep 2014, Valencia, Spain. Abstract submission deadline, 28 Feb 2014.

37th CEOS WGCV-36, Frascati, Italy, Feb 17-21, 2014.

[GV2M: Global Vegetation Monitoring and Modelling](#), 3rd - 7th Feb 2014, Palais des Papes, Avignon, France.

[7th EARSeL Workshop on Land Ice and Snow](#), Feb 03 - 06, 2014, Bern, Switzerland.

[Land Product Validation & Evolution](#) workshop, Jan 28-30, 2014, Frascati, Italy.



LPV Mission

To foster quantitative validation of higher-level global land products derived from remote sensing data and to relay results so they are relevant to users

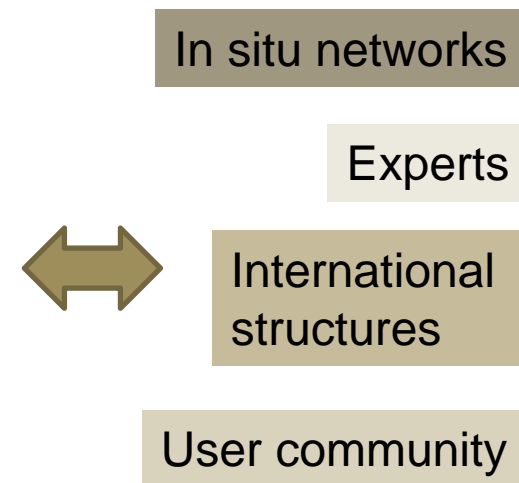
The value of satellite derived land products for science applications and research is dependent upon the known accuracy of the data. The Committee on Earth Observation Satellites (CEOS), the space arm of the Group on Earth Observations (GEO), plays a key role in coordinating the land product validation process. The Land Product Validation (LPV) sub-group of the CEOS Working Group on Calibration and Validation (WGCV) aims to address the challenges associated with the validation of global land products. The LPV subgroup activities are divided up into 8 focus areas related to product families; biophysical, surface radiation/albedo, fire/burn scar detection, land cover mapping, land

2. Standards and Validation Protocols - Validation Hierarchy

Stage 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.
Stage 2	Product accuracy is estimated over a <i>significant set of locations and time periods</i> by comparison with reference in situ or other suitable reference data. <i>Spatial and temporal consistency of the product with similar products has been evaluated over globally</i>
Most products currently at stage (1-) 2 (-3)!	
Stage 3	Uncertainties in the product and its associated structure are well quantified from comparison with in situ or other suitable reference data. Spatial and temporal consistency of the product with similar products has been evaluated over globally representative locations and time periods. <i>Uncertainties are characterized in a statistically robust way over multiple locations and time periods representing global conditions.</i> Results are published in the peer-reviewed literature.
Stage 4	Validation <i>results for stage 3 are systematically updated</i> when new product versions are released and as the time-series expands.

LPV Working Flow – Product Specific!

1. Good practice protocol
 - Product definition
 - Intercomparison guide (eg. spatial, temporal resolution of different products, metrics, reporting)
 - Validation guide (eg. spatial sampling of in situ data, heterogeneity tests)
2. Identification of (in situ) reference data sets
3. Platforms for intercomparison and validation
4. Evaluate and develop new validation methods



Good Practice Protocols - Examples

T10 - FAPAR

Validation concept presented in Dec 2012, updated last week

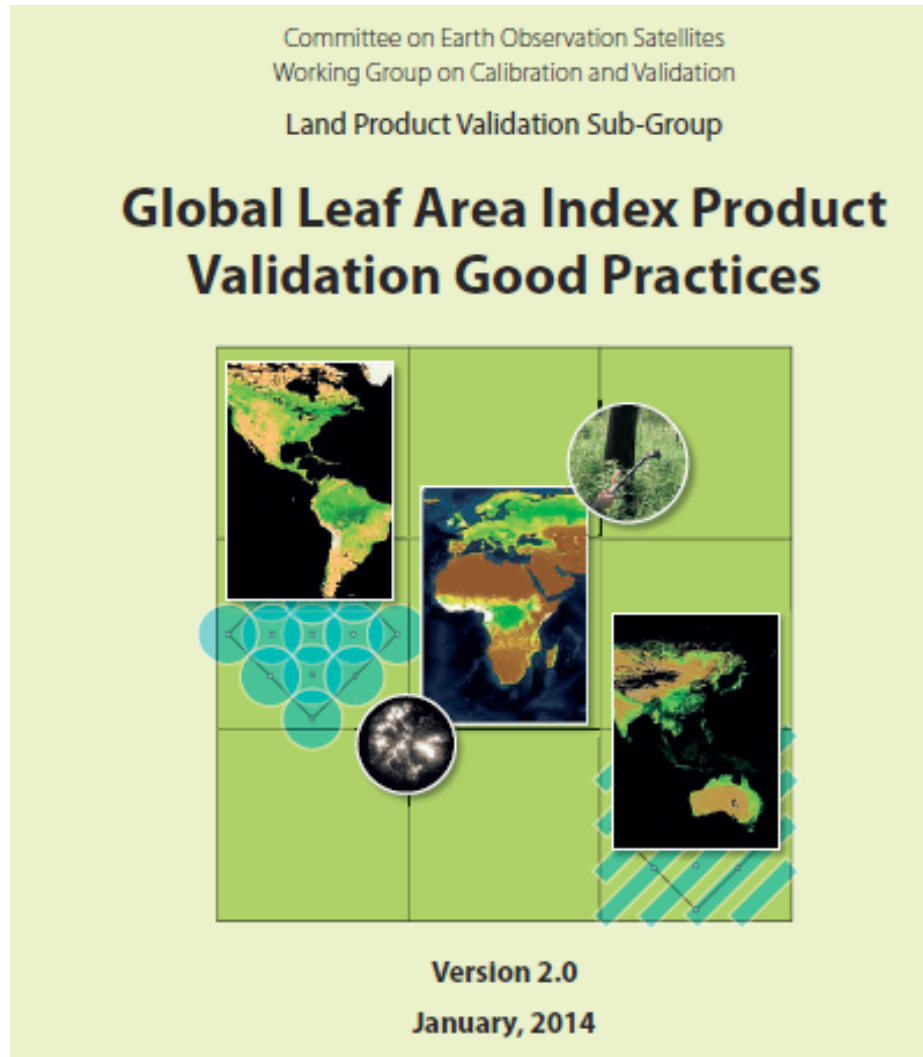
T9 – Land cover

„Good practices for estimating area and assessing accuracy of land change maps“, Olofsson et al., in review

T11 - Leaf area index

Good practices Version 2 release during this workshop!

LAI Validation Good Practices Version 2



- Printed version
- Online version on LPV website
- Reviewer comments and responses on LPV website
- Living document

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Identification of (in situ) reference data and sites

- Generation of reference data
(eg Land cover: Global reference database, joint effort by USGS/Boston U/GOFC-GOLD. Goal: 500 sites world-wide mapped with very high resolution images)
- Collaboration with in situ networks (e.g. NEON, BSRN, FLUXNET, TERN)
- Spatial representativeness of in situ measurements for satellite spatial resolution
(eg Albedo: analysis of spatial representativeness of tower based albedometers)
- New approaches - supersites with fully characterized vegetation to test algorithms and products?
- Global representativeness
- Continuity of in situ data for validation

OLIVE – Online Validation Exercise (CEOS Cal/Val Portal)



CalVal Home

- Overview ▶
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- Sites ▶
- Documentation ▶
- Cal/Val Campaigns & Events ▶
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- Projects ▶
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YOU NEED TO BE A CAL/VAL REGISTERED USER TO USE OLIVE. [PLEASE REGISTER HERE](#)



The On LIne Validation Exercise is a web service designed to:

- Quantify the performances of Earth observation land products (LAI, FAPAR, and FCOVER)

Manuscript ready to be submitted!

- Capitalize on the several initiatives undertaken within the community.

OLIVE is fully supported by the [CEOS/LPV](#) subgroup and allows to reach stage 2 and 3 of the validation process: it allows to estimate product accuracy over a significant set of locations and time through an inter-comparison exercise between existing products. Product uncertainty is quantified using reference in situ data over multiple location data representative of the Earth's surface. OLIVE is expected to help reaching the stage 4 of the validation process thanks to regular updates and to an increasing participation of the scientific community.

The scientific community is thus largely encouraged to use OLIVE to validate and inter-compare a new product to the existing ones. A validation exercise can be achieved in a private mode (results only accesible to user) or public (access to the whole OLIVE community).

OLIVE is still running in beta mode, the CEOS/LPV approval being still in process. Feedback, recommendations and suggestions are very welcomed. Please, contact the OLIVE team at: Alessandro.Burini@esa.int



3. Provide Feedback to International Structures

1. CEOS response to GCOS implementation plans (ie. IP-10 and following)
2. Contributions to GCOS Terrestrial Observation Panel
3. Future collaboration with QA4ECV
4. Future collaboration with GEO (eg. Land cover)

CEOS LPV Response to GCOS IP-10

10 LPV focus area leads contacted as matter experts

Report submitted 24 September 2012, LPV contributions to action items

- T10 Submit weekly surface and sub-surface water temperature, date of freeze-up and date of break-up of lakes in GTN-L to HYDROLARE
- T13 Develop record of validated globally-gridded near-surface soil moisture from satellites
- T14 Develop Global Terrestrial Network for Soil Moisture (GTN-SM)
- T16 Obtain integrated analyses of snow cover over both hemispheres
- T24 Obtain, archive and make available *in situ* calibration/validation measurements and co-located albedo products from all space agencies generating such products; promote benchmarking activities to assess quality and reliability of albedo products
- T27 Generate annual products documenting global land-cover characteristics and dynamics at resolutions between 250m and 1km, according to internationally-agreed standards and accompanied by statistical descriptions of their accuracy.
- T28 Generate maps documenting global land cover, based on continuous 10-30 m land surface imager radiances every 5 years, according to internationally-agreed standards and accompanied by statistical descriptions of their accuracy
- T29 Establish a calibration/validation network of in situ reference sites for FAPAR and LAI and conduct systematic, comprehensive evaluation campaigns to understand and resolve differences between the products and increase their accuracy
- T30 Evaluate the various LAI satellite products and benchmark them against *in situ* measurements, to arrive at an agreed operational product.
- T31 Operationalize the generation of FAPAR and LAI products as gridded global products at spatial resolution of 2km or better, over as long time periods as possible
- T37 Develop and apply validation protocol to fire disturbance data

Status Update

LPV workshop end of this week

- Update of validation status for all variables, planned peer-reviewed article
- Update status validation protocols
- Progress GCOS action items
- Update website
- Identification of in situ networks and site selection
- Reference data set endorsement

Ways Forward

- Space agencies increasingly invest in validation efforts of products.
- CEOS LPV mission is to foster and coordinate validation (intercomparison and validation with reference data) **across** products – contributions mostly through product PIs and universities, low funding for independent across product validation.
- Support independent operational validation efforts such as OLIVE (in situ data repository; common reference, metrics, reporting; transparency towards users).

Ways Forward

- Strengthen methodological development
- Expansion of LPV with new Focus areas?
- When does a product fullfill ECV requirements?
-> LPV supporting discussion with independent validation of products, relating to GCOS requirements
- Mediating discussions to solve disagreements

- Ideas?
- Questions?
- Collaboration?

-> LPV website

-> subscribe to emailing lists

-> contact us!

Thank you!

ESA, NASA

USGS, USDA

NR Canada

Chinese Academy of Sciences

University of Zurich

University of Massachusetts

Boston University

University of Montana

University of Southampton

Wageningen University

JRC

Vienna University of Technology

University of Valencia

University of Alberta

University of Leicester

University of Maryland

Joanne Nightingale for having served
as chair until spring 2013!

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protocol