Land Product Validation (LPV)

Gabriela Schaepman-Strub (U. of Zurich) – LPV Chair
Miguel Roman (NASA GSFC) – LPV Vice-chair
on behalf of LPV focus areas

Update for CEOS WGCVCV-36, Shanghai, 13-17 May 2013
Outline

- LPV objectives and goals
- LPV structure update
- Interactions with other initiatives during report period
- Outreach to the science community
- Future meetings
- Next steps
LPV Objective & Goals

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.

To increase the quality and efficiency of global satellite product validation by developing and promoting international standards and protocols/best practices for

- Field sampling
- Scaling techniques
- Accuracy reporting
- Data and information exchange

To provide feedback to international structures (GEOSS) for

- Requirements on product accuracy and quality assurance (QA4EO)
- Terrestrial ECV measurement standards (GCOS)
- Definitions for future missions
LPV Structure Update

Chair: Gabriela Schaepman-Strub (U. of Zurich) (1 March 2013 – 2016) replacing Joanne Nightingale (now with NPL, QA4EO)

Vice-Chair: Miguel Roman (NASA GSFC) (1 March 2013 – 2016)

Support: Jaime Nickeson (NASA GSFC)

8 Land Product Focus Groups – 2 international co-leads each
Focus Areas

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<tr>
<th>Focus Area</th>
<th>Dorothy Hall</th>
<th>Tao Che</th>
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<td>Snow cover (T5)*, Ice</td>
<td>(NASA GSFC)</td>
<td>(Chinese Academy of Sciences)</td>
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<td>Surface radiation (Reflectance, BRDF, Albedo (T8)*)</td>
<td>Crystal Schaaf</td>
<td>Gabriela Schaepman</td>
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<td>Land cover (T9)*</td>
<td>(U. Massachusetts)</td>
<td>(University of Zurich, SW)</td>
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<td>FAPAR (T10)*</td>
<td>Pontus Oloffson</td>
<td>Martin Herold</td>
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<td>Leaf area index (T11)*</td>
<td>Arturo Sanchez-Azofeifa</td>
<td>(Wageningen University, NL)</td>
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<td>Fire (T13)*</td>
<td>Richard Fernandes</td>
<td>Nadine Gobron</td>
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<td>(Active Fire, Burned Area)</td>
<td>(NR Canada)</td>
<td>(JRC, IT)</td>
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<td>Land surface temperature*</td>
<td>Luigi Boschetti</td>
<td>Stephen Plummer</td>
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<td>Soil moisture*</td>
<td>(University of Maryland)</td>
<td>Kevin Tansey</td>
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<td>Land surface phenology</td>
<td>Simon Hook</td>
<td>Jose Sobrino</td>
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<td></td>
<td>(NASA JPL)</td>
<td>(University of Valencia, SP)</td>
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<td></td>
<td>Tom Jackson</td>
<td>Wolfgang Wagner</td>
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<td>(USDA)</td>
<td>(Vienna Uni of Technology, AT)</td>
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<td></td>
<td>Matt Jones</td>
<td>Jadu Dash</td>
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<td>(U of Montana)</td>
<td>(University of Southampton, UK)</td>
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CEOS Response to GCOS IP-10 - LPV Contributions

- Coordination by WG Climate
- 10 LPV focus area leads contacted as matter experts
- Report submitted 24 September 2012
- LPV contributions to following 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 colocated 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
LPV Participation at GCOS TOPC Meeting

- GCOS/GTOS/WCRP Terrestrial Observation Panel for Climate (TOPC), XVth Session, 6-7 March 2013

- New TOPC chair Konrad Steffen CH (Han Dolman outgoing)

- GTOS (global terrestrial observation system - FAO) is not functional anymore (R. Valentini resigned)

- Update of Implementation Plan in preparation for 2016 – evaluation of new ECVs

- Request for input to (meta-) data portals: GOSIC, ECV- inventory, OSCAR, LSI

- LPV update delivered (2nd time LPV is attending)

- TOPC-LPV action item on selection of representative validation sites
LPV Participation in QA4EO

- Teleconference participation
- Submission of first case-study on 3D vegetation lab
- Contribution of LPV to QA4EO has to be discussed in more detail with Nigel Fox and Joanne Nightingale
3D Vegetation Lab


Choice of two contrasting FLUXNET sites

1. Laegeren (CH): mixed forest, various tree development stages, sloped terrain, heterogeneous background

2. Tharandt (GER): single (coniferous) species forest, evenly aged, flat terrain, homogenous background (no understorey)

‘Complete’ 3D reconstruction of these sites using

– laboratory, terrestrial and airborne laser scanning approaches (leaf-on and leaf-off data)
– spectral properties of foliage, understorey, soil/litter (leaf optical properties, background reflectance, biochemistry, ..)
– conventional measurements (LAI2000, hemispherical photographs, dGPS, dbh, crown dimensions, etc.)
– tree species determination
3D Vegetation Lab – Sampling Approach

Two stage cluster sampling scheme with stratification (Köhl et al., 2006)
- First-stage clustering (area of interest, 300x300m)
- Second-stage clustering (primary sampling units, 60x60m; secondary sampling units, 20x20m (Baret et al., 2004; NFI, 2001))

Provision of fully parameterized scenes in 2013, composed of
- 3D world files
- scene analysis tools
- radiative transfer models (DART, librat, libradtran)
- exhaustive Earth observation data set
- encapsulated in a BEAM* toolbox.

* http://www.brockmann-consult.de/cms/web/beam/
The Online Validation Exercise is a web service designed to:

- Quantify the performances of Earth observation land products (LAI, FAPAR, and FCOVER)
- Use transparent and traceable methods following standards defined by the CEOS (Committee on Earth Observation Satellites) Product Validation subgroup
- Provide open access of the results to the whole scientific community.
- 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 accuracy over a significant set of locations and time through an inter-comparison exercise between existing products. Product usefulness is quantified using reference in situ data over multiple location data representative of the Earth’s surface. OLIVE is expected to help in reaching 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. An exercise can be achieved in a private mode (results only accessible 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 welcomed. Please, contact the OLIVE team at: Alessandro.Burini@esa.int
• Official recognition of the need for long-term in-situ radiation measurements for spectral and broadband BRDF/albedo.
• Stresses importance of BSRN, Fluxnet, AERONET.
• Provides guidelines for data collection protocols and standardization across the flux networks.

Schaaf et al., 2008
We compared MODIS albedo retrievals with measurements taken at 53 FLUXNET sites that met strict conditions of land cover homogeneity.

A good agreement between MODIS derived mean annual values and tower-based measurements was found ($r^2 = 0.82$).

The mismatch is correlated with the spatial heterogeneity of surface albedo; stressing the relevance of spatially-representative in-situ data when validating satellite products.

**Figure 1:** Spatial distribution of the 120 FLUXNET sites for which albedo measurements are available.

**Figure 2:** Classification of four FLUXNET sites according to their spatial representativeness at the resolution of MODIS satellite imagery (~1 km$^2$).
Outreach to the Science Community

LPV submitted a session proposal to AGU fall meeting 2012 on “Quality Assessment of Satellite-Derived Land Surface Variables”.

2 oral + 1 poster session with ~30 contributions from LPV and international community, covering
- Development of validation methods
- Product or satellite specific validation results
- New datasets for ECVs

Achievements beyond exchange of scientific results
- Attracting validation community not actively involved in LPV
- Platform for validation contributions -> motivation of (young) researchers to invest their time in validation!

Goal to have alternating LPV sessions at AGU and EGU in the future. Good platform for LPV side-meetings!
Recent and Future Meetings

- Phenology Land Product Validation Workshop – side meeting AGU, Dec 2012.


Next Steps

Strategy development and priorities for LPV 2013-16
• within WGCV terms of references
• including focus area leads in discussion

Points for discussion include
• Protocol/best practices development strategy
• Communication with emailing lists
• Coordination with WG Climate (eg. GCOS IP)
• Coordination with (meta-) data portals
• Identification and reduction of redundencies
• Definition of LPV role in QA4EO
• Website renewal and updates (WGCV, LPV, focus areas)
• Selection of representative validation sites
• Endorsement of validation data sets (and DOI assignment)
• LPV workshop on methods and results (2013/2014)
• LPV publication strategy
• Attracting next generation of focus area leads
http://lpvs.gsfc.nasa.gov/

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 sub-group activities are divided up into 8 focus areas related to product families: biophysical, surface radiation/albedo, fire/burn scar detection, land cover mapping, land surface temperature/emissivity, soil moisture, snow and phenology.

LPV Terms of Reference