# Land Product Validation (LPV) Sub-group Update

Gabriela Schaepman-Strub (U Zurich) - Chair
Miguel Román (NASA GSFC) – Vice-Chair
Jaime Nickeson (NASA GSFC) - Support
Contributions by LVP focus area co-leads

WGCV-38
30 Sept- 2 Oct 2014, NOAA, USGS, NASA, College Park, USA

# Update Focus Area Co-leads

* ECV

| | | |
|---|---|---|
| Snow cover (T5)*, Ice | Thomas Nagler (ENVEO, Austria) | 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 (U. Montreal) | 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

# Focus Area Co-Lead Terms and Procedure

- Chair transition Feb 2016 (3yrs)
- Fixed terms for co-leads (2 x 3yrs)
- Major shift expected for Dec 2016 (end of 2nd term for long-term co-leads)
- Change in replacement procedure

  Announcement of vacancies to general LPV mailing list.
  Evaluation of candidates by outgoing co-leads and LPV chair and vice-chair, selection by chair/vice-chair.

# Achievements since WGCV-37

1. Progress of LPV contributions to CEOS WP 2014-16 (CV1, CV11 & CV12)

2. Meetings and outreach

3. LPV collaborations

4. Focus area updates

5. Open actions

# 1. Progress CV11 & 12 (CEOS WP 2014-16)

| | | |
|---|---|---|
| CV-11: Validation of terrestrial ECV products | Q1 2015 – Q4 2016 | The validation of terrestrial ECV products is in line with activities carried out in WGCV-Land Product Validation (LPV). The validation of ECVs covered within WGCV-LPV shall be strengthened. This includes (a) an update of validation stage, (b) ECV-specific synthesis of a state-of-the-art validation approach for each terrestrial variable with corresponding references and protocols, (c) ECV-specific identification of a golden standard for validation, and (d) continuation of development of ECV-specific validation protocols, including a community review process and updates. Results of each step will be made public via the WGCV-LPV website and finally the Cal/Val portal. |
| CV-12: Evaluation of validation supersites and new validation approaches | Q2 2015 | 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. |

# 1. Progress CV11 – LPV Website Update

Information on all 9 ECVs/EBVs updated, common structure!

1. Focus area co-leads contact
2. Definition of variable
3. Highest validation stage reached and challenges
4. Validation good practice (dedicated protocol or paper)
5. Reference data sets
6. References – sensor specific validation results
7. Products – product list with download link & contact
8. Collaborations and contributions to international programmes (In situ networks, GCOS, etc.)

-> email to LPV general list/climlist in October

Big thanks to all focus area co-leads and Jaime!

# ECV-Specific Home Page Content

## Focus Area on Soil Moisture Product Validation

Tom Jackson, USDA, Agricultural Research Service, USA
Wolfgang Wagner, Vienna University of Technology, Austria

### Soil Moisture Definition

Soil moisture is expressed as soil water content (mass or volume of water in the soil) or soil water potential (soil water energy status). The volumetric soil water content is defined as the volume of the water divided by the total volume (volume of dry soil, air, and water) of a soil sample. Conversion is possible if soil properties are known. (WMO, 2008, updated 2012.)

Units: Volumetric soil water content is expressed in units of $m^3m^{-3}$. Additionally, degree of saturation and gravimetric are used for some products, expressed as percent and g $cm^{-3}$, respectively.

### Highest Validation Stage Currently Reached for Satellite-Derived Soil Moisture Products

***Validation stage 3*** (LPV validation stage hierarchy) - The highest LPV validation stage reached for satellite-derived Soil Moisture products. Limitations to reach higher validation stage include gaps in spatial distribution of reference data and limited representativeness of point measurements at the satellite pixel resolution.

### Validation Good Practice

Currently, most recent satellite product validation plan documents serve as best references for validation of soil moisture:

- SMAP - The SMAP Handbook includes a description of the Cal/Val plan.
- SMOS - Delwart, S., Bouzinac, 3., Wursteisen, P., Berger, M., Drinkwater, M., MartÃn-Neira, M. and Kerr, Y.H., 2008:
  SMOS validation and the COSMOS campaigns. *IEEE TGRS* 46 (3), 695-703.
- ASCAT - Brocca, L., F. Melone, T. Moramarco, W. Wagner, C. Albergel (2014) Scaling and filtering approaches for the
  use of satellite observations, Chapter 17 in *Remote Sensing of Engergy Fluxes and Soil Moisture Content*,
  G.P. Petropoulus (Ed), CRC Press, Boca Raton London New York, 411-425.
- ESA CCI
- AMSR2

# ECV-Specific List of Reference

## Satellite-Derived Soil Moisture Intercomparison and Validation References


Brocca, L., F. Melone, T. Moramarco, W. Wagner, C. Albergel (2014) Scaling and filtering approaches for the use of satellite observations, Chapter 17 in *Remote Sensing of Engergy Fluxes and Soil Moisture Content*, G.P. Petropoulus (Ed), CRC Press, Boca Raton London New York, 411-425.

Crow, W.T. and Yilmaz, M.T., 2014: The auto-tuned land data assimilation system (ATLAS). *Water Resources Research* 50 (1), 371-385.

Mladenova, I.E., T.J. Jackson, E. Njoku, R. Bindlish, S. Chan, M.H. Cosh, T.R.H. Holmes, R.A.M. de Jeu, L. Jones, J. Kimball, S. Paloscia, E. Santi, 2014. Remote monitoring of soil moisture using passive microwave-based techniques — Theoretical basis and overview of selected algorithms for AMSR-E, *Remote Sensing of Environment*, Volume 144, Pages 197-213.

Wagner, W., Brocca, L., Naeimi, V., Reichle, R., Draper, C., de Jeu, R., Ryu, D., Su, C-H., Western, A., Calvet, J-C., (2014). Clarifications on the Comparison Between SMOS, VUA, ASCAT, and ECMWF Soil Moisture Products Over Four Watersheds in US, *IEEE Transactions on Geoscience and Remote Sensing*, 99, 1-6.

Yilmaz, T.M. and Crow, W.T., 2014: Evaluation of assumptions in soil moisture triple collocation analysis. *Journal of Hydrometeorology* 15 (3), 1293-1302.

Albergel, C., L. Brocca, W. Wagner, P. de Rosnay, and J. Calvet, 2013. Selection of Performance Metrics for Global Soil Moisture Products: The Case of ASCAT Soil Moisture, pp. 431-447. in *Remote Sensing of Energy Fluxes and Soil Moisture Content*, Editor G. P. Petropoulos, CRC Press.

Draper, C, R. Reichle, R. de Jeu, V. Naeimi, R. Parinussa, W. Wagner (2013) Estimating root mean square errors in remotely sensed soil moisture over continental scale domains, *Remote Sensing of Environment*, 137, 288-29.

Gruber, A., W.A. Dorigo, S. Zwieback, A. Xaver, W. Wagner (2013) Characterizing coarse-scale representativeness of in-situ soil moisture measurements from the International Soil Moisture Network

# ECV-Specific Contributions to International Structures

## Soil Moisture Focus Area Contributions
## Links to International Structures and In situ Measurement Networks

### GCOS

GCOS target requirements for 'Global near-surface soil moisture maps (up to 5cm soil depth)' were set as follows (GCOS-154):

| Variable/Parameter | Horizontal Resolution | Vertical Resolution | Temporal Resolution | Accuracy | Stability |
|---|---|---|---|---|---|
| Volumetric Soil Moisture | 50km | N/A | Daily | 0.04$m^3/m^3$) | 0.01$m^3/m^3/yr$) |

LPV Soil Moisture contributions towards Action item T13 and T14 (IP-10, GCOS-138).

Wolfgang Wagner, the soil moisture focus area co-lead, is a member of GCOS Terrestrial Observation Panel for Climate (TOPC).

### Link to the International Soil Moisture Network

ISMN

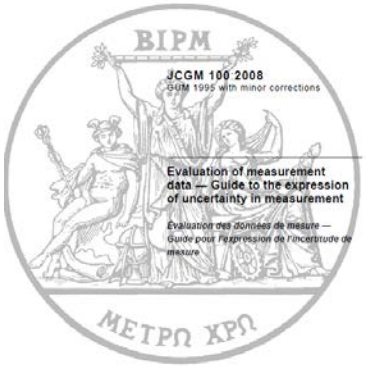
# 1. Progress CV11 - Terminology

1. Validation stage 3 definition – 'robust' replaced by 'rigorous' -> update of validation hierarchy table in paper

| | |
|---|---|
| **Stage 3 Validation** | Uncertainties in the product and its associated structure are well quantified from comparison with reference in situ or other suitable reference data. Uncertainties are characterized in a statistically rigorous way over multiple locations and time periods representing global conditions. |

2. Terminology for statistical quantities (eg. accuracy, precision, uncertainty) -> LPV will follow international standard "Guide to the expression of uncertainty in measurement and follow-up docs"
   http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf
   http://www.bipm.org/en/publications/guides/gum.html

Comments by WGCV welcome!



# 1. Progress CV11 - OLIVE Publication

*Remote Sens.* **2014**, *6*, 4190-4216; doi:10.3390/rs6054190

OPEN ACCESS

*remote sensing*

ISSN 2072-4292

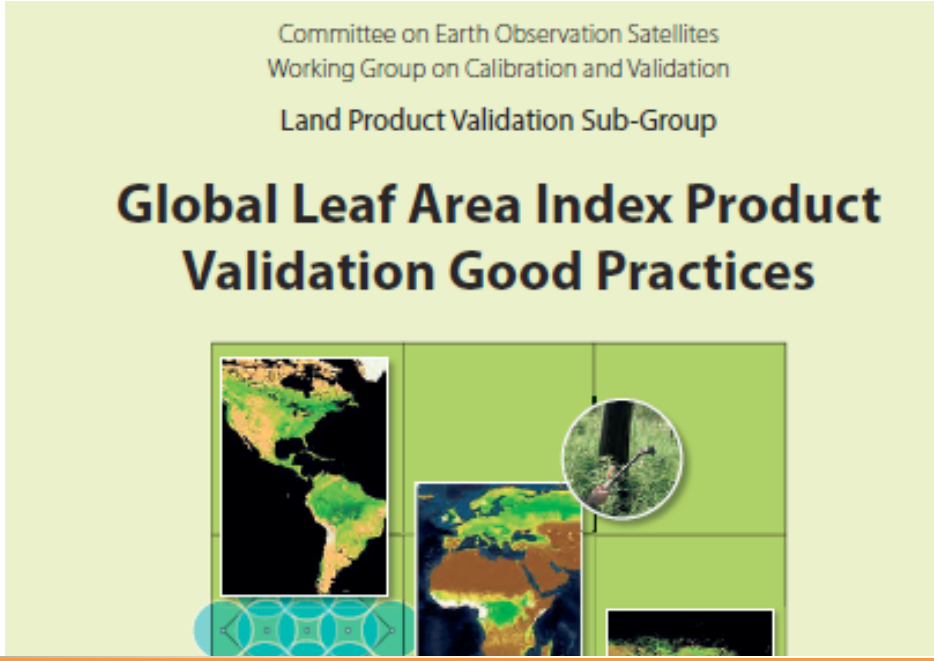
www.mdpi.com/journal/remotesensing

*Article*

## On Line Validation Exercise (OLIVE): A Web Based Service for the Validation of Medium Resolution Land Products. Application to FAPAR Products

**Marie Weiss [1,*], Frédéric Baret [1], Tom Block [2], Benjamin Koetz [3], Alessandro Burini [3], Bettina Scholze [2], Patrice Lecharpentier [1], Carsten Brockmann [2], Richard Fernandes [4], Stephen Plummer [5], Ranga Myneni [6], Nadine Gobron [7], Joanne Nightingale [8], Gabriela Schaepman-Strub [9], Fernando Camacho [10] and Arturo Sanchez-Azofeifa [11]**

# DOI Assignment for Validation Best Practice Protocols




Digital object identifier (DOI)

- CEOS does not issue DOIs
- LPV established procedure with NASA to assign DOIs to selected documents
- Standard citation format for validation documents

Fernandes, R., Plummer, S., Nightingale, J., Baret, F., Camacho, F., Fang, H., Garrigues, S., Gobron, N., Lang, M., Lacaze, R., LeBlanc, S., Meroni, M., Martinez, B., Nilson, T., Pinty, B., Pisek, J., Sonnentag, O., Verger, A., Welles, J., Weiss, M., & Widlowski, J.L. (2014). Global Leaf Area Index Product Validation Good Practices. Version 2.0. In G. Schaepman-Strub, M. Román, & J. Nickeson (Eds.), *Best Practice for Satellite-Derived Land Product Validation* (p. 76): Land Product Validation Subgroup (WGCV/CEOS), doi:10.5067/doc/ceoswgcv/lpv/lai.002

# 2. Meetings and Outreach

- Climate Symposium Darmstadt Oct'14

  LPV poster presentation

- AGU'14

  'Assessment of satellite-derived essential climate variables in the terrestrial domain' (IN006-O) – please join us!

  G. Schaepman-Strub, M.O. Roman, C. Schaaf

  18 submissions (1 oral, 1 poster session)

- EGU'15

  'Validation and quality assurance of terrestrial ECVs'

  G. Schaepman-Strub, J.P. Muller, M. Roman, M. Disney

  Joint session proposal LPV and QA4ECV – watch out for final programme!

# 3. LPV Collaborations

1. IVOS (June '14)

   LPV presentation, evaluation of representativeness of Gobabeb site (C. Schaaf & team) in framework of Radcalnet

2. NEON (July '14)

   LPV presentation; discussion about LAI, FPAR, albedo, soil moisture reference data sets and measurements; AGU LPV session invited speaker S. Petroy

3. NCAR (July '14)

   LPV presentation; discussion about international land model benchmarking project http://zea.ess.uci.edu/mmu/ILAMB/

4. QA4ECV

   EC FP7 SPACE project – JP Muller terrestrial lead. Goals: 1. Develop traceable quality assurance methods for ECVs, 2. Generate multi-decadal satellite-derived global ECV records (3 terrestrial, ie LAI, FPAR, albedo)

5. GCOS

   LPV presentation at TOPC meeting (March '14); GCOS ECV assessment report submitted for Land cover, Fire, Soil moisture, Albedo, LAI

6. ICOS

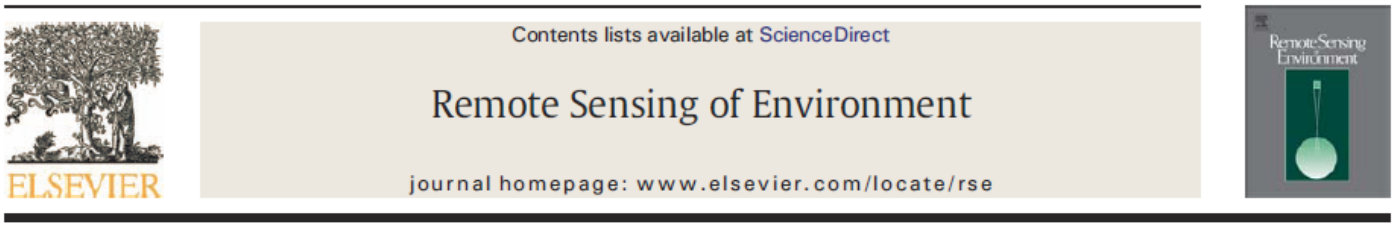
   3 biome-specific LAI measurement protocols reviewed

# 4. Focus Area Updates

- Albedo
  - 2 proposals selected for BRDF reference data generation from NASA airborne (CAR/P3B) and UAV (MALIBU/Tempest) platforms. Collaborations from three WGCV Subgroups (LPV, TMSG, IVOS).
- Snow
  - Intercomparison workshop in framework of SNOWPEX (ESA)
  - http://calvalportal.ceos.org/projects/snowpex;jsessionid=23C2669CE6442BF91B26B092D50D6F28
  - Agreement on intercomparison of 14 snow extent products and 5 SWE!
  - Retrieval algorithms and products reviewed
  - 4 golden yrs between 2000-2014 selected for intercomparison
  - key regions for high resolution intercomparison defined.
  - Follow-up workshop very likely in the US, begin Feb 2015.
- Soil moisture
  - Validation WS July '14 Amsterdam, issue of sustainable funding ISMN (database with quality-checked soil moisture measurements)
  - SMAP delayed (Jan'15); publication of SMAP handbook incl. cal/val chapter http://smap.jpl.nasa.gov/files/smap2/SMAP_Handbook_FINAL_1_JULY_2014_Web.pdf

# 4. Focus Area Updates cont.

– Land cover



Contents lists available at ScienceDirect

Remote Sensing of Environment

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

Review

Good practices for estimating area and assessing accuracy of land change

Pontus Olofsson [a,*], Giles M. Foody [b], Martin Herold [c], Stephen V. Stehman [d], Curtis E. Woodcock [a], Michael A. Wulder [e]

– LST

Guillevic, P. C., Biard, J., Hulley, G. C., Privette, J. L., Hook, S. J., Göttsche, F.-M., Radocinski, R., Román, M. O., Yu, Y., and Csiszar I., 2014. Validation of Land Surface Temperature products derived from the Visible Infrared Imager Radiometer Suite (VIIRS) using ground-based and heritage satellite measurements. Remote Sensing of Environment, 154, 19-37, doi: 10.1016/j.rse.2014.08.013.

# 4. Focus Area Updates cont.

- LAI – Feedback to 3 ICOS protocols (grassland, forest, peatland)
- FAPAR – 2nd validation meeting planned around IGARSS'15 (Milan)
- Phenology – only 2 current products with continuity: MODIS (global) and USGS (US only)

# 5. Open Actions

## LPV level

- Finalizing website update (general pages) -> CEOS WP CV1
- Finalizing validation status publication
- Supersite selection -> CEOS WP CV12
- LPV plenary meeting 2015 – discussion of intercomparison and validation methods across variables!

## Coordination within WGCV/CEOS

- GEO BON responsibility within CEOS?
  Status of '**Group on Remote Sensing for Biodiversity and Conservation'**?