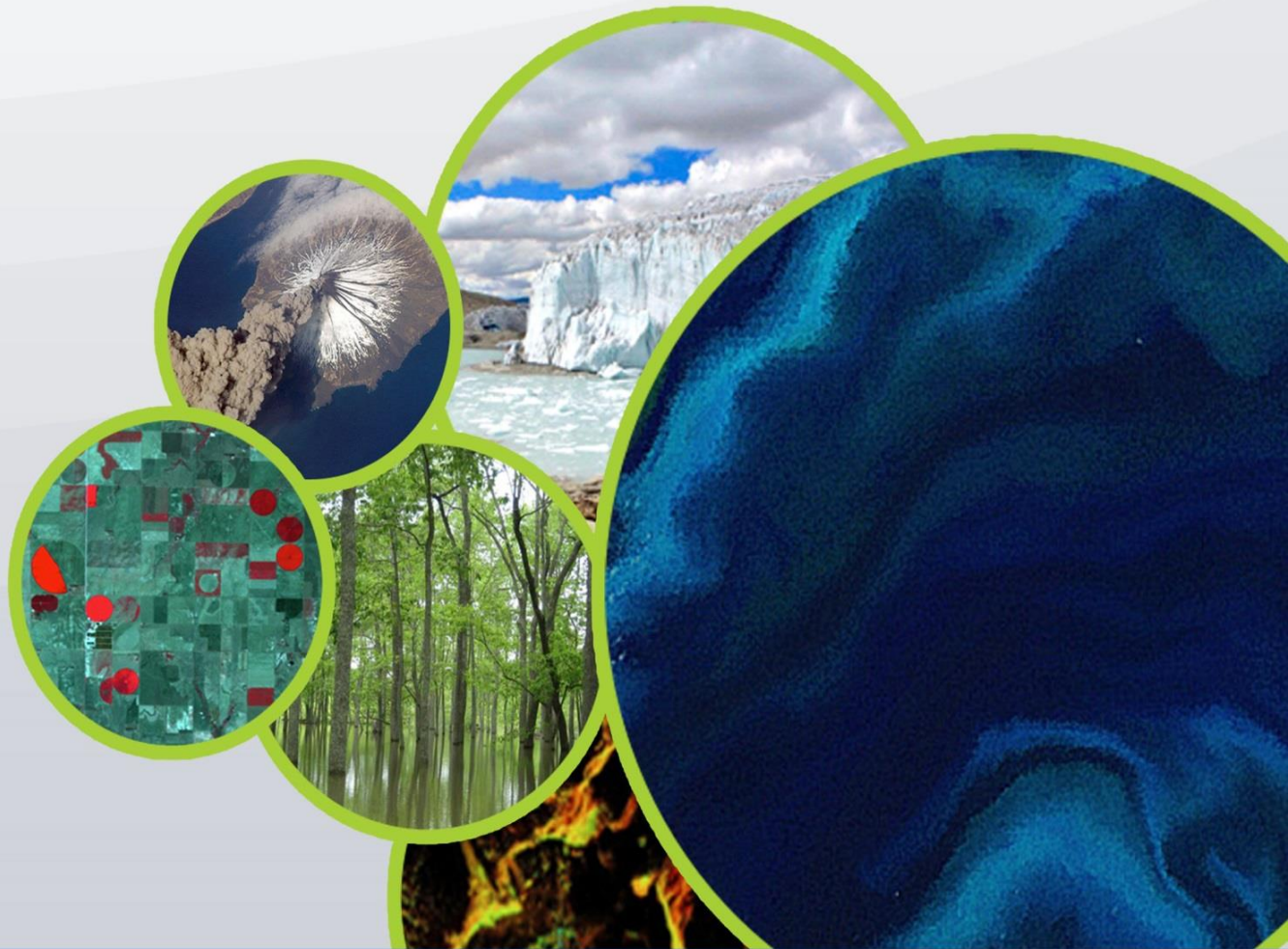




Committee on Earth Observation Satellites



CEOS WGCV Land Product Validation

Action Plan 2019-2022

Outcome of the LPV plenary meeting in Milan, 15th May.
Prepared by F. Camacho, June 2019





Introduction:

This document presents the LPV action plan for the period Q2 2019 – Q1 2022. This action plan is the outcome of the LPV Plenary held in Milan, May 15th, as a side event of the ESA Living Planet Symposium. During the LPV meeting, the current Chair presented the overall strategy for this period (presentation#1, F. Camacho), and each Focus Area presented its ongoing and scheduled activities (presentation#7 to #15). ESA reported to LPV its contribution to cal/val activities of land products (#2, F. Gascón) and the contribution to validation supersites (#3, V. Boccia). EC Land Monitoring Service representatives presented the Ground-Based Observations for Validation (GBOV, #4, C. Lerebourg) and the quality assessment of the Global Land products (#5, R. Lacaze). CSIRO presented their activities on continental surface reflectance validation (#6, M. Thankappan). All these presentations can be found here: https://lpvs.gsfc.nasa.gov/LPV_Meetings/LPV_plenary2019.html

This document first recalls the LPV mission and general objectives, then the LPV strategy for the current Chair's term is described, along with the main actions needed to achieve our goals. Recommendations based on the discussions during the LPV Plenary are also provided. Finally, the identified actions are presented.

LPV Mission:

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

LPV Objectives:

1. To **foster and coordinate quantitative validation** of higher level (> Level 2) global land products derived from remotely sensed data, in a traceable way.
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 **improve quality of ground references** used for product validation
 - Field campaigns for fiducial references
 - Identification of supersites for land product validation
4. To provide **feedback to international structures** for
 - Requirements on product accuracy and quality assurance
 - Terrestrial ECV measurement standards



LPV Strategy for this period:

The primary role of LPV is to ensure that the global land products derived from CEOS Agency satellite missions are able to reach the highest achievable validation stage. This is a commitment that all CEOS Agencies made through the CEOS/SIT's Action CV-11 (2015-2017 WP) by identification of golden standards for validation, and continuation of development of ECV-specific validation protocols, including a community review process and updates.

Up to now, the LPV strategy has mainly been focused on the development of an **LPV Validation Framework** for standardizing validation results and reporting. This included the implementation of ESA's On Line Interactive Validation Exercise (OLIVE) tool, the development of good practice protocols for ECVs (completing LAI, LST, and Albedo), the compilation of reference data for the validation of satellite products (e.g., DIRECT database for LAI and FAPAR), and the identification of benchmarking sites (e.g. BELMANIP2.1, SAVS, and the recently identified LPV supersites) for land product validation.

However, implementing such an all-encompassing validation framework in an operational way will undoubtedly take a lot more time and resources than what LPV can manage without strong monetary commitments from CEOS agencies. As an example, the OLIVE tool hosted in the ESA cal/val portal is not updated as the time series expand or with new satellite products in the market and then is not useful for the validation community.

The overall strategy for the three-year period (Q2 2019- Q1 2022, Chair term) will be focused on enhancing the main aspects of the Validation Framework, as follows:

1. **Continuous Development of Good Practices** for global satellite land product validation

Current focus area leads are responsible for producing a validation protocol for their respective variables describing current methods and good practices within their respective communities. Some of these documents have been produced, and the following are in the pipeline:

- a. *Biomass* protocol (contribution to CEOS CARBON strategy, CARB-16 and WGCV-19) under internal evaluation. Expected in Q4 2019.
- b. *Soil Moisture, Vegetation Indices, Land Cover, Active Fire and Phenology* validation protocols are beginning development now. The objective is to have them ready for community review in about two years from now.
- c. *LAI* protocol needs to be updated to cover new in-situ tools and good practices for high resolution products. The protocol document can also be updated to incorporate *FAPAR* as well. Expected for Q4 2021.
- d. *Surface Reflectance* protocols need to be written. ESA is developing protocols for fiducial references and product validation under the FRM4Veg project.



Similar exercises are being conducted by the Australian government. Moreover, the WGCV IVOS subgroup proposed that validation of surface reflectance to be subject of a new task force or extension of ACIX (IVOS R-2018-1). This is of strategic need also for LPV subgroup as surface reflectance is the input for most of our land products.

LPV Recommendation R-2019-1: To promote FRMVeg surface reflectance protocols under CEOS WGCV, to involve other agencies to get the needed international consensus on the surface reflectance validation protocols.

2. **Improving ground references**, to achieve higher satellite product validation stage by improving the uncertainty characterization and spatio/temporal coverage of ground reference measurements. The following main actions are considered:
 - a. Support the collection of Fiducial Reference Measurement contributing to data collection. In this regard, LPV members are actively involved in ESA FRM4Veg and FRM4LST projects.
 - b. Seek collaborations with nationally funded terrestrial ecosystem networks (e.g. TERN Australia, NEON USA, ICOS in EU) and other networks to help with the expansion of validation supersites.
 - c. Update and improve the selection of supersites for land product validation. An objective of this period is to support the establishment of a European Network of validation supersites where current activities conducted by ESA (FRMVeg, FLEX) and EC (CLMS) could converge, whilst improving the spatial coverage over areas not well covered (e.g., Asia or Africa). The revision of LPV supersites is expected for Q2 2021.
 - d. Complete the list of Carbon supersites for the validation of biomass products (CARB-16 action, ESA/NASA). Expected for Q4 2019.
 - e. Analyze the scientific quality of reference datasets before promoting them for validation (e.g. GBOV datasets).
 - f. Contribute to expansion of databases for gathering ground references for validating high resolution products. For instance, the Biophysical group is working on FAIR principles (Findable, Accessible, Interoperable and Reusable) for gathering LAI and FAPAR measurements for validation of high-resolution products.

LPV Recommendation R-2019-2: To adopt Fiducial Reference Measurement concept in the CEOS LPV and modify the validation hierarchy table accordingly.

LPV Recommendation R-2019-3: To endorse carbon supersites as CEOS WGCV cal/val sites (contribution to CARB-16).



3. **Promoting validation and intercomparison exercises** (products and algorithms) with CEOS main agencies in collaboration with operational services.

Focus area leads are responsible to promote intercomparison and validation exercises and relay results to users in the form of publications. This should be done in collaboration with the international community and using good practices for validation when available.

- a. Identify opportunities for international coordination and collaboration in validation and intercomparison of satellite land products. For instance, through collaboration with Copernicus Services, who are conducting validation activities in an operational manner. Albedo and VI focus areas will conduct intercomparison and validation exercises in collaboration with Copernicus Services and the results of these will be published.
- b. Contribute to the Biomass intercomparison exercise-2 (BRIX-2).
- c. Promote a surface reflectance validation and intercomparison exercise.

LPV Recommendation R-2019-4: In collaboration with IVOS, propose a new CEOS WGCV surface reflectance validation and intercomparison exercise lead by ESA and NPL (UK) in the framework of FRM4Veg.

4. **Improving LPV communication** with stakeholders

- a. Promote special sessions in symposiums and conferences. The Chair and secretariat to organize sessions at AGU and EGU conferences.
- b. Each focus area will organize Topical workshops (at least 1 during this three-year period) to address specific land product validation issues, intercomparison activities and review of CEOS endorsed, community consensus protocol documents.
- c. Keep the LPV Subgroup website updated (at least annually).
- d. The LPV Subgroup will distribute an annual community newsletter each Fall. We want our *listserv* to feel like they are a part of LPV, and this is done in part by keeping them informed of LPV activities. We want them to participate in focus area meetings, and to exchange information about their own activities, particularly when related to field work and reference data collection. To add new young scientists to each FA list is highly encouraged.



- e. The LPV focus area leads will distribute newsletter to their own listserv in the Spring, approximately 6 months from the LPV-wide newsletter, keeping their community apprised of FA activities.

Additional outcome of the LPV Plenary:

During the LPV Plenary, the EC GBOV service was presented (#4). The LPV community acknowledges the value of the GBOV initiative for validation of land products but expressed their concerns on the quality of the GBOV datasets due to the lack of independent quality evaluation (see #5). It is thus recommended the following:

LPV Recommendation R-2019-5: That the Copernicus Land Monitoring Service perform an independent quality assessment of GBOV procedures and database. The LPV community stresses that this evaluation is mandatory to qualify the GBOV database as CEOS reference datasets for validation activities. The LPV focus area experts propose to act as external evaluators in this independent review process.

LPV Actions (2019-2022):

The following actions have been agreed. When the action is directly related to the 2019-2022 CEOS Work Plan (www.ceos.org) the ID of the CEOS WP was indicated. These actions will be reviewed annually.

Group	Lead / PoC	ID	Action	Deadline
Chair	F.Camacho	19-LPV-01	Revise hierarchy table including FRM concept	Q3/2019
Chair	F.Camacho	19-LPV-02	Update LPV supersites over Europe and expand coverage over poorly represented areas/biomes	Q2/2021
Chair	F.Camacho	19-LPV-03	Investigate suitability of ICOS delivered data for validation	Q1/2020
Chair	F.Camacho	AGRI-13	Stablish mechanism to collaborate with GEOGLAM related to Essential Agriculture Variables (EAVs)	Q4/2019
Chair	F.Camacho	19-LPV-04	Promote a new WGCV SR task (LPV-IVOS) in the context of FRM4VEG	Q3/2019
Chair / Secretariat	F.Camacho	19-LPV-05	Promote special sessions on land product validation at AGU and EGU	Q4/2021
Secretariat	J. Nickenson / All	19-LPV-06	Update web page	Q2/annually
Secretariat	J. Nickeson / All	19-LPV-07	To send LPV newsletter to LPV list members	Q3/annually
FA Leads	FA Leads	19-LPV-08	FA leads send community newsletter.	Q2/annually
Biomass	L.Duncanson / FA leads	CARB-16	Cal/val and production of biomass products from CEOS missions	Q4/2019



Biomass	L.Duncanson / FA leads	CARB-16-2018-2	Biomass validation paper	Q2/2019
Biomass	L.Duncanson / FA leads	CARB-16-2018-3	CEOS WGCV biomass protocol	Q3/2019
Biomass	L.Duncanson / FA leads	CARB-16-2018-5	Establishment of ground-based carbon super-sites	Q4/2019
Biomass	L.Duncanson / FA leads	CARB-16-2018-7	Biomass Intercomparison Exercise-2 (BRIX-2)	Q4/2020
Albedo	Ian Grant / FA leads	19-LPV-09	Developing protocols for surface downwelling radiation product validation	Q4/2020
Albedo	F.Camacho / FA leads	19-LPV-10	Paper on albedo validation and intercomparison	Q1/2020
Land Cover	Sophie Bontemps	19-LPV-11	Land Cover product validation	Q3/2020
Land Cover	FA leads	19-LPV-12	Workshop on LC product validation	TBD
Biophysical	H. Fang	19-LPV-13	Biophysical Workshop at IGARSS	Q3/2019
Biophysical	M. Weiss	19-LPV-14	Datasharing platform under FAIR principles for ground references	Q2/2020
Biophysical	M. Weiss / FA leads	19-LPV-15	Update the LAI protocol, complement it with Fapar	Q4/2021
Active Fire /BA	FA leads	19-LPV-16	Finalize the BA protocol	Q4/2022
Active Fire /BA	FA leads	19-LPV-17	Develop validation protocol for Active Fire / FRP	Q2/2021
Soil Moisture	FA leads	19-LPV-18	Soil Moisture Protocol	Q2/2021
LST	leads	19-LPV-19	TBD	TBD
LST	leads	19-LPV-20	TBD	TBD
Phenology	FA leads	19-LPV-21	Phenology Validation Protocol	Q4/2021
VI	FA leads	19-LPV-22	VI validation protocol	Q4/2021
VI	FA leads	19-LPV-23	3rd Workshop VI	Q2/2021
VI	E. Swinnen	19-LPV-24	paper on VI product intercomparison	Q3/2020
VI	T. Miura	19-LPV-25	paper on VI VIIRS validation	Q2/2020



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