Land Product Validation and Evolution (LPVE) 2023 Workshop Objectives, Agenda and Logistics

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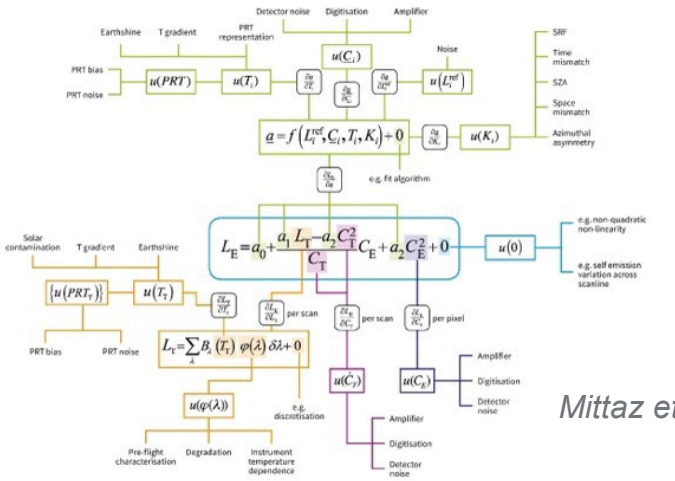
Motivations

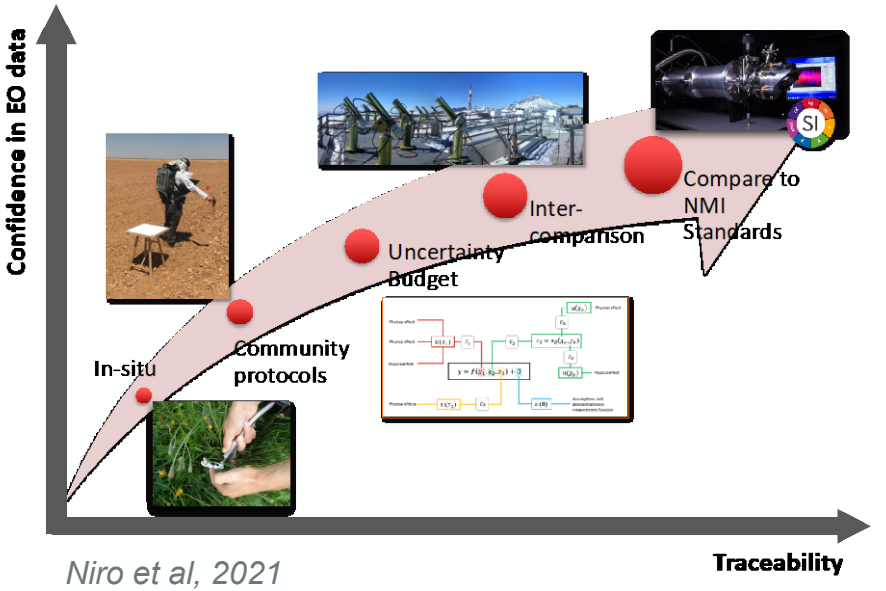
- Land EO domain has gone through **radical changes** over last years and further advances are expected in the coming years:
  - ✓ **Current and Future satellite missions**: Hyperspectral (EnMAP, PRISMA/NG, CHIME, SBG), future HR Thermal (TRISHNA, LSTM, SBG-TIR), future Biomass and SIF/GPP focused mission (BIOMASS, NISAR, Flex)
  - ✓ **Advanced ground-based Cal/Val sensors/platforms**: automated low cost devices, UAV-based systems and robotic platforms for inexpensive and dense sampling
  - ✓ **New Space EO data providers**: providing a number of constellation in the optical, TIR domains at ever growing temporal, spatial and spectral resolution
- This poses obvious **challenges** to Cal/Val: are we ready to support the needs (sites, protocols, tools) of those missions? How we can best exploit advances in ground-based sensors/platforms?

ESA Cal/Val Strategy

- Provision of **uncertainty** for both **reference** and **satellite** data is a **prerequisite** for a rigorous and meaningful validation
- Ideally, the reference measurement should be **traceable** to community **standards** and its uncertainty smaller and better characterized than that of the satellite estimate
- In the **real scenario**, Cal/Val reference data are seldom traceable and uncertainties are often not estimated
- This generic reference data is not **fit-for purpose** to fulfil Cal/Val needs of most recent, highly sophisticated spaceborne sensors
- In order to address this gap, ESA is promoting a new concept, **Fiducial Reference Measurements (FRM)** :
  - ✓ Evidence of metrological SI-traceability
  - ✓ Follow community agreed best practices for measurements
  - ✓ Rigorous uncertainty budget, e.g., uncertainty tree diagrams
  - ✓ Intercomparison exercises are regularly performed



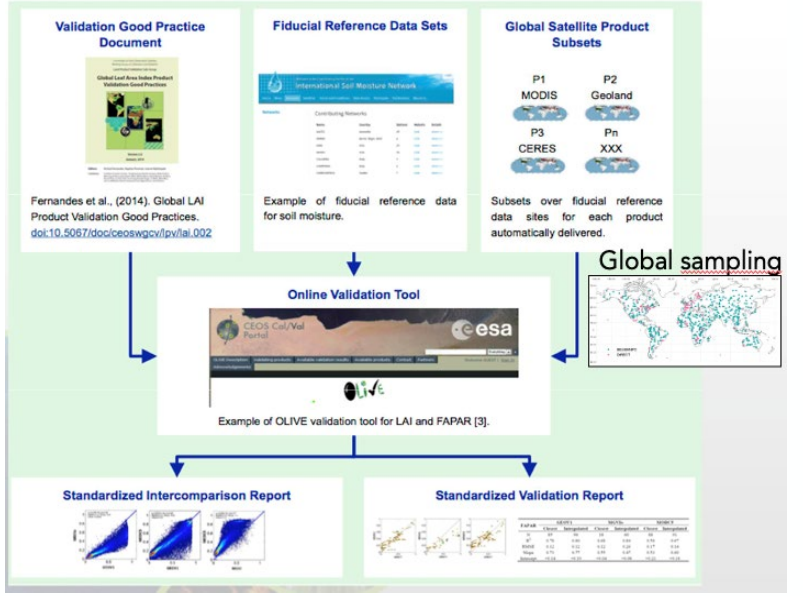
Mittaz et al. 2019

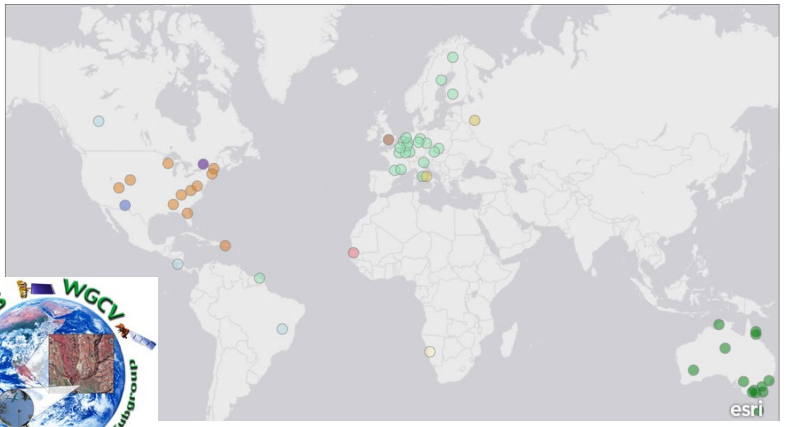


Niro et al, 2021

CEOS-WGCV-LPV strategy

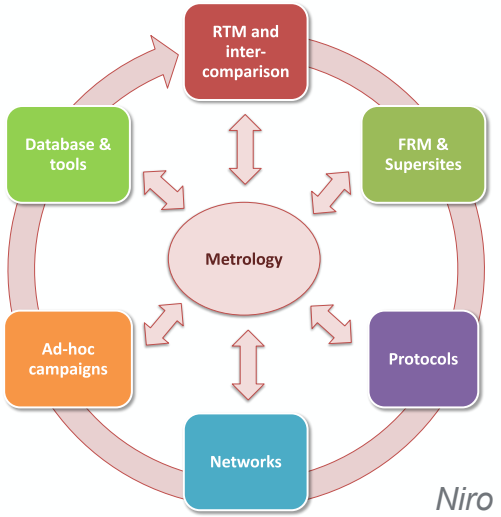
- CEOS WGCV Land Product Validation (CEOS-WGCV-LPV) subgroup works towards developing and promoting:
  - ✓ Community-agreed **Cal/Val protocols** for field sampling, upscaling approaches, uncertainty estimate of terrestrial ECV
  - ✓ Standardized **approaches** and **tools** for for global validation
  - ✓ Common reporting about satellite-derived land products quality and maturity level (**validation stage**)
  - ✓ Enhanced **quality** of Cal/Val reference data
- As part of these goals, the LPV **Super-sites** were defined as:
  - ✓ Super characterized sites following well-established protocols useful for the validation of satellite land products (**at least 3**) and for radiative transfer modeling approaches
  - ✓ Active, long-term operations, supported by appropriate funding
  - ✓ Supported by airborne LiDAR and hyperspectral acquisitions

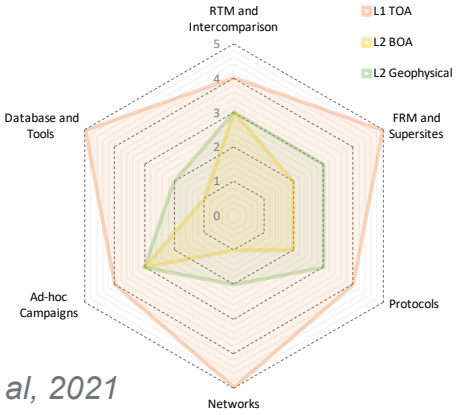




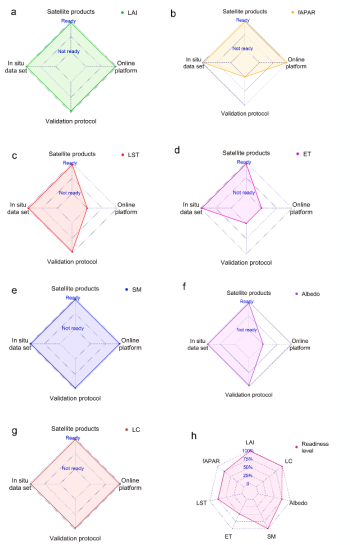
ESA CEOS-WGCV-LPV complementary vision

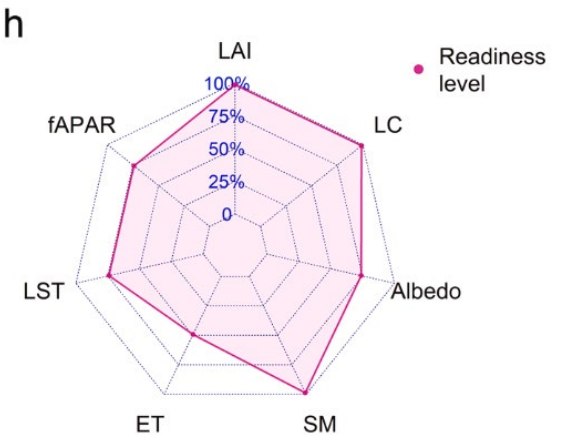
- ESA and CEOS-WGCV-LPV approaches are complementary in defining a set of basic elements that should be available to ensure comprehensive validation:
  - ✓ **Cal/Val reference data**: data collected as part of FRM compliant sites, Super-sites, field campaigns, expanded at global scale with Networks
  - ✓ **Cal/Val protocols**: community-agreed best practices for field sampling, upscaling methods, RTM-based modelling approaches, uncertainty estimate
  - ✓ **Cal/Val database and tools**: centralised repository of reference data for operational validation of satellite products at global scale (**FAIR** principles)
- Assessing the **readiness level** for each of these components, allows identifying **gaps** to be addressed to enhance maturity level of EO land products





Niro et al, 2021





Bayat et al, 2021

LPVE Workshops

- As part of this complementary strategy, ESA/CEOS-WGCV-LPV jointly convene a series of workshops (LPVE)
- The last **in-person WS** was held in **2018** here in ESRIN, the last one was held on-line in Dec 2020
- Main take-away from last **2020 WS**
  - ✓ A large number of concurrent projects are running under different umbrellas (ESA, EC, CEOS, …)
  - ✓ **Synergies** are still largely **under-exploited** causing duplication of efforts and increase of costs
  - ✓ Existing networks are potentially available, although most of them **not primarily designed** for Cal/Val
  - ✓ We **cannot just leverage on existing infrastructure**, we should work to **fill gaps** (with priorities) with a **sustainable** long-term solution

esa

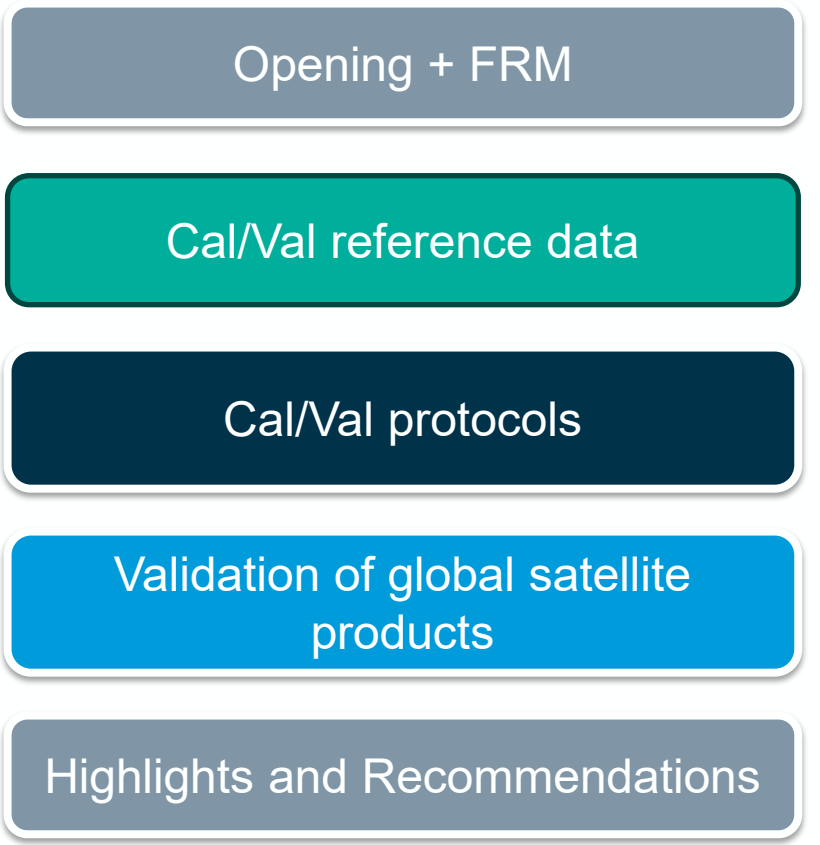
CEOS WGCV Land Product Validation Subgroup

esa esrin

ESA Workshop on Land Validation Strategy (30/11– 1/12/2020): Highlights and Recommendations

Workshop Objectives and Expected Outcomes

- The main objective is to **review** the current status and discuss the **way forward** for addressing data and knowledge gaps with respect to:
  - ✓ **Cal/Val Reference Data:** supersites, network, field campaigns and advanced solutions
  - ✓ **Cal/Val Protocols:** sampling design and upscaling approaches, uncertainty budget estimate
  - ✓ **Validation of global products:** operational validation and maturity level of current satellite global products
- The Oral program was organised accordingly into three main sessions with discussion slot at the end
- Highlights and recommendations from the sessions will be further elaborated in a **report**, which will be used to better shaping driving ESA-CEOS-LPV future strategy



LPVE23 Oral Program

Magellan

12 June

Opening Session + FRM
9:00 – 10:40

Cal/Val Reference data: Supersites, Networks, field Campaigns
11:00 – 13:00

LUNCH – 13:00 – 14:00

Cal/Val Reference data: Supersites, Networks, field Campaigns
14:00 – 17:40

Discussion (40 min)

Ice-Break + Poster + Demo
18:20 – 19:30

13 June

Cal/Val Protocols and Uncertainty Budget estimate
9:00 – 13:00

LUNCH – 13:00 – 14:00

Cal/Val Protocols (continued)
14:00 – 15:20

Discussion (40 min)

Retrieval and Validation of Global Satellite products
16:20 – 18:00

Ice-Break + Poster + Demo
18:00 – 19:30

14 June

Retrieval and Validation of Global Satellite products
9:00 – 12:20

Discussion (40 min)

LUNCH – 13:00 – 14:20

Closing Session
14:20 – 16:20

Big Hall

LPVE23 demo program

Time: during poster session (**18:00 – 19:30**)

Duration: 45 min each

Location: Annex Room

12 June

- W. Preimesberger (TUW) – "The **Quality Assurance for Soil Moisture** (**QA4SM**) service for Cal/Val standardization and operability"
- J.P. Arroyo Mora (NRC) and M. Kalacska (McGill University) – "Standalone **flight planning application** for push-broom **hyperspectral** imagers and Spatial Coverage Map and Resampling Error Assessment"

13 June

- S. Schunke (Rayference) – "**Eradiate**: an **open-source 3D radiative transfer model** for Earth observation applications"

LPVE23: Poster Program

#	Title	Author
1	Utilizing the Largest Hyperspectral Surface Reflectance Data Set and Some Adjustment Techniques to Account for Spectral Response Differences Among Optical Sensors	Martin Claverie, UCL Geomatics, Belgium
2	Harmonization and comparison of atmospheric radiative transfer models with the ALG toolbox	Jorge Vincent, Magellium, France
3	Semi-empirical modelling and deep learning for burned area near-real time monitoring in the framework of the Copernicus Global Land Service	Marc Padilla, Complutig, UK
4	An improved hyperspectral surface reflectance datasets and aerosol model over four selected PICS	Yves Govaerts, Rayference, Belgium
5	Earth Observation of ECVs tends to overestimate low and underestimate high values: blame statistics, not models	Hongxiao Jin, Lund University, Sweden
6	Validation of Copernicus Global Land Service Sentinel-3 OLCI Leaf Area Index, Fraction of Absorbed PAR and Vegetation Cover products	Enrique Martinez-Sanchez, Eolab, Spain
7	Validation of LSA-SAF EUMETSAT Polar System LAI, FAPAR and FVC global vegetation products derived from AVHRR sensor.	Enrique Martinez-Sanchez, Eolab, Spain
8	Evaluation of Proba-V Collection 2 Products	Carolien Toté, VITO, Belgium
9	PRISMA for land cover mapping: different approaches for the classification of the Earth's surface	Federico Carotenuto, CNR, Italy
10	Data fusion of PRISMA hyperspectral imagery with Sentinel-2 multispectral imagery for spatial resolution improvement	Giandomenico De Luca, CNR, Italy

LPVE23: Poster Program

#	Title	Author
11	SITES Spectral - Swedish Infrastructure for Ecosystem Science	José M. Beltrán Abaun, Lund University, Sweden
12	Intercomparisons of sentinel 3 SYNERGY surface directional reflectance – Results and plans for the OPT-MPC routine service validation.	Naga Moparthy, ACRI-ST, France
13	Validating long-term actual and reference SEVIRI-MSG ET estimates along five dimensions	Bagher Bayat, Forschungszentrum Jülich, Germany
14	Multi-spectral UAV sensor limitations in mapping complex vegetation and satellite validation	Margaret Kalacska, McGill University, Canada
15	Artillery crater mapping in VHR satellite imagery: methodology and validation aspects	Sergii Skakun, University of Maryland, USA
16	The impact of mapping accuracy on crop area estimation: the case of winter wheat in Ukraine	Sergii Skakun, University of Maryland, USA
17	Web-based tool for validation of Sentinel-2 and Sentinel-3 derived bio-geophysical products against ICOS terrestrial ecosystems measurements.	Noelle Cremer, Serco/ESA, Italy
18	The Quality Assurance for Soil Moisture (QA4SM) service for Cal/Val standardization and operability	Pietro Stradiotti, TUW, Austria
19	Surface ALbedo VALidation (SALVAL) Platform: Towards CEOS LPV Validation Stage 4	Jorge Sanchez-Zapero, EOLab, Spain
20	Algorithm and preliminary validation of Sentinel-3 based surface albedo product for the continuity of Copernicus Climate Change Service	Jorge Sanchez-Zapero, EOLab, Spain

LPVE23: Poster Program

#	Title	Author
21	Challenges of in situ validation of Land Surface Temperature from Geostationary products	João Paulo, Martins, IPMA, Portugal
22	Validating long, temporally dense time-series from a network of autonomous field-spectrometers around the globe using Sentinel-2.	Paul Naethe, JB Hyperspectral, Germany
23	Ground Reference Observations Underlying Novel Decametric Vegetation Data Products from Earth Observation (GROUNDED EO): Project Overview and Status	Luke Brown, University of Salford, UK
24	The Fire Radiative Power (FRP) Inter-comparison framework: an approach to identify differences for non- simultaneous detection products.	Bernardo Mota, NPL, UK
25	CEOS WGCV LPV Vegetation Index Validation Protocol	Else Swinnen, VITO, Belgium
26	Generating and validating an irrigation map in Spain using in-situ not collected specifically to be used with Earth Observation data	Sophie Bontemps, UCLouvain, Belgium
27	Validation of the Copernicus Sentinel-2 Sen2cor Scene Classification Products	Avi Putri Pertiwi, DLR, Germany
28	Copernicus Snow & Ice products from Sentinel-2 and Sentinel-1 over Europe	Florence Marti, Magellium, France
29	Spatially explicit vegetation fractions to improve climate model simulation: A 29-year time series of annual Plant Functional Type (PFT) fraction maps through the fusion of the CCI MRLC 300 m land cover dataset and existing high-resolution data products	Céline Lamarche, UCLouvain, Beglium
30	Time series performance of Copernicus Sentinel-2 operational L2A-Products of year 2022	Bringfried Pflug, DLR, Germany

LPVE23: Poster Program

#	Title	Author
31	ENMAP background mission: support for the Hyperspectral monitoring of Cal/Val network sites for satellite radiance, reflectances and land product validation	Sabine Chabrillat, GFZ, Germany
32	Overview of Copernicus Global Land LAI, FAPAR and FCover from SPOT/VEGETATION to Sentinel-3/OLCI	Aleixandre Verger, CSIC, Spain
33	3D forest model validation of woodland from inter-comparison between simulated and real Terrestrial LiDAR	Chloe Randall, NPL, UK
34	The CEOS Land Product Validation Subgroup	Jaime Nickeson, NASA, USA
35	Characterization and correction of the spatiotemporal mismatch between satellite and in situ measurements with independent high-resolution measurements	Ruben Urraca, JRC, Italy
36	Correcting plant area index for woody material using near-infrared digital hemispherical photography	Luke Brown, University of Salford, UK
37	Land HYPERNET	Agnieszka Bialek, NPL, UK
38	Earth Observation LAI and FAPAR products operational Cal/Val. A new integrated system for long-term deployment of Digital Hemispherical Pictures systems	Gael Polles, TimeLapse Go, UK
39	Utilising the Land Hypernet sites for understanding the temporal dynamics of reflectance for vegetation	Harry Morris, NPL, UK
40	Cloud-based calibration & validation API	Lauri Häme, Terramonitor, Finland

Logistics

- No parallel session, oral talks of 15 min + 5 min Q&A
- First 2 days in Magellan, the last day in Big Hall (sorry for the inconvenience)
- Discussion session at the end of each macro-session
- Final wrap-up with reports from rapporteurs
- Poster session will be held in the James Cook Room
- Demo session will be held in Annex on 12th and 13th June during poster session
- Coffee breaks and Icebreaks will be organised in the Terrace (weather permitting)
- Lunch breaks in the canteen downstairs
- Bus is available: Frascati – ESRIN and back (leaving from Frascati at 8:00 AM, from ESRIN at 7:40PM)

We wish you a fruitful and pleasent Workshop !