



Committee on Earth Observation Satellites

WG Calibration and Validation

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CEOS SIT-34

Session 5 and Agenda Item 5.3

Miami, FL, USA

3 – 4 April 2019





- **The mission of the CEOS Working Group on Calibration & Validation (WGCV) is to ensure long-term confidence in the accuracy and quality of Earth Observation data and products and to provide a forum for the exchange of information about calibration and validation, including the coordination of cooperative activities.**
 - Atmospheric Composition (ACSG)
 - Infrared Visible Optical Sensors (IVOS)
 - Land Product Validation (LPV)
 - Microwave Sensors (MSSG)
 - Synthetic Aperture Radar (SAR)
 - Terrain Mapping (TMSG)

Chair: C. Ong (CSIRO), Vice Chair: A. Kuze (JAXA)



Data Quality Deliverables: 2019-2021			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
CV-3: Workshop on state of the art for pre-flight calibration techniques	Q3 2019	Hold an open-invitation workshop to discuss and promote best practices on pre-flight and onboard calibration of sensors, initially focusing on optical.	WGCV
CV-14: Report on application of approaches for cloud masking	Q2 2020	The WGCV task team "Cloud Masking" will research different cloud masking approaches for different sensors and spectral areas in order to deliver a report about their findings including recommendations for the applications of cloud	WGCV
CV-15: L1 top-of-atmosphere interoperability	Q4 2019	Develop an initial recommendation of a community reference in collaboration with GSICS.	WGCV
CV-17: Continental scale surface reflectance validation	Q3 2019	Provide guidance for development of methodologies to validate the results of the recent ACIX work leading to protocols for determining uncertainties for interoperable reflectance products.	WGCV
CV-18: Greenhouse gas reference standards for interoperability	Q4 2019	Develop list of reference standards for CO ₂ and CH ₄ products that are suitable for use in intercomparison of multiple missions	WGCV
CV-19: Biomass validation protocols	Q2 2020	Development of an initial set of guidance for validation of biomass products using near-term missions such as NISAR, GEDI, and BIOMASS	WGCV
FDA-12: Inventory of space data product formats used by CEOS agencies.	Q4 2019	Develop an inventory of current product format used in CEOS agencies and identify recommendations to facilitate interoperability.	WGCV



Carbon Observations, Including Forested Regions Objectives/Deliverables: 2018-2020			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
CARB-16: Cal/Val and production of biomass products from CEOS missions	Q4 2019	Development of a coordinated cal/val strategy across NASA and ESA biomass missions that rationalizes protocols, data sharing, and the establishment of ground-based carbon super-sites.	WGCV
CARB-23: Forest Biomass measurements for GFOI countries	Q4 2019	The new generation of Above Ground Biomass measurement missions offers great promise to forest monitoring capabilities. SDCG and WGCV Land Product Validation group will work with GFOI Capacity Building partners, including World Bank, to accelerate the policy relevance and application of these missions through strong communications, education, and interchange between GFOI countries and space data providers. SDCG will promote to GFOI countries the CEOS Biomass Protocol currently under development by WGCV LPV (due Q1 2019), and will develop education materials to help inform countries as to the opportunities ahead. Measures to address the policy relevance of the data from the relevant missions will be identified, making best use of the user and policy interface provided by GFOI.	WGCV, SDCG for GFOI

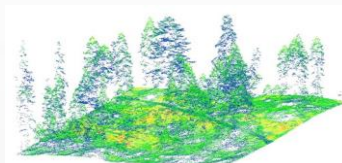
CEOS Services Objectives/Deliverables: 2018-2020			
Objective/Deliverable	Projected Completion Date	Background Information	Responsible CEOS Entity
CV-09: Radiometric Calibration Network (RADCALNET)	Ongoing	Operate an automated multiagency network of coordinated infrastructure and land-based test-sites for postlaunch traceable calibration of sensor radiometric gain.	WGCV

Biomass Validation Protocol



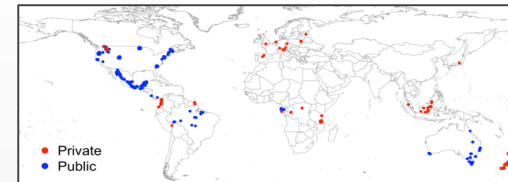
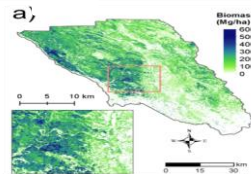
Achievement: Review paper on the Importance of Biomass Product Validation. Accepted in Surveys in Geophysics

1. TLS and Field Data for plot biomass estimates



2. Calibrate Airborne lidar with *in situ* data

3. Generate local biomass maps at desired (spaceborne product) resolution



4. Report accuracy over geographic domain of interest given available data

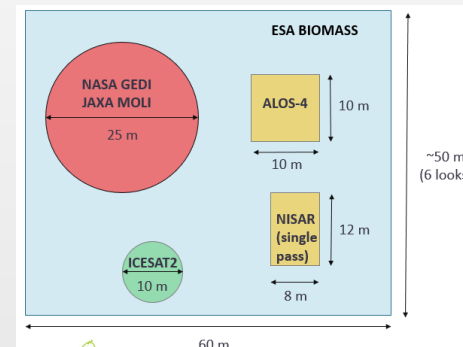
Expected outcome: A community-driven good practices guidebook for EO biomass product validation . External review expected in summer 2019

Chapters

- Good practices for biomass estimation in the field
- Linking remote sensing observations to field estimates
- Error Propagation
- Using existing *in situ* data for map validation
- Independent Validation and Reporting
- Utility of Protocol for Other Communities
- Knowledge Gaps

CV19: contributing towards

- **CEOS Strategy for Carbon Observations from Space**
- **CARB16: Cal/Val and production of biomass products from CEOS missions**
- **CARB-23: Forest Biomass measurements for GFOI countries;**
- **AGRI-13: Iteratively respond to GEOGLAM EO Data Coordination team's definitions of "Applications Ready Data" (ARD+) and "Essential Agricultural Variables for GEOGLAM"**





Achievement: Global Surface Albedo Product Validation Best Practices Protocol completed, ready to be endorsed at the WGCV-45 in July in Perth, Australia; LPV Super Sites

Committee on Earth Observation Satellites
Working Group on Calibration and Validation
Land Product Validation Subgroup

Global Surface Albedo Product Validation Best Practices Protocol

Version 1.0 – 2018

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Citation: Wang, Z., Schaaf, C., Lattanzio, A., Carrer, D., Grant, I., Román, M., Camacho, F., Yu, Y., Sánchez-Zapero, J. & Nickeson, J. (2019). Global Surface Albedo Product Validation Best Practices Protocol. Version 1.0. In Z. Wang, J. Nickeson & M. Román (Eds.), Best Practice for Satellite Derived Land Product Validation (p. 45); Land Product Validation Subgroup (WGCV/CEOS), doi: 10.5067/DOC/CEOSWGCV/LPV/ALBEDO.001

Contributing to global products ECVs from a variety of satellite sensors per Action Items outlined in the 2010 GCOS Implementation Plan in Support of the UNFCCC (GCOS-138, 2010, aka IP-10) and the 2011 update [GCOS-154, 2011]

LPV Supersites

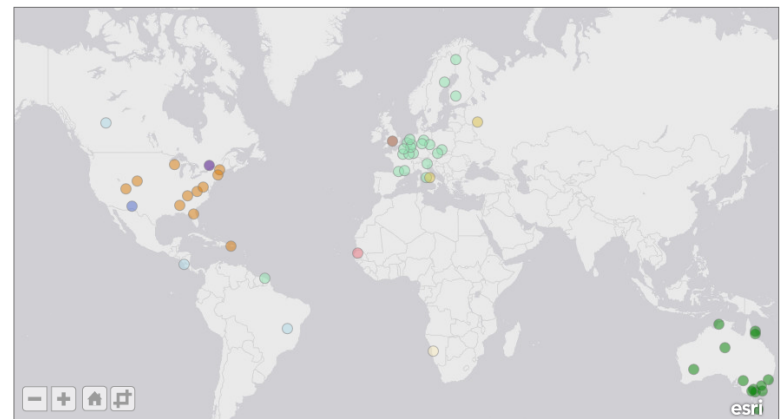
CEOS land validation sites

The CEOS Land Product Validation subgroup adopted the EOS Land Validation core sites back in the early MODIS era, and augmented the list with more European and international coverage in the mid 2000's. But many of these sites were not longer active, and our needs and strategy for ground reference sites have changed over time. The LPV thus undertook an effort to define and evaluate several study sites that could fulfill the needs of multiple products within our focus areas.

We have defined sites that we refer to as LPV Supersites as:

- Super characterized (canopy structure and bio-geophysical variables) site following well-established protocols useful for the validation of satellite land products (at least 3) and for radiative transfer modelling approaches.
- Active, long-term operations, supported by appropriate funding and infrastructural capacity.
- Supported by airborne LIDAR and hyperspectral acquisitions (desirable).

The supersites were selected primarily from well known and established networks, and several were also nominated by each of the LPV focus areas, and then all sites were evaluated for their suitability by ranking them first based on the availability of data (active site) and their spatial representativeness. After this the variables were ranked based on how many key variables could be validated with a given site, whether structural information were available for the site, and if atmospheric and other properties were measured. The sites were also ranked according to global region and by land cover. All of this information was combined to come up with a score for each site and a cut-off was established for accepting a given site. The subset of sites that we have initially adopted using this criteria are shown on the map below, and in this [spreadsheet](#).



Network Visibility:

TERN NEON ENV EFDC NCC ForestGeo ISRN ICOS KIT LTER

Greenhouse Gas Reference Standards

Expected Outcome: A list of reference standards for the validation of CO₂ and CH₄ (and CO, N₂O) products suitable for use in inter-comparison of multiple GHG missions

- Identify the current shortcomings/gaps/sustainability in GHG Cal/Val, and, formulate recommendations on the medium- to long-term way forward, that is, specific focus on GHG Fiducial Reference Measurement (FRM)

CV-18: Drivers/contributing to

- **CEOS AC-VC GHG Whitepaper “A Constellation Architecture For Monitoring Carbon Dioxide And Methane From Space”;**
- **Past CEOS chair initiative on “an international coordinated Greenhouse Gases monitoring system”;**





- In-situ / EO Data Discovery, Visualization and Pixel Access**

- Atmospheric Correction Inter-Comparison Exercise (ACIX) (CV-14)**

- ACIX II-land, 115 sites were selected based on AERONET stations' location and measurements availability for one-year period starting from October 2017. A total of around 7000 image scenes acquired by Sentinel-2A, -2B and Landsat-8;
 - ACIX-Aqua, the exercise is split into phases: Phase I, processors over coastal waters (20 AERONET-OC sites) and Phase II, processors over inland waters (15 sites with in-situ measurements)

- Radiometric Calibration Network**

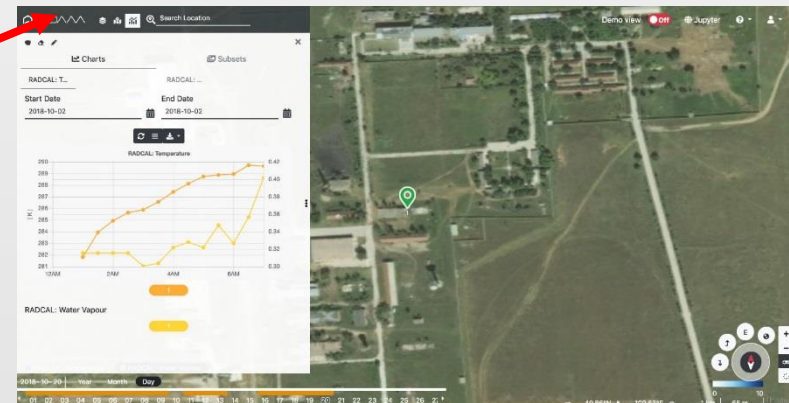
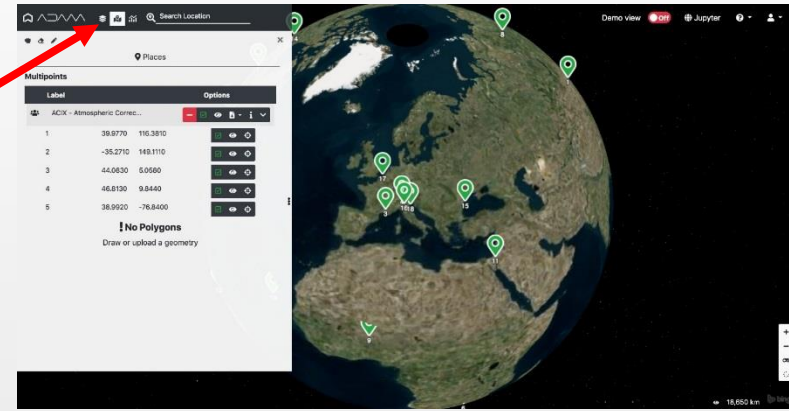
- (RadCalNet) (CV-09)**

- 108 users since portal opening

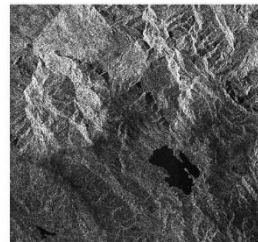
- Pre-configured list of sites
 - Data Discovery

Data	Status
In-situ AERONET (AOT, WV, SR)	Data collection: completed Data ingestion: in progress
EO Data Landsat-8 (AOT, SR)	Data collection: in progress
EO Data Sentinel-2 (AOT, WV, SR)	On-line

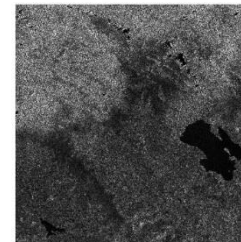
- Direct access to the selected site
 - In-situ Data Visualization and pixel access;



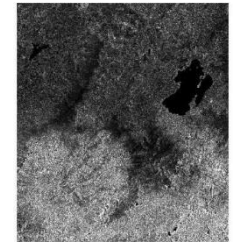
- Support LSI-VC on the CARD4L Product Alignment Assessment Process through peer-review of products generated by data providers adopting these standards;
- Contributed paper “Role Of CEOS Working Group On Calibration And Validation In Analysis Ready Data Products”. IGARSS invited session organised by LSI-VC;
- **Proposed new CV**
 - CV-20: Support CARD4L SAR PFS Development and Product Assessment.
 - Support LSI-VC with the development of CARD4L SAR Product Family Specifications and support of the CARD4L Product Alignment Assessment Process through peer-review of products generated by data providers adopting these standards;
 - CV-21: SAR Radiometric Calibration and Geolocation Supersites.
 - Update the calibration target and sites database and augment where needed;
 - Produce a standards and requirements document for a multi-mission SAR image Cal/Val supersite including the characterization of targets and sites. This Cal/Val supersite may include a virtual array of active radar and passive calibration devices.



Unprocessed - VH Intensity
Lake: Laguna de Tota
Location: Sogamoso, Colombia



Steps 1 to 6
Gamma-0, VH Intensity



Step 7 - Orthorectification
Gamma-0, VH, UTM-WRS84